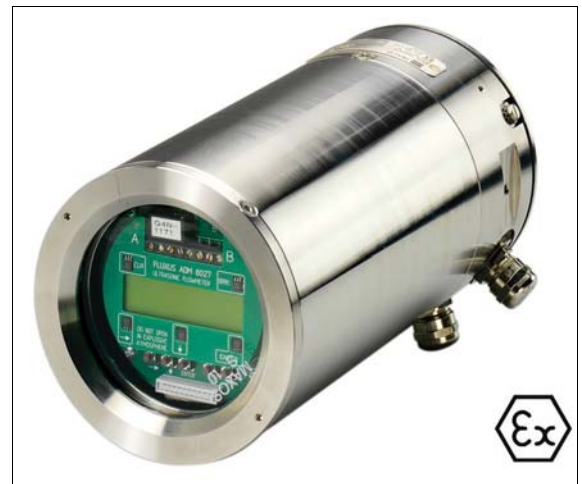


Ultrasonic Gas Flowmeters for Permanent Installation in Hazardous Areas

Especially designed for the stationary use in explosive atmosphere

Features

- Precise bi-directional and highly dynamic flow measurement with the non-intrusive clamp-on technology
- High precision at fast and slow flow rates, high temperature and zero point stability
- All stainless steel and seawater resistant FLUXUS G801 is ATEX/IECEx certified and thus suited for off-shore applications
- 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 (6...2100 mm) and fluid temperatures (-40...+200 °C)
- ATEX, IECEx approved transducers for hazardous areas available
- Measurement is unaffected by gas density, viscosity, composition, dust, humidity, temperature or pressure



FLUXUS G801

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



Measurement with transducers mounted by Variofix C

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Function

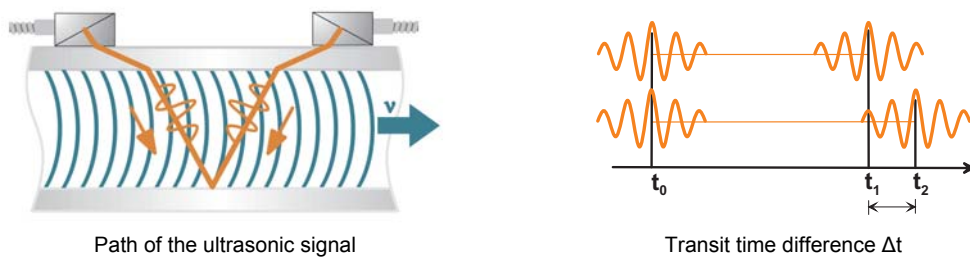
Measurement Principle

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.



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

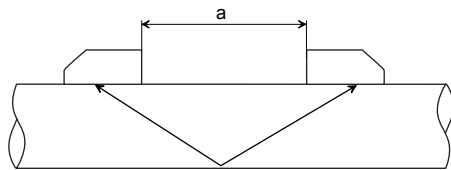
Number of Sound Paths

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:

- **reflection 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. In the case of a high signal attenuation by the fluid, pipe and coatings, diagonal arrangement with 1 sound path will be used.

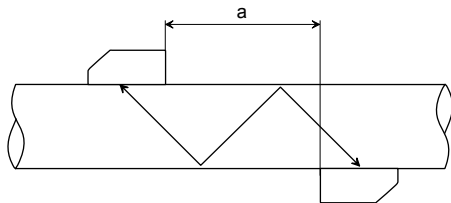
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

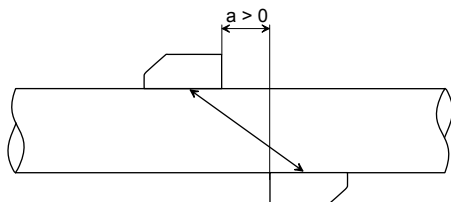


a - transducer distance

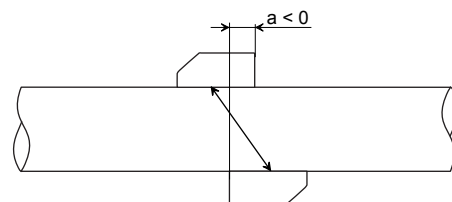
Reflection arrangement, number of sound paths: 2



Diagonal arrangement, number of sound paths: 3

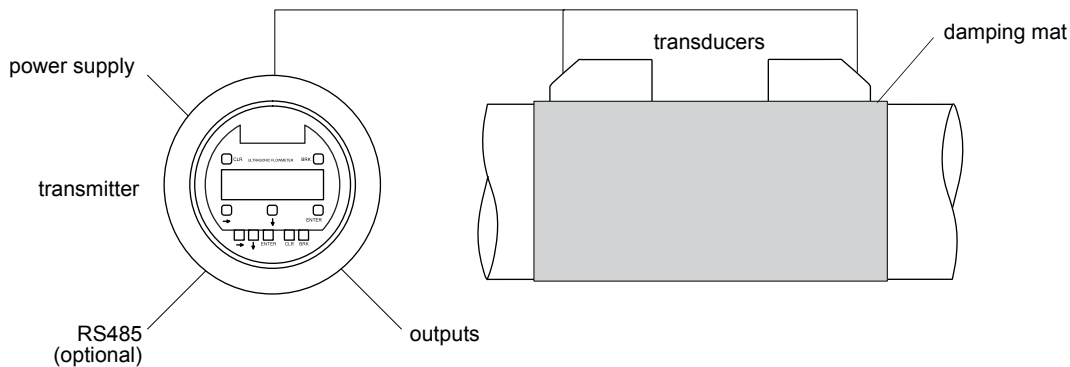


Diagonal arrangement, number of sound paths: 1



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

Typical Measurement Setup



Example of a gas flow measurement in reflection arrangement with standard volumetric flow rate output

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.

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

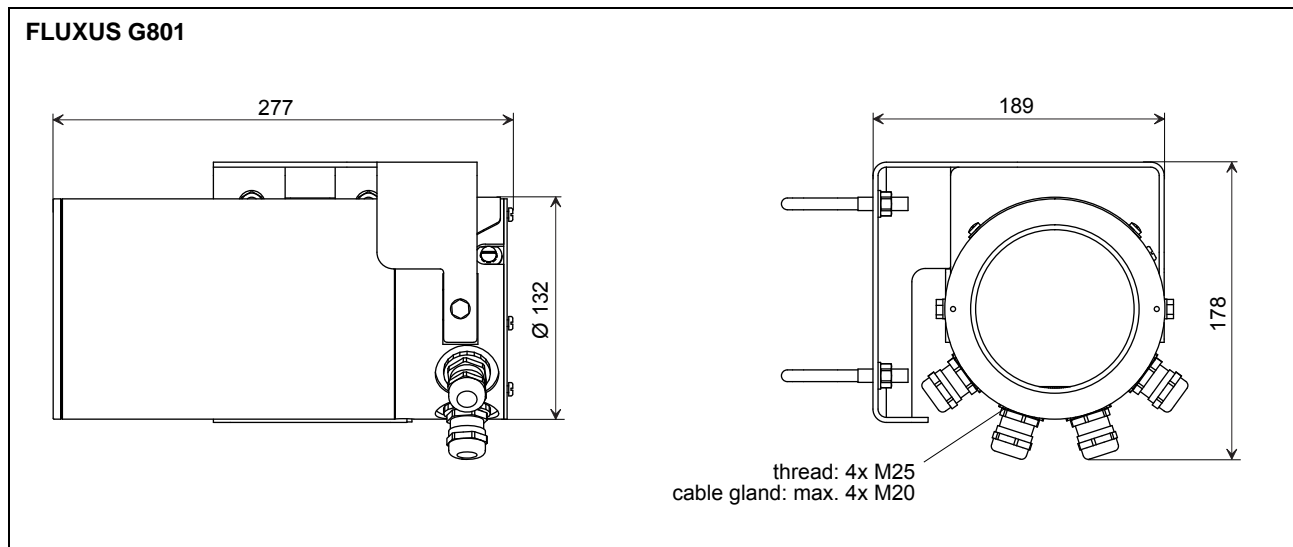
Technical Data

FLUXUS	G801**-A1		G801C24	
model code	G801**-A10*****A G801**-A10*****P	G801**-A10****-FF	G801**-A1B	
design	explosion proof offshore device			
				
measurement				
measurement principle	transit time difference correlation principle			
flow velocity	0.01...35 m/s, depending on pipe diameter			
repeatability	0.15 % of reading ±0.01 m/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...3 % of reading ±0.01 m/s depending on application ± 0.5 % of reading ±0.01 m/s with field calibration			
flow transmitter				
power supply	100...240 V/50...60 Hz or 20...32 V DC or on request: 11...16 V DC	24 V DC ±10 %		
power consumption	< 8 W	< 4 W		
number of flow measuring channels	1, optional: 2			
damping	0...100 s, adjustable			
measuring cycle (1 channel)	100...1000 Hz			
response time	1 s (1 channel), option: 70 ms			
housing material	stainless steel 316/316L (1.4401, 1.4404, 1.4432)			
degree of protection according to IEC/EN 60529	IP66			
dimensions	see dimensional drawing			
weight	8.5 kg			
fixation	wall mounting, 2" pipe mounting			
ambient temperature	-20...+60 °C	-20...+50 °C		
display	2 x 16 characters, dot matrix, backlight			
menu language	English, German, French, Dutch, Spanish			
explosion protection				
ATEX / IECEx	zone	1		
	marking	CE 0637 Ex d e IIC T6 Gb Ex tb IIIC T 100 °C Db T _a -20...+60 °C	CE 0637 Ex d e [ib] IIC T4 Gb T _a -20...+50 °C	
	certification ATEX	IBExU05ATEX1078		
	certification IECEx	IECEX IBE 12.0020		
	type of protection	electronics compartment: flameproof enclosure connection compartment: increased safety	electronics compartment: flameproof enclosure connection compartment: increased safety output circuits: intrinsic safety	
	intrinsic safety parameters	-		U _m = 250 V AC intrinsically safe outputs: U _i = 28.2 V P _i = 0.76 W L _i , C _i negligible

FLUXUS	G801**-A1	G801C24	
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 (2 measuring channels necessary)		
diagnostic functions	sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times		
data logger			
loggable values	all physical quantities, totalized values and diagnostic values		
capacity	> 100 000 measured values		
communication			
interface	- process integration (optional): RS485 (emitter) or Modbus RTU or HART - diagnosis: RS232 ¹	- diagnosis: RS232 ¹	- diagnosis: RS232 ¹
serial data kit (optional)			
software (all Windows™ versions)	- FluxData: download of measurement data, graphical presentation, conversion to other formats (e.g. for Excel™) - FluxDiag (optional): online diagnostics and report generation - FluxKoeff: creating fluid data sets - FluxSubstanceLoader: upload of fluid data sets		
cable	RS232 ¹		
adapter	RS232 - USB ¹		
outputs (optional)			
	The outputs are galvanically isolated from the transmitter.		
number	current output: 1...2 and binary output (open collector): 1...2 or current output: 1...2 and binary output (open collector): 1 and binary output (Reed relays): 1	frequency output: 1 and binary output (open collector): 1	current output: 1 and binary output (open collector): 1
current output			
current output I1, I2 - range - accuracy - active output - passive output	0/4...20 mA 0.1 % of reading ±15 µA R _{ext} < 500 Ω U _{ext} = 4...26.4 V, depending on R _{ext} R _{ext} < 1 kΩ	- - - -	4...20 mA 0.1 % of reading ±15 µA - U _{ext} = 4...28.2 V, depending on R _{ext} R _{ext} < 1 kΩ intrinsic safety
current output I1 in HART mode - range - passive output	4...20 mA U _{ext} = 10...24 V	- -	- -
frequency output			
range open collector	- -	0...5 kHz 30 V/100 mA I _{off} = 0.8 mA optional: 8.2 V DIN EN 60947-5-6 (NAMUR)	- -
binary output			
Reed relay open collector	48 V/100 mA 24 V/4 mA	- 30 V/100 mA I _{off} = 0.8 mA	- 24 V/4 mA intrinsic safety
binary output as alarm output - functions	limit, change of flow direction or error		
open collector as pulse output - pulse value - pulse width	0.01...1000 units 1...1000 ms		

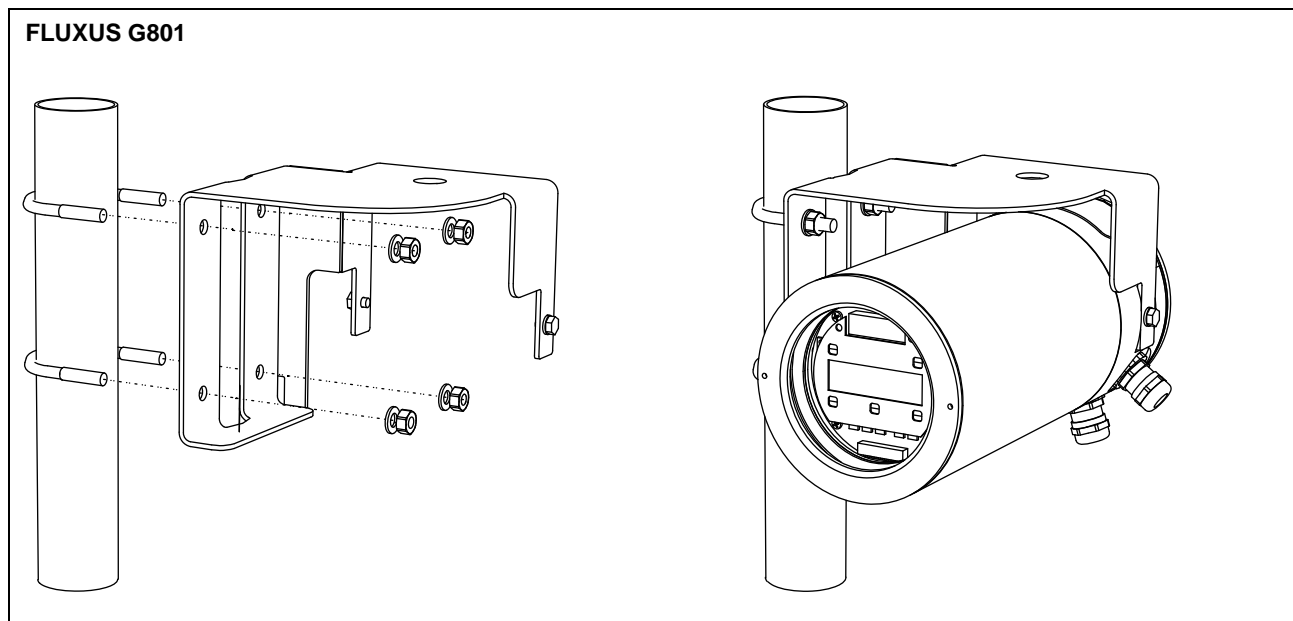
¹ connection of the interface RS232 outside of explosive atmosphere (housing cover open)

Dimensions



in mm

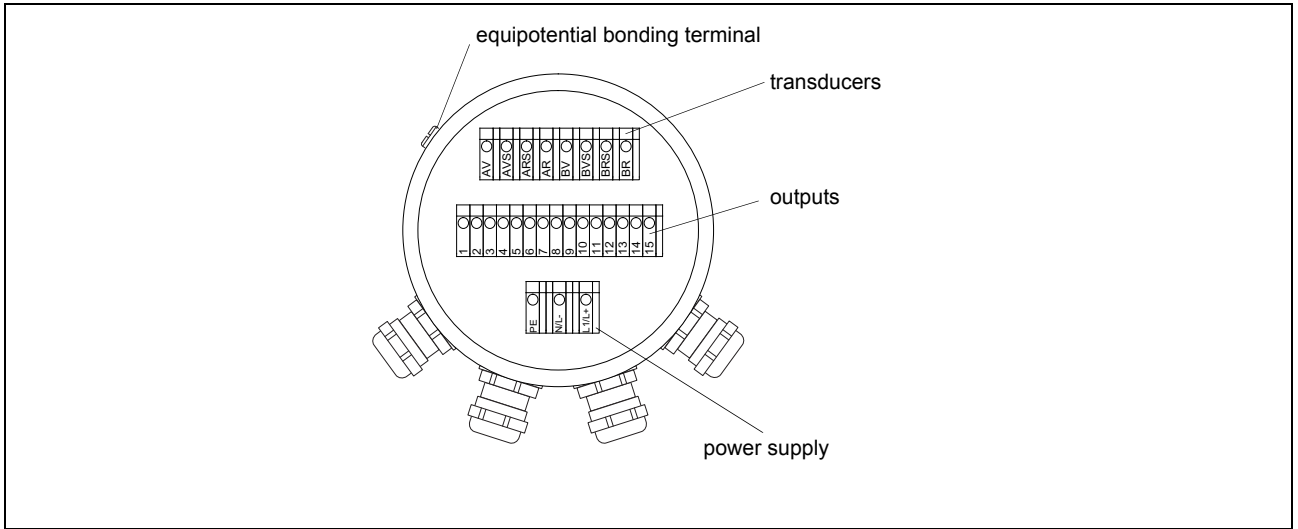
Wall and 2 " Pipe Mounting Kit



Terminal Assignment

FLUXUS G801**-A10****-*A

FLUXUS G801**-A10****-*P



power supply

AC		DC	
terminal	connection	terminal	connection
PE	earth	PE	earth
N	neutral	L-	-
L1	phase	L+	+

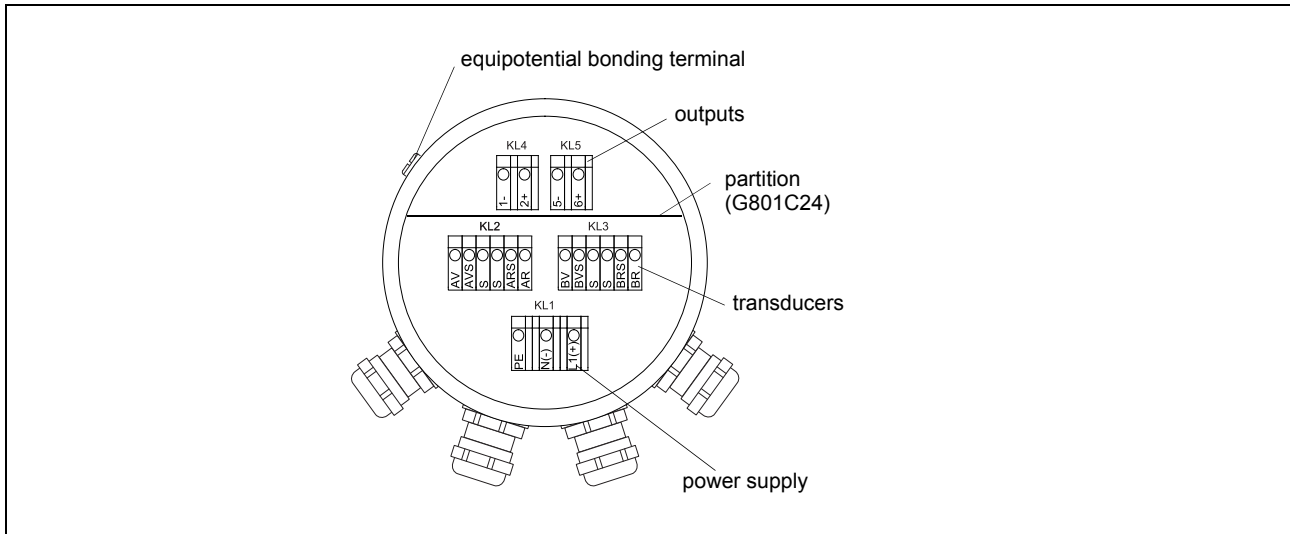
transducers

measuring channel A		measuring channel B	
terminal	connection	terminal	connection
AV	transducer ↑, signal	BV	transducer ↑, signal
AVS	transducer ↑, internal shield	BVS	transducer ↑, internal shield
ARS	transducer ↗, internal shield	BRS	transducer ↗, internal shield
AR	transducer ↗, signal	BR	transducer ↗, signal
cable gland	external shield	cable gland	external shield

outputs

G801**-A10****-*A		G801**-A10****-*P	
terminal	connection	terminal	connection
1(-), 2(+)	active current output I1	1(+), 2(-)	passive current output I1
3(-), 4(+)	active current output I2 (optional)	3(+), 4(-)	passive current output I2 (optional)
5(-), 6(+)	binary output B1 (open collector)		
7(-), 8(+)	binary output B2 (open collector, optional)		
9(a), 10(b)	binary output B1 (open collector, Reed relay, optional)		
11(a), 12(b)	binary output B2 (open collector, Reed relay, optional)		
13(B-), 14(A+), 15 (shield)	RS485 (optional)		

FLUXUS G801C24
FLUXUS G801-A10****-FF**



power supply

AC (G801**-A10****-FF)		DC	
terminal	connection	terminal	connection
PE	earth	PE	earth
N	neutral	L-	-
L1	phase	L+	+

transducers

measuring channel A		measuring channel B	
terminal	connection	terminal	connection
AV	transducer ↑, signal	BV	transducer ↑, signal
AVS	transducer ↑, internal shield	BVS	transducer ↑, internal shield
ARS	transducer ↗, internal shield	BRS	transducer ↗, internal shield
AR	transducer ↗, signal	BR	transducer ↗, signal
S	not connected	S	not connected
cable gland	external shield	cable gland	external shield

outputs

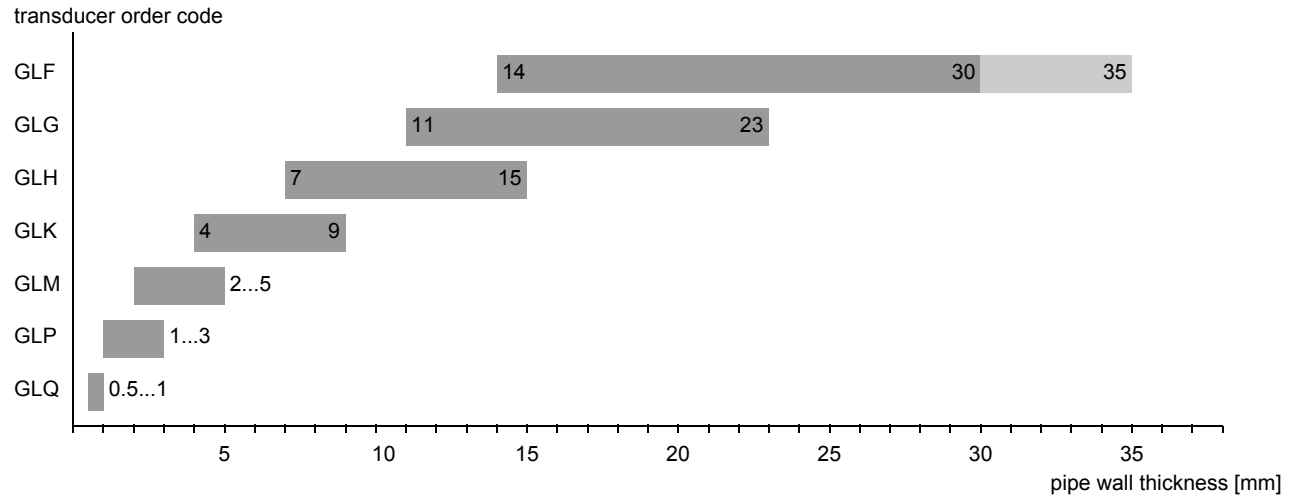
	G801C24	G801**-A10****-FF
colour of terminals	blue (intrinsic safety)	green
terminal	connection	
1(-), 2(+)	current output I1	frequency output F1
5(-), 6(+)	binary output B1 (open collector)	binary output B1 (open collector)

Transducers

Transducer Selection

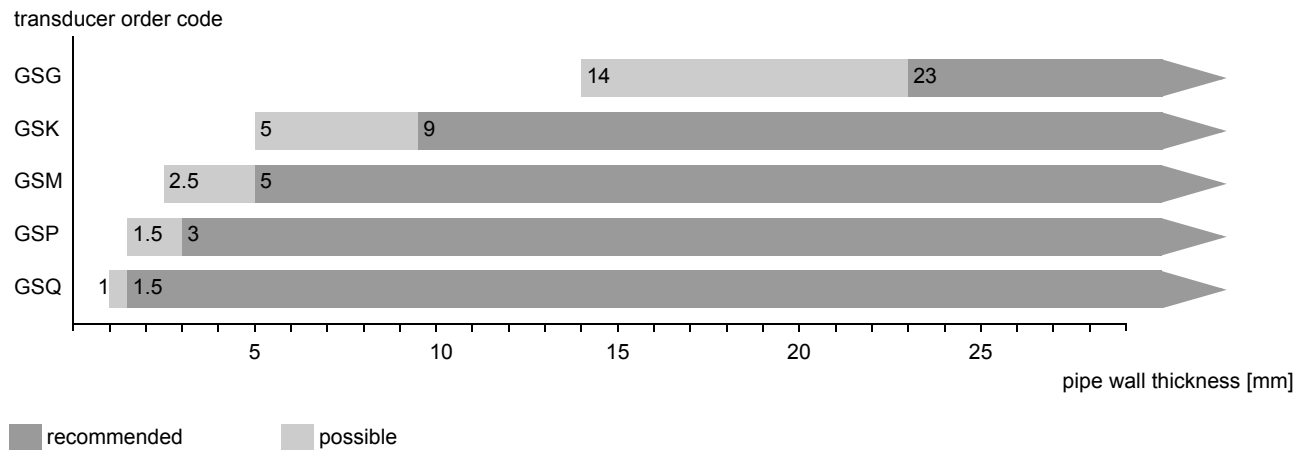
Step 1a

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:

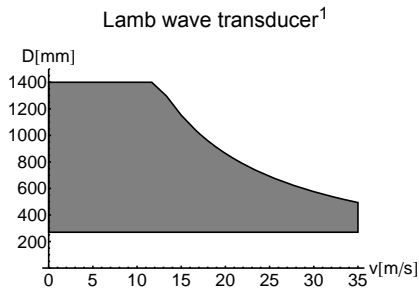


Step 2

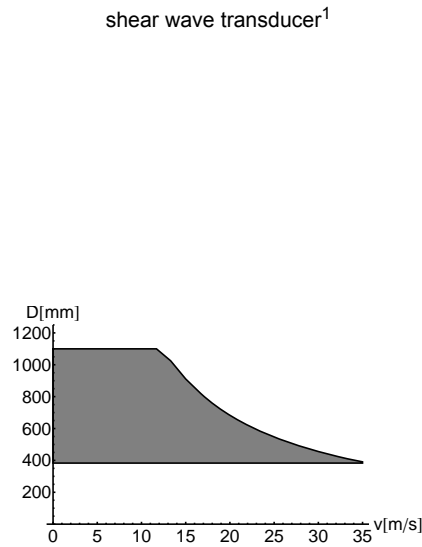
inner pipe diameter d dependent on the flow velocity v of the fluid in the pipe

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.

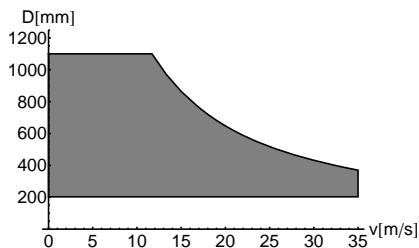
Lamb wave transducers: If the values d and v are not in the range, the diagonal arrangement with 1 sound path may be used, i.e. the same characteristics can be used with doubling the inner pipe diameter. If the values are still not in the range, shear waves transducers regarding the pipe wall thickness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



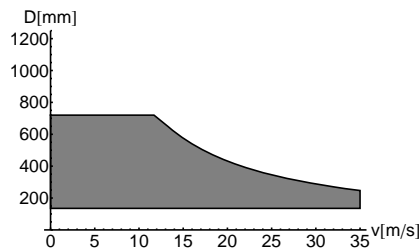
GLF



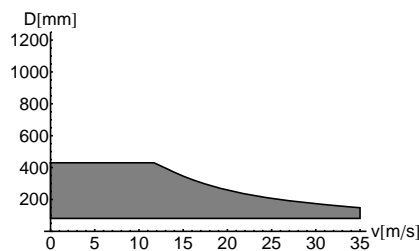
GSG



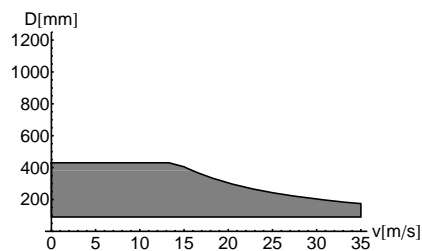
GLG



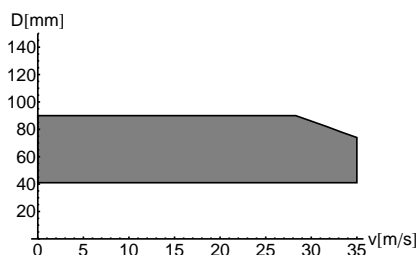
GLH



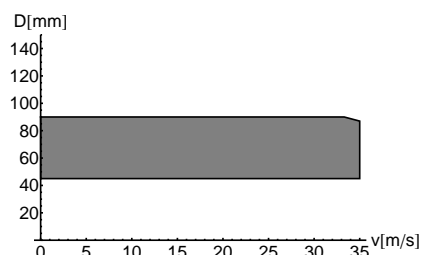
GLK



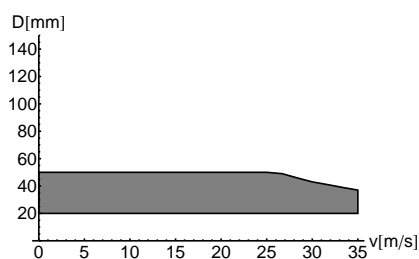
GSK



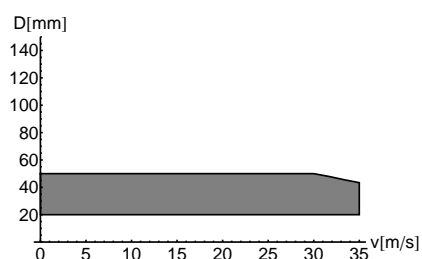
GLM



GSM

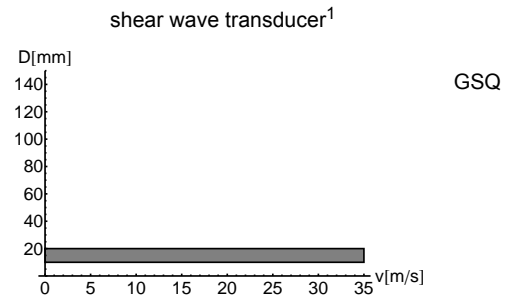
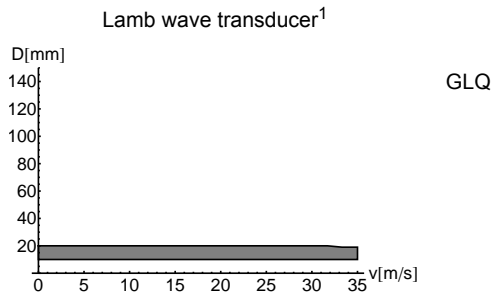


GLP



GSP

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



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

Step 3

min. fluid pressure

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

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

¹ depending on application, typical absolute value for natural gas, nitrogen, compressed air
d - inner pipe diameter

Example

step						
1	pipe wall thickness selected transducer	mm	12 GLG or GLH	12 GLG or GLH	12 GLG or GLH	30 GS
2	inner pipe diameter max. flow velocity selected transducer	mm m/s	800 15 GLG	600 15 GLG or GLH	800 30 values not in the range of the characteristics, but by using diagonal arrangement with 1 sound path, the inner pipe diameter in the characteristics is doubled: GLG	300 15 GSK
3	min. fluid pressure selected transducer	bar	17 GLG	17 GLG or GLH influence of acoustic noise is reduced with increased transducer frequency, thus recommended: GLH	17 GLG	35 GSK

Step 4

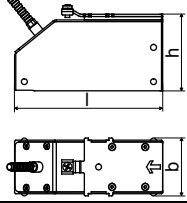
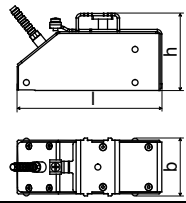
for the characters 4..11 of the transducer order code (ambient temperature, explosion protection, connection system, extension cable) see page 14

Step 5

for the technical data of the selected transducer see page 15 et seqq.

Technical Data

Shear Wave Transducers (zone 1)

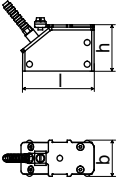
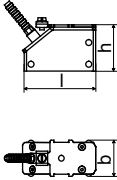
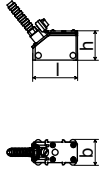
technical type		GDG1N81	GDK1N81
order code		GSG-NA1TS GSG-NA1TS/OS	GSK-NA1TS GSK-NA1TS/OS
transducer frequency	MHz	0.2	0.5
fluid pressure¹			
min. extended	bar	metal pipe: 20	metal pipe: 20
min.	bar	metal pipe: 30 plastic pipe: 1	metal pipe: 30 plastic pipe: 1
inner pipe diameter d²			
min. extended	mm	250	70
min. recommended	mm	380	80
max. recommended	mm	810	500
max. extended	mm	1100	720
pipe wall thickness			
min.	mm	14	5
max.	mm	-	-
material			
housing		PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)
contact surface		PEEK	PEEK
degree of protection according to IEC/EN 60529		IP65	IP66
transducer cable			
type		1699	1699
length	m	5	5
dimensions			
length l	mm	129.5	126.5
width b	mm	51	51
height h	mm	67	67.5
dimensional drawing			
ambient temperature			
min.	°C	-40	-40
max.	°C	+130	+130
temperature compensation		x	x
explosion protection			
category zone		gas: 2G dust: 2D 1 21	gas: 2G dust: 2D 1 21
explosion protection temperature (pipe surface)			
min.	°C	-55	-55
max.	°C	+180	+180
marking		CE 0637 Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db
certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X
certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X
type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
transducer mounting fixture necessary		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 gases on request

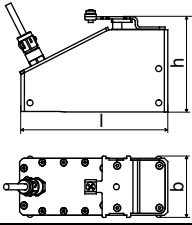
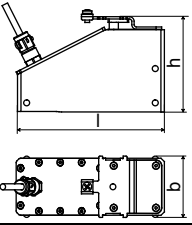
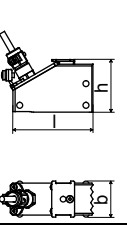
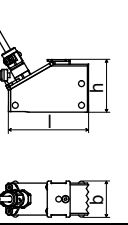
pipe diameter min. recommended/max. recommended/max. extended: in diagonal arrangement and for a flow velocity of 15 m/s

technical type		GDM2N81	GDP2N81	GDQ2N81
order code		GSM-NA1TS GSM-NA1TS/OS	GSP-NA1TS GSP-NA1TS/OS	GSQ-NA1TS GSQ-NA1TS/OS
transducer frequency	MHz	1	2	4
fluid pressure¹				
min. extended	bar	metal pipe: 20	metal pipe: 20	metal pipe: 20
min.	bar	metal pipe: 30	metal pipe: 30	metal pipe: 30
		plastic pipe: 1	plastic pipe: 1	plastic pipe: 1
inner pipe diameter d²				
min. extended	mm	30	15	6
min. recommended	mm	40	20	10
max. recommended	mm	80	40	20
max. extended	mm	120	60	30
pipe wall thickness				
min.	mm	2.5	1.5	1
max.	mm	-	-	-
material				
housing		PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)
contact surface		PEEK	PEEK	PEEK
degree of protection according to IEC/EN 60529		IP66	IP66	IP65
transducer cable				
type		1699	1699	1699
length	m	4	4	3
dimensions				
length l	mm	64	64	40
width b	mm	32	32	22
height h	mm	40.5	40.5	25.5
dimensional drawing				
ambient temperature				
min.	°C	-40	-40	-40
max.	°C	+130	+130	+130
temperature compensation		x	x	x
explosion protection				
category		gas: 2G dust: 2D	gas: 2G dust: 2D	gas: 2G dust: 2D
zone		1 21	1 21	1 21
explosion protection temperature (pipe surface)				
min.	°C	-55	-55	-55
max.	°C	+180	+180	+180
ATEX / IECEx	marking	CE 0637 Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db
	certification ATEX	IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IECEx	IECEX IBE 08.0007X	IECEX IBE 08.0007X	IECEX IBE 08.0007X
	type of protection	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
	transducer mounting fixture necessary	x	x	x
remark			on request	on request

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 gases on request
 pipe diameter min. recommended/max. recommended/max. extended: in diagonal arrangement and for a flow velocity of 15 m/s

Shear Wave Transducers (zone 1, IP68)

technical type		GDG1L11	GDK1L11	GDM2L11	GDP2L11
order code		GSG-NA1TS/IP68	GSK-NA1TS/IP68	GSM-NA1TS/IP68	GSP-NA1TS/IP68
transducer frequency		MHz 0.2	0.5	1	2
fluid pressure¹					
min. extended min.		bar metal pipe: 20 bar metal pipe: 30 plastic pipe: 1	metal pipe: 20 metal pipe: 30 plastic pipe: 1	metal pipe: 20 metal pipe: 30 plastic pipe: 1	metal pipe: 20 metal pipe: 30 plastic pipe: 1
inner pipe diameter d²					
min. extended		mm 250	70	30	15
min. recommended		mm 380	80	40	20
max. recommended		mm 810	500	80	40
max. extended		mm 1100	720	120	60
pipe wall thickness					
min.		mm 14	5	2.5	1.5
max.		mm -	-	-	-
material					
housing		PEEK with stainless steel cap 316Ti (1.4571)	PEEK with stainless steel cap 316Ti (1.4571)	PEEK with stainless steel cap 316Ti (1.4571)	PEEK with stainless steel cap 316Ti (1.4571)
contact surface		PEEK	PEEK	PEEK	PEEK
degree of protection according to IEC/EN 60529		IP68 ³	IP68 ³	IP68 ³	IP68 ³
transducer cable					
type		2550	2550	2550	2550
length		m 12	12	12	12
dimensions					
length l		mm 130	130	72	72
width b		mm 54	54	32	32
height h		mm 83.5	83.5	46	46
dimensional drawing					
ambient temperature					
min.		°C -40	-40	-40	-40
max.		°C +100	+100	+100	+100
temperature compensation		x	x	x	x
explosion protection					
category zone		gas: 2G dust: 2D 1 21	gas: 2G dust: 2D 1 21	gas: 2G dust: 2D 1 21	gas: 2G dust: 2D 1 21
explosion protection temperature (pipe surface)					
min.		°C -55	-55	-55	-55
max.		°C +180	+180	+180	+180
marking		CE 0637 II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db
certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
certification IECEx		IECEX IBE 08.0007X	IECEX IBE 08.0007X	IECEX IBE 08.0007X	IECEX IBE 08.0007X
type of protection		gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure
transducer mounting fixture necessary		x	x	x	x
remark					on request

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

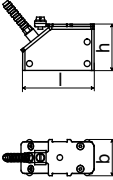
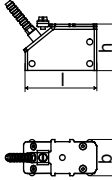
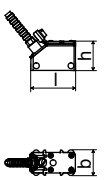
² shear wave transducer:

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

pipe diameter min. recommended/max. recommended/max. extended: in diagonal arrangement and for a flow velocity of 15 m/s

³ test conditions: 3 months/2 bar (20 m)/20 °C

Shear Wave Transducers (zone 1, extended temperature range)

technical type		GDM2E85	GDP2E85	GDQ2E85
order code		GSM-EA1TS GSM-EA1TS/OS	GSP-EA1TS GSP-EA1TS/OS	GSQ-EA1TS GSQ-EA1TS/OS
transducer frequency	MHz	1	2	4
fluid pressure¹				
min. extended min.	bar	metal pipe: 20 metal pipe: 30 plastic pipe: 1	metal pipe: 20 metal pipe: 30 plastic pipe: 1	metal pipe: 20 metal pipe: 30 plastic pipe: 1
inner pipe diameter d²				
min. extended	mm	30	15	6
min. recommended	mm	40	20	10
max. recommended	mm	80	40	20
max. extended	mm	120	60	30
pipe wall thickness				
min.	mm	2.5	1.5	1
max.	mm	-	-	-
material				
housing		PI with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PI with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PI with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)
contact surface		PI	PI	PI
degree of protection according to IEC/EN 60529		IP66	IP66	IP56
transducer cable				
type		6111	6111	6111
length	m	4	4	3
dimensions				
length l	mm	64	64	40
width b	mm	32	32	22
height h	mm	40.5	40.5	25.5
dimensional drawing				
ambient temperature				
min.	°C	-30	-30	-30
max.	°C	+200	+200	+200
temperature compensation		x	x	x
explosion protection				
category zone		gas: 2G dust: 3D 1 22	gas: 2G dust: 3D 1 22	gas: 2G dust: 3D 1 22
explosion protection temperature (pipe surface)				
min.	°C	-45	-45	-45
max.	°C	+225	+225	+225
marking		CE 0637 Ex e q IIC T6...T2 Gb Ex tb IIIA TX Db	CE 0637 Ex e q IIC T6...T2 Gb Ex tb IIIA TX Db	CE 0637 Ex e q IIC T6...T2 Gb Ex tb IIIA TX Db
certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
certification IECEx		IECEX IBE 08.0007X	IECEX IBE 08.0007X	IECEX IBE 08.0007X
type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
transducer mounting fixture necessary		x	x	x
remark			on request	on request

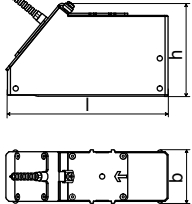
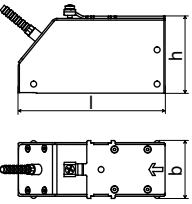
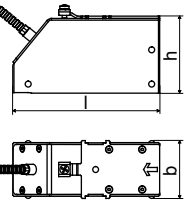
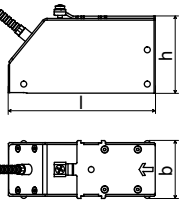
¹ depending on application, typical absolute value for natural gas, nitrogen, compressed air

² shear wave transducer:

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

pipe diameter min. recommended/max. recommended/max. extended: in diagonal arrangement and for a flow velocity of 15 m/s

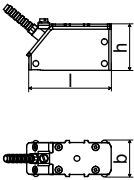
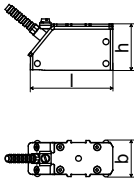
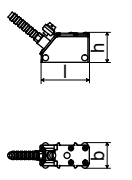
Lamb Wave Transducers (zone 1)

technical type		GRF1N83	GRG1N83	GRH1N83	GRK1N83
order code		GLF-NA1TS GLF-NA1TS/OS	GLG-NA1TS GLG-NA1TS/OS	GLH-NA1TS GLH-NA1TS/OS	GLK-NA1TS GLK-NA1TS/OS
transducer frequency	MHz	0.15	0.2	0.3	0.5
fluid pressure¹					
min. extended	bar	metal pipe: 10	metal pipe: 10	metal pipe: 10	metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)
min.	bar	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1
inner pipe diameter d²					
min. extended	mm	230	190	120	60
min. recommended	mm	270	220	140	80
max. recommended	mm	1200	900	600	300
max. extended	mm	2100	1600	1000	500
pipe wall thickness					
min.	mm	14	11	7	4
max.	mm	30	23	15	9
max. extended	mm	35	-	-	-
material					
housing		PPSU with stainless steel cap 304 (1.4301), option OS: 316L, 316Ti (1.4404, 1.4571)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L, 316Ti (1.4404, 1.4571)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L, 316Ti (1.4404, 1.4571)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L, 316Ti (1.4404, 1.4571)
contact surface		PPSU	PPSU	PPSU	PPSU
degree of protection according to IEC/EN 60529		IP65	IP66	IP66	IP66
transducer cable					
type		1699	1699	1699	1699
length	m	5	5	5	5
dimensions					
length l	mm	163	128.5	128.5	128.5
width b	mm	54	51	51	51
height h	mm	91.3	67.5	67.5	67.5
dimensional drawing					
ambient temperature					
min.	°C	-40	-40	-40	-40
max.	°C	+170	+170	+170	+170
temperature compensation		x	x	x	x
explosion protection					
category zone		gas: 2G dust: 2D 1 21	gas: 2G dust: 2D 1 21	gas: 2G dust: 2D 1 21	gas: 2G dust: 2D 1 21
explosion protection temperature (pipe surface)					
min.	°C	-55	-55	-55	-55
max.	°C	+140	+140	+140	+140
ATEX / IECEx	marking	CE 0637 II2G II2D Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 II2G II2D Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 II2G II2D Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 II2G II2D Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db
	certification ATEX	IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IECEx	IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X
	type of protection	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
transducer mounting fixture necessary		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 gases on request
 pipe diameter min. recommended/max. recommended: in reflection arrangement and for a flow velocity of 15 m/s
 pipe diameter max. extended: in diagonal arrangement and for a flow velocity of 25 m/s

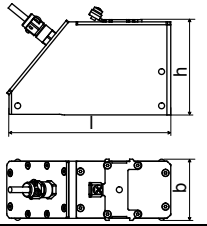
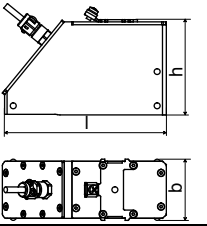
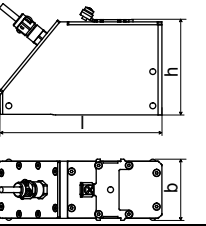
technical type		GRM1N83	GRP1N83	GRQ1N83	
order code		GLM-NA1TS GLM-NA1TS/OS	GLP-NA1TS GLP-NA1TS/OS	GLQ-NA1TS GLQ-NA1TS/OS	
transducer frequency	MHz	1	2	4	
fluid pressure¹					
min. extended	bar	metal pipe: 3 (d < 60 mm)	metal pipe: 3 (d < 35 mm)	metal pipe: 3 (d < 15 mm)	
min.	bar	metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1	metal pipe: 10 (d > 15 mm) 5 (d < 15 mm) plastic pipe: 1	
inner pipe diameter d²					
min. extended	mm	30	15	7	
min. recommended	mm	40	20	10	
max. recommended	mm	90	50	22	
max. extended	mm	150	70	35	
pipe wall thickness					
min.	mm	2	1	0.5	
max.	mm	5	3	1	
max. extended	mm	-	-	-	
material					
housing		PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	
contact surface		PPSU	PPSU	PPSU	
degree of protection according to IEC/EN 60529		IP65	IP65	IP65	
transducer cable					
type		1699	1699	1699	
length	m	4	4	3	
dimensions					
length l	mm	74	74	42	
width b	mm	32	32	22	
height h	mm	40.5	40.5	25.5	
dimensional drawing					
ambient temperature					
min.	°C	-40	-40	-40	
max.	°C	+170	+170	+170	
temperature compensation		x	x	x	
explosion protection					
A T E X / I E C E x	category zone	gas: 2G dust: 2D 1 21	gas: 2G dust: 2D 1 21	gas: 2G dust: 2D 1 21	
	explosion protection temperature (pipe surface)				
	min.	°C	-55	-55	-55
	max.	°C	+140	+140	+140
	marking		CE 0637 Ex II2G II2D Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex e q IIC T6...T3 Gb Ex tb IIIC TX Db
	certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X
	type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
	transducer mounting fixture necessary		x	x	x
	remark			on request	on request

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 gases on request
 pipe diameter min. recommended/max. recommended: in reflection arrangement and for a flow velocity of 15 m/s
 pipe diameter max. extended: in diagonal arrangement and for a flow velocity of 25 m/s

Lamb Wave Transducers (zone 1, IP68)

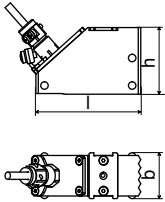
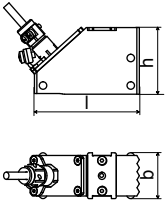
technical type		GRG1LI3	GRH1LI3	GRK1LI3
order code		GLG-NA1TS/IP68	GLH-NA1TS/IP68	GLK-NA1TS/IP68
transducer frequency		MHz 0.2	0.3	0.5
fluid pressure¹				
min. extended	bar	metal pipe: 10	metal pipe: 10	metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)
min.	bar	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1
inner pipe diameter d²				
min. extended	mm	190	120	60
min. recommended	mm	220	140	80
max. recommended	mm	900	600	300
max. extended	mm	1600	1000	500
pipe wall thickness				
min.	mm	11	7	4
max.	mm	23	15	9
material				
housing		PPSU with stainless steel cap 316Ti (1.4571)	PPSU with stainless steel cap 316Ti (1.4571)	PPSU with stainless steel cap 316Ti (1.4571)
contact surface		PPSU	PPSU	PPSU
degree of protection according to IEC/EN 60529		IP68 ³	IP68 ³	IP68 ³
transducer cable				
type		2550	2550	2550
length	m	12	12	12
dimensions				
length l	mm	143.5	143.5	143.5
width b	mm	54	54	54
height h	mm	83.5	83.5	83.5
dimensional drawing				
ambient temperature				
min.	°C	-40	-40	-40
max.	°C	+100	+100	+100
temperature compensation		x	x	x
explosion protection				
category		gas: 2G dust: 2D	gas: 2G dust: 2D	gas: 2G dust: 2D
zone		1 21	1 21	1 21
explosion protection temperature (pipe surface)				
min.	°C	-55	-55	-55
max.	°C	+140	+140	+140
marking		CE 0637 II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db
certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X
type of protection		gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure
transducer mounting fixture necessary		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 gases on request
 pipe diameter min. recommended/max. recommended: in reflection arrangement and for a flow velocity of 15 m/s
 pipe diameter max. extended: in diagonal arrangement and for a flow velocity of 25 m/s

³ test conditions: 3 months/2 bar (20 m)/20 °C

technical type		GRM1LI3	GRP1LI3
order code		GLM-NA1TS/IP68	GLP-NA1TS/IP68
transducer frequency	MHz	1	2
fluid pressure¹			
min. extended	bar	metal pipe: 3 (d < 60 mm)	metal pipe: 3 (d < 35 mm)
min.	bar	metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1
inner pipe diameter d²			
min. extended	mm	30	15
min. recommended	mm	40	20
max. recommended	mm	90	50
max. extended	mm	150	70
pipe wall thickness			
min.	mm	2	1
max.	mm	5	3
material			
housing		PPSU with stainless steel cap 316Ti (1.4571)	PPSU with stainless steel cap 316Ti (1.4571)
contact surface		PPSU	PPSU
degree of protection according to IEC/EN 60529		IP68 ³	IP68 ³
transducer cable			
type		2550	2550
length	m	12	12
dimensions			
length l	mm	73	73
width b	mm	31.6	31.6
height h	mm	46	46
dimensional drawing			
ambient temperature			
min.	°C	-40	-40
max.	°C	+100	+100
temperature compensation		x	x
explosion protection			
category		gas: 2G dust: 2D	gas: 2G dust: 2D
zone		1 21	1 21
explosion protection temperature (pipe surface)			
min.	°C	-55	-55
max.	°C	+140	+140
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db
certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X
certification IECEx		IECEX IBE 08.0007X	IECEX IBE 08.0007X
type of protection		gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure
transducer mounting fixture necessary		x	x
remark			on request

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

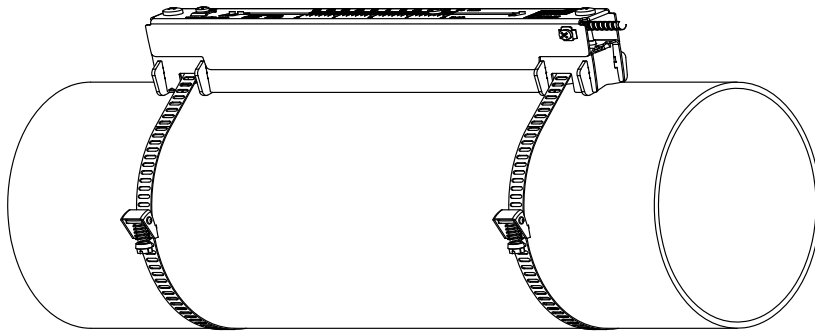
² Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other gases on request
pipe diameter min. recommended/max. recommended: in reflection arrangement and for a flow velocity of 15 m/s
pipe diameter max. extended: in diagonal arrangement and for a flow velocity of 25 m/s

³ test conditions: 3 months/2 bar (20 m)/20 °C

Transducer Mounting Fixture Order Code

1, 2	3	4	5	6	7...9	10, 11	no. of character			
transducer mounting fixture	transducer	-	measurement arrangement	size	-	fixation	outer pipe diameter	/	option	description
VL										Variofix L
VC										Variofix C
	K									transducers with transducer frequency F (VCK-*L-****/IP68), G, H, K
	M									transducers with transducer frequency M, P
	Q									transducers with transducer frequency Q
		D								reflection arrangement or diagonal arrangement
		R								reflection arrangement
			S							small
			M							medium
			L							large
				S						tension straps
				W						welding
				N						without fixation
						002				10...20 mm
						004				20...40 mm
						T36				40...360 mm
						013				10...130 mm
						036				130...360 mm
						092				360...920 mm
						200				920...2000 mm
									IP68	degree of protection IP68
									OS	housing with stainless steel 316
									Z	special design
example										
VL	K	-	D	S	-	S	200			Variofix L and tension straps for transducers with transducer frequency G, H, K
		-			-			/		

Variofix L (VLK, VLM, VLQ)

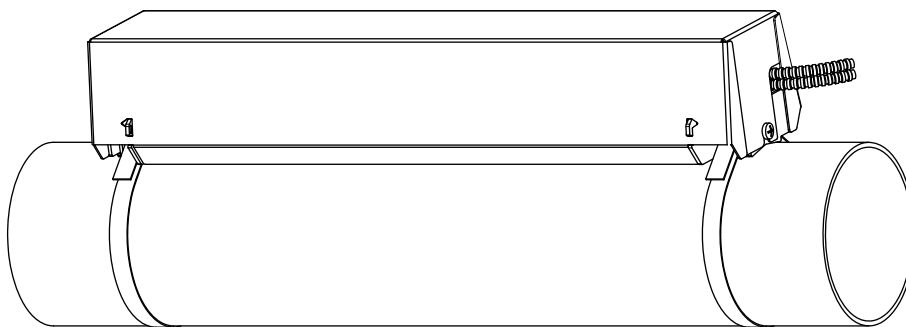


material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006)
 option OS: 316 (1.4571), 316L (1.4404), 17-7PH (1.4568)

inner length:
VLK: 348 mm,
 option IP68: 368 mm
VLM: 234 mm
VLQ: 176 mm

dimensions:
VLK: 423 x 90 x 93 mm,
 option IP68: 443 x 94 x 105 mm
VLM: 309 x 57 x 63 mm
VLQ: 247 x 43 x 47 mm

Variofix C (VC)



material: stainless steel 304 (1.4301), 301 (1.4310)
 option OS: 316 (1.4571)

inner length:
VCK-*L: 500 mm
VCK-*S: 350 mm
VCM: 400 mm
VCQ: 250 mm

dimensions:
VCK-*L: 560 x 122 x 102 mm,
 option IP68: 560 x 126 x 120 mm
VCK-*S: 410 x 122 x 102 mm,
 option IP68: 410 x 126 x 120 mm
VCM: 460 x 96 x 80 mm
VCQ: 310 x 85 x 62 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)	
	< 100 °C	< 170 °C	< 150 °C	< 200 °C
< 24 h	coupling compound type N or coupling foil type VT	coupling compound type E or coupling foil type VT	coupling compound type E or coupling foil type VT	coupling compound type E or H or coupling foil type VT
long time measurement	coupling foil type VT ¹	coupling foil type VT ²	coupling foil type VT ¹	coupling foil type VT ²

¹ < 5 years

² < 6 months

Technical Data

type	order code	ambient temperature °C	material	remark
coupling compound type N	990739-1	-30...+130	mineral grease paste	
coupling compound type E	990739-2	-30...+200	silicone paste	
coupling compound type H	990739-3	-30...+250	fluoropolymer paste	
coupling foil type VT	990739-61	-10...+200	fluoroelastomer	for transducers with transducer frequency F
	990739-0			for transducers with transducer frequency G, H, K
	990739-6			for shear wave transducers with transducer frequency M, P
	990739-14			for shear wave transducers IP68 and Lambwave transducers with transducer frequency M, P
	990739-5			for transducers with transducer frequency Q

Damping Mats (optional)

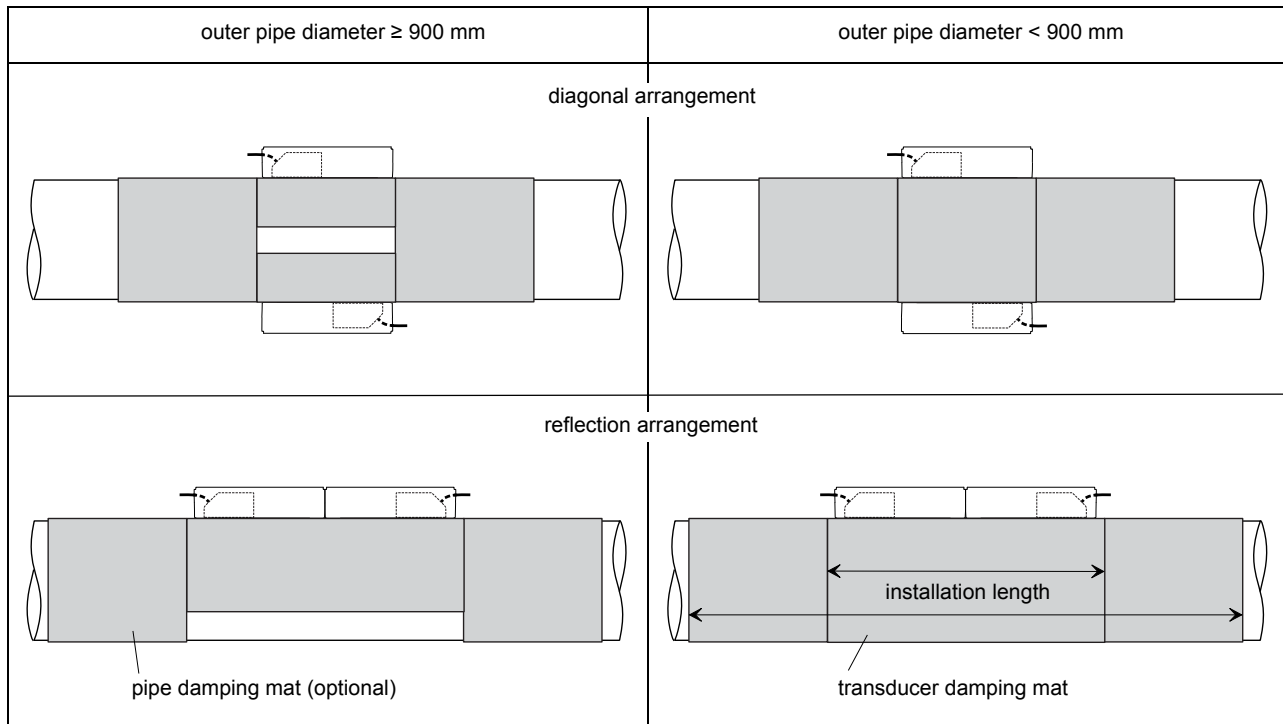
Damping mats will be used for the gas measurement to reduce acoustic noise influences on the measurement.

transducer damping mat

Transducer damping mats will be installed below the transducers.

pipe damping mat

Pipe damping mats will be installed if the sound propagation is disturbed at reflection points (e.g. flange, weld). Depending on the noise, the pipe damping mats will be installed at one or both sides of the transducer damping mat. If the local conditions are unknown, pipe damping mats should be installed.



Technical Data

type		E30R4	E30R3
width	mm	225	50
thickness	mm	0.7	
length (per roll)	m	10	
weight	kg/m ²	1.015	
ambient temperature	°C	-30...+80	
properties		self-adhesive	

Dimensioning

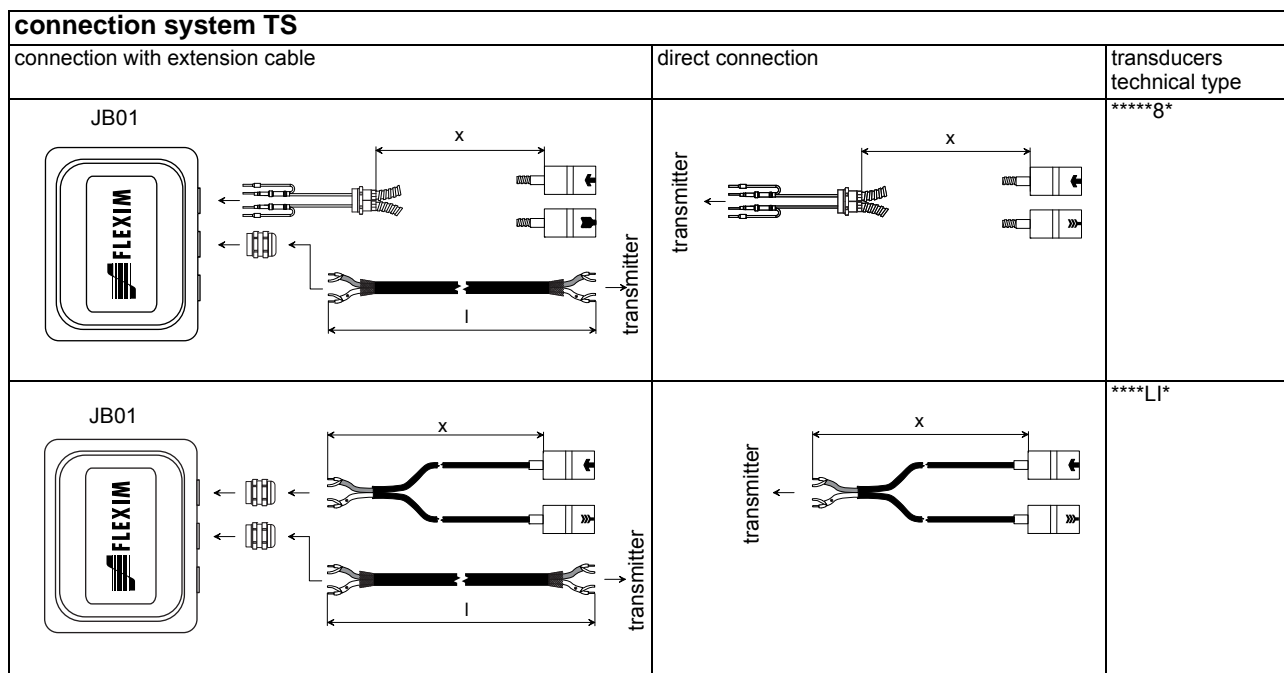
transducer		damping mat							
transducer mounting fixture	order code	type	number of layers	transducer damping mat			transducer damping mat + 2x pipe damping mat		
				max. installation length [mm]	number of rolls ¹		max. installation length [mm]	number of rolls ¹	
					standard ²	extended ²		standard	extended
VarioFix L									
VLK	GLG	E30R4	3	890	4	4	1830	9	13
	GSG		3		4	4		9	11
	GLH		2		2	3		4	7
	GLK		1		1	1		1	2
	GSK		1		1	1		2	3
VLK-**-****/IP68	GLG	E30R4	3	930	5	5	1910	10	14
	GSG		3		5	5		10	11
	GLH		2		2	3		5	7
	GLK		1		1	1		2	2
	GSK		1		1	2		2	3
VLM	GLM	E30R3	1	660	1	1	1360	1	2
	GSM		1		1	1		2	
	GLP		1		1	1		1	
	GSP		1		1	1		1	
VLQ	GLQ	E30R3	1	540	1	1	1120	1	1
	GSQ		1		1	1		1	
Variofix C									
VCK-*L-****/IP68	GLF	E30R4	3	1160	6	6	2360	13	18
VCK-*L-****/IP68	GLG	E30R4	3	1160	6	6	2360	11	15
	GSG		3		6	6		11	12
	GLH		2		3	4		5	8
	GLK		1		1	1		2	2
	GSK		1		2	2		3	3
VCK-*S-****/IP68	GLG	E30R4	3	860	4	4	1760	7	10
	GSG		3		4	4		7	8
	GLH		2		2	3		4	5
	GLK		1		1	1		1	2
	GSK		1		1	1		2	2
VCM	GLM	E30R3	1	960	1	2	1960	2	3
	GSM		1		1	1		2	2
	GLP		1		1	1		1	1
	GSP		1		1	1		1	1
VCQ	GLQ	E30R3	1	660	1	1	1360	1	1
	GSQ		1		1	1		1	

¹ calculation on the base of:

- max. installation length (installation of one transducer mounting fixture per transducer in reflection arrangement) and
- max. recommended pipe diameter (standard) or max. extended pipe diameter (extended)
(for inner pipe diameter max. recommended and max. extended see Technical Data of the Transducers from page 15)

² calculation for the number of rolls when both transducers are mounted in one transducer mounting fixture (reflection arrangement) or in diagonal arrangement: number of rolls/2 and round up to the nearest integer

Connection Systems



transducer frequency (3d character of transducer order code)		F, G, H, K		M, P		Q		S		
T S	cable length	m	x	l	x	l	x	l	x	l
	cable length (option IP68)	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40
			12	≤ 300	12	≤ 300	-	-	-	-

x - transducer cable length
l - max. length of extension cable


Transducer Cable

Technical Data

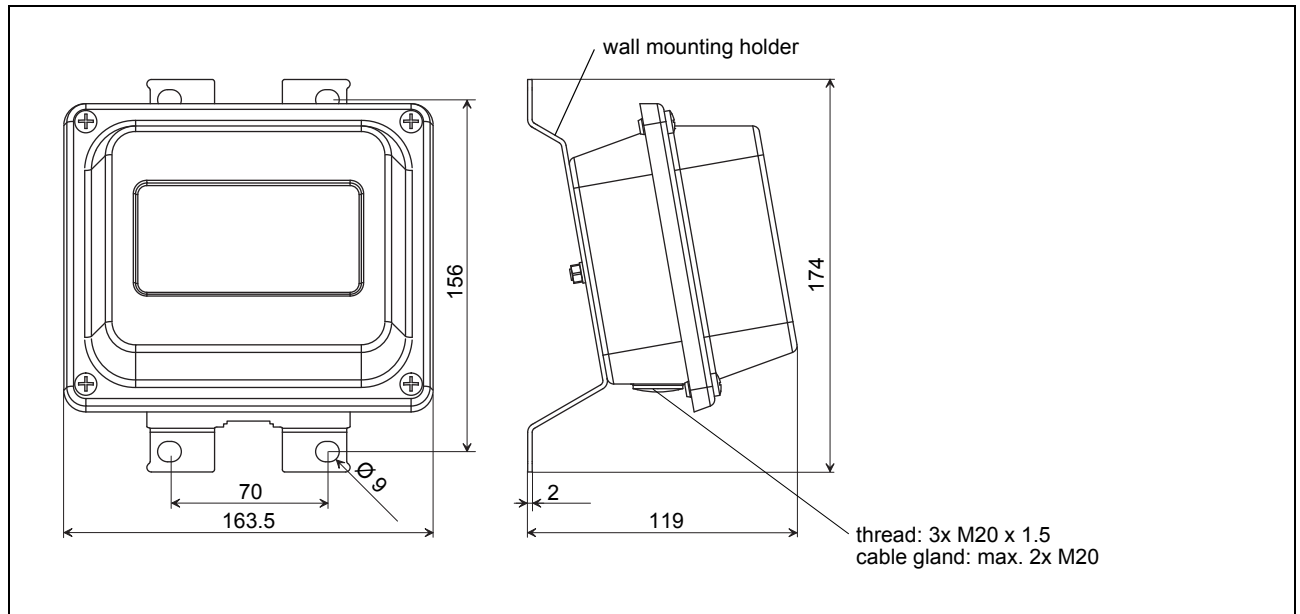
		transducer cable			extension cable
type		1699	2550 (option IP68)	6111	5245
ambient temperature	°C	-55...+200	-40...+100	-100...+225	-30...+70
properties			longitudinal water tight		halogen free fire propagation test according to IEC 60332-1 combustion test according to IEC 60754-2
cable jacket					
material		PTFE	PUR	PFA	PUR
outer diameter	mm	2.9	5.2 ±0.2	2.7	12
thickness	mm	0.3	0.9	0.5	2
colour		brown	grey	white	black
shield		x	x	x	x
sheath					
material		stainless steel 304 (1.4301) option OS: 316L (1.4404)	-	stainless steel 304 (1.4301) option OS: 316L (1.4404)	steel wire braid with copolymer sheath
outer diameter	mm	8	-	8	15.6

Junction Box

Technical Data

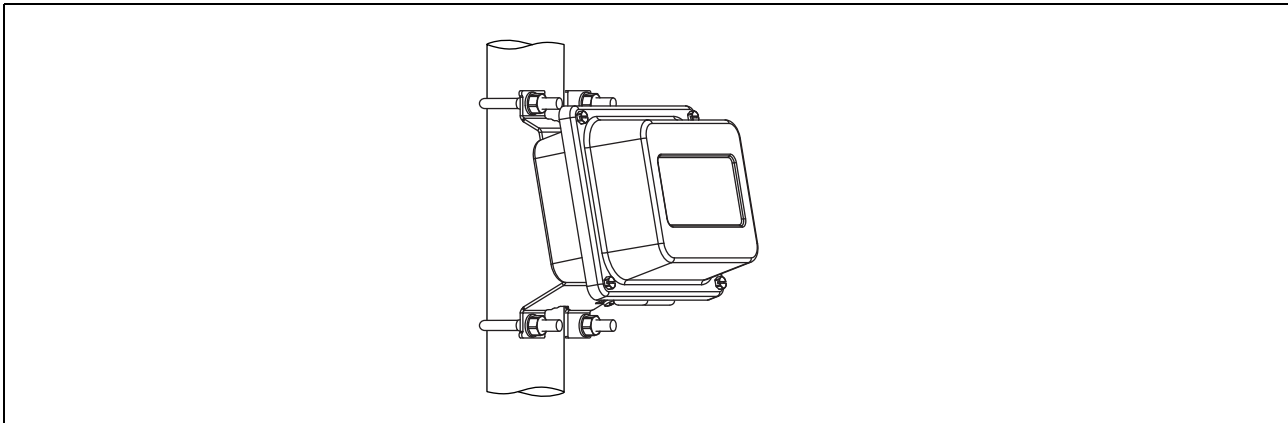
technical type	JB01S4E3M	
dimensions	see dimensional drawing	
fixation	wall mounting, optional: 2" pipe mounting	
material		
housing	stainless steel 316L (1.4404)	
gasket	silicone	
degree of protection according to IEC/EN 60529	IP67	
ambient temperature		
min.	°C	-40
max.	°C	+80
explosion protection		
zone	1	
ATEX / IECEx	marking	CE 0637  II2G II2D Ex e mb IIC (T6)...T4 Gb Ex tb IIIC T 100 °C Db Ta -40...+(70)80 °C
	certification ATEX	IBExU06ATEX1161
	certification IECEx	IECEX IBE 08.0006
	type of protection	gas: • increased safety • decoupled network: encapsulation dust: protection by enclosure

Dimensions



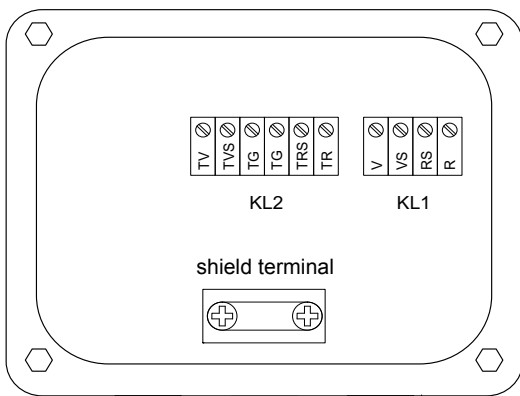
in mm

2 " Pipe Mounting Kit (optional)



Terminal Assignment

JB01



equipotential bonding terminal
(at wall mounting holder)

transducers

terminal strip KL1

terminal	connection
V	transducer ↗, signal
VS	transducer ↗, internal shield
RS	transducer ↘, internal shield
R	transducer ↘, signal
cable gland	external shield

extension cable

terminal strip KL2

terminal	connection
TV	signal
TVS	internal shield
TRS	internal shield
TR	signal
shield terminal	external shield



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