

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
- TR TS certified transmitter FLUXUS G800 is presented in a flameproof housing (IP66) and can be operated by a magnet pen without opening the housing
- All stainless steel and seawater resistant FLUXUS G801 is TR TS 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
- TR TS 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 G800



FLUXUS G801



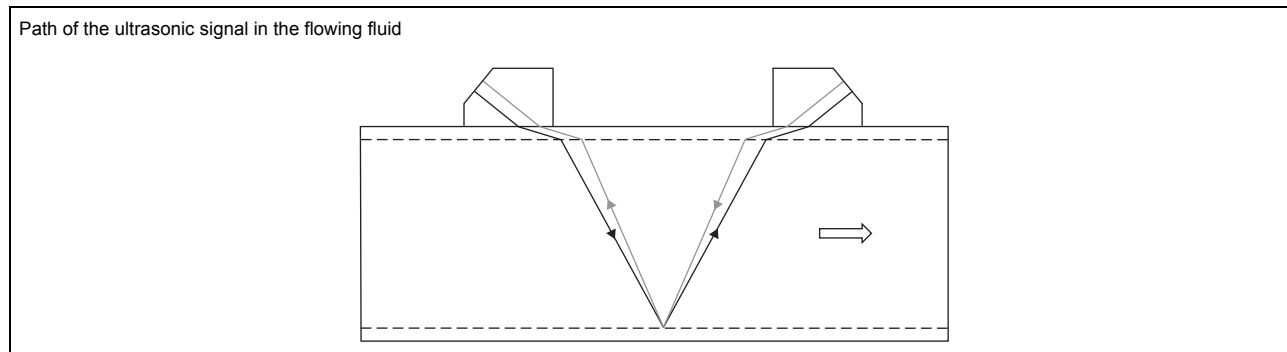
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Function	3
Measurement principle	3
Calculation of volumetric flow rate	3
Number of sound paths	4
Typical measurement setup	5
Standard volumetric flow rate	5
Transmitter	6
Technical data	6
Dimensions	8
Wall and 2" pipe mounting kit	9
Terminal assignment	10
Transducers	14
Transducer selection	14
Technical data	17
Transducer mounting fixture	22
Coupling materials for transducers	24
Damping material (optional)	25
Damping mats	25
Damping coat	26
Connection systems	27
Junction box	29
Technical data	29
Dimensions	29
2" pipe mounting kit	30

Function

Measurement principle

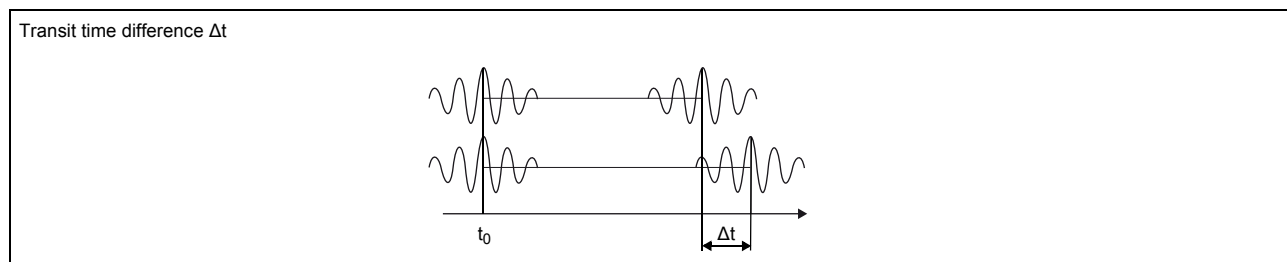
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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

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

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



Calculation of volumetric flow rate

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

where

- \dot{V} - volumetric flow rate
- k_{Re} - fluid mechanics calibration factor
- A - cross-sectional pipe area
- k_a - acoustical calibration factor
- Δt - transit time difference
- t_y - average of transit times in the fluid

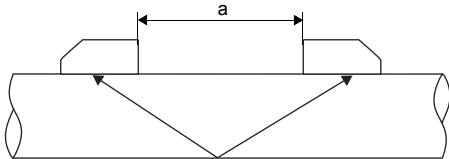
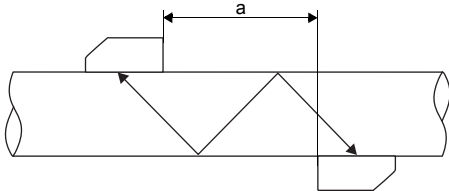
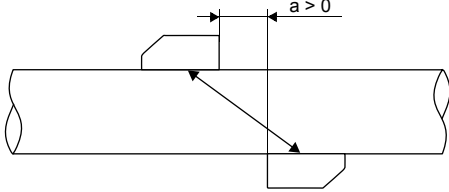
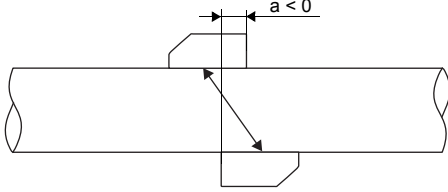
Number of sound paths

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 easier.
- **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.

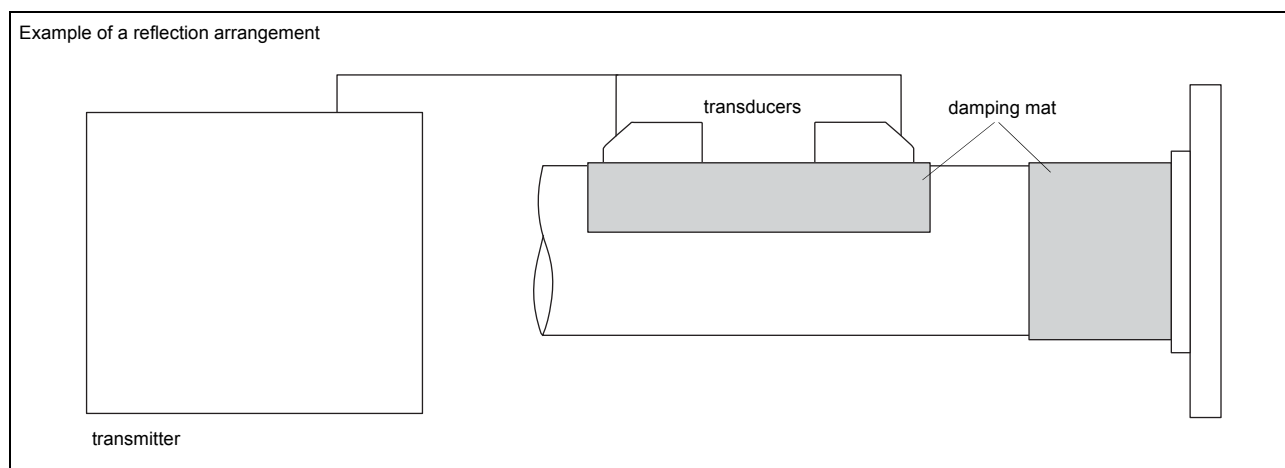
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

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
	

a - transducer distance

Typical measurement setup



Standard volumetric flow rate

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

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

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 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

Transmitter

Technical data

		FLUXUS G800 FLUXUS G800L FLUXUS G800P FLUXUS G800LP	FLUXUS G800P	FLUXUS G800C24 FLUXUS G800LC24	FLUXUS G801 FLUXUS G801P	FLUXUS G801P	FLUXUS G801C24
							
design		explosion proof field device			explosion proof offshore device		
supported transducer frequencies		F, G, H, K, M on request: P, Q			F, G, H, K, M on request: P, Q		
measurement							
measurement principle		transit time difference correlation principle			transit time difference correlation principle		
flow velocity	m/s	0.01...35, depending on pipe diameter			0.01...35, depending on pipe diameter		
repeatability		0.15 % of reading ±0.01 m/s			0.15 % of reading ±0.01 m/s		
fluid		all acoustically conductive gases, e.g. nitrogen, air, oxygen, hydrogen, argon, helium, ethylene, propane			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			corresponding to the recommendations in ANSI/ASME MFC-5.1-2011		
accuracy							
according to Russian metrological certificate no. 54513		±2(1) % * on request			±2(1) % * on request		
transmitter							
power supply		• 100...230 V/50...60 Hz or • 20...32 V $\overline{=}$ or • on request: 11...16 V $\overline{=}$		• 24 V $\overline{=}$ ±10 %	• 100...230 V/50...60 Hz or • 20...32 V $\overline{=}$ or • on request: 11...16 V $\overline{=}$		• 24 V $\overline{=}$ ±10 %
power consumption	W	< 10		< 4	< 8		< 4
number of measuring channels		1, optional: 2			1, optional: 2		
damping	s	0...100 (adjustable)			0...100 (adjustable)		
measuring cycle	Hz	100...1000 (1 channel)			100...1000 (1 channel)		
response time	s	1 (1 channel), option: 0.07			1 (1 channel), option: 0.07		
housing material		cast aluminum • powder coated (G800, G800P, G800C24) • special offshore coating (G800L, G800LP, G800LC24)			stainless steel 316/316L (1.4401, 1.4404, 1.4432)		
degree of protection		IP66			IP66		
dimensions	mm	see dimensional drawing			see dimensional drawing		
weight	kg	6			6.6		
fixation		wall mounting, 2" pipe mounting			wall mounting, 2" pipe mounting		
ambient temperature	°C	-20...+60		-20...+50	-20...+50		
display		2 x 16 characters, dot matrix, backlight			2 x 16 characters, dot matrix, backlight		
menu language		Russian, English, German			Russian, English, German		
explosion protection							
• TR TS							
marking		• G800: 1Ex d e IIC T6 Gb от -20 °C до +60 °C • G800L: 1Ex d e IIB T6 Gb от -20 °C до +60 °C • G800P: 1Ex d e IIC T4 Gb от -20 °C до +60 °C • G800LP: 1Ex d e IIB T4 Gb от -20 °C до +60 °C		• G800C24: 1Ex d e [ib] IIC T4 Gb от -20 °C до +50 °C • G800LC24: 1Ex d e [ib] IIB T4 Gb от -20 °C до +50 °C	• G801: 1Ex d e IIC T6 Gb от -20 °C до +50 °C • G801P: 1Ex d e IIC T4 Gb от -20 °C до +50 °C		1Ex d e [ib] IIC T4 Gb от -20 °C до +50 °C
certification		ERC Ex TC RU C-DE.BH02.B.00644			ERC Ex TC RU C-DE.BH02.B.00644		
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	-		U _m = 250 V AC intrinsically safe outputs: U _i = 28.2 V P _i = 0.76 W L _i , C _i negligible

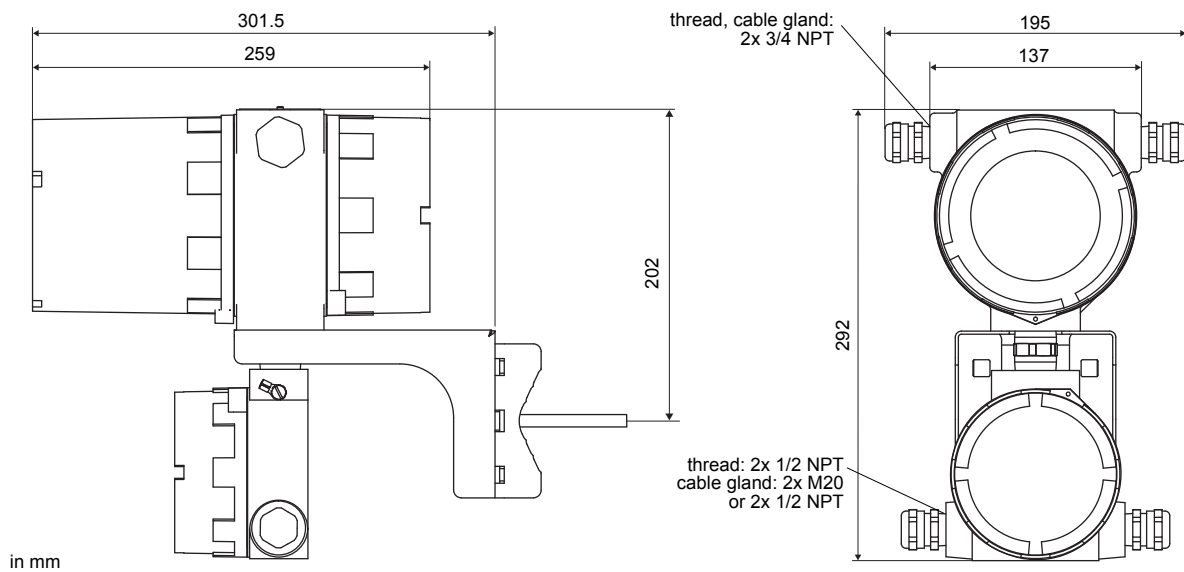
¹ connection of the interface RS232 outside of explosive atmosphere (housing cover open)

		FLUXUS G800 FLUXUS G800L FLUXUS G800P FLUXUS G800LP	FLUXUS G800P	FLUXUS G800C24 FLUXUS G800LC24	FLUXUS G801 FLUXUS G801P	FLUXUS G801P	FLUXUS G801C24
measuring functions							
physical quantities		operating volumetric flow rate, standard volumetric flow rate, mass flow rate, flow velocity			operating volumetric flow rate, standard volumetric flow rate, mass flow rate, flow velocity		
totalizer		volume, mass			volume, mass		
calculation functions		average, difference, sum (2 measuring channels necessary)			average, difference, sum (2 measuring channels necessary)		
diagnostic functions		sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times			sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times		
communication interfaces							
service interfaces		• RS232 ¹ • USB (with adapter) ¹			• RS232 ¹ • USB (with adapter) ¹		
process interfaces		max. 1 option: • RS485 (ASCII sender) • Modbus RTU • HART	-	-	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • HART	-	-
accessories							
serial data kit • cable • adapter		RS232 RS232 - USB			RS232 RS232 - USB		
software		• FluxDiagReader: download of measured values and parameters, graphical presentation • FluxDiag (optional): download of measurement data, graphical presentation, report generation • FluxSubstanceLoader: upload of fluid data sets			• FluxDiagReader: download of measured values and parameters, graphical presentation • FluxDiag (optional): download of measurement data, graphical presentation, report generation • FluxSubstanceLoader: upload of fluid data sets		
data logger							
loggable values		all physical quantities, totaled values and diagnostic values			all physical quantities, totaled values and diagnostic values		
capacity		> 100 000 measured values			> 100 000 measured values		
outputs							
number		The outputs are galvanically isolated from the transmitter. 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 relay): 1	frequency output: 1 and binary output (open collector): 1	current output: 1 and binary output (open collector): 1	The outputs are galvanically isolated from the transmitter. 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 relay): 1	frequency output: 1 and binary output (open collector): 1	current output: 1 and binary output (open collector): 1
• current output							
range	mA	0/4...20	-	4...20	0/4...20	-	4...20
accuracy		0.1 % of reading ±15 µA	-	0.1 % of reading ±15 µA	0.1 % of reading ±15 µA	-	0.1 % of reading ±15 µA
active output		G800, G800L: R _{ext} < 500 Ω	-	-	R _{ext} < 500 Ω	-	-
passive output		G800P, G800LP: U _{ext} = 4...26.4 V, depending on R _{ext} (R _{ext} < 1 kΩ at 26.4 V)	-	U _{ext} = 4...28.2 V, depending on R _{ext} (R _{ext} < 1 kΩ at 28.2 V) intrinsic safety	U _{ext} = 4...26.4 V, depending on R _{ext} (R _{ext} < 1 kΩ at 26.4 V)	-	U _{ext} = 4...28.2 V, depending on R _{ext} (R _{ext} < 1 kΩ at 28.2 V) intrinsic safety
current output in HART mode • range • active output • passive output	mA	I1 4...20 U _{int} = 24 V U _{ext} = 10...24 V	- - - -	- - - -	I1 4...20 U _{int} = 24 V U _{ext} = 10...24 V	- - - -	- - - -
• frequency output							
range	kHz	-	0...5	-	-	0...5	-
open collector		-	30 V/100 mA I _{off} = 0.8 mA optional: 8.2 V DIN EN 60947-5-6 (NAMUR)	-	-	30 V/100 mA I _{off} = 0.8 mA optional: 8.2 V DIN EN 60947-5-6 (NAMUR)	-
• binary output							
open collector		24 V/4 mA	30 V/100 mA I _{off} = 0.8 mA	24 V/4 mA intrinsic safety	24 V/4 mA	30 V/100 mA I _{off} = 0.8 mA	24 V/4 mA intrinsic safety
Reed relay		48 V/100 mA	-	-	48 V/100 mA	-	-
binary output as alarm output							
• functions		limit, change of flow direction or error			limit, change of flow direction or error		
binary output as pulse output							
• functions		mainly for totalizing			mainly for totalizing		
• pulse value	units	0.01...1000			0.01...1000		
• pulse width	ms	1...1000			1...1000		

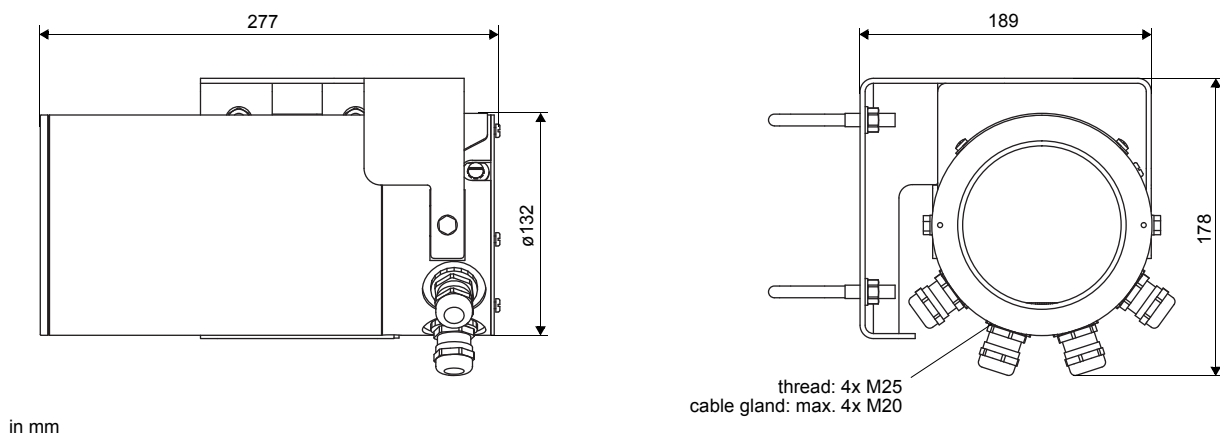
¹ connection of the interface RS232 outside of explosive atmosphere (housing cover open)

Dimensions

G800

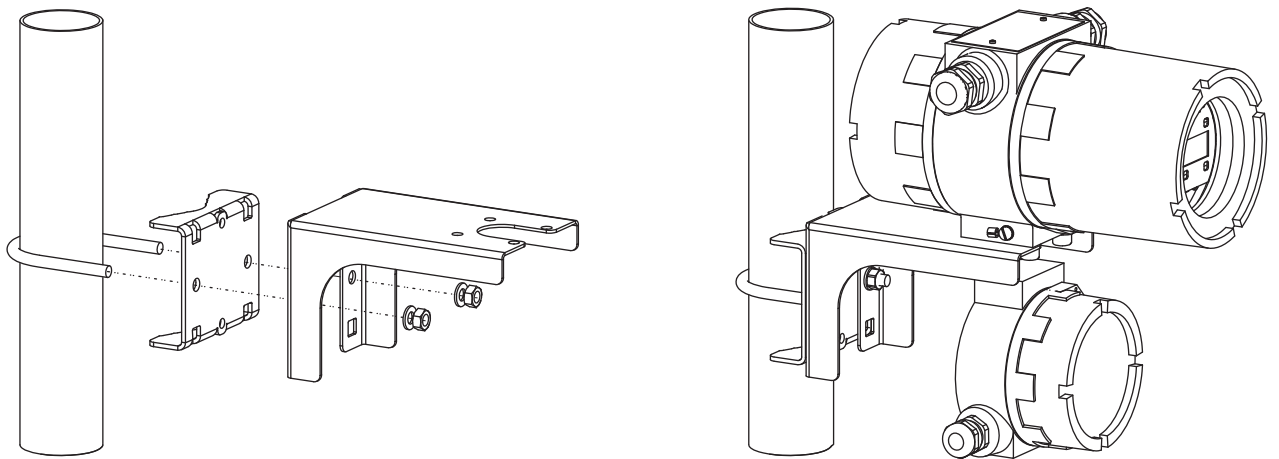


G801

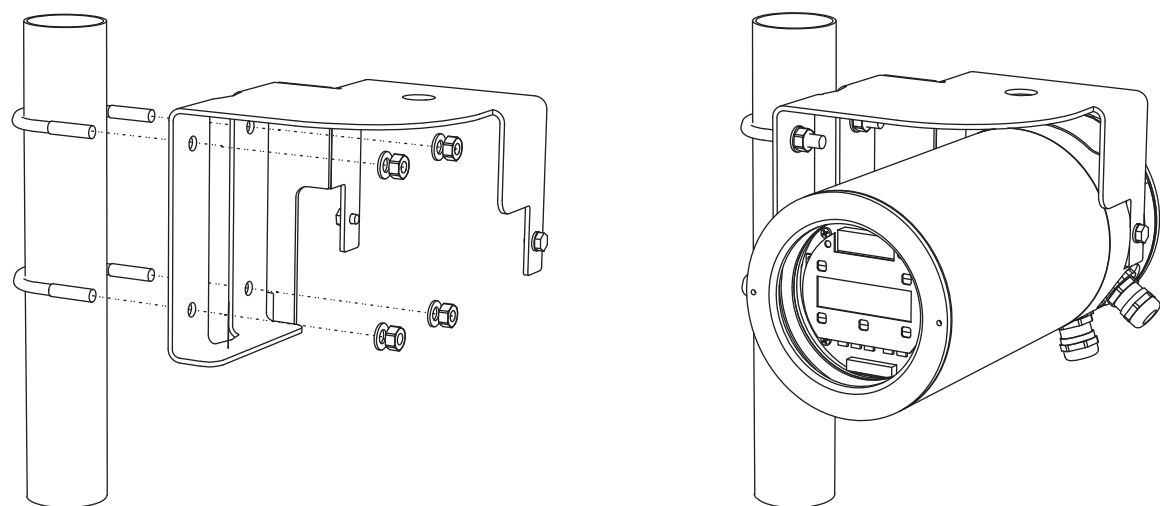


Wall and 2" pipe mounting kit

G800

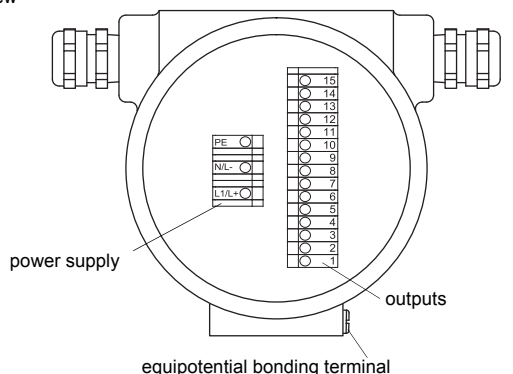
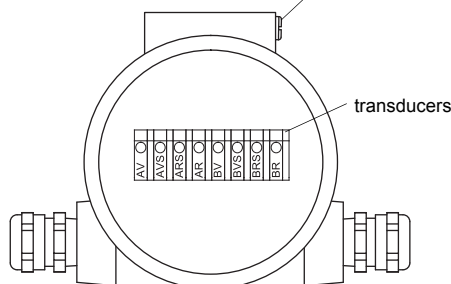


G801



Terminal assignment

G800, G800L, G800LP
G800P (transmitter without frequency output)

 upper housing,
back view

 lower housing,
front view


power supply¹

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

transducers, extension cable

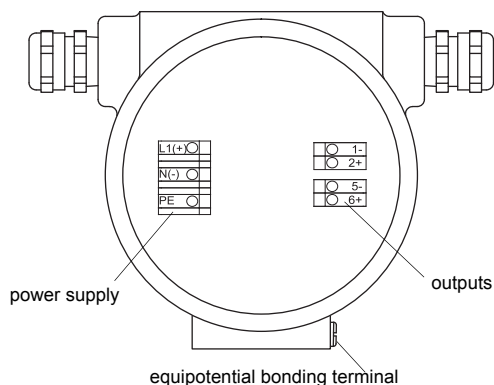
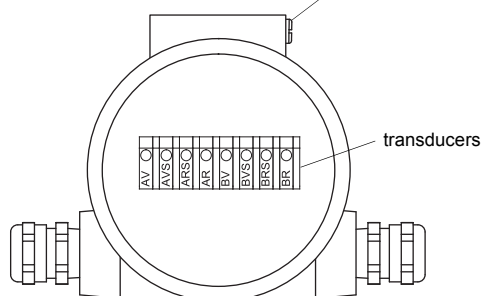
measuring channel A		measuring channel B		transducer
terminal	connection	terminal	connection	
AV	signal	BV	signal	↑
AVS	internal shield	BVS	internal shield	
ARS	internal shield	BRS	internal shield	⌋
AR	signal	BR	signal	
cable gland	external shield	cable gland	external shield	↑ ⌋

outputs¹

G800, G800L		G800P, G800LP	
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)	communication interface		

¹ cable (by customer): e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.25...2.5 mm²

**G800C24, G800LC24
G800P (transmitter with frequency output)**

 upper housing,
back view

 lower housing,
front view

power supply¹

AC		DC	
G800P		G800C24, G800LC24, G800P	
terminal	connection	terminal	connection
L1	phase	L+	+
N	neutral	L-	-
PE	earth	PE	earth

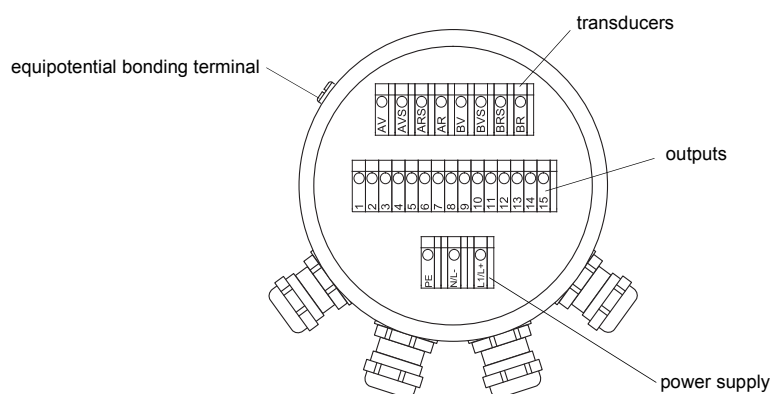
transducers, extension cable

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	↑ ⌋

outputs¹

G800C24, G800LC24		G800P
colour of terminals		green
terminal	connection	
1(-), 2(+)	current output I1	frequency output F1
5(-), 6(+)	binary output B1	binary output B1

¹ cable (by customer): e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.25...2.5 mm²

G801, G801P (transmitter without frequency output)**power supply¹**

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

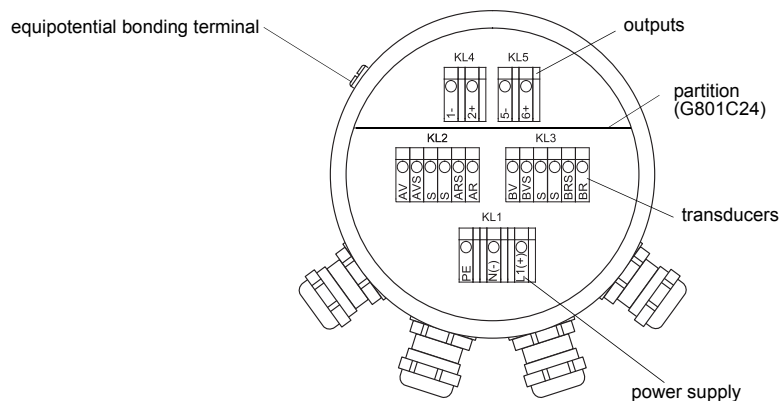
transducers, extension cable

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	↑ ↑

outputs¹

G801		G801P	
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)	communication interface		

¹ cable (by customer): e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.25...2.5 mm²

G801C24, G801P (transmitter with frequency output)**power supply¹**

AC		DC	
G801P		G801C24, G801P	
terminal	connection	terminal	connection
L1	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	↑ ⤴

outputs¹

	G801C24	G801P
colour of terminals	blue (intrinsic safety)	green
terminal	connection	
1(-), 2(+)	current output I1	
5(-), 6(+)	binary output B1	frequency output F1

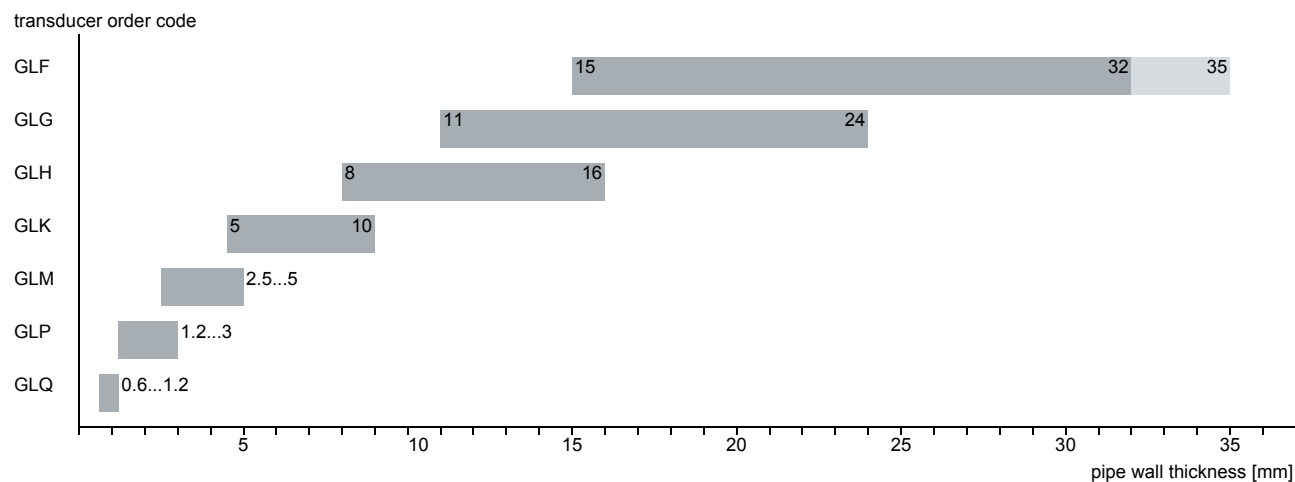
¹ cable (by customer): e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.25...2.5 mm²

Transducers

Transducer selection

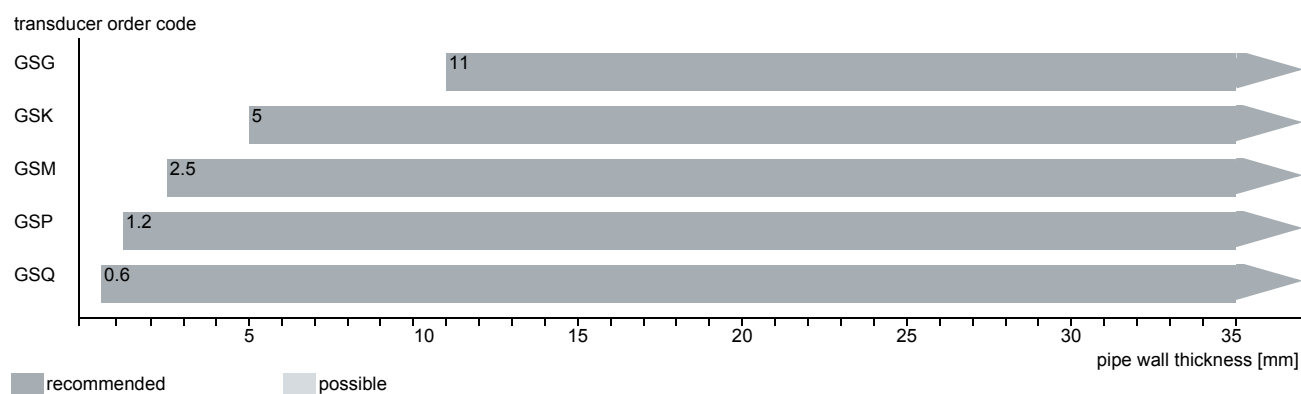
Step 1a

Select a Lamb wave transducer:



Step 1b

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



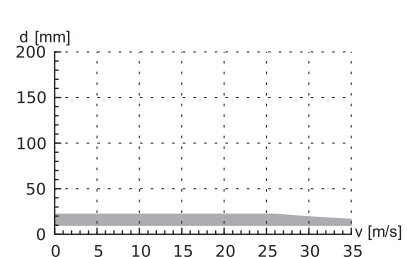
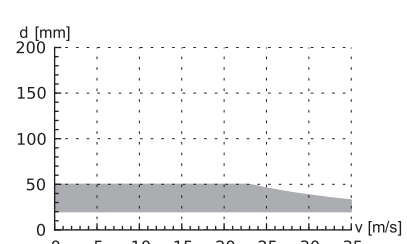
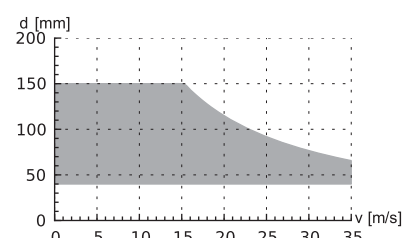
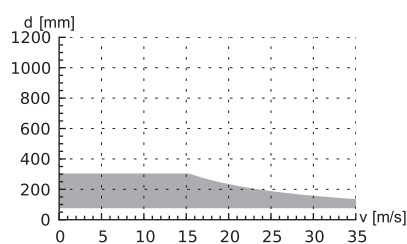
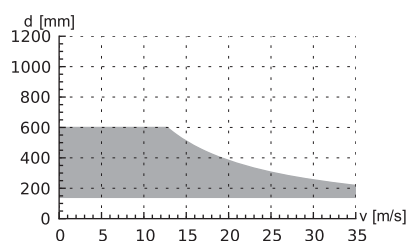
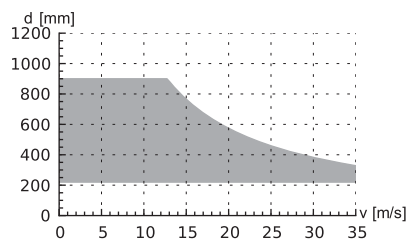
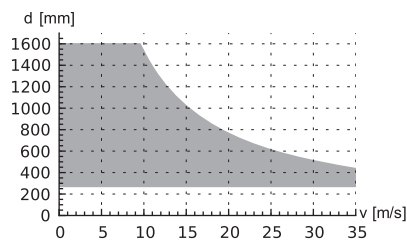
Step 2

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

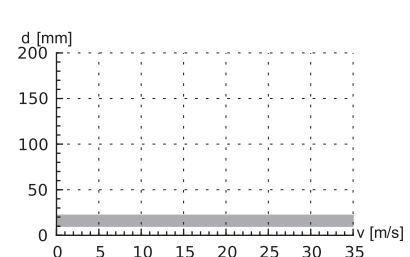
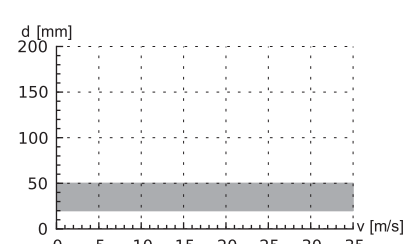
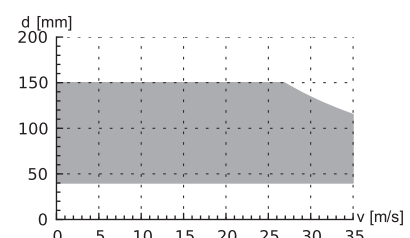
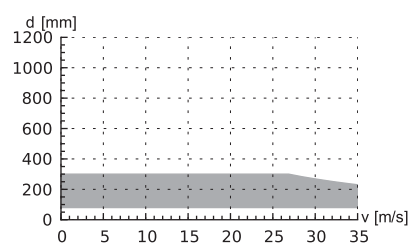
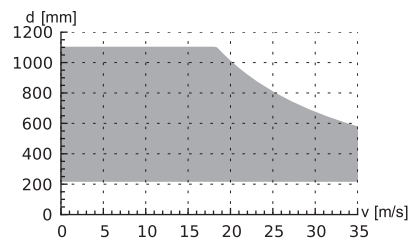
The transducers are selected from the characteristics (see next page). Lamb wave transducers are selected from the left column, shear wave transducers from the right column.

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

Lamb wave transducer¹



shear wave transducer¹



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 or- der 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 or- der 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

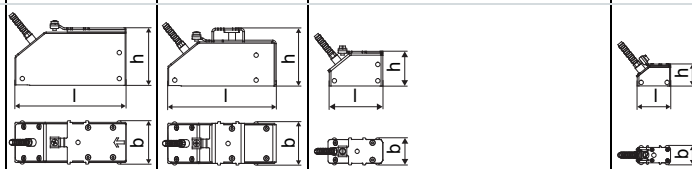
step					
1	pipe wall thickness	mm	14.3	8.6	38
	selected transducer		GLG or GLH	GLH or GLK	GS
2	inner pipe diameter	mm	581	96.8	143
	max. flow velocity	m/s	15	30	30
	selected transducer		GLG	GLK	GSK
3	min. fluid pressure	bar	20	15	40
	selected transducer		GLG	GLK	GSK

Step 4

for the technical data of the selected transducer see page 17 et seqq.

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		GDG1N81	GDK1N81	GDM2N81	GDP2N81	GDQ2N81
transducer frequency	MHz	0.2	0.5	1	2	4
fluid pressure ¹						
min. extended	bar	metal pipe: 20				
min.	bar	metal pipe: 30, plastic pipe: 1				
inner pipe diameter d ²						
min. extended	mm	180	60	30	15	7
min. recommended	mm	220	80	40	20	10
max. recommended	mm	900	300	150	50	22
max. extended	mm	1100	360	180	60	30
pipe wall thickness						
min.	mm	11	5	2.5	1.2	0.6
material						
housing		PEEK with stainless steel cap 304 (1.4301), ***-*****/OS: 316L (1.4404)				
contact surface		PEEK				
degree of protection		IP65	IP66			IP65
transducer cable						
type		1699				
length	m	5		4		3
dimensions						
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
pipe surface temperature						
min.	°C	-40				
max.	°C	+130				
ambient temperature						
min.	°C	-40				
max.	°C	+130				
temperature compensation		x				
explosion protection						
• TR TS						
order code		GSG-NE1TS/**	GSK-NE1TS/**	GSM-NE1TS/**	GSP-NE1TS/**	GSQ-NE1TS/**
marking		1Ex e q IIC T6...T3 Gb Ex tb IIC T130 °C Db от -55 °C до +140 °C				
certification		[RE] [X] TC RU C-DE.BH02.B.00644				
remark					on request	on request

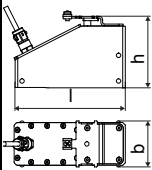
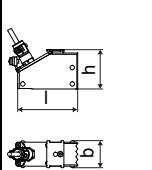
¹ depending on application, typical absolute value for natural gas, nitrogen, compressed air

² shear wave transducer:

typical values for natural gas, nitrogen, oxygen, pipe diameters for other 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		GDG1LI1	GDK1LI1	GDM2LI1	GDP2LI1
transducer frequency	MHz	0.2	0.5	1	2
fluid pressure ¹					
min. extended	bar	metal pipe: 20			
min.	bar	metal pipe: 30, plastic pipe: 1			
inner pipe diameter d ²					
min. extended	mm	180	60	30	15
min. recommended	mm	220	80	40	20
max. recommended	mm	900	300	150	50
max. extended	mm	1100	360	180	60
pipe wall thickness					
min.	mm	11	5	2.5	1.2
material					
housing		PEEK with stainless steel cap 316Ti (1.4571)			
contact surface		PEEK			
degree of protection		IP68 ³			
transducer cable					
type		2550			
length	m	12			
dimensions					
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	
pipe surface temperature					
min.	°C	-40			
max.	°C	+100			
ambient temperature					
min.	°C	-40			
max.	°C	+100			
temperature compensation		x			
explosion protection					
• TR TS					
order code		GSG-NE1TS/IP68	GSK-NE1TS/IP68	GSM-NE1TS/IP68	GSP-NE1TS/IP68
marking		1Ex q IIC T6...T3 Gb Ex tb IIC T130 °C Db от -55 °C до +140 °C			
certification		EAC [Ex] TC RU C-DE.BH02.B.00644			
remark					on request

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

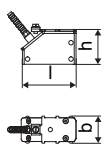
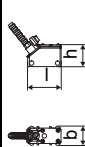
² shear wave transducer:

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

inner pipe diameter max. recommended/max. extended: in reflection 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, TS, extended temperature range)

order code		GSM-E*1TS/**	GSP-E*1TS/**	GSQ-E*1TS/**
technical type		GDM2E85	GDP2E85	GDQ2E85
transducer frequency	MHz	1	2	4
fluid pressure ¹				
min. extended	bar	metal pipe: 20		
min.	bar	metal pipe: 30, plastic pipe: 1		
inner pipe diameter d ²				
min. extended	mm	30	15	7
min. recommended	mm	40	20	10
max. recommended	mm	150	50	22
max. extended	mm	180	60	30
pipe wall thickness				
min.	mm	2.5	1.2	0.6
material				
housing		PI with stainless steel cap 304 (1.4301), ***/****/OS: 316L (1.4404)		
contact surface		PI		
degree of protection		IP66		IP56
transducer cable				
type		6111		
length	m	4		3
dimensions				
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
pipe surface temperature				
min.	°C	-30		-30
max.	°C	+240 ³		+200
ambient temperature				
min.	°C	-30		-30
max.	°C	+40 +200 ⁴		+200
temperature compensation		x		
explosion protection				
• TR TS				
order code		GSM-EE1TS/**	GSP-EE1TS/**	GSQ-EE1TS/**
marking		1Ex e q IIC T6...T2 Gb Ex tb IIIA T215 °C...65 °C Db от -45 °C до +225 °C ³		
certification		[RE][Ex] TC RU C-DE.BH02.B.00644		
remark			on request	on request

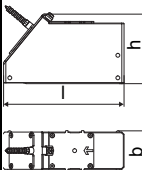
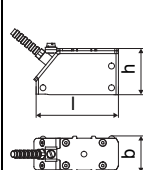
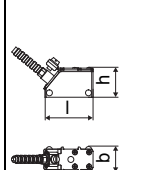
¹ depending on application, typical absolute value for natural gas, nitrogen, compressed air

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

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

⁴ 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		GRF1N83	GRG1N83	GRH1N83	GRK1N83	GRM1N83	GRP1N83	GRQ1N83
transducer frequency	MHz	0.15	0.2	0.3	0.5	1	2	4
fluid pressure ¹								
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
inner pipe diameter d ²								
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
pipe wall thickness								
min.	mm	15	11	8	5	2.5	1.2	0.6
max.	mm	32	24	16	10	5	3	1.2
max. extended		35	-	-	-	-	-	-
material								
housing		PPSU with stainless steel cap 304 (1.4301), ***-****/OS: 316L, 316Ti (1.4404, 1.4571)				PPSU with stainless steel cap 304 (1.4301), ***-****/OS: 316L (1.4404)		
contact surface		PPSU						
degree of protection		IP65				IP66		
transducer cable								
type		1699						
length	m	5				4		3
dimensions								
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
pipe surface temperature								
min.	°C	-40						
max.	°C	+150				+170		
ambient temperature								
min.	°C	-40						
max.	°C	+150				+170		
temperature compensation		x						
explosion protection								
• TR TS								
order code		GLF-NE1TS/**	GLG-NE1TS/**	GLH-NE1TS/**	GLK-NE1TS/**	GLM-NE1TS/**	GLP-NE1TS/**	GLQ-NE1TS/**
technical type		GRF1N83	GRG1N83	GRH1N83	GRK1N83	GRM1N83	GRP1N83	GRQ1N83
marking		1Ex e q IIC T6...T3 Gb Ex tb IIIC T130 °C Db от -55 °C до +140 °C						
certification		[ATEX] TC RU C-DE.BH02.B.00644						
remark							on request	on request

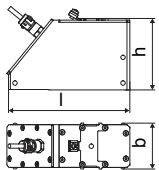
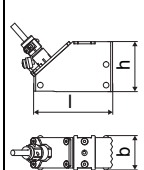
¹ depending on application, typical absolute value for natural gas, nitrogen, compressed air² Lamb wave transducer:

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		GLG-N*1TS/IP68	GLH-N*1TS/IP68	GLK-N*1TS/IP68	GLM-N*1TS/IP68	GLP-N*1TS/IP68
technical type		GRG1LI3	GRH1LI3	GRK1LI3	GRM1LI3	GRP1LI3
transducer frequency	MHz	0.2	0.3	0.5	1	2
fluid pressure ¹						
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)
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
inner pipe diameter d ²						
min. extended	mm	180	110	60	30	15
min. recommended	mm	220	140	80	40	20
max. recommended	mm	900	600	300	150	50
max. extended	mm	1400	1000	360	180	60
pipe wall thickness						
min.	mm	11	8	5	2.5	1.2
max.	mm	24	16	10	5	3
max. extended		-	-	-	-	-
material						
housing		PPSU with stainless steel cap 316Ti (1.4571)				
contact surface		PPSU				
degree of protection		IP68 ³				
transducer cable						
type		2550				
length	m	12				
dimensions						
length l	mm	143.5			73	
width b	mm	54			31.6	
height h	mm	83.5			46	
dimensional drawing						
weight (without cable)	kg	0.639			0.093	
pipe surface temperature						
min.	°C	-40				
max.	°C	+100				
ambient temperature						
min.	°C	-40				
max.	°C	+100				
temperature compensation		x				
explosion protection						
• TR TS						
order code		GLG-NE1TS/IP68	GLH-NE1TS/IP68	GLK-NE1TS/IP68	GLM-NE1TS/IP68	GLP-NE1TS/IP68
marking		1Ex q IIC T6...T3 Gb Ex tb IIIC T130 °C Db от -55 °C до +140 °C				
certification		[RE] [Ex] TC RU C-DE.BH02.B.00644				
remark						on request

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

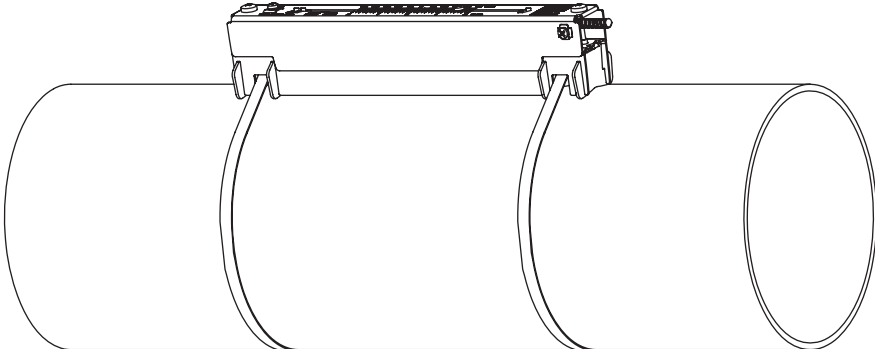
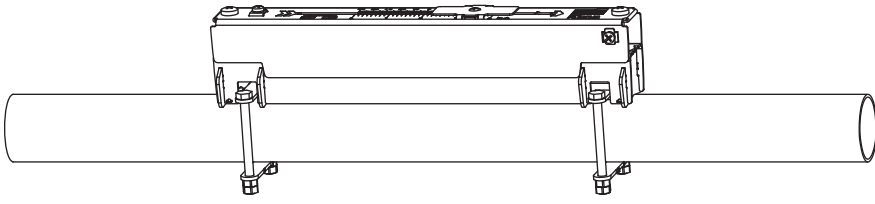
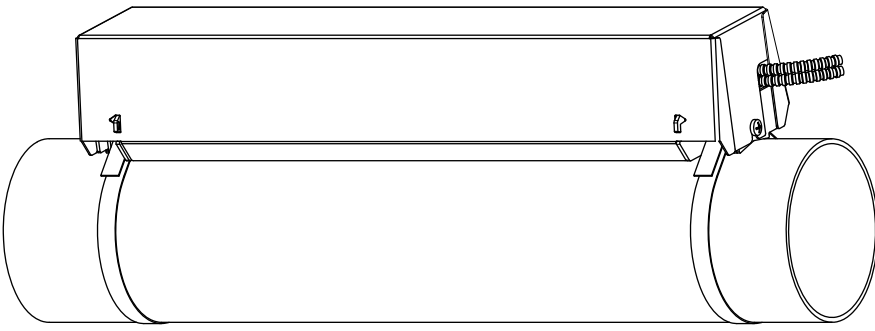
² Lamb wave transducer:
 typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
 inner pipe diameter max. recommended: in reflection arrangement (diagonal arrangement) and for a flow velocity of 15 m/s (30 m/s)
 inner pipe diameter max. extended: in reflection arrangement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

³ 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	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>Variofix L (VLK, VLM, VLQ)</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: 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</p>
<p>Variofix L with bolt mounting plates (VL*-**-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: VLM: 234 mm VLQ: 176 mm dimensions: VLM: 309 x 57 x 63 mm VLQ: 247 x 43 x 47 mm outer pipe diameter: max. 48 mm</p>
<p>Variofix C (VC)</p> 	<p>material: stainless steel 304 (1.4301), 301 (1.4310) option OS: 316Ti (1.4571) inner length: VCF-*L, VCK-*L: 500 mm VCF-*S, VCK-*S: 350 mm VCM: 400 mm VCQ: 250 mm dimensions: VCK-*L: 560 x 122 x 102 mm, VCF-*L, VCK-*L (option IP68): 560 x 126 x 120 mm VCK-*S: 410 x 122 x 102 mm, VCF-*S, VCK-*S (option IP68): 410 x 126 x 120 mm VCM: 460 x 96 x 80 mm VCQ: 310 x 85 x 62 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 ¹	coupling foil type VT ²	coupling foil type VT ¹	coupling foil type VT ²	coupling foil type TF

¹ < 5 years

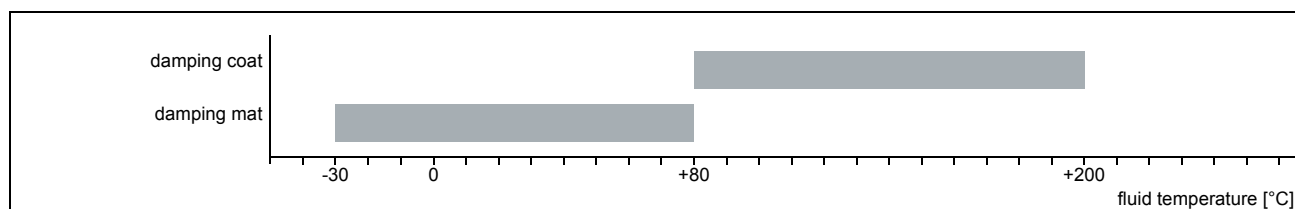
² < 6 months

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.



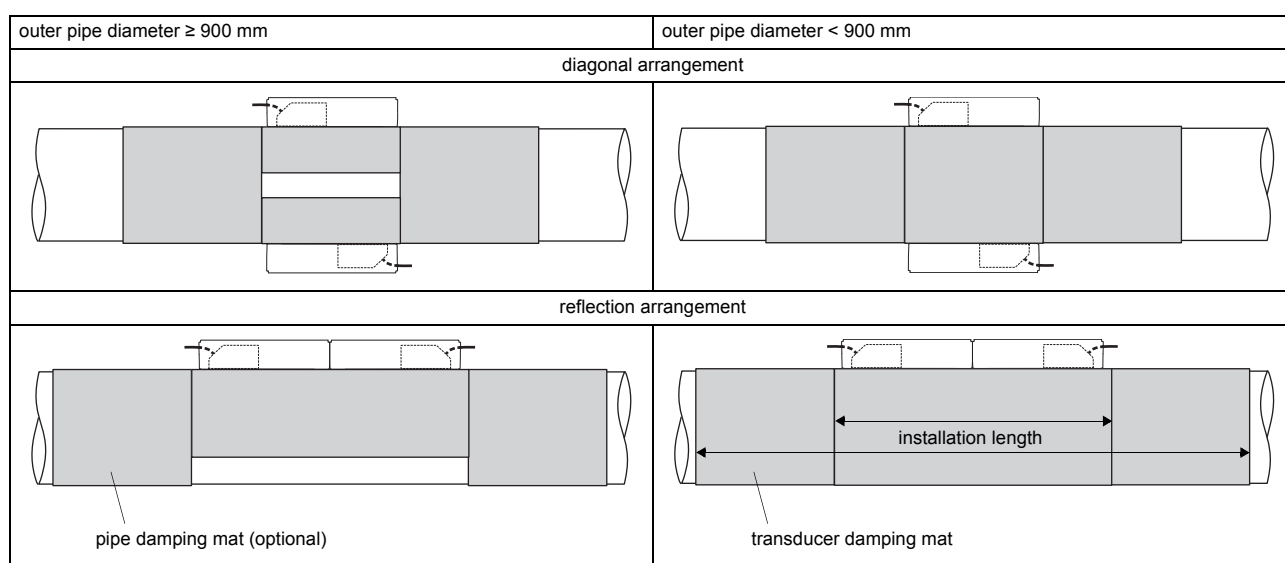
Damping mats

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
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 moun- ting fixture	order code	type	number of layers	transducer damping mat			transducer damping mat + 2x pipe damping mat		
				max. installati- on length [mm]	number of rolls ¹		max. installati- on length [mm]	number of rolls ¹	
					standard ²	extended ²		standard	extended
VarioFix L									
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
Variofix C									
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

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)

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

Damping coat

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

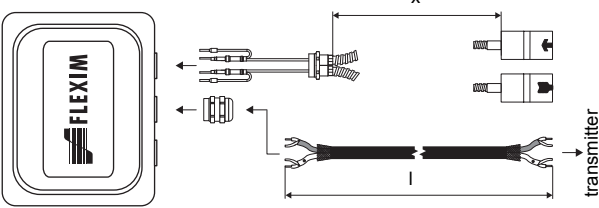
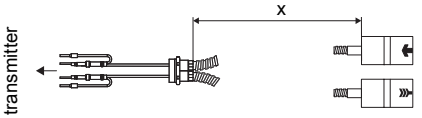
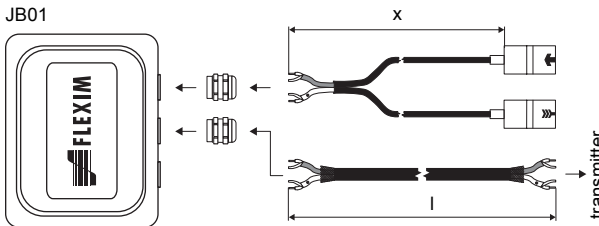
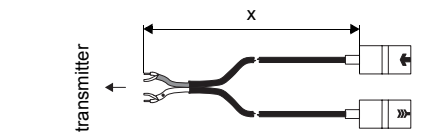
Technical data

material		multipolymeric matrix/inorganic ceramic coating
packing drum	I	1
properties		heat resistant, inert

Dimensioning

transducer	number of packing drums		
	outer pipe diameter		
	≤400	≤600	≤800
	mm		
F	3	4	5
G	2	3	4
H	1	2	3
K	1	-	-
M	1	-	-
P	1	-	-
Q	1	-	-

Connection systems

connection system TS		
connection with extension cable	direct connection	transducers technical type
<p>JB01</p> 		****8*
<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
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	12	12
thickness	mm	2	2
colour		black	black
shield		x	x
sheath			
material		-	steel wire braid with copolymer sheath
outer diameter	mm	-	15.1

Cable length

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

x - transducer cable length

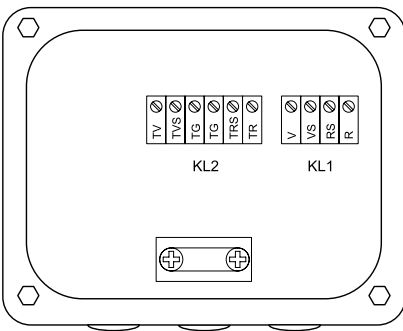
l - max. length of extension cable (depending on application)

Junction box

Technical data

JB01S4E3M			
weight	kg	1.2 kg	
fixation		wall mounting optional: 2" pipe mounting	
material			
housing		stainless steel 316L (1.4404)	
gasket		silicone	
degree of protection		IP67	
ambient temperature			
min.	°C	-40	
max.	°C	+80	
explosion protection			
• TR TS			
marking		1Ex e mb II T6...T4 Gb Ex tb IIIC 100°C Db T6: от -40 °C до +70 °C T4, T5: от -40 °C до +80 °C	
certification		EAC TC RU C-DE.BH02.B.00644	
type of protection		gas: increased safety decoupled network: encapsulation dust: protection by enclosure	

Connection



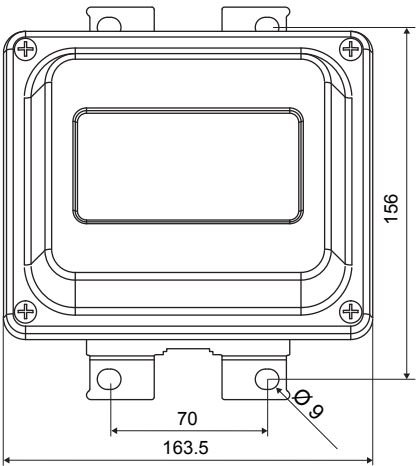
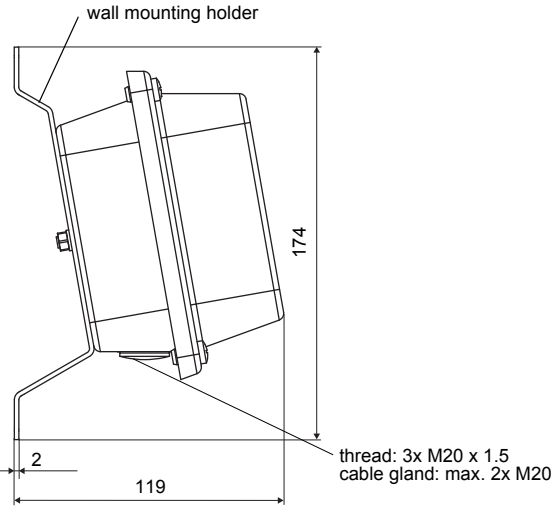
The diagram shows the rear panel of the enclosure with two terminal blocks. Block KL2 (left) has terminals TV, TVS, TG, TRS, and TR. Block KL1 (right) has terminals V, VS, RS, and R. Below the blocks is a battery symbol with a plus sign and a minus sign.

Transducers			
terminal strip	terminal	connection	transducer
KL1	V	signal	↑
	VS	internal shield	
	RS	internal shield	⤴
	R	signal	

Extension cable

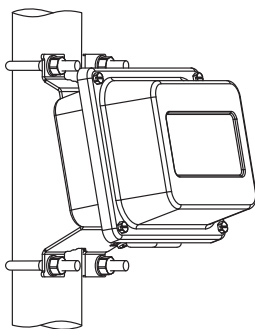
terminal strip	terminal	connection
KL2	TV	signal
	TVS	internal shield
	TRS	internal shield
	TR	signal

Dimensions

JB0*, JBP*	
	
in mm	

2" pipe mounting kit

JB**



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