

### Ultrasonic gas flowmeters for permanent installation in hazardous areas

Especially designed for the stationary use in explosive atmosphere

#### Features

- Precise bidirectional 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
- All stainless steel and seawater resistant FLUXUS G801 is ATEX/IECEX certified and thus suited for offshore 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 and fluid temperatures
- ATEX, IECEx approved transducers for hazardous areas available
- Measurement is unaffected by gas density, viscosity, composition, dust, humidity, temperature or pressure

#### 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



FLUXUS G801



Variofix C

**Function** ..... 3  
 Measurement principle ..... 3  
 Calculation of volumetric flow rate ..... 3  
 Number of sound paths ..... 4  
 Typical measurement setup ..... 5  
 Calculation of standard volumetric flow rate ..... 5

**Transmitter** ..... 6  
 Technical data ..... 6  
 Dimensions ..... 8  
 Wall and 2" pipe mounting kit ..... 8  
 Strap wrench ..... 8  
 Terminal assignment ..... 9

**Transducers** ..... 11  
 Transducer selection ..... 11  
 Transducer order code ..... 14  
 Technical data ..... 15

**Transducer mounting fixture** ..... 21

**Coupling materials for transducers** ..... 23

**Damping material (optional)** ..... 24  
 Damping mats ..... 24  
 Damping coat ..... 25

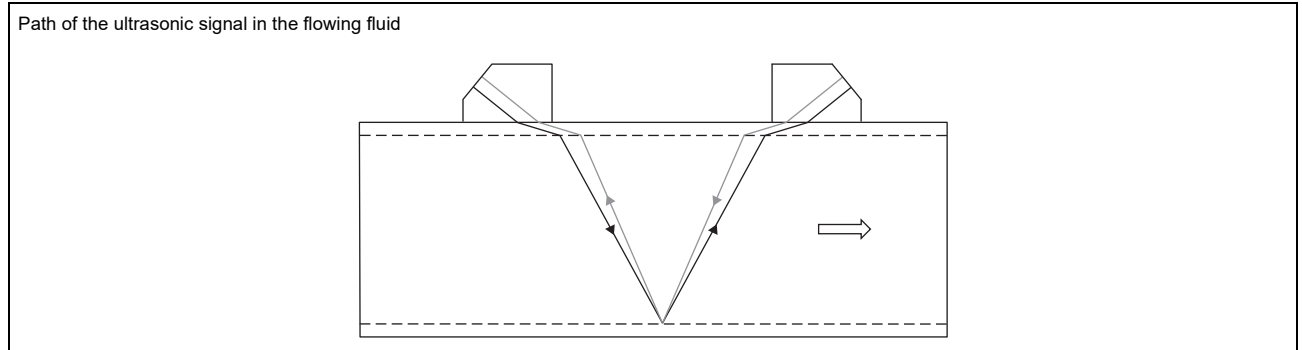
**Connection systems** ..... 26

**Junction box** ..... 28  
 Technical data ..... 28  
 Dimensions ..... 28  
 2" pipe mounting kit ..... 29

## Function

### Measurement principle

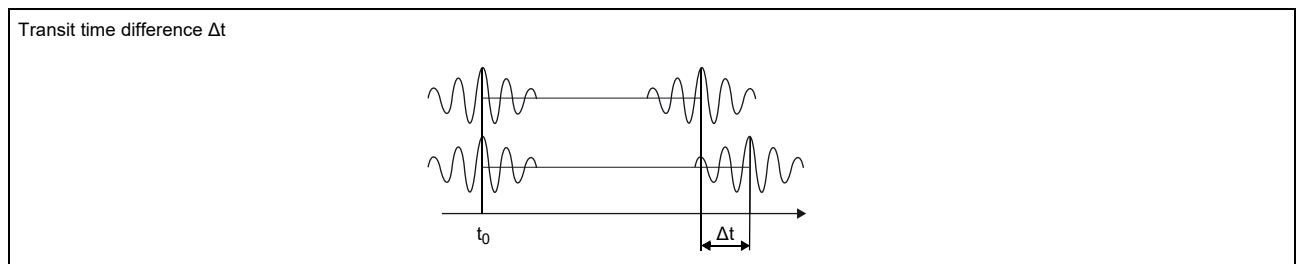
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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

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

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



### Calculation of volumetric flow rate

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

where

- $\dot{V}$  - volumetric flow rate
- $k_{Re}$  - fluid mechanics calibration factor
- $A$  - cross-sectional pipe area
- $k_a$  - acoustical calibration factor
- $\Delta t$  - transit time difference
- $t_{\gamma}$  - average of transit times 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**

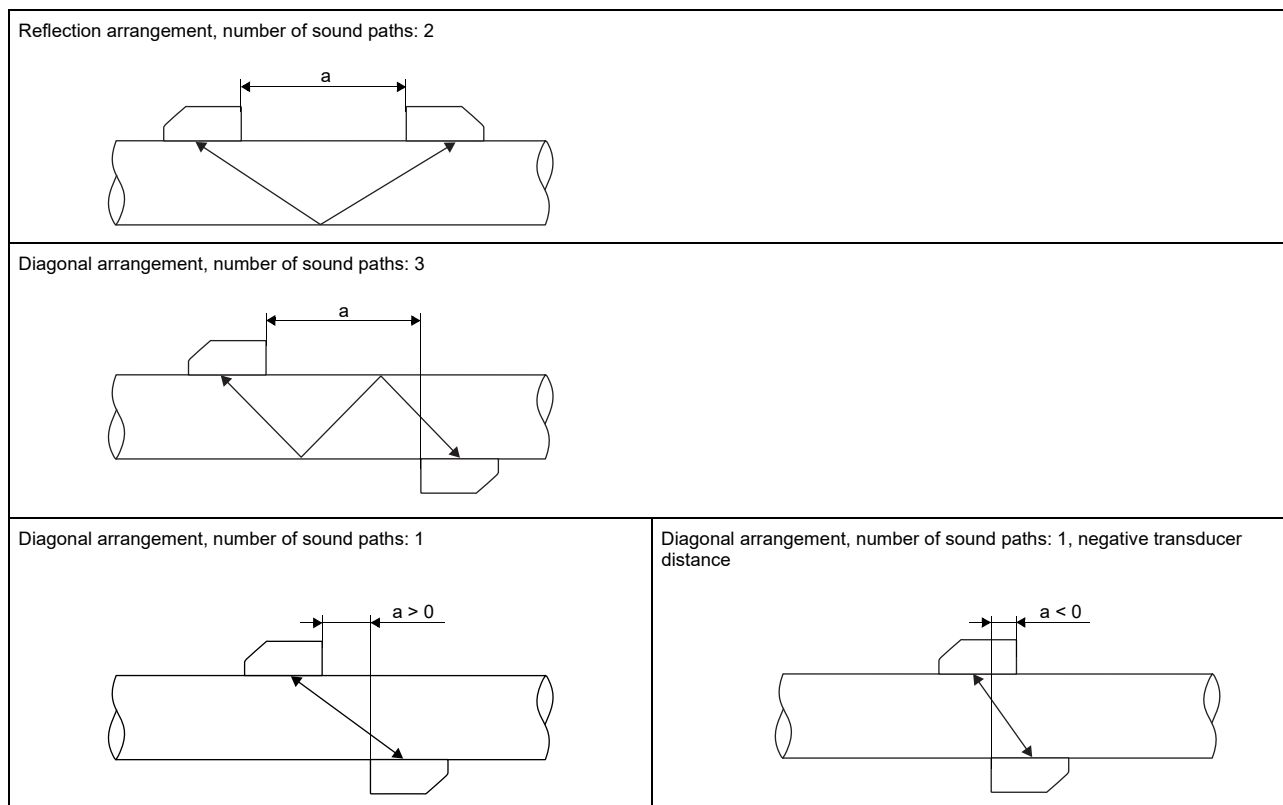
The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easy.

- **diagonal arrangement**

The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe. In the case of a high signal attenuation by the fluid, pipe and coatings, diagonal arrangement with 1 sound path will be used.

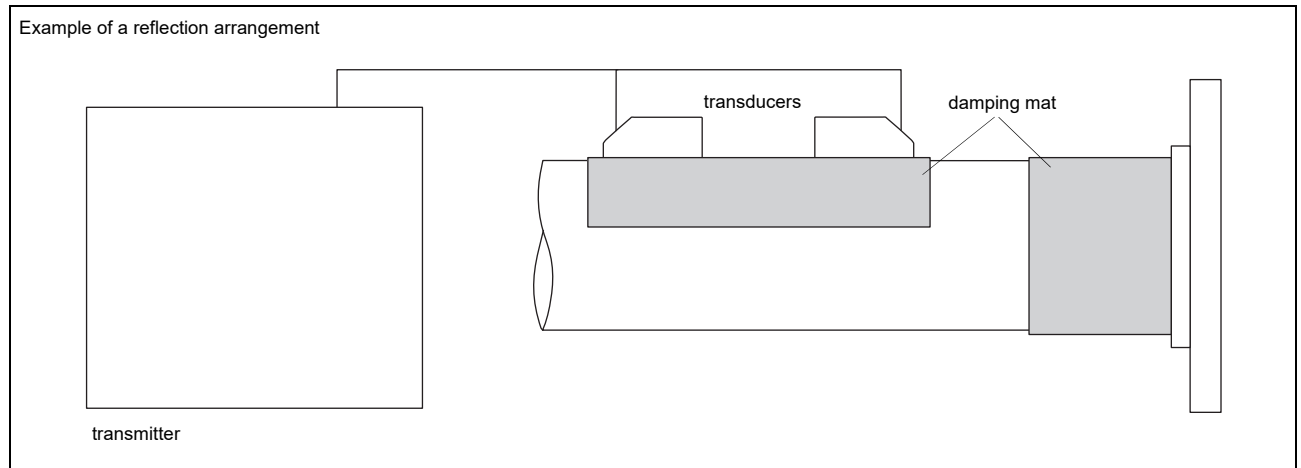
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

## Typical measurement setup



### Calculation of standard volumetric flow rate

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

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

where

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




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

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

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

## Transmitter

### Technical data

	FLUXUS G801**-A1	FLUXUS G801C24
order code	G801**-A10****-A G801**-A10****-P	G801**-A10****-FF G801**-A1B
		
design	explosion-proof offshore device	
supported transducer frequencies	F, G, H, K, M on request: P, Q	
<b>measurement</b>		
measurement principle	transit time difference correlation principle	
flow velocity	m/s 0.01...35, depending on pipe diameter	
repeatability	0.15 % MV ±0.005 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	
<b>measurement uncertainty (volumetric flow rate)</b>		
measurement uncertainty of the measuring system <sup>1</sup>	±0.3 % MV ±0.005 m/s	
measurement uncertainty at the measuring point	±1...2 % MV ±0.005 m/s, depending on the application	
<b>transmitter</b>		
power supply	<ul style="list-style-type: none"> <li>• 100...230 V/50...60 Hz or</li> <li>• 20...32 V DC or</li> <li>• on request: 11...16 V DC</li> </ul>	• 24 V DC ±10 %
power consumption	W < 8	< 4
number of measuring channels	1, optional: 2	
damping	s 0...100 (adjustable)	
measuring cycle	Hz 100...1000 (1 channel)	
response time	s 1 (1 channel), option: 0.07	
housing material	stainless steel 316/316L (1.4401, 1.4404, 1.4432)	
degree of protection	IP66	
dimensions	mm see dimensional drawing	
weight	kg 6.6	
fixation	wall mounting, 2" pipe mounting	
ambient temperature	°C -20...+60	-20...+50
display	2 x 16 characters, dot matrix, backlight	
menu language	English, German, French, Dutch, Spanish	
<b>explosion protection</b>		
<b>• ATEX/IECEX</b>		
marking	CE 0637  II2G II2D Ex db eb IIC T6 Gb Ex tb IIIC T100 °C Db T <sub>a</sub> -20...+60 °C	CE 0637  II2G Ex db eb [ib] IIC T4 Gb T <sub>a</sub> -20...+50 °C
certification ATEX	IBExU05ATEX1078	
certification IECEX	IECEX IBE 12.0020	
intrinsic safety parameters	-	U <sub>m</sub> = 250 V intrinsically safe outputs: U <sub>i</sub> = 28.2 V P <sub>i</sub> = 0.76 W L <sub>i</sub> , C <sub>i</sub> negligible

<sup>1</sup> with aperture calibration of the transducers

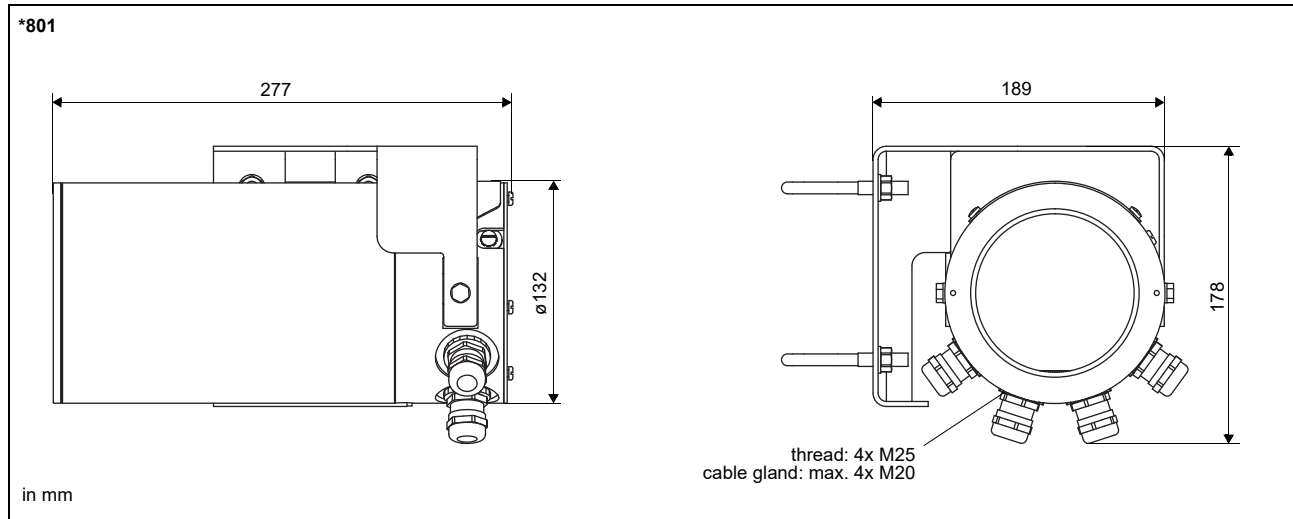
<sup>2</sup> connection of the RS232 interface outside the explosive atmosphere (housing cover is open)

		FLUXUS G801**-A1	FLUXUS G801C24
<b>measuring functions</b>			
physical quantities		operating volumetric flow rate, standard volumetric flow rate, mass flow rate, flow velocity	
totaliser		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	
<b>communication interfaces</b>			
service interfaces		<ul style="list-style-type: none"> <li>• RS232<sup>2</sup></li> <li>• USB (with adapter)<sup>2</sup></li> </ul>	
process interfaces		max. 1 option: <ul style="list-style-type: none"> <li>• RS485 (ASCII sender)</li> <li>• Modbus RTU</li> <li>• HART</li> </ul>	-
<b>accessories</b>			
data transmission kit		RS232 RS232 - USB	
<ul style="list-style-type: none"> <li>• cable</li> <li>• adapter</li> </ul>			
software		<ul style="list-style-type: none"> <li>• FluxDiagReader: reading of measured values and parameters, graphical presentation</li> <li>• FluxDiag (optional): reading of measurement data, graphical presentation, report generation</li> </ul>	
<b>data logger</b>			
loggable values		all physical quantities, totalised physical quantities and diagnostic values	
capacity		> 100 000 measured values	
<b>outputs</b>			
		The outputs are galvanically isolated from the transmitter.	
number		<ul style="list-style-type: none"> <li>• current output: 1...2</li> <li>• binary output (open collector): 1...2</li> </ul> or <ul style="list-style-type: none"> <li>• current output: 1...2</li> <li>• binary output (open collector): 1</li> <li>• binary output (Reed relay): 1</li> </ul>	<ul style="list-style-type: none"> <li>• frequency output: 1</li> <li>• binary output (open collector): 1</li> </ul>
			<ul style="list-style-type: none"> <li>• current output: 1</li> <li>• binary output (open collector): 1</li> </ul>
<b>• current output</b>			
range	mA	0/4...20	4...20
accuracy		0.1 % MV ±15 µA	0.1 % MV ±15 µA
active output		R <sub>ext</sub> < 500 Ω	-
passive output		U <sub>ext</sub> = 4...26.4 V, depending on R <sub>ext</sub> (R <sub>ext</sub> < 1 kΩ at 26.4 V)	U <sub>ext</sub> = 4...28.2 V, depending on R <sub>ext</sub> (R <sub>ext</sub> < 1 kΩ at 28.2 V)
			intrinsic safety
current output in HART mode		I1	-
• range	mA	4...20	-
• active output		U <sub>int</sub> = 24 V	-
• passive output		U <sub>ext</sub> = 10...24 V	-
<b>• frequency output</b>			
range	kHz	-	0...5
open collector			30 V/100 mA I <sub>off</sub> = 0.8 mA optional: 8.2 V DIN EN 60947-5-6 (NAMUR)
<b>• binary output</b>			
open collector		24 V/4 mA	30 V/100 mA I <sub>off</sub> = 0.8 mA 24 V/4 mA intrinsic safety
Reed relay		48 V/100 mA	-
binary output as alarm output			
• functions		limit, change of flow direction or error	
binary output as pulse output			
• functions		mainly for totalising	
• pulse value	units	0.01...1000	
• pulse width	ms	1...1000	

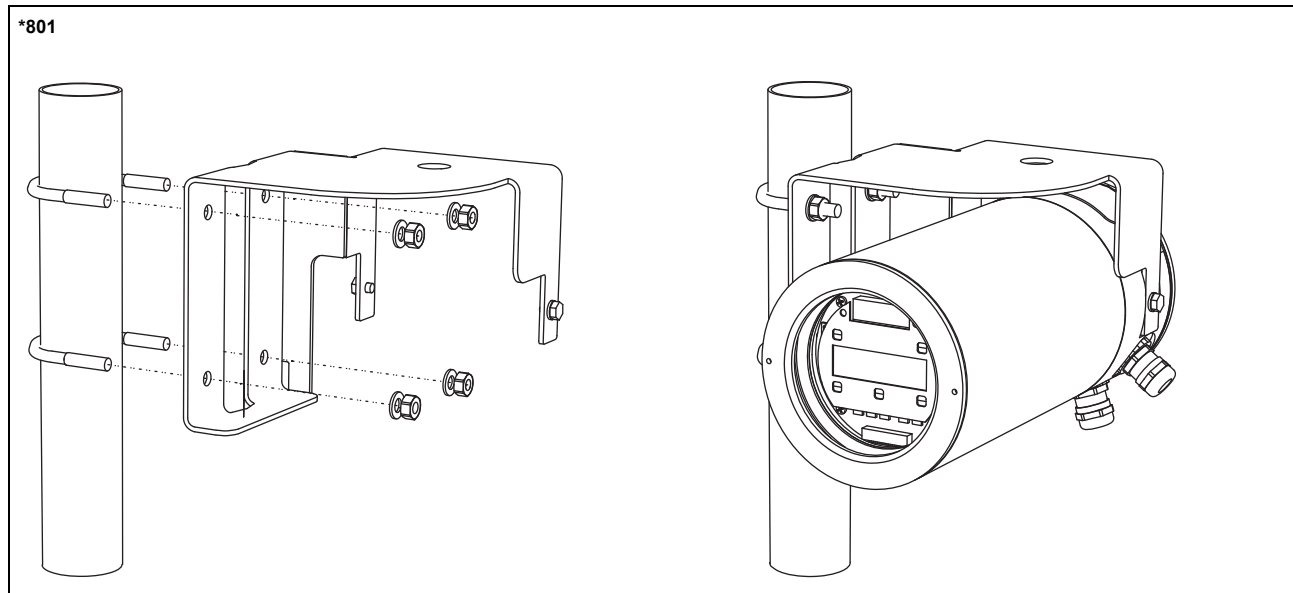
<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> connection of the RS232 interface outside the explosive atmosphere (housing cover is open)

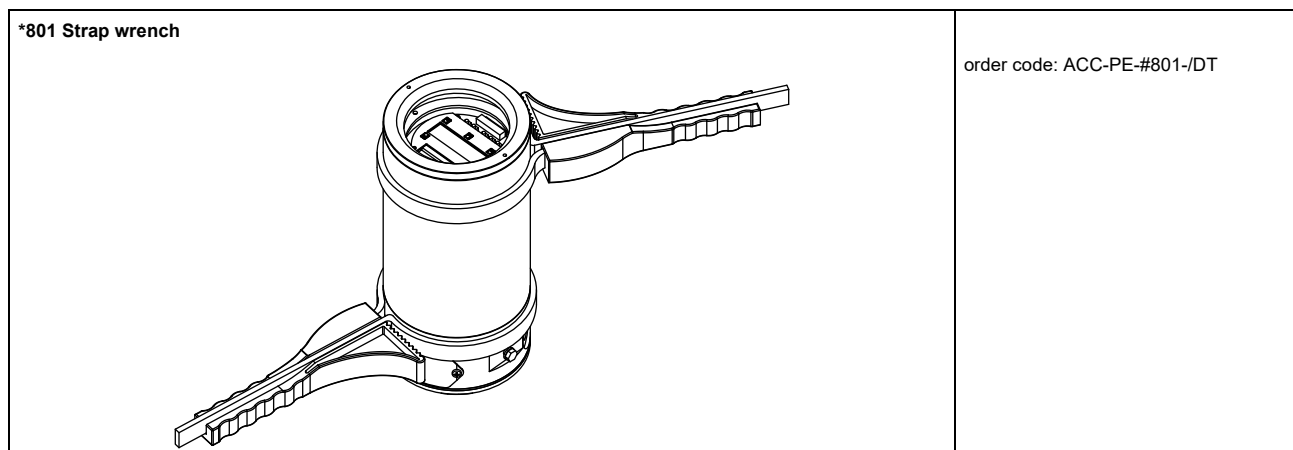
### Dimensions



### Wall and 2" pipe mounting kit

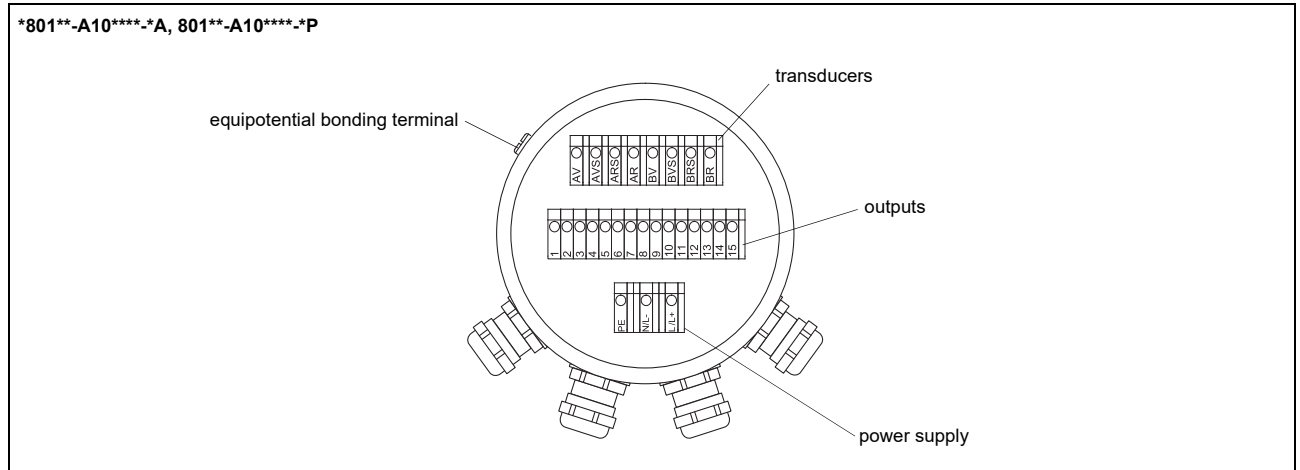


### Strap wrench



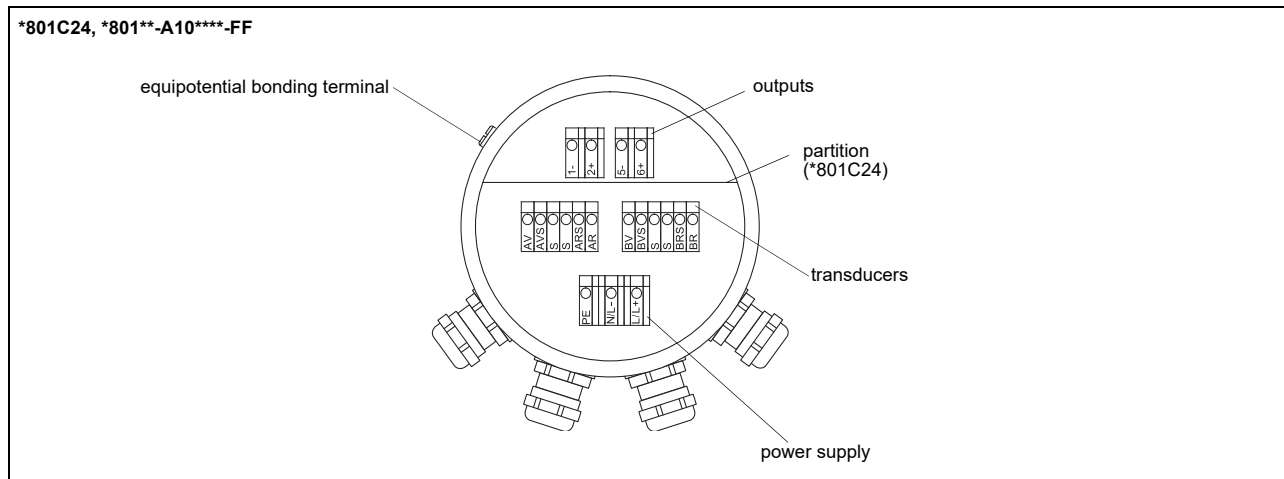


## Terminal assignment



power supply <sup>1</sup>				
AC		DC		
terminal	connection	terminal	connection	
L	phase	L+	+	
N	neutral	L-	-	
PE	earth	PE	earth	
transducers, extension cable				
measuring channel A		measuring channel B		transducer
terminal	connection	terminal	connection	
AV	signal	BV	signal	↑
AVS	internal shield	BVS	internal shield	
ARS	internal shield	BRS	internal shield	⤴
AR	signal	BR	signal	
cable gland	external shield	cable gland	external shield	↑ ⤴
outputs <sup>1</sup>				
terminal	connection			
1(-), 2(+)	current output I1			
3(-), 4(+)	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)	communication interface			

<sup>1</sup> cable (by customer): e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm<sup>2</sup>



power supply <sup>1</sup>				
<b>AC</b>		<b>DC</b>		
*801**-A10****-FF		*801C24, *801**-A10****-FF		
terminal	connection	terminal	connection	
L	phase	L+	+	
N	neutral	L-	-	
PE	earth	PE	earth	
transducers, extension cable				
measuring channel A		measuring channel B		transducer
terminal	connection	terminal	connection	
AV	signal	BV	signal	↑
AVS	internal shield	BVS	internal shield	
ARS	internal shield	BRS	internal shield	↕
AR	signal	BR	signal	
S	not connected	S	not connected	
cable gland	external shield	cable gland	external shield	↑ ↕
outputs <sup>1</sup>				
colour of terminals	*801C24	*801**-A10****-FF		
	blue (intrinsic safety)	green		
terminal	connection			
1(-), 2(+)	current output I1		frequency output F1	
5(-), 6(+)	binary output B1		binary output B1	

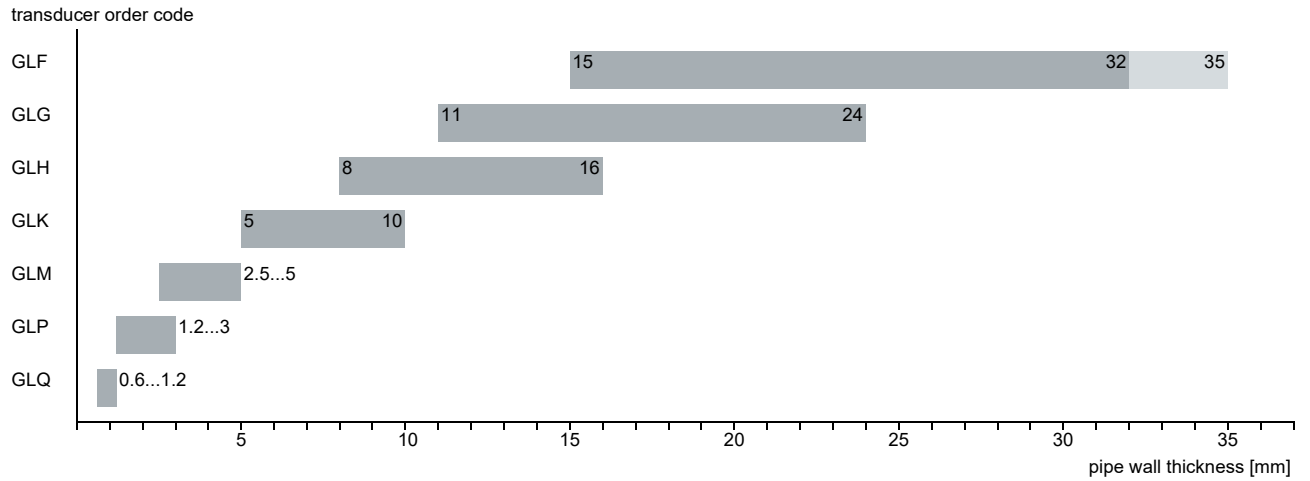
<sup>1</sup> cable (by customer): e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm<sup>2</sup>

## Transducers

### Transducer selection

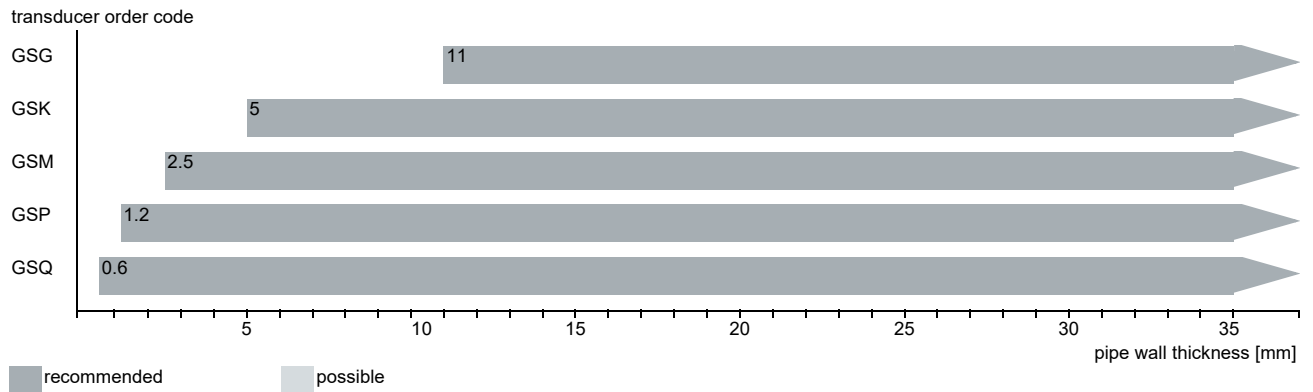
#### Step 1a

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:

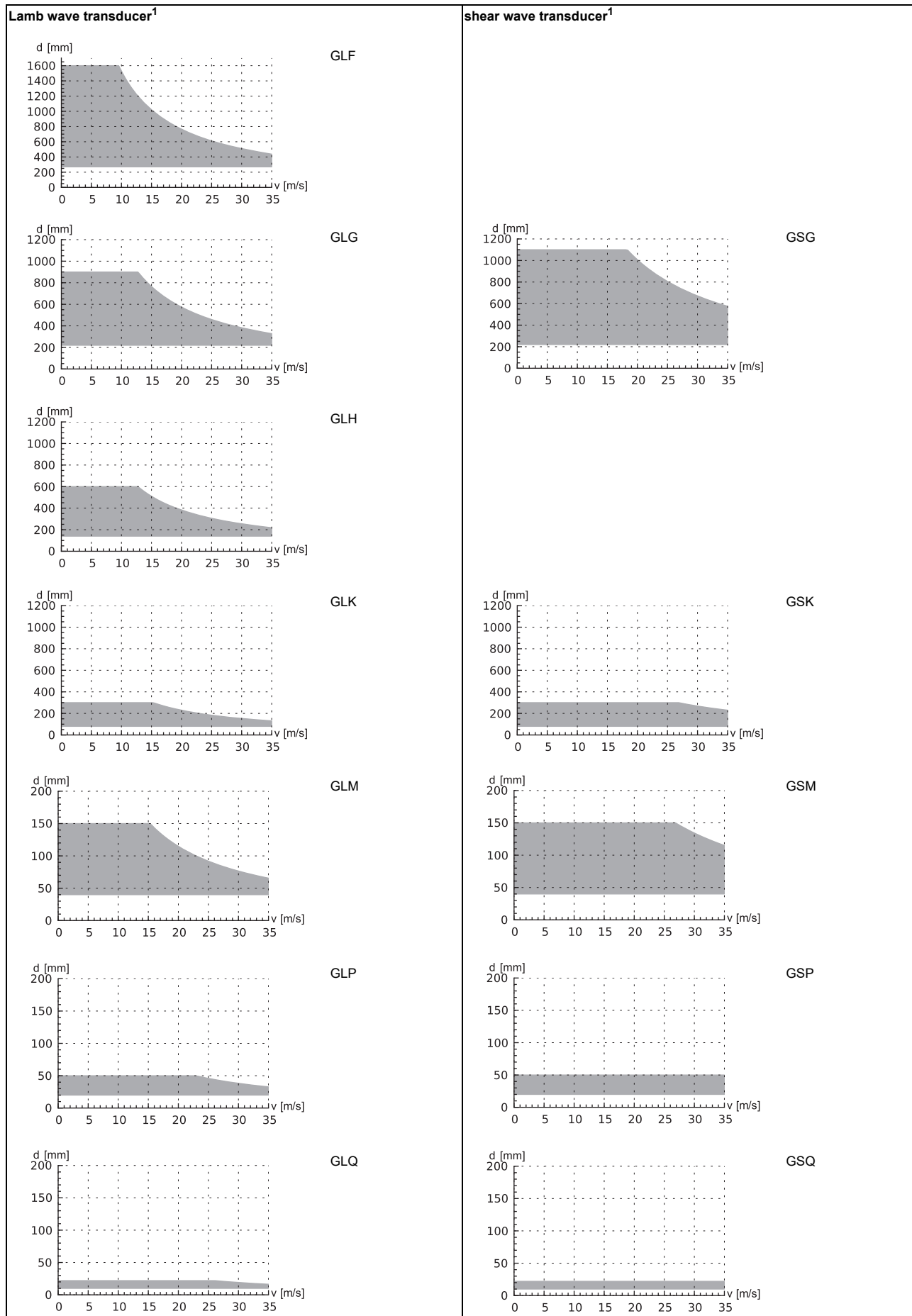


#### Step 2

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.



<sup>1</sup> 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 <sup>1</sup> [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 <sup>1</sup> [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

<sup>1</sup> depending on the application, typical absolute value for natural gas, nitrogen, compressed air

d - inner pipe diameter

### Example

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

### Step 4

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

### Step 5

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

### Transducer order code

1, 2	3	4	5, 6	7, 8	9...11	no. of character				
transducer	transducer frequency	-	ambient temperature	explosion protection	connection system	-	extension cable	/	option	description
GS										set of ultrasonic flow transducers for gas measurement, shear wave
GL										set of ultrasonic flow transducers for gas measurement, Lamb wave
	F									0.15 MHz
	G									0.2 MHz
	H									0.3 MHz
	K									0.5 MHz
	M									1 MHz
	P									2 MHz (on request)
	Q									4 MHz (on request)
		N								normal temperature range
		E								extended temperature range
			A1							ATEX zone 1/IECEx zone 1
				TS						direct connection or connection via junction box
							XXX			0 m: without extension cable
										> 0 m: with extension cable
								LC		long transducer cable
								IP68		degree of protection IP68
								OS		housing with stainless steel 316

## Technical data

### Shear wave transducers (zone 1, TS)

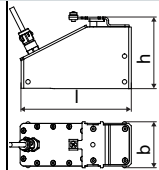
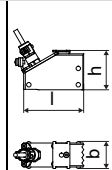

order code		GSG-N*1TS/**	GSK-N*1TS/**	GSM-N*1TS/**	GSP-N*1TS/**	GSQ-N*1TS/**
technical type		G(DL)G1N81	G(DL)K1N81	G(DL)M2N81	G(DL)P2N81	G(DL)Q2N81
transducer frequency	MHz	0.2	0.5	1	2	4
<b>fluid pressure<sup>1</sup></b>						
min. extended	bar	metal pipe: 20				
min.	bar	metal pipe: 30, plastic pipe: 1				
<b>inner pipe diameter d<sup>2</sup></b>						
min. extended	mm	180	60	30	15	7
min. recommended	mm	220	80	40	20	10
max. recommended	mm	900	300	150	50	22
max. extended	mm	1100	360	180	60	30
<b>pipe wall thickness</b>						
min.	mm	11	5	2.5	1.2	0.6
<b>material</b>						
housing		PEEK with stainless steel cover 304 (1.4301), ***-****/OS: 316L (1.4404)				
contact surface		PEEK				
degree of protection		IP65	IP66			IP65
<b>transducer cable</b>						
type		1699				
length	m	5		4		3
length (***-****/LC)	m	9				
<b>dimensions</b>						
length l	mm	129.5	126.5	64		40
width b	mm	51	51	32		22
height h	mm	67	67.5	40.5		25.5
dimensional drawing						
weight (without cable)	kg	0.47	0.36	0.066		0.016
<b>pipe surface temperature</b>						
min.	°C	-40				
max.	°C	+130				
<b>ambient temperature</b>						
min.	°C	-40				
max.	°C	+130				
temperature compensation		x				
<b>explosion protection</b>						
• ATEX/IECEx						
order code		GSG-NA1TS/**	GSK-NA1TS/**	GSM-NA1TS/**	GSP-NA1TS/**	GSQ-NA1TS/**
pipe surface temperature (Ex)						
• min.	°C	-55				
• max.	°C	+180				
marking		CE 0637 (E) II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC T80 °C...T185 °C Db				
certification ATEX		IBExU07ATEX1168 X				
certification IECEx		IECEx IBE 08.0007X				
remark					on request	on request

<sup>1</sup> depending on the application, typical absolute value for natural gas, nitrogen, compressed air

<sup>2</sup> shear wave transducer:

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

**Shear wave transducers (zone 1, TS, IP68)**

order code	GSG-N*1TS/IP68	GSK-N*1TS/IP68	GSM-N*1TS/IP68	GSP-N*1TS/IP68
technical type	GDG1L11	GDK1L11	GDM2L11	GDP2L11
transducer frequency MHz	0.2	0.5	1	2
<b>fluid pressure<sup>1</sup></b>				
min. extended	bar	metal pipe: 20		
min.	bar	metal pipe: 30, plastic pipe: 1		
<b>inner pipe diameter d<sup>2</sup></b>				
min. extended	mm	180	60	30
min. recommended	mm	220	80	40
max. recommended	mm	900	300	150
max. extended	mm	1100	360	180
<b>pipe wall thickness</b>				
min.	mm	11	5	2.5
<b>material</b>				
housing	PEEK with stainless steel cover 316Ti (1.4571)			
contact surface	PEEK			
degree of protection	IP68 <sup>3</sup>			
<b>transducer cable</b>				
type	2550			
length	m	12		
<b>dimensions</b>				
length l	mm	130		72
width b	mm	54		32
height h	mm	83.5		46
dimensional drawing				
weight (without cable)	kg	0.43		0.085
<b>pipe surface temperature</b>				
min.	°C	-40		
max.	°C	+100		
<b>ambient temperature</b>				
min.	°C	-40		
max.	°C	+100		
temperature compensation		x		
<b>explosion protection</b>				
<b>• ATEX/IECEx</b>				
order code	GSG-NA1TS/IP68	GSK-NA1TS/IP68	GSM-NA1TS/IP68	GSP-NA1TS/IP68
pipe surface temperature (Ex)	• min. °C -40 • max. °C +80			
marking	CE 0637  II2G II2D Ex q IIC T6...T5 Gb Ex tb IIIC T80 °C...T85 °C Db			
certification ATEX	IBExU07ATEX1168 X			
certification IECEx	IECEx IBE 08.0007X			
remark				on request

<sup>1</sup> depending on the application, typical absolute value for natural gas, nitrogen, compressed air

<sup>2</sup> shear wave transducer:

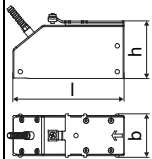
typical values for natural gas, nitrogen, oxygen; pipe diameters for other fluids on request

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

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



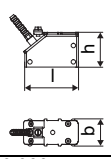
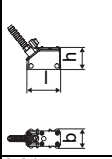

**Shear wave transducers (zone 1, TS, extended temperature range)**

order code		GSG-E*1TS/**	GSK-E*1TS/**
technical type		G(DL)G1E83	G(DL)K1E83
transducer frequency	MHz	0.2	0.5
<b>fluid pressure<sup>1</sup></b>			
min. extended	bar	metal pipe: 20	
min.	bar	metal pipe: 30, plastic pipe: 1	
<b>inner pipe diameter d<sup>2</sup></b>			
min. extended	mm	180	60
min. recommended	mm	220	80
max. recommended	mm	900	300
max. extended	mm	1100	360
<b>pipe wall thickness</b>			
min.	mm	11	5
<b>material</b>			
housing		PPSU with stainless steel cover 304 (1.4301), **_*****/OS: 316L (1.4404)	
contact surface		PPSU	
degree of protection		IP65	
<b>transducer cable</b>			
type		1699	
length	m	5	
length (**_*****/LC)	m	9	
<b>dimensions</b>			
length l	mm	129.5	
width b	mm	51	
height h	mm	67	
dimensional drawing			
weight (without cable)	kg	0.82	
<b>pipe surface temperature</b>			
min.	°C	-40	
max.	°C	+170	
<b>ambient temperature</b>			
min.	°C	-40	
max.	°C	+170	
temperature compensation		x	
<b>explosion protection</b>			
• ATEX/IECEX			
order code		GSG-EA1TS/**	GSK-EA1TS/**
pipe surface temperature (Ex)			
• min.	°C	-50	
• max.	°C	+155	
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC T80 °C...T160 °C Db	
certification ATEX		IBExU07ATEX1168 X	
certification IECEx		IECEX IBE 08.0007X	

<sup>1</sup> depending on the application, typical absolute value for natural gas, nitrogen, compressed air

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

**Shear wave transducers (zone 1, TS, extended temperature range)**

order code		GSM-E*1TS/**	GSP-E*1TS/**	GSQ-E*1TS/**
technical type		G(DL)M2E85	G(DL)P2E85	G(DL)Q2E85
transducer frequency	MHz	1	2	4
<b>fluid pressure<sup>1</sup></b>				
min. extended	bar	metal pipe: 20		
min.	bar	metal pipe: 30, plastic pipe: 1		
<b>inner pipe diameter d<sup>2</sup></b>				
min. extended	mm	30	15	7
min. recommended	mm	40	20	10
max. recommended	mm	150	50	22
max. extended	mm	180	60	30
<b>pipe wall thickness</b>				
min.	mm	2.5	1.2	0.6
<b>material</b>				
housing		PI with stainless steel cover 304 (1.4301), ***-****/OS: 316L (1.4404)		
contact surface		PI		
degree of protection		IP66		IP56
<b>transducer cable</b>				
type		6111		
length	m	4		3
length (***-****/LC)	m	9		
<b>dimensions</b>				
length l	mm	64		40
width b	mm	32		22
height h	mm	40.5		25.5
dimensional drawing				
weight (without cable)	kg	0.066		0.017
<b>pipe surface temperature</b>				
min.	°C	-30		-30
max.	°C	+240 <sup>3</sup>		+200
<b>ambient temperature</b>				
min.	°C	-30		-30
max.	°C	+40 +200 <sup>4</sup>		+200
temperature compensation		x		
<b>explosion protection</b>				
<b>• ATEX/IECEX</b>				
order code		GSM-EA1TS/**	GSP-EA1TS/**	GSQ-EA1TS/**
pipe surface temperature (Ex)				
• min.	°C	-45		
• max.	°C	+225 <sup>3</sup>		
marking		CE 0637  II2G II2D Ex q IIC T6...T2 Gb Ex tb IIIA T80 °C...T230 °C Db		
certification ATEX		IBExU07ATEX1168 X		
certification IECEx		IECEX IBE 08.0007X		
remark		on request		on request

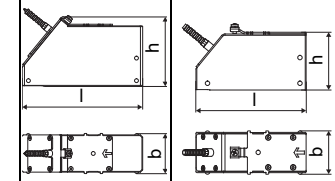
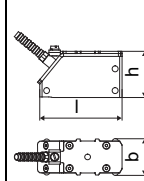
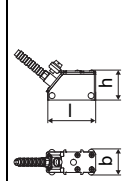
<sup>1</sup> depending on the application, typical absolute value for natural gas, nitrogen, compressed air

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

<sup>3</sup> > +200 °C :  
 Variofix L or Variofix C  
 observe the insulation instruction  
 ambient temperature max. +40 °C

<sup>4</sup> pipe surface temperature max. +200 °C

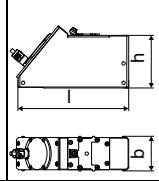
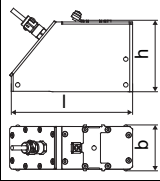
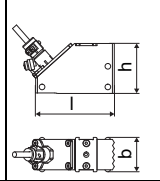
**Lamb wave transducers (zone 1, TS)**

order code		GLF-N*1TS/**	GLG-N*1TS/**	GLH-N*1TS/**	GLK-N*1TS/**	GLM-N*1TS/**	GLP-N*1TS/**	GLQ-N*1TS/**	
technical type		G(RT)F1N83	G(RT)G1N83	G(RT)H1N83	G(RT)K1N83	G(RT)M1N83	G(RT)P1N83	G(RT)Q1N83	
transducer frequency	MHz	0.15	0.2	0.3	0.5	1	2	4	
<b>fluid pressure<sup>1</sup></b>									
min. extended	bar	metal pipe: 10			metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)	metal pipe: 3 (d < 60 mm)	metal pipe: 3 (d < 35 mm)	metal pipe: 3 (d < 15 mm)	
min.	bar	metal pipe: 15 plastic pipe: 1			metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1	metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1	metal pipe: 10 (d > 15 mm) 5 (d < 15 mm) plastic pipe: 1	
<b>inner pipe diameter d<sup>2</sup></b>									
min. extended	mm	220	180	110	60	30	15	7	
min. recommended	mm	270	220	140	80	40	20	10	
max. recommended	mm	1200	900	600	300	150	50	22	
max. extended	mm	1600	1400	1000	360	180	60	30	
<b>pipe wall thickness</b>									
min.	mm	15	11	8	5	2.5	1.2	0.6	
max.	mm	32	24	16	10	5	3	1.2	
max. extended	mm	35	-	-	-	-	-	-	
<b>material</b>									
housing		PPSU with stainless steel cover 304 (1.4301), ***-****/OS: 316L, 316Ti (1.4404, 1.4571)				PPSU with stainless steel cover 304 (1.4301), ***-****/OS: 316L (1.4404)			
contact surface		PPSU							
degree of protection		IP54				IP66			
<b>transducer cable</b>									
type		1699							
length	m	5				4		3	
length (***_****/LC)	m	9							
<b>dimensions</b>									
length l	mm	163		128.5		74		42	
width b	mm	54		51		32		22	
height h	mm	91.3		67.5		40.5		25.5	
dimensional drawing									
weight (without cable)	kg	0.935		0.471		0.077		0.019	
<b>pipe surface temperature</b>									
min.	°C	-40							
max.	°C	+130							
<b>ambient temperature</b>									
min.	°C	-40							
max.	°C	+130							
temperature compensation		x							
<b>explosion protection</b>									
<b>• ATEX/IECEx</b>									
order code		GLF-NA1TS/**	GLG-NA1TS/**	GLH-NA1TS/**	GLK-NA1TS/**	GLM-NA1TS/**	GLP-NA1TS/**	GLQ-NA1TS/**	
pipe surface temperature (Ex)									
• min.	°C	-50							
• max.	°C	+155							
marking		<b>CE</b> 0637 <b>Ex</b> II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIA T80 °C...T160 °C Db		<b>CE</b> 0637 <b>Ex</b> II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC T80 °C...T160 °C Db					
certification ATEX		IBExU07ATEX1168 X							
certification IECEx		IECEx IBE 08.0007X							
remark							on request		on request

<sup>1</sup> depending on the application, typical absolute value for natural gas, nitrogen, compressed air

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

**Lamb wave transducers (zone 1, TS, IP68)**

order code		GLF-N*1TS/IP68	GLG-N*1TS/IP68	GLH-N*1TS/IP68	GLK-N*1TS/IP68	GLM-N*1TS/IP68	GLP-N*1TS/IP68
technical type		GRF1LI3	GRG1LI3	GRH1LI3	GRK1LI3	GRM1LI3	GRP1LI3
transducer frequency	MHz	0.15	0.2	0.3	0.5	1	2
<b>fluid pressure<sup>1</sup></b>							
min. extended	bar	metal pipe: 10	metal pipe: 10	metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)	metal pipe: 3 (d < 60 mm)	metal pipe: 3 (d < 35 mm)	
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	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	
<b>inner pipe diameter d<sup>2</sup></b>							
min. extended	mm	220	180	110	60	30	15
min. recommended	mm	270	220	140	80	40	20
max. recommended	mm	1200	900	600	300	150	50
max. extended	mm	1600	1400	1000	360	180	60
<b>pipe wall thickness</b>							
min.	mm	15	11	8	5	2.5	1.2
max.	mm	32	24	16	10	5	3
max. extended	mm	35	-	-	-	-	-
<b>material</b>							
housing		PPSU with stainless steel cover 316Ti (1.4571)	PPSU with stainless steel cover 316Ti (1.4571)				
contact surface		PPSU	PPSU				
degree of protection		IP68 <sup>3</sup>	IP68 <sup>3</sup>				
<b>transducer cable</b>							
type		2550	2550				
length	m	12	12				
<b>dimensions</b>							
length l	mm	173	143.5			73	
width b	mm	54	54			31.6	
height h	mm	91.5	83.5			46	
dimensional drawing							
weight (without cable)	kg	1.36	0.639			0.093	
<b>pipe surface temperature</b>							
min.	°C	-40	-40				
max.	°C	+100	+100				
<b>ambient temperature</b>							
min.	°C	-40	-40				
max.	°C	+100	+100				
temperature compensation		x	x				
<b>explosion protection</b>							
<b>• ATEX/IECEx</b>							
order code		GLF-NA1TS/IP68	GLG-NA1TS/IP68	GLH-NA1TS/IP68	GLK-NA1TS/IP68	GLM-NA1TS/IP68	GLP-NA1TS/IP68
pipe surface temperature (Ex)							
• min.	°C	-40					
• max.	°C	+80					
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T5 Gb Ex tb IIIC T80 °C...T85 °C Db					
certification ATEX		IBExU07ATEX1168 X					
certification IECEx		IECEx IBE 08.0007X					
remark							on request

<sup>1</sup> depending on the application, typical absolute value for natural gas, nitrogen, compressed air

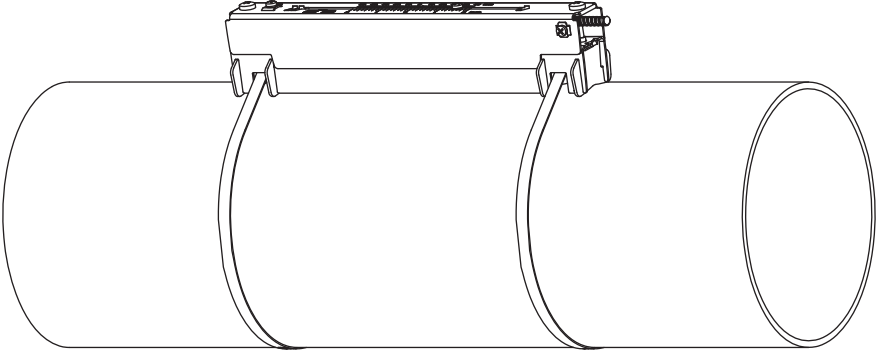
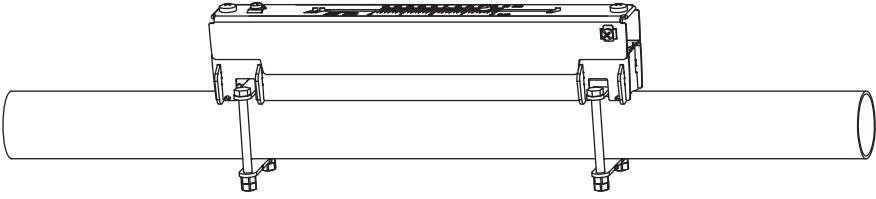
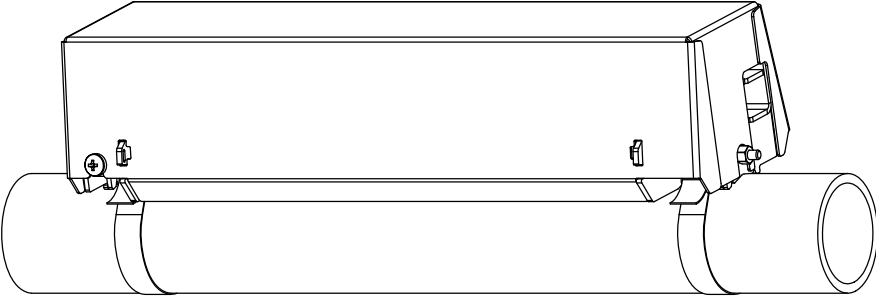
<sup>2</sup> Lamb wave transducer:  
 typical values for natural gas, nitrogen, oxygen; pipe diameters for other fluids on request  
 inner pipe diameter max. recommended: in reflection arrangement (diagonal arrangement) and for a flow velocity of 15 m/s (30 m/s)  
 inner pipe diameter max. extended: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

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

# Transducer mounting fixture

## Order code

1, 2	3	4	5	6	7...9	no. of character
transducer mounting fixture	transducer	measurement arrangement	size	fixation	outer pipe diameter	option
						description
VL						Variofix L
VC						Variofix C
	F					transducers with transducer frequency F
	K					transducers with transducer frequency 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
				B		bolts
				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 for transducers with degree of protection IP68
						OS housing with stainless steel 316
						Z special design

<p><b>Variofix L (VLK, VLM, VLQ)</b></p> 	<p>material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006)  option OS: 316Ti (1.4571), 316L (1.4404), 17-7PH (1.4568)  inner length:  <b>VLK:</b> 348 mm,  option IP68: 368 mm  <b>VLM:</b> 234 mm  <b>VLQ:</b> 176 mm  dimensions:  <b>VLK:</b> 423 x 90 x 93 mm  option IP68: 443 x 94 x 105 mm  <b>VLM:</b> 309 x 57 x 63 mm  <b>VLQ:</b> 247 x 43 x 47 mm</p>
<p><b>Variofix L with bolt mounting plates (VL*-**-B)</b></p> 	<p>material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006)  option OS: 316Ti (1.4571), 316L (1.4404), 17-7PH (1.4568)  inner length:  <b>VLM:</b> 234 mm  <b>VLQ:</b> 176 mm  dimensions:  <b>VLM:</b> 309 x 57 x 63 mm  <b>VLQ:</b> 247 x 43 x 47 mm  outer pipe diameter:  max. 48 mm</p>
<p><b>Variofix C (VC)</b></p> 	<p>material: stainless steel 316Ti (1.4571)  inner length:  <b>VCF-*L, VCK-*L:</b> 500 mm  <b>VCF-*S, VCK-*S:</b> 350 mm  <b>VCM:</b> 400 mm  <b>VCO:</b> 250 mm  dimensions:  <b>VCF-*L, VCK-*L:</b> 560 x 126 x 125 mm  <b>VCF-*S, VCK-*S:</b> 410 x 126 x 125 mm  <b>VCM:</b> 460 x 96 x 82 mm  <b>VCO:</b> 310 x 85 x 71 mm</p>

## Coupling materials for transducers

	normal temperature range (4th character of transducer order code = N)		extended temperature range (4th character of transducer order code = E)		
	< 100 °C	< 170 °C	< 150 °C	< 200 °C	200...240 °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	coupling foil type TF
long time measurement	coupling foil type VT	coupling foil type VT	coupling foil type VT	coupling foil type VT	coupling foil type TF

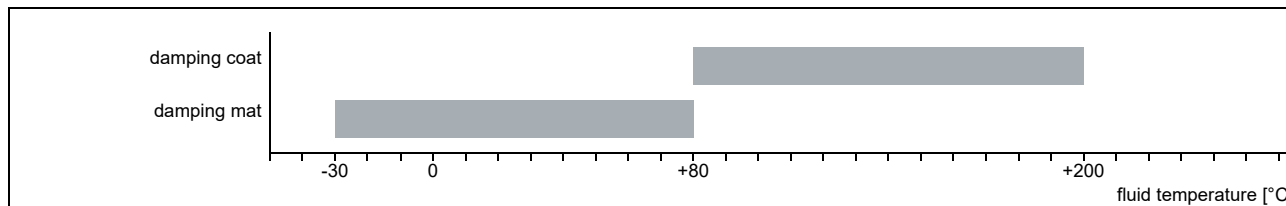
type VT: fluid temperature 200 °C: min. 2 years

### Technical data

type	ambient temperature °C
coupling compound type N	-30...+130
coupling compound type E	-30...+200
coupling compound type H	-30...+250
coupling foil type VT	-10...+200
coupling foil type TF	200...240

### Damping material (optional)

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



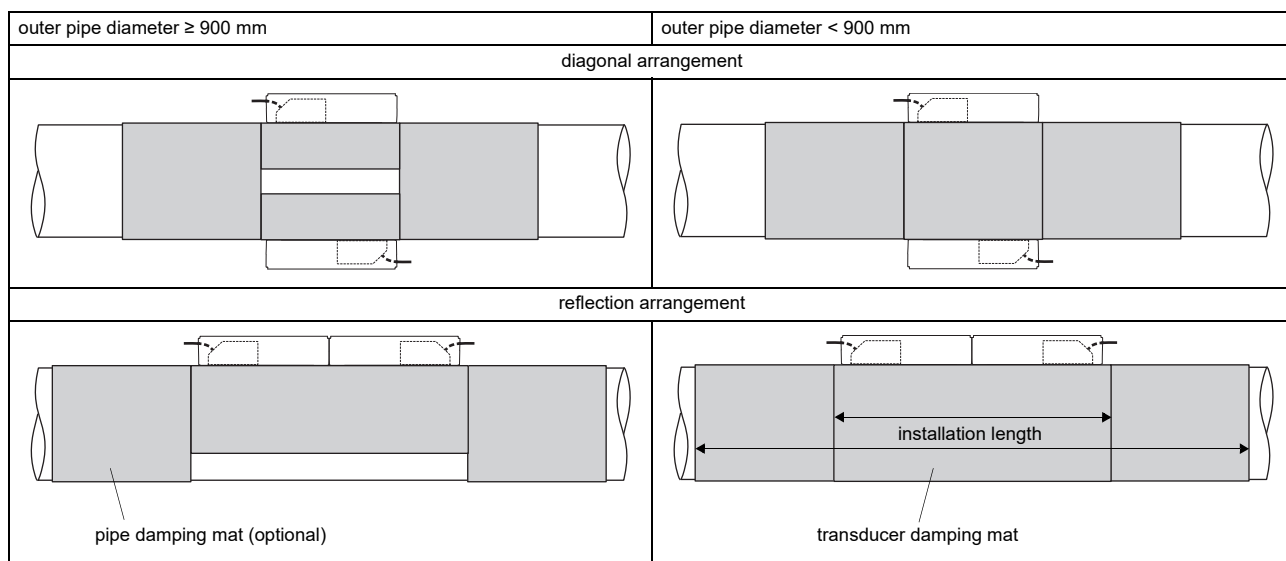
### Damping mats

#### 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
order code		ACC-PE-GNNN-/DPD2	ACC-PE-GNNN-/DPD1
width	mm	225	50
thickness	mm	0.7	
length (per roll)	m	10	
weight	kg/m <sup>2</sup>	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 <sup>1</sup>		max. installation length [mm]	number of rolls <sup>1</sup>	
					standard <sup>2</sup>	extended <sup>2</sup>		standard	extended
<b>VarioFix L</b>									
VLK	GLG	E30R4	3	890	4	4	1830	9	12
	GSG		3		4	4		9	10
	GLH		2		2	3		4	7
	GLK		1		1	1		2	2
	GSK		1		1	1		2	2
VLK-**-****/IP68	GLG	E30R4	3	930	5	5	1910	10	13
	GSG		3		5	5		10	11
	GLH		2		2	3		5	7
	GLK		1		1	1		2	2
	GSK		1		1	1		2	2
VLM	GLM	E30R3	1	660	1	1	1360	2	2
	GSM		1		1	1		2	2
	GLP		1		1	1		1	1
	GSP		1		1	1		1	1
VLQ	GLQ	E30R3	1	540	1	1	1120	1	1
	GSQ		1		1	1		1	1
<b>Variofix C</b>									
VCF-*L-****/IP68	GLF	E30R4	3	1160	6	6	2360	13	15
VCK-*L VCK-*L-****/IP68	GLG	E30R4	3	1160	6	6	2360	11	14
	GSG		3		6	6		11	12
	GLH		2		3	4		5	8
	GLK		1		1	1		2	2
	GSK		1		1	1		2	2
VCF-*S-****/IP68	GLF	E30R4	3	860	4	4	1760	9	10
VCK-*S VCK-*S-****/IP68	GLG	E30R4	3	860	4	4	1760	7	9
	GSG		3		4	4		7	8
	GLH		2		2	3		4	5
	GLK		1		1	1		1	1
	GSK		1		1	1		1	1
VCM	GLM	E30R3	1	960	2	2	1960	3	3
	GSM		1		2	2		3	3
	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

<sup>1</sup> 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)

<sup>2</sup> calculation of 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

### Damping coat

For high temperatures it is recommended to apply the damping coat onto the pipe.

### Technical data

order code	ACC-PE-GNNN/DPL1
material	multipolymeric matrix/inorganic ceramic coating
packing drum	1
properties	heat resistant, inert

Observe installation instructions (TI\_DampingCoat).

### Dimensioning

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

### Connection systems

connection system TS		
connection with extension cable	direct connection	transducers technical type
<p>JB01</p>		****g*
<p>JB01</p>		****L*

### Cable

transducer cable				
type		1699	2550	6111
weight	kg/m	0.094	0.035	0.092
ambient temperature	°C	-55...+200	-40...+100	-100...+225
properties			longitudinal watertight	
cable jacket				
material		PTFE	PUR	PFA
outer diameter	mm	2.9	5.2 ±0.2	2.7
thickness	mm	0.3	0.9	0.5
colour		brown	grey	white
shield		x	x	x
sheath				
material		stainless steel 304 (1.4301) option OS: 316Ti (1.4571)	-	stainless steel 304 (1.4301) option OS: 316Ti (1.4571)
outer diameter	mm	8	-	8

extension cable			
type		2615	5245
order code		ACC-PE- GNNN-/EXEXXX	ACC-PE- GNNN-/EXA1XXX
weight	kg/m	0.18	0.38
ambient temperature	°C	-30...+70	-30...+70
properties		halogen free fire propagation test according to IEC 60332-1 combustion test according to IEC 60754-2	halogen free fire propagation test according to IEC 60332-1 combustion test according to IEC 60754-2
cable jacket			
material		PUR	PUR
outer diameter	mm	max. 12	max. 12
thickness	mm	2	2
colour		black	black
shield		x	x
sheath			
material		-	steel wire braid with copolymer sheath
outer diameter	mm	-	max. 15.5

XXX - cable length in m

**Cable length**


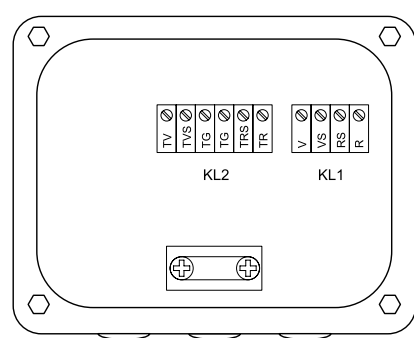
transducer frequency		F, G, H, K		M, P		Q		S	
<b>connection system TS</b>									
<b>transducers technical type</b>		x	l	x	l	x	l	x	l
*(DR)***8*	m	5	≤ 300	4	≤ 300	3	≤ 90	-	-
option LC: *(LT)***8*	m	9	≤ 300	9	≤ 300	9	≤ 90	-	-
option IP68: ****L*	m	12	≤ 300	12	≤ 300	-	-	-	-

x - transducer cable length

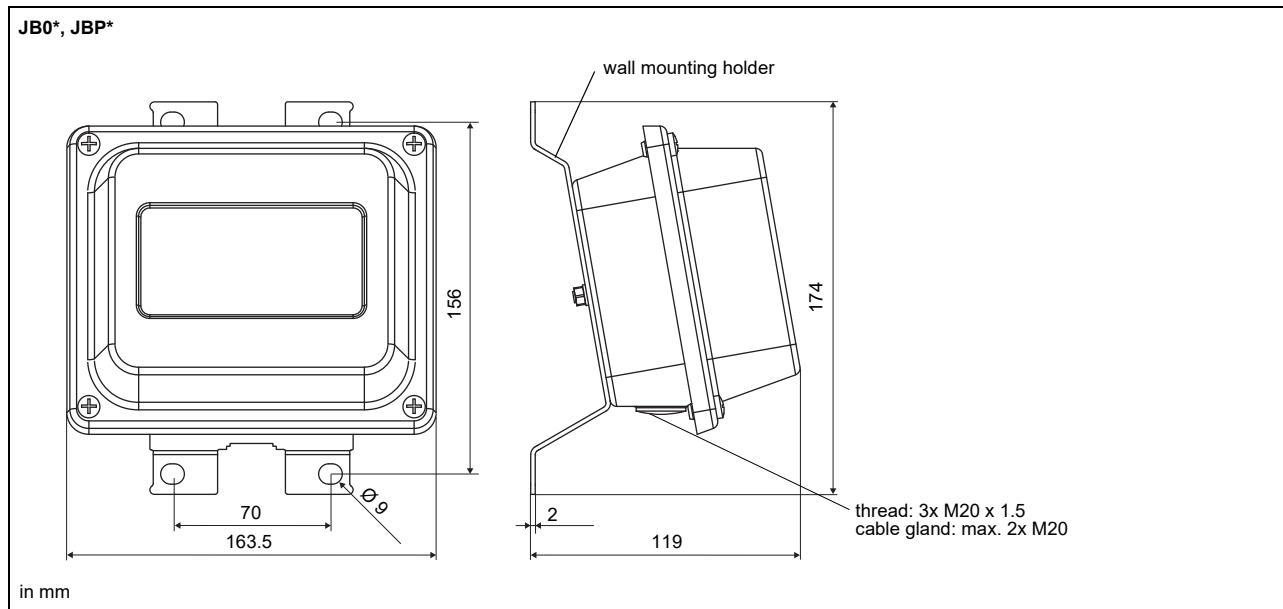
l - max. length of extension cable (depending on the application)

# Junction box

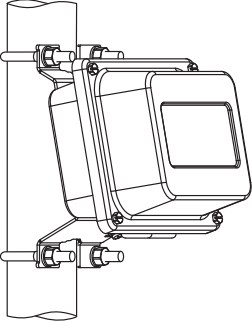
## Technical data

JB01S4E3M																																	
weight	kg 1.2 kg																																
fixation	wall mounting optional: 2" pipe mounting																																
<b>material</b>																																	
housing	stainless steel 316L (1.4404)																																
gasket	silicone																																
degree of protection	IP67																																
<b>ambient temperature</b>																																	
min.	°C -40																																
max.	°C +80																																
<b>explosion protection</b>																																	
• ATEX/IECEX																																	
marking	CE 0637  II2G II2D Ex eb mb IIC T6...T4 Gb Ex tb IIIC T100 °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																																
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> <th>transducer</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL1</td> <td>V</td> <td>signal</td> <td rowspan="2">↑</td> </tr> <tr> <td>VS</td> <td>internal shield</td> </tr> <tr> <td>RS</td> <td>internal shield</td> <td rowspan="2">↕</td> </tr> <tr> <td>R</td> <td>signal</td> </tr> </tbody> </table> </div> <div style="width: 45%;"> <p><b>Transducers</b></p> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> <th>transducer</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL2</td> <td>TV</td> <td>signal</td> <td></td> </tr> <tr> <td>TVS</td> <td>internal shield</td> <td></td> </tr> <tr> <td>TRS</td> <td>internal shield</td> <td></td> </tr> <tr> <td>TR</td> <td>signal</td> <td></td> </tr> </tbody> </table> </div> </div>		terminal strip	terminal	connection	transducer	KL1	V	signal	↑	VS	internal shield	RS	internal shield	↕	R	signal	terminal strip	terminal	connection	transducer	KL2	TV	signal		TVS	internal shield		TRS	internal shield		TR	signal	
terminal strip	terminal	connection	transducer																														
KL1	V	signal	↑																														
	VS	internal shield																															
	RS	internal shield	↕																														
	R	signal																															
terminal strip	terminal	connection	transducer																														
KL2	TV	signal																															
	TVS	internal shield																															
	TRS	internal shield																															
	TR	signal																															
<p><b>Connection</b></p> 																																	
<p><b>Extension cable</b></p> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL2</td> <td>TV</td> <td>signal</td> </tr> <tr> <td>TVS</td> <td>internal shield</td> </tr> <tr> <td>TRS</td> <td>internal shield</td> </tr> <tr> <td>TR</td> <td>signal</td> </tr> </tbody> </table>		terminal strip	terminal	connection	KL2	TV	signal	TVS	internal shield	TRS	internal shield	TR	signal																				
terminal strip	terminal	connection																															
KL2	TV	signal																															
	TVS	internal shield																															
	TRS	internal shield																															
	TR	signal																															

## Dimensions



## 2" pipe mounting kit

<p><b>JB**</b></p> 	<p>order code: ACC-PE-GNNN-JBPMK4</p>
------------------------------------------------------------------------------------------------------	-------------------------------------------

FLEXIM GmbH  
Boxberger Str. 4  
12681 Berlin  
Germany  
Tel.: +49 (30) 93 66 76 60  
Fax: +49 (30) 93 66 76 80  
internet: [www.flexim.com](http://www.flexim.com)  
e-mail: [info@flexim.com](mailto:info@flexim.com)

Subject to change without prior notice.  
Errors excepted.

FLUXUS is a registered trademark of FLEXIM GmbH.

Copyright (©) FLEXIM GmbH 2021