

Portable ultrasonic flowmeter for gas, steam and liquids

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. 356 °F
 - 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
- Integrated wall thickness measurement with connectable wall thickness probe
- The transmitter is water and dust-tight (NEMA 4), resistant against oil, many liquids and dirt
- Robust, water-tight (NEMA 4) transport case with comprehensive accessories
- 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

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



FLUXUS G601



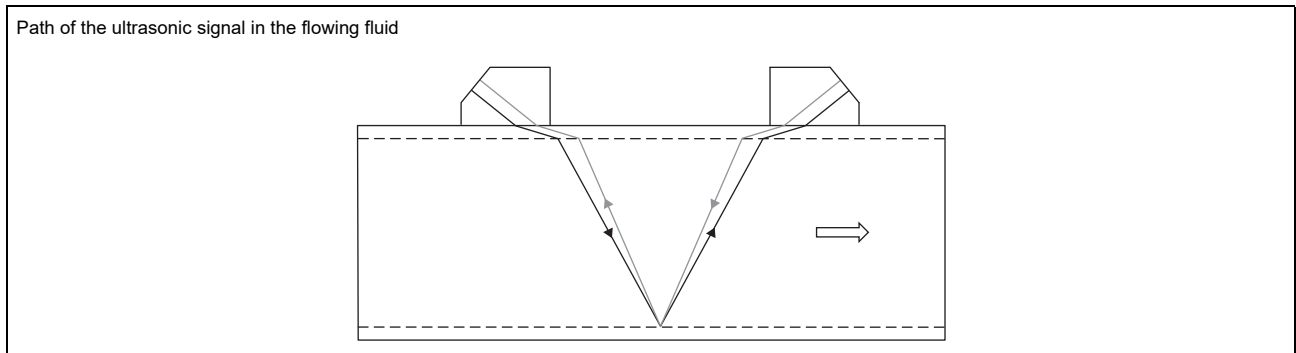
Measurement equipment in transport case

Function	3
Measurement principle	3
Calculation of volumetric flow rate	3
Calculation of mass flow rate	4
Calculation of standard volumetric flow rate	4
Number of sound paths	5
Typical measurement setup	5
Transmitter	6
Technical data	6
Saturated steam pressure curve (steam measurement)	7
Dimensions	8
Standard scope of supply	8
Adapters	9
Example of transport case equipment	10
Transducers	11
Transducer selection (gas measurement)	11
Transducer selection (G**1S*3, steam measurement)	14
Transducer order code	15
Technical data	16
Transducer mounting fixture	20
Coupling materials for transducers	22
Damping material (optional)	23
Damping mats	23
Damping coat	24
Connection systems	25
Clamp-on temperature probe (optional)	26
Technical data	26
Fixation	27
Wall thickness measurement (optional)	28
Technical data	28

Function

Measurement principle

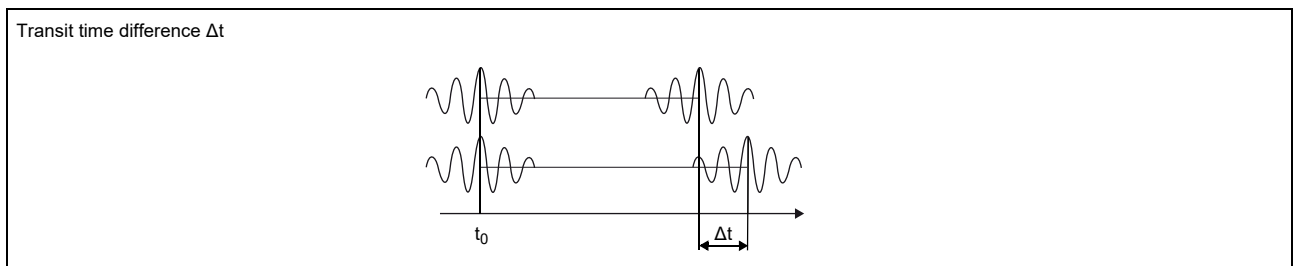
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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 mechanics calibration factor
- A - cross-sectional pipe area
- k_a - acoustical 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.

or:

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

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

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

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 gas compressibility coefficient K of the gas is entered in 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:

- **reflect 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**

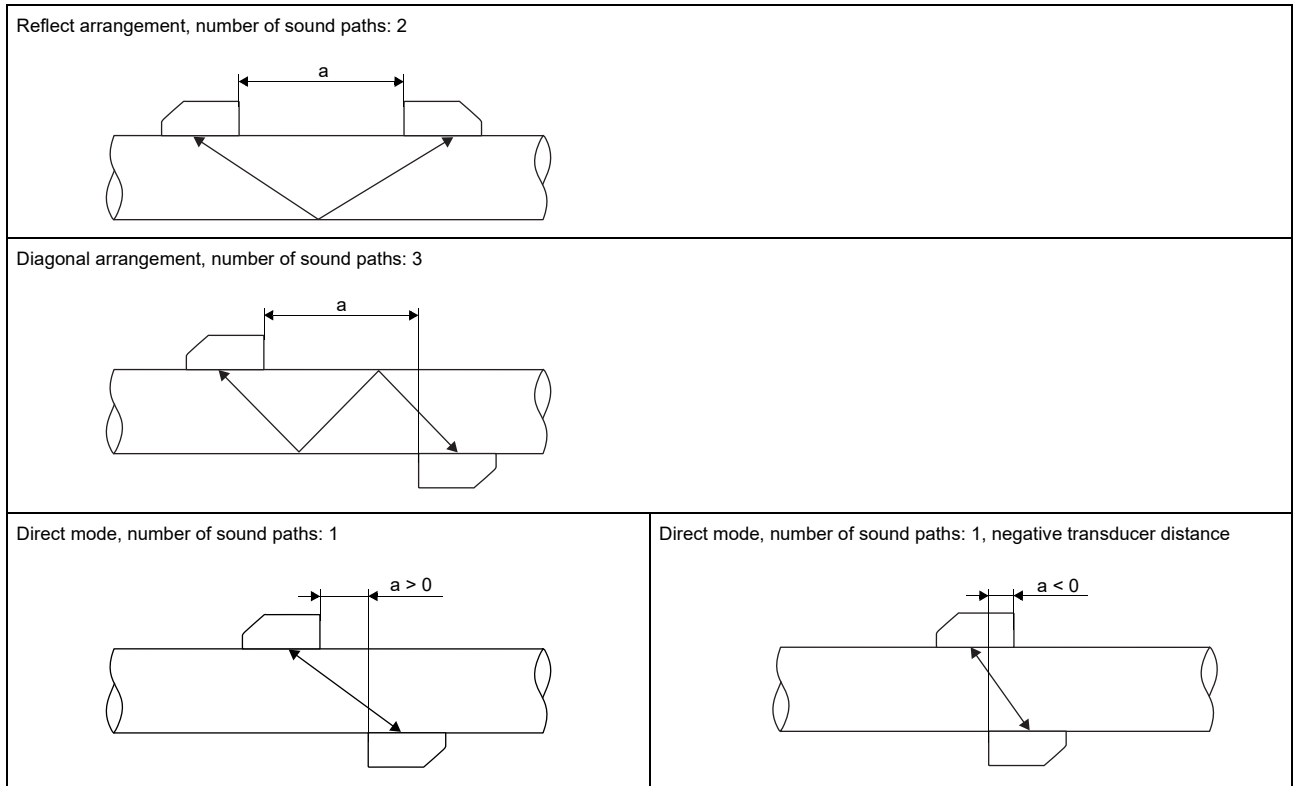
The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe.

- **direct mode**

Diagonal arrangement with 1 sound path. This should be used in the case of a high signal attenuation by the fluid, pipe or coatings.

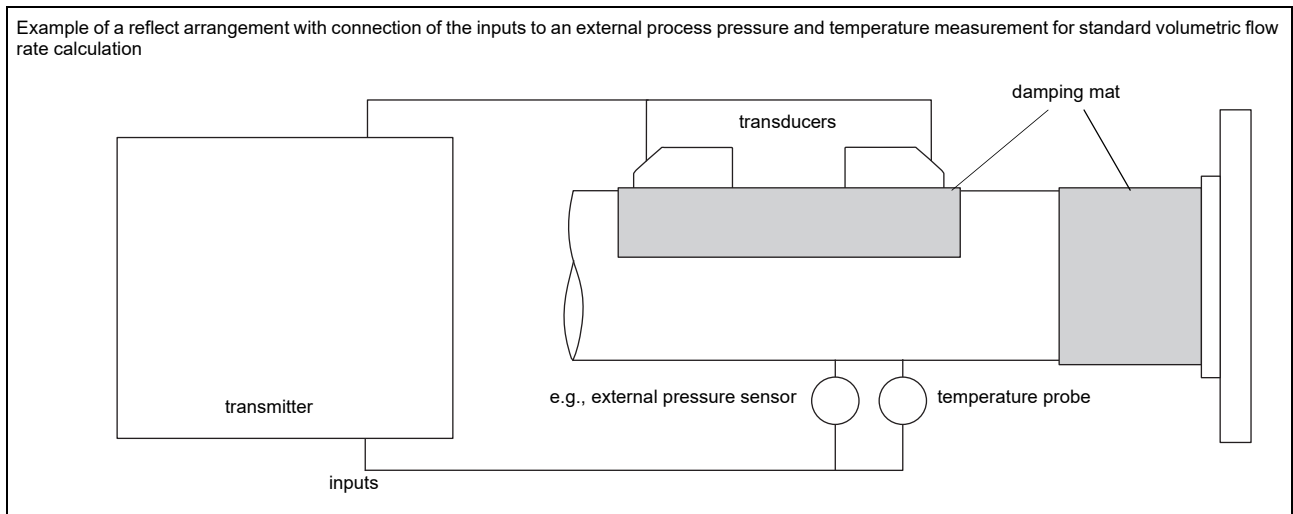
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

As the transducers can be mounted with the transducer mounting fixture in reflect 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 G601, G601ST	FLUXUS G601ST (steam measurement ²)
			
design		portable	
measurement			
measurement principle		transit time difference correlation principle	
flow velocity	ft/s	0.03 to 115, depending on pipe diameter	depending on pipe diameter and transducer, see diagrams
repeatability		0.15 % MV ±0.02 ft/s	
fluid		all acoustically conductive gases, e.g., nitrogen, air, oxygen, hydrogen, argon, helium, ethylene, propane	saturated steam, superheated steam
fluid pressure	psia	see transducers	44 to 145
fluid temperature	°F	see transducers	275 to 356
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 ±0.02 ft/s includes calibration certificate traceable to NIST	±0.3 % MV ±0.02 ft/s includes calibration certificate traceable to NIST
measurement uncertainty at the measuring point		±1 to 2 % MV ±0.02 ft/s, contact FLEXIM for an application specific uncertainty evaluation	±1 to 3 % MV ±0.02 ft/s, depending on the application
transmitter			
power supply		• 100 to 230 V/50 to 60 Hz (power supply unit: IP40, 32 to 104 °F) • 10.5 to 15 V DC (socket at transmitter) • integrated battery	
integrated battery		Li-Ion, 7.2 V/6.2 Ah	
operating time	h	• > 14 (without outputs, inputs and backlight) • > 25 (1 measuring channel, ambient temperature > 50 °F, without outputs, inputs and backlight)	
power consumption	W	< 6 (with outputs, inputs and backlight), charging: 18	
number of measuring channels		2	
damping	s	0 to 100 (adjustable)	
measuring cycle	Hz	100 to 1000 (1 channel)	
response time	s	1 (1 channel), option: 0.07	
housing material		PA, TPE, AutoTex, stainless steel	
degree of protection		NEMA 4	
dimensions	inch	see dimensional drawing	
weight	lb	4.6	
fixation		QuickFix pipe mounting fixture	
ambient temperature	°F	14 to 140	
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
totalizer		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		RS232 RS232 - USB	
software		• FluxDiagReader: reading of measured values and parameters, graphical presentation • FluxDiag (optional): reading of measurement data, graphical presentation, report generation	
adapter		AO5, AO6, AO7, AO8, AI1, AI2	
transport case		dimensions: 19.7 x 15.7 x 7.5 inch	
data logger			
loggable values		all physical quantities, totaled physical quantities and diagnostic values	
capacity		> 100 000 measured values	

¹ with aperture calibration of the transducers

² test measurement to validate the application required in advance, especially for pipe diameters < 4 inch

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

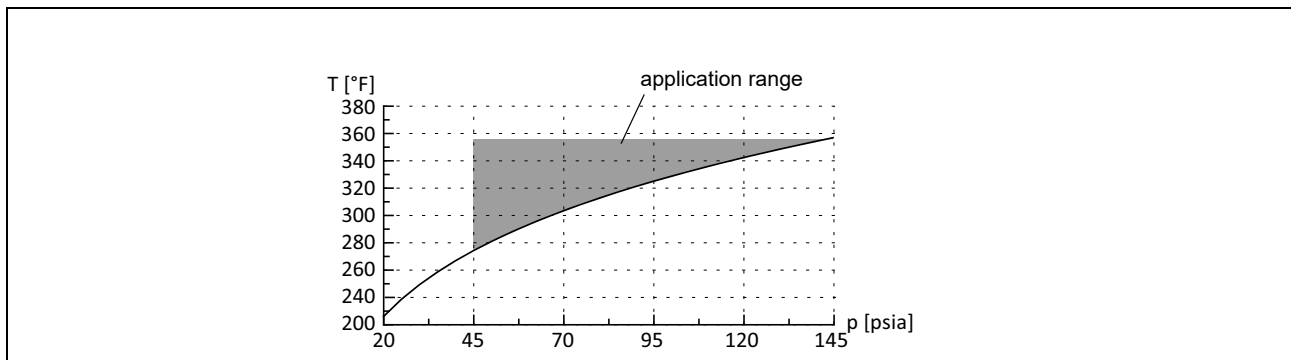
		FLUXUS G601, G601ST	FLUXUS G601ST (steam measurement ²)
outputs			
		The outputs are galvanically isolated from the transmitter.	
number		see standard scope of supply, max. on request	
• switchable current output			
		All switchable current outputs are jointly switched to active or passive.	
range	mA	4 to 20 (3.2 to 24)	
accuracy		0.04 % MV ±3 µA	
active output		U _{int} = 24 V, R _{ext} < 500 Ω	
passive output		U _{ext} = 8 to 30 V, depending on R _{ext} (R _{ext} < 900 Ω at 30 V)	
• frequency output			
range	kHz	0 to 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 totalizing	
• pulse value	units	0.01 to 1000	
• pulse width	ms	1 to 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	°F	-238 to +1040	
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 to +20	
• voltage input			
range	V	0 to 1	-
accuracy		0.1 % MV ±1 mV	-
internal resistance		R _{int} = 1 MΩ	-

¹ with aperture calibration of the transducers

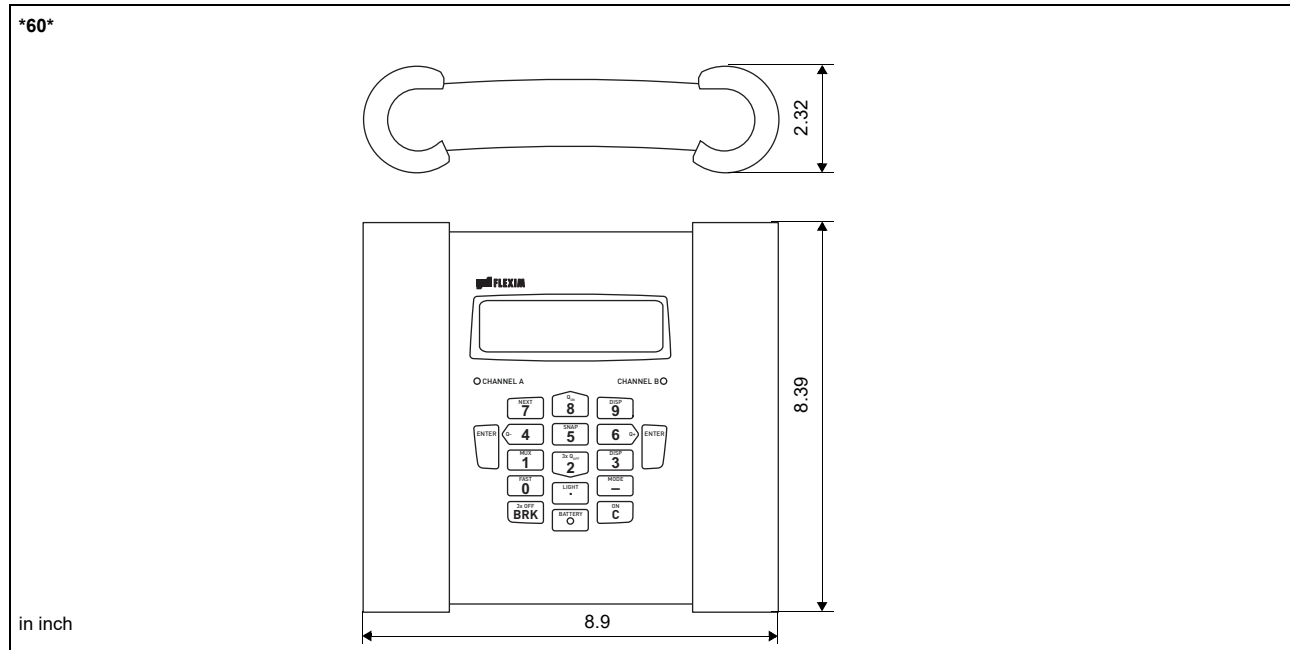
² test measurement to validate the application required in advance, especially for pipe diameters < 4 inch

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

Saturated steam pressure curve (steam measurement)



Dimensions

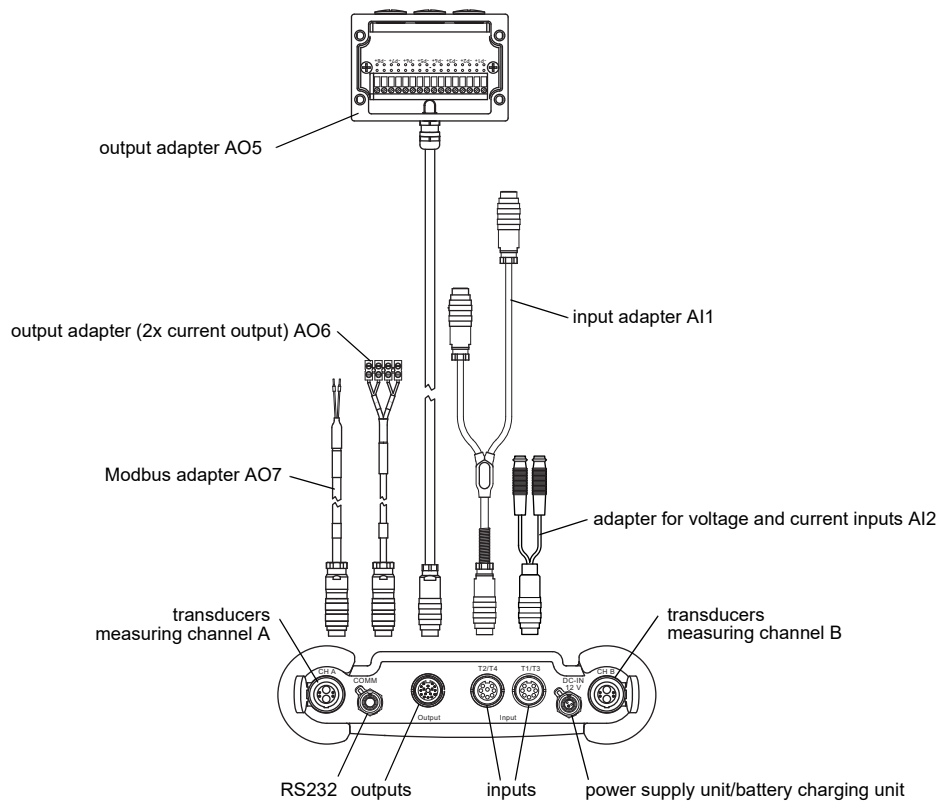


Standard scope of supply

	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

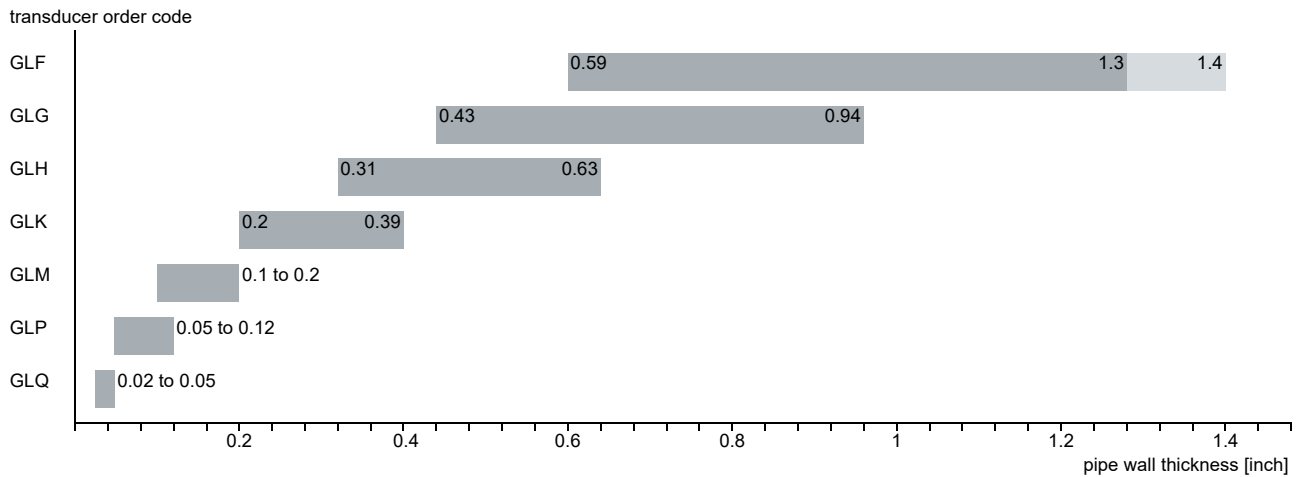


Transducers

Transducer selection (gas measurement)

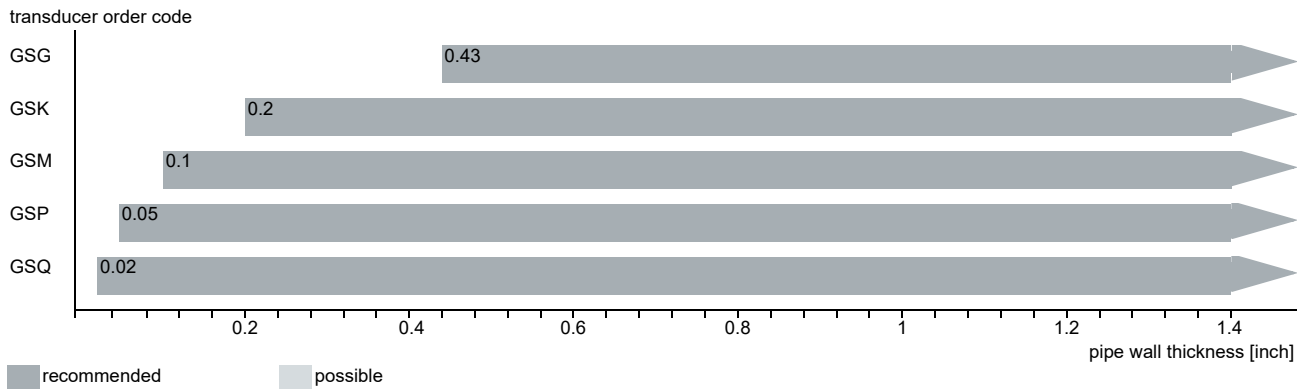
Step 1a

Select a Lamb wave transducer:



Step 1b

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

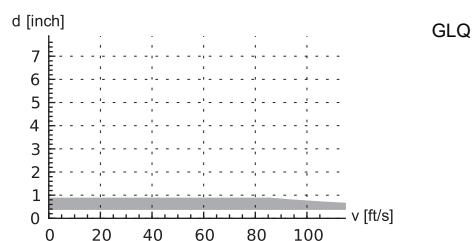
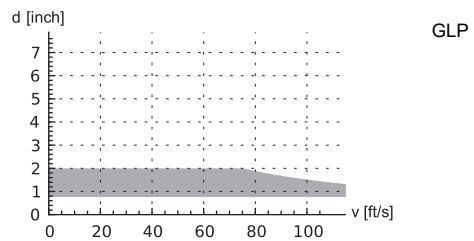
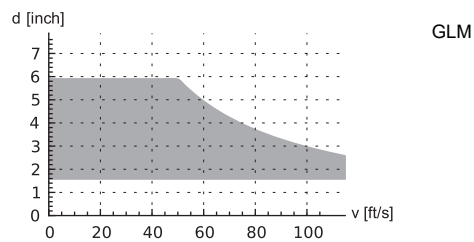
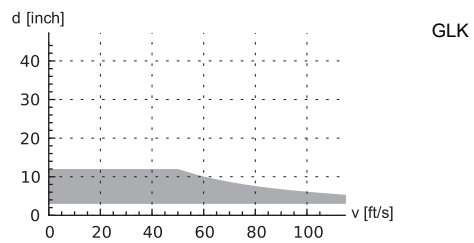
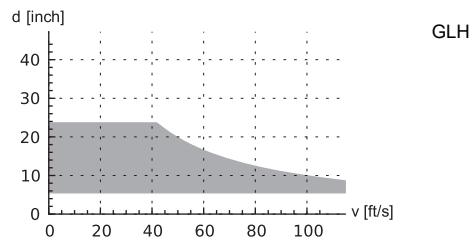
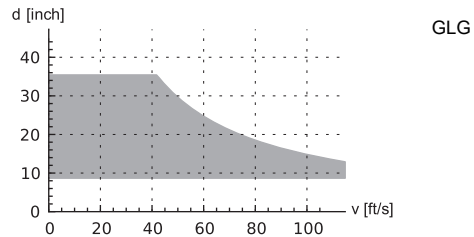
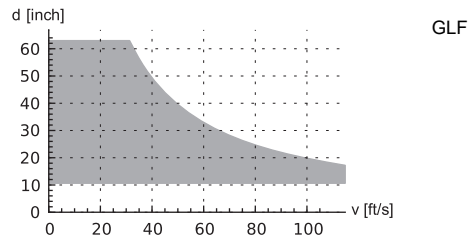
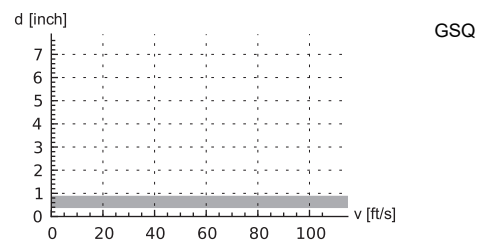
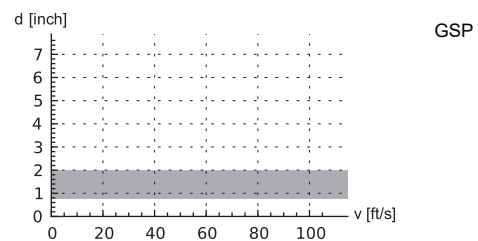
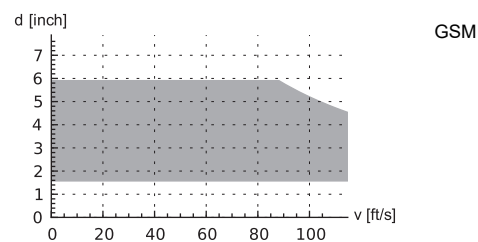
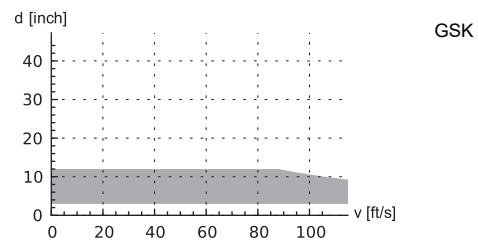
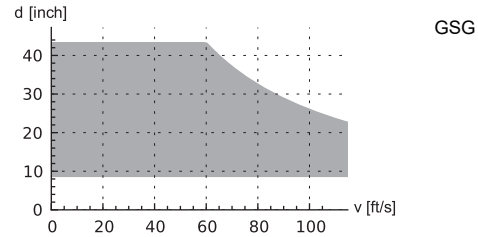


Step 2

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 transducer¹**shear wave transducer¹**

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

Step 3

min. fluid pressure

Lamb wave transducer			
transducer or- der code	fluid pressure ¹ [psi]		
	metal pipe		plastic pipe
	min.	min. extended	min.
GLF	218	145	15
GLG	218	145	15
GLH	218	145	15
GLK	218 (d > 4.7 inch) 145 (d < 4.7 inch)	145 (d > 4.7 inch) 44 (d < 4.7 inch)	15
GLM	145 (d > 2.4 inch) 73 (d < 2.4 inch)	44 (d < 2.4 inch)	15
GLP	145 (d > 1.4 inch) 73 (d < 1.4 inch)	44 (d < 1.4 inch)	15
GLQ	145 (d > 0.59 inch) 73 (d < 0.59 inch)	44 (d < 0.59 inch)	15

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

d = inner pipe diameter

shear wave transducer			
transducer or- der code	fluid pressure ¹ [psi]		
	metal pipe		plastic pipe
	min.	min. extended	min.
GSG	435	290	15
GSK	435	290	15
GSM	435	290	15
GSP	435	290	15
GSQ	435	290	15

Example

step					
1	pipe wall thickness	inch	0.56	0.34	1.5
	selected transducer		GLG or GLH	GLH or GLK	GS
2	inner pipe diameter	inch	22.9	3.8	5.6
	max. flow velocity	ft/s	49	98	98
	selected transducer		GLG	GLK	GSK
3	min. fluid pressure	psi	290	218	580
	selected transducer		GLG	GLK	GSK

Step 4

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

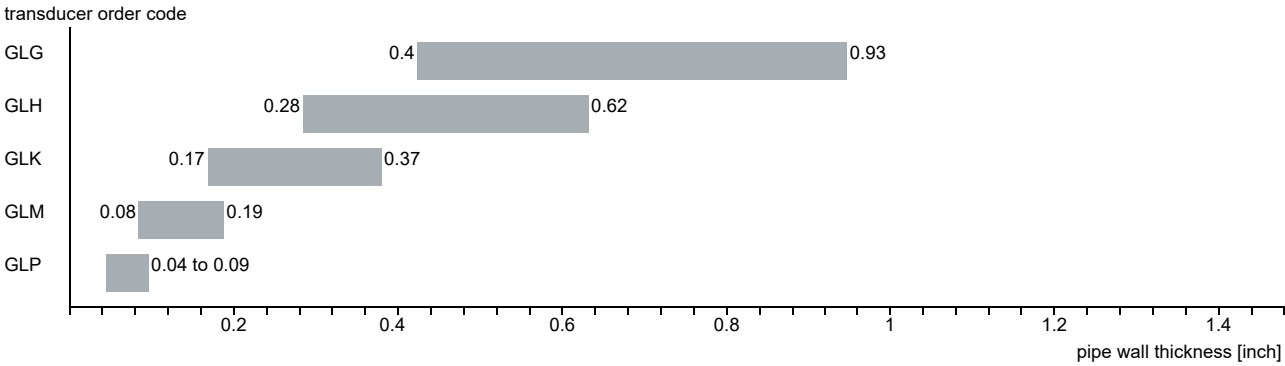
Step 5

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

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

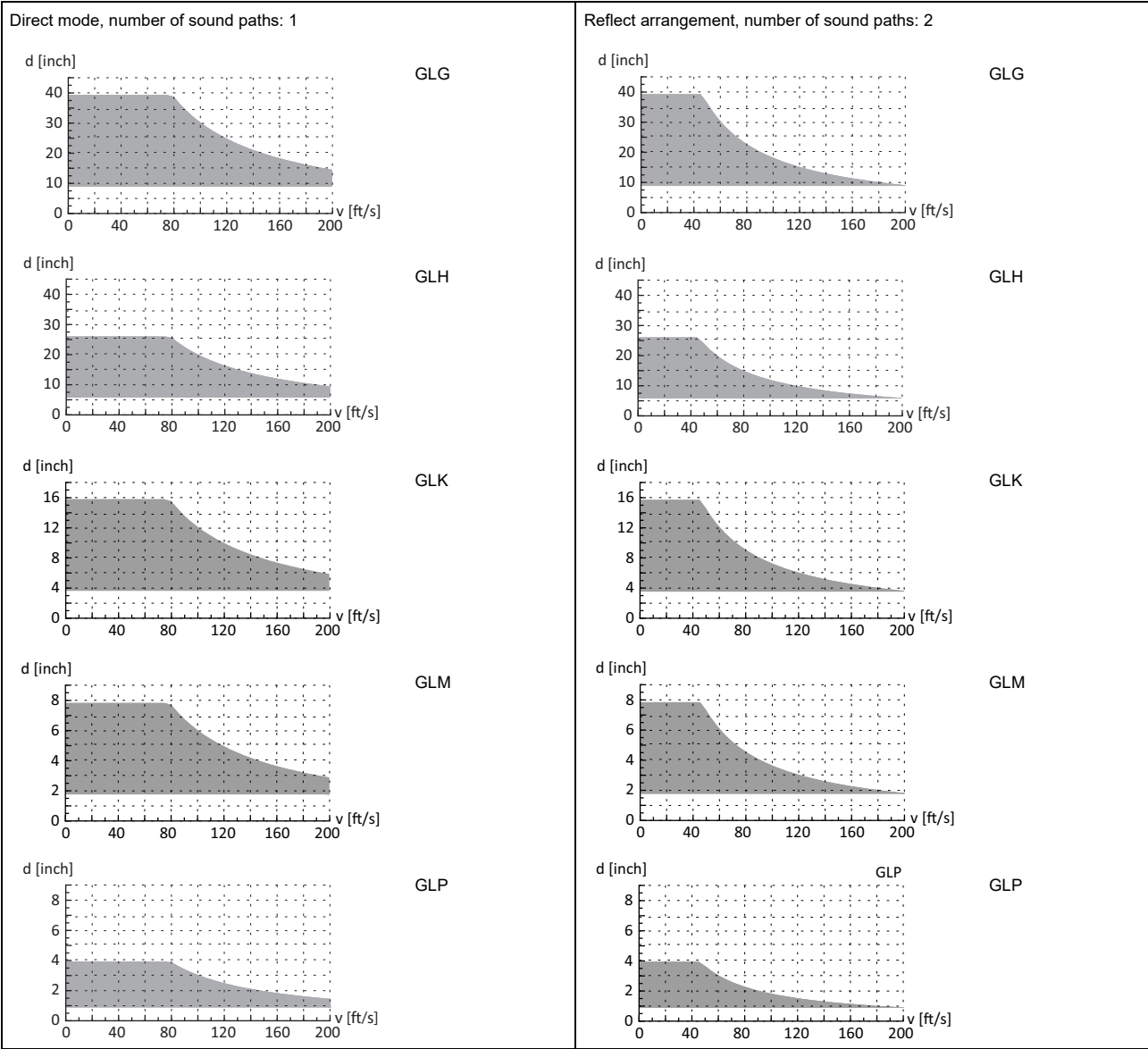
Step 1

pipe wall thickness



Step 2

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



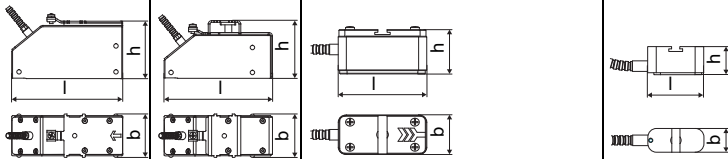
inner pipe diameter and max. flow velocity for a steam application

Transducer order code

1, 2	3	4	5, 6	7, 8	9 to 11	no. of character				
transducer	transducer frequency	-	ambient temperature	explosion protection	connection system	-	extension cable	/	option	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
			NN							not explosion-proof
				NL						with Lemo connector
						XXX				0 m: without extension cable > 0 m: with extension cable
								LC		long transducer cable

Technical data


Shear wave transducers (nonEx, NL)

order code		GSG-NNNNL/**	GSK-NNNNL/**	GSM-NNNNL/**	GSP-NNNNL/**	GSQ-NNNNL/**
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	psi	metal pipe: 290				
min.	psi	metal pipe: 435, plastic pipe: 15				
inner pipe diameter d ²						
min. extended	inch	7.1	2.4	1.2	0.59	0.28
min. recommended	inch	8.7	3.1	1.6	0.79	0.39
max. recommended	inch	35.4	11.8	5.9	2	0.87
max. extended	inch	43.3	14.2	7.1	2.4	1.2
pipe wall thickness						
min.	inch	0.43	0.2	0.1	0.05	0.02
material						
housing		PEEK with stainless steel cover 304		stainless steel 304		
contact surface		PEEK		PEEK		
degree of protection		NEMA 6				
transducer cable						
type		1699				
length	ft	16		13		9
length (***-****/LC)	ft	29				
dimensions						
length l	inch	5.1	4.98	2.36	1.67	
width b	inch	2.01	2.01	1.18	0.71	
height h	inch	2.64	2.66	1.32	0.85	
dimensional drawing						
weight (without cable)	lb	1	0.79	0.08	0.03	
pipe surface temperature						
min.	°F	-40				
max.	°F	+266				
ambient temperature						
min.	°F	-40				
max.	°F	+266				
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 reflect arrangement and for a flow velocity of 49 ft/s

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

order code		GSM-ENNNL/**	GSP-ENNNL/**	GSQ-ENNNL/**
technical type		G(DL)M1EZ7	G(DL)P1EZ7	G(DL)Q1EZ7
transducer frequency	MHz	1	2	4
fluid pressure ¹				
min. extended	psi	metal pipe: 290		
min.	psi	metal pipe: 435, plastic pipe: 15		
inner pipe diameter d ²				
min. extended	inch	1.2	0.59	0.28
min. recommended	inch	1.6	0.79	0.39
max. recommended	inch	5.9	2	0.87
max. extended	inch	7.1	2.4	1.2
pipe wall thickness				
min.	inch	0.1	0.05	0.02
material				
housing		stainless steel 304		
contact surface		Sintimid		
degree of protection		NEMA 4		
transducer cable				
type		1699		
length	ft	13		9
length (***,*****/LC)	ft	29		
dimensions				
length l	inch	2.36		1.67
width b	inch	1.18		0.71
height h	inch	1.32		0.85
dimensional drawing				
weight (without cable)	lb	0.09		0.02
pipe surface temperature				
min.	°F	-22		
max.	°F	+392		
ambient temperature				
min.	°F	-22		
max.	°F	+392		
temperature compensation		x		

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

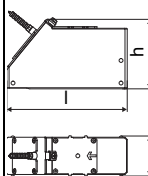
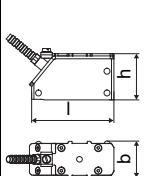
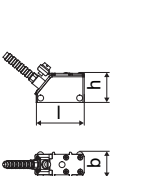
² shear wave transducer:

typical values for natural gas, nitrogen, oxygen; pipe diameters for other fluids on request

inner pipe diameter max. recommended/max. extended: in reflect arrangement and for a flow velocity of 49 ft/s

Lamb wave transducers

Lamb wave transducers (nonEx, NL)

order code		GLF-NNNNL	GLG-NNNNL	GLH-NNNNL	GLK-NNNNL	GLM-NNNNL	GLP-NNNNL	GLQ-NNNNL
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	psi	metal pipe: 145			metal pipe: 145 (d > 4.7 inch) 44 (d < 4.7 inch)	metal pipe: 44 (d < 2.4 inch)	metal pipe: 44 (d < 1.4 inch)	metal pipe: 44 (d < 0.59 inch)
min.	psi	metal pipe: 218 plastic pipe: 15			metal pipe: 218 (d > 4.7 inch) 145 (d < 4.7 inch) plastic pipe: 15	metal pipe: 145 (d > 2.4 inch) 73 (d < 2.4 inch) plastic pipe: 15	metal pipe: 145 (d > 1.4 inch) 73 (d < 1.4 inch) plastic pipe: 15	metal pipe: 145 (d > 0.59 inch) 73 (d < 0.59 inch) plastic pipe: 15
inner pipe diameter d ²								
min. extended	inch	8.7	7.1	4.3	2.4	1.2	0.59	0.28
min. recommended	inch	10.6	8.7	5.5	3.1	1.6	0.79	0.39
max. recommended	inch	47.2	35.4	23.6	11.8	5.9	2	0.87
max. extended	inch	63	55.1	39.4	14.2	7.1	2.4	1.2
pipe wall thickness								
min.	inch	0.59	0.43	0.31	0.2	0.1	0.05	0.02
max.	inch	1.3	0.94	0.63	0.39	0.2	0.12	0.05
max. extended	inch	1.4	-	-	-	-	-	-
material								
housing		PPSU with stainless steel cover 316Ti		PPSU with stainless steel cover 304				
contact surface		PPSU						
degree of protection		NEMA 4						
transducer cable								
type		1699						
length	ft	16				13		9
length (***/****/LC)	ft	29						
dimensions								
length l	inch	6.42	5.06				2.91	1.65
width b	inch	2.13	2.01				1.26	0.87
height h	inch	3.59	2.66				1.59	1
dimensional drawing								
weight (without cable)	lb	2.1	1				0.17	0.04
pipe surface temperature								
min.	°F	-40						
max.	°F	+266						
ambient temperature								
min.	°F	-40						
max.	°F	+266						
temperature compensation		x						

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

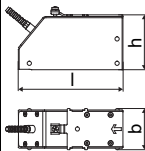
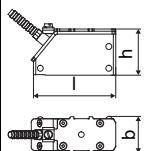
² Lamb wave transducer:

typical values for natural gas, nitrogen, oxygen; pipe diameters for other fluids on request

inner pipe diameter max. recommended: in reflect arrangement (diagonal arrangement) and for a flow velocity of 49 ft/s (98 ft/s)

inner pipe diameter max. extended: in reflect arrangement (diagonal arrangement) and for a flow velocity of 39 ft/s (82 ft/s)

Lamb wave transducers (nonEx, steam measurement, NL)

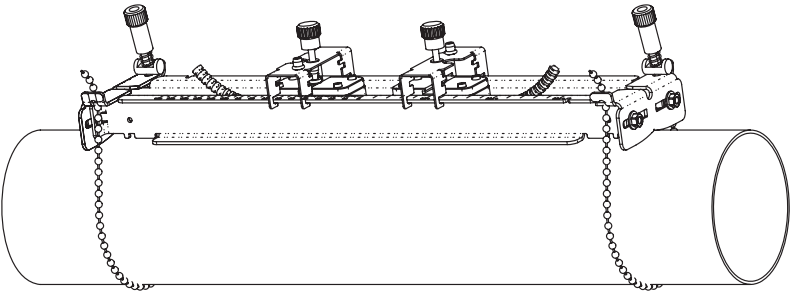
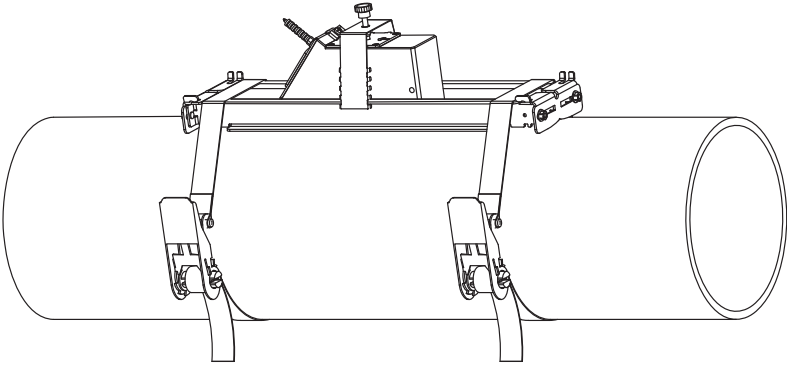
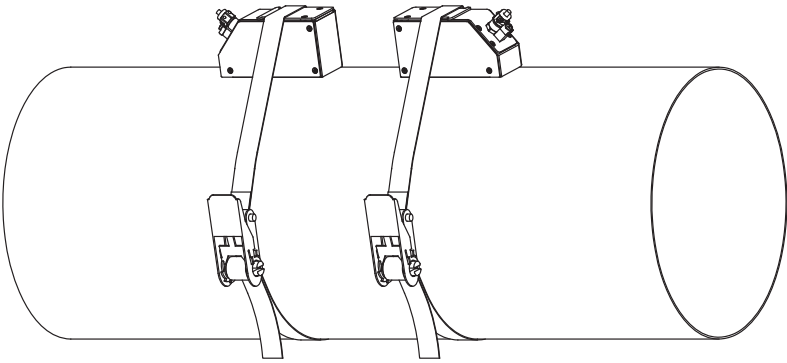
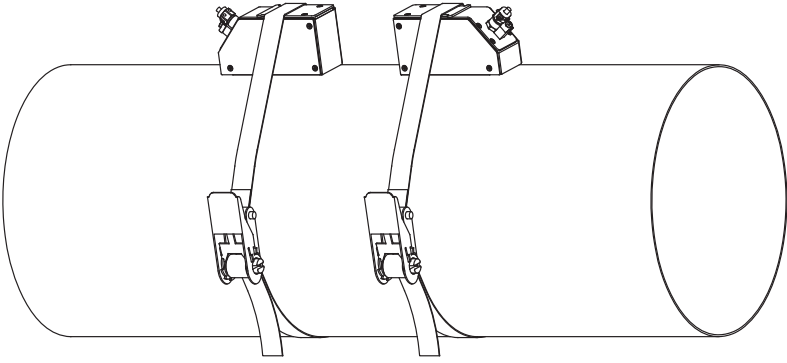
order code		GLG-SNNNL/**	GLH-SNNNL/**	GLK-SNNNL/**	GLM-SNNNL/**	GLP-SNNNL/**
technical type		G(RT)G1SC3	G(RT)H1SC3	G(RT)K1SC3	G(RT)M1SC3	G(RT)P1SC3
transducer frequency	MHz	0.2	0.3	0.5	1	2
inner pipe diameter d						
min.	inch	8.9	5.9	3.5	1.8	0.91
max.	inch	39.4	26.3	15.7	7.9	3.9
pipe wall thickness						
min.	inch	0.42	0.28	0.17	0.08	0.04
max.	inch	0.93	0.62	0.37	0.19	0.09
material						
housing		PPSU with stainless steel cover 316Ti				
contact surface		PPSU				
degree of protection		IP65				
transducer cable						
type		1699				
length	ft	16			13	
length (**-****/LC)	ft	29			29	
dimensions						
length l	inch	5.06			2.91	
width b	inch	2.01			1.3	
height h	inch	2.66			1.59	
dimensional drawing						
weight (without cable)	lb	1.8			0.35	
storing temperature						
min.	°F	-40				
max.	°F	+356				
operating temperature ¹						
min.	°F	212				
max.	°F	356				
warm-up time	h	3			1	
temperature compensation		x				

completely thermally insulated transducer installation necessary

Transducer mounting fixture

Order code

1, 2	3	4	5	6	7 to 9	no. of character		
transducer mounting fixture	transducer	-	measurement arrangement	size	-	fixation	outer pipe diameter	description
VP								portable Variofix
TB								tension belts
TH								high-temperature tension belts
	A							all transducers
		D						reflect arrangement or diagonal arrangement/direct mode
		R						reflect arrangement
			S					small
			M					medium
				C				chains
				G				tension belts
				H				high-temperature tension belts
				N				without fixation
						055		0.39 to 21.7 inch
						060		2 to 23.6 inch
						150		2 to 59.1 inch
					210		2 to 82.7 inch	

<p>portable Variofix VP and chains (optional)</p> 	<p>material: stainless steel 304, 301, 303 dimensions: 16.3 x 3.7 x 2.99 inch chain length: 6 ft</p>
<p>portable Variofix VP and tension belts</p> 	
<p>tension belts TB (optional)</p> 	<p>material: steel, powder coated and textile tension belt length: 16/22 ft</p> <p>ambient temperature: max. 140 °F outer pipe diameter: max. 59.1/82.7 inch</p>
<p>high-temperature tension belts TH (optional)</p> 	<p>material: clasp: stainless steel 304 tension belt: Aramid length: 6/16 ft ambient temperature: max. 500 °F outer pipe diameter: max. 23.6/59.1 inch</p>

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)
< 212 °F	< 338 °F	< 302 °F	< 392 °F	< 302 °F
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 pad type VT

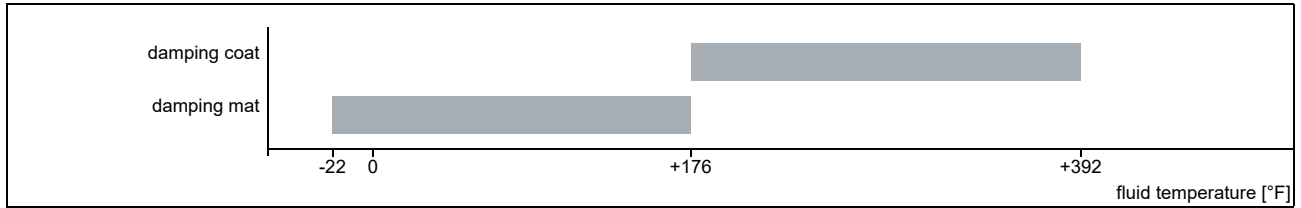
¹ in combination with type VT only

Technical data

type	ambient temperature °F
coupling compound type N	-22 to +266
coupling compound type E	-22 to +392
coupling compound type H	-22 to +482
coupling pad type VT	14 to +392

Damping material (optional)

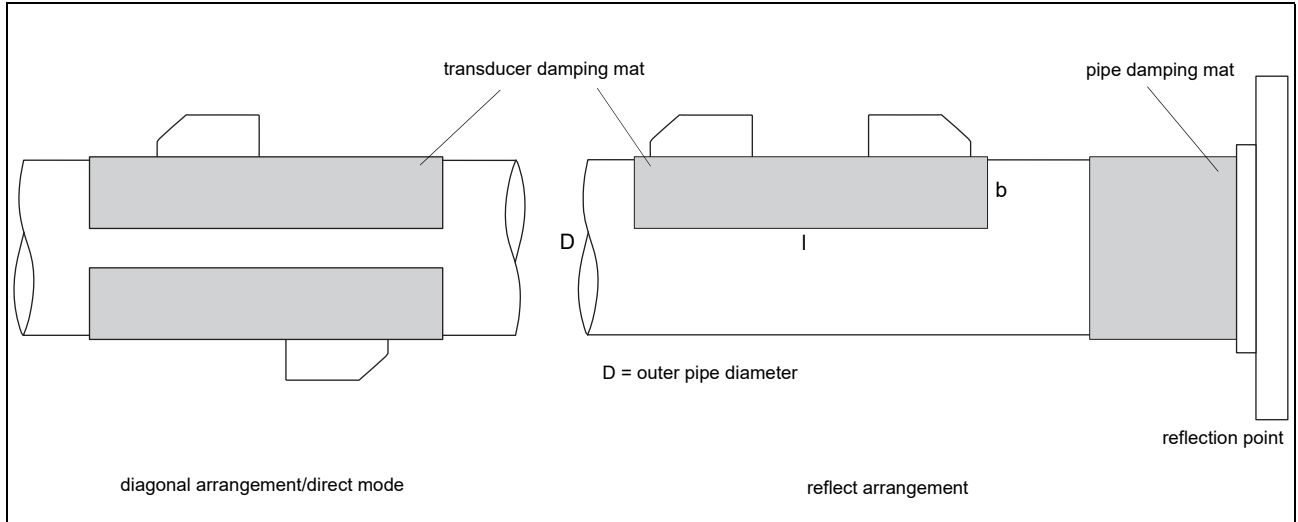
Damping material will be used for the gas measurement to reduce acoustic noise influences on the measurement.



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	dimensions l x b x h	transducer frequency								technical type	ambient temperature	remark
		inch	inch	F	G	H	K	M	P	Q		°F		
transducer damping mat														
D	for temporary installation (multiple use), fixed with coupling compound	< 3.1	17.72 x 4.53 x 0.02	-	-	-	-	x	x	x	D20S3	-13 to +140		
		≥ 3.1	35.43 x 9.06 x 0.02	-	-	-	x	x	-	-	D20S2			
			35.43 x 9.06 x 0.05	x	x	x	-	-	-	-	D50S2			
pipe damping mat														
A	for temporary installation (multiple use), fixed with coupling compound	< 11.8	11.81 x 4.53 x 0.02	x	x	x	x	x	x	x	A20S4	-13 to +140	for quantity see table below	
B	self-adhesive	≥ 11.8	l x 3.94 x 0.04	x	x	x	x	x	x	-	B35R2	-31 to +122	l - see table below	

Quantity for pipe damping mat - type A

(depending on outer pipe diameter)

outer pipe diameter D inch	transducer frequency	
	F, G, H	K, M, P, Q
3.9	12	6
7.9	24	12
11.8	32	16

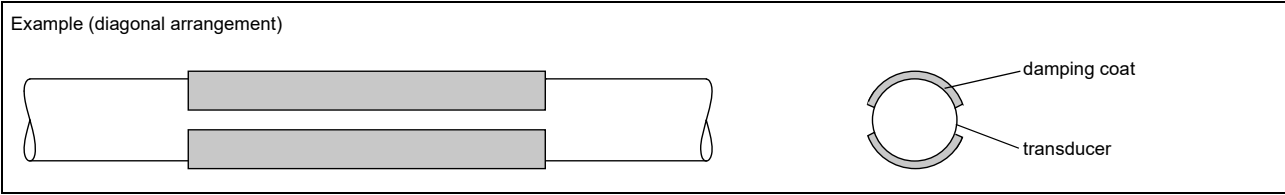
Length of pipe damping mat - type B

(length l depending on transducer frequency and outer pipe diameter)

outer pipe diameter D inch	transducer frequency	
	F, G, H ft	K, M, P ft
11.8	39	19
19.7	104	52
39.4	413	206

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

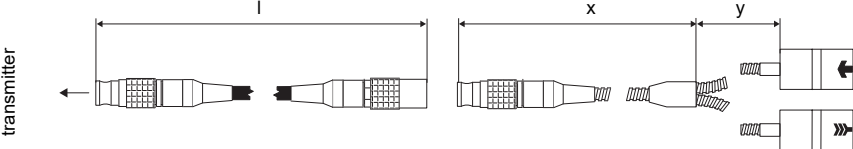
material		multipolymeric matrix/inorganic ceramic coating
packing drum	gal	1
properties		heat resistant, inert
fluid temperature when applying	°F	50 to 392
drying time (example)		approx. 3 h at 68 °F approx. 15 min at 302 °F
temperature resistance in dry state	°F	max. 1202
durability of the packing drum (unopened)		2 years

Observe installation instructions (TI_DampingCoat).

Dimensioning

transducer frequency	number of packing drums		
	outer pipe diameter		
	≤11.8	≤19.7	≤27.6
	inch		
F	1	2	2
G	1	1	2
H	1	1	1
K	1	1	-
M	1	-	-
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	lb/ft	0.06
ambient temperature	°F	-67 to +392
cable jacket		
material		PTFE
outer diameter	inch	0.11
thickness	inch	0.01
color		brown
shield		x
sheath		
material		stainless steel 304
outer diameter	inch	0.31

extension cable			
type		1750	2551
standard length	ft	16 32	-
max. length	ft	32	see table below
weight	lb/ft	0.08	0.06
ambient temperature	°F	< 144	-13 to +176
cable jacket			
material		PE	TPE-O
outer diameter	inch	0.24	0.31
thickness	inch	0.02	
color		black	black
shield		x	x
sheath			
material		stainless steel 304	-
outer diameter	inch	0.35	-
remark		optional	

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
*D***Z7 ¹ *R***C3 ¹	ft	6	9	≤ 82	6	6	≤ 82	6	3	≤ 82	3	3	≤ 65
option LC: *L***Z7 ¹ *T***C3 ¹	ft	6	22	≤ 82	22	6	≤ 82	26	3	≤ 82	-	-	-

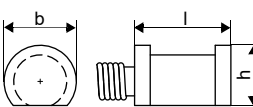
¹ l > 82 to 328 ft on request


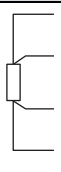
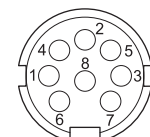
x, y = transducer cable length

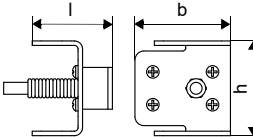
l = max. length of extension cable

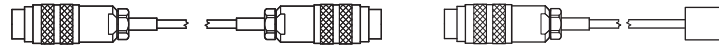
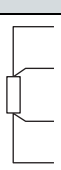
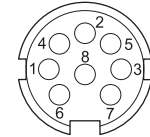
Clamp-on temperature probe (optional)

Technical data

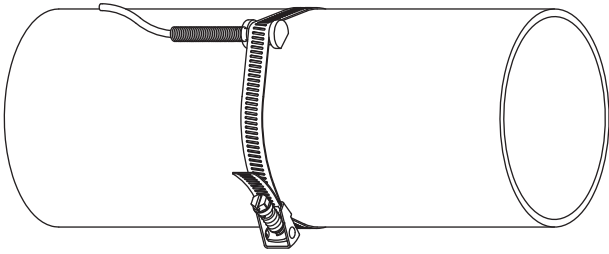
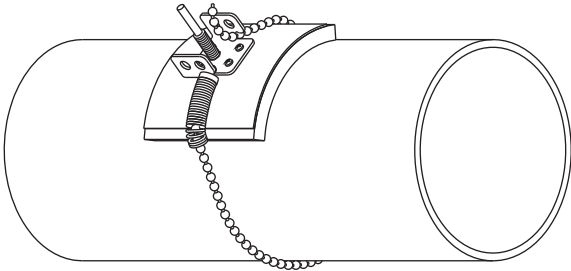
PT13N			
design		clamp-on with connector	
type		Pt1000	
connection		4-wire	
measuring range	°F	-40 to +392	
accuracy T		±(0.27 °F + 2 · 10 ⁻³ · (T [°F] - 32 °F)) class A	
accuracy ΔT (2x Pt matched according to EN 1434-1)		≤ 0.03 °F (at 50 °F)	
housing		360 brass alloy	
degree of protection		NEMA 4	
dimensions			
length l	inch	0.79	
width b	inch	0.59	
height h	inch	0.49	
dimensional drawing			
weight	lb	0.437 (without connector)	
accessories			
thermal conductivity foil 482 °F		x	

Connection system			
direct connection/connection with extension cable			
extension cable 			
Connection			
	temperature probe	extension cable	connector
	red	black	2
	red	green	6
	white	white	1
	white	red	7
			
Cable			
	temperature probe	extension cable	
type		4 x 24 AWG	4 x 18 AWG
standard length	ft	20	-
max. length	ft	-	656
cable jacket		PTFE	LS PVC

PT13F			
design		clamp-on short response time, with connector	
type		Pt1000	
connection		4-wire	
measuring range	°F	-58 to +482	
accuracy T		±(0.27 °F + 2 · 10 ⁻³ · (T [°F] - 32 °F)) 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 (t ₅₀ , T ₁ = 25 °C, T ₂ = 60 °C)	
housing		PEEK, stainless steel 304, copper	
degree of protection		IP54	
dimensions			
length l	inch	0.55	
width b	inch	1.18	
height h	inch	1.06	
dimensional drawing			
weight	lb	0.7 (without connector)	
accessories			
thermal conductivity paste 392 °F		x	
thermal conductivity foil 482 °F		x	
plastic protection plate, insulation foam		x	

Connection system			
direct connection/connection with extension cable			
extension cable 			
Connection			
	temperature probe	extension cable	connector
	red	black	2
	red/blue	green	6
	white/blue	white	1
	white	red	7
			
Cable			
	temperature probe	extension cable	
type		4 x 0.22 mm ²	4 x 18 AWG
standard length	ft	9	-
max. length	ft	-	656
ambient temperature	°F	-58 to +482	
min. bend radius	inch	1.06	
cable jacket			
material		PFA	LS PVC
outer diameter	inch	0.15 ±0.01	
color		black	

Fixation

<p>tension strap PT13N</p>  <p>A technical line drawing showing a cylindrical object with a tension strap PT13N attached to its side. The strap is a flat, ribbed band that loops around the cylinder and is secured with a metal clasp and a locking mechanism.</p>	<p>material: stainless steel 301, 410 thermal insulation necessary</p>
<p>ball chain PT13F</p>  <p>A technical line drawing showing a cylindrical object with a ball chain PT13F attached to its side. The chain is a series of spherical links connected by a metal bracket and a locking mechanism.</p>	<p>material: stainless steel 316L length: 3 ft</p>

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

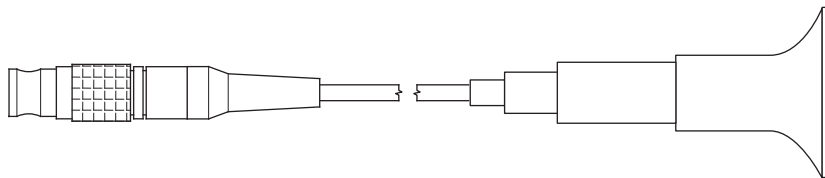
DWR1NZ7		
order code		ACC-PO-G601-/W6
measuring range ¹	inch	0.04 to 9.8
resolution	inch	0.0004
accuracy		1 % ±0.004 inch
fluid temperature	°F	-4 to +392, short-time peak max. 932
cable		
type		2616
length	ft	4

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	°F	<392
cable jacket		
material		FEP
outer diameter	inch	0.2
color		black
shield		x

DWR1NZ7



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