

Portable ultrasonic flowmeter for gas, steam and liquids in explosive atmospheres

Portable instrument for non-invasive, quick ultrasonic flow measurement with clamp-on technology for all types of piping

Features

- Configurable as multifunctional measuring system:
 - 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 with a serial interface
- Water tight; resistant against oil, many liquids and dirt
- Extremely resistant carbon fiber housing
- Robust, water-tight (IP67) transport case with comprehensive accessories
- Compact and very lightweight, allowing the measuring system to be easily carried as personal luggage, e.g. for offshore visits
- Covered by ATEX/IECEx zone 2 certification
- Li-Ion battery provides up to 25 hours of measurement operation
- User-friendly design
- QuickFix for a simple and fast transmitter fixation, e.g. on pipes
- Transducers available for a wide range of inner pipe diameters and fluid temperatures
- Rugged transducers (ATEX/IECEx zone 1 and 2, resistant to rough environments, dust and humidity)

Applications

Designed for the following industries:

- Upstream (on- and offshore)
- Midstream and downstream (pipelines and refineries)
- Chemical industry
- Energy sector (e.g. HVAC, geothermal, power plants)



FLUXUS G608



Measurement with transducers mounted with the portable Variofix VP



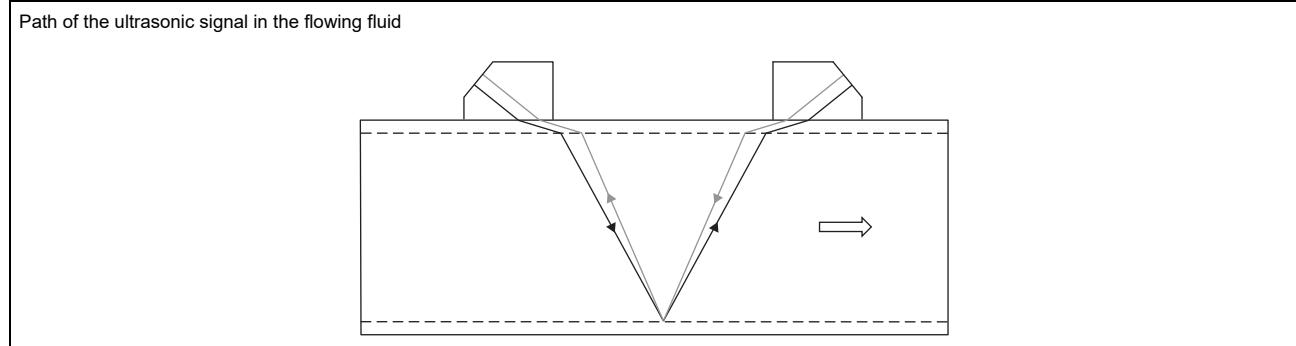
Measurement with the flow transmitter fixed to the pipe with the QuickFix pipe mounting fixture

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Function

Measurement principle

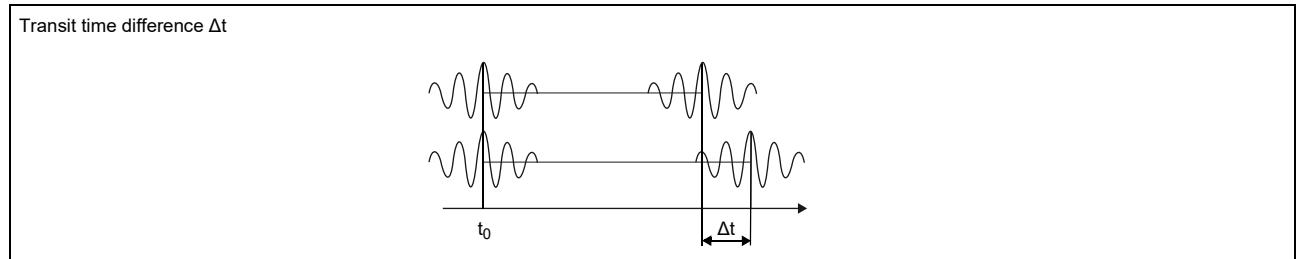
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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.



Calculation of volumetric flow rate

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

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_y - 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. If temperature inputs are installed (optional), the 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**

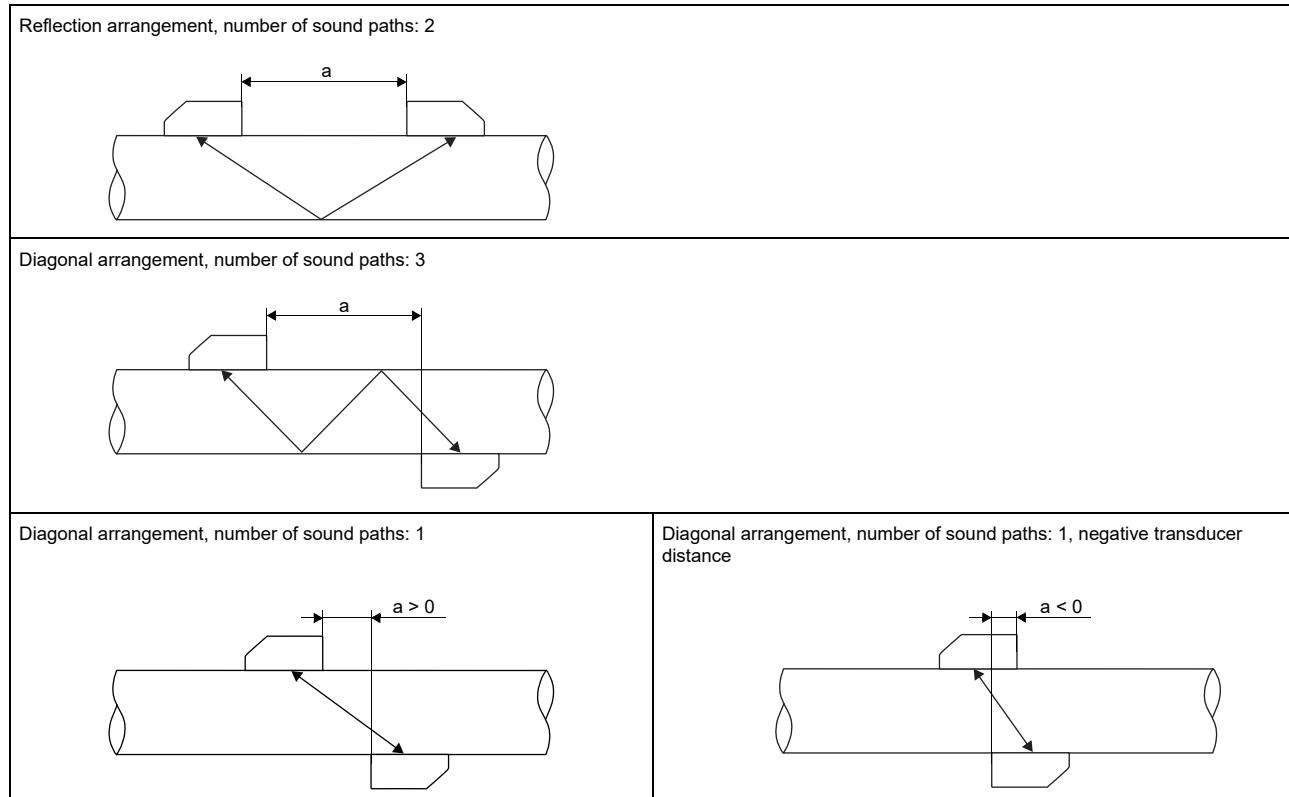
The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easy.

- **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.

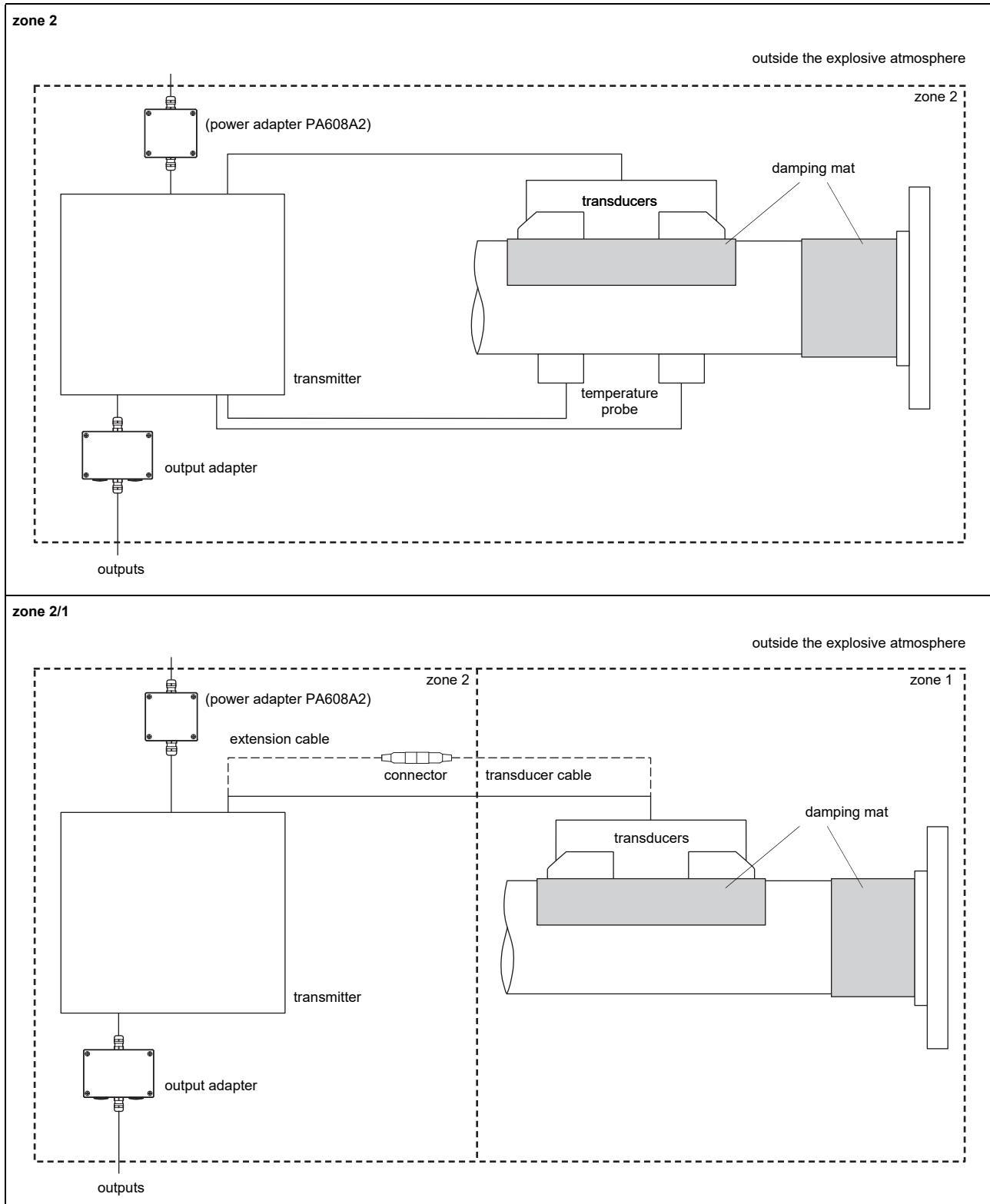
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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



a - transducer distance

Typical measurement setup



Transmitter

Technical data

		FLUXUS G608**-A2	FLUXUS G608ST-A2 (steam measurement ²)
			
design	portable, zone 2		
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 transducers zone 2: max. 165 transducers zone 1: max. 155
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		<ul style="list-style-type: none"> • 100...230 V/50...60 Hz (power supply unit, outside the explosive atmosphere) • 10.5...15 V DC (socket at transmitter, with power adapter PA608A2 (optional) and power connection adapter PA608NN (optional)) • integrated battery 	
integrated battery		Li-Ion, 7.2 V/6.2 Ah, max. 47 Wh	
• operating time	h	> 14 (without outputs, inputs and backlight) > 25 (1 measuring channel, ambient temperature > 10 °C, without outputs, inputs and backlight)	
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, TPS, PC, Polyester, stainless steel	
degree of protection		IP65	
dimensions	mm	see dimensional drawing	
weight	kg	2.2	
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	

¹ with aperture calibration of the transducers

² test measurement to validate the application required in advance (especially for pipe diameters < 100 mm)

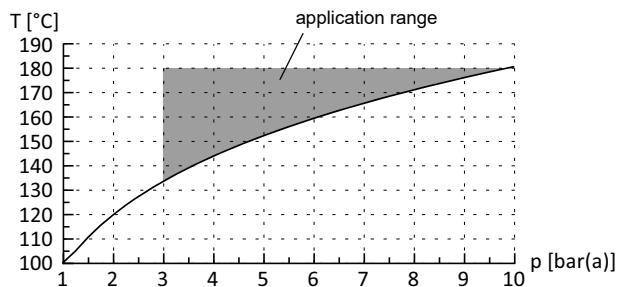
For the technical data in the flow measurement of liquids mode see Technical specification TSFLUXUS_F608xx-A2V*-*.

	FLUXUS G608**-A2		FLUXUS G608ST-A2 (steam measurement ²)		
explosion protection					
• ATEX/IECEx					
marking	without inputs (608-A): II3G II2D Ex nA nC ic IIC (T6)T4 Gc Ex tb IIIC T100 °C Db T _a -10...+(50)60 °C with inputs (608-B): II3G II2D Ex nA nC ic [ic] IIC (T6)T4 Gc Ex tb IIIC T100 °C Db T _a -10...+(50)60 °C				
certification	IBExU10ATEX1067, IECEx IBE 12.0006				
intrinsic safety parameters	U _m = 16 V DC intrinsically safe inputs: U _o = 22 V, I _o = 6 mA, P _o = 33 mW, C _o = 450 nF, L _o = 10 mH C _i = 1.8 nF, L _i = 10 µH				
measuring functions					
physical quantities	operating volumetric flow rate, standard volumetric flow rate, mass flow rate, flow velocity				
totaliser	mass, volume				
calculation functions	average, difference, sum				
diagnostic functions	sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times				
communication interfaces					
service interfaces	<ul style="list-style-type: none"> RS232 USB (with adapter) 				
accessories					
data transmission kit					
• cable	RS232				
• adapter	RS232 - USB				
software	<ul style="list-style-type: none"> FluxDiagReader: reading of measured values and parameters, graphical representation FluxDiag (optional): reading of measurement data, graphical representation, report generation 				
adapter	<ul style="list-style-type: none"> output adapter (necessary, option) input adapter (if number of inputs > 2) 				
transport case	dimensions: 500 x 400 x 190 mm				
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	analog outputs: max. 4 <ul style="list-style-type: none"> 0, 2 or 4 active current outputs or passive current outputs or frequency outputs or 2 active current outputs and 2 passive current outputs or 2 active current outputs and 2 frequency outputs or 2 passive current outputs and 2 frequency outputs binary outputs: max. 4				
• current output					
range	mA	0/4...20			
accuracy		0.1 % MV ±15 µA			
active output		R _{ext} < 200 Ω			
passive output		U _{ext} = 4...9 V, depending on R _{ext} (R _{ext} < 200 Ω at 9 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	max. 4				
• temperature input					
type		Intrinsic safety			
connection		Pt100/Pt1000			
range	°C	-150...+560			
resolution	K	0.01			
accuracy		±0.01 % MV ±0.03 K			

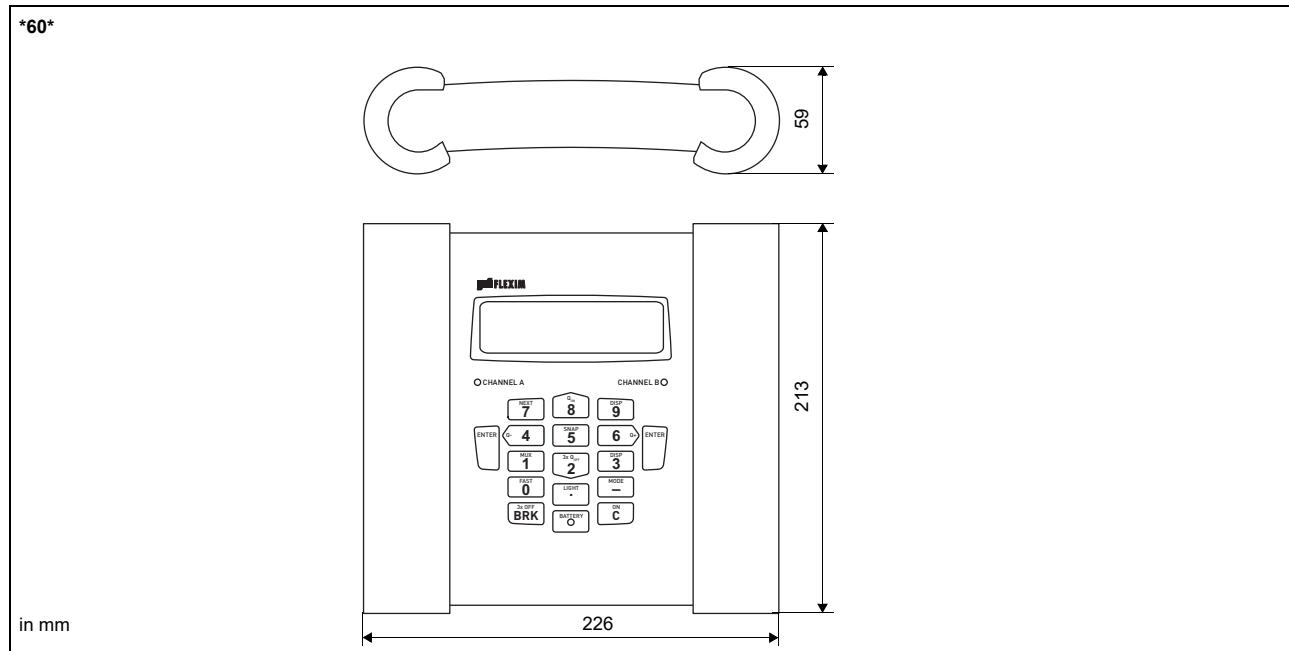
¹ with aperture calibration of the transducers² test measurement to validate the application required in advance (especially for pipe diameters < 100 mm)

For the technical data in the flow measurement of liquids mode see Technical specification TSFLUXUS_G608xx-A2V*-*.

Saturated steam pressure curve



Dimensions



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

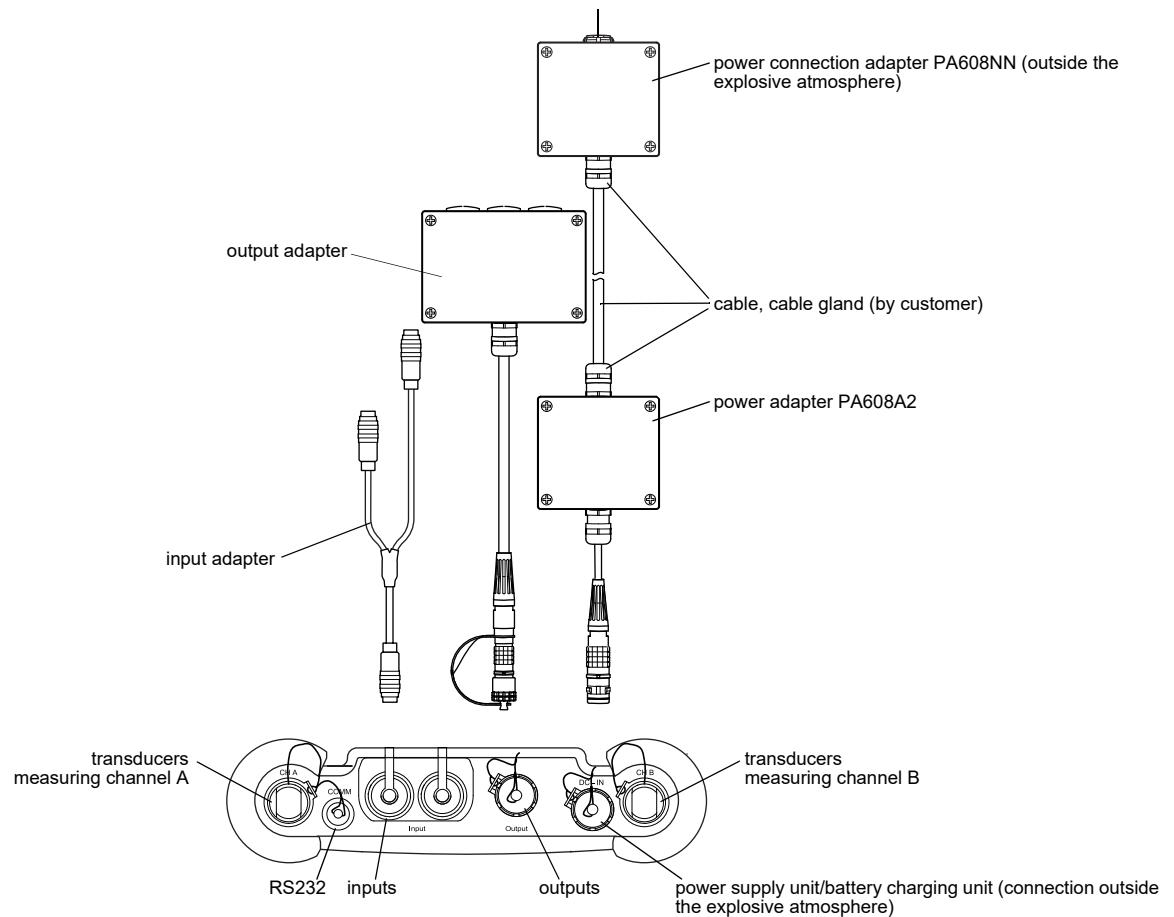
	G608 Standard	G608 CA-Energy	G608ST-A2 Steam
application	flow measurement of gas and liquids 2 independent measuring channels calculation of standard volumetric flow rate liquids: integrated thermal energy computer for monitoring of energy flows	calculation of standard volumetric flow rate with optional use of current measured temperature values calculation of mass flow rate according to saturated steam pressure curve	
outputs			
passive current output	2	2	2
inputs			
temperature input	-	4	4
accessories			
transport case	x	x	x
power supply unit, mains cable	x	x	x
battery	x	x	x
power adapter PA608A2 ¹	-	-	-
power connection adapter PA608NN ¹	-	-	-
output adapter ¹	-	-	-
input adapter	-	2	2
QuickFix pipe mounting fixture for transmitter	x	x	x
data transmission kit	x	x	x
measuring tape	x	x	x
wall thickness probe	-	x	x
operating instruction, safety instructions, Quick start guide	x	x	x
connector board at the upper side of the transmitter			

¹ to be ordered separately, if required

Adapters

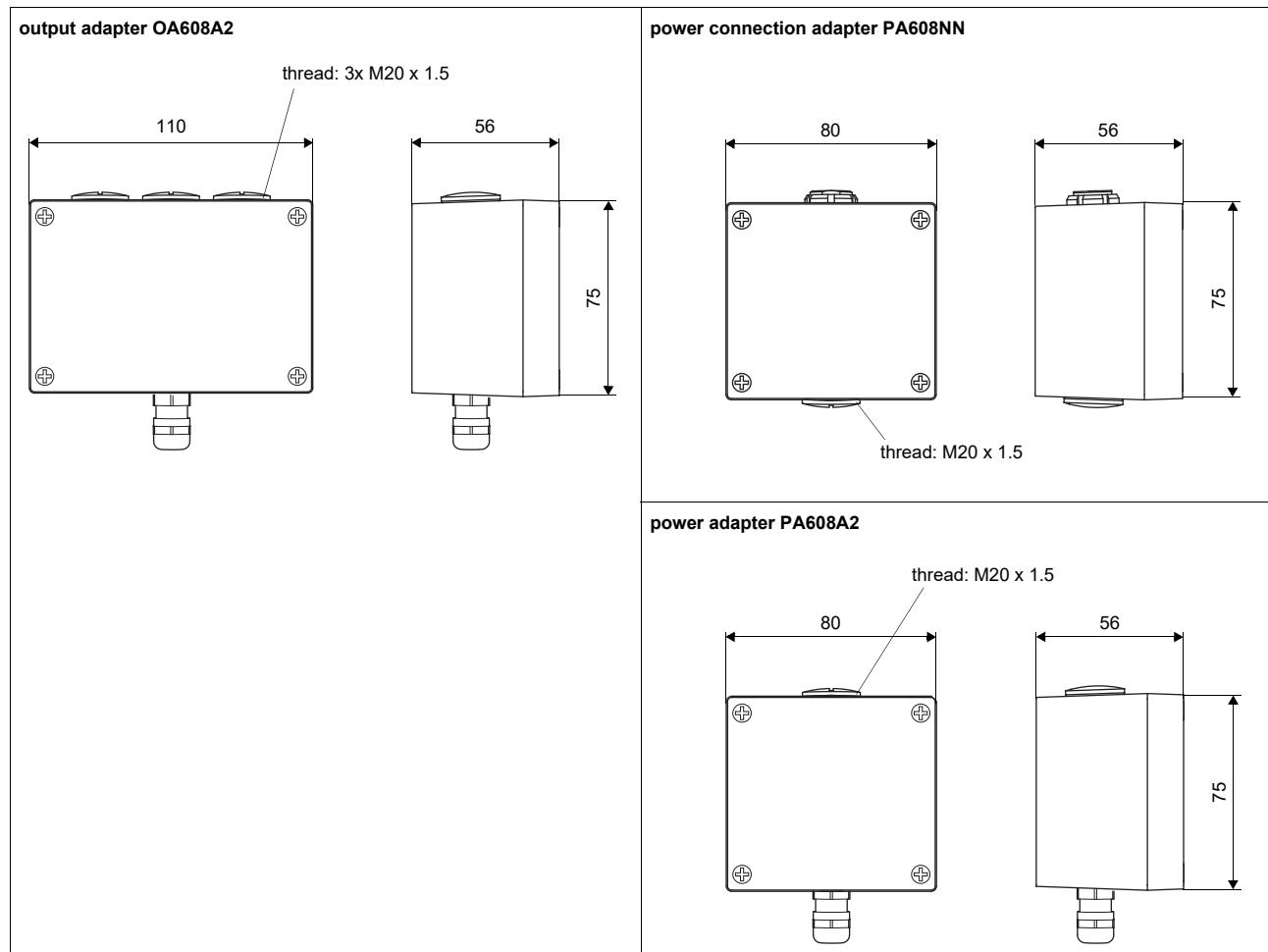
*608**-A2

power supply unit/battery charging unit (connection during operation)



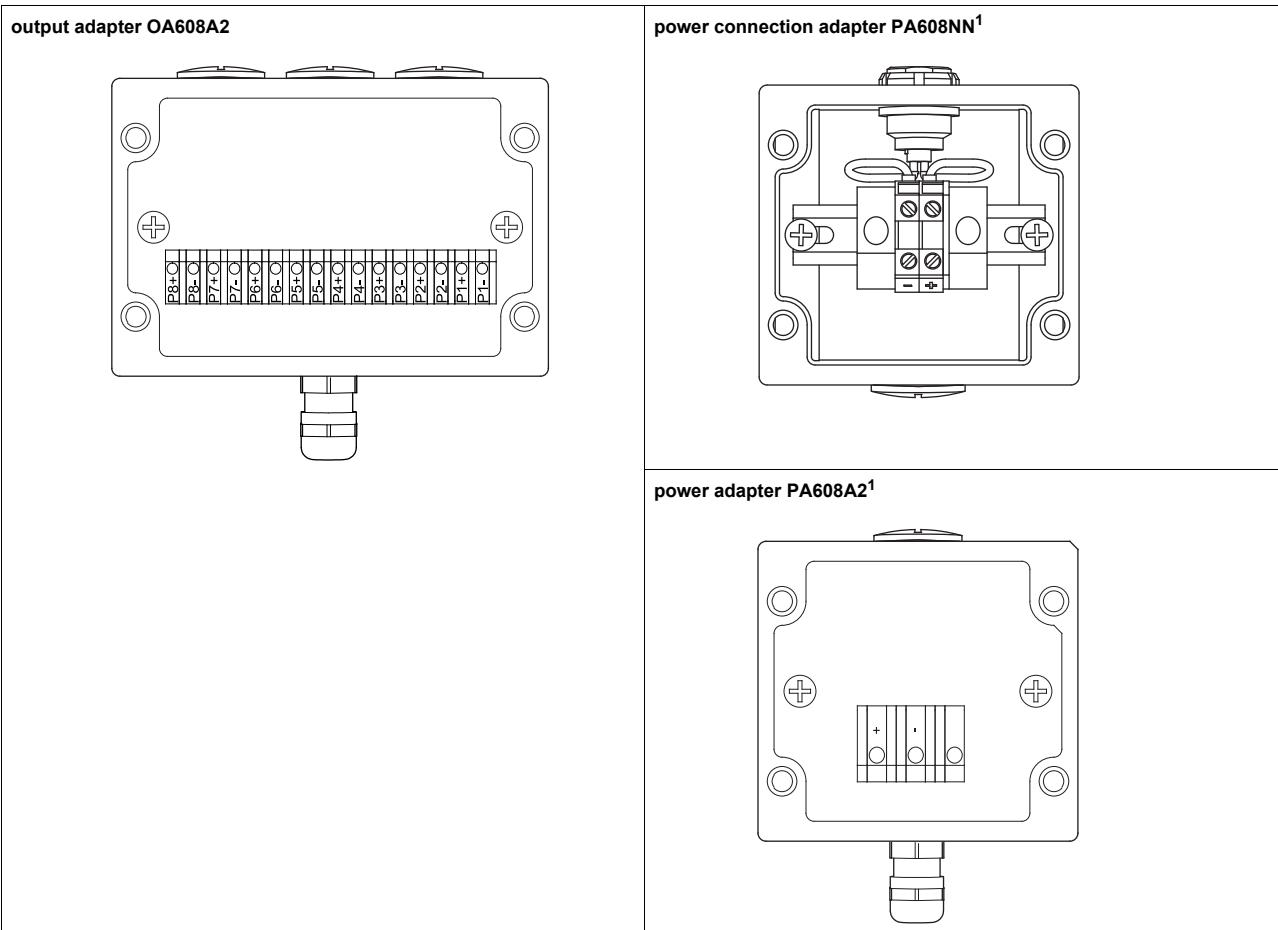
Technical data

	output adapter	power adapter	power connection adapter
technical type	OA608A2	PA608A2	PA608NN
connection voltage		10.5...15 V DC	
weight	kg 0.26	0.26	0.32
material			
housing	polyester		polyester
gasket	silicone		chloroprene
degree of protection	IP66		IP65
ambient temperature			
min.	°C -20		-10
max.	°C +90		+60
explosion protection			
• ATEX/UKCA			
marking	C E Ex II3G Ex nA IIC T6 Gc UK CA Ta -10...+60 °C		-

Dimensions

in mm

Terminal assignment



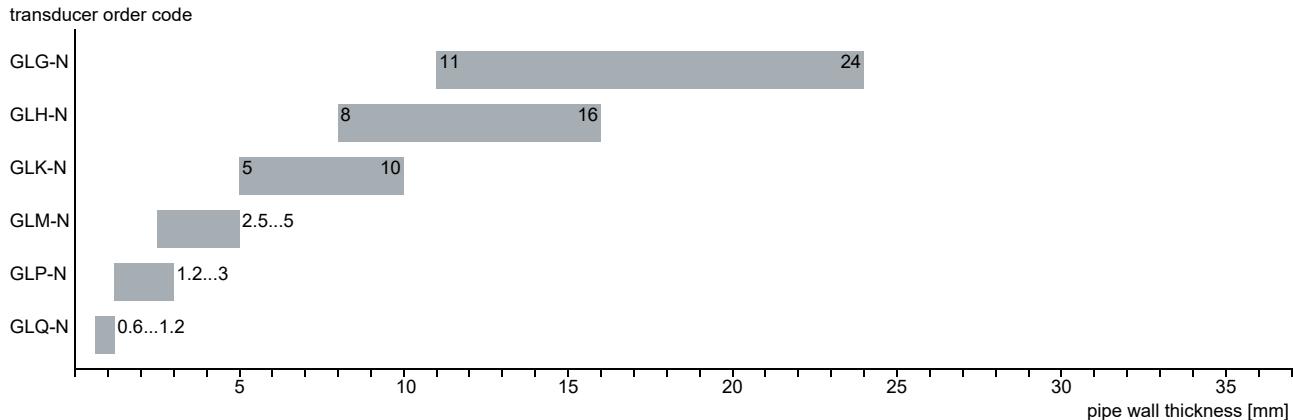
¹ cable PA608A2 - PA608NN (by customer):
length: max. 30 m
wire cross-section: 1.5...2.5 mm²

Transducers

Transducer selection (gas measurement)

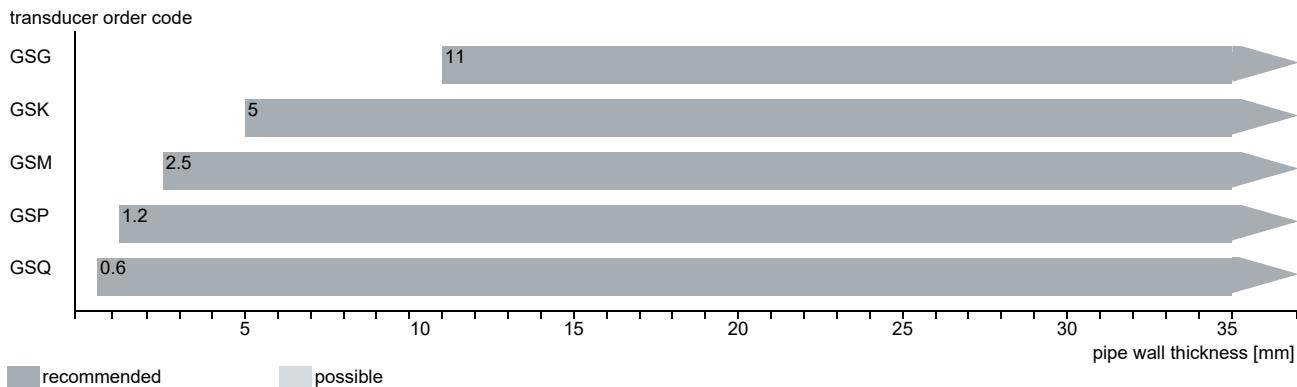
Step 1a

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:

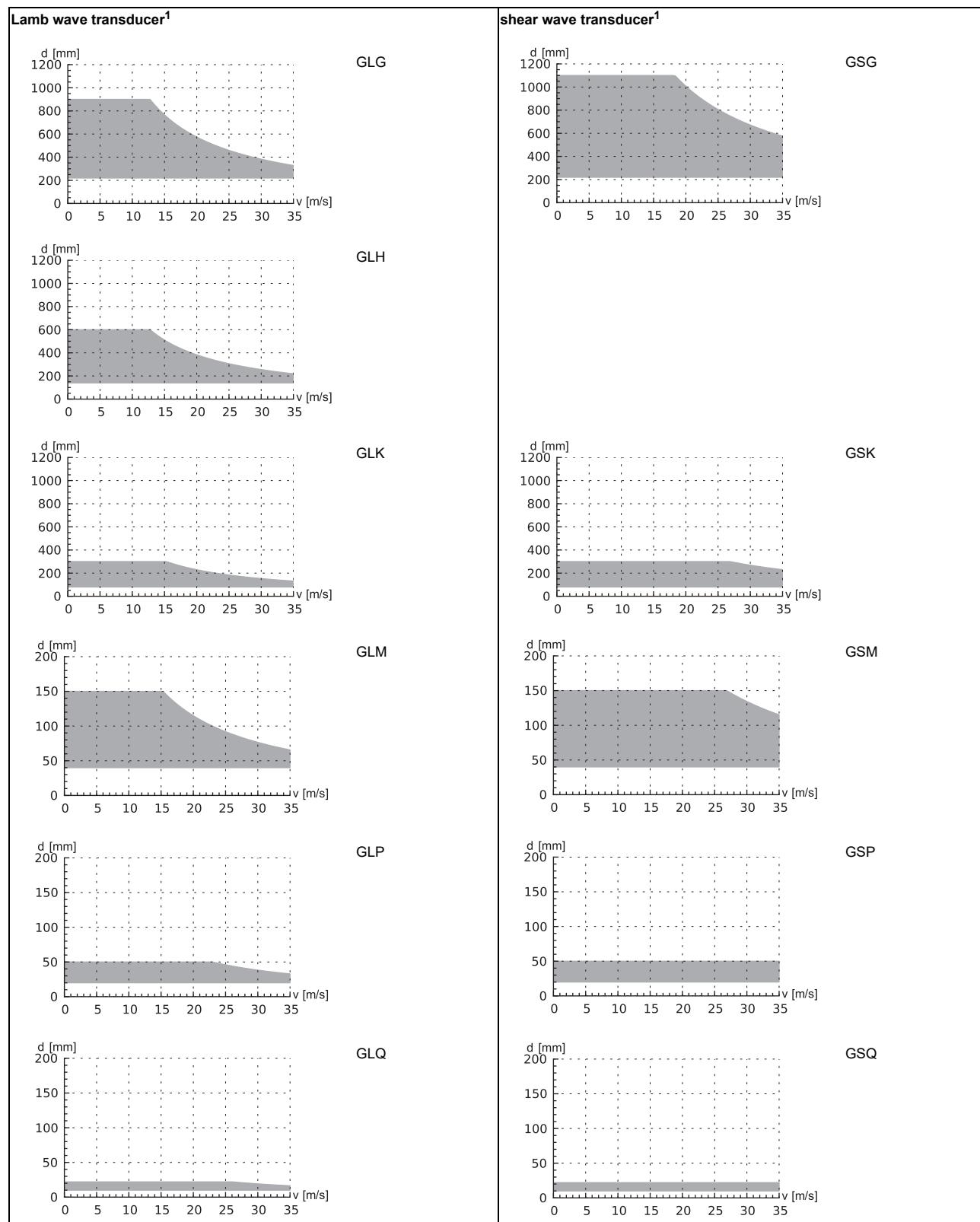


Step 2

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.



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

Step 4

for the characters 4...11 of the transducer order code (ambient temperature, explosion protection, connection system, extension cable) see page 18

Step 5

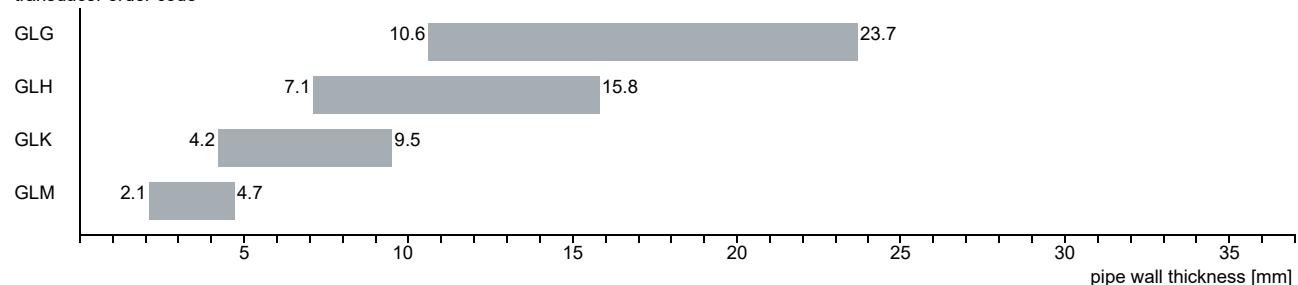
for the technical data of the selected transducer see page 19 et seqq.

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

Step 1

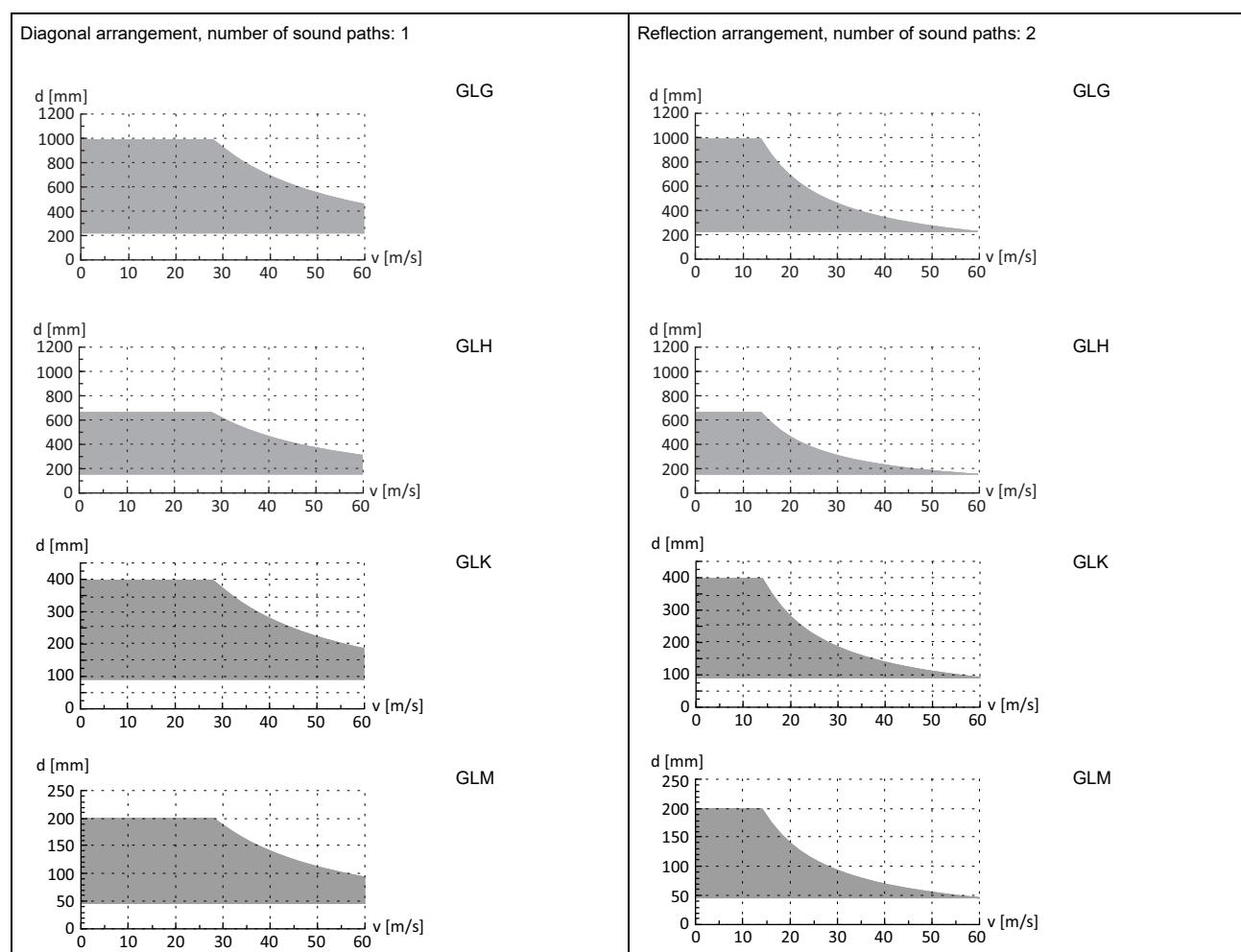
pipe wall thickness

transducer order code



Step 2

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



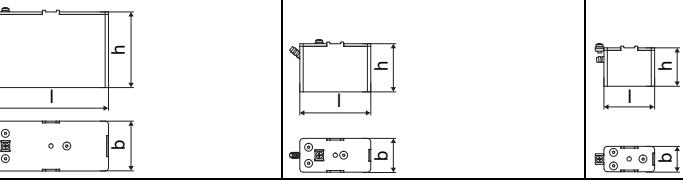
inner pipe diameter and max. flow velocity for a steam application

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									
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
A2N										ATEX zone 2/IECEx zone 2
A1N										ATEX zone 1/IECEx zone 1
**										
				NL						with LEMO connector
					***					in m (connector outside of ATEX zone 1/IECEx zone 1)

Technical data

Shear wave transducers (zone 2, NL)

order code	GSG-N*2*--NL	GSK-N*2*--NL	GSM-N*2*--NL	GSP-N*2*--NL	GSQ-N*2*--NL				
technical type	G(DL)G1NH1	G(DL)K1NH1	G(DL)M2NH1	G(DL)P2NH1	G(DL)Q2NH1				
transducer frequency MHz	0.2	0.5	1	2	4				
fluid pressure¹									
min. extended	bar	metal pipe: 20							
min.	bar	metal pipe: 30, plastic pipe: 1							
inner pipe diameter d²									
min. extended	mm	180	60	30	15				
min. recommended	mm	220	80	40	20				
max. recommended	mm	900	300	150	50				
max. extended	mm	1100	360	180	60				
pipe wall thickness									
min.	mm	11	5	2.5	1.2				
material									
housing		PEEK with stainless steel cover and transducer shoe 304 (1.4301)							
contact surface		PEEK							
degree of protection		IP66							
transducer cable									
type		1699							
length	m	5	4		3				
dimensions									
length l	mm	136.5		84	70				
width b	mm	59		40	30				
height h	mm	90.5		59	47.5				
dimensional drawing									
weight (without cable)	kg	1.674	0.504		0.251				
pipe surface temperature	°C	-40...+130							
ambient temperature	°C	-40...+130							
temperature compensation		x							
explosion protection									
• ATEX/IECEx									
order code		GSG-NA2*--NL	GSK-NA2*--NL	GSM-NA2*--NL	GSP-NA2*--NL				
pipe surface temperature (Ex)	°C	gas: -55...+190 dust: -55...+180							
marking		CEx0637 Ex II3G II2D Ex nA IIC T6..T3 Gc Ex tb IIIC T80 °C...T185 °C Db							
certification		IBExU10ATEX1163 X, IECEx IBE 12.0005X							

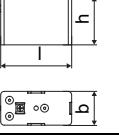
¹ depending on the application, typical absolute value for natural gas, nitrogen, compressed air

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 (zone 2, NL, extended temperature range)

order code		GSM-E*2*-*NL	GSP-E*2*-*NL	GSQ-E*2*-*NL
technical type		G(DL)M2EH5	G(DL)P2EH5	G(DL)Q2EH5
transducer frequency	MHz	1	2	4
fluid pressure¹				
min. extended	bar	metal pipe: 20		
min.	bar	metal pipe: 30, plastic pipe: 1		
inner pipe diameter d²				
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		PI with stainless steel cover and transducer shoe 304 (1.4301)		
contact surface		PI		
degree of protection		IP66/IP67		
transducer cable				
type		6111		
length	m	4	3	
dimensions				
length l	mm	84	70	
width b	mm	40	30	
height h	mm	59	47.5	
dimensional drawing				
weight (without cable)	kg	0.505	0.252	
pipe surface temperature	°C	-30...+200		
ambient temperature	°C	-30...+200		
temperature compensation		x		
explosion protection				
• ATEX/IECEx				
order code		GSM-EA2*-*NL	GSP-EA2*-*NL	GSQ-EA2*-*NL
pipe surface temperature (Ex)	°C	gas: -45...+235 dust: -45...+225		
marking		CE0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIA T80 °C...230 °C Db		
certification		IBExU10ATEX1163 X, IECEx IBE 12.0005X		

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 (zone 1, NL)

order code		GSG-N*1*--NL	GSK-N*1*--NL	GSM-N*1*--NL	GSP-N*1*--NL	GSQ-N*1*--NL				
technical type		G(DL)G1NW1	G(DL)K1NW1	G(DL)M2NW1	G(DL)P2NW1	G(DL)Q2NW1				
transducer frequency MHz	0.2	0.5	1	2	4					
fluid pressure¹										
min. extended	bar	metal pipe: 20								
min.	bar	metal pipe: 30, plastic pipe: 1								
inner pipe diameter d²										
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 and transducer shoe 304 (1.4301)								
contact surface		PEEK								
degree of protection		IP66	IP66/IP67							
transducer cable										
type		1699								
length	m	5	4		3					
dimensions										
length l	mm	136.5		84		70				
width b	mm	59		40		30				
height h	mm	90.5		59		47.5				
dimensional drawing										
weight (without cable)	kg	1.674	0.504		0.251					
pipe surface temperature	°C	-40...+130								
ambient temperature	°C	-40...+130								
temperature compensation		x								
explosion protection										
• ATEX/IECEx										
order code		GSG-NA1*--NL	GSK-NA1*--NL	GSM-NA1*--NL	GSP-NA1*--NL	GSQ-NA1*--NL				
pipe surface temperature (Ex)	°C	-55...+180								
marking		CEx0637 II2G Ex q IIC T6...T3 Gb Ex tb IIIC T80 °C...T185 °C Db								
certification		IBExU07ATEX1168 X, IECEx IBE 08.0007X								

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 (zone 1, NL, extended temperature range)

order code	GSM-E*1*-*NL	GSP-E*1*-*NL	GSQ-E*1*-*NL
technical type	G(DL)M2EW5	G(DL)P2EW5	G(DL)Q2EW5
transducer frequency MHz	1	2	4
fluid pressure¹			
min. extended	bar	metal pipe: 20	
min.	bar	metal pipe: 30, plastic pipe: 1	
inner pipe diameter d²			
min. extended	mm	30	15
min. recommended	mm	40	20
max. recommended	mm	150	50
max. extended	mm	180	60
pipe wall thickness			
min.	mm	2.5	1.2
material			
housing	PI with stainless steel cover and transducer shoe 304 (1.4301)		
contact surface	PI		
degree of protection	IP66/IP67		
transducer cable			
type	6111		
length	m	4	3
dimensions			
length l	mm	84	70
width b	mm	40	30
height h	mm	59	47.5
dimensional drawing			
weight (without cable)	kg	0.505	0.252
pipe surface temperature	°C	-30...+200	
ambient temperature	°C	-30...+200	
temperature compensation		x	
explosion protection			
• ATEX/IECEx			
order code	GSM-EA1*-*NL	GSP-EA1*-*NL	GSQ-EA1*-*NL
pipe surface temperature (Ex)	°C	-45...+225	
marking		CE 0637 Ex II2G Ex q IIC T6...T2 Gb Ex tb IIIA T80 °C...T230 °C Db	
certification		IBExU07ATEX1168 X, IECEx IBE 08.0007X	

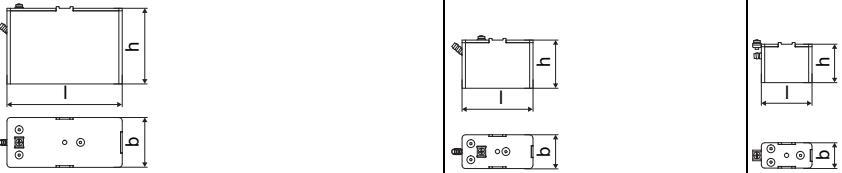
¹ depending on the application, typical absolute value for natural gas, nitrogen, compressed air

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 (zone 2, NL)

order code		GLG-N*2*-*NL	GLH-N*2*-*NL	GLK-N*2*-*NL	GLM-N*2*-*NL	GLP-N*2*-*NL	GLQ-N*2*-*NL
technical type		G(RT)G1NH3	G(RT)H1NH3	G(RT)K1NH3	G(RT)M1NH3	G(RT)P1NH3	G(RT)Q1NH3
transducer frequency MHz	0.2	0.3	0.5	1	2	4	
fluid pressure¹							
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)	metal pipe: 10 (d > 60 mm) 5 (d < 60 mm)	metal pipe: 10 (d > 35 mm) 5 (d < 35 mm)	metal pipe: 10 (d > 15 mm) 5 (d < 15 mm)	plastic pipe: 1
inner pipe diameter d²							
min. extended	mm	180	110	60	30	15	7
min. recommended	mm	220	140	80	40	20	10
max. recommended	mm	900	600	300	150	50	22
max. extended	mm	1400	1000	360	180	60	30
pipe wall thickness							
min.	mm	11	8	5	2.5	1.2	0.6
max.	mm	24	16	10	5	3	1.2
material							
housing		PPSU with stainless steel cover and transducer shoe 304 (1.4301)					
contact surface		PPSU					
degree of protection		IP66					
transducer cable							
type		1699					
length	m	5		4		3	
dimensions							
length l	mm	136.5		84		70	
width b	mm	59		40		30	
height h	mm	90.5		59		47.5	
dimensional drawing							
weight (without cable)	kg	1.652		0.504		0.251	
pipe surface temperature	°C	-40...+130					
ambient temperature	°C	-40...+130					
temperature compensation		x					
explosion protection							
• ATEX/IECEx							
order code		GLG-NA2*-*NL	GLH-NA2*-*NL	GLK-NA2*-*NL	GLM-NA2*-*NL	GLP-NA2*-*NL	GLQ-NA2*-*NL
pipe surface temperature (Ex)	°C	gas: -50...+165					
		dust: -50...+155					
marking		CE 0637	II3G	II2D			
		Ex nA IIC T6...T3 Gc					
		Ex tb IIIC T80 °C...T160 °C Db					
certification		IBExU10ATEX1163 X, IECEx IBE 12.0005X					

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 (zone 2, steam measurement, NL)

order code		GLG-SA2*-*NL	GLH-SA2*-*NL	GLK-SA2*-*NL	GLM-SA2*-*NL
technical type		G(RT)G1SH3	G(RT)H1SH3	G(RT)K1SH3	G(RT)M1SH3
transducer frequency	MHz	0.2	0.3	0.5	1
fluid pressure		see saturated steam pressure curve			
inner pipe diameter d					
min.	mm	225	150	90	45
max.	mm	1000	667	400	200
pipe wall thickness					
min.	mm	10.6	7.1	4.2	2.1
max.	mm	23.7	15.8	9.5	4.7
material					
housing		PPSU with stainless steel cover and transducer shoe 304 (1.4301)			
contact surface		PPSU			
degree of protection		IP66			
transducer cable					
type		1699			
length	m	5		4	
dimensions					
length l	mm	136.5		84	
width b	mm	59		40	
height h	mm	90.5		59	
dimensional drawing					
weight (without cable)	kg	1.652		0.504	
storing temperature	°C	-40...+130			
operating temperature	°C	100...165			
warm-up time	h	3		1	
temperature compensation		x			
explosion protection					
• ATEX/IECEx					
pipe surface temperature (Ex)	°C	gas: -50...+165 dust: -50...+155			
marking		CE 0637 Ex II3G Ex nA IIC T6...T3 Gc Ex tb IIIC T80 °C...T160 °C Db			
certification		IBExU10ATEX1163 X, IECEx IBE 12.0005X			

completely thermally insulated transducer installation necessary

Lamb wave transducers (zone 1, NL)

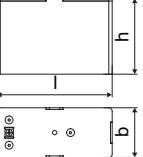
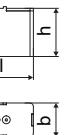
order code		GLG-N*1*--NL	GLH-N*1*--NL	GLK-N*1*--NL	GLM-N*1*--NL	GLP-N*1*--NL	GLQ-N*1*--NL
technical type		G(RT)G1NW3	G(RT)H1NW3	G(RT)K1NW3	G(RT)M1NW3	G(RT)P1NW3	G(RT)Q1NW3
transducer frequency [MHz]	0.2	0.3	0.5	1	2	4	
fluid pressure¹							
min. extended	bar	metal pipe: 10 plastic pipe: 1	metal pipe: 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)	metal pipe: 10 (d > 60 mm) 5 (d < 60 mm)	metal pipe: 10 (d > 35 mm) 5 (d < 35 mm)	metal pipe: 10 (d > 15 mm) 5 (d < 15 mm)	plastic pipe: 1
inner pipe diameter d²							
min. extended	mm	180	110	60	30	15	7
min. recommended	mm	220	140	80	40	20	10
max. recommended	mm	900	600	300	150	50	22
max. extended	mm	1400	1000	360	180	60	30
pipe wall thickness							
min.	mm	11	8	5	2.5	1.2	0.6
max.	mm	24	16	10	5	3	1.2
material							
housing		PPSU with stainless steel cover and transducer shoe 304 (1.4301)					
contact surface		PPSU					
degree of protection		IP66					
transducer cable							
type		1699					
length	m	5		4		3	
dimensions							
length l	mm	136.5		84		70	
width b	mm	59		40		30	
height h	mm	90.5		59		47.5	
dimensional drawing							
weight (without cable)	kg	1.652		0.504		0.251	
pipe surface temperature	°C	-40...+130					
ambient temperature	°C	-40...+130					
temperature compensation		x					
explosion protection							
• ATEX/IECEx							
order code		GLG-NA1*--NL	GLH-NA1*--NL	GLK-NA1*--NL	GLM-NA1*--NL	GLP-NA1*--NL	GLQ-NA1*--NL
pipe surface temperature (Ex)	°C	-50...+155					
marking		CE 0637 II2G Ex q IIC T6...T3 Gb Ex tb IIIC T80 °C...T160 °C Db					
certification		IBExU07ATEX1168 X, IECEx IBE 08.0007X					

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 (zone 1, steam measurement, NL)

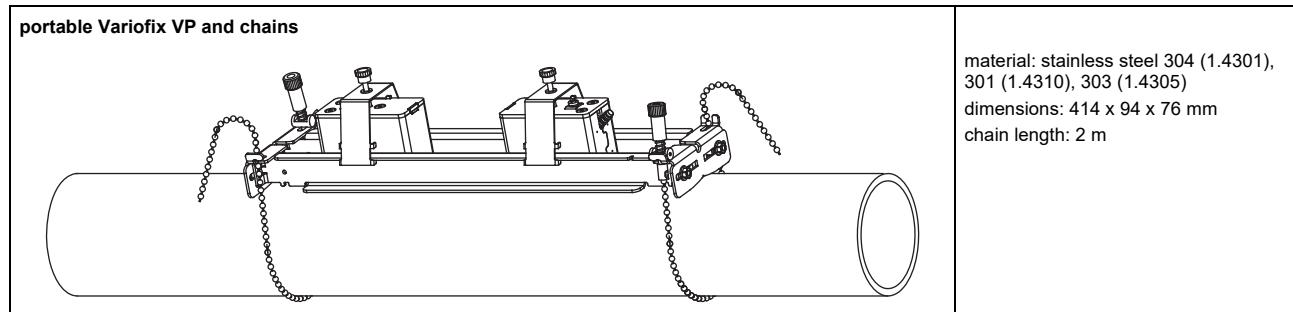
order code		GLG-SA1*-*NL	GLH-SA1*-*NL	GLK-SA1*-*NL	GLM-SA1*-*NL
technical type		G(RT)G1SW3	G(RT)H1SW3	G(RT)K1SW3	G(RT)M1SW3
transducer frequency	MHz	0.2	0.3	0.5	1
fluid pressure		see saturated steam pressure curve			
inner pipe diameter d					
min.	mm	225	150	90	45
max.	mm	1000	667	400	200
pipe wall thickness					
min.	mm	10.6	7.1	4.2	2.1
max.	mm	23.7	15.8	9.5	4.7
material					
housing		PPSU with stainless steel cover and transducer shoe 304 (1.4301)			
contact surface		PPSU			
degree of protection		IP66			
transducer cable					
type		1699			
length	m	5		4	
dimensions					
length l	mm	136.5		84	
width b	mm	59		40	
height h	mm	90.5		59	
dimensional drawing					
weight (without cable)	kg	1.652		0.504	
storing temperature	°C	-40...+130			
operating temperature	°C	100...155			
warm-up time	h	3		1	
temperature compensation		x			
explosion protection					
• ATEX/IECEx					
pipe surface temperature (Ex)	°C	-50...+155			
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC T80 °C...T160 °C Db			
certification		IBExU07ATEX1168 X, IECEx IBE 08.0007X			

completely thermally insulated transducer installation necessary

Transducer mounting fixture

Order code

1, 2 transducer fixture	3 transducer	4 measurement arrangement	5 size	6 fixation	7...10 outer pipe diameter	no. of character description
VP	-					portable Variofix
	A					all transducers
	D					reflection arrangement or diagonal arrangement
	R					reflection arrangement
	M					medium
	C					chains
	N					without fixation
	0550					10...550 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)		higher temperatures (4th character of transducer order code = S)
< 100 °C	< 170 °C	< 150 °C	< 200 °C	< 180 °C
coupling compound type N	coupling compound type E	coupling compound type E	coupling compound type E or H	coupling compound type E ¹ and coupling foil type VT

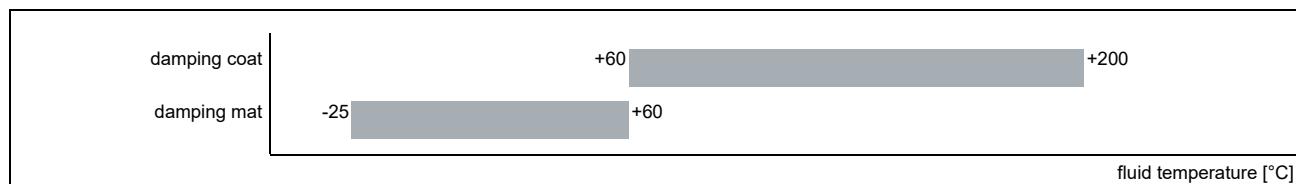
¹ in combination with type VT only

Technical data

type	ambient temperature °C
coupling compound type N	-30...+130
coupling compound type E	-30...+200
coupling compound type H	-30...+250
coupling foil type VT	-10...+200

Damping material (optional)

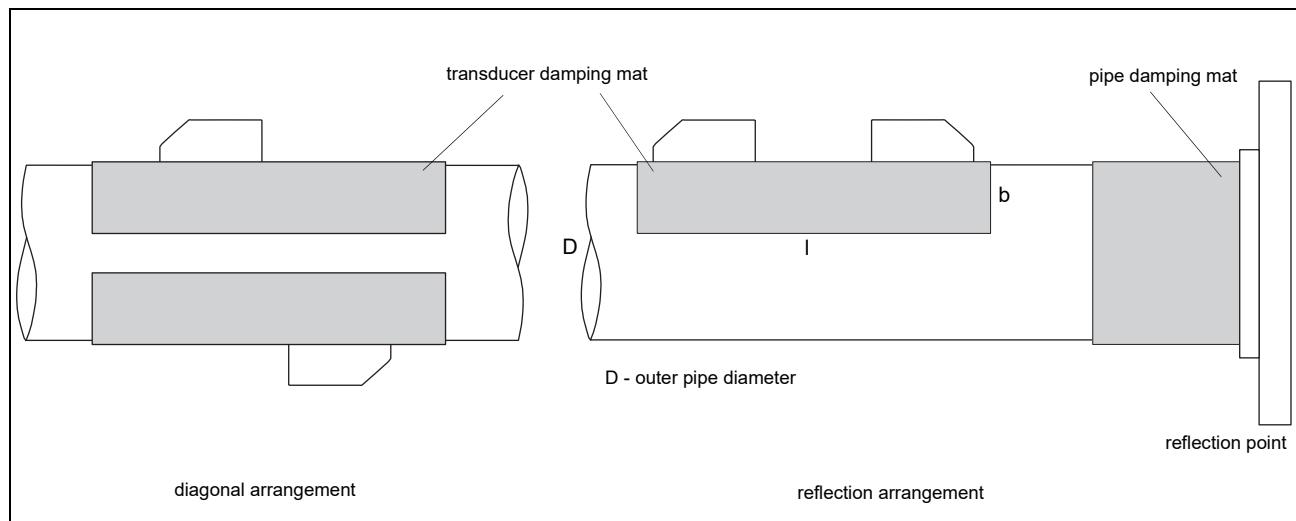
Damping material will be used for the gas measurement to reduce acoustic noise influences on the measurement.



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 I 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 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.

Technical data

item number	992080-13	
material	multipolymeric matrix/inorganic ceramic coating	
packing drum	I	1
properties	heat-resistant, inert	

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			transducers technical type
direct connection/connection with extension cable			
transmitter	I	x y	*****W* *****H*

Cable

transducer cable			
type	1699	6111	
weight	kg/m	0.094	0.092
ambient temperature °C	-55...+200	-100...+225	
cable jacket			
material	PTFE	PFA	
outer diameter	mm	2.9	2.7
thickness	mm	0.3	0.5
colour	brown	white	
shield	x	x	
sheath			
material	stainless steel 304 (1.4301)		stainless steel 304 (1.4301)
outer diameter	mm	8	8

extension cable			
type	1750		
standard length	m	5	
		10	
weight	kg/m	0.12	
ambient temperature °C	< 80		
cable jacket			
material	PE		
outer diameter	mm	6	
thickness	mm	0.5	
colour	black		
shield	x		
sheath			
material	stainless steel 304 (1.4301)		
outer diameter	mm	9	

Cable length

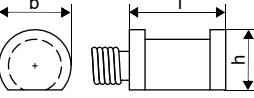
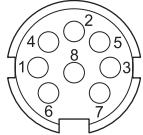
transducer frequency		F, G, H, K			M, P			Q			S		
connection system NL													
transducers technical type		x	y	l	x	y	l	x	y	l	x	y	l
*(DR)***W*	m	2	3	≤ 10	2	2	≤ 10	2	1	≤ 10	-	-	-
*(DR)***H*													
*(LT)***W*	m	2	7	≤ 10	7	2	≤ 10	8	1	≤ 10	-	-	-
*(LT)***H*													

x, y - transducer cable length

l - max. length of extension cable

Clamp-on temperature probe (optional)

Technical data

PT12N		Connection system			
item number		direct connection/connection with extension cable			
design	clamp-on with connector	extension cable			
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 (t ₅₀ , T ₁ = 25 °C, T ₂ = 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				
Cable					
		temperature probe	extension cable		
type		4 x 0.22 mm ²	LIYCY 8 x 0.14 mm ²		
standard length	m 3		5/10/25		
max. length	m -		100		
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 ±2		
colour		black	grey		

PT12F							
item number		<ul style="list-style-type: none"> • 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		$\pm(0.15 \text{ °C} + 2 \cdot 10^{-3} \cdot T \text{ [°C]})$ class A					
accuracy ΔT (2x Pt matched according to EN 1434-1)		$\leq 0.1 \text{ K}$ ($3 \text{ K} < \Delta T < 6 \text{ K}$), more corresponding to EN 1434-1					
response time	s	8 (t ₅₀ , T ₁ = 25 °C, T ₂ = 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			
		red	grey	pin 2			
		red/blue	red	6			
		white/blue	blue	1			
		white	white	7			
Cable							
		temperature probe	extension cable				
type		4 x 0.22 mm ²	LIYCY 8 x 0.14 mm ²				
standard length	m	3	5/10/25				
max. length	m	-	100				
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 ±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.

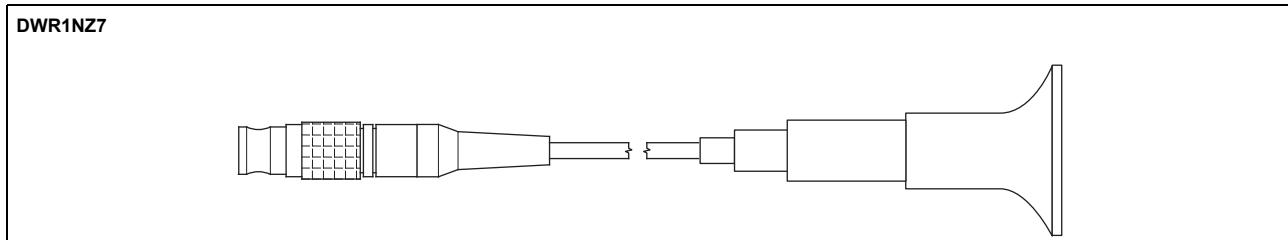
Technical data

	DWR1NZ7
item number	600522-0
measuring range ¹	mm 1...250
resolution	mm 0.01
accuracy	1 % \pm 0.1 mm
fluid temperature	°C -20...+200, short-time peak max. 500
explosion protection	-
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





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