Flexim FLUXUS G601
Ultrasonic Flowmeter

Portable Ultrasonic Flowmeter for Gas, Steam and Liquids

Features

- Flow measurement of gases, compressed air and saturated steam up to max. 180 °C
- Flow and thermal energy measurement of liquids
- Precise bidirectional and highly dynamic flow measurement with the non-invasive clamp-on technology
- Automatic loading of calibration data and transducer detection for a fast and easy set-up (less than 5 min), providing precise and long-term stable results
- High precision at fast and slow flow rates, high temperature and zero point stability
- Portable, easy-to-use flow transmitter with 2 flow channels, multiple inputs/outputs, an integrated data logger
- Integrated wall thickness measurement with connectable wall thickness probe
- The transmitter is water and dust-tight (IP65), resistant against oil, many liquids and dirt
- Li-Ion battery provides up to 25 hours of measurement operation
- Transducers available for a wide range of inner pipe diameters and fluid temperatures

Applications

Designed for industrial use in harsh environments, applicable in all areas such as maintenance, energy management, troubleshooting and verification of installed measuring systems. Example applications:

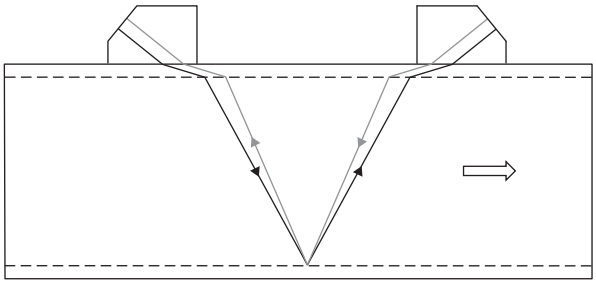
- Measurement on natural gas pipelines and in natural gas storage installations
- Data gathering in energy management and certifications according to ISO 50001
- Supervision and monitoring of compressed air and steam systems
- Hydraulic balancing of cooling towers
- Measurement on natural gas pipelines and in natural gas storage installations
- Measurement of synthesized gas and injection gas
- Measurement for the gas supply industry
- Supervision of permanently installed meters, service and maintenance

Function

Measurement principle

The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.

Path of the ultrasonic signal in the flowing fluid

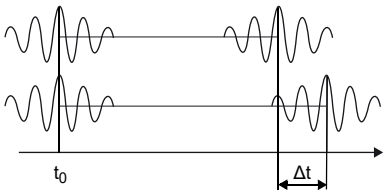


As the fluid where the ultrasound propagates is flowing, the transit time of the ultrasonic signal in flow direction is shorter than the one against the flow direction.

The transit time difference Δt is measured and allows the flowmeter to determine the average flow velocity along the propagation path of the ultrasonic signals. A flow profile correction is then performed in order to obtain the area averaged flow velocity, which is proportional to the volumetric flow rate.

The integrated microprocessors control the entire measuring cycle. The received ultrasonic signals are checked for measurement usability and evaluated for their reliability. Noise signals are eliminated.

Transit time difference Δt



Calculation of volumetric flow rate

$$\dot{V} = k_{Re} \cdot A \cdot k_a \cdot \frac{\Delta t}{2 \cdot t_\gamma}$$

where

- $\dot{V}$ - volumetric flow rate
- k_{Re} - fluid mechanic calibration factor
- A - cross-sectional pipe area
- k_a - acoustic calibration factor
- Δt - transit time difference
- t_γ - average of transit times in the fluid

Calculation of mass flow rate

The mass flow rate is calculated from the operating density and the volumetric flow rate:

$\dot{m} = \rho \cdot \dot{V}$

The operating density of the fluid is calculated as the function of pressure and temperature of the fluid:

$\rho = f(p, T)$

where

- ρ - operating density
- p - fluid pressure
- T - fluid temperature
- $\dot{m}$ - mass flow rate
- $\dot{V}$ - volumetric flow rate

Calculation of standard volumetric flow rate

The standard volumetric flow rate can be selected as physical quantity. It is calculated with the following formula:

$$\dot{V}_N = \dot{V} \cdot \frac{p}{p_N} \cdot \frac{T_N}{T} \cdot \frac{1}{K}$$

where

- $\dot{V}_N$ - standard volumetric flow rate
- $\dot{V}$ - operating volumetric flow rate
- p_N - standard pressure (absolute value)
- p - operating pressure (absolute value)
- T_N - standard temperature in K
- T - operating temperature in K
- K compressibility coefficient of gas: ratio of the compressibility factors of the gas at operating conditions and at standard conditions Z/Z_N

The operational pressure p and the operational temperature T of the fluid will be entered directly as fixed values into the transmitter.

or:

If inputs are installed (optional), pressure and temperature can be measured by the customer and fed in the transmitter.

The compressibility coefficient of gas K is entered into the transmitter:

- as fixed value or
- as approximation, e.g. according to AGA8 or GERG

Number of sound paths

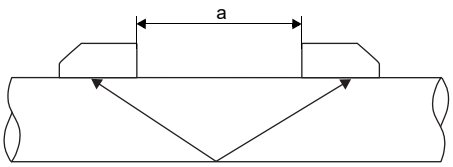
The number of sound paths is the number of transits of the ultrasonic signal through the fluid in the pipe. Depending on the number of sound paths, the following methods of installation exist:

- **reflection arrangement**
  The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easy.
- **diagonal arrangement**
  The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe. In case of high signal attenuation by the fluid or pipe, diagonal arrangement with 1 sound path is used.

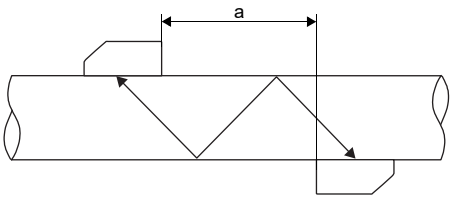
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the transmitter.

As the transducers can be mounted with the transducer mounting fixture in reflection arrangement or diagonal arrangement, the number of sound paths can be adjusted optimally for the application.

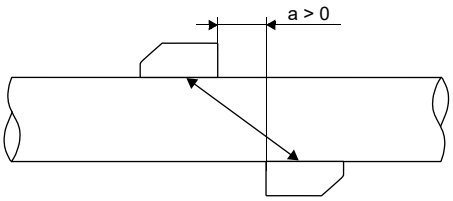
Reflection arrangement, number of sound paths: 2



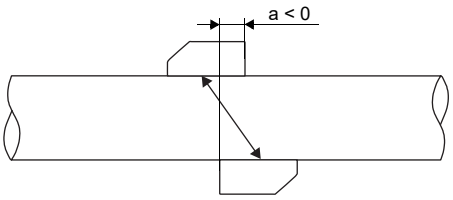
Diagonal arrangement, number of sound paths: 3



Diagonal arrangement, number of sound paths: 1



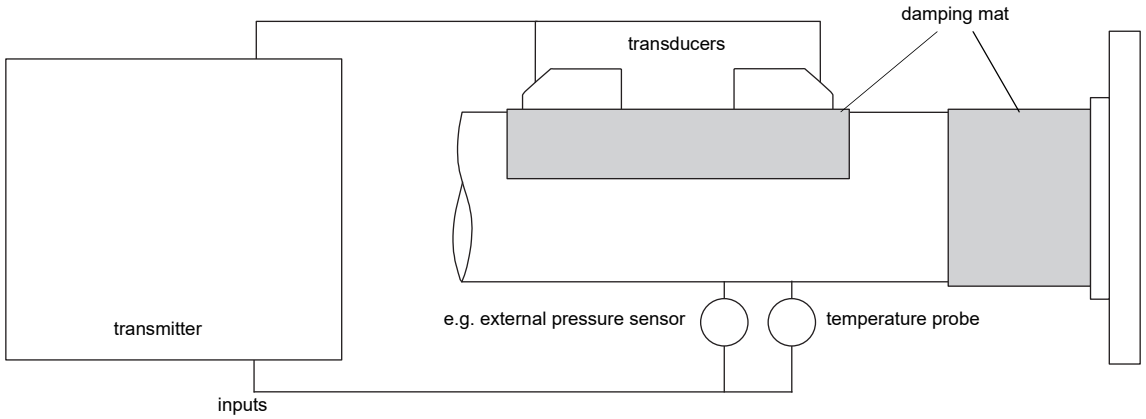
Diagonal arrangement, number of sound paths: 1, negative transducer distance



a - transducer distance

Typical measurement setup

Example of a reflection arrangement with connection of the inputs to an external process pressure and temperature measurement for standard volumetric flow rate calculation



Transmitter

Technical data

		FLUXUS G601, G601ST	FLUXUS G601ST (steam measurement[2])
			
design		portable	
measurement			
measurement principle		transit time difference correlation principle	
flow direction		bidirectional	
flow velocity	m/s	0.01...35, depending on pipe diameter	depending on pipe diameter and transducer, see diagrams
repeatability		0.15 % MV ±0.005 m/s	
fluid		all acoustically conductive gases, e.g. nitrogen, air, oxygen, hydrogen, argon, helium, ethylene, propane	saturated steam, superheated steam
fluid pressure	bar (a)	see transducers	3...10
fluid temperature	°C	see transducers	135...180
temperature compensation		corresponding to the recommendations in ANSI/ASME MFC-5.1-2011	
measurement uncertainty (volumetric flow rate)			
measurement uncertainty of the measuring system[1]		±0.3 % MV ±0.005 m/s	±0.3 % MV ±0.005 m/s
measurement uncertainty at the measuring point		±1...2 % MV ±0.005 m/s, depending on the application	±1...3 % MV ±0.005 m/s, depending on the application
transmitter			
power supply		• 100...230 V/50...60 Hz (power supply unit: IP40, 0...40 °C) • 10.5...15 V DC (socket at transmitter) • integrated battery	
integrated battery • operating time	h	Li-Ion, 7.2 V/6.2 Ah, max. 47 Wh > 14 (without outputs, inputs and backlight)[3] > 25 (1 measuring channel, ambient temperature > 10 °C, without outputs, inputs and backlight)[3]	
power consumption	W	< 6 (with outputs, inputs and backlight), charging: 18	
number of measuring channels		2	
damping	s	0...100 (adjustable)	
measuring cycle	Hz	100...1000 (1 channel)	
response time	s	1 (1 channel), option: 0.07	
housing material		PA, TPE, AutoTex, stainless steel	
degree of protection		IP65	
dimensions	mm	see dimensional drawing	
weight	kg	2.1	
fixation		QuickFix pipe mounting fixture	
ambient temperature	°C	-10...+60	
display		2 x 16 characters, dot matrix, backlight	
menu language		English, German, French, Dutch, Spanish	
measuring functions			
physical quantities		operating volumetric flow rate, standard volumetric flow rate, mass flow rate, flow velocity	operating volumetric flow rate, mass flow rate, flow velocity
totaliser		volume, mass	
calculation functions		average, difference, sum	
diagnostic functions		sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times	
communication interfaces			
service interfaces		• RS232 • USB (with adapter)	
process interfaces		• Modbus RTU (optional)	
accessories			
data transmission kit • cable • adapter		 RS232 RS232 - USB	
software		• FluxDiagReader: reading of measured values and parameters, graphical representation • FluxDiag (optional): reading of measurement data, graphical representation, report generation	
adapter		AO5, AO6, AO7, AO8, AI1, AI2	
transport case		dimensions: 500 x 400 x 190 mm	

[1] with aperture calibration of the transducers

[2] test measurement to validate the application required in advance, especially for pipe diameters < 100 mm

[3] operating time extension using the power pack PP0026NN (optional, order code: ACC-PO-#601-/B6)

For the technical data in the flow measurement of liquids mode see Technical specification TSFLUXUS_F601V*-*.

		FLUXUS G601, G601ST	FLUXUS G601ST (steam measurement[2])
data logger			
loggable values		all physical quantities, totalised physical quantities and diagnostic values	
capacity		> 100 000 measured values	
outputs			
		The outputs are galvanically isolated from the transmitter.	
number		see standard scope of supply, max. on request	
• switchable current output			
		All switchable current outputs are jointly switched to active or passive.	
range	mA	4...20 (3.2...24)	
accuracy		0.04 % MV ±3 µA	
active output		U_{int} = 24 V, $U_{opencircuit}$ = 28 V (open circuit), R_{ext} < 500 Ω	
passive output		U_{ext} = 8...30 V, depending on R_{ext} (R_{ext} < 900 Ω at 30 V)	
• frequency output			
range	kHz	0...5	-
open collector		24 V/4 mA	-
• binary output			
optorelay		26 V/100 mA	
binary output as alarm output			
• functions		limit, change of flow direction or error	
binary output as pulse output			
• functions		mainly for totalising	
• pulse value	units	0.01...1000	
• pulse width	ms	1...1000	
inputs			
		The inputs are galvanically isolated from the transmitter.	
number		see standard scope of supply, max. 4	
• temperature input			
type		Pt100/Pt1000	
connection		4-wire	
range	°C	-150...+560	
resolution	K	0.01	
accuracy		±0.01 % MV ±0.03 K	
• current input			
accuracy		0.1 % MV ±10 µA	
passive input		R_{int} = 50 Ω, P_{int} < 0.3 W	
• range	mA	-20...+20	
• voltage input			
range	V	0...1	-
accuracy		0.1 % MV ±1 mV	-
internal resistance		R_{int} = 1 MΩ	-

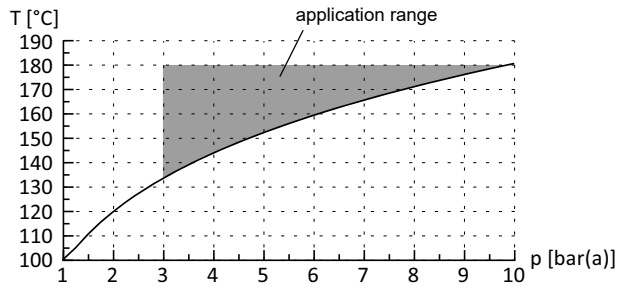
[1] with aperture calibration of the transducers

[2] test measurement to validate the application required in advance, especially for pipe diameters < 100 mm

[3] operating time extension using the power pack PP0026NN (optional, order code: ACC-PO-#601-/B6)

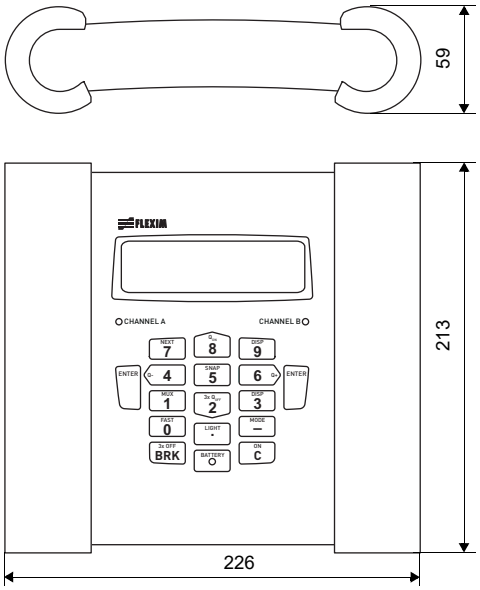
For the technical data in the flow measurement of liquids mode see Technical specification TSFLUXUS_F601V*-*.

Saturated steam pressure curve (steam measurement)



Dimensions

60



in mm

Storage

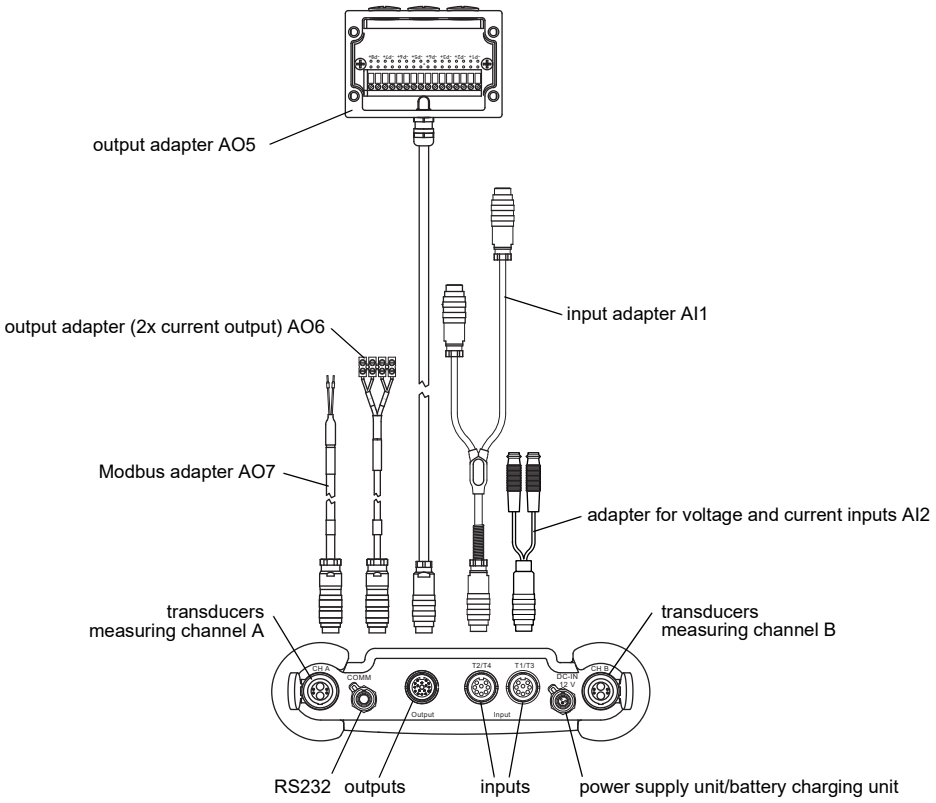
- do not store outdoors
- store within the original package
- store in a dry and dust-free place
- protect against sunlight
- keep all openings closed
- storing temperature: -10...+60 °C

Standard scope of supply

	G601 Basic	G601 CA-Energy	G601ST Steam
application	flow measurement of gas and liquids		
	2 independent measuring channels		
	calculation of standard volumetric flow rate	calculation of standard volumetric flow rate with optional use of current measured pressure and temperature values	
		liquids: integrated thermal energy computer for monitoring of energy flows	
			calculation of mass flow rate according to saturated steam pressure curve
outputs			
switchable current output	2	2	2
inputs			
temperature input	-	2	2
passive current input	-	2	2
accessories			
transport case	x	x	x
power supply unit, mains cable	x	x	x
battery	x	x	x
adapter	AO6	AO6, AI1, AI2	AO6, AI1, AI2
QuickFix pipe mounting fixture for transmitter	x	x	x
data transmission kit	x	x	x
measuring tape	x	x	x
operating instruction, Quick start guide	x	x	x

Adapters

***601**



Example of transport case equipment

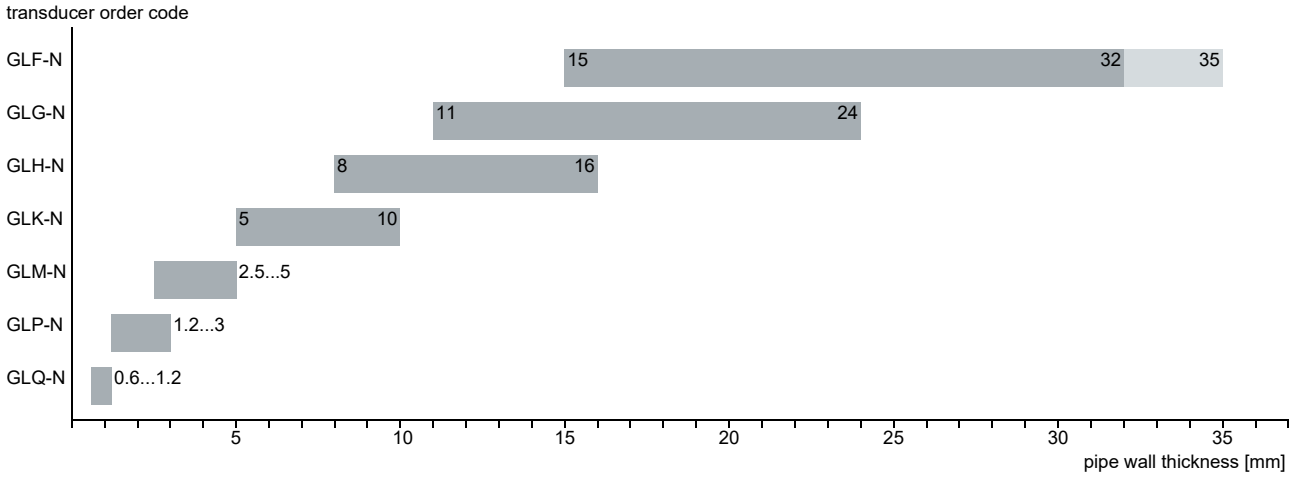
G601

Transducers

Transducer selection (gas measurement)

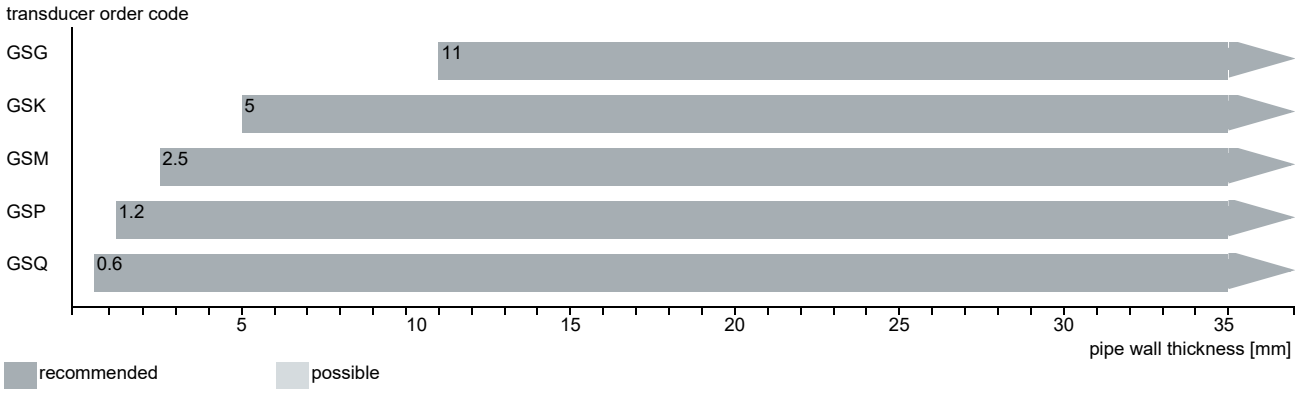
Step 1a

Select Lamb wave transducers:



Step 1b

If the pipe wall thickness is not in the range of the Lamb wave transducers, select a shear wave transducer:

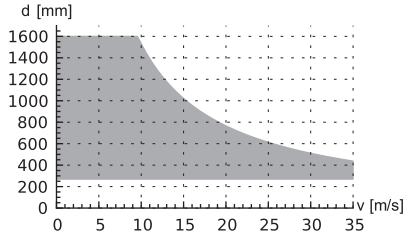
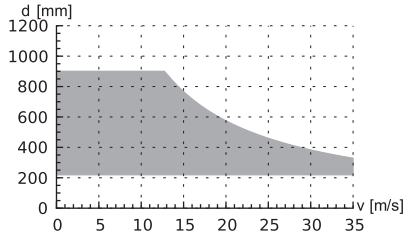
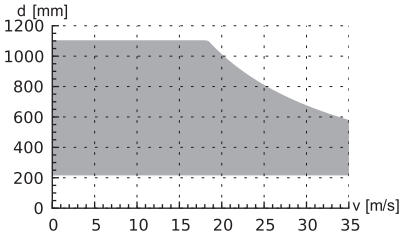
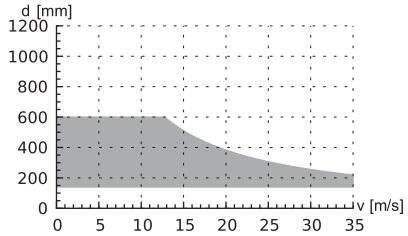
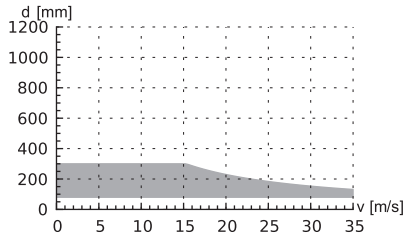
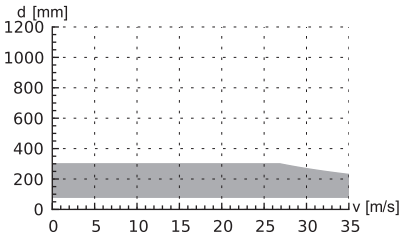
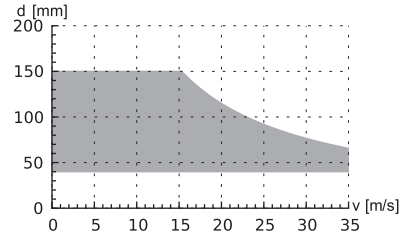
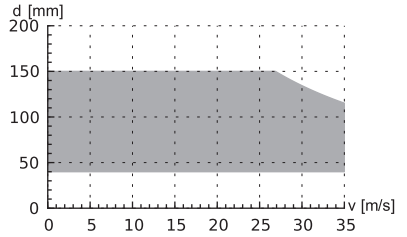
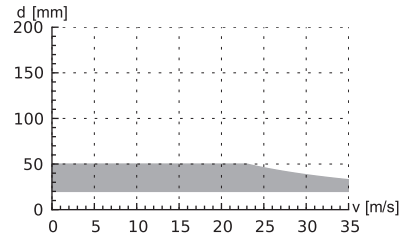
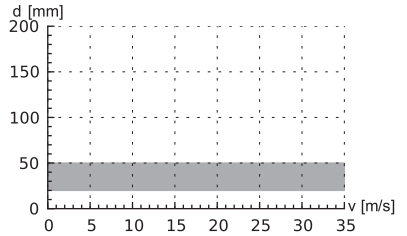
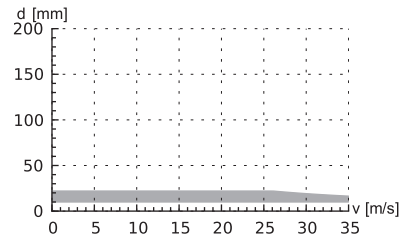
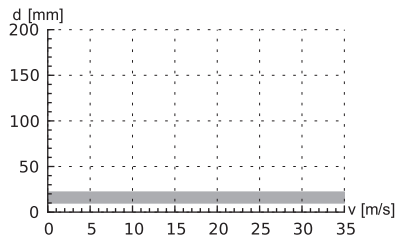


Step 2

inner pipe diameter d dependent on the flow velocity v of the fluid in the pipe

The transducers are selected from the characteristics (see next page). Lamb wave transducers are selected from the left column, shear wave transducers from the right column.

Lamb wave transducers: If the values d and v are not in the range, the diagonal arrangement with 1 sound path may be used, i.e. the same characteristics can be used with doubling the inner pipe diameter. If the values are still not in the range, shear waves transducers regarding the pipe wall thickness have to be selected in step 1b.

Lamb wave transducer[1]	shear wave transducer[1]
GLF 	
GLG 	GSG 
GLH 	
GLK 	GSK 
GLM 	GSM 
GLP 	GSP 
GLQ 	GSQ 

[1] inner pipe diameter and max. flow velocity for a typical application with natural gas, nitrogen, oxygen in reflection arrangement with 2 sound paths (Lamb wave transducers)/1 sound path (shear wave transducers)

Step 3

min. fluid pressure

Lamb wave transducer			
transducer order code	fluid pressure[1] [bar]		
	metal pipe		plastic pipe
	min.	min. extended	min.
GLF	15	10	1
GLG	15	10	1
GLH	15	10	1
GLK	15 (d > 120 mm) 10 (d < 120 mm)	10 (d > 120 mm) 3 (d < 120 mm)	1
GLM	10 (d > 60 mm) 5 (d < 60 mm)	3 (d < 60 mm)	1
GLP	10 (d > 35 mm) 5 (d < 35 mm)	3 (d < 35 mm)	1
GLQ	10 (d > 15 mm) 5 (d < 15 mm)	3 (d < 15 mm)	1

shear wave transducer			
transducer order code	fluid pressure[1] [bar]		
	metal pipe		plastic pipe
	min.	min. extended	min.
GSG	30	20	1
GSK	30	20	1
GSM	30	20	1
GSP	30	20	1
GSQ	30	20	1

[1] depending on the application, typical absolute value for natural gas, nitrogen, compressed air

d - inner pipe diameter

Example

step					
1	pipe wall thickness	mm	14.3	8.6	38
	selected transducer		GLG or GLH	GLH or GLK	GS
2	inner pipe diameter	mm	581	96.8	143
	max. flow velocity	m/s	15	30	30
	selected transducer		GLG	GLK	GSK
3	min. fluid pressure	bar	20	15	40
	selected transducer		GLG	GLK	GSK

Step 4

for the characters 4...11 of the transducer order code (ambient temperature, explosion protection, connection system, extension cable) see page 15

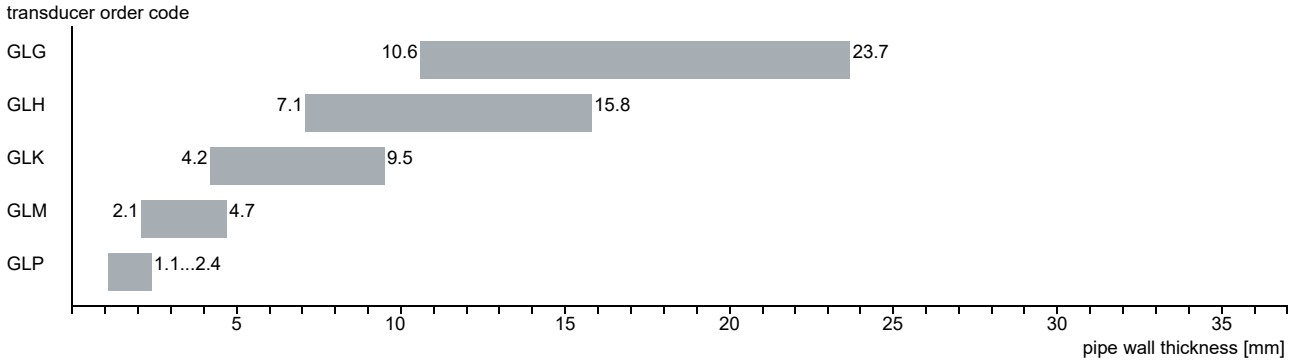
Step 5

for the technical data of the selected transducer see page 16 et seqq.

Transducer selection (G**1S*3, steam measurement)

Step 1

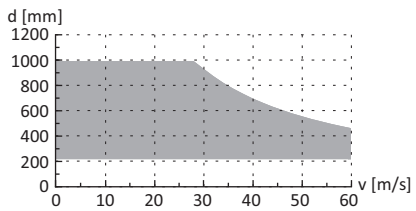
pipe wall thickness

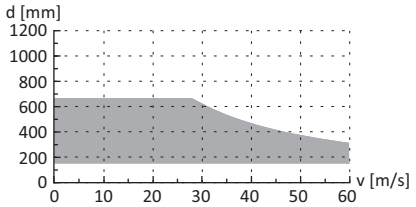


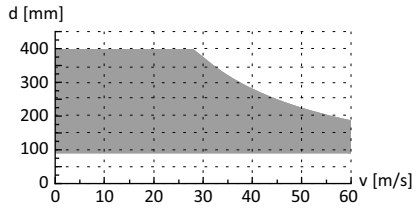
Step 2

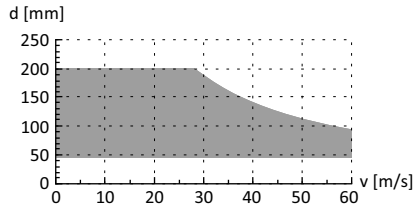
inner pipe diameter d dependent on the flow velocity v of the fluid in the pipe

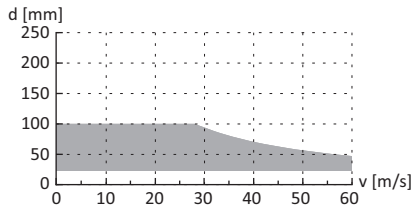
Diagonal arrangement, number of sound paths: 1



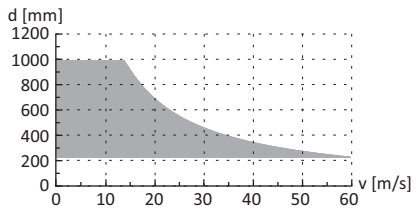


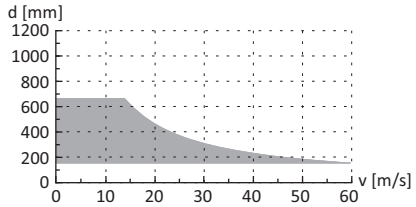


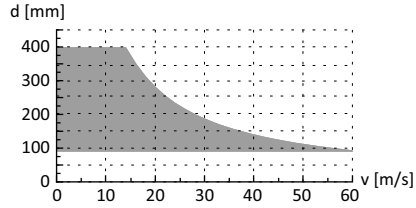


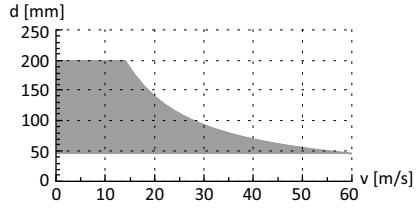


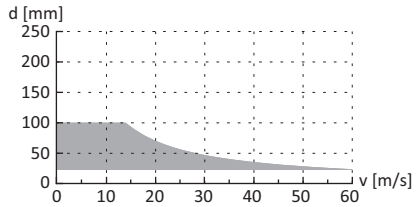
Reflection arrangement, number of sound paths: 2











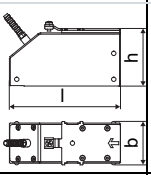
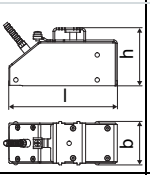
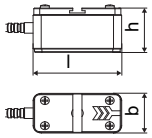
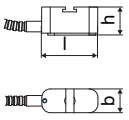
inner pipe diameter and max. flow velocity for a steam application

Transducer order code

1, 2	3		4	5...7		8, 9	10, 11		12...14	no. of character
transducer	**transducer frequency**	**-**	**ambient temperature**	**explosion protection**	**-**	**certification**	**connection system**	**-**	**cable length**	**description**
GS										set of ultrasonic flow transducers for Gas Measurement, shear wave
GL										set of ultrasonic flow transducers for Gas Measurement, Lamb wave
	F									0.15 MHz
	G									0.2 MHz
	H									0.3 MHz
	K									0.5 MHz
	M									1 MHz
	P									2 MHz
	Q									4 MHz
			N							normal temperature range
			E							extended temperature range
			S							higher temperatures
				NNN						not explosion-proof
						**				
							NL			with LEMO connector
									***	in m

Technical data

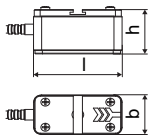
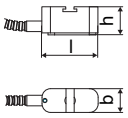
Shear wave transducers (nonEx, NL)

order code		GSG-NNNN-**NL	GSK-NNNN-**NL	GSM-NNNN-**NL	GSP-NNNN-**NL	GSQ-NNNN-**NL
technical type		G(DL)G1NZ7	G(DL)K1NZ7	G(DL)M1NZ7	G(DL)P1NZ7	G(DL)Q1NZ7
transducer frequency	MHz	0.2	0.5	1	2	4
fluid pressure[1]						
min. extended	bar	metal pipe: 20				
min.	bar	metal pipe: 30, plastic pipe: 1				
inner pipe diameter d[2]						
min. extended	mm	180	60	30	15	7
min. recommended	mm	220	80	40	20	10
max. recommended	mm	900	300	150	50	22
max. extended	mm	1100	360	180	60	30
pipe wall thickness						
min.	mm	11	5	2.5	1.2	0.6
material						
housing		PEEK with stainless steel cover 304 (1.4301)		stainless steel 304 (1.4301)		
contact surface		PEEK		PEEK		
degree of protection		IP66		IP66		
transducer cable						
type		1699				
length	m	5		4		3
dimensions						
length l	mm	129.5	126.5	60		42.5
width b	mm	51	51	30		18
height h	mm	67	67.5	33.5		21.5
dimensional drawing						
weight (without cable)	kg	0.47	0.36	0.035		0.011
pipe surface temperature	°C	-40...+130				
ambient temperature	°C	-40...+130				
temperature compensation		x				

[1] depending on the application, typical absolute value for natural gas, nitrogen, compressed air

[2] shear wave transducer:
typical values for natural gas, nitrogen, oxygen; pipe diameters for other fluids on request
inner pipe diameter max. recommended/max. extended: in reflection arrangement and for a flow velocity of 15 m/s

Shear wave transducers (nonEx, NL, extended temperature range)

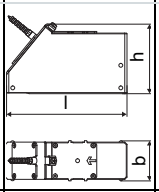
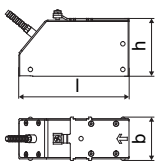
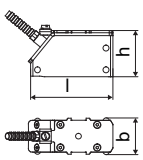
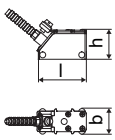
order code		GSM-ENNN-**NL	GSP-ENNN-**NL	GSQ-ENNN-**NL
technical type		G(DL)M1EZ7	G(DL)P1EZ7	G(DL)Q1EZ7
transducer frequency	MHz	1	2	4
fluid pressure[1]				
min. extended	bar	metal pipe: 20		
min.	bar	metal pipe: 30, plastic pipe: 1		
inner pipe diameter d[2]				
min. extended	mm	30	15	7
min. recommended	mm	40	20	10
max. recommended	mm	150	50	22
max. extended	mm	180	60	30
pipe wall thickness				
min.	mm	2.5	1.2	0.6
material				
housing		stainless steel 304 (1.4301)		
contact surface		Sintimid		
degree of protection		IP66		
transducer cable				
type		1699		
length	m	4		3
dimensions				
length l	mm	60		42.5
width b	mm	30		18
height h	mm	33.5		21.5
dimensional drawing				
weight (without cable)	kg	0.042		0.011
pipe surface temperature	°C	-30...+200		
ambient temperature	°C	-30...+200		
temperature compensation		x		

[1] depending on the application, typical absolute value for natural gas, nitrogen, compressed air

[2] shear wave transducer:
typical values for natural gas, nitrogen, oxygen; pipe diameters for other fluids on request
inner pipe diameter max. recommended/max. extended: in reflection arrangement and for a flow velocity of 15 m/s

Lamb wave transducers

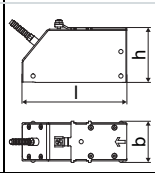
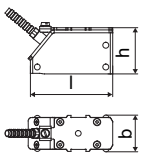
Lamb wave transducers (nonEx, NL)

order code		GLF-NNNN-**NL	GLG-NNNN**NL	GLH-NNNN-**NL	GLK-NNNN-**NL	GLM-NNNN-**NL	GLP-NNNN-**NL	GLQ-NNNN-**NL
technical type		G(RT)F1NC3	G(RT)G1NC3	G(RT)H1NC3	G(RT)K1NC3	G(RT)M1NC3	G(RT)P1NC3	G(RT)Q1NC3
transducer frequency	MHz	0.15	0.2	0.3	0.5	1	2	4
fluid pressure[1]								
min. extended	bar	metal pipe: 10			metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)	metal pipe: 3 (d < 60 mm)	metal pipe: 3 (d < 35 mm)	metal pipe: 3 (d < 15 mm)
min.	bar	metal pipe: 15 plastic pipe: 1			metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1	metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1	metal pipe: 10 (d > 15 mm) 5 (d < 15 mm) plastic pipe: 1
inner pipe diameter d[2]								
min. extended	mm	220	180	110	60	30	15	7
min. recommended	mm	270	220	140	80	40	20	10
max. recommended	mm	1200	900	600	300	150	50	22
max. extended	mm	1600	1400	1000	360	180	60	30
pipe wall thickness								
min.	mm	15	11	8	5	2.5	1.2	0.6
max.	mm	32	24	16	10	5	3	1.2
max. extended	mm	35	-	-	-	-	-	-
material								
housing		PPSU with stainless steel cover 316Ti (1.4571)	PPSU with stainless steel cover 304 (1.4301)					
contact surface		PPSU						
degree of protection		IP66/IP67	IP66					
transducer cable								
type		1699						
length	m	5				4		3
dimensions								
length l	mm	163	128.5			74		42
width b	mm	54	51			32		22
height h	mm	91.3	67.5			40.5		25.5
dimensional drawing								
weight (without cable)	kg	0.935	0.471			0.077		0.019
pipe surface temperature	°C	-40...+130						
ambient temperature	°C	-40...+130						
temperature compensation		x						

[1] depending on the application, typical absolute value for natural gas, nitrogen, compressed air

[2] Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen; pipe diameters for other fluids on request
inner pipe diameter max. recommended: in reflection arrangement (diagonal arrangement) and for a flow velocity of 15 m/s (30 m/s)
inner pipe diameter max. extended: in reflection arrangement (diagonal arrangement) and for a flow velocity of 12 m/s (25 m/s)

Lamb wave transducers (nonEx, steam measurement, NL)

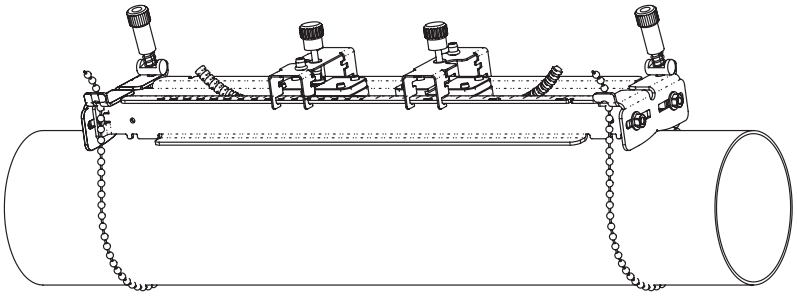
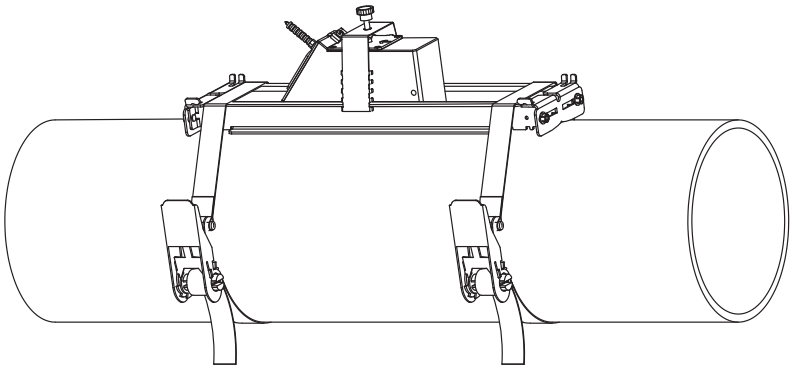
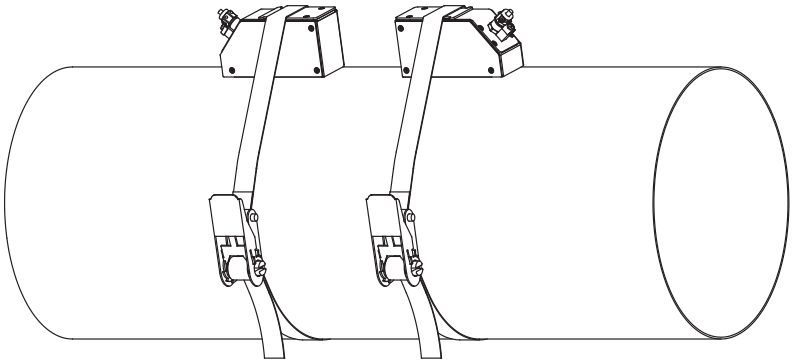
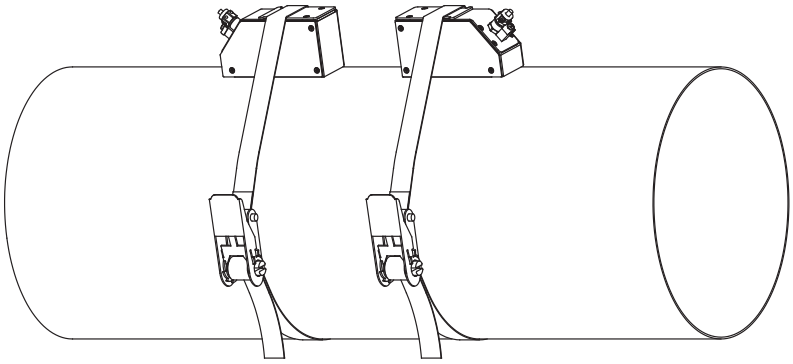
order code		GLG-SNNN-**NL	GLH-SNNN-**NL	GLK-SNNN-**NL	GLM-SNNN-**NL	GLP-SNNN-**NL
technical type		G(RT)G1SC3	G(RT)H1SC3	G(RT)K1SC3	G(RT)M1SC3	G(RT)P1SC3
transducer frequency	MHz	0.2	0.3	0.5	1	2
fluid pressure		see saturated steam pressure curve				
inner pipe diameter d						
min.	mm	225	150	90	45	23
max.	mm	1000	667	400	200	100
pipe wall thickness						
min.	mm	10.6	7.1	4.2	2.1	1.1
max.	mm	23.7	15.8	9.5	4.7	2.4
material						
housing		PPSU with stainless steel cover 316Ti (1.4571)				
contact surface		PPSU				
degree of protection		IP66				
transducer cable						
type		1699				
length	m	5			4	
length (***-*****/LC)	m	9			9	
dimensions						
length l	mm	128.5			74	
width b	mm	51			32	
height h	mm	67.5			40.5	
dimensional drawing						
weight (without cable)	kg	0.8			0.16	
storing temperature	°C	-40...+180				
operating temperature	°C	100...180				
warm-up time	h	3			1	
temperature compensation		x				

completely thermically insulated transducer installation necessary

Transducer mounting fixture

Order code

1, 2	3		4	5		6	7...10	no. of character
transducer mounting fixture	**transducer**	**-**	**measurement arrangement**	**size**	**-**	**fixation**	**outer pipe diameter**	**description**
VP								portable Variofix
	A							all transducers
			D					reflection arrangement or diagonal arrangement
			R					reflection arrangement
				M				medium
						C		chains
						G		tension belts
						H		high-temperature tension belts
							0100	10...100 mm
							0250	10...250 mm
							0550	10...550 mm
							0600	50...600 mm
							1500	50...1500 mm
							2100	50...2100 mm

portable Variofix VP and chains 	material: stainless steel 304 (1.4301), 301 (1.4310), 303 (1.4305) dimensions: 414 x 94 x 76 mm chain length: 2 m
portable Variofix VP and tension belts 	
tension belts 	material: steel, powder coated and textile tension belt length: 5/7 m ambient temperature: max. 60 °C outer pipe diameter: max. 1500/2100 mm
high-temperature tension belts 	material: clasp: stainless steel 304 (1.4301) tension belt: Aramid length: 2/5 m ambient temperature: max. 260 °C outer pipe diameter: max. 600/1500 mm

Coupling materials for transducers

normal temperature range (4th character of transducer order code = N) **extended temperature range** (4th character of transducer order code = E)	**steam measurement** (4th character of transducer order code = S)
	< 180 °C
coupling compound type E	coupling compound type E[1] and coupling foil type VT

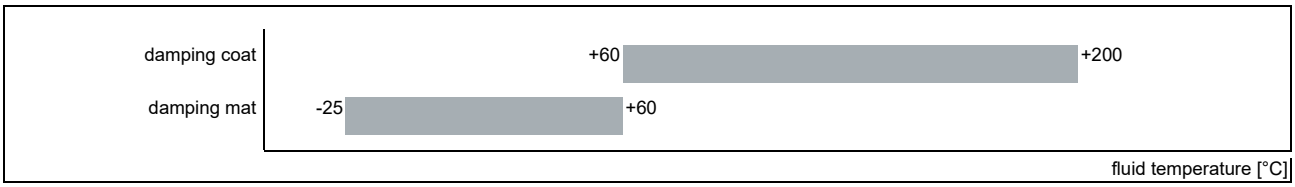
[1] in combination with type VT only

Technical data

type	**ambient temperature** °C	**remark**
coupling compound type E (Elbesil BL)	-30...+200	
coupling foil type VT	-10...+200	fluid temperature 200 °C: min. 2 years

Damping material (optional)

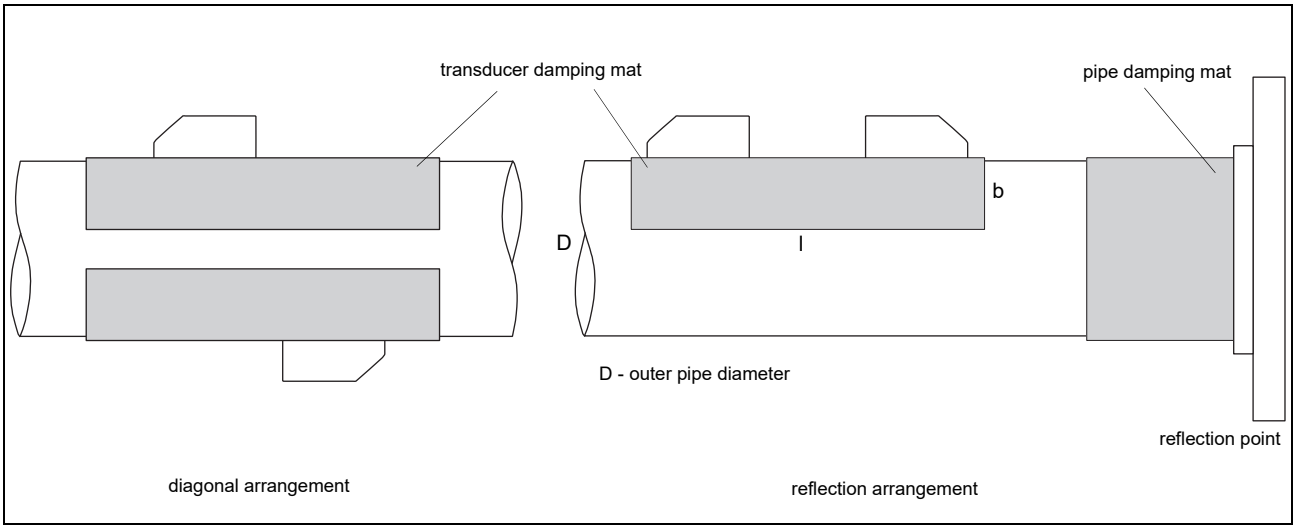
Damping material will be used for the gas measurement to reduce acoustic noise influences on the measurement.



Damping mats

Transducer damping mats will be installed below the transducers.

Pipe damping mats will be installed at reflection points, e.g. flange, weld.



Selection of damping mats

type	description	outer pipe diameter mm	dimensions l x b x h mm	transducer frequency F	G	H	K	M	P	Q	technical type	ambient temperature °C	remark
transducer damping mat													
D	for temporary installation (multiple use), fixed with coupling compound	< 80	450 x 115 x 0.5	-	-	-	-	x	x	x	D20S3	-25...+60	
		≥ 80	900 x 230 x 0.5	-	-	-	x	x	-	-	D20S2		
			900 x 230 x 1.3	x	x	x	-	-	-	-	D50S2		
pipe damping mat													
A	for temporary installation (multiple use), fixed with coupling compound	< 300	300 x 115 x 0.5	x	x	x	x	x	x	x	A20S4	-25...+60	for quantity see table below

Quantity for pipe damping mat - type A

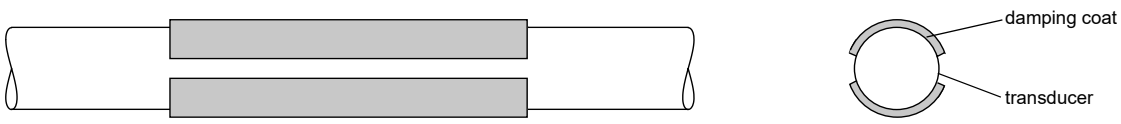
(depending on outer pipe diameter)

outer pipe diameter D mm	transducer frequency F, G, H	K, M, P, Q
100	12	6
200	24	12
300	32	16

Damping coat

For high temperatures it is recommended to apply the damping coat onto the pipe. In case of steam measurement it is mandatory.

Example (diagonal arrangement)



Technical data

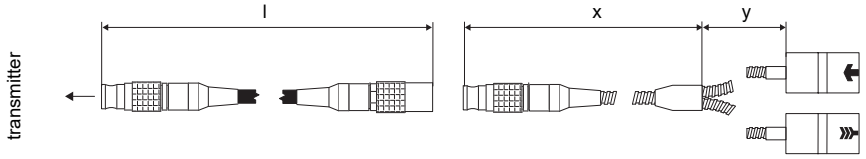
item number		992080-13
material		multipolymeric matrix/inorganic ceramic coating
packing drum	l	1
properties		heat-resistant, inert
fluid temperature when applying	°C	10...200
drying time (example)		approx. 3 h at 20 °C approx. 15 min at 150 °C
temperature resistance in dry state	°C	max. 650
durability of the packing drum (unopened)		2 years

Observe installation instructions (TI_DampingCoat).

Dimensioning

transducer frequency	**number of packing drums**		
	outer pipe diameter		
	≤300	≤500	≤700
	mm		
F	3	4	5
G	2	3	4
H	2	2	3
K	2	2	-
M	2	-	-
P	1	-	-
Q	1	-	-

Connection systems

connection system NL	
direct connection/connection with extension cable	transducers technical type
	*****Z7 *****C3

Cable

transducer cable		
type		**1699**
weight	kg/m	0.094
ambient temperature	°C	-55...+200
cable jacket		
material		PTFE
outer diameter	mm	2.9
thickness	mm	0.3
colour		brown
shield		x
sheath		
material		stainless steel 316Ti (1.4571)
outer diameter	mm	8

extension cable			
type		**1750**	**2551**
standard length	m	5 10	-
max. length	m	10	see table below
weight	kg/m	0.12	0.083
ambient temperature	°C	< 80	-25...+80
cable jacket			
material		PE	TPE-O
outer diameter	mm	6	8
thickness	mm	0.5	
colour		black	black
shield		x	x
sheath			
material		stainless steel 304 (1.4301)	-
outer diameter	mm	9	-
remark		optional	

Cable length

transducer frequency		F, G, H, K			M, P			Q			S		
transducers technical type		x	y	l	x	y	l	x	y	l	x	y	l
*D***Z7[1] *R***C3[1]	m	2	3	≤ 25	2	2	≤ 25	2	1	≤ 25	1	1	≤ 20
*L***Z7[1] *T***C3[1]	m	2	7	≤ 25	7	2	≤ 25	8	1	≤ 25	-	-	-

[1] l > 25...100 m on request

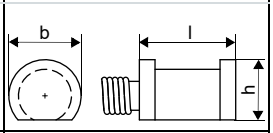
x, y - transducer cable length

l - max. length of extension cable

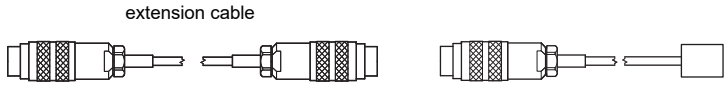
Clamp-on temperature probe (optional)

Technical data

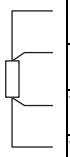
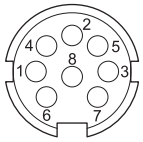
PT12N

item number		• 670415-1 • 670414-1 (matched)
design		clamp-on with connector
type		Pt100
connection		4-wire
measuring range	°C	-30...+250
accuracy T		±(0.15 °C + 2 · 10^{-3} · |T [°C]|) class A
accuracy ΔT (2x Pt matched according to EN 1434-1)		≤ 0.1 K (3 K < ΔT < 6 K), more corresponding to EN 1434-1
response time	s	50 (t50, T1 = 25 °C, T2 = 60 °C)
housing material		aluminum
degree of protection		IP54
dimensions		
length l	mm	20
width b	mm	15
height h	mm	13
dimensional drawing		
weight	kg	0.25 (without connector)
accessories		
thermal conductivity paste 200 °C		x
thermal conductivity foil 250 °C		x

Connection system

direct connection/connection with extension cable


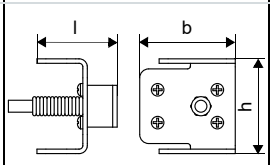
Connection

	temperature probe	extension cable	connector	
			pin	
	red	grey	2	
	red/blue	red	6	
	white/blue	blue	1	
	white	white	7	

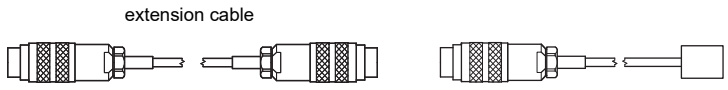
Cable

		temperature probe	extension cable
type		4 x 0.22 mm²	LIYCY 8 x 0.14 mm²
standard length	m	3	5/10/25
max. length	m	-	200
ambient temperature	°C	-30...+250	-25...+80
min. bend radius	mm	27	68
cable jacket			
material		PFA	PVC
outer diameter	mm	3.8 ±0.15	4.8 ±0.2
colour		black	grey

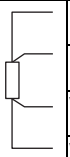
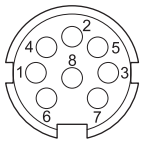
PT12F

item number		• 670415-2 • 670414-2 (matched)
design		clamp-on short response time, with connector
type		Pt100
connection		4-wire
measuring range	°C	-50...+250
accuracy T		±(0.15 °C + 2 · 10^{-3} · |T [°C]|) class A
accuracy ΔT (2x Pt matched according to EN 1434-1)		≤ 0.1 K (3 K < ΔT < 6 K), more corresponding to EN 1434-1
response time	s	8 (t50, T1 = 25 °C, T2 = 60 °C)
housing material		PEEK, stainless steel 304 (1.4301), copper
degree of protection		IP54
dimensions		
length l	mm	14
width b	mm	30
height h	mm	27
dimensional drawing		
weight	kg	0.32 (without connector)
accessories		
thermal conductivity paste 200 °C		x
thermal conductivity foil 250 °C		x
plastic protection plate, insulation foam		x

Connection system

direct connection/connection with extension cable


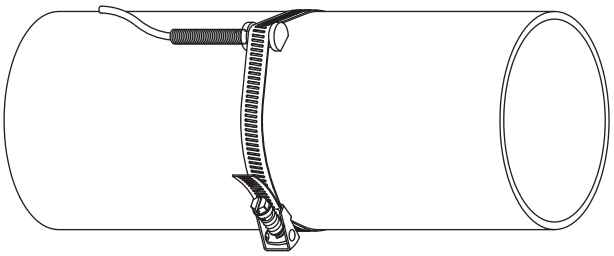
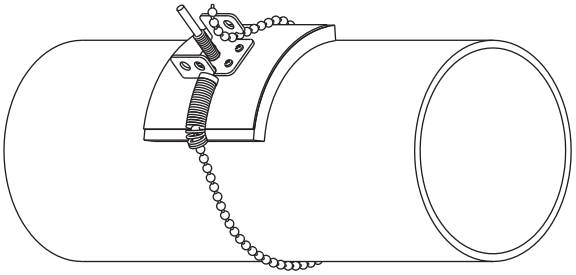
Connection

	temperature probe	extension cable	connector	
			pin	
	red	grey	2	
	red/blue	red	6	
	white/blue	blue	1	
	white	white	7	

Cable

		temperature probe	extension cable
type		4 x 0.22 mm²	LIYCY 8 x 0.14 mm²
standard length	m	3	5/10/25
max. length	m	-	200
ambient temperature	°C	-50...+250	-25...+80
min. bend radius	mm	27	68
cable jacket			
material		PFA	PVC
outer diameter	mm	3.8 ±0.15	4.8 ±0.2
colour		black	grey

Fixation

tension strap PT12N 	material: stainless steel 301 (1.4310), 410 (1.4006) thermal insulation necessary
ball chain PT12F 	material: stainless steel 316L (1.4404) length: 1 m

Wall thickness measurement (optional)

The pipe wall thickness is an important pipe parameter which has to be determined exactly for a good measurement. However, the pipe wall thickness often is unknown.

The wall thickness probe can be connected to the transmitter instead of the flow transducers and the wall thickness measurement mode is activated automatically.

Acoustic coupling compound is applied to the wall thickness probe which then is placed firmly on the pipe. The wall thickness is displayed and can be stored directly in the transmitter.

Technical data

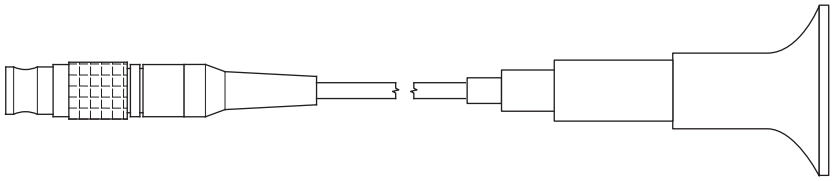
		DWR1NZ7
item number		600522-0
measuring range[1]	mm	1...250
resolution	mm	0.01
accuracy		1 % ±0.1 mm
fluid temperature	°C	-20...+200, short-time peak max. 500
cable		
type		2616
length	m	1.5

[1] The measuring range depends on the attenuation of the ultrasonic signal in the pipe. For strongly attenuating plastics (e.g. PFA, PTFE, PP) the measuring range is smaller.

Cable

		2616
ambient temperature	°C	<200
cable jacket		
material		FEP
outer diameter	mm	5.1
colour		black
shield		x

DWR1NZ7



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