Gas ultrasonic flowmeter for permanent installation

Transmitter for permanent outdoor wall or pipe mounting

Features

- Exact and highly reliable bi-directional clamp-on flow measurement of operational and standard volume flow rates as well as mass flow rates (involving fluid temperature and pressure)
- Installation and startup do not cause any pipe works nor any process interruptions
- Virtually unlimited measurement range, high measurement accuracy even at very low as well as very high flow rates and independent of the flow direction (bi-directional)
- User oriented configurations guarantee the optimal adaptation of the meter in regard to the individual application
- Automatic loading of calibration data and transducer recognition
- Bidirectional communication and support of common bus technologies (Profibus PA, Foundation Fieldbus, HART, Modbus, BACnet, M-Bus)
- Easy parameterization of the device via connection of PC/laptop (Ethernet, USB) or within the SCADA system, even without external power supply
- Extensive diagnostic functions for the evaluation of the measurement quality and process situation
- Advanced self-diagnosis and possibilities for event based triggering of data recording for the supervision and control of critical processes
- The transmitter is available with an aluminum or stainless steel enclosure (for especially corrosive environments). Both enclosures feature an IP66 protection degree
- Transmitter and transducers for usage in hazardous areas are available
- Transmitter and transducers are separately calibrated (traceable to national standards), guaranteeing a specified measurement accuracy as well as the possibility for later exchange of components
- Transducers available for a wide range of inner pipe diameters and fluid temperatures
- The measurement is zero point stable, drift free and independent of the pipe material as well as the internal pressurisation (> 3 bar at steel pipes; no minimum pressure for plastic pipes) and the flowing fluids
- The measurement system also precisely measures wet gas flow rates up to 5 % LVF (liquid volume fraction)

FLUXUS G721**-****A

FLUXUS G721**-****S

Variofix C

Applications

- Chemical industry
- Petrochemical industry
- Oil and gas industry
- Manufacturing industries

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Function

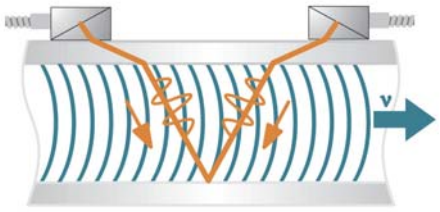
Measurement principle

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

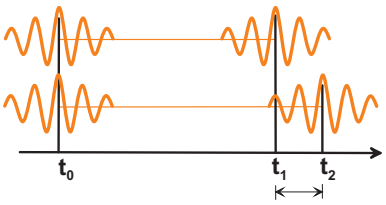
As the fluid in which the signals propagate is flowing, the transit time of the ultrasonic signals in the flow direction is shorter than against the flow direction.

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

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



Path of the ultrasonic signal



Transit time difference Δt

Calculation of volumetric flow rate

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

where

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

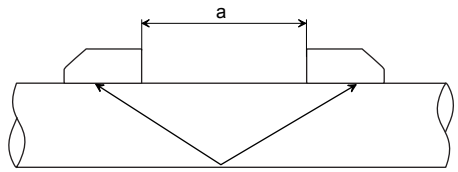
Number of sound paths

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

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

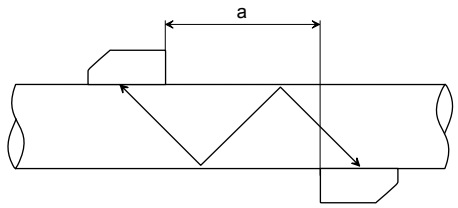
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

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

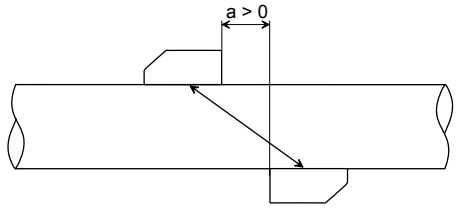


Reflection arrangement, number of sound paths: 2

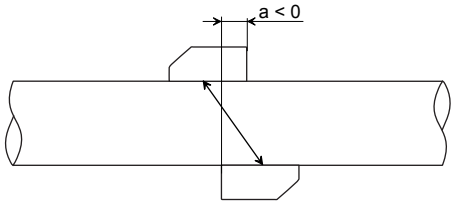
a - transducer distance



Diagonal arrangement, number of sound paths: 3

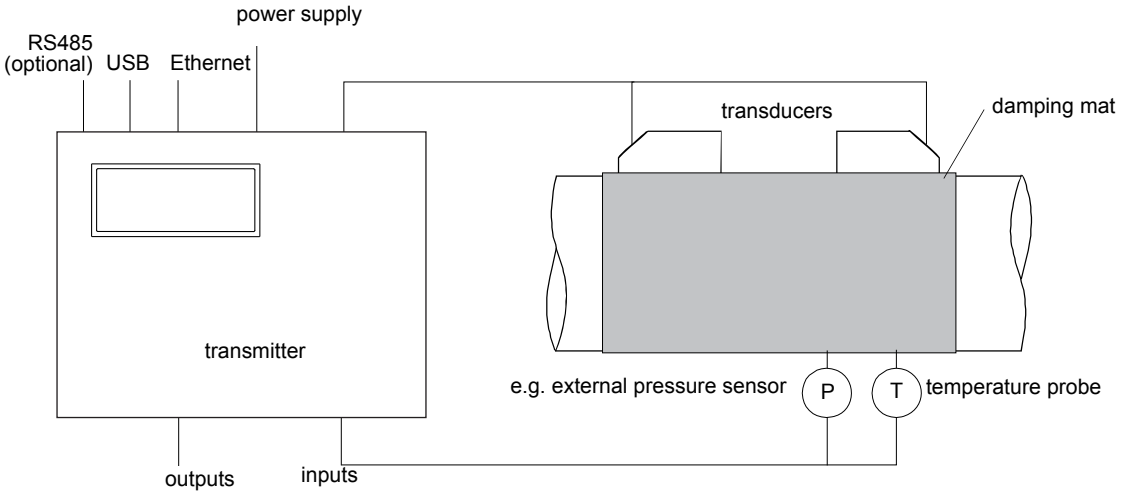


Diagonal arrangement, number of sound paths: 1



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

Typical measurement setup



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

Standard volumetric flow rate

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

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

where

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

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

or:

If inputs are installed (optional), pressure and temperature can be measured by the customer and fed in the transmitter.

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

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

Flow transmitter

Technical data

FLUXUS	**G721**-NNN*A**	**G721**-NNN*S** **G721**-A20*S**
order code	TF7-G721**-****A*-*******-*****-**	TF7-G721**-****S*-*******-*****-** TF7-G721**-****B*-*******-*****-**
design	standard field device	field device with stainless steel housing
		
measurement		
measurement principle	transit time difference correlation principle	
flow velocity	0.01...35 m/s, depending on pipe diameter	
repeatability	0.15 % of reading ±0.01 m/s	
fluid	all acoustically conductive gases, e.g. nitrogen, air, oxygen, hydrogen, argon, helium, ethylene, propane	
temperature compensation	corresponding to the recommendations in ANSI/ASME MFC-5.1-2011	
accuracy		
volumetric flow rate	± 1...3 % of reading ±0.01 m/s depending on application ± 0.5 % of reading ±0.01 m/s with field calibration	
flow transmitter		
power supply	100...230 V/50...60 Hz or 20...32 V DC or 11...16 V DC	
power consumption	< 15 W	
number of flow measuring channels	1, optional: 2	
damping	0...100 s, adjustable	
measuring cycle (1 channel)	100...1000 Hz	
response time	1 s (1 channel), option: 20 ms	
housing material	aluminum, powder coated	stainless steel 316L (1.4404)
degree of protection according to IEC/EN 60529	IP66	IP66
dimensions	see dimensional drawing	
weight	5.4 kg	5.1 kg
fixation	wall mounting, optional: 2 " pipe mounting	
ambient temperature	-40...+60 °C (< -20 °C without operation of the display)	
display	128 x 64 dots, backlight	
menu language	English, German, French, Spanish, Dutch, Russian, Polish	
explosion protection		
ATEX / IECEx technical type		G721**-A20*S
ATEX / IECEx zone	-	2
ATEX / IECEx marking	-	CE 0637 Ex II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T 120 °C Db T_a -40...+60 °C
ATEX / IECEx certification ATEX	-	IBExU11ATEX1015
ATEX / IECEx certification IECEx	-	IECEx IBE 11.0008
ATEX / IECEx type of protection	-	gas: non sparking dust: protection by enclosure

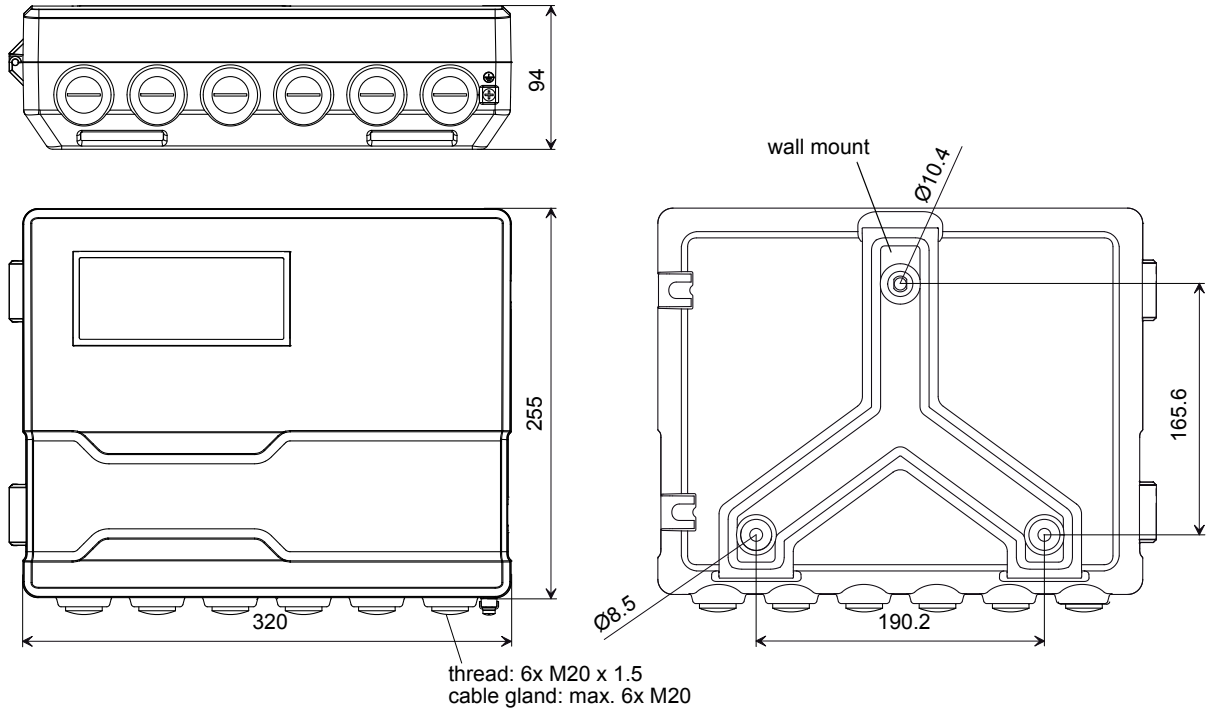
FLUXUS	**G721**-NNN*A**	**G721**-NNN*S G721**-A20*S**
measuring functions		
physical quantities	operating volumetric flow rate, standard volumetric flow rate, mass flow rate, flow velocity	
totalizer	volume, mass	
calculation functions	average, difference, sum (2 measuring channels necessary)	
diagnostic functions	sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times	
data logger		
loggable values	all physical quantities, totalized values and diagnostic values	
capacity	max. 800 000 measured values	
communication (optional)		
service/diagnosis[1]	measured value transmission, parametrization of the transmitter: - USB - Ethernet	
process integration (max. 1 optional)	- BACnet MS/TP - BACnet IP - M-Bus (nonEx) - RS485 (ASCII sender) with inputs and including parametrization of the transmitter: - Modbus RTU - Modbus TCP - HART - Profibus PA - FF H1	
serial data kit (optional)		
software	FluxDiag: online diagnostics and report generation (min. Windows 7)	
cable	USB cable[1]	
outputs (optional)		
	The outputs are galvanically isolated from the transmitter.	
number	on request	
	switchable current output	
- range - accuracy - active output - passive output	All switchable current outputs are switched to active or passive mode at the same time. 4...20 mA (3.2...22 mA) 0.04 % of reading ±3 µA R_{ext} < 350 Ω U_{ext} = 8...30 V, depending on R_{ext}, R_{ext} < 1 kΩ	
	current output	
current output - range - accuracy - active output - passive output	 0/4...20 mA 0.1 % of reading ±15 µA R_{ext} < 500 Ω U_{ext} = 4...24 V, depending on R_{ext}, R_{ext} < 1 kΩ	
current output I1 in HART mode - range - active output - passive output	 4...20 mA U_{int} = 24 V U_{ext} = 10...24 V	
	voltage output	
range accuracy internal resistance	0...1 V or 0...10 V 0...1 V: 0.1 % of reading ±1 mV 0...10 V: 0.1 % of reading ±10 mV R_{int} = 500 Ω	
	frequency output	
range open collector	0...5 kHz 24 V/4 mA, R_{int} = 66.5 Ω	
	binary output	
Reed relay optorelay	48 V/100 mA, R_{int} = 22 Ω 26 V/100 mA	
binary output as alarm output - functions	 limit, change of flow direction or error	
binary output as pulse output - pulse value - pulse width	mainly for totalizing 0.01...1000 units optorelay: 1...1000 ms Reed relay: 80...1000 ms	

[1] outside of explosive atmosphere (housing cover open)

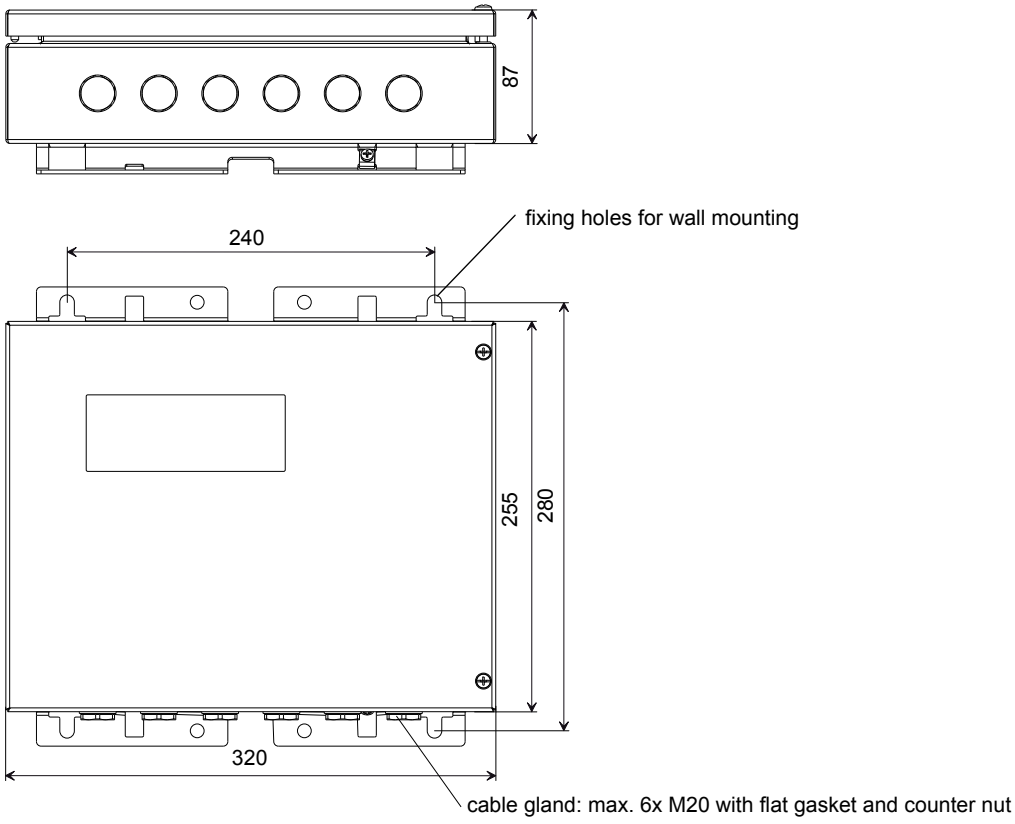
FLUXUS	**G721**-NNN*A**	**G721**-NNN*S** **G721**-A20*S**
inputs (optional)		
	The inputs are galvanically isolated from the transmitter.	
number	max. 4, on request	
	temperature input	
type	Pt100/Pt1000	
connection	4-wire	
range	-150...+560 °C	
resolution	0.01 K	
accuracy	±0.01 % of reading ±0.03 K	
	current input	
accuracy	0.1 % of reading ±10 µA	
active input	U_{int} = 24 V, R_{int} = 50 Ω, P_{int} < 0.5 W, not short-circuit proof	
- range	0...20 mA	
passive input	R_{int} = 50 Ω, P_{int} < 0.3 W	
- range	-20...+20 mA	
	voltage input	
range	0...1 V	
accuracy	0.1 % of reading ±1 mV	
internal resistance	R_{int} = 1 MΩ	
	binary input	
switching signal	5...30 V, 1 mA	
functions	- resetting the measured values - resetting the totalizers - stopping the totalizers - activation of the measuring mode for highly dynamic flows	

Dimensions

FLUXUS G721-****A**



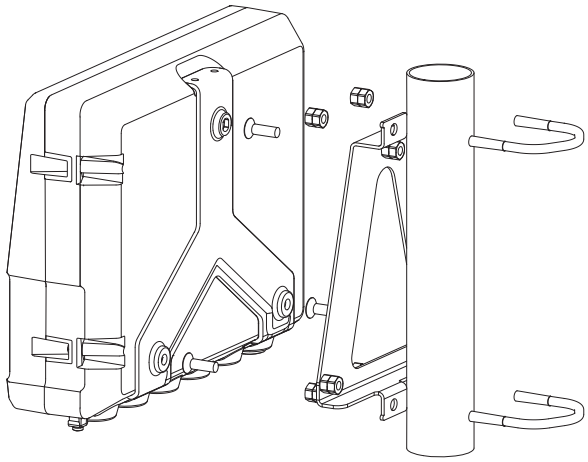
FLUXUS G721-****S**



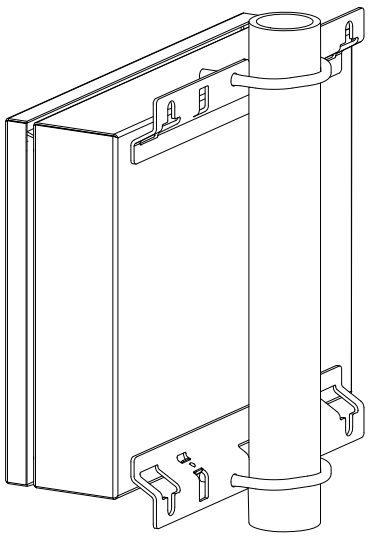
in mm

2 " pipe mounting kit (optional)

FLUXUS G721-****A**

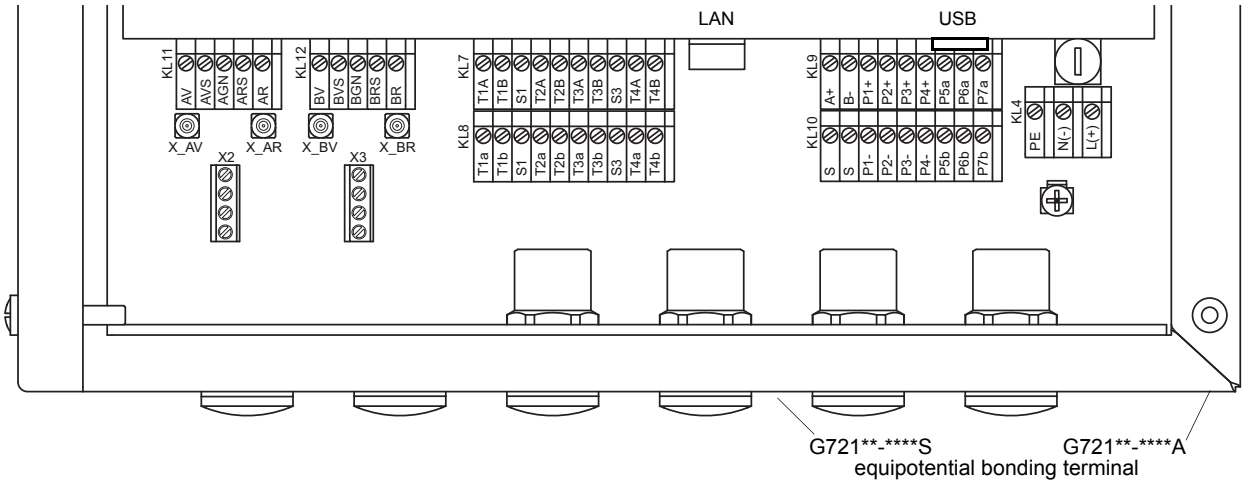


FLUXUS G721-****S**



Terminal assignment

FLUXUS G721



power supply

terminal strip KL4

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

transducers

terminal strip KL11, KL12

extension cable (transducers *****8*, ****LI*, *****52) **transducer cable** (transducers *****8*, ****LI*)			
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

transducer cable (transducers *****52)		
measuring channel A	**measuring channel B**	
terminal		**connection**
X_AV	X_BV	SMB connector
X_AR	X_BR	SMB connector

outputs[1]

terminal strip KL9, KL10

terminal	connection
P1+...P4+, P1-...P4-	current output, voltage output, frequency output, binary output (Reed relay)
P5a...P7a, P5b...P7b	binary output (optorelay)

communication interface

terminal strip KL9, KL10

terminal	connection	communication interface
A+	signal +	- BACnet MS/TP - M-Bus - RS485 - Modbus RTU - Profibus PA - FF H1
B-	signal -	
S	shield	

USB	- USB
LAN	- Ethernet - BACnet IP - Modbus TCP

analog inputs[1]

terminal strip KL7, KL8

	temperature probe		passive current source	active current source
terminal	**direct connection**	**connection with extension cable**	**connection of an active input**	**connection of a passive input**
T1a...T4a	red	red	not connected	not connected
T1A...T4A	red/blue	grey	-	+
T1b...T4b	white/blue	blue	+	not connected
T1B...T4B	white	white	not connected	-
S1, S3	shield	shield	not connected	not connected

binary inputs[1]

terminal strip KL9, KL10

terminal
P1+...P2+, P1-...P2-

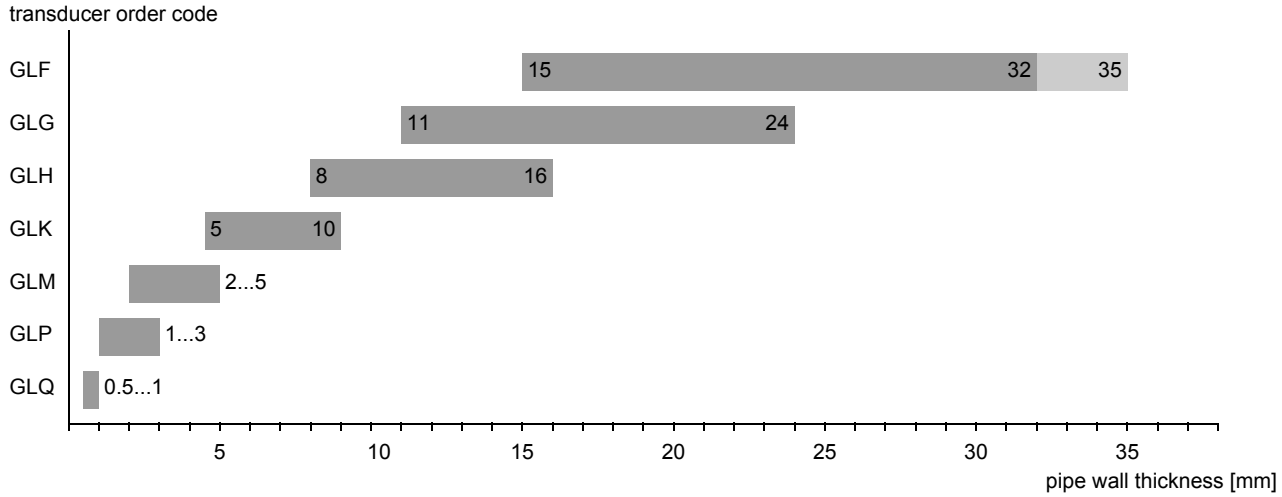
[1] The number, type and terminal assignment of the outputs and inputs will be customized.

Transducers

Transducer selection

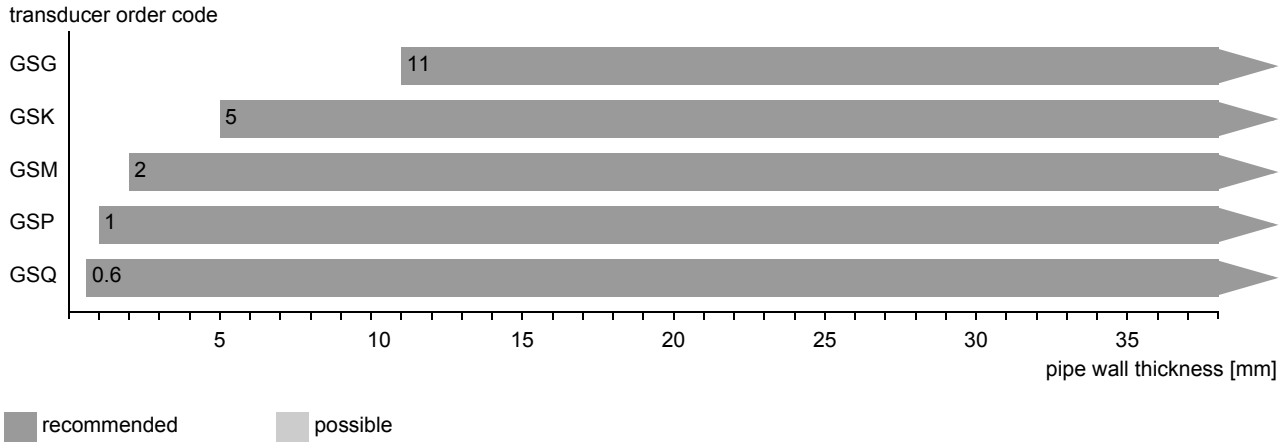
Step 1a

Select a Lamb wave transducer:



Step 1b

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

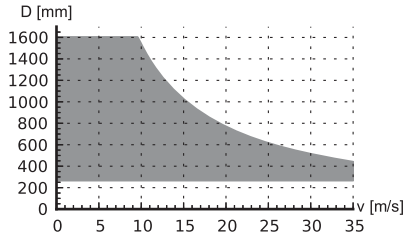
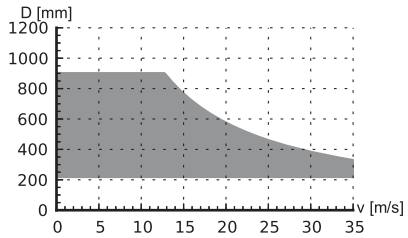
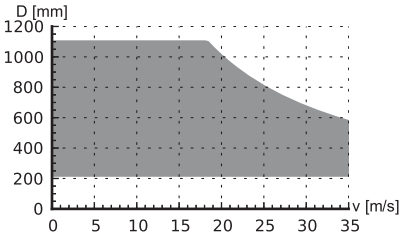
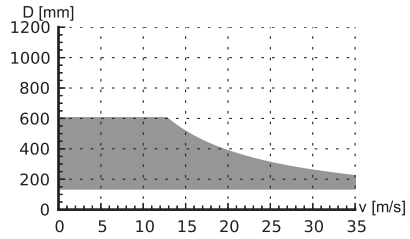
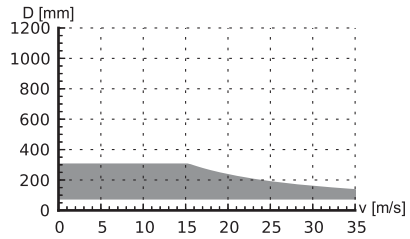
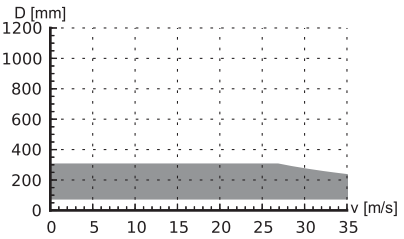
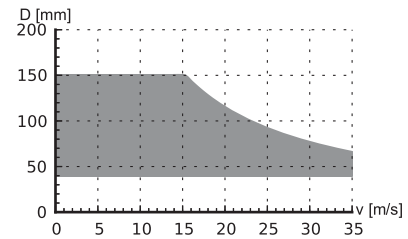
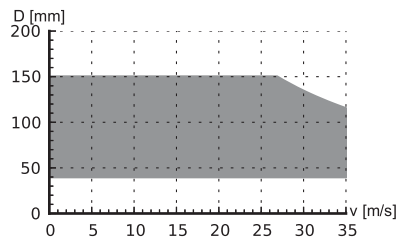
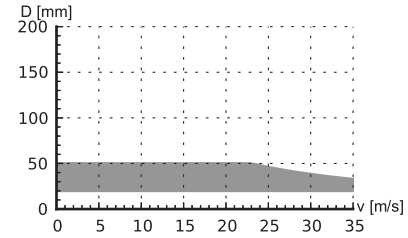
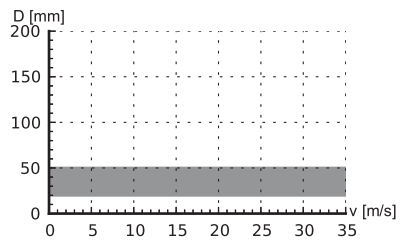


Step 2

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

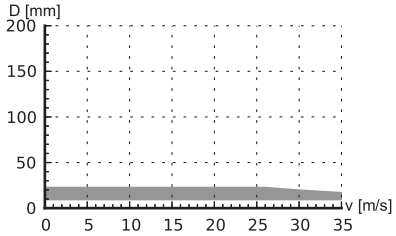
The transducers are selected from the characteristics (see next page). Lamb wave transducers are selected from the left column, shear wave transducers from the right column.

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

Lamb wave transducer[1]		shear wave transducer[1]
	GLF	
	GLG	 GSG
	GLH	
	GLK	 GSK
	GLM	 GSM
	GLP	 GSP

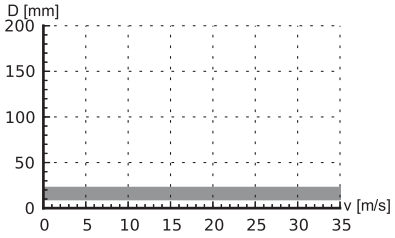
[1] inner pipe diameter and max. flow velocity for a typical application with natural gas, nitrogen, oxygen in reflection arrangement with 2 sound paths (Lamb wave transducers)/1 sound path (shear wave transducers)

Lamb wave transducer[1]



GLQ

shear wave transducer[1]



GSQ

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

Step 3

min. fluid pressure

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

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

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

d - inner pipe diameter

Example

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

Step 4

for the characters 4...11 of the transducer order code (ambient temperature, explosion protection, connection system, extension cable) see page 15

Step 5

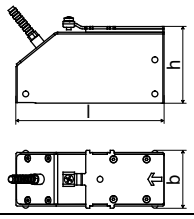
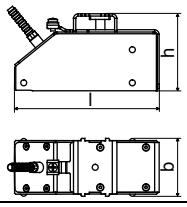
for the technical data of the selected transducer see page 16 et seqq.

Transducer order code

1, 2	3		4	5, 6	7, 8		9...11		12, 13	no. of character
transducer	transducer frequency	-	ambient temperature	explosion protection	connection system	-	extension cable	/	option	description
GL										set of ultrasonic flow transducers for gas measurement, Lamb wave
GS										set of ultrasonic flow transducers for gas measurement, shear wave
	F									0.15 MHz (Lamb wave only)
	G									0.2 MHz
	H									0.3 MHz (Lamb wave only)
	K									0.5 MHz
	M									1 MHz
	P									2 MHz
	Q									4 MHz
			N							normal temperature range
			E							extended temperature range (FSM, FSP, FSQ)
				A1						ATEX zone 1/IECEx zone 1
				A2						ATEX zone 2/IECEx zone 2
				F2						FM Class I Div. 2
				NN						not explosion proof
					TS					direct connection or connection via junction box
							XXX			cable length in m, for max. length of extension cable see page 44 connection system TS: 0 m: without junction box > 0 m: with junction box
									IP68	degree of protection IP68 (with connection system TS)
									OS	housing with stainless steel 316 (with connection system TS)
example										
GL	K	-	N	A1	TS	-	030			Lamb wave transducer 0.5 MHz, normal temperature range, ATEX zone 1/IECEx zone 1, connection system TS with junction box JB01 and extension cable 30 m
		-				-		/		

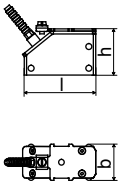
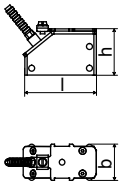
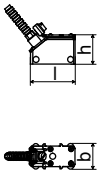
Technical data

Shear wave transducers (zone 1)

technical type			GDG1N81	GDK1N81
order code			**GSG-NA1TS** **GSG-NA1TS/OS**	**GSK-NA1TS** **GSK-NA1TS/OS**
transducer frequency		MHz	0.2	0.5
fluid 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	180 220 900 1100	60 80 300 360
pipe wall thickness				
min.		mm	11	5
material				
housing contact surface			PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PEEK	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PEEK
degree of protection according to IEC/ EN 60529			IP65	IP66
transducer cable				
type length		 m	1699 5	1699 5
dimensions				
length l width b height h		mm mm mm	129.5 51 67	126.5 51 67.5
dimensional drawing				
ambient temperature				
min. max.		°C °C	-40 +130	-40 +130
temperature compen-sation			x	x
explosion protection				
ATEX / IECEx	category EPL zone		gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21
	explosion protection temperature (pipe surface)			
	min. max.	°C °C	-55 +180	-55 +180
	marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db
	certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X
	type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
	transducer mounting fixture necessary		x	x

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

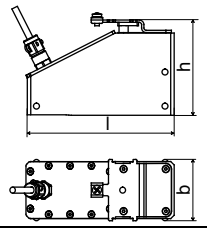
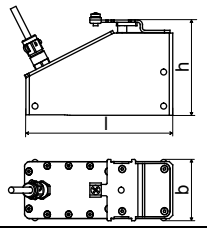
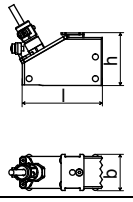
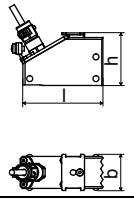
[2] shear wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
inner pipe diameter max. recommended/max. extended: in reflection arrangement and for a flow velocity of 15 m/s

technical type		GDM2N81	GDP2N81	GDQ2N81
order code		**GSM-NA1TS** **GSM-NA1TS/OS**	**GSP-NA1TS** **GSP-NA1TS/OS**	**GSQ-NA1TS** **GSQ-NA1TS/OS**
transducer frequency	MHz	1	2	4
fluid 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	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 40 150 180	15 20 50 60	7 10 22 30
pipe wall thickness				
min.	mm	2	1	0.6
material				
housing contact surface		PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PEEK	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PEEK	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PEEK
degree of protection according to IEC/ EN 60529		IP66	IP66	IP65
transducer cable				
type length	 m	1699 4	1699 4	1699 3
dimensions				
length l width b height h	mm mm mm	64 32 40.5	64 32 40.5	40 22 25.5
dimensional drawing				
ambient temperature				
min. max.	°C °C	-40 +130	-40 +130	-40 +130
temperature compen-sation		x	x	x
explosion protection				
ATEX / IECEx category EPL zone		gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21
explosion protection temperature (pipe surface)				
min. max.	°C °C	-55 +180	-55 +180	-55 +180
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db
certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X
type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
transducer mounting fixture necessary		x	x	x

[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, IP68)

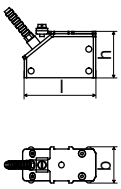
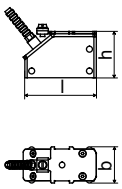
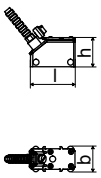
technical type		GDG1LI1	GDK1LI1	GDM2LI1	GDP2LI1
order code		**GSG-NA1TS/IP68**	**GSK-NA1TS/IP68**	**GSM-NA1TS/IP68**	**GSP-NA1TS/IP68**
transducer frequency	MHz	0.2	0.5	1	2
fluid pressure[1]					
min. extended min.	bar bar	metal pipe: 20 metal pipe: 30 plastic pipe: 1	metal pipe: 20 metal pipe: 30 plastic pipe: 1	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	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	1
material					
housing contact surface		PEEK with stainless steel cap 316Ti (1.4571) PEEK	PEEK with stainless steel cap 316Ti (1.4571) PEEK	PEEK with stainless steel cap 316Ti (1.4571) PEEK	PEEK with stainless steel cap 316Ti (1.4571) PEEK
degree of protection according to IEC/ EN 60529		IP68[3]	IP68[3]	IP68[3]	IP68[3]
transducer cable					
type		2550	2550	2550	2550
length	m	12	12	12	12
dimensions					
length l	mm	130	130	72	72
width b	mm	54	54	32	32
height h	mm	83.5	83.5	46	46
dimensional drawing					
ambient temperature					
min.	°C	-40	-40	-40	-40
max.	°C	+100	+100	+100	+100
temperature compensation		x	x	x	x
explosion protection					
ATEX / IECEx category EPL zone		gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21
explosion protection temperature (pipe surface)					
min. max.	°C °C	-55 +180	-55 +180	-55 +180	-55 +180
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db
certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X
type of protection		gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure
transducer mounting fixture necessary		x	x	x	x

[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

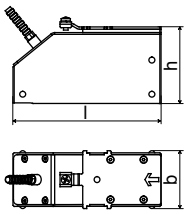
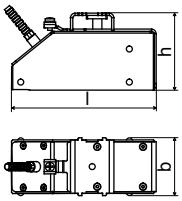
Shear wave transducers (zone 1, extended temperature range)

technical type		GDM2E85	GDP2E85	GDQ2E85
order code		**GSM-EA1TS** **GSM-EA1TS/OS**	**GSP-EA1TS** **GSP-EA1TS/OS**	**GSQ-EA1TS** **GSQ-EA1TS/OS**
transducer frequency	MHz	1	2	4
fluid 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	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 40 150 180	15 20 50 60	7 10 22 30
pipe wall thickness				
min.	mm	2	1	0.6
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	PI with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PI
degree of protection according to IEC/ EN 60529		IP66	IP66	IP56
transducer cable				
type length	 m	6111 4	6111 4	6111 3
dimensions				
length l width b height h	mm mm mm	64 32 40.5	64 32 40.5	40 22 25.5
dimensional drawing				
ambient temperature				
min. max.	°C °C	-30 +200	-30 +200	-30 +200
temperature compen-sation		x	x	x
explosion protection				
ATEX / IECEx category EPL zone		gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21
explosion protection temperature (pipe surface)				
min. max.	°C °C	-45 +225	-45 +225	-45 +225
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T2 Gb Ex tb IIIA TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T2 Gb Ex tb IIIA TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T2 Gb Ex tb IIIA TX Db
certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X
type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
transducer mounting fixture necessary		x	x	x

[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 2, FM Class I Div. 2 or not explosion proof)

technical type		GDG1N52	GDK1N52
order code		**GSG-NA2TS** **GSG-NA2TS/OS** **GSG-NF2TS** **GSG-NF2TS/OS** **GSG-NNNTS** **GSG-NNNTS/OS**	**GSK-NA2TS** **GSK-NA2TS/OS** **GSK-NF2TS** **GSK-NF2TS/OS** **GSK-NNNTS** **GSK-NNNTS/OS**
transducer frequency	MHz	0.2	0.5
fluid 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	180 220 900 1100	60 80 300 360
pipe wall thickness			
min.	mm	11	5
material			
housing contact surface		PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PEEK	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PEEK
degree of protection according to IEC/ EN 60529		IP67	IP67
transducer cable			
type length	 m	1699 5	1699 5
dimensions			
length l width b height h	mm mm mm	129.5 51 67	126.5 51 67.5
dimensional drawing			
ambient temperature			
min. max.	°C °C	-40 +130	-40 +130
temperature compen-sation		x	x

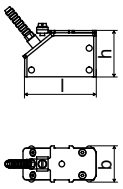
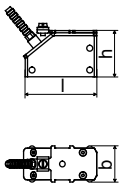
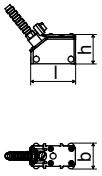
[1] depending on application, typical absolute value for natural gas, nitrogen, compressed air

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

continued on next page

technical type			GDG1N52	GDK1N52
explosion protection				
ATEX / IECEx	order code		GSG-NA2TS GSG-NA2TS/OS	GSK-NA2TS GSK-NA2TS/OS
	category EPL zone		gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21
	explosion protection temperature (pipe surface)			
	min. max.	°C °C	-55 gas: +190, dust: +180	-55 gas: +190, dust: +180
	marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db
	certification ATEX		IBExU10ATEX1163 X	IBExU10ATEX1163 X
	certification IECEx		IECEx IBE 12.0005X	IECEx IBE 12.0005X
	type of protection		gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure
	transducer mounting fixture necessary		x	x
FM	order code		GSG-NF2TS GSG-NF2TS/OS	GSK-NF2TS GSK-NF2TS/OS
	explosion protection temperature			
	min. max.	°C °C	-40 +125	-40 +125
	marking		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860	FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860
	type of protection		non incendive	non incendive

Shear wave transducers (zone 2, FM Class I Div. 2 or not explosion proof)

technical type		GDM2N52	GDP2N52	GDQ2N52
order code		**GSM-NA2TS** **GSM-NA2TS/OS** **GSM-NF2TS** **GSM-NF2TS/OS** **GSM-NNNTS** **GSM-NNNTS/OS**	**GSP-NA2TS** **GSP-NA2TS/OS** **GSP-NF2TS** **GSP-NF2TS/OS** **GSP-NNNTS** **GSP-NNNTS/OS**	**GSQ-NA2TS** **GSQ-NA2TS/OS** **GSQ-NF2TS** **GSQ-NF2TS/OS** **GSQ-NNNTS** **GSQ-NNNTS/OS**
transducer frequency	MHz	1	2	4
fluid 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	metal pipe: 20 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	1	0.6
material				
housing contact surface		PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PEEK	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PEEK	PEEK with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PEEK
degree of protection according to IEC/ EN 60529		IP67	IP67	IP67
transducer cable				
type length	 m	1699 4	1699 4	1699 3
dimensions				
length l width b height h	mm mm mm	64 32 40.5	64 32 40.5	40 22 25.5
dimensional drawing				
ambient temperature				
min. max.	°C °C	-40 +130	-40 +130	-40 +130
temperature compen-sation		x	x	x

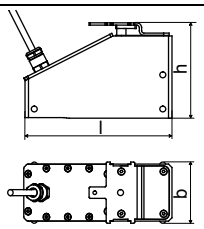
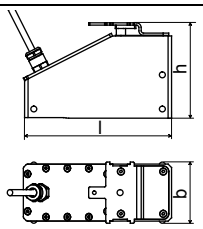
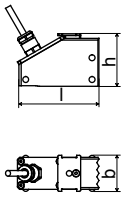
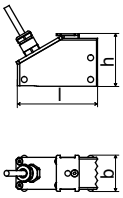
[1] depending on application, typical absolute value for natural gas, nitrogen, compressed air

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

continued on next page

technical type			GDM2N52	GDP2N52	GDQ2N52
explosion protection					
ATEX / IECEx	order code		GSM-NA2TS GSM-NA2TS/OS	GSP-NA2TS GSP-NA2TS/OS	GSQ-NA2TS GSQ-NA2TS/OS
	category EPL zone		gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21
	explosion protection temperature (pipe surface)				
	min. max.	°C °C	-55 gas: +190, dust: +180	-55 gas: +190, dust: +180	-55 gas: +190, dust: +180
	marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db
	certification ATEX		IBExU10ATEX1163 X	IBExU10ATEX1163 X	IBExU10ATEX1163 X
	certification IECEx		IECEx IBE 12.0005X	IECEx IBE 12.0005X	IECEx IBE 12.0005X
	type of protection		gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure
	transducer mounting fixture necessary		x	x	x
FM	order code		GSM-NF2TS GSM-NF2TS/OS	GSP-NF2TS GSP-NF2TS/OS	GSQ-NF2TS GSQ-NF2TS/OS
	explosion protection temperature				
	min. max.	°C °C	-55 +190	-55 +190	-55 +190
	marking		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860	FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860	FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860
	type of protection		non incendive	non incendive	non incendive

Shear wave transducers (zone 2 or not explosion proof, IP68)

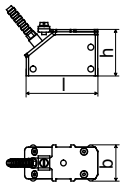
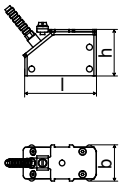
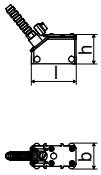
technical type		GDG1LI8	GDK1LI8	GDM2LI8	GDP2LI8
order code		**GSG-NA2TS/IP68** **GSG-NNNTS/IP68**	**GSK-NA2TS/IP68** **GSK-NNNTS/IP68**	**GSM-NA2TS/IP68** **GSM-NNNTS/IP68**	**GSP-NA2TS/IP68** **GSP-NNNTS/IP68**
transducer frequency	MHz	0.2	0.5	1	2
fluid pressure[1]					
min. extended min.	bar bar	metal pipe: 20 metal pipe: 30 plastic pipe: 1	metal pipe: 20 metal pipe: 30 plastic pipe: 1	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	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	1
material					
housing contact surface		PEEK with stainless steel cap 316Ti (1.4571) PEEK	PEEK with stainless steel cap 316Ti (1.4571) PEEK	PEEK with stainless steel cap 316Ti (1.4571) PEEK	PEEK with stainless steel cap 316Ti (1.4571) PEEK
degree of protection according to IEC/ EN 60529		IP68[3]	IP68[3]	IP68[3]	IP68[3]
transducer cable					
type		2550	2550	2550	2550
length	m	12	12	12	12
dimensions					
length l	mm	130	130	72	72
width b	mm	54	54	32	32
height h	mm	83.5	83.5	46	46
dimensional drawing					
ambient temperature					
min.	°C	-40	-40	-40	-40
max.	°C	+100	+100	+100	+100
temperature compensation		x	x	x	x
explosion protection					
ATEX / IECEx order code		GSG-NA2TS/IP68	GSK-NA2TS/IP68	GSM-NA2TS/IP68	GSP-NA2TS/IP68
category EPL zone		gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21
explosion protection temperature (pipe surface)					
min. max.	°C °C	-40 +90	-40 +90	-40 +90	-40 +90
marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db
certification ATEX		IBExU10ATEX1163 X	IBExU10ATEX1163 X	IBExU10ATEX1163 X	IBExU10ATEX1163 X
certification IECEx		IECEx IBE 12.0005X	IECEx IBE 12.0005X	IECEx IBE 12.0005X	IECEx IBE 12.0005X
type of protection		gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure
transducer mounting fixture necessary		x	x	x	x

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

[2] 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 (extended temperature range, zone 2, FM Class I Div. 2 or not explosion proof)

technical type		GDM2E52	GDP2E52	GDQ2E52
order code		**GSM-EA2TS** **GSM-EA2TS/OS** **GSM-EF2TS** **GSM-EF2TS/OS** **GSM-ENNTS** **GSM-ENNTS/OS**	**GSP-EA2TS** **GSP-EA2TS/OS** **GSP-EF2TS** **GSP-EF2TS/OS** **GSP-ENNTS** **GSP-ENNTS/OS**	**GSQ-EA2TS** **GSQ-EA2TS/OS** **GSQ-EF2TS** **GSQ-EF2TS/OS** **GSQ-ENNTS** **GSQ-ENNTS/OS**
transducer frequency	MHz	1	2	4
fluid 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	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 40 150 180	15 20 50 60	7 10 22 30
pipe wall thickness				
min.	mm	2	1	0.6
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	PI with stainless steel cap 304 (1.4301), option OS: 316L (1.4404) PI
degree of protection according to IEC/ EN 60529		IP56	IP56	IP56
transducer cable				
type length	 m	6111 4	6111 4	6111 3
dimensions				
length l width b height h	mm mm mm	64 32 40.5	64 32 40.5	40 22 25.5
dimensional drawing				
ambient temperature				
min. max.	°C °C	-30 +200	-30 +200	-30 +200
temperature compen-sation		x	x	x

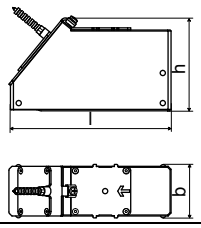
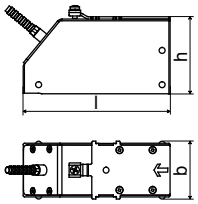
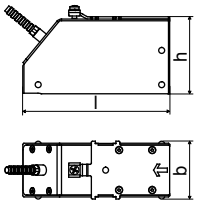
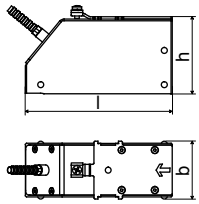
[1] depending on application, typical absolute value for natural gas, nitrogen, compressed air

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

continued on next page

	technical type		GDM2E52	GDP2E52	GDQ2E52
explosion protection					
ATEX/IECEx	order code		GSM-EA2TS GSM-EA2TS/OS	GSP-EA2TS GSP-EA2TS/OS	GSQ-EA2TS GSQ-EA2TS/OS
	category EPL zone		gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21
	explosion protection temperature (pipe surface)				
	min. max.	°C °C	-45 gas: +235, dust: +225	-45 gas: +235, dust: +225	-45 gas: +235, dust: +225
	marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIA TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIA TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIA TX Db
	certification ATEX		IBExU10ATEX1163 X	IBExU10ATEX1163 X	IBExU10ATEX1163 X
	certification IECEx		IECEx IBE 12.0005X	IECEx IBE 12.0005X	IECEx IBE 12.0005X
	type of protection		gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure
	transducer mounting fixture necessary		x	x	x
FM	order code		**G**SM-EF2TS **G**SM-EF2TS/OS	**G**SP-EF2TS **G**SP-EF2TS/OS	**G**SQ-EF2TS **G**SQ-EF2TS/OS
	explosion protection temperature				
	min. max.	°C °C	-45 +235	-45 +235	-45 +235
	marking		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860	FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860	FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860
	type of protection		non incendive	non incendive	non incendive

Lamb wave transducers (zone 1)

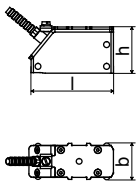
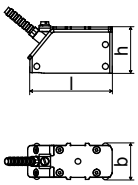
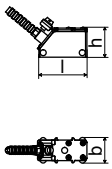
technical type		GRF1N83	GRG1N83	GRH1N83	GRK1N83
order code		**GLF-NA1TS** **GLF-NA1TS/OS**	**GLG-NA1TS** **GLG-NA1TS/OS**	**GLH-NA1TS** **GLH-NA1TS/OS**	**GLK-NA1TS** **GLK-NA1TS/OS**
transducer frequency	MHz	0.15	0.2	0.3	0.5
fluid pressure[1]					
min. extended	bar	metal pipe: 10	metal pipe: 10	metal pipe: 10	metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)
min.	bar	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1
inner pipe diameter d[2]					
min. extended	mm	220	180	110	60
min. recommended	mm	270	220	140	80
max. recommended	mm	1200	900	600	300
max. extended	mm	1600	1400	1000	360
pipe wall thickness					
min.	mm	15	11	8	5
max.	mm	32	24	16	10
max. extended	mm	35	-	-	-
material					
housing		PPSU with stainless steel cap 304 (1.4301), option OS: 316L, 316Ti (1.4404, 1.4571)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L, 316Ti (1.4404, 1.4571)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L, 316Ti (1.4404, 1.4571)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L, 316Ti (1.4404, 1.4571)
contact surface		PPSU	PPSU	PPSU	PPSU
degree of protection according to IEC/ EN 60529		IP65	IP66	IP66	IP66
transducer cable					
type		1699	1699	1699	1699
length	m	5	5	5	5
dimensions					
length l	mm	163	128.5	128.5	128.5
width b	mm	54	51	51	51
height h	mm	91.3	67.5	67.5	67.5
dimensional drawing					
ambient temperature					
min.	°C	-40	-40	-40	-40
max.	°C	+170	+170	+170	+170
temperature compen-sation		x	x	x	x

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

[2] Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
inner pipe diameter max. recommended: in 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)

continued on next page

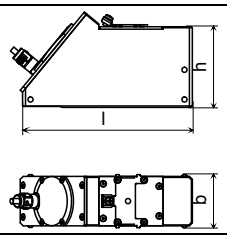
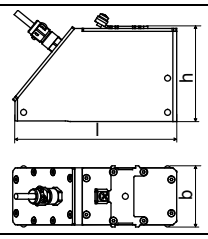
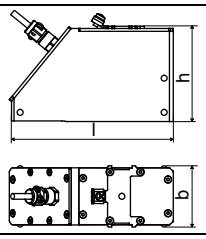
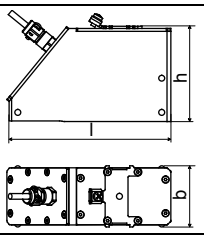
	technical type		GRF1N83	GRG1N83	GRH1N83	GRK1N83
explosion protection						
ATEX / IECEx	category EPL zone		gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21
	explosion protection temperature (pipe surface)					
	min. max.	°C °C	-55 +140	-55 +140	-55 +140	-55 +140
	marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db
	certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X
	type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
	transducer mounting fixture necessary		x	x	x	x

technical type			GRM1N83	GRP1N83	GRQ1N83
order code			**GLM-NA1TS, GLM-NA1TS/OS**	**GLP-NA1TS, GLP-NA1TS/OS**	**GLQ-NA1TS, GLQ-NA1TS/OS**
transducer frequency	MHz		1	2	4
fluid pressure[1]					
min. extended min.	bar bar		metal pipe: 3 (d < 60 mm) metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 3 (d < 35 mm) metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1	metal pipe: 3 (d < 15 mm) 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		150	50	22
max. extended	mm		180	60	30
pipe wall thickness					
min.	mm		2	1	0.5
max.	mm		5	3	1
max. extended	mm		-	-	-
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 IEC/ EN 60529			IP65	IP65	IP65
transducer cable					
type length	 m		1699 4	1699 4	1699 3
dimensions					
length l width b height h	mm mm mm		74 32 40.5	74 32 40.5	42 22 25.5
dimensional drawing					
ambient temperature					
min. max.	°C °C		-40 +170	-40 +170	-40 +170
temperature compen-sation			x	x	x
explosion protection					
ATEX/IECEx	category EPL zone		gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21
	explosion protection temperature (pipe surface)				
	min. max.	°C °C	-55 +140	-55 +140	-55 +140
	marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db
	certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X
	type of protection		gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure	gas: increased safety, powder filling dust: protection by enclosure
	transducer mounting fixture necessary		x	x	x

[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)

Lamb wave transducers (zone 1, IP68)

technical type		GRF1LI3	GRG1LI3	GRH1LI3	GRK1LI3
order code		**GLF-NA1TS/IP68**	**GLG-NA1TS/IP68**	**GLH-NA1TS/IP68**	**GLK-NA1TS/IP68**
transducer frequency	MHz	0.15	0.2	0.3	0.5
fluid pressure[1]					
min. extended	bar	metal pipe: 10	metal pipe: 10	metal pipe: 10	metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)
min.	bar	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1
inner pipe diameter d[2]					
min. extended	mm	220	180	110	60
min. recommended	mm	270	220	140	80
max. recommended	mm	1200	900	600	300
max. extended	mm	1600	1400	1000	360
pipe wall thickness					
min.	mm	15	11	8	5
max.	mm	32	24	16	10
max. extended	mm	35	-	-	-
material					
housing contact surface		PPSU with stainless steel cap 316Ti (1.4571) PPSU	PPSU with stainless steel cap 316Ti (1.4571) PPSU	PPSU with stainless steel cap 316Ti (1.4571) PPSU	PPSU with stainless steel cap 316Ti (1.4571) PPSU
degree of protection according to IEC/ EN 60529		IP68[3]	IP68[3]	IP68[3]	IP68[3]
transducer cable					
type		2550	2550	2550	2550
length	m	12	12	12	12
dimensions					
length l	mm	173	143.5	143.5	143.5
width b	mm	54	54	54	54
height h	mm	91.5	83.5	83.5	83.5
dimensional drawing					
ambient temperature					
min.	°C	-40	-40	-40	-40
max.	°C	+100	+100	+100	+100
temperature compen-sation		x	x	x	x

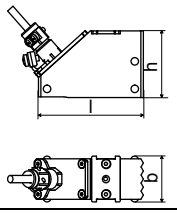
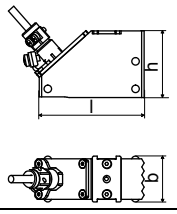
[1] depending on application, typical absolute value for natural gas, nitrogen, compressed air

[2] Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
inner pipe diameter max. recommended: in 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

continued on next page

technical type			GRF1LI3	GRG1LI3	GRH1LI3	GRK1LI3
explosion protection						
ATEX / IECEx	category EPL zone			gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21
	explosion protection temperature (pipe surface)					
	min. max.	°C °C	-55 +140	-55 +140	-55 +140	-55 +140
	marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db
	certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X	IECEx IBE 08.0007X
	type of protection		gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure
	transducer mounting fixture necessary		x	x	x	x

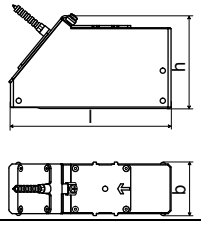
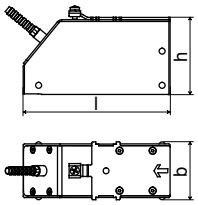
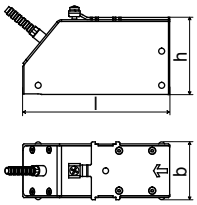
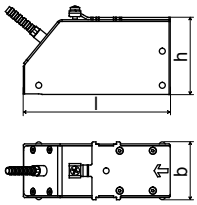
technical type			GRM1LI3	GRP1LI3
order code			**GLM-NA1TS/IP68**	**GLP-NA1TS/IP68**
transducer frequency		MHz	1	2
fluid pressure[1]				
min. extended min.		bar bar	metal pipe: 3 (d < 60 mm) metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 3 (d < 35 mm) metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1
inner pipe diameter d[2]				
min. extended		mm	30	15
min. recommended		mm	40	20
max. recommended		mm	150	50
max. extended		mm	180	60
pipe wall thickness				
min.		mm	2	1
max.		mm	5	3
max. extended		mm	-	-
material				
housing contact surface			PPSU with stainless steel cap 316Ti (1.4571) PPSU	PPSU with stainless steel cap 316Ti (1.4571) PPSU
degree of protection according to IEC/ EN 60529			IP68[3]	IP68[3]
transducer cable				
type			2550	2550
length		m	12	12
dimensions				
length l		mm	73	73
width b		mm	31.6	31.6
height h		mm	46	46
dimensional drawing				
ambient temperature				
min.		°C	-40	-40
max.		°C	+100	+100
temperature compen-sation			x	x
explosion protection				
ATEX / IECEx	category EPL zone		gas: 2G dust: 2D Gb Db 1 21	gas: 2G dust: 2D Gb Db 1 21
	explosion protection temperature (pipe surface)			
	min.	°C	-55	-55
	max.	°C	+140	+140
	marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db	CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db
	certification ATEX		IBExU07ATEX1168 X	IBExU07ATEX1168 X
	certification IECEx		IECEx IBE 08.0007X	IECEx IBE 08.0007X
	type of protection		gas: powder filling dust: protection by enclosure	gas: powder filling dust: protection by enclosure
	transducer mounting fixture necessary		x	x

[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

Lamb wave transducers (ATEX zone 2, FM Class I Div. 2 or not explosion proof)

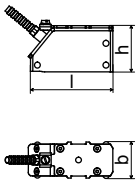
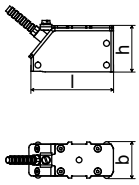
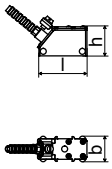
technical type		GRF1N52	GRG1N52	GRH1N52	GRK1N52
order code		**GLF-NA2TS GLF-NA2TS/OS GLF-NF2TS GLF-NF2TS/OS GLF-NNNTS GLF-NNNTS/OS**	**GLG-NA2TS GLG-NA2TS/OS GLG-NF2TS GLG-NF2TS/OS GLG-NNNTS GLG-NNNTS/OS**	**GLH-NA2TS GLH-NA2TS/OS GLH-NF2TS GLH-NF2TS/OS GLH-NNNTS GLH-NNNTS/OS**	**GLK-NA2TS GLK-NA2TS/OS GLK-NF2TS GLK-NF2TS/OS GLK-NNNTS GLK-NNNTS/OS**
transducer frequency	MHz	0.15	0.2	0.3	0.5
fluid pressure[1]					
min. extended	bar	metal pipe: 10	metal pipe: 10	metal pipe: 10	metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)
min.	bar	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1
inner pipe diameter d[2]					
min. extended	mm	220	180	110	60
min. recommended	mm	270	220	140	80
max. recommended	mm	1200	900	600	300
max. extended	mm	1600	1400	1000	360
pipe wall thickness					
min.	mm	15	11	8	5
max.	mm	32	24	16	10
max. extended	mm	35	-	-	-
material					
housing		PPSU with stainless steel cap 316Ti (1.4571)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)	PPSU with stainless steel cap 304 (1.4301), option OS: 316L (1.4404)
contact surface		PPSU	PPSU	PPSU	PPSU
degree of protection according to IEC/ EN 60529		IP65	IP67	IP67	IP67
transducer cable					
type		1699	1699	1699	1699
length	m	5	5	5	5
dimensions					
length l	mm	163	128.5	128.5	128.5
width b	mm	54	51	51	51
height h	mm	91.3	67.5	67.5	67.5
dimensional drawing					
ambient temperature					
min.	°C	-40	-40	-40	-40
max.	°C	+170	+170	+170	+170
temperature compen-sation		x	x	x	x

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

[2] Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
inner pipe diameter max. recommended: in 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)

continued on next page

	technical type		GRF1N52	GRG1N52	GRH1N52	GRK1N52
explosion protection						
ATEX/IECEx	order code		GLF-NA2TS GLF-NA2TS/OS	GLG-NA2TS GLG-NA2TS/OS	GLH-NA2TS GLH-NA2TS/OS	GLK-NA2TS GLK-NA2TS/OS
	category EPL zone		gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21
	explosion protection temperature (pipe surface)					
	min. max.	°C °C	-55 gas: +150, dust: +140	-55 gas: +150, dust: +140	-55 gas: +150, dust: +140	-55 gas: +150, dust: +140
	marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db
	certification ATEX		IBExU10ATEX1163 X	IBExU10ATEX1163 X	IBExU10ATEX1163 X	IBExU10ATEX1163 X
	certification IECEx		IECEx IBE 12.0005X	IECEx IBE 12.0005X	IECEx IBE 12.0005X	IECEx IBE 12.0005X
	type of protection		gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure
	transducer mounting fixture necessary		x	x	x	x
FM	order code		GLF-NF2TS GLF-NF2TS/OS	GLG-NF2TS GLG-NF2TS/OS	GLH-NF2TS GLH-NF2TS/OS	GLK-NF2TS GLK-NF2TS/OS
	explosion protection temperature					
	min. max.	°C °C	-40 +165	-40 +165	-40 +165	-40 +165
	marking		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860	FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860	FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860	FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860
	type of protection		non incendive	non incendive	non incendive	non incendive

technical type		GRM1N52	GRP1N52	GRQ1N52
order code		**GLM-NA2TS** **GLM-NA2TS/OS** **GLM-NF2TS** **GLM-NF2TS/OS** **GLM-NNNTS** **GLM-NNNTS/OS**	**GLP-NA2TS** **GLP-NA2TS/OS** **GLP-NF2TS** **GLP-NF2TS/OS** **GLP-NNNTS** **GLP-NNNTS/OS**	**GLQ-NA2TS** **GLQ-NA2TS/OS** **GLQ-NF2TS** **GLQ-NF2TS/OS** **GLQ-NNNTS** **GLQ-NNNTS/OS**
transducer frequency	MHz	1	2	4
fluid pressure[1]				
min. extended min.	bar bar	metal pipe: 3 (d < 60 mm) metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 3 (d < 35 mm) metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1	metal pipe: 3 (d < 15 mm) metal pipe: 10 (d > 15 mm) 5 (d < 15 mm) plastic pipe: 1
inner pipe diameter d[2]				
min. extended min. recommended max. recommended max. extended	mm mm mm mm	30 40 150 180	15 20 50 60	7 10 22 30
pipe wall thickness				
min. max. max. extended	mm mm mm	2 5 -	1 3 -	0.5 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 IEC/ EN 60529		IP65	IP65	IP65
transducer cable				
type length	 m	1699 4	1699 4	1699 3
dimensions				
length l width b height h	mm mm mm	74 32 40.5	74 32 40.5	42 22 25.5
dimensional drawing				
ambient temperature				
min. max.	°C °C	-40 +170	-40 +170	-40 +170
temperature compen-sation		x	x	x

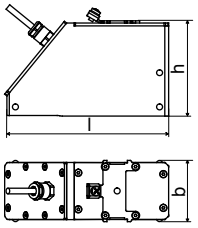
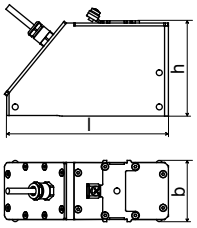
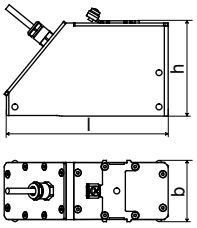
[1] depending on application, typical absolute value for natural gas, nitrogen, compressed air

[2] Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
inner pipe diameter max. recommended: in 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)

continued on next page

	technical type		GRM1N52	GRP1N52	GRQ1N52
explosion protection					
ATEX/IECEx	order code		GLM-NA2TS GLM-NA2TS/OS	GLP-NA2TS GLP-NA2TS/OS	GLQ-NA2TS GLQ-NA2TS/OS
	category EPL zone		gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21
	explosion protection temperature (pipe surface)				
	min. max.	°C °C	-55 gas: +150, dust: +140	-55 gas: +150, dust: +140	-55 gas: +150, dust: +140
	marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db
	certification ATEX		IBExU10ATEX1163 X	IBExU10ATEX1163 X	IBExU10ATEX1163 X
	certification IECEx		IECEx IBE 12.0005X	IECEx IBE 12.0005X	IECEx IBE 12.0005X
	type of protection		gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure
	transducer mounting fixture necessary		x	x	x
FM	order code		GLM-NF2TS GLM-NF2TS/OS	GLP-NF2TS GLP-NF2TS/OS	GLQ-NF2TS GLQ-NF2TS/OS
	explosion protection temperature				
	min. max.	°C °C	-55 +165	-55 +165	-55 +165
	marking		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860	FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860	FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860
	type of protection		non incendive	non incendive	non incendive

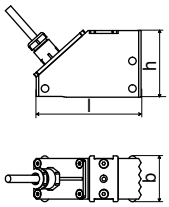
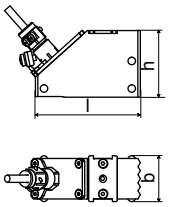
Lamb wave transducers (zone 2 or not explosion proof, IP68)

technical type		GRG1LI8	GRH1LI8	GRK1LI8
order code		**GLG-NA2TS/IP68** **GLG-NNNTS/IP68**	**GLH-NA2TS/IP68** **GLH-NNNTS/IP68**	**GLK-NA2TS/IP68** **GLK-NNNTS/IP68**
transducer frequency	MHz	0.2	0.3	0.5
fluid pressure[1]				
min. extended	bar	metal pipe: 10	metal pipe: 10	metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)
min.	bar	metal pipe: 15 plastic pipe: 1	metal pipe: 15 plastic pipe: 1	metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1
inner pipe diameter 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
max. extended	mm	-	-	-
material				
housing		PPSU with stainless steel cap 316Ti (1.4571)	PPSU with stainless steel cap 316Ti (1.4571)	PPSU with stainless steel cap 316Ti (1.4571)
contact surface		PPSU	PPSU	PPSU
degree of protection according to IEC/ EN 60529		IP68[3]	IP68[3]	IP68[3]
transducer cable				
type		2550	2550	2550
length	m	12	12	12
dimensions				
length l	mm	143.5	143.5	143.5
width b	mm	54	54	54
height h	mm	83.5	83.5	83.5
dimensional drawing				
ambient temperature				
min.	°C	-40	-40	-40
max.	°C	+100	+100	+100
temperature compen-sation		x	x	x
explosion protection				
order code		GLG-NA2TS/IP68	GLH-NA2TS/IP68	GLK-NA2TS/IP68
category EPL zone		gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21
ATEX/IECEx **explosion protection temperature (pipe surface)**				
min.	°C	-40	-40	-40
max.	°C	+90	+90	+90
marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db
certification ATEX		IBExU10ATEX1163 X	IBExU10ATEX1163 X	IBExU10ATEX1163 X
certification IECEx		IECEx IBE 12.0005X	IECEx IBE 12.0005X	IECEx IBE 12.0005X
type of protection		gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure
transducer mounting fixture necessary		x	x	x

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

[2] Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other 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

technical type			GRM1LI8	GRP1LI8
order code			**GLM-NA2TS/IP68** **GLM-NNNTS/IP68**	**GLP-NA2TS/IP68** **GLP-NNNTS/IP68**
transducer frequency	MHz		1	2
fluid pressure[1]				
min. extended min.	bar bar		metal pipe: 3 (d < 60 mm) metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 3 (d < 35 mm) metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1
inner pipe diameter d[2]				
min. extended	mm		30	15
min. recommended	mm		40	20
max. recommended	mm		150	50
max. extended	mm		180	60
pipe wall thickness				
min.	mm		2	1
max.	mm		5	3
max. extended	mm		-	-
material				
housing contact surface			PPSU with stainless steel cap 316Ti (1.4571) PPSU	PPSU with stainless steel cap 316Ti (1.4571) PPSU
degree of protection according to IEC/ EN 60529			IP68[3]	IP68[3]
transducer cable				
type			2550	2550
length	m		12	12
dimensions				
length l	mm		73	73
width b	mm		31.6	31.6
height h	mm		46	46
dimensional drawing				
ambient temperature				
min.	°C		-40	-40
max.	°C		+100	+100
temperature compen-sation			x	x
explosion protection				
ATEX / IECEx	order code		GLM-NA2TS/IP68	GLP-NA2TS/IP68
	category EPL zone		gas: 3G dust: 2D Gc Db 2 21	gas: 3G dust: 2D Gc Db 2 21
	explosion protection temperature (pipe surface)			
	min. max.	°C °C	-40 +90	-40 +90
	marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db
	certification ATEX		IBExU10ATEX1163 X	IBExU10ATEX1163 X
	certification IECEx		IECEx IBE 12.0005X	IECEx IBE 12.0005X
	type of protection		gas: non sparking dust: protection by enclosure	gas: non sparking dust: protection by enclosure
	transducer mounting fixture necessary		x	x

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

[2] Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
inner pipe diameter max. recommended: in 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)

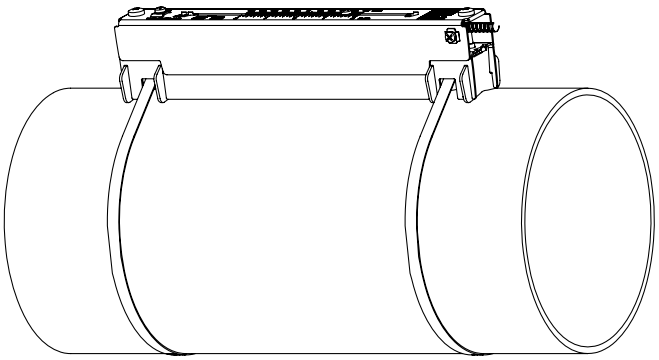
[3] test conditions: 3 months/2 bar (20 m)/20 °C

Transducer mounting fixture

Order code

1, 2	3		4	5		6	7...9		10, 11	no. of character
transducer mounting fixture	transducer	-	measurement arrangement	size	-	fixation	outer pipe diameter	/	option	description
VL										Variofix L
VC										Variofix C
	K									transducers with transducer frequency F (VCK-*L-****/IP68), G, H, K
	M									transducers with transducer frequency M, P
	Q									transducers with transducer frequency Q
			D							reflection arrangement or diagonal arrangement
			R							reflection arrangement
				S						small
				M						medium
				L						large
						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	degree of protection IP68
									OS	housing with stainless steel 316
									Z	special design
example										
VL	K	-	D	S	-	S	200			Variofix L and tension straps for transducers with transducer frequency G, H, K
		-			-			/		

Variofix L (VLK, VLM, VLQ)

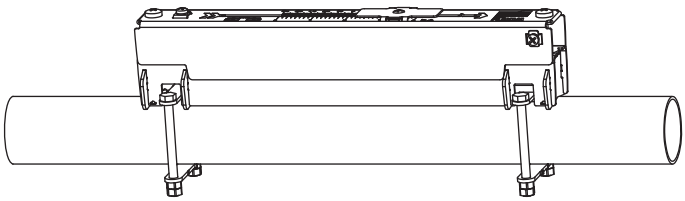


material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006)
option OS: 316 (1.4571), 316L (1.4404), 17-7PH (1.4568)

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

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

Variofix L with bolt mounting plates (VL*-**-B)



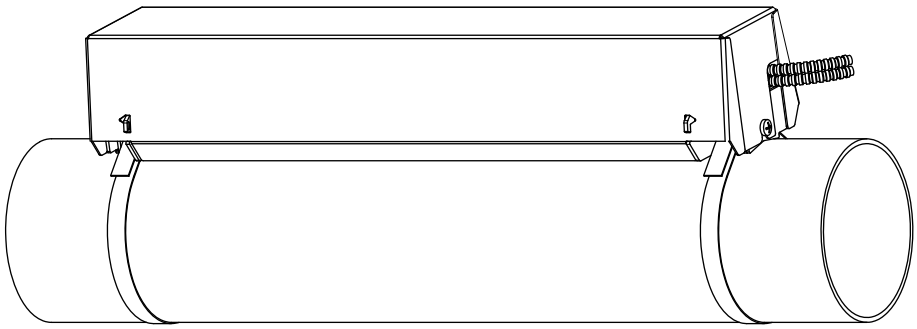
material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006)
option OS: 316 (1.4571), 316L (1.4404), 17-7PH (1.4568)

inner length:
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

Variofix C (VC)



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

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

dimensions:
VCK-*L: 560 x 122 x 102 mm,
option IP68: 560 x 126 x 120 mm
VCK-*S: 410 x 122 x 102 mm,
option IP68: 410 x 126 x 120 mm
VCM: 460 x 96 x 80 mm
VCQ: 310 x 85 x 62 mm

Coupling materials for transducers

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

[1] < 5 years
[2] < 6 months

Technical data

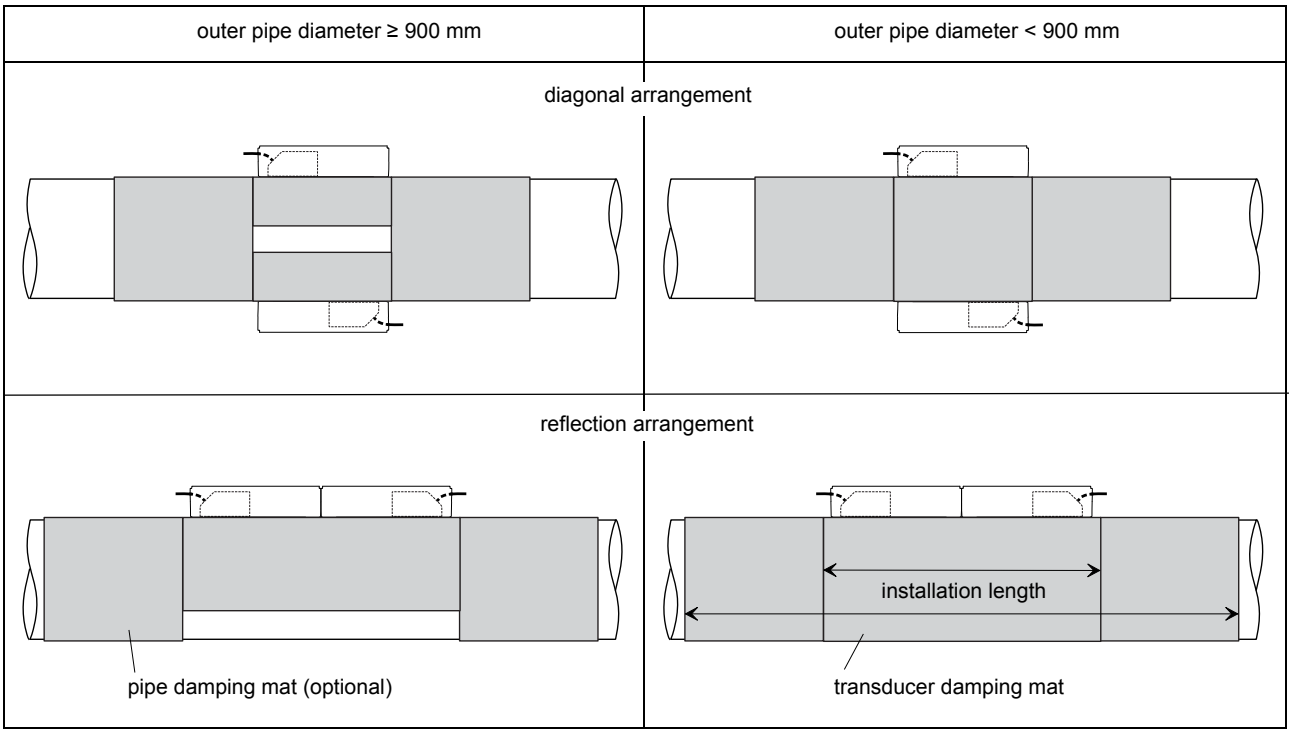
type	**ambient temperature** °C	**material**
coupling compound type N	-30...+130	mineral grease paste
coupling compound type E	-30...+200	silicone paste
coupling compound type H	-30...+250	fluoropolymer paste
coupling foil type VT	-10...+200	fluoroelastomer

Damping mats (optional)

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

transducer damping mat
Transducer damping mats will be installed below the transducers.

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



Technical data

type		E30R4	E30R3
width	mm	225	50
thickness	mm	0.7	
length (per roll)	m	10	
weight	kg/m²	1.015	
ambient temperature	°C	-30...+80	
properties		self-adhesive	

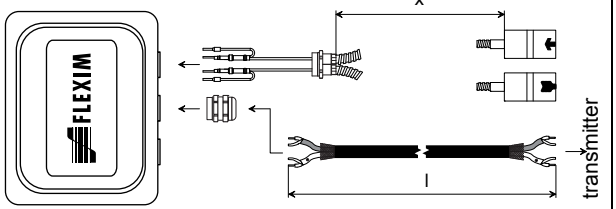
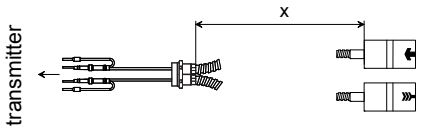
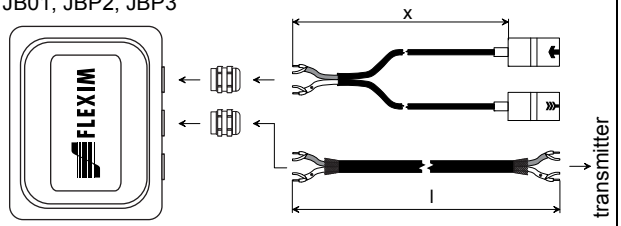
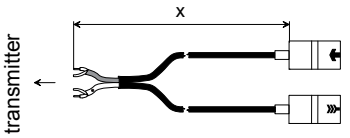
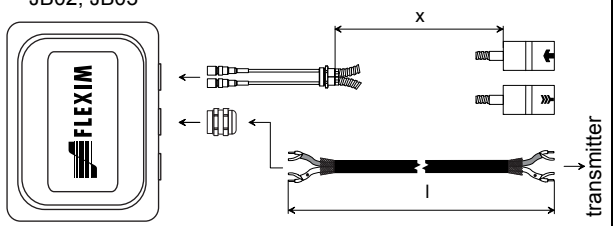
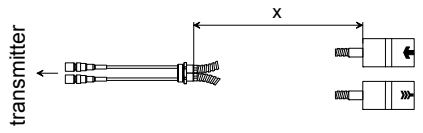
Dimensioning

transducer		damping mat							
transducer mounting fixture	order code	type	number of layers	transducer damping mat			transducer damping mat + 2x pipe damping mat		
				max. installation length [mm]	number of rolls[1] standard[2]	extended[2]	max. installation length [mm]	number of rolls[1] 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	3
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									
VCK-*L-****/IP68	GLF	E30R4	3	1160	6	6	2360	13	15
VCK-*L	GLG	E30R4	3	1160	6	6	2360	11	14
VCK-*L-****/IP68	GSG		3		6	6		11	12
	GLH		2		3	4		5	8
	GLK		1		1	1		2	2
	GSK		1		1	1		2	2
VCK-*S	GLG	E30R4	3	860	4	4	1760	7	9
VCK-*S-****/IP68	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		1	2		2	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)
(for inner pipe diameter max. recommended and max. extended see Technical Data of the Transducers from page 16)

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

Connection systems

connection system TS		
connection with extension cable	direct connection	transducers technical type
JB01 		*****8*
JB01, JBP2, JBP3 		****LI*
JB02, JB03 		*****52

	transducer frequency (3d character of transducer order code)		F, G, H, K		M, P		Q		S	
			x	l	x	l	x	l	x	l
TS	cable length	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40
	cable length (option LC)	m	9	≤ 300	-	-	-	-	-	-
	cable length (option IP68)	m	12	≤ 300	12	≤ 300	-	-	-	-

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

Transducer cable

Technical data

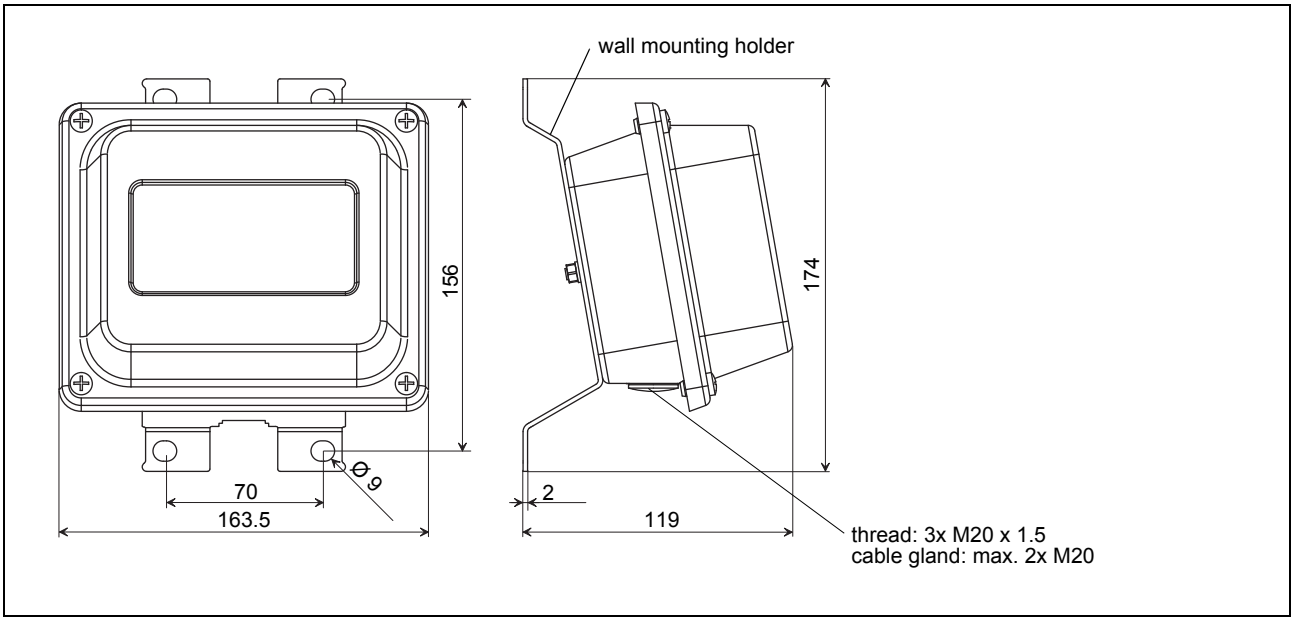
		transducer cable			**extension cable**	
type		1699	2550 (option IP68)	6111	2615	5245
standard length	m	see table above			-	
max. length	m	-			see table above	
ambient temperature	°C	-55...+200	-40...+100	-100...+225	-30...+70	-30...+70
properties			longitudinal water tight		halogen free fire propagation 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		PTFE	PUR	PFA	PUR	PUR
outer diameter	mm	2.9	5.2 ±0.2	2.7	12	12
thickness	mm	0.3	0.9	0.5	2	2
colour		brown	grey	white	black	black
shield		x	x	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)	-	steel wire braid with copolymer sheath
outer diameter	mm	8	-	8	-	15.6

Junction box

Technical data

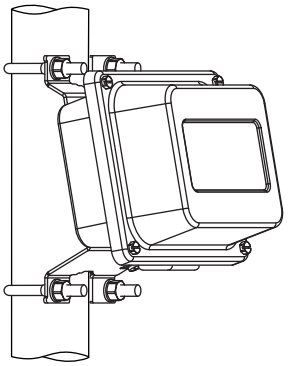
technical type		JB01S4E3M	JB02	JB03	JBP2	JBP3
dimensions		see dimensional drawing	see dimensional drawing	see dimensional drawing	see dimensional drawing	see dimensional drawing
weight	kg	1.2 kg	1.2 kg	1.2 kg	1.2 kg	1.2 kg
fixation		wall mounting, optional: 2 " pipe mounting	wall mounting, optional: 2 " pipe mounting	wall mounting, optional: 2 " pipe mounting	wall mounting, optional: 2 " pipe mounting	wall mounting, optional: 2 " pipe mounting
material						
housing gasket		stainless steel 316L (1.4404) silicone	stainless steel 316L (1.4404) silicone	stainless steel 316L (1.4404) silicone	stainless steel 316L (1.4404) silicone	stainless steel 316L (1.4404) silicone
degree of protection according to IEC/ EN 60529		IP67	IP67	IP67	IP67	IP67
ambient temperature						
min.	°C	-40	-40	-40	-40	-40
max.	°C	+80	+80	+80	+80	+80
explosion protection						
ATEX/IECEx zone		1	2	-	2	-
ATEX/IECEx marking		CE 0637 Ex II2G II2D Ex e mb IIC (T6)...T4 Gb Ex tb IIIC T 100 °C Db Ta -40...+(70)80 °C	CE Ex II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc IIIC T 100 °C Dc Ta -40...+(70)80 °C	-	CE Ex II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc IIIC T 100 °C Dc Ta -40...+(70)80 °C	-
ATEX/IECEx certification ATEX		IBExU06ATEX1161	-	-	-	-
ATEX/IECEx certification IECEx		IECEx IBE 08.0006	-	-	-	-
ATEX/IECEx type of protection		gas: • increased safety • decoupled net-work: encapsula-tion dust: protection by enclosure	gas: non sparking dust: protection by enclosure	-	gas: non sparking dust: protection by enclosure	-

Dimensions



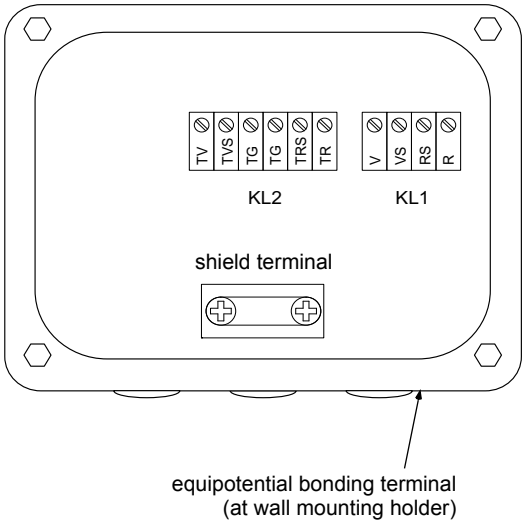
in mm

2 " pipe mounting kit (optional)



Terminal assignment

JB01



transducers

terminal strip KL1

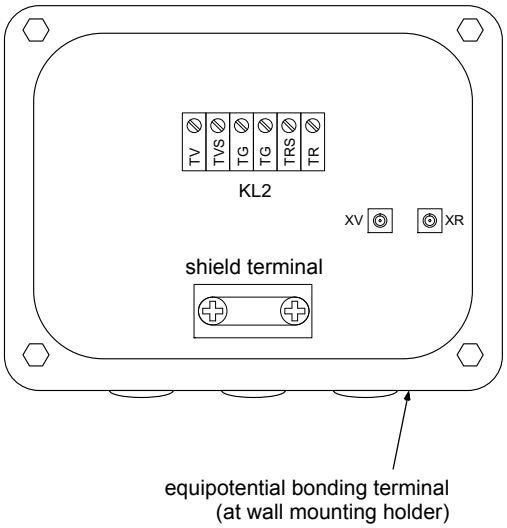
terminal	connection
V	transducer ↑, signal
VS	transducer ↑, internal shield
RS	transducer ⇈, internal shield
R	transducer ⇈, signal
cable gland	external shield

extension cable

terminal strip KL2

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

JB02, JB03



transducers

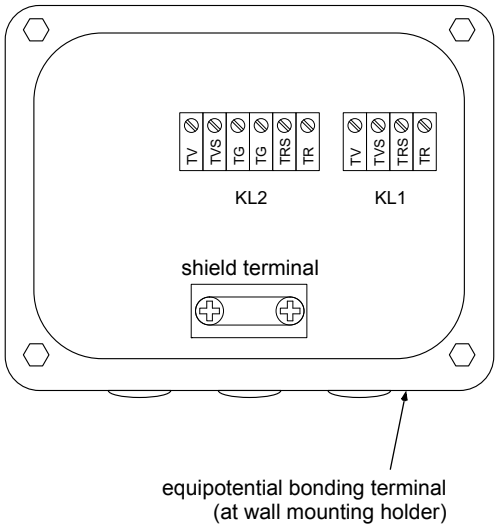
terminal	connection
XV	transducer ↑, SMB connector
XR	transducer ⇈, SMB connector
cable gland	external shield

extension cable

terminal strip KL2

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

JBP2, JBP3



transducers

terminal strip KL1

terminal	connection
TV	transducer ↑, signal
TVS	transducer ↑, internal shield
TRS	transducer ⅄, internal shield
TR	transducer ⅄, signal
cable gland	external shield

extension cable

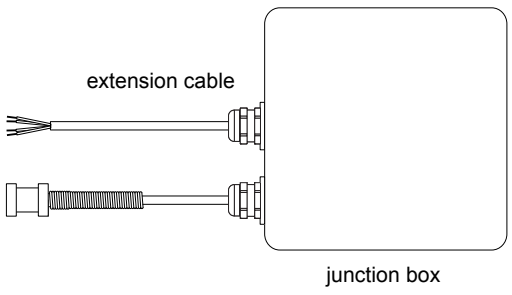
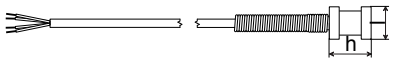
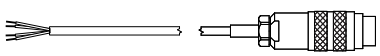
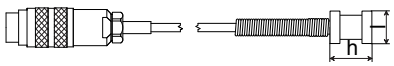
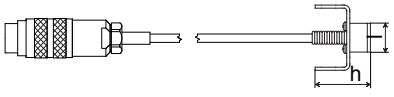
terminal strip KL2

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

Clamp-on temperature probe (optional)

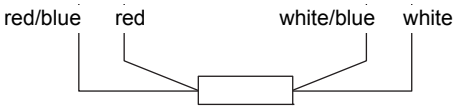
Technical data

technical type		**PT12N**	**PT12N**	**PT12N**	**PT12F**
design		with connector		zone 2	short response time, with connector
type		Pt100	Pt100	Pt100	Pt100
connection		4-wire	4-wire	4-wire	4-wire
measuring range	°C	-30...+250	-30...+250	-30...+250	-50...+250
accuracy T		±(0.15 °C + 2 · 10^{-3} · |T [°C]|), class A	±(0.15 °C + 2 · 10^{-3} · |T [°C]|), class A	±(0.15 °C + 2 · 10^{-3} · |T [°C]|), class A	±(0.15 °C + 2 · 10^{-3} · |T [°C]|), class A
response time	s	50	50	50	8
housing		aluminum	aluminum	aluminum	PEEK, stainless steel 304 (1.4301), copper
degree of protection according to IEC/ EN 60529		IP66	IP66	IP66	IP66
weight (without connector)	kg	0.25	0.25	0.25	0.32
fixation		clamp-on	clamp-on	clamp-on	clamp-on
accessories					
thermal conductivity paste 200 °C		x	-	-	x
thermal conductivity foil 250 °C		x	x	x	x
plastic protection plate, insulation foam		-	-	-	x
dimensions					
length l	mm	15	15	15	14
width b	mm	15	15	15	30
height h	mm	20	20	20	27
explosion protection					
ATEX zone		-	-	2	-
explosion protection temperature					
ATEX min.	°C	-	-	-30	-
ATEX max.	°C	-	-	+250	-
ATEX marking		-	-	CE Ex II3G Ex nA IIC T6...T2 Gc Ta -30...+250 °C	-

connection with extension cable	direct connection	technical type
		PT12N
		PT12N
		PT12F

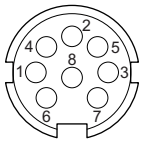
Connection

Temperature probe



Connector

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



Cable

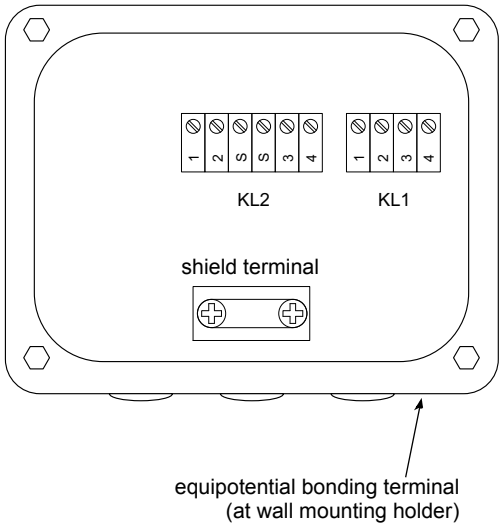
		cable of temperature probe	extension cable
type		4 x 0.25 mm² black	LIYCY 8 x 0.14 mm² grey
standard length	m	3	5/10/25
max. length	m	-	200
cable jacket		PTFE	PVC

Junction box

technical type		JBT2	JBT3
dimensions		see dimensional drawing	see dimensional drawing
fixation		wall mounting, optional: 2 " pipe mounting	wall mounting, optional: 2 " pipe mounting
material			
housing gasket		stainless steel 316L (1.4404) silicone	stainless steel 316L (1.4404) silicone
degree of protection according to IEC/ EN 60529		IP67	IP67
cable gland		max. 2x M12	max. 2x M12
ambient temperature			
min. max.	°C °C	-40 +80	-40 +80
explosion protection			
ATEX zone		2	-
ATEX marking		CE Ex II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc IIIC T 100 °C Dc Ta -40...+(70)80 °C	-
ATEX certification		-	-
ATEX type of protection		gas: non sparking, dust: protection by enclosure	-

Terminal assignment

JBT2, JBT3



temperature probe

terminal strip KL1

terminal	connection
1	red
2	red/blue
3	white
4	white/blue

extension cable

terminal strip KL2

terminal	connection
1	red
2	grey
3	white
4	blue

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