Ultrasonic Gas Flowmeters for Permanent Installation in Hazardous Areas

Especially designed for the stationary use in explosive atmosphere

Features

- Non-invasive measurement using the clamp-on technology for precise bi-directional, highly dynamic flow measurement
- ATEX, IEC approved transducers for hazardous areas available
- ATEX certified FLUXUS G800 is presented in a flameproof housing (IP 66) and can be operated by a magnet pen without opening the housing
- All stainless steel and seawater resistant FLUXUS G801 is ATEX certified and thus suited for offshore applications
- Automatic loading of calibration data and transducer detection reduce set-up times and provide precise, long-term stable results
- Transducers available for a wide range of inner pipe diameters (7...1600 mm) and fluid temperatures (-40...+200 °C)
- Proven clamp-on technology, transducers resistant to dust and humidity
- Measurement is unaffected by gas density, viscosity and composition, dust, humidity, temperature or pressure
- User-friendly design

FLUXUS G800

FLUXUS G801

Applications

- Designed for industrial use in harsh environments, in gas processing and natural gas extraction, chemical industry and in the petroleum industry. Practical applications:
  - Measurement on natural gas pipelines and in natural gas storage installations
  - Measurement of synthesized gas and injection gas
  - Measurement for the gas supply industry

Measurement with transducers mounted by Variofix L

Table of Contents

Function

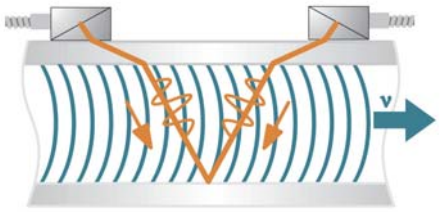
Measurement Principle

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

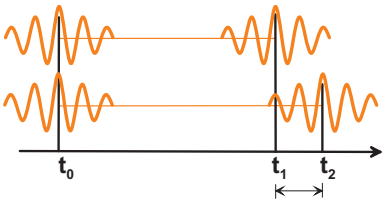
As the medium in which the signals propagate is flowing, the transit time of the ultrasonic signals in the flow direction is shorter than against the flow direction.

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

The received ultrasonic signals will be checked for their usefulness for the measurement and the plausibility of the measured values will be evaluated. The complete measuring cycle is controlled by the integrated microprocessors. Disturbance signals will be eliminated.



Path of the ultrasonic signal



Transit time difference Δt

Calculation of Volumetric Flow Rate

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

where:

Q	-	volumetric flow rate
k_{Re}	-	fluid mechanics calibration factor
A	-	cross-sectional area of the pipe
k_a	-	acoustical calibration factor
Δt	-	transit time difference
t_{fl}	-	transit time in the medium

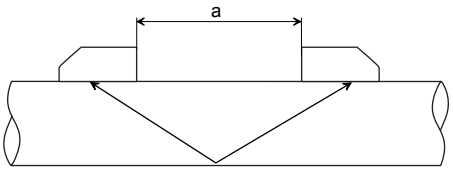
Number of Sound Paths

The number of sound paths is the number of transits of the ultrasonic signal through the medium in the pipe. Depending on the number of sound paths, the following methods of installation exist:

- **reflection mode**
  The number of sound paths is even. Both of the transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easier.
- **diagonal mode**
  The number of sound paths is odd. Both of the transducers are mounted on opposite sides of the pipe. In the case of a high signal attenuation by the medium, pipe and coatings, diagonal mode with 1 sound path will be used.

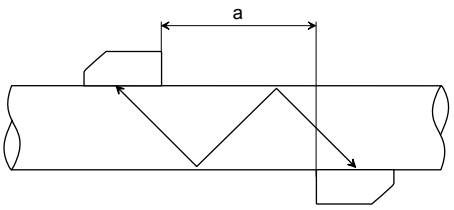
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be detemined automatically by the transmitter.

As the transducers can be mounted with the transducer mounting fixture in reflection mode or diagonal mode, the number of sound paths can be adjusted optimally for the application.

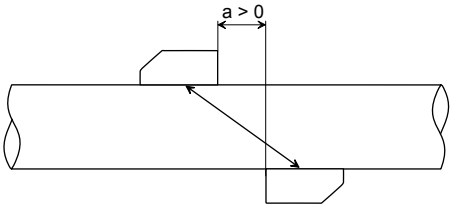


Reflection mode, number of sound paths: 2

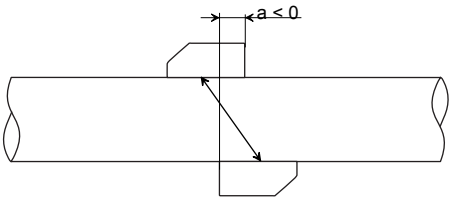
a - transducer distance



Diagonal mode, number of sound paths: 3

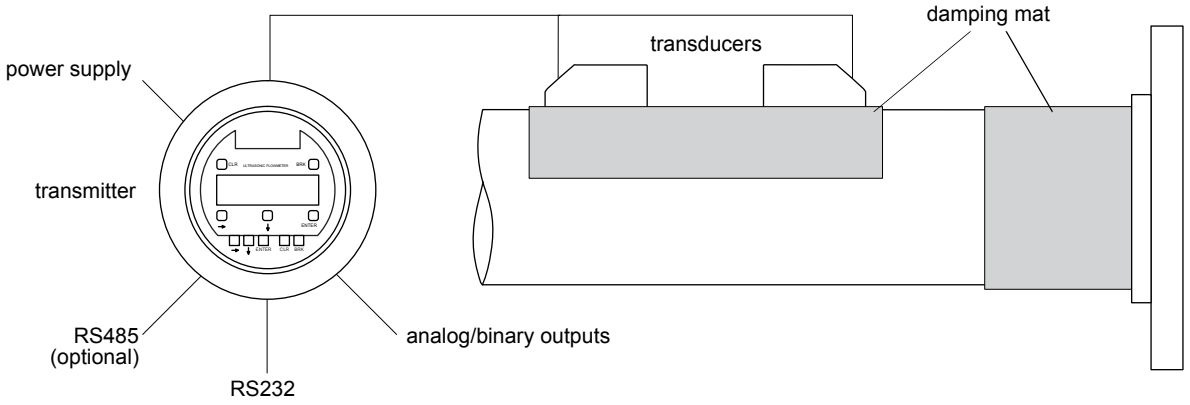


Diagonal mode , number of sound paths: 1



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

Typical Measurement Setup



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

Standard Volumetric Flow Rate

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

$V_N = V \cdot p/p_N \cdot T_N/T \cdot 1/K$

where:

V_N	-	standard volumetric flow rate
V	-	operational volumetric flow rate
p_N	-	standard pressure (absolute value)
p	-	operational pressure (absolute value)
T_N	-	standard temperature in K
T	-	operational temperature in K
K	-	gas compressibility factor

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

The gas compressibility factor K will be entered in the transmitter:

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

Flow Transmitter

Technical Data

FLUXUS	G800 G800L G800P G800LP	G800C24 G800LC24	G801 G801P	G801C24
design	explosion proof field device		explosion proof offshore device	
				
measurement				
measuring principle	transit time difference correlation principle			
flow velocity	0.01...35 m/s, pipe diameter dependent			
repeatability	0.15 % of reading ±0.01 m/s			
accuracy				
- volumetric flow rate	± 1...3 % of reading ±0.01 m/s depending on application ± 0.5 % of reading ±0.01 m/s with field calibration			
medium	gases with a ratio of the characteristic acoustic impedances of pipe wall and gas < 3000, e.g. nitrogen, air, oxygen, hydrogen, argon, helium, ethylene, propane			
temperature compensation	corresponding to the recommendations in ANSI/ASME MFC-5M-1985			
flow transmitter				
power supply	100...240 V/50...60 Hz or 20...32 V DC or on request: 11...16 V DC	24 V DC ±10 %	100...240 V/50...60 Hz or 20...32 V DC or on request: 11...16 V DC	24 V DC ±10 %
power consumption	< 15 W	< 4 W	< 15 W	< 4 W
number of flow measuring channels	1, optional: 2			
signal damping	0...100 s, adjustable			
measuring cycle (1 channel)	100...1000 Hz			
response time	1 s (1 channel), optional: 70 ms			
housing material	cast aluminum G800, G800P, G800C24: powder coated G800L, G800LP, G800LC24: special four-layer coating		stainless steel 316Ti (1.4571)	
degree of protection according to EN 60529	IP 66		IP 66	
dimensions	see dimensional drawing			
weight	6 kg		8.5 kg	
fixation	wall mounting, optional: 2 " pipe mounting			
operating temperature	-20...+60 °C	-20...+50 °C	-20...+50 °C	-20...+50 °C
display	2 x 16 characters, dot matrix, backlit			
menu language	English, German, French, Dutch, Spanish			

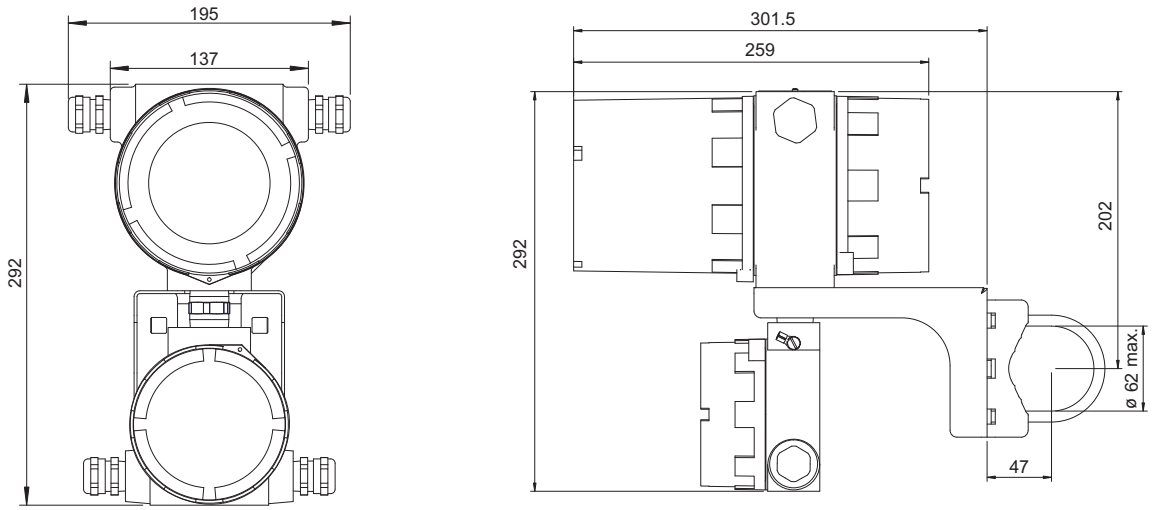
FLUXUS		G800 G800L G800P G800LP	G800C24 G800LC24	G801 G801P	G801C24
explosion protection					
ATEX	zone	1	1	1	1
	marking	**G800**: CE 0044; Ex II2G Ex de IIC T6 T_a -20...+60 °C **G800L**: CE 0044; Ex II2G Ex de IIB T6 T_a -20...+60 °C **G800P**: CE 0044; Ex II2G Ex de IIC T4 T_a -20...+60 °C **G800LP**: CE 0044; Ex II2G Ex de IIB T4 T_a -20...+60 °C	**G800C24**: CE 0044; Ex II2G Ex de [ib] IIC T4 T_a -20...+50 °C **G800LC24**: CE 0044; Ex II2G Ex de [ib] IIB T4 T_a -20...+50 °C	**G801**: CE 0044; Ex II2G Ex de IIC T6 T_a -20...+50 °C **G801P**: CE 0044; Ex II2G Ex de IIC T4 T_a -20...+50 °C	CE 0044; Ex II2G Ex de [ib] IIC T4 T_a -20...+50 °C
	certification	IBExU01ATEX1064	IBExU01ATEX1064	IBExU05ATEX1078	IBExU05ATEX1078
	type of protection	electronics compartment: flameproof enclosure connection compartment: increased safety	electronics compartment: flameproof enclosure connection compartment: increased safety output circuits: intrinsic safety	electronics compartment: flameproof enclosure connection compartment: increased safety	electronics compartment: flameproof enclosure connection compartment: increased safety output circuits: intrinsic safety
measuring functions					
physical quantities		operational volumetric flow rate, standard volumetric flow rate, mass flow, flow velocity			
totalizers		volume, mass			
calculation functions		average, difference, sum			
diagnostic functions		sound velocity, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times			
data logger					
loggable values		all physical quantities, totalized values and diagnostic values			
capacity		> 100 000 measured values			
communication					
interface		- process integration: optional: RS485 (Modbus, sender) or HART - diagnosis: RS232[1]	- diagnosis: RS232[1]	- process integration: optional: RS485 (Modbus, sender) or HART - diagnosis: RS232[1]	- diagnosis: RS232[1]
serial data kit (optional)					
software (all Windows™ versions)		- FluxData: download of measured data, graphical presentation, conversion to other formats (e.g. for Excel™) - FluxKoef: creating medium data sets			
cable		RS232[1]			
adapter		RS232 - USB[1]			

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

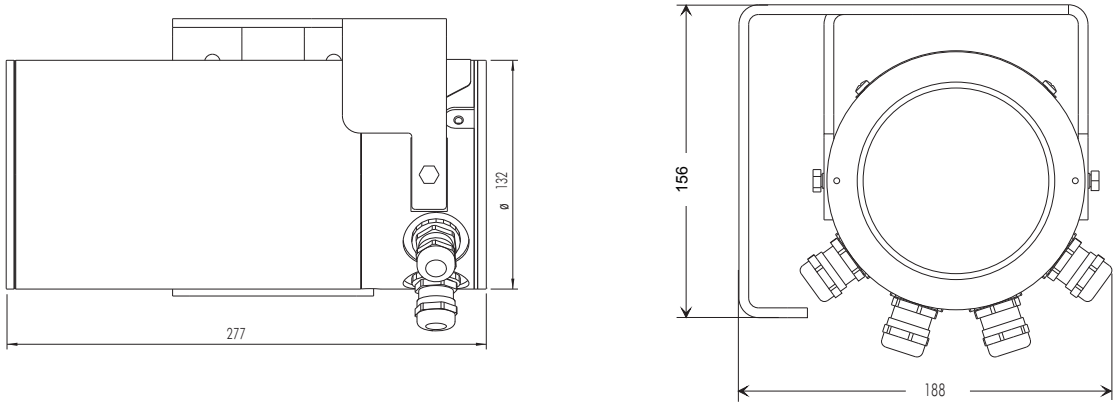
FLUXUS	**G800** **G800L** **G800P** **G800LP**	**G800C24** **G800LC24**	**G801** **G801P**	**G801C24**
outputs (optional)				
	The outputs are galvanically isolated from the transmitter.			
			current output	
number	1, optional: additionally 1	1	1, optional: additionally 1	1
current output I1, I2				
- range	0/4...20 mA	4...20 mA	0/4...20 mA	4...20 mA
- 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	-	**G801**: R_{ext} < 500 Ω	-
- passive output	**G800P,** **G800LP**: U_{ext} = 4...26.4 V, dependent on R_{ext} R_{ext} < 1 kΩ	U_i = 26.4 V P_i = 0.7 W L_i, C_i negligible	**G801P**: U_{ext} = 4...26.4 V, dependent on R_{ext} R_{ext} < 1 kΩ	U_i = 26.4 V P_i = 0.7 W L_i, C_i negligible
current output I1 in HART mode				
- range	4...20 mA	-	4...20 mA	-
- passive output	U_{ext} = 10...24 V	-	U_{ext} = 10...24 V	-
			binary output	
number	1 open collector optional: additionally 1 open collector and max. 2 relay or max. 3 open collector	1	1 open collector optional: additionally 1 open collector and max. 2 relay or max. 3 open collector	1
Reed relay	48 V/0.25 A	-	48 V/0.25 A	-
open collector	24 V/4 mA	24 V/4 mA	24 V/4 mA	24 V/4 mA
intrinsic safety parameters	-	U_i = 26.4 V P_i = 0.7 W L_i, C_i negligible	-	U_i = 26.4 V P_i = 0.7 W L_i, C_i negligible
binary output as alarm output				
- functions	limit, change of flow direction or error	limit, change of flow direction or error	limit, change of flow direction or error	limit, change of flow direction or error
binary output as pulse output				
- pulse value	0.01...1000 units	0.01...1000 units	0.01...1000 units	0.01...1000 units
- pulse width	1...1000 ms	1...1000 ms	1...1000 ms	1...1000 ms

Dimensions and Fixation

FLUXUS G800



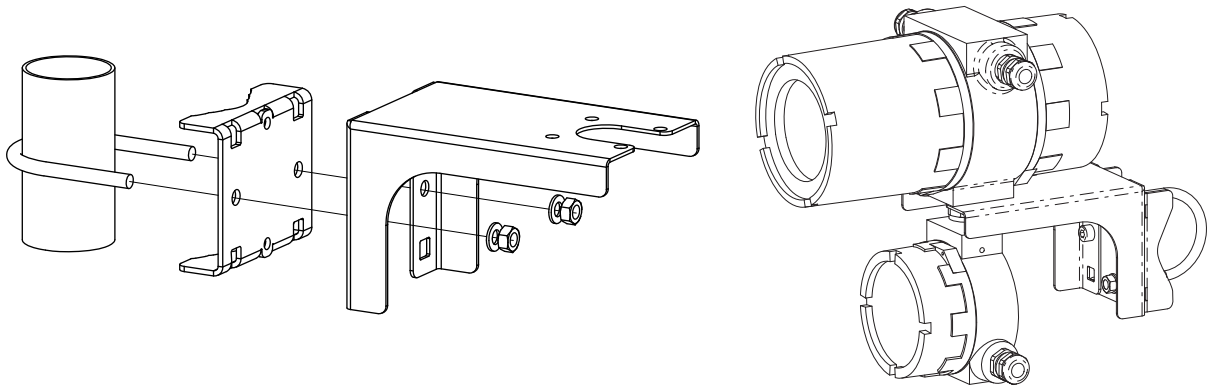
FLUXUS G801



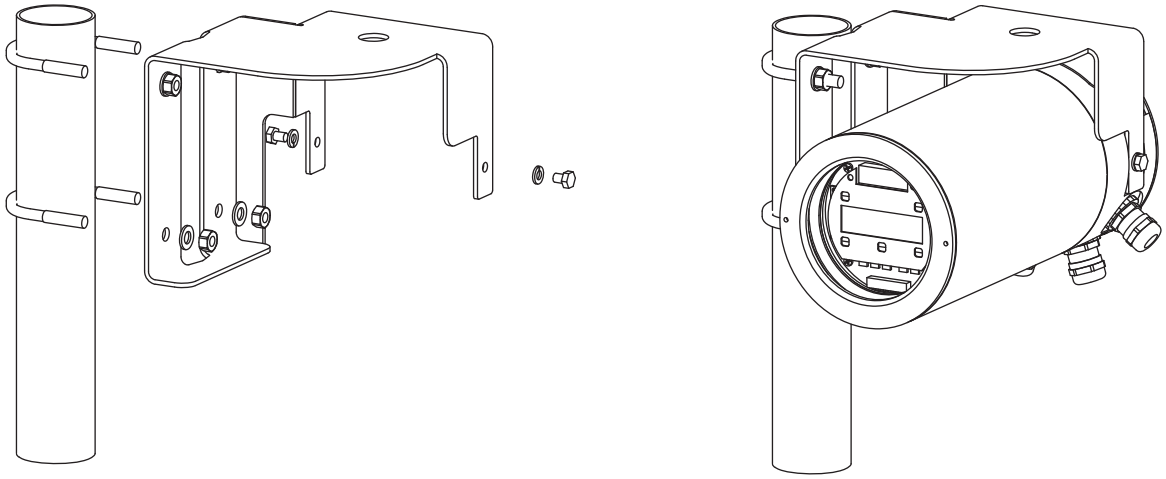
in mm

Wall and 2 " Pipe Mounting Kit

FLUXUS G800

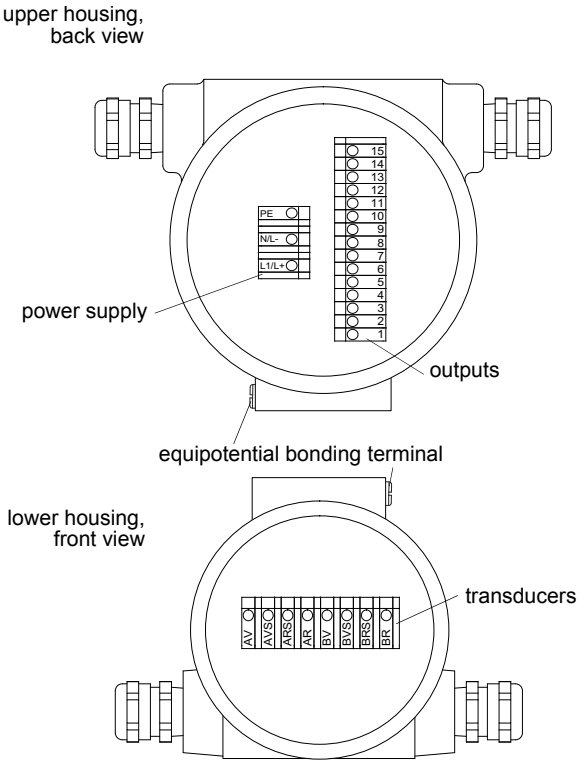


FLUXUS G801

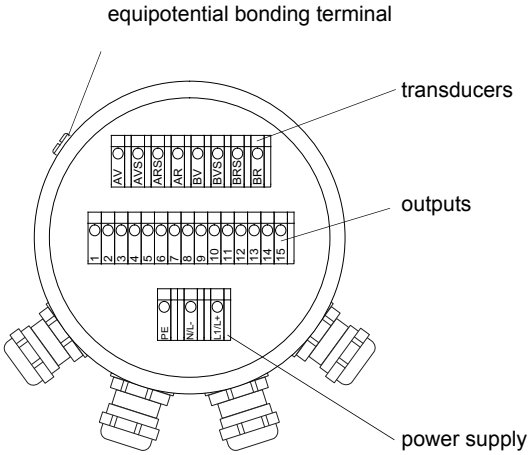


Terminal Assignment

FLUXUS G800, G800L, G800P, G800LP



FLUXUS G801, G801P



Power Supply

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

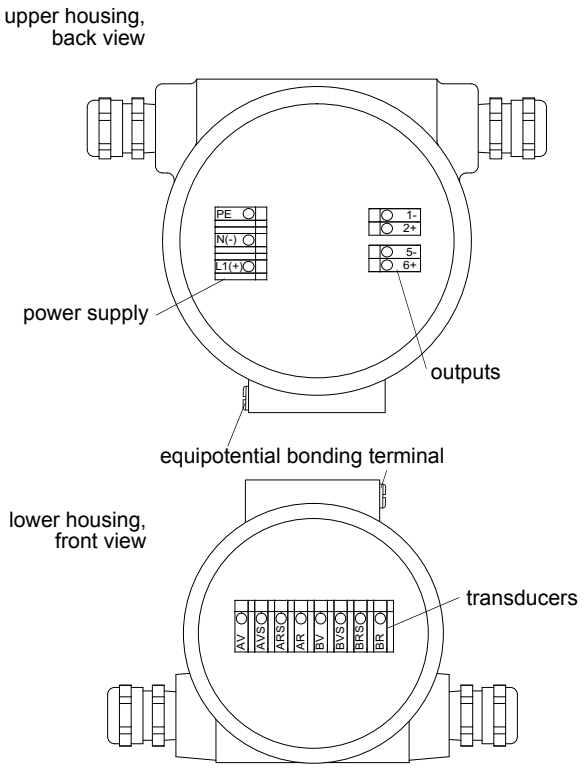
Transducers

measuring channel A		measuring channel B	
terminal	connection	terminal	connection
AV	signal	BV	signal
AVS	shield	BVS	shield
ARS	shield	BRS	shield
AR	signal	BR	signal

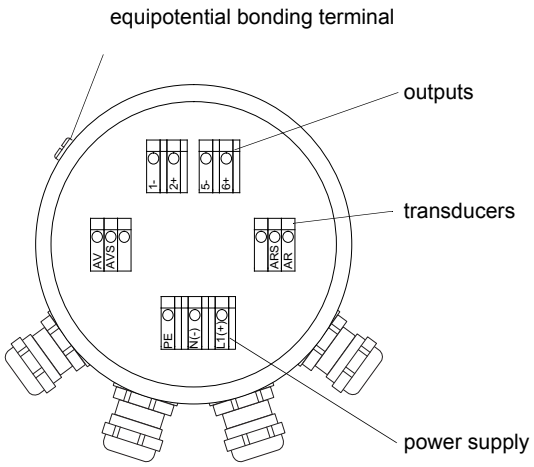
Outputs

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 B3 (open collector or Reed relay, optional)
11(a), 12(b)	binary output B4 (open collector or Reed relay, optional)
13(B-), 14(A+)	RS485 (optional)

FLUXUS G800C24, G800LC24



FLUXUS G801C24



Power Supply

DC	
terminal	connection
PE	earth
N(-)	-
L1(+)	+

Transducers

measuring channel A	
terminal	connection
AV	signal
AVS	shield
ARS	shield
AR	signal

Outputs

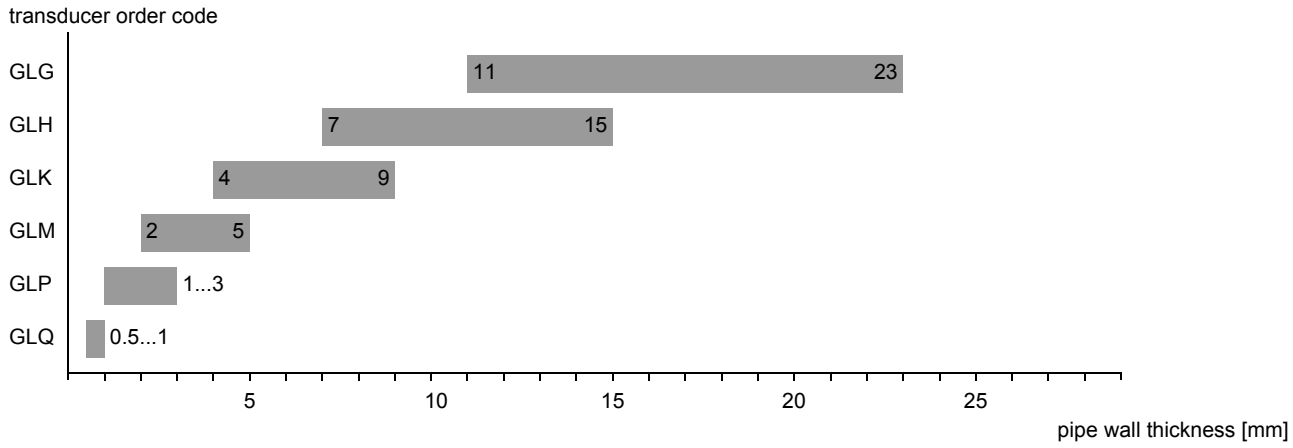
terminal	connection
1(-), 2(+)	current output I1
5(-), 6(+)	binary output B1 (open collector)

Transducers

Transducer Selection

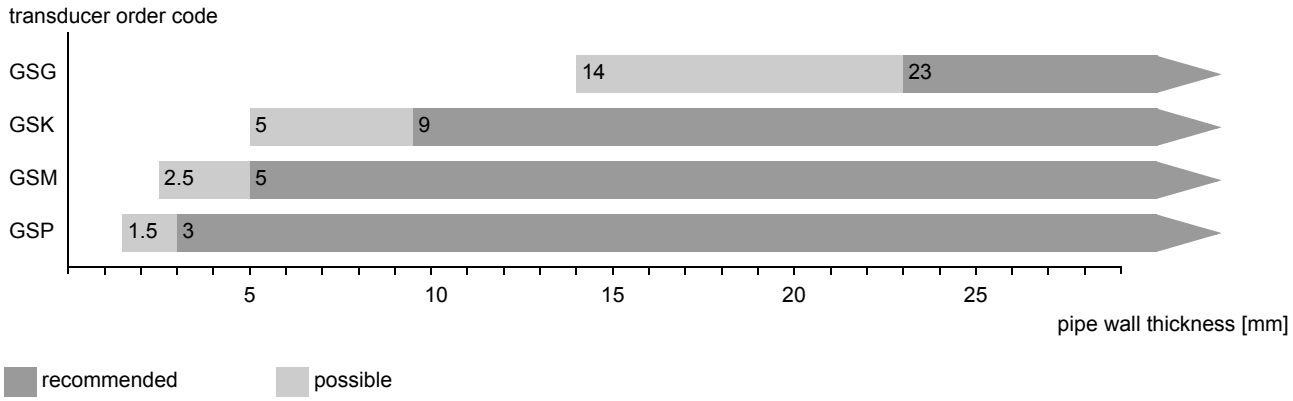
Step 1a

Select a Lamb wave transducer:



Step 1b

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



Step 2

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

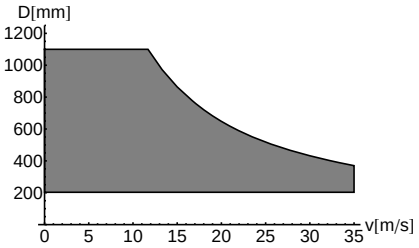
The transducers are selected from the characteristics (see next page). Lamb wave transducers are selected from the left column, shear wave transducers from the right column.

Lamb wave transducers: If the values d and v are not in the range, diagonal mode 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.

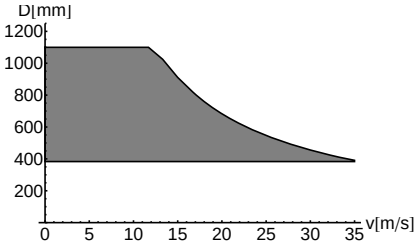
Lamb wave transducers[1]

shear wave transducers[1]

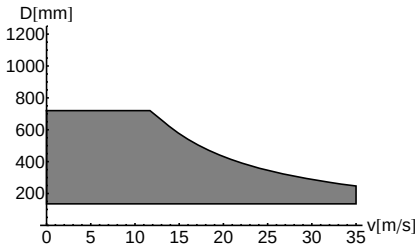
GLG



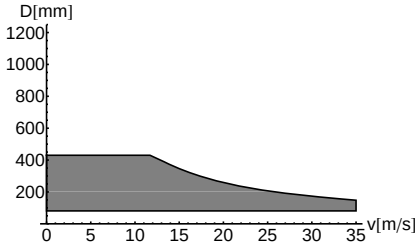
GSG



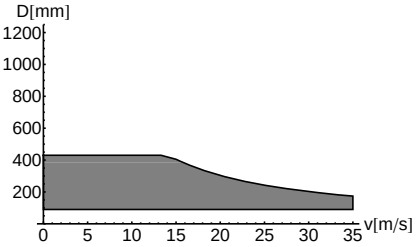
GLH



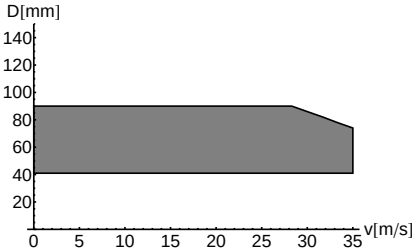
GLK



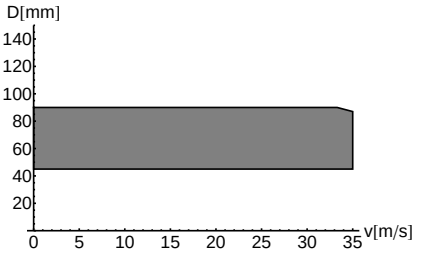
GSK



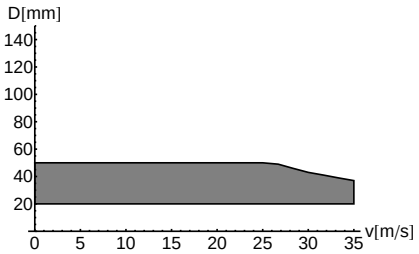
GLM



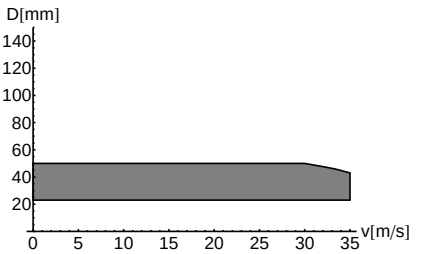
GSM



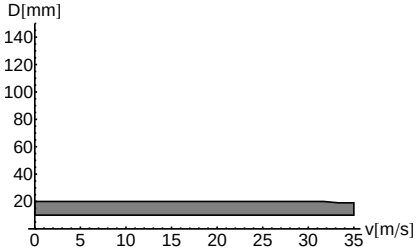
GLP



GSP



GLQ



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

Step 3

min. medium pressure

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

shear wave transducers			
transducer order code	medium 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

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

d - inner pipe diameter

Examples

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

Step 4

for determination of characters 4...11 of the transducer order code (temperature, explosion protection, connection system, extension cable) see page 16

Step 5

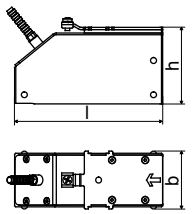
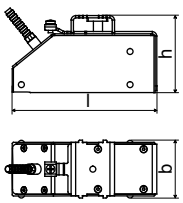
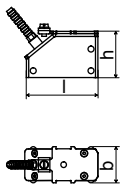
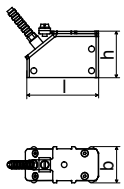
for the technical data of the selected transducer see page 17 et seqq.

Transducer Order Codes

1, 2	3		4	5, 6	7, 8		9...11		12, 13	no. of character
transducer	transducer frequency	-	temperature	explosion protection	connection system	-	extension cable	/	options	description
GL										set of ultrasonic flow transducers for gas measurement, Lamb wave
GS										set of ultrasonic flow transducers for gas measurement, shear wave
	G									0.2 MHz
	H									0.3 MHz (Lamb wave only)
	K									0.5 MHz
	M									1 MHz
	P									2 MHz
	Q									4 MHz (Lamb wave only)
			N							normal temperature range
			E							extended temperature range (shear wave transducers with transducer frequency M, P, Q)
				A1						ATEX zone 1
				I1						IEC zone 2
					TS					direct connection or connection via junction box
							XXX			cable length in m, for max. length of extension cable see page 31 connection system TS: 0 m: without junction box > 0 m: with junction box JB01
									IP68	degree of protection IP 68
									OS	housing with stainless steel 316
example										
GL	K	-	N	A1	TS	-	030			Lamb wave transducer 0.5 MHz, normal temperature range, zone 1, connection system TS with junction box JB01 and 30 m extension cable
		-				-		/		

Technical Data

Shear Wave Transducers (zone 1)

technical type		GDG1N81	GDK1N81	GDM2N81	GDP2N81
order code		GSG-NA1TS GSG-NA1TS/OS GSG-NI1TS GSG-NI1TS/OS	GSK-NA1TS GSK-NA1TS/OS GSK-NI1TS GSK-NI1TS/OS	GSM-NA1TS GSM-NA1TS/OS GSM-NI1TS GSM-NI1TS/OS	GSP-NA1TS GSP-NA1TS/OS GSP-NI1TS GSP-NI1TS/OS
transducer frequency	MHz	0.2	0.5	1	2
medium pressure[1]					
min. extended	bar	metal pipe: 20	metal pipe: 20	metal pipe: 20	metal pipe: 20
min.	bar	metal pipe: 30 plastic pipe: 1	metal pipe: 30 plastic pipe: 1	metal pipe: 30 plastic pipe: 1	metal pipe: 30 plastic pipe: 1
inner pipe diameter d[2]					
min. extended	mm	250	70	30	15
min. recommended	mm	380	80	40	20
max. recommended	mm	810	500	80	40
max. extended	mm	1100	720	120	60
pipe wall thickness					
min.	mm	14	5	2.5	1.5
max.	mm	-	-	-	-
material					
housing		PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)
contact surface		PEEK	PEEK	PEEK	PEEK
degree of protection according to EN 60529		IP 65	IP 65	IP 65	IP 65
transducer cable					
type		1699	1699	1699	1699
length	m	5	5	4	4
dimensions					
length l	mm	129.5	126.5	62.5	62.5
width b	mm	51	51	32	32
height h	mm	67	67.5	40.5	40.5
dimensional drawing					
operating temperature					
min.	°C	-40	-40	-40	-40
max.	°C	+130	+130	+130	+130
temperature compensation		x	x	x	x

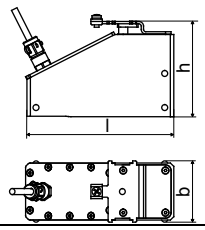
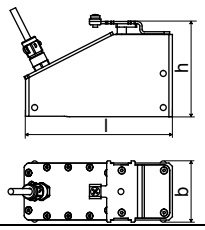
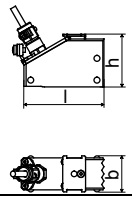
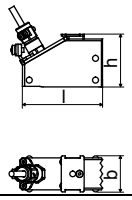
[1] depending on application, typical absolute value for natural gas, nitrogen, compressed air

[2] shear wave transducers:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other gases on request
pipe diameter min. recommended/max. recommended/max. extended: in diagonal mode and for a flow velocity of 15 m/s

continued on next page

technical type			GDG1N81	GDK1N81	GDM2N81	GDP2N81
explosion protection						
ATEX / IEC Ex	transducer ATEX		GSG-NA1TS GSG-NA1TS/OS	GSK-NA1TS GSK-NA1TS/OS	GSM-NA1TS GSM-NA1TS/OS	GSP-NA1TS GSP-NA1TS/OS
	transducer IEC Ex		GSG-NI1TS GSG-NI1TS/OS	GSK-NI1TS GSK-NI1TS/OS	GSM-NI1TS GSM-NI1TS/OS	GSP-NI1TS GSP-NI1TS/OS
	zone		1	1	1	1
	explosion protection temperature					
	min. max.	°C °C	-55 +180	-55 +180	-55 +180	-55 +180
	marking		CE 0044; Ex II2G II2D Ex eq II T6...T3 Ex tD A21 IP65 TX	CE 0044; Ex II2G II2D Ex eq II T6...T3 Ex tD A21 IP65 TX	CE 0044; Ex II2G II2D Ex eq II T6...T3 Ex tD A21 IP65 TX	CE 0044; Ex II2G II2D Ex eq II T6...T3 Ex tD A21 IP65 TX
	certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IEC Ex		IECEx IBE08.0007 X	IECEx IBE08.0007 X	IECEx IBE08.0007 X	IECEx IBE08.0007 X
	type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
	necessary transducer mounting fixture		Variofix L or Variofix C	Variofix L or Variofix C	Variofix L or Variofix C	Variofix L or Variofix C

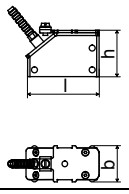
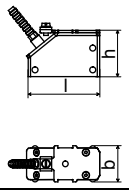
Shear Wave Transducers (zone 1, IP 68)

technical type		GDG1LI1	GDK1LI1	GDM2LI1	GDP2LI1
order code		**GSG-NA1TS/IP68** **GSG-NI1TS/IP68**	**GSK-NA1TS/IP68** **GSK-NI1TS/IP68**	**GSM-NA1TS/IP68** **GSM-NI1TS/IP68**	**GSP-NA1TS/IP68** **GSP-NI1TS/IP68**
transducer frequency	MHz	0.2	0.5	1	2
medium pressure[1]					
min. extended	bar	metal pipe: 20	metal pipe: 20	metal pipe: 20	metal pipe: 20
min.	bar	metal pipe: 30 plastic pipe: 1	metal pipe: 30 plastic pipe: 1	metal pipe: 30 plastic pipe: 1	metal pipe: 30 plastic pipe: 1
inner pipe diameter d[2]					
min. extended	mm	250	70	30	15
min. recommended	mm	380	80	40	20
max. recommended	mm	810	500	80	40
max. extended	mm	1100	720	120	60
pipe wall thickness					
min.	mm	14	5	2.5	1.5
max.	mm	-	-	-	-
material					
housing		PEEK with stainless steel cap 316Ti (1.4571)	PEEK with stainless steel cap 316Ti (1.4571)	PEEK with stainless steel cap 316Ti (1.4571)	PEEK with stainless steel cap 316Ti (1.4571)
contact surface		PEEK	PEEK	PEEK	PEEK
degree of protection according to EN 60529		IP 68	IP 68	IP 68	IP 68
transducer cable					
type		2550	2550	2550	2550
length	m	12	12	12	12
dimensions					
length l	mm	128.5	128.5	70	70
width b	mm	54	54	32	32
height h	mm	83.5	83.5	46	46
dimensional drawing					
operating temperature					
min.	°C	-40	-40	-40	-40
max.	°C	+100	+100	+100	+100
temperature compensation		x	x	x	x
explosion protection					
ATEX / IEC Ex transducer ATEX		GSG-NA1TS/IP68	GSK-NA1TS/IP68	GSM-NA1TS/IP68	GSP-NA1TS/IP68
transducer IEC Ex		GSG-NI1TS/IP68	GSK-NI1TS/IP68	GSM-NI1TS/IP68	GSP-NI1TS/IP68
zone		1	1	1	1
explosion protection temperature					
min.	°C	-55	-55	-55	-55
max.	°C	+180	+180	+180	+180
marking		CE 0044; Ex II2G II2D Ex q II T6...T3 Ex tD A21 IP68 TX	CE 0044; Ex II2G II2D Ex q II T6...T3 Ex tD A21 IP68 TX	CE 0044; Ex II2G II2D Ex q II T6...T3 Ex tD A21 IP68 TX	CE 0044; Ex II2G II2D Ex q II T6...T3 Ex tD A21 IP68 TX
certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
certification IEC Ex		IECEx IBE08.0007 X	IECEx IBE08.0007 X	IECEx IBE08.0007 X	IECEx IBE08.0007 X
type of protection		gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure
necessary transducer mounting fixture		Variofix L or Variofix C	Variofix L or Variofix C	Variofix L or Variofix C	Variofix L or Variofix C

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

[2] shear wave transducers:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other gases on request
pipe diameter min. recommended/max. recommended/max. extended: in diagonal mode and for a flow velocity of 15 m/s

Shear Wave Transducers (zone 1, extended temperature range)

technical type		GDM2E85	GDP2E85
order code		**GSM-EA1TS** **GSM-EA1TS/OS** **GSM-EI1TS** **GSM-EI1TS/OS**	**GSP-EA1TS** **GSP-EA1TS/OS** **GSP-EI1TS** **GSP-EI1TS/OS**
transducer frequency	MHz	1	2
medium pressure[1]			
min. extended min.	bar bar	metal pipe: 20 metal pipe: 30 plastic pipe: 1	metal pipe: 20 metal pipe: 30 plastic pipe: 1
inner pipe diameter d[2]			
min. extended min. recommended max. recommended max. extended	mm mm mm mm	30 40 80 120	15 20 40 60
pipe wall thickness			
min. max.	mm mm	2.5 -	1.5 -
material			
housing contact surface		PI with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PI	PI with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PI
degree of protection according to EN 60529		IP 56	IP 56
transducer cable			
type length	 m	6111 4	6111 4
dimensions			
length l width b height h	mm mm mm	62.5 32 40.5	62.5 32 40.5
dimensional drawing			
operating temperature			
min. max.	°C °C	-30 +200	-30 +200
temperature compensation		x	x

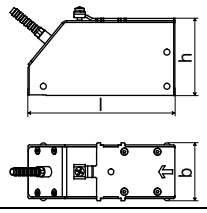
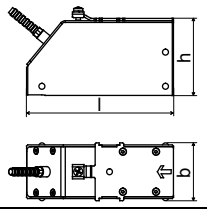
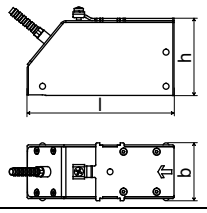
[1] depending on application, typical absolute value for natural gas, nitrogen, compressed air

[2] shear wave transducers:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other gases on request
pipe diameter min. recommended/max. recommended/max. extended: in diagonal mode and for a flow velocity of 15 m/s

continued on next page

technical type			GDM2E85	GDP2E85
explosion protection				
ATEX/IEC Ex	transducer ATEX		GSM-EA1TS GSM-EA1TS/OS	GSP-EA1TS GSP-EA1TS/OS
	transducer IEC Ex		GSM-EI1TS GSM-EI1TS/OS	GSP-EI1TS GSP-EI1TS/OS
	zone		1/2 (gas/dust)	1/2 (gas/dust)
	explosion protection temperature			
	min. max.	°C °C	-45 +225	-45 +225
	marking		CE 0044; Ex II2G II3D Ex eq II T6...T2 Ex tD A22 IP56 TX	CE 0044; Ex II2G II3D Ex eq II T6...T2 Ex tD A22 IP56 TX
	certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IEC Ex		IECEx IBE08.0007 X	IECEx IBE08.0007 X
	type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
	necessary transducer mounting fixture		Variofix L or Variofix C	Variofix L or Variofix C

Lamb Wave Transducers (zone 1)

technical type		GRG1N83	GRH1N83	GRK1N83
order code		**GLG-NA1TS** **GLG-NA1TS/OS** **GLG-NI1TS** **GLG-NI1TS/OS**	**GLH-NA1TS** **GLH-NA1TS/OS** **GLH-NI1TS** **GLH-NI1TS/OS**	**GLK-NA1TS** **GLK-NA1TS/OS** **GLK-NI1TS** **GLK-NI1TS/OS**
transducer frequency	MHz	0.2	0.3	0.5
medium pressure[1]				
min. extended min.	bar bar	metal pipe: 10 metal pipe: 15 plastic pipe: 1	metal pipe: 10 metal pipe: 15 plastic pipe: 1	metal pipe: 10 (d > 120 mm) 5 (d < 120 mm) metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1
inner pipe diameter d[2]				
min. extended	mm	190	120	60
min. recommended	mm	220	140	80
max. recommended	mm	900	600	300
max. extended	mm	1600	1000	500
pipe wall thickness				
min.	mm	11	7	4
max.	mm	23	15	9
material				
housing contact surface		PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PPSU	PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PPSU	PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PPSU
degree of protection according to EN 60529		IP 65	IP 65	IP 65
transducer cable				
type		1699	1699	1699
length	m	5	5	5
dimensions				
length l	mm	128.5	128.5	128.5
width b	mm	51	51	51
height h	mm	67.5	67.5	67.5
dimensional drawing				
operating temperature				
min.	°C	-40	-40	-40
max.	°C	+170	+170	+170
temperature compensation		x	x	x

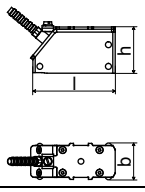
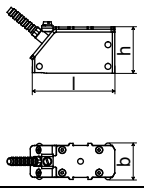
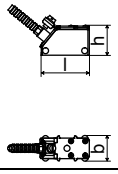
[1] depending on application, typical absolute value for natural gas, nitrogen, compressed air

[2] shear wave transducers:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other gases on request
pipe diameter min. recommended/max. recommended/max. extended: in diagonal mode and for a flow velocity of 15 m/s

continued on next page

technical type			GRG1N83	GRH1N83	GRK1N83
explosion protection					
ATEX/IEC Ex	transducer ATEX		GLG-NA1TS GLG-NA1TS/OS	GLH-NA1TS GLH-NA1TS/OS	GLK-NA1TS GLK-NA1TS/OS
	transducer IEC Ex		GLG-NI1TS GLG-NI1TS/OS	GLH-NI1TS GLH-NI1TS/OS	GLK-NI1TS GLK-NI1TS/OS
	zone		1	1	1
	explosion protection temperature				
	min. max.	°C °C	-55 +140	-55 +140	-55 +140
	marking		CE 0044; Ex II2G II2D Ex eq II T6...T3 Ex tD A21 IP65 TX	CE 0044; Ex II2G II2D Ex eq II T6...T3 Ex tD A21 IP65 TX	CE 0044; Ex II2G II2D Ex eq II T6...T3 Ex tD A21 IP65 TX
	certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IEC Ex		IECEx IBE08.0007 X	IECEx IBE08.0007 X	IECEx IBE08.0007 X
	type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
	necessary transducer mounting fixture		Variofix L or Variofix C	Variofix L or Variofix C	Variofix L or Variofix C

Lamb Wave Transducers (zone 1)

technical type		GRM1N83	GRP1N83	GRQ1N83
order code		**GLM-NA1TS** **GLM-NA1TS/OS** **GLM-NI1TS** **GLM-NI1TS/OS**	**GLP-NA1TS** **GLP-NA1TS/OS** **GLP-NI1TS** **GLP-NI1TS/OS**	**GLQ-NA1TS** **GLQ-NA1TS/OS** **GLQ-NI1TS** **GLQ-NI1TS/OS**
transducer frequency	MHz	1	2	4
medium pressure[1]				
min. extended min.	bar bar	- metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	- metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1	- metal pipe: 10 (d > 15 mm) 5 (d < 15 mm) plastic pipe: 1
inner pipe diameter d[2]				
min. extended	mm	30	15	7
min. recommended	mm	40	20	10
max. recommended	mm	90	50	22
max. extended	mm	150	70	35
pipe wall thickness				
min.	mm	2	1	0.5
max.	mm	5	3	1
material				
housing contact surface		PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PPSU	PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PPSU	PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PPSU
degree of protection according to EN 60529		IP 65	IP 65	IP 65
transducer cable				
type length	 m	1699 4	1699 4	1699 3
dimensions				
length l	mm	74	74	42
width b	mm	32	32	22
height h	mm	40.5	40.5	25.5
dimensional drawing				
operating temperature				
min. max.	°C °C	-40 +170	-40 +170	-40 +170
temperature compensation		x	x	x

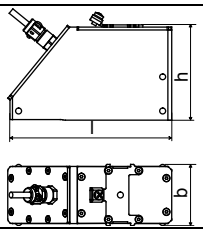
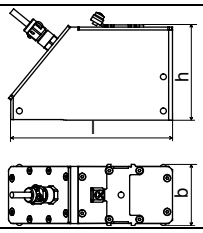
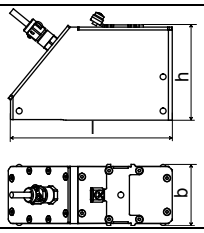
[1] depending on application, typical absolute value for natural gas, nitrogen, compressed air

[2] shear wave transducers:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other gases on request
pipe diameter min. recommended/max. recommended/max. extended: in diagonal mode and for a flow velocity of 15 m/s

continued on next page

technical type			GRM1N83	GRP1N83	GRQ1N83
explosion protection					
ATEX/IEC Ex	transducer ATEX		GLM-NA1TS GLM-NA1TS/OS	GLP-NA1TS GLP-NA1TS/OS	GLQ-NA1TS GLQ-NA1TS/OS
	transducer IEC Ex		GLM-NI1TS GLM-NI1TS/OS	GLP-NI1TS GLP-NI1TS/OS	GLQ-NI1TS GLQ-NI1TS/OS
	zone		1	1	1
	explosion protection temperature				
	min. max.	°C °C	-55 +140	-55 +140	-55 +140
	marking		CE 0044; Ex II2G II2D Ex eq II T6...T3 Ex tD A21 IP65 TX	CE 0044; Ex II2G II2D Ex eq II T6...T3 Ex tD A21 IP65 TX	CE 0044; Ex II2G II2D Ex eq II T6...T3 Ex tD A21 IP65 TX
	certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IEC Ex		IECEx IBE08.0007 X	IECEx IBE08.0007 X	IECEx IBE08.0007 X
	type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
	necessary transducer mounting fixture		Variofix L or Variofix C	Variofix L or Variofix C	Variofix L or Variofix C
remark					on request

Lamb Wave Transducers (zone 1, IP 68)

technical type		GRG1LI3	GRH1LI3	GRK1LI3
order code		**GLG-NA1TS/IP68**	**GLH-NA1TS/IP68**	**GLK-NA1TS/IP68**
transducer frequency	MHz	0.2	0.3	0.5
medium pressure[1]				
min. extended	bar	metal pipe: 10	metal pipe: 10	metal pipe: 10 (d > 120 mm) 5 (d < 120 mm)
min.	bar	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1
inner pipe diameter d[2]				
min. extended	mm	190	120	60
min. recommended	mm	220	140	80
max. recommended	mm	900	600	300
max. extended	mm	1600	1000	500
pipe wall thickness				
min.	mm	11	7	4
max.	mm	23	15	9
material				
housing		PPSU with stainless steel cap 316Ti (1.4571)	PPSU with stainless steel cap 316Ti (1.4571)	PPSU with stainless steel cap 316Ti (1.4571)
contact surface		PPSU	PPSU	PPSU
degree of protection according to EN 60529		IP 68	IP 68	IP 68
transducer cable				
type		2550	2550	2550
length	m	12	12	12
dimensions				
length l	mm	143.5	143.5	143.5
width b	mm	54	54	54
height h	mm	83.5	83.5	83.5
dimensional drawing				
operating temperature				
min.	°C	-40	-40	-40
max.	°C	+100	+100	+100
temperature compensation		x	x	x
explosion protection				
ATEX transducer		GLG-NA1TS/IP68	GLH-NA1TS/IP68	GLK-NA1TS/IP68
ATEX zone		1	1	1
ATEX **explosion protection temperature**				
ATEX min.	°C	-55	-55	-55
ATEX max.	°C	+140	+140	+140
ATEX marking		CE 0044; Ex II2G II2D Ex q II T6...T3 Ex tD A21 IP68 TX	CE 0044; Ex II2G II2D Ex q II T6...T3 Ex tD A21 IP68 TX	CE 0044; Ex II2G II2D Ex q II T6...T3 Ex tD A21 IP68 TX
ATEX certification		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
ATEX type of protection		gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure
ATEX necessary transducer mounting fixture		Variofix L or Variofix C	Variofix L or Variofix C	Variofix L or Variofix C

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

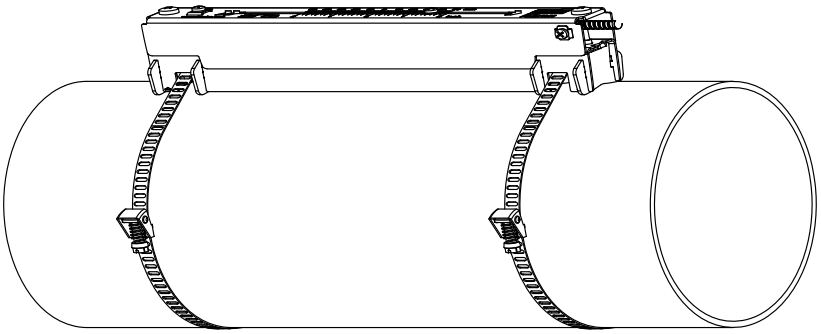
[2] Lamb wave transducers:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other gases on request
pipe diameter min. recommended/max. recommended: in reflection mode and for a flow velocity of 15 m/s
pipe diameter max. extended: in diagonal mode and for a flow velocity of 25 m/s

Transducer Mounting Fixtures

Order Codes

1, 2	3		4	5		6	7...9		10, 11	no. of character
transducer mounting fixture	transducer	-	measuring mode	size	-	fixation	outer pipe diameter	/	option	description
VL										Variofix L
VC										Variofix C
	K									transducers with transducer frequency G, H, K
	M									transducers with transducer frequency M, P
	Q									transducers with transducer frequency Q
			D							reflection mode or diagonal mode
			R							reflection mode
				S						small
				M						medium
				L						large
						S				tension straps
						W				welding
						N				without fixation
							002			10...20 mm
							004			20...40 mm
							T36			40...360 mm
							013			10...130 mm
							036			130...360 mm
							092			360...920 mm
							200			920...2000 mm
									IP68	degree of protection IP 68
									OS	housing with stainless steel 316
									Z	special design
example										
VL	K	-	D	S	-	S	200			Variofix L and tension straps for transducers with transducer frequency G, H, K
		-			-			/		

Variofix L (VL)



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

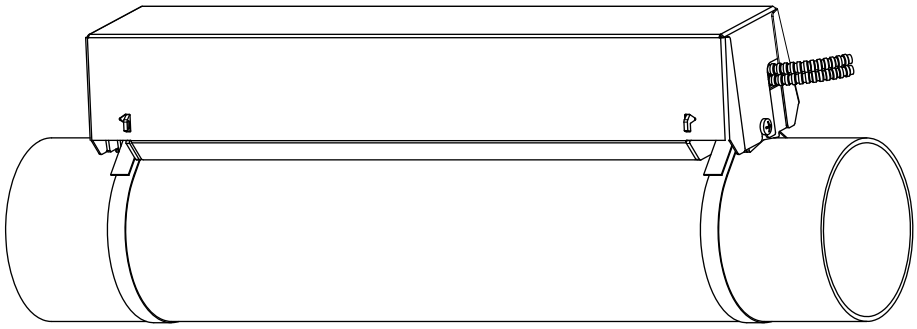
inner length:

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

dimensions:

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

Variofix C (VC)



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

inner length:

VCK-xL: 500 mm,
VCK-xS: 350 mm,
VCM: 400 mm
VCQ: 250 mm

dimensions:

VCK-xL: 560 x 122 x 102 mm,
option IP68: 560 x 126 x 120 mm
VCK-xS: 410 x 122 x 102 mm,
option IP68: 410 x 126 x 120 mm
VCM: 460 x 96 x 80 mm
VCQ: 310 x 85 x 62 mm

Coupling Materials for Transducers

		normal temperature range (4th character of transducer order code = N)		**extended temperature range (4th character of transducer order code = E)**	
		< 100 °C	100...170 °C	< 150 °C	150...200 °C
< 2 h		coupling compound type N	coupling compound type E	coupling compound type E	coupling compound type E or H
< 24 h		coupling compound type N	coupling compound type E	coupling compound type E	coupling foil type VT
long time measure-ment	indoor	coupling compound type N	coupling compound type E	coupling foil type VT[1]	coupling foil type VT[2]
	outdoor	coupling foil type VT	coupling foil type VT	coupling foil type VT[1]	coupling foil type VT[2]

[1] < 5 years

[2] < 6 months

Technical Data

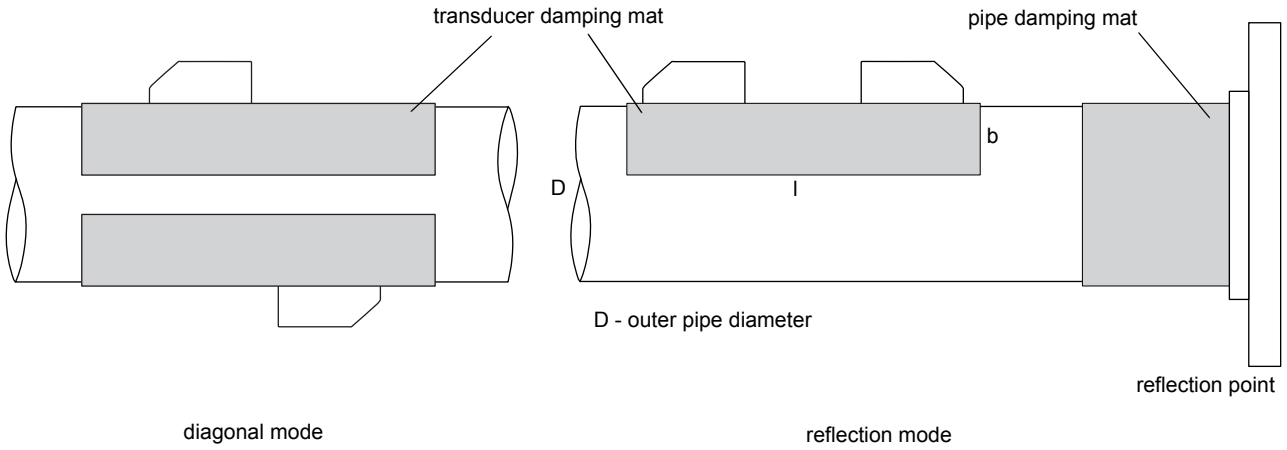
type	**order code**	**temperature** °C	**material**	**remark**
coupling compound type N	990739-1	-30...+130	mineral grease paste	
coupling compound type E	990739-2	-30...+200	silicone paste	
coupling compound type H	990739-3	-30...+250	fluoropolymer paste	
coupling foil type VT	990739-0	-10...+150, peak max. 200	fluoroelastomer	for transducers with transducer frequency G, H, K
	990739-6			for shear wave transducers with transducer frequency M, P
	990739-14			for IP 68 shear wave transducers and Lambwave transducers with transducer frequency M, P
	990739-15			for shear wave transducers with transducer frequency Q
	990739-5			for Lambwave transducers with transducer frequency Q

Damping Mats (optional)

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

Transducer damping mats will be installed below the transducers.

Pipe damping mats will be installed at reflection points, e.g. flange, weld.



Selection of Damping Mats

type	description	outer pipe diameter	dimensions l x b x h	transducer frequency (3rd character of transducer order code)					technical type	temperature	remark
		mm	mm	G	H	K	M	P		°C	
transducer damping mat											
C	self-adhesive, for stationary installation	< 80	450 x 115 x 0.5	-	-	-	x	x	C20S3	-25...+60	
		≥ 80	900 x 230 x 0.5	-	-	x	x	-	C20S2		
			900 x 230 x 1.3	x	x	-	-	-	C50S2		
pipe damping mat											
B	self-adhesive, for stationary installation		l x 100 x 0.9	x	x	x	x	x	B35R2	-35...+50	l - see table below

Length of Pipe Damping Mat - Type B

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

outer pipe diameter D	transducer frequency	
	G, H	K, M, P
mm	m	m
100	2	1
200	6	3
300	12	6
500	32	16
1000	126	63

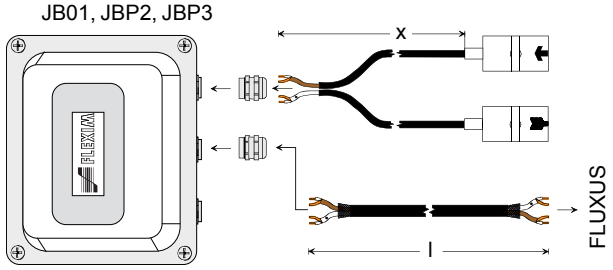
Connection Systems

Connection System TS

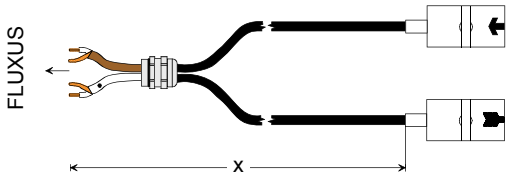
transducer frequency (3rd character of transducer order code)		G, H, K		M, P		Q		S	
		x	l	x	l	x	l	x	l
cable length	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40

connection via junction box

JB01, JBP2, JBP3



direct connection



x - transducer cable length

l - max. length of extension cable

Transducer Cables

Technical Data

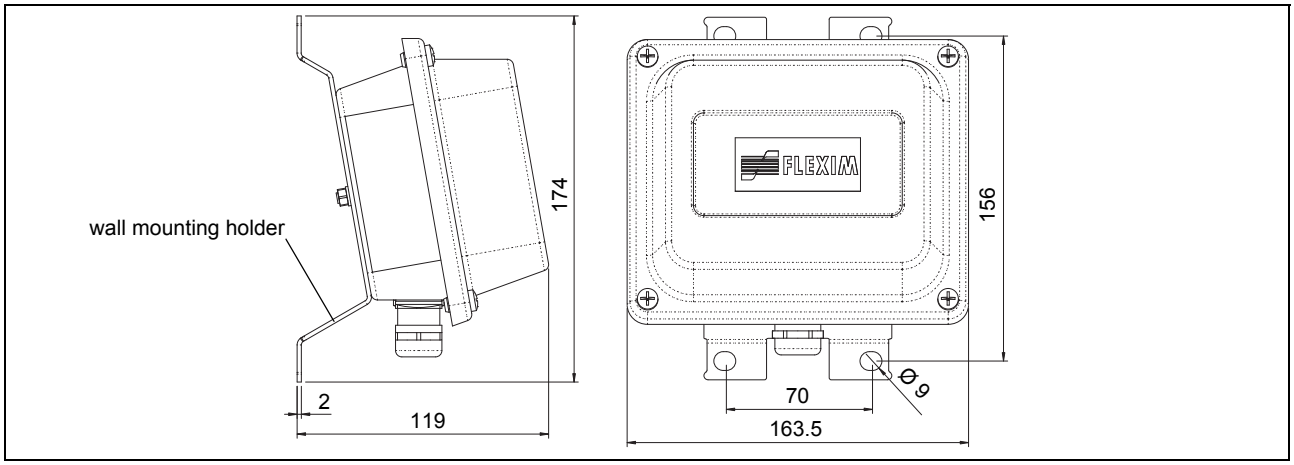
		transducer cable			extension cable
item number		1699	2550	6111	2615
standard length	m	see table above	12	see table above	-
max. length	m	-	-	-	see table above
temperature	°C	-55...+200	-40...+100	-100...+225	-40...+70
properties			longitudinal water tight		halogen free fire propagation test according to IEC 60332-1 combustion test according to IEC 60754-2
sheath					
material		stainless steel 304 (1.4301) option OS: 316L (1.4404)	-	stainless steel 304 (1.4301) option OS: 316L (1.4404)	-
outer diameter	mm	8	-	8	-
cable jacket					
material		PTFE	PUR	PFA	PUR
outer diameter	mm	2.9	5.2 ±0.2	2.7	12
thickness	mm	0.3	0.9	0.5	2
color		brown	gray	white	black
shield		x	x	x	x

Junction Box

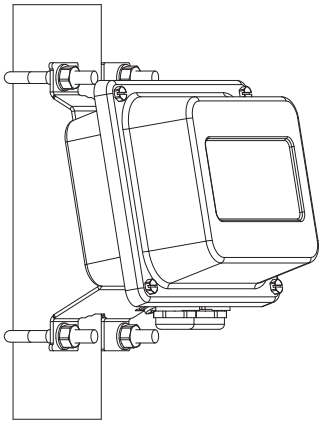
Technical Data

technical type			**JB01S4E3M**
dimensions			see dimensional drawing
fixation			wall mounting optional: 2 " pipe mounting
material			
housing			stainless steel 316L (1.4404)
gasket			silicone
degree of protection according to EN 60529			IP 67
cable gland			M20
operating temperature			
min.		°C	-40
max.		°C	+80
explosion protection			
ATEX	zone		1
	marking		CE 0044 Ex II2G Ex e mb II (T6)...T4 T_a -40...+(70) 80 °C Ex II2D Ex tD A21 IP67 T 100 °C
	certification		IBExU06ATEX1161
	type of protection		junction box: increased safety decoupled network: encapsulation

Dimensions

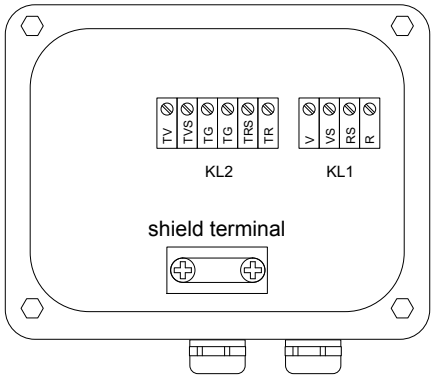


2 " Pipe Mounting Kit (optional)



Terminal Assignment

JB01



Transducers

terminal strip KL1

terminal	connection
V	transducer ↑, signal
VS	transducer ↑, internal shield
RS	transducer ⇈, internal shield
R	transducer ⇈, signal
cable gland	external shield

Extension Cable

terminal strip KL2

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

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