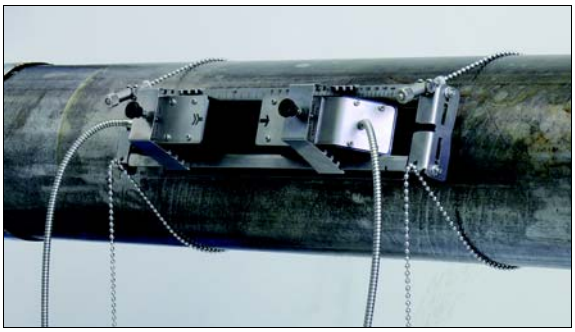
Portable ultrasonic flow measurement of gas

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

Features

- Precise bi-directional and highly dynamic flow measurement with the non-invasive clamp-on technology
- 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 and dust-tight (NEMA 4); resistant against oil, many liquids and dirt
- Li-Ion battery provides up to 25 hours of measurement operation
- 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
- User-friendly design
- Transducers available for a wide range of inner pipe diameters and fluid temperatures
- Probe for wall thickness measurement available
- Robust, water-tight (NEMA 4) transport case with comprehensive accessories
- QuickFix for fast mounting of the flow transmitter in difficult conditions
- Including measurement of liquids

FLUXUS G601 supported by handle



Measurement with transducers mounted with the portable Variofix VP

Applications

Designed for industrial use in harsh environments, in gas processing and natural gas extraction, chemical industry and in the petroleum industry. Practical applications:

- 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

Measurement equipment in transport case

Table of contents

Function

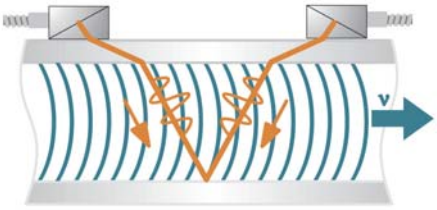
Measurement principle

In order to measure the flow of a fluid in a pipe, ultrasonic signals are used, employing the transit time difference principle. Ultrasonic signals are emitted by a transducer installed on the pipe and received by a second transducer. These signals are emitted alternately in the flow direction and against it.

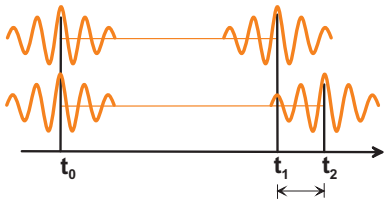
As the fluid in which the signals propagate is flowing, the transit time of the ultrasonic signals in the flow direction is shorter than against the flow direction.

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.

Two integrated microprocessors control the entire measuring process. This allows the flowmeter to remove disturbance signals, and to check each received ultrasonic wave for its validity which reduces noise.



Path of the ultrasonic signal



Transit time difference Δt

Calculation of volumetric flow rate

$\dot{V} = k_{Re} \cdot A \cdot k_a \cdot \Delta t/(2 \cdot t_{fl})$

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_{fl}	=	transit time in the fluid

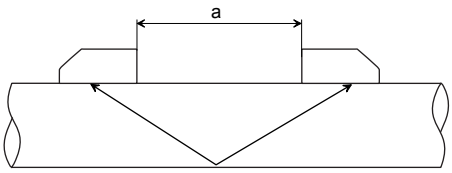
Number of sound paths

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. Both of the transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easier.
- **diagonal arrangement**
  The number of sound paths is odd. Both of 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.

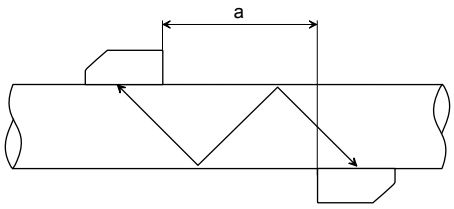
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

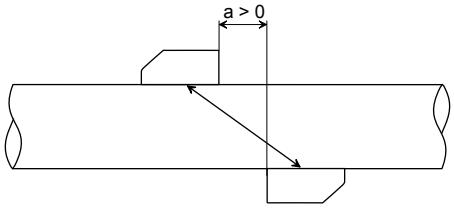


Reflect arrangement, number of sound paths: 2

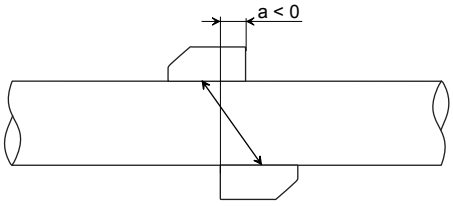
a = transducer distance



Diagonal arrangement, number of sound paths: 3

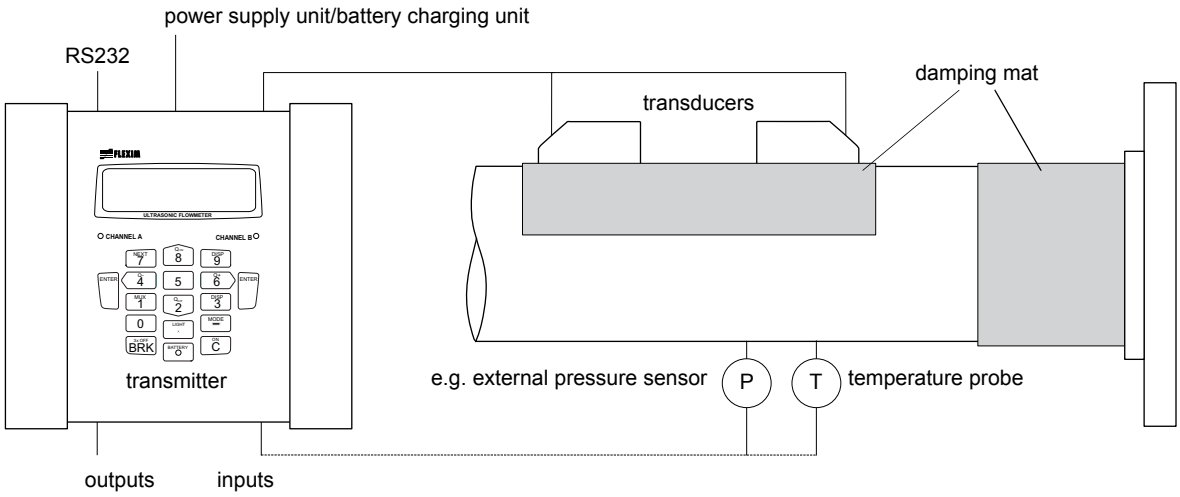


Direct mode, number of sound paths: 1



Direct mode, number of sound paths: 1,
negative transducer distance

Typical measurement setup



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

Standard volumetric flow rate

The standard volumetric flow rate can be selected as physical quantity to be measured. It will be calculated internally by:

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

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 the 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 according to e.g. AGA8 or GERG

Flow transmitter

Technical data

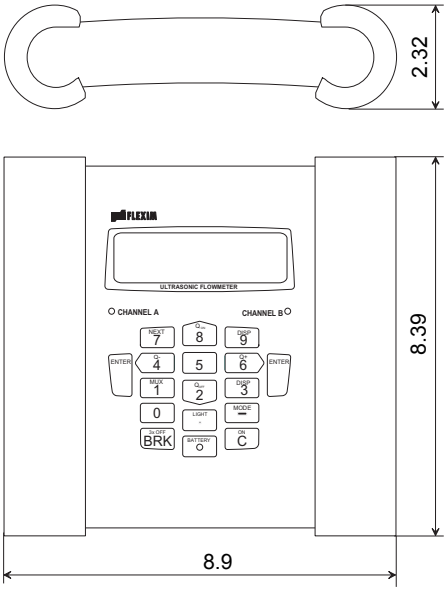
FLUXUS	**G601**
design	portable
	
measurement	
measurement principle	transit time difference correlation principle
flow velocity	0.03 to 115 ft/s, depending on pipe diameter
repeatability	0.15 % of reading ±0.03 ft/s
fluid	all acoustically conductive gases, e.g. nitrogen, air, oxygen, hydrogen, argon, helium, ethylene, propane
temperature compensation	corresponding to the recommendations in ANSI/ASME MFC-5.1-2011
accuracy	
volumetric flow rate	± 1 to 3 % of reading ±0.03 ft/s depending on application ± 0.5 % of reading ±0.03 ft/s with field calibration
flow transmitter	
power supply	100 to 230 V/50 to 60 Hz (power supply unit) 10.5 to 15 V DC (socket at transmitter) integrated battery
integrated battery - operating time	Li-Ion, 7.2 V/6.2 Ah > 14 h (without outputs, inputs and backlight) > 25 h (1 measuring channel, ambient temperature > 50 °F, without outputs, inputs and backlight)
power consumption	< 6 W (with outputs, inputs and backlight)
number of flow measuring channels	2
damping	0 to 100 s, adjustable
measuring cycle (1 channel)	100 to 1000 Hz
response time	1 s (1 channel), option: 70 ms
housing material	PA, TPE, AutoTex, stainless steel
degree of protection	NEMA 4
dimensions	see dimensional drawing
weight	4.6 lb
fixation	QuickFix pipe mounting fixture
ambient temperature	14 to 140 °F
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
totalizer	volume, mass
calculation functions	average, difference, sum
diagnostic functions	sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times

FLUXUS	G601
communication interfaces	
diagnostic interfaces	- RS232 - USB (with adapter)
process interfaces (optional)	- Modbus RTU
serial data kit	
software	- FluxDiagReader: download of measured values and parameters, graphical presentation - FluxDiag (optional): download of measurement data, graphical presentation, report generation - FluxSubstanceLoader: upload of fluid data sets
cable	RS232
adapter	RS232 - USB
data logger	
loggable values	all physical quantities, totalized values and diagnostic values
capacity	> 100 000 measured values
transport case	
dimensions	19.7 x 15.7 x 7.5 in
outputs	
	The outputs are galvanically isolated from the transmitter.
number	see standard scope of supply on page 9, max. on request
accessories	output adapter (if number of outputs > 4)
	current output
range	0/4 to 20 mA
accuracy	0.1 % of reading ±15 µA
active output	R_{ext} < 750 Ω (U_{int} = 24 V DC)
passive output	U_{ext} = 4 to 16 V, depending on R_{ext} R_{ext} < 500 Ω
	frequency output
range	0 to 5 kHz
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 - pulse value - pulse width	mainly for totalizing 0.01 to 1000 units 1 to 1000 ms
inputs	
	The inputs are galvanically isolated from the transmitter.
number	see standard scope of supply on page 9, max. 4
accessories	input adapter (if number of inputs > 2)
	temperature input
type	Pt100/Pt1000
connection	4-wire
range	-238 to +1040 °F
resolution	0.01 K
accuracy	±0.01 % of reading ±0.03 K
	current input
accuracy	0.1 % of reading ±10 µA
passive input	R_{int} = 50 Ω, P_{int} < 0.3 W
- range	-20 to +20 mA
	voltage input
range	0 to 1 V
accuracy	0.1 % of reading ±1 mV
internal resistance	R_{int} = 1 MΩ

For the technical data in the flow measurement of liquids mode see Technical specification TSFLUXUS_F601Vx-x.

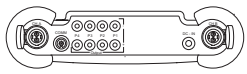
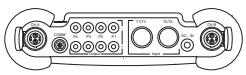
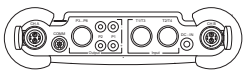
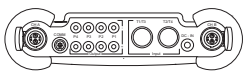
Dimensions

FLUXUS G601

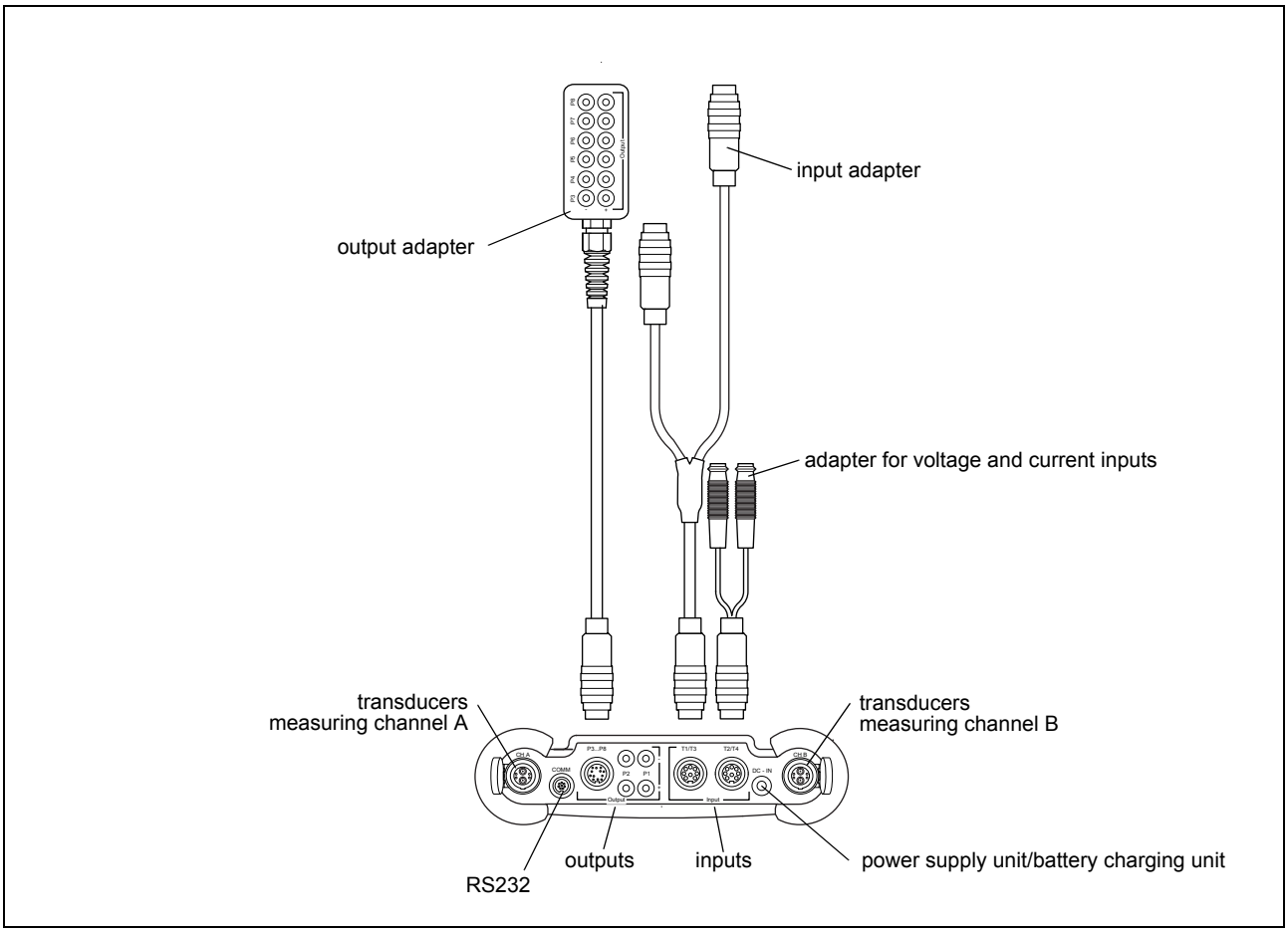


in inch

Standard scope of supply

	G601 Standard		G601 Extended Standard		G601 Multi-functional		G601 CA-Energy	
application	flow measurement on gas						flow measurement on compressed air, industrial gases 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					
			including energy calculator for BTU and heat measurements		simultaneous monitoring of 2 energy flows		liquids: integrated heat flow computer for monitoring of energy flows	
outputs								
passive current output	2	2	2	2	2	2	2	2
binary output	2	1	1	1	2	2	2	1
frequency output	-	-	1	-	1	0	-	-
Modbus	-	x	-	x	-	x	-	x
inputs								
temperature input	-	-	-	-	1	1	2	2
passive current input	-	-	2	2	2	2	2	2
voltage input	-	-	-	-	1	1	-	-
accessories								
transport case	x	x	x	x	x	x	x	x
power supply unit, mains cable	x	x	x	x	x	x	x	x
battery	x	x	x	x	x	x	x	x
output adapter	-	-	-	-	x	x	-	-
input adapter	-	-	2	2	2	2	2	2
adapter for voltage and current inputs	-	-	-	-	3	3	2	2
QuickFix pipe mounting fixture for transmitter	x	x	x	x	x	x	x	x
serial data kit	x	x	x	x	x	x	x	x
measuring tape	x	x	x	x	x	x	x	x
wall thickness probe	-	-	-	-	x	x	x	x
user manual, Quick start guide	x	x	x	x	x	x	x	x
connector board at the upper side of the transmitter								

Connection of adapters



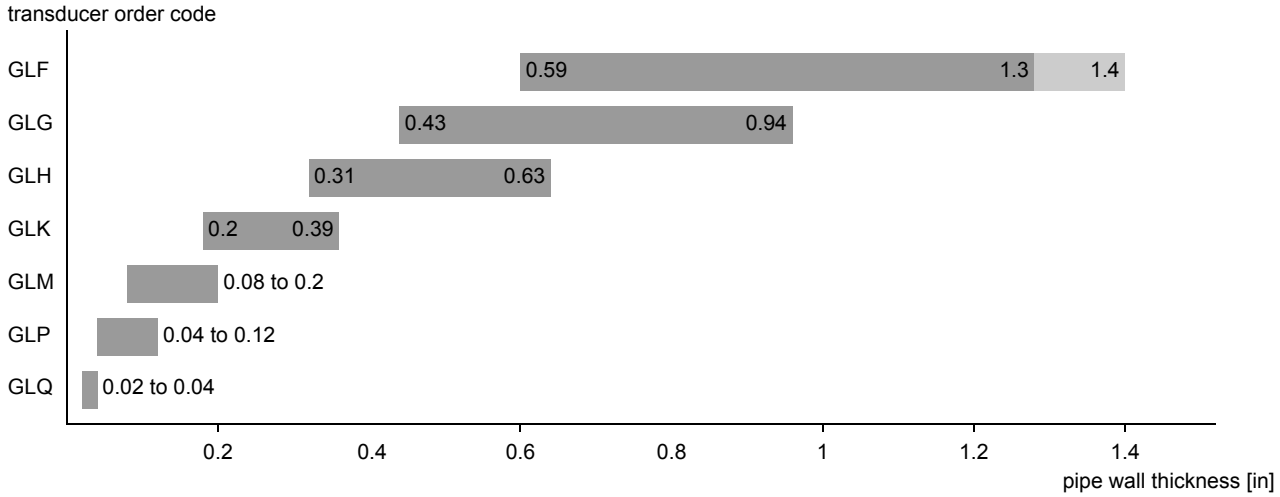
Example for the equipment of a transport case

Transducers

Transducer selection

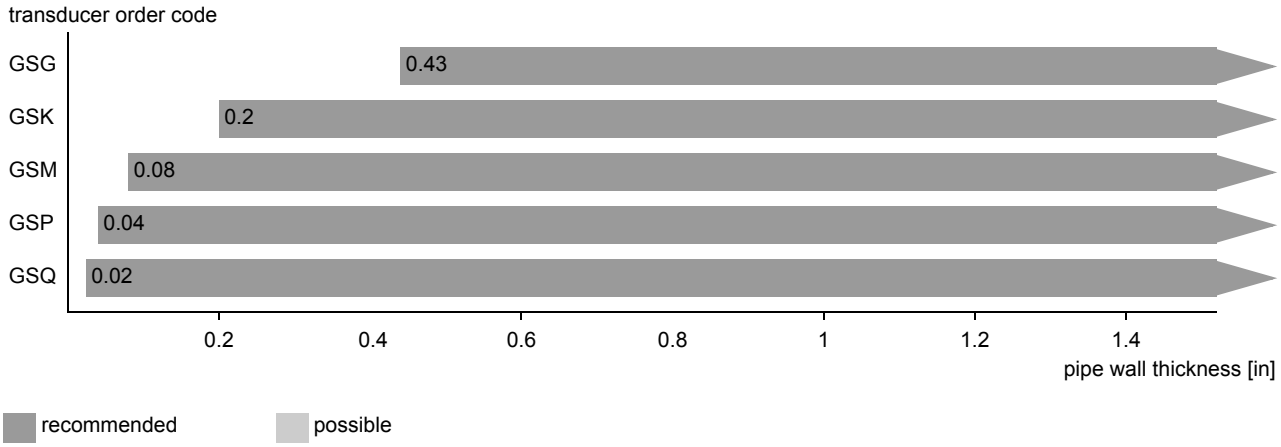
Step 1a

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

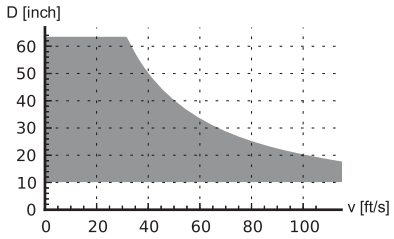
The transducers are selected from the characteristics (see next page). Lamb wave transducers are selected from the left column, shear wave transducers from the right column.

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.

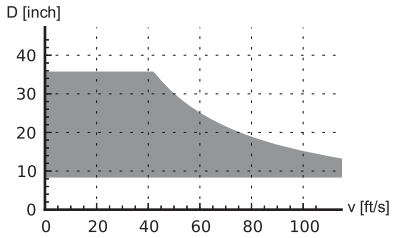
Lamb wave transducer[1]

shear wave transducer[1]

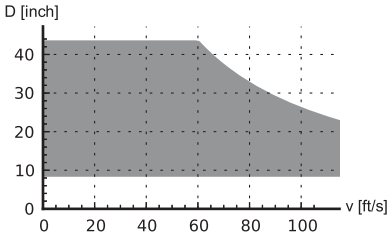
GLF



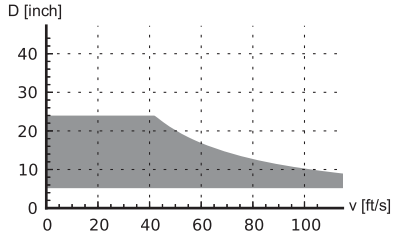
GLG



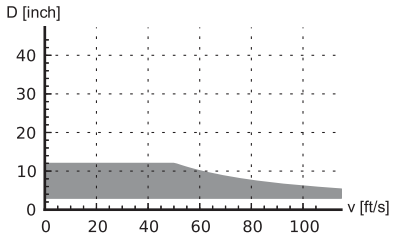
GSG



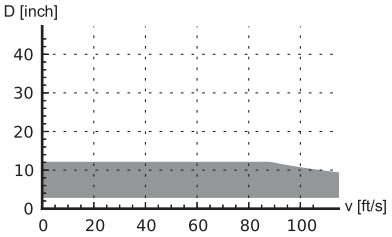
GLH



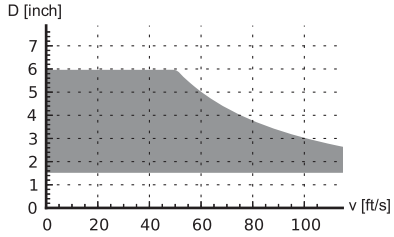
GLK



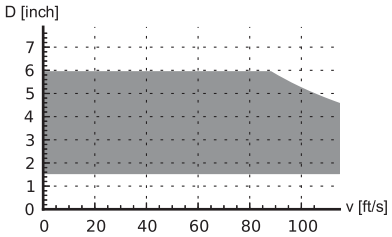
GSK



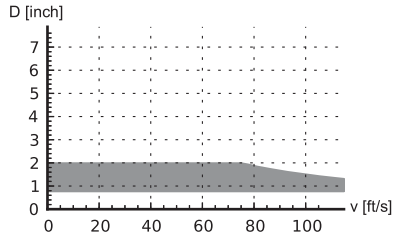
GLM



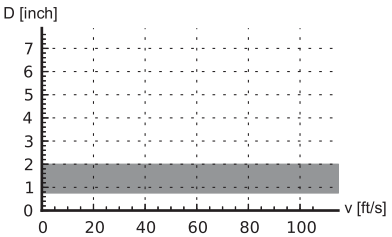
GSM



GLP

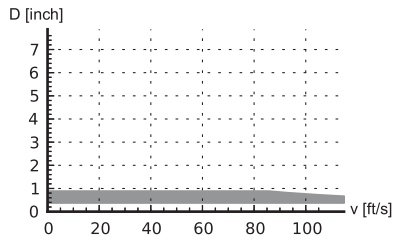


GSP



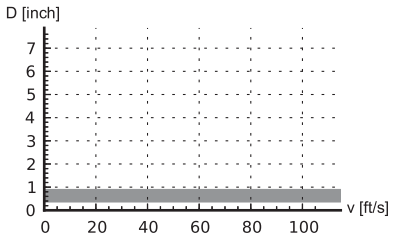
[1] inner pipe diameter and max. flow velocity for a typical application with natural gas, nitrogen, oxygen in reflect arrangement with 2 sound paths (Lamb wave transducers)/1 sound path (shear wave transducers)

Lamb wave transducer[1]



GLQ

shear wave transducer[1]



GSQ

[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 order 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 in) 145 (d < 4.7 in)	145 (d > 4.7 in) 44 (d < 4.7 in)	15
GLM	145 (d > 2.4 in) 73 (d < 2.4 in)	44 (d < 2.4 in)	15
GLP	145 (d > 1.4 in) 73 (d < 1.4 in)	44 (d < 1.4 in)	15
GLQ	145 (d > 0.59 in) 73 (d < 0.59 in)	44 (d < 0.59 in)	15

shear wave transducer			
transducer order 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

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

d = inner pipe diameter

Example

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

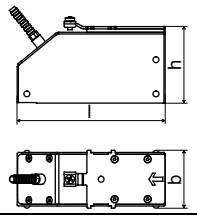
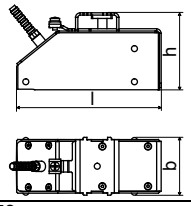
for the technical data of the selected transducer see page 16 et seqq.

Transducer 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	description
GL								set of ultrasonic flow transducers for gas measurement, Lamb wave
GS								set of ultrasonic flow transducers for gas measurement, shear wave
	F							0.15 MHz (Lamb wave only)
	G							0.2 MHz
	H							0.3 MHz (Lamb wave only)
	K							0.5 MHz
	M							1 MHz
	P							2 MHz
	Q							4 MHz
			N					normal temperature range
			E					extended temperature range (FSM, FSP, FSQ)
				NN				not explosion proof
					NL			with Lemo connector
							XXX	cable length in m, for max. length of extension cable see page 25
example								
GL	K	-	N	NN	NL	-	000	Lamb wave transducer 0.5 MHz, normal temperature range, connection system NL with Lemo connector
		-				-		

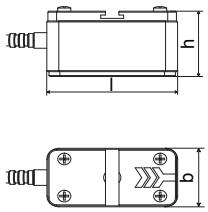
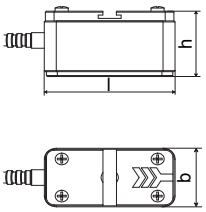
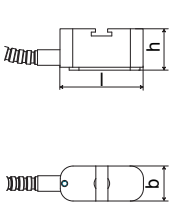
Technical data

Shear wave transducers

technical type		GDG1NZ7	GDK1NZ7
order code		**GSG-NNNNL**	**GSK-NNNNL**
transducer frequency	MHz	0.2	0.5
fluid pressure[1]			
min. extended min.	psi psi	metal pipe: 290 metal pipe: 435 plastic pipe: 15	metal pipe: 290 metal pipe: 435 plastic pipe: 15
inner pipe diameter d[2]			
min. extended	in	7.1	2.4
min. recommended	in	8.7	3.1
max. recommended	in	35.4	11.8
max. extended	in	43.3	14.2
pipe wall thickness			
min.	in	0.43	0.2
material			
housing contact surface		PEEK with stainless steel cap 304 PEEK	PEEK with stainless steel cap 304 PEEK
degree of protection		NEMA 6	NEMA 6
transducer cable			
type length	 ft	1699 16	1699 16
dimensions			
length l width b height h	in in in	5.1 2.01 2.64	4.98 2.01 2.66
dimensional drawing			
weight (without cable)	lb	1	0.79
ambient temperature			
min. max.	°F °F	-40 +266	-40 +266
temperature compensation		x	x

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

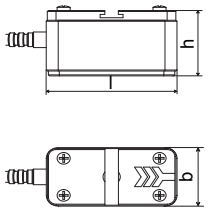
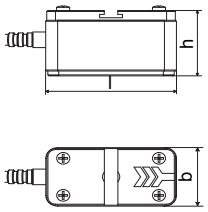
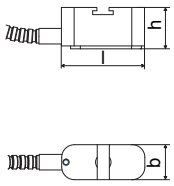
[2] shear wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
inner pipe diameter max. recommended/max. extended: in reflect arrangement and for a flow velocity of 49 ft/s

technical type		GDM1NZ7	GDP1NZ7	GDQ1NZ7
order code		**GSM-NNNNL**	**GSP-NNNNL**	**GSQ-NNNNL**
transducer frequency	MHz	1	2	4
fluid pressure[1]				
min. extended min.	psi psi	metal pipe: 290 metal pipe: 435 plastic pipe: 15	metal pipe: 290 metal pipe: 435 plastic pipe: 15	metal pipe: 290 metal pipe: 435 plastic pipe: 15
inner pipe diameter d[2]				
min. extended	in	1.2	0.59	0.28
min. recommended	in	1.6	0.79	0.39
max. recommended	in	5.9	2	0.87
max. extended	in	7.1	2.4	1.2
pipe wall thickness				
min.	in	0.08	0.04	0.02
material				
housing contact surface		stainless steel 304 PEEK	stainless steel 304 PEEK	stainless steel 304 PEEK
degree of protection		NEMA 6	NEMA 6	NEMA 6
transducer cable				
type length	 ft	1699 13	1699 13	1699 9
dimensions				
length l width b height h	in in in	2.36 1.18 1.32	2.36 1.18 1.32	1.67 0.71 0.85
dimensional drawing				
ambient temperature				
min. max.	°F °F	-40 +266	-40 +266	-40 +266
temperature compensation		x	x	x

[1] depending on 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

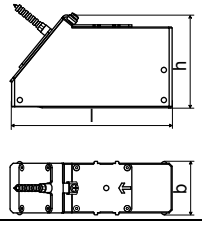
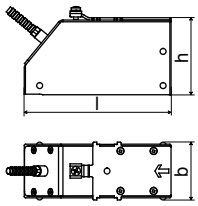
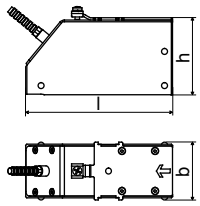
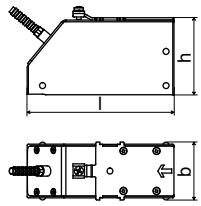
Shear wave transducers (extended temperature range)

technical type		GDM1EZ7	GDP1EZ7	GDQ1EZ7
order code		**GSM-ENNNL**	**GSP-ENNNL**	**GSQ-ENNNL**
transducer frequency	MHz	1	2	4
fluid pressure[1]				
min. extended min.	psi psi	metal pipe: 290 metal pipe: 435 plastic pipe: 15	metal pipe: 290 metal pipe: 435 plastic pipe: 15	metal pipe: 290 metal pipe: 435 plastic pipe: 15
inner pipe diameter d[2]				
min. extended min. recommended max. recommended max. extended	in in in in	1.2 1.6 5.9 7.1	0.59 0.79 2 2.4	0.28 0.39 0.87 1.2
pipe wall thickness				
min.	in	0.08	0.04	0.02
material				
housing contact surface		stainless steel 304 Sintimid	stainless steel 304 Sintimid	stainless steel 304 Sintimid
degree of protection		NEMA 4	NEMA 4	NEMA 4
transducer cable				
type length	 ft	1699 13	1699 13	1699 9
dimensions				
length l width b height h	in in in	2.36 1.18 1.32	2.36 1.18 1.32	1.67 0.71 0.85
dimensional drawing				
ambient temperature				
min. max.	°F °F	-22 +392	-22 +392	-22 +392
temperature compensation		x	x	x

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

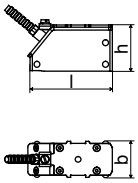
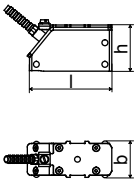
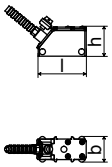
[2] shear wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
inner pipe diameter max. recommended/max. extended: in reflect arrangement and for a flow velocity of 49 ft/s

Lamb Wave Transducers

technical type		GRF1NC3	GRG1NC3	GRH1NC3	GRK1NC3
order code		**GLF-NNNNL**	**GLG-NNNNL**	**GLH-NNNNL**	**GLK-NNNNL**
transducer frequency	MHz	0.15	0.2	0.3	0.5
fluid pressure[1]					
min. extended	psi	metal pipe: 145	metal pipe: 145	metal pipe: 145	metal pipe: 145 (d > 4.7 in) 44 (d < 4.7 in)
min.	psi	metal pipe: 218 plastic pipe: 15	metal pipe: 218 plastic pipe: 15	metal pipe: 218 plastic pipe: 15	metal pipe: 218 (d > 4.7 in) 145 (d < 4.7 in) plastic pipe: 15
inner pipe diameter d[2]					
min. extended	in	8.7	7.1	4.3	2.4
min. recommended	in	10.6	8.7	5.5	3.1
max. recommended	in	47.2	35.4	23.6	11.8
max. extended	in	63	55.1	39.4	14.2
pipe wall thickness					
min.	in	0.59	0.43	0.31	0.2
max.	in	1.3	0.94	0.63	0.39
max. extended	in	1.4	-	-	-
material					
housing contact surface		PPSU with stainless steel cap 316Ti PPSU	PPSU with stainless steel cap 304 PPSU	PPSU with stainless steel cap 304 PPSU	PPSU with stainless steel cap 304 PPSU
degree of protection		NEMA 4	NEMA 4	NEMA 4	NEMA 4
transducer cable					
type		1699	1699	1699	1699
length	ft	16	16	16	16
dimensions					
length l	in	6.42	5.06	5.06	5.06
width b	in	2.13	2.01	2.01	2.01
height h	in	3.59	2.66	2.66	2.66
dimensional drawing					
ambient temperature					
min.	°F	-40	-40	-40	-40
max.	°F	+338	+338	+338	+338
temperature compensation		x	x	x	x

[1] depending on 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)

technical type		GRM1NC3	GRP1NC3	GRQ1NC3
order code		**GLM-NNNNL**	**GLP-NNNNL**	**GLQ-NNNNL**
transducer frequency	MHz	1	2	4
fluid pressure[1]				
min. extended	psi	metal pipe: 44 (d < 2.4 in)	metal pipe: 44 (d < 1.4 in)	metal pipe: 44 (d < 0.59 in)
min.	psi	metal pipe: 145 (d > 2.4 in) 73 (d < 2.4 in) plastic pipe: 15	metal pipe: 145 (d > 1.4 in) 73 (d < 1.4 in) plastic pipe: 15	metal pipe: 145 (d > 0.59 in) 73 (d < 0.59 in) plastic pipe: 15
inner pipe diameter d[2]				
min. extended	in	1.2	0.59	0.28
min. recommended	in	1.6	0.79	0.39
max. recommended	in	5.9	2	0.87
max. extended	in	7.1	2.4	1.2
pipe wall thickness				
min.	in	0.08	0.04	0.02
max.	in	0.2	0.12	0.04
max. extended	in	-	-	-
material				
housing		PPSU with stainless steel cap 304	PPSU with stainless steel cap 304	PPSU with stainless steel cap 304
contact surface		PPSU	PPSU	PPSU
degree of protection		NEMA 4	NEMA 4	NEMA 4
transducer cable				
type		1699	1699	1699
length	ft	13	13	9
dimensions				
length l	in	2.91	2.91	1.65
width b	in	1.26	1.26	0.87
height h	in	1.59	1.59	1
dimensional drawing				
ambient temperature				
min.	°F	-40	-40	-40
max.	°F	+338	+338	+338
temperature compensation		x	x	x
remark				

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

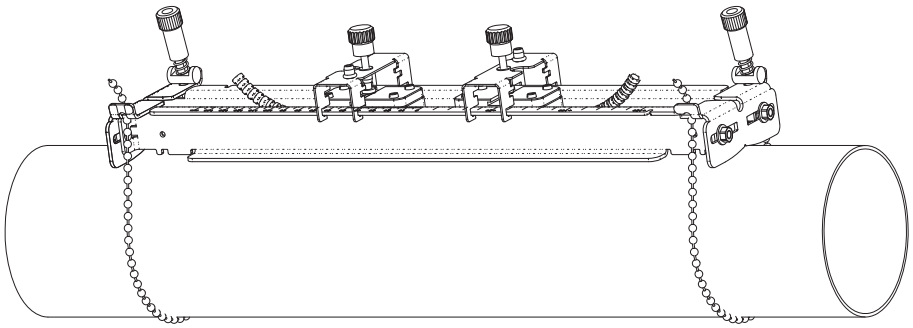
[2] Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
inner pipe diameter max. recommended: in reflect arrangement (diagonal arrangement) and for a flow velocity of 49 ft/s (98 ft/s)
inner pipe diameter max. extended: in reflect arrangement (diagonal arrangement) and for a flow velocity of 39 ft/s (82 ft/s)

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
	A							all transducers
			D					reflect arrangement or diagonal arrangement/direct mode
			R					reflect arrangement
				S				small
				M				medium
						C		chains
						G		tension belts
						N		without fixation
							055	0.39 to 21.7 in
							150	2 to 59.1 in
							210	2 to 82.7 in
example								
VP	A	-	D	M	-	C	055	portable Variofix and chains
		-			-			

portable Variofix VP and chains (optional)

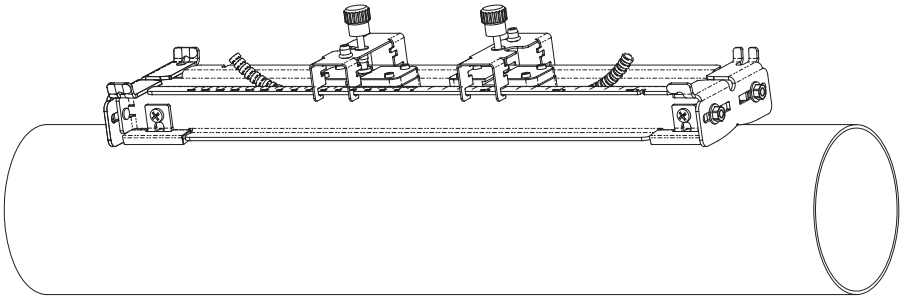


material: stainless steel 304, 301, 303

dimensions:
16.3 x 3.7 x 2.99 in

chain length: 6 ft

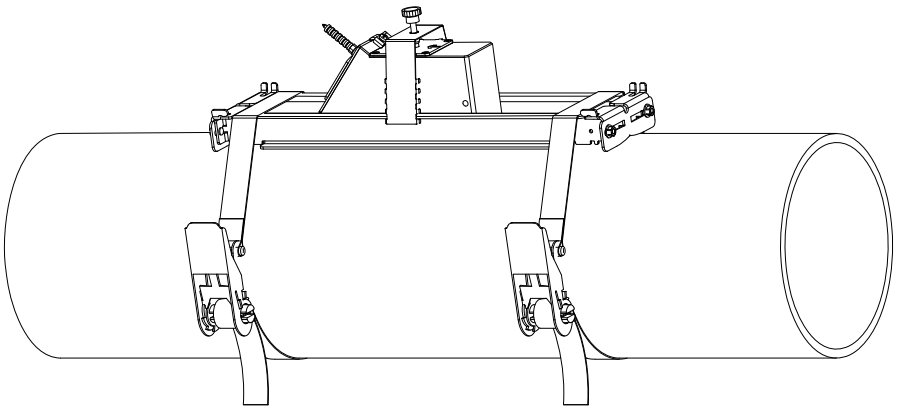
portable Variofix VP and magnet (optional)



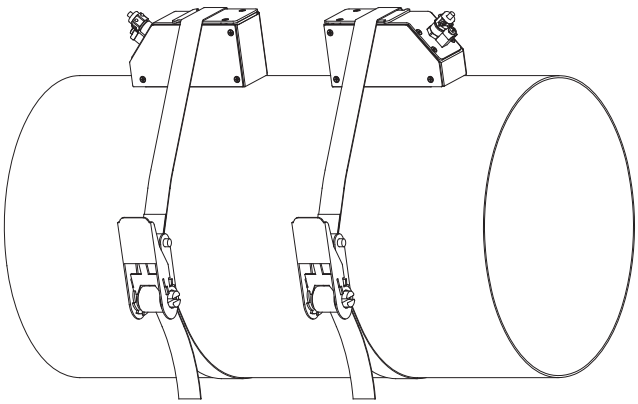
material: stainless steel 304, 301, 303

dimensions:
16.3 x 3.7 x 1.57 in

portable Variofix VP and tension belts



tension belts TB (optional)



material: steel, powder coated and textile tension belt

length: 16/22 ft

ambient temperature:
max. 140 °F

outer pipe diameter:
max. 59.1/82.7 in

Coupling materials for transducers

normal temperature range (4th character of transducer order code = N)		**extended temperature range (4th character of transducer order code = E)**	
< 212 °F	< 338 °F	< 302 °F	< 392 °F
coupling compound type N	coupling compound type E	coupling compound type E	coupling compound type E or H

Technical data

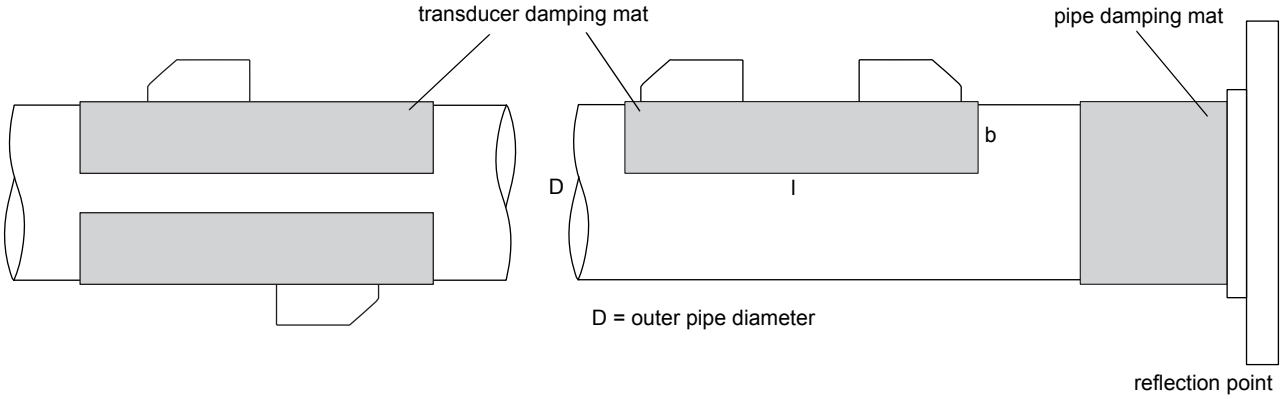
type	**ambient temperature** °F	**material**
coupling compound type N	-22 to +266	mineral grease paste
coupling compound type E	-22 to +392	silicone paste
coupling compound type H	-22 to +482	fluoropolymer paste

Damping mats (optional)

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

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 in	dimensions l x b x h in	transducer frequency F	G	H	K	M	P	Q	technical type	ambient temperature °F	remark
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 the outer pipe diameter)

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

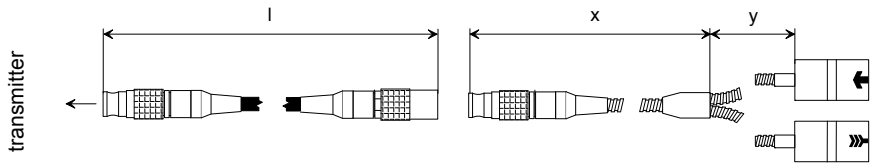
Length of pipe damping mat - type B

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

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

Connection systems

connection system NL



transducer frequency (3d character of transducer order code)			F, G, H, K			M, P			Q			S		
N L	cable length	ft	**x** 6	**y** 9	**l**[1] ≤ 82	**x** 6	**y** 6	**l**[1] ≤ 82	**x** 6	**y** 3	**l**[1] ≤ 82	**x** 3	**y** 3	**l** ≤ 65

[1] > 82 to 328 ft on request

x, y = transducer cable length
l = max. length of extension cable

Transducer cable

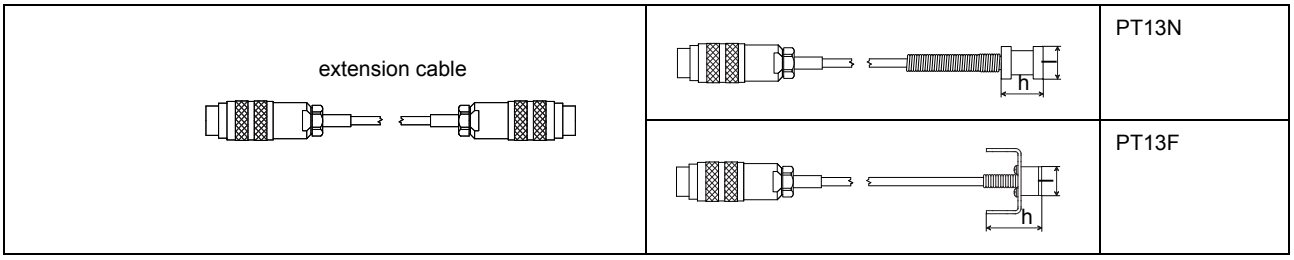
Technical data

		transducer cable	extension cable	
type		1699	2551	1750
standard length	ft	see table above	-	16 32
max. length	ft	-	see table above	32
ambient temperature	°F	-67 to +392	-13 to +176	< 144
cable jacket				
material		PTFE	TPE-O	PE
outer diameter	in	0.11	0.31	0.24
thickness	in	0.01		0.02
color		brown	black	black
shield		x	x	x
sheath				
material		stainless steel 304	-	stainless steel 304
outer diameter	in	0.31	-	0.35
remark				optional

Clamp-on temperature probe (optional)

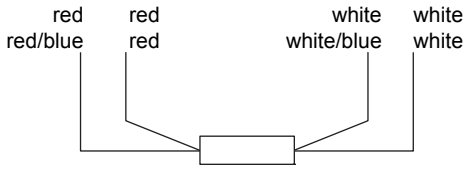
Technical data

technical type		**PT13N**	**PT13F**
design			short response time
type		Pt1000	Pt1000
connection		4-wire	4-wire
measuring range	°F	-40 to +392	-58 to +482
accuracy T		±(0.27 °F + 2 · 10^{-3} · (|T [°F]| - 32 °F)) class A	±(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)	≤ 0.1 K (3 K < ΔT < 6 K), more corresponding to EN 1434-1
response time	s		8
housing		360 brass alloy	PEEK, stainless steel 304, copper
degree of protection			NEMA 4
weight	lb	0.437	0.7
fixation		clamp-on	clamp-on
accessories			
thermal conductivity paste 392 °F		-	x
thermal conductivity foil 482 °F		x	x
plastic protection plate, insulation foam		-	x
dimensions			
length l	in	0.59	0.55
width b	in	0.49	1.18
height h	in	0.79	1.06



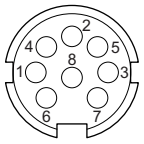
Connection

Temperature probe



Connector

pin	cable of temperature probe PT13F	cable of temperature probe PT13N	extension cable
1	white/blue	white	white
2	red/blue	red	black
3, 4, 5	not connected		
6	red	red	green
7	white	white	red
8	not connected		



Cable

		cable of temperature probe	cable of temperature probe	extension cable
temperature probe		**PT13F**	**PT13N**	
type		4 x 0.25 mm² black	4 x 24 AWG	4 x 18 AWG
standard length	ft	9	20	-
max. length	ft	-	-	656
cable jacket		PTFE	PTFE	LS PVC

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.

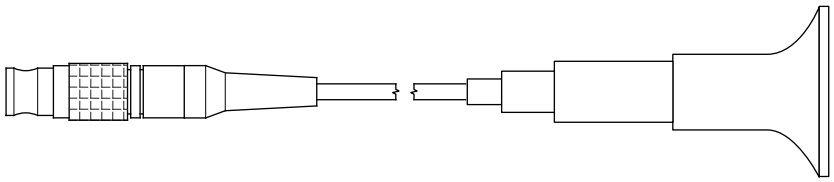
Technical data

technical type		DWR1NZ7
measuring range[1]	in	0.04 to 9.8
resolution	in	0.0004
accuracy		1 % ± 0.004 in
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

type		2616
ambient temperature	°F	<392
cable jacket		
material		FEP
outer diameter	in	0.2
color		black
shield		x



DWR1NZ7

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