

Gas ultrasonic flowmeter for permanent installation

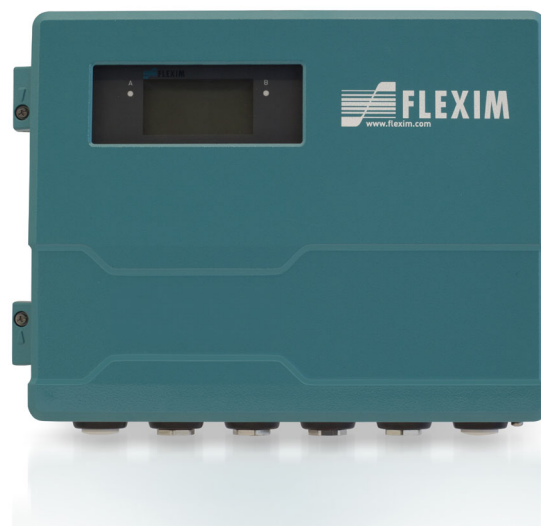
Transmitter for permanent outdoor wall or pipe mounting

Features

- Exact and highly reliable bidirectional clamp-on flow measurement of operational and standard volume flow rates as well as mass flow rates
- High measurement accuracy even at very low as well as very high flow rates and independent of the flow direction (bidirectional)
- The measurement is zero point stable, drift free and independent of the pipe material as well as the process pressure (> 3 bar on steel pipes; no minimum pressure for plastic pipes) and the process fluid
- The measurement system also precisely measures wet gas flow rates up to 5 % LVF (liquid volume fraction)
- Advanced self-diagnosis and possibilities for event-based triggering of data recording for the supervision and control of critical processes
- G722 with advanced functionality:
 - Synchronized channel averaging to reduce turbulence-related fluctuations of the measured value
 - Multifunctional digital outputs
- Bidirectional communication and support of common bus technologies (Profibus PA, Foundation Fieldbus, HART, Modbus, BACnet, M-Bus)
- Installation and start-up do not require any pipe work nor any process interruptions
- Transmitter and transducers are separately calibrated (traceable to national standards)
- Automatic loading of calibration data and transducer recognition
- Transducers available for a wide range of inner pipe diameters and fluid temperatures
- Transmitter and transducers for use in hazardous areas are available

Applications

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



FLUXUS G72***-****A



FLUXUS G72***-****S



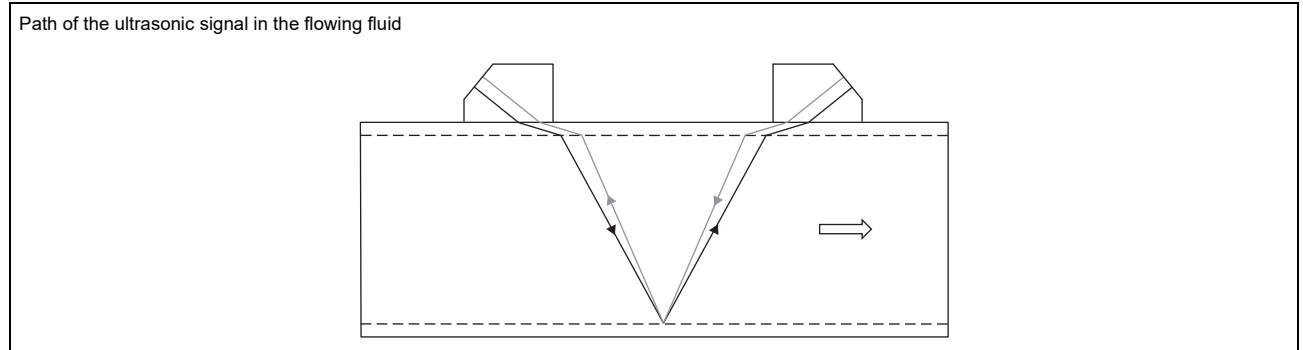
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Function

Measurement principle

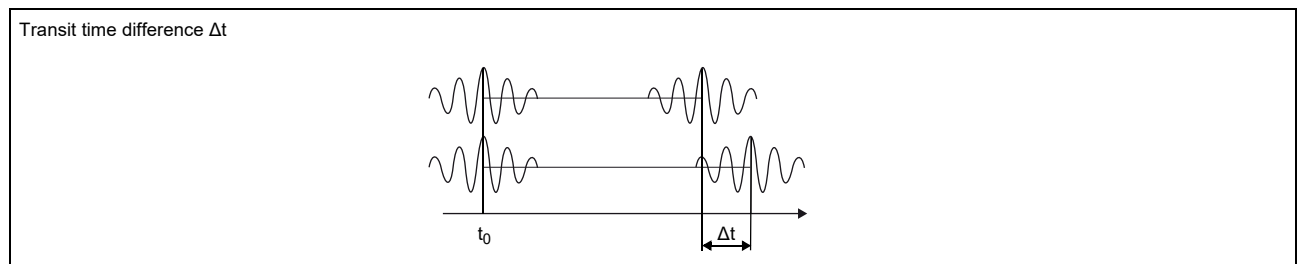
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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

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

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



Calculation of volumetric flow rate

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

where

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

Calculation of mass flow rate

The mass flow rate is calculated from the operating density and the volumetric flow rate:

$$\dot{m} = \rho \cdot \dot{V}$$

The operating density of the fluid is calculated as the function of pressure and temperature of the fluid:

$$\rho = f(p, T)$$

where

- ρ - operating density
- p - fluid pressure
- T - fluid temperature
- $\dot{m}$ - mass flow rate
- $\dot{V}$ - volumetric flow rate

Calculation of standard volumetric flow rate

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

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

where

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

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

or:

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

Calculation of gas energy flow rate (NGE)

For natural gas with changing composition (NGE fluid data sets), the Natural Gas Engine (NGE) can be used to calculate the gas energy flow rate:

$$\Phi = HHV_V \cdot \dot{V}_N = HHV_m \cdot \dot{m}$$

$$HHV_m = \rho_N \cdot HHV_V$$

where

- Φ - gas energy flow rate
- $\dot{V}_N$ - standard volumetric flow rate
- $\dot{m}$ - mass flow rate
- HHV_V - higher heating value, volume-related
- HHV_m - higher heating value, mass-related
- ρ_N - normalised density

Number of sound paths

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

- **reflection arrangement**

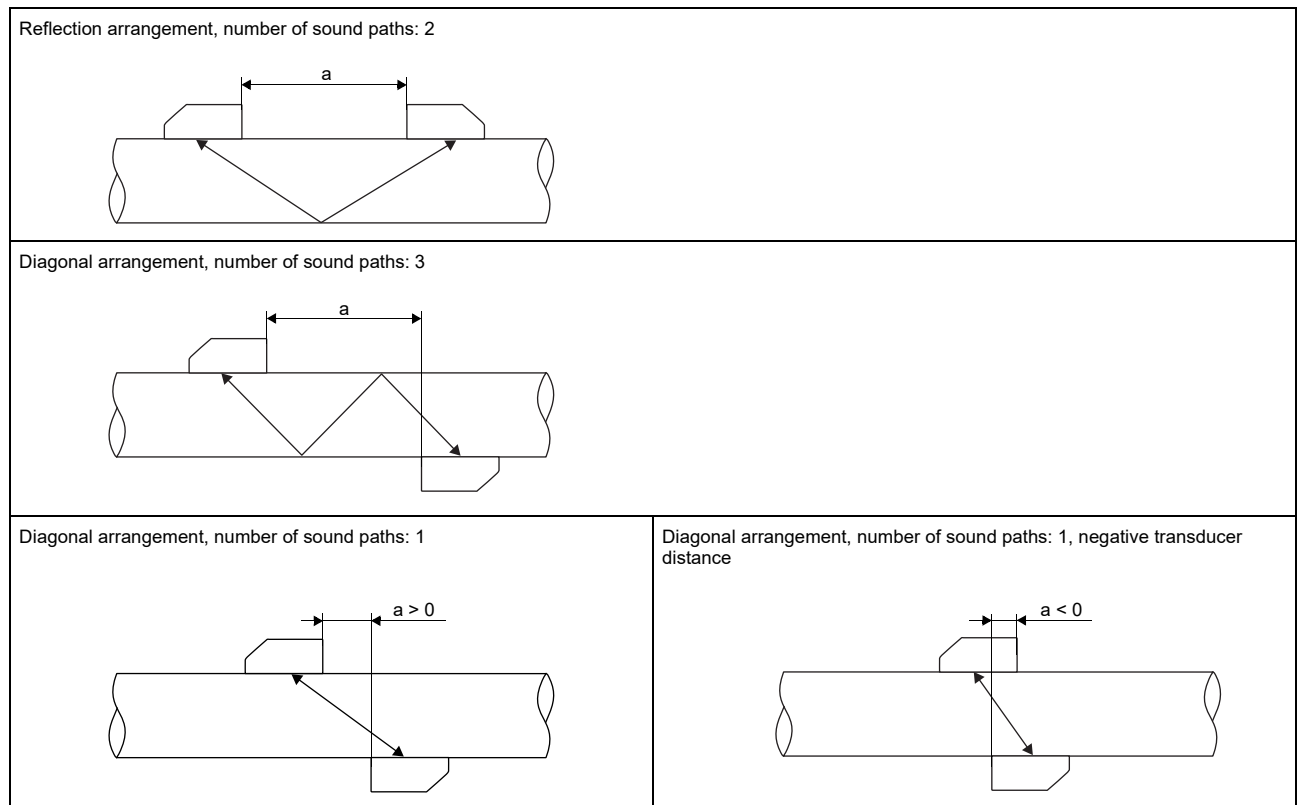
The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easy.

- **diagonal arrangement**

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

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

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



a - transducer distance

Transmitter

Technical data

		FLUXUS G721**-NN0*A G721**-NN0*S	FLUXUS G721**-A20*A G721**-A20*S	FLUXUS G721**-F20*A G721**-F20*S	FLUXUS G722**-NN0*A G722**-NN0*S	FLUXUS G722**-A20*A G722**-A20*S	FLUXUS G722**-F20*A G722**-F20*S
							
design		standard field device	standard field device zone 2	standard field device FM Class I Div. 2	standard field device	standard field device zone 2	standard field device FM Class I Div. 2
measurement							
measurement principle		transit time difference correlation principle					
synchronised channel averaging		-				x (2 measuring channels necessary)	
flow velocity	m/s	0.01...35, depending on pipe diameter					
repeatability		0.15 % MV ±0.005 m/s					
fluid		all acoustically conductive gases, e.g. nitrogen, air, oxygen, hydrogen, argon, helium, ethylene, propane					
temperature compensation		corresponding to the recommendations in ANSI/ASME MFC-5.1-2011					
measurement uncertainty (volumetric flow rate)							
measurement uncertainty of the measuring system ¹		±0.3 % MV ±0.005 m/s					
measurement uncertainty at the measuring point		±1...2 % MV ±0.005 m/s, depending on the application					
transmitter							
power supply		• 100...230 V/50...60 Hz or • 20...32 V DC or • 11...16 V DC					
power consumption	W	< 15					
number of measuring channels		1, optional: 2				1, optional: 2 (1 measuring point)	
damping	s	0...100 (adjustable)					
measuring cycle	Hz	100...1000 (1 channel)					
response time	s	1 (1 channel), option: 0.02				1 (1 channel), option: 0.02	
housing material		aluminum, powder coated or stainless steel 316L (1.4404)				aluminum, powder coated or stainless steel 316L (1.4404)	
degree of protection		IP66		aluminum housing: IP66/NEMA 4X stainless steel housing: IP65	IP66		aluminum housing: IP66/NEMA 4X stainless steel housing: IP65
dimensions	mm	see dimensional drawing					
weight	kg	aluminum housing: 5.4 stainless steel housing: 5.1					
fixation		wall mounting, optional: 2" pipe mounting					
ambient temperature	°C	-40...+60 (< -20 °C without operation of the display)		aluminum housing: -40...+55/60 (< -20 °C without operation of the display) stainless steel housing: -20...+55/60	-40...+60 (< -20 °C without operation of the display)		aluminum housing: -40...+55/60 (< -20 °C without operation of the display) stainless steel housing: -20...+55/60
display		128 x 64 pixels, backlight					
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian					
explosion protection							
• ATEX/IECEx							
marking		-	CE 0637 Ex II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 °C Db T _a -40...+60 °C	-	-	CE 0637 Ex II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 °C Db T _a -40...+60 °C	-
certification ATEX		-	IBExU11ATEX1015	-	-	IBExU11ATEX1015	-
certification IECEx		-	IECEx IBE 11.0008	-	-	IECEx IBE 11.0008	-

¹ with aperture calibration of the transducers² outside the explosive atmosphere (housing cover open)

		FLUXUS G721**-NN0*A G721**-NN0*S	FLUXUS G721**-A20*A G721**-A20*S	FLUXUS G721**-F20*A G721**-F20*S	FLUXUS G722**-NN0*A G722**-NN0*S	FLUXUS G722**-A20*A G722**-A20*S	FLUXUS G722**-F20*A G722**-F20*S
• FM							
marking		-	-	G721**-F20**2, G721**-F20**3:  NI/Cl. I,II,III/ Div. 2/GP. A,B,C,D,E, F,G/ T5 G721**-F20**1:  NI/Cl. I,II,III/ Div. 2/GP. A,B,C,D,E, F,G/ T4A	-	-	G722**-F20**2, G722**-F20**3:  NI/Cl. I,II,III/ Div. 2/GP. A,B,C,D,E, F,G/ T5 G722**-F20**1:  NI/Cl. I,II,III/ Div. 2/GP. A,B,C,D,E, F,G/ T4A
measuring functions							
physical quantities		operating volumetric flow rate, standard volumetric flow rate, mass flow rate, flow velocity, gas energy flow rate (NGE)					
totaliser		volume, mass, gas energy (NGE)					
calculation functions		average, difference, sum (2 measuring channels necessary)					
diagnostic functions		sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times					
communication interfaces							
service interfaces		measured value transmission, parametrisation of the transmitter: • USB ² • LAN ²					
process interfaces		max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • M-Bus • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • M-Bus • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP
accessories							
data transmission kit		USB cable					
software		• FluxDiagReader: reading of measured values and parameters, graphical presentation • FluxDiag (optional): reading of measurement data, graphical presentation, report generation, parametrisation of the transmitter					
data logger							
loggable values		all physical quantities, totalised physical quantities and diagnostic values					
capacity		max. 800 000 measured values					
outputs							
		The outputs are galvanically isolated from the transmitter.					
number		on request					
• switchable current output							
		All switchable current outputs are jointly switched to active or passive.					
range	mA	4...20 (3.2...22)					
accuracy		0.04 % MV ±3 µA					
active output		R _{ext} < 350 Ω					
passive output		U _{ext} = 8...30 V, depending on R _{ext} (R _{ext} < 1 kΩ at 30 V)					
• HART							
range	mA	4...20					
accuracy		0.1 % MV ±15 µA					
active output		U _{int} = 24 V, R _{ext} < 500 Ω					
passive output		U _{ext} = 10...24 V DC, depending on R _{ext} (R _{ext} < 1 kΩ at 24 V)					
• voltage output							
range	V	0...1 or 0...10					
accuracy		0...1 V: 0.1 % MV ±1 mV 0...10 V: 0.1 % MV ±10 mV					
internal resistance		R _{int} = 500 Ω					
• frequency output							
range	kHz	0...5					
optorelay		24 V/4 mA, R _{int} = 66.5 Ω					

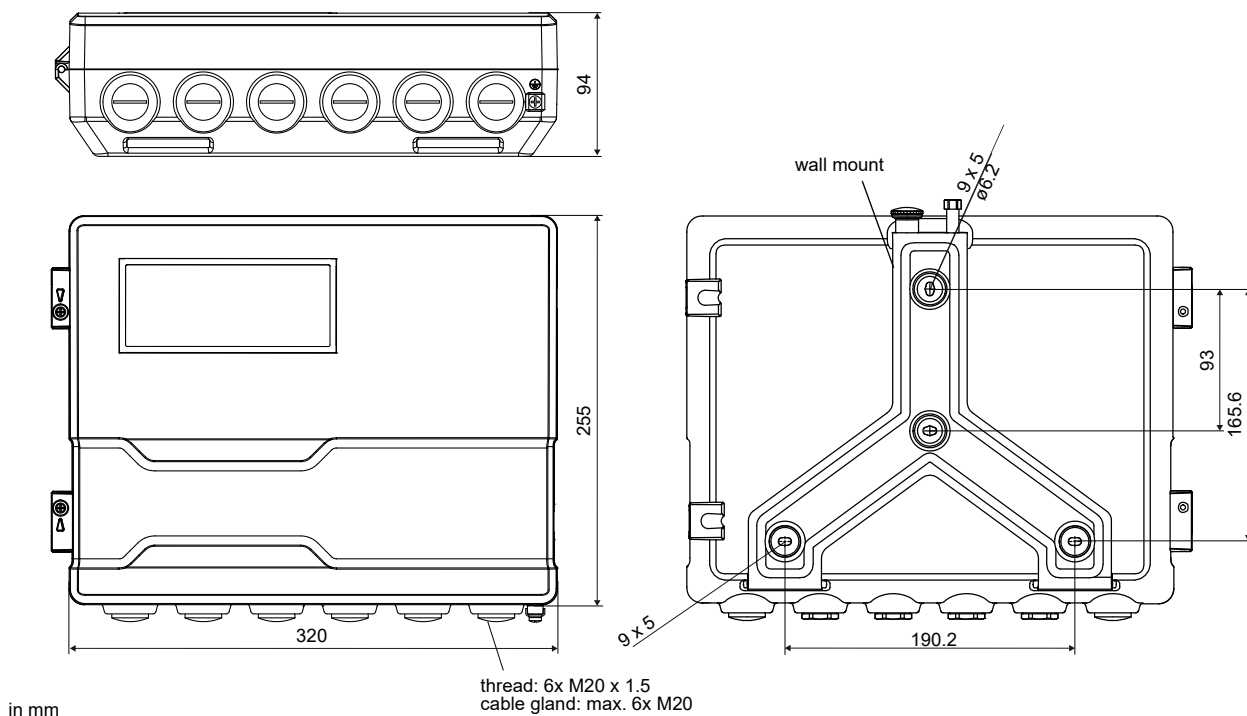
¹ with aperture calibration of the transducers² outside the explosive atmosphere (housing cover open)

		FLUXUS G721**-NN0*A G721**-NN0*S	FLUXUS G721**-A20*A G721**-A20*S	FLUXUS G721**-F20*A G721**-F20*S	FLUXUS G722**-NN0*A G722**-NN0*S	FLUXUS G722**-A20*A G722**-A20*S	FLUXUS G722**-F20*A G722**-F20*S
• binary output							
optorelay		26 V/100 mA			-		
Reed relay		48 V/100 mA, R _{int} = 22 Ω			-		
binary output as alarm output							
• functions		limit, change of flow direction or error			-		
binary output as pulse output							
• functions		mainly for totalising			-		
• pulse value	units	0.01...1000			-		
• pulse width	ms	optorelay: 1...1000 Reed relay: 80...1000			-		
• digital output							
functions		-			• frequency output • binary output • pulse output		
number		-			3		
operating parameters		-			5...30 V/< 100 mA		
frequency output							
• range	kHz	-			0...5		
binary output							
• binary output as alarm output		-			limit, change of flow direction or error		
pulse output							
• functions		-			mainly for totalising		
• pulse value	units	-			0.01...1000		
• pulse width	ms	-			0.05...1000		
inputs							
		The inputs are galvanically isolated from the transmitter.					
number		max. 4, on request					
• temperature input							
type		Pt100/Pt1000					
connection		4-wire					
range	°C	-150...+560					
resolution	K	0.01					
accuracy		±0.01 % MV ±0.03 K					
• current input							
accuracy		0.1 % MV ±10 µA					
active input		U _{int} = 24 V, R _{int} = 50 Ω, P _{int} < 0.5 W, not short-circuit proof					
• range	mA	0...20					
passive input		R _{int} = 50 Ω, P _{int} < 0.3 W					
• range	mA	-20...+20					
• voltage input							
range	V	0...1					
accuracy		0.1 % MV ±1 mV					
internal resistance		R _{int} = 1 MΩ					
• binary input							
switching signal		5...30 V, 1 mA		5...26 V, 1 mA	5...30 V, 1 mA		5...26 V, 1 mA
functions		• reset of the measured values • reset of the totalisers • stop of the totalisers • activation of the measuring mode for highly dynamic flows					

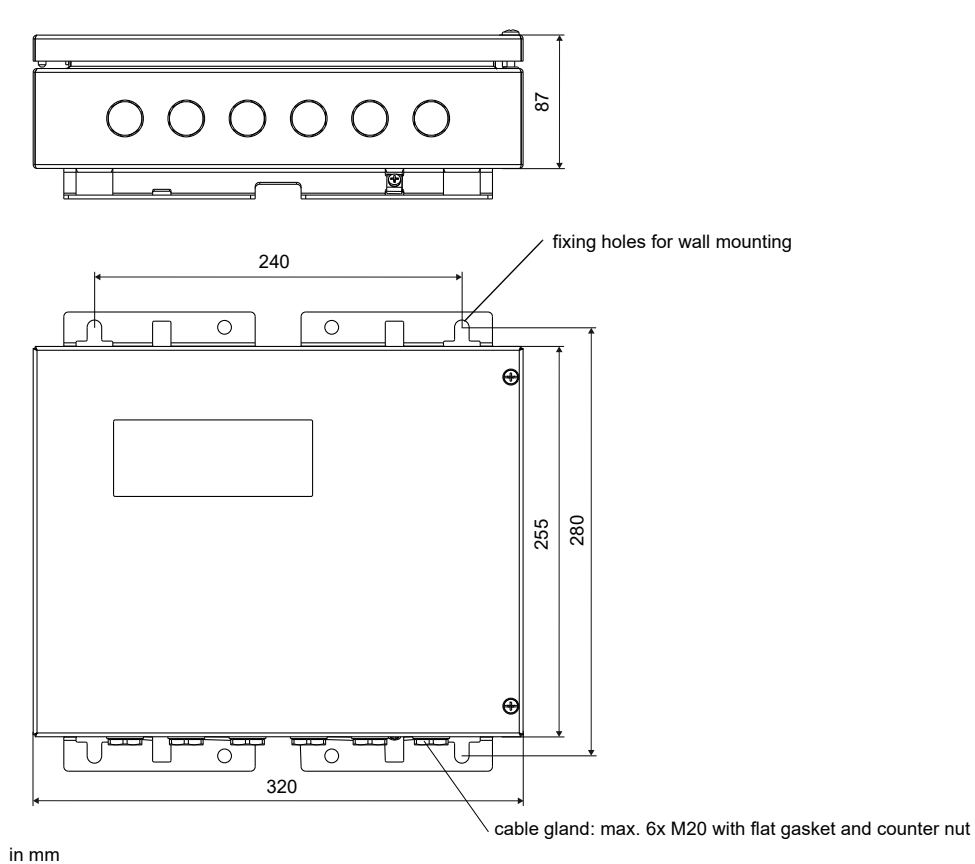
¹ with aperture calibration of the transducers² outside the explosive atmosphere (housing cover open)

Dimensions

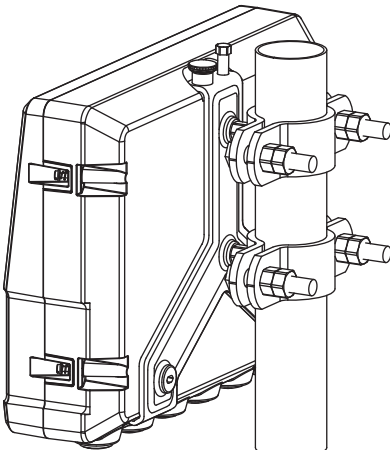
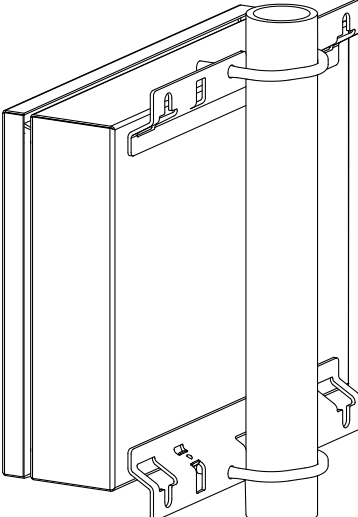
72-****A**



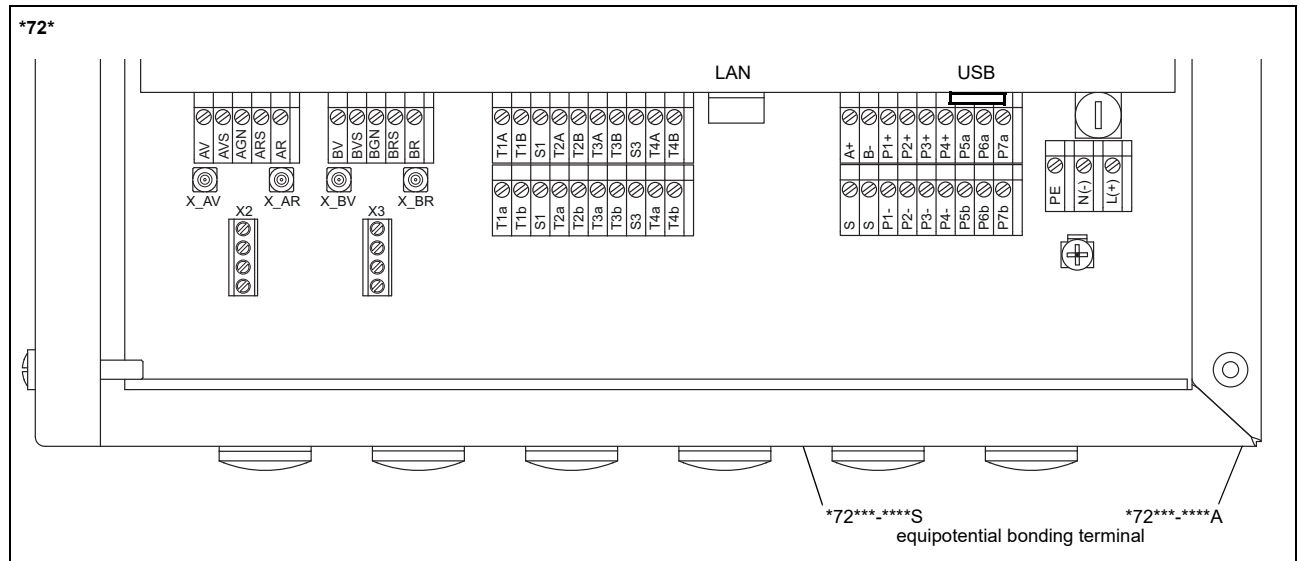
72-****S**



2" pipe mounting kit

*72***.****A 	order code: ACC-PE-*721-/PMK4
*72***.****S 	order code: ACC-PE-*721-/PMK6

Terminal assignment



power supply ¹							
terminal		connection (AC)		connection (DC)			
PE		earth		earth			
N(-)		neutral		-			
L(+)		phase		+			
transducers							
transducer cable (transducers ***** ¹ , ****LI ¹), extension cable					transducer cable (transducers ***** ²)		
measuring channel A		measuring channel B			measuring channel A	measuring channel B	
terminal	connection	terminal	connection	transducer	terminal		connection
AV	signal	BV	signal	↑	X_AV	X_BV	SMB connector
AVS	shield	BVS	shield				
ARS	shield	BRS	shield	↗	X_AR	X_BR	SMB connector
AR	signal	BR	signal				
outputs ^{1, 2}							
terminal		connection		terminal	connection	communication interface	
P1+...P4+ P1-...P4-		current output, voltage output, frequency output, binary output (Reed relay), HART (P1)		A+	signal +	• RS485¹ • Modbus RTU¹ • BACnet MS/TP¹ • M-Bus¹ • Profibus PA¹ • FF H1¹	
				B-	signal -		
P5a...P7a P5b...P7b		binary output (optorelay), digital output		S	shield		
				USB	type B Hi-Speed USB 2.0 Device	• service (FluxDiag/FluxDiagReader)	
				LAN	RJ45 10/100 Mbps Ethernet	• service (FluxDiag/FluxDiagReader) • BACnet IP • Modbus TCP	
analog inputs ^{1, 2}							
		temperature probe		passive sensor		active sensor	
terminal	direct connection	connection with extension cable		connection		connection	
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, 2}							
terminal							
P1+...P2+, P1-...P2-							

¹ cable (by customer):

- e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm²
- outer diameter of the cable (*72***-****S with ferrite nut): max. 7.6 mm

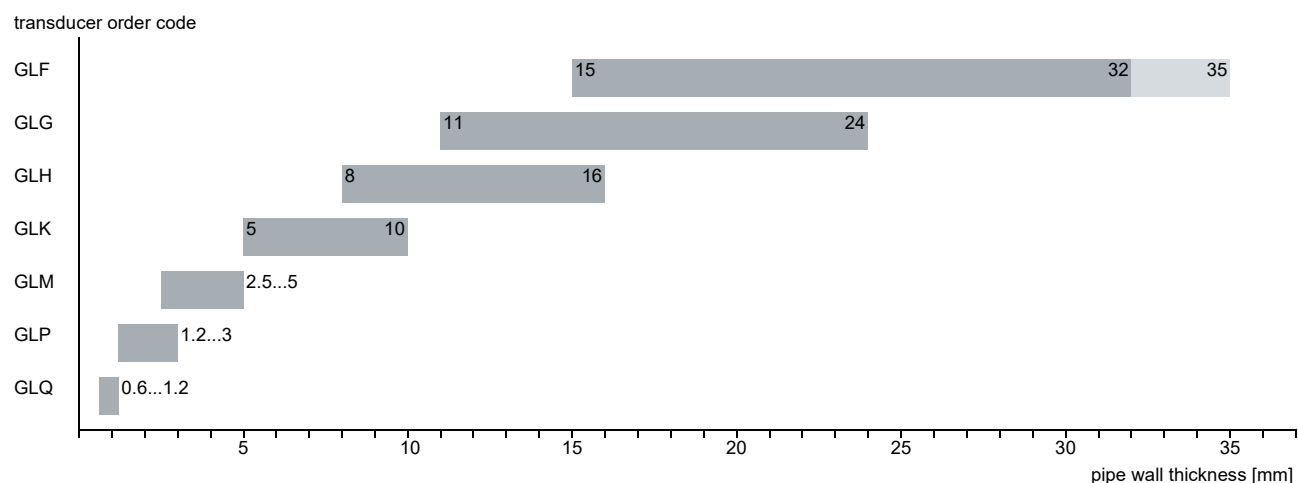
² The number, type and terminal assignment are customised.

Transducers

Transducer selection

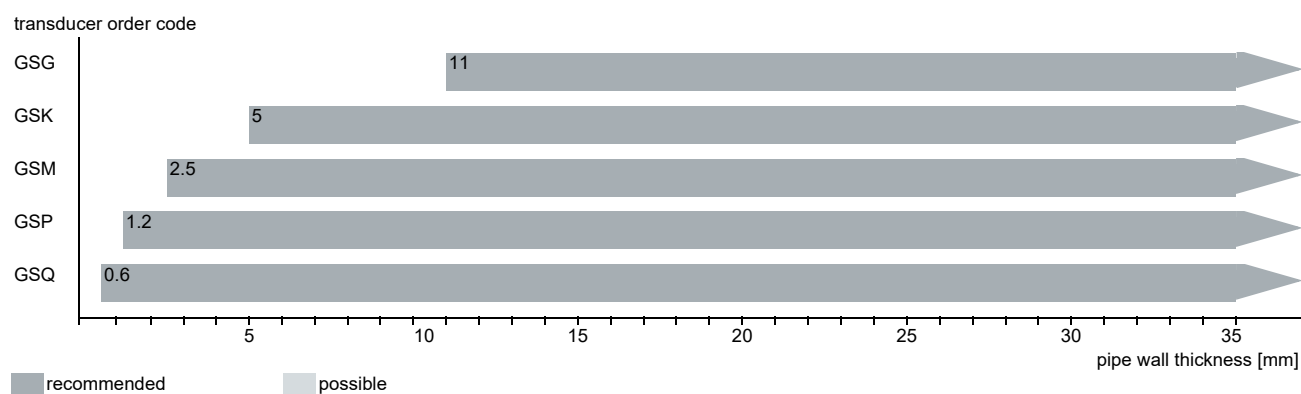
Step 1a

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:

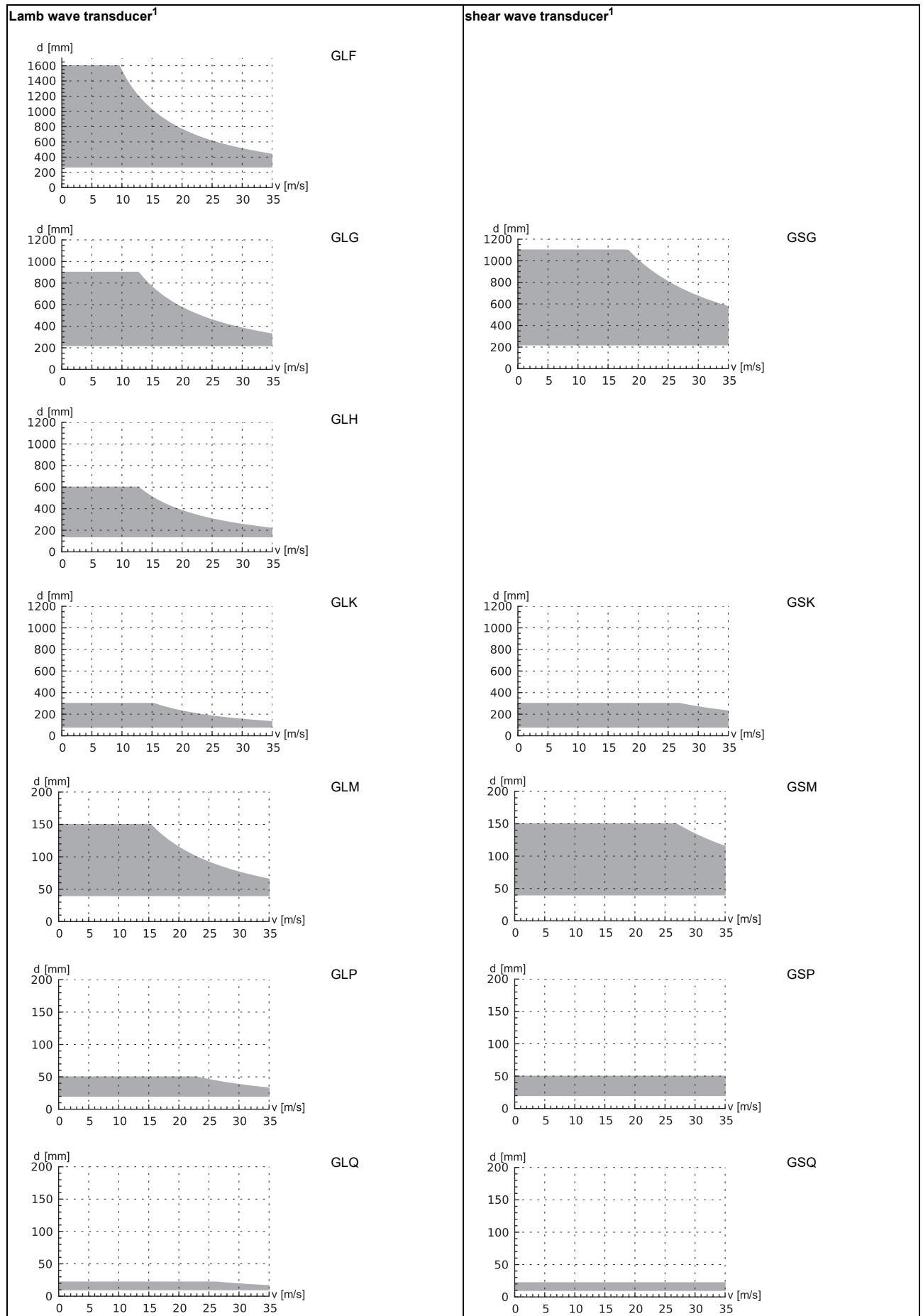


Step 2

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.



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

Step 3

min. fluid pressure

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

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

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

d - inner pipe diameter

Example

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

Step 4

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

Step 5

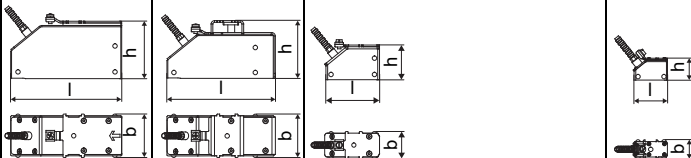
for the technical data of the selected transducer see page 16 et seqq.

Transducer order code

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

Technical data

Shear wave transducers (zone 2 - FM Class I Div. 2 - nonEx, TS)

order code		GSG-N**TS/**	GSK-N**TS/**	GSM-N**TS/**	GSP-N**TS/**	GSQ-N**TS/**
technical type		G(DL)G1N52	G(DL)K1N52	G(DL)M2N52	G(DL)P2N52	G(DL)Q2N52
transducer frequency	MHz	0.2	0.5	1	2	4
fluid pressure ¹						
min. extended	bar	metal pipe: 20				
min.	bar	metal pipe: 30, plastic pipe: 1				
inner pipe diameter d ²						
min. extended	mm	180	60	30	15	7
min. recommended	mm	220	80	40	20	10
max. recommended	mm	900	300	150	50	22
max. extended	mm	1100	360	180	60	30
pipe wall thickness						
min.	mm	11	5	2.5	1.2	0.6
material						
housing		PEEK with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)				
contact surface		PEEK				
degree of protection		IP67				
transducer cable						
type		1699				
length	m	5		4		3
length (***-*****/LC)	m	9				
dimensions						
length l	mm	129.5	126.5	64		40
width b	mm	51	51	32		22
height h	mm	67	67.5	40.5		25.5
dimensional drawing						
weight (without cable)	kg	0.47	0.36	0.066		0.016
pipe surface temperature						
min.	°C	-40				
max.	°C	+130				
ambient temperature						
min.	°C	-40				
max.	°C	+130				
temperature compensation		x				
explosion protection						
• ATEX/IECEx						
order code		GSG-NA2TS/**	GSK-NA2TS/**	GSM-NA2TS/**	GSP-NA2TS/**	GSQ-NA2TS/**
pipe surface temperature (Ex)						
• min.	°C	-55				
• max.	°C	gas: +190, dust: +180				
marking		CE 0637 Ex II 3G II 2D Ex nA IIC T6...T3 Gc Ex tb IIIC T80 °C...T185 °C Db				
certification ATEX		IBExU10ATEX1163 X				
certification IECEx		IECEx IBE 12.0005X				
• FM						
order code		GSG-NF2TS/**	GSK-NF2TS/**	GSM-NF2TS/**	GSP-NF2TS/**	GSQ-NF2TS/**
pipe surface temperature (Ex)						
• min.	°C	-40				
• max.	°C	+125 +190				
degree of protection		IP66				
marking		 NI/CI. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860				

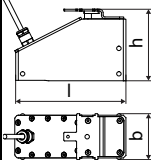
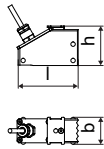
¹ depending on the application, typical absolute value for natural gas, nitrogen, compressed air

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 - nonEx, TS, IP68)

order code		GSG-N**TS/IP68	GSK-N**TS/IP68	GSM-N**TS/IP68	GSP-N**TS/IP68
technical type		GDG1LI8	GDK1LI8	GDM2LI8	GDP2LI8
transducer frequency	MHz	0.2	0.5	1	2
fluid pressure ¹					
min. extended	bar	metal pipe: 20			
min.	bar	metal pipe: 30, plastic pipe: 1			
inner pipe diameter d ²					
min. extended	mm	180	60	30	15
min. recommended	mm	220	80	40	20
max. recommended	mm	900	300	150	50
max. extended	mm	1100	360	180	60
pipe wall thickness					
min.	mm	11	5	2.5	1.2
material					
housing		PEEK with stainless steel cover 316Ti (1.4571)			
contact surface		PEEK			
degree of protection		IP68 ³			
transducer cable					
type		2550			
length	m	12			
dimensions					
length l	mm	130		72	
width b	mm	54		32	
height h	mm	83.5		46	
dimensional drawing					
weight (without cable)	kg	0.43		0.085	
pipe surface temperature					
min.	°C	-40			
max.	°C	+100			
ambient temperature					
min.	°C	-40			
max.	°C	+100			
temperature compensation		x			
explosion protection					
• ATEX/IECEx					
order code		GSG-NA2TS/IP68	GSK-NA2TS/IP68	GSM-NA2TS/IP68	GSP-NA2TS/IP68
pipe surface temperature (Ex)					
• min.	°C	-40			
• max.	°C	gas: +90, dust: +80			
marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T5 Gc Ex tb IIIC T80 °C...T85 °C Db			
certification ATEX		IBExU10ATEX1163 X			
certification IECEx		IECEx IBE 12.0005X			

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

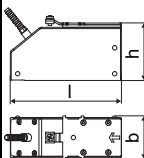
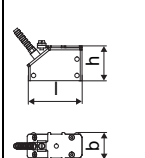
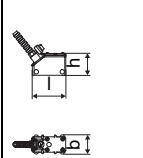
² shear wave transducer:

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 2 - FM Class I Div. 2 - nonEx, TS, extended temperature range)

order code		GSG-ENNTS/**	GSK-ENNTS/**	GSM-E**TS/**	GSP-E**TS/**	GSQ-E**TS/**
technical type		G(DL)G1E52	G(DL)K1E52	G(DL)M2E52	G(DL)P2E52	G(DL)Q2E52
transducer frequency	MHz	0.2	0.5	1	2	4
fluid pressure ¹						
min. extended	bar	metal pipe: 20		metal pipe: 20		
min.	bar	metal pipe: 30, plastic pipe: 1		metal pipe: 30, plastic pipe: 1		
inner pipe diameter d ²						
min. extended	mm	180	60	30	15	7
min. recommended	mm	220	80	40	20	10
max. recommended	mm	900	300	150	50	22
max. extended	mm	1100	360	180	60	30
pipe wall thickness						
min.	mm	11	5	2.5	1.2	0.6
material						
housing		PPSU with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)		PI with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)		
contact surface		PPSU		PI		
degree of protection		IP65		IP56		
transducer cable						
type		1699		6111		
length	m	5		4		3
length (***-*****/LC)	m	9		9		
dimensions						
length l	mm	129.5		64		40
width b	mm	51		32		22
height h	mm	67		40.5		25.5
dimensional drawing						
weight (without cable)	kg	0.82		0.066		0.017
pipe surface temperature						
min.	°C	-40		-30		-30
max.	°C	+180		+240 ³		+200
ambient temperature						
min.	°C	-40		-30		-30
max.	°C	+180		+40 +60 ⁴ +200 ⁵		+200
temperature compensation		x		x		
explosion protection						
• ATEX/IECEx						
order code		-	-	GSM-EA2TS/**	GSP-EA2TS/**	GSQ-EA2TS/**
pipe surface temperature (Ex)						
• min.	°C	-	-	-45		
• max.	°C	-	-	gas: +235 ³ , dust: +225 ³		
marking		-	-	CE 0637 Ex II 3G II 2D Ex nA IIC T6...T2 Gc Ex tb IIIA T80 °C...230 °C Db		
certification ATEX		-	-	IBExU10ATEX1163 X		
certification IECEx		-	-	IECEx IBE 12.0005X		
• FM						
order code		-	-	GSM-EF2TS/**	GSP-EF2TS/**	GSQ-EF2TS/**
pipe surface temperature (Ex)						
• min.	°C	-	-	-40		
• max.	°C	-	-	+235 ³		
degree of protection		-	-	IP66		
marking		-	-	 NI/CI. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwa 3860		

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

² shear wave transducer:

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

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

³ > +200 °C:

Variofix C without cover or Variofix L

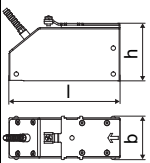
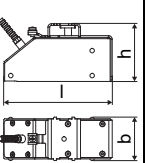
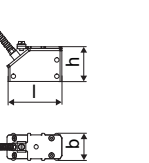
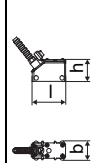
observe the insulation instruction

Ex: ambient temperature max. +40 °C

⁴ pipe surface temperature +200...+240 °C: Variofix C without cover

⁵ pipe surface temperature max. +200 °C

Shear wave transducers (zone 1, TS)

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

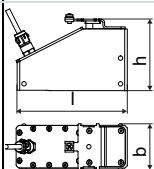
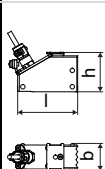
¹ depending on the application, typical absolute value for natural gas, nitrogen, compressed air

² shear wave transducer:

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

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

Shear wave transducers (zone 1, TS, IP68)

order code		GSG-N*1TS/IP68	GSK-N*1TS/IP68	GSM-N*1TS/IP68	GSP-N*1TS/IP68
technical type		GDG1LI1	GDK1LI1	GDM2LI1	GDP2LI1
transducer frequency	MHz	0.2	0.5	1	2
fluid pressure ¹					
min. extended	bar	metal pipe: 20			
min.	bar	metal pipe: 30, plastic pipe: 1			
inner pipe diameter d ²					
min. extended	mm	180	60	30	15
min. recommended	mm	220	80	40	20
max. recommended	mm	900	300	150	50
max. extended	mm	1100	360	180	60
pipe wall thickness					
min.	mm	11	5	2.5	1.2
material					
housing		PEEK with stainless steel cover 316Ti (1.4571)			
contact surface		PEEK			
degree of protection		IP68 ³			
transducer cable					
type		2550			
length	m	12			
dimensions					
length l	mm	130		72	
width b	mm	54		32	
height h	mm	83.5		46	
dimensional drawing					
weight (without cable)	kg	0.43		0.085	
pipe surface temperature					
min.	°C	-40			
max.	°C	+100			
ambient temperature					
min.	°C	-40			
max.	°C	+100			
temperature compensation		x			
explosion protection					
• ATEX/IECEx					
order code		GSG-NA1TS/IP68	GSK-NA1TS/IP68	GSM-NA1TS/IP68	GSP-NA1TS/IP68
pipe surface temperature (Ex)					
• min.	°C	-40			
• max.	°C	+80			
marking		CE 0637  II2G II2D Ex q IIC T6...T5 Gb Ex tb IIC T80 °C...T85 °C Db			
certification ATEX		IBExU07ATEX1168 X			
certification IECEx		IECEx IBE 08.0007X			

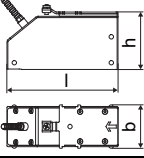
¹ depending on the application, typical absolute value for natural gas, nitrogen, compressed air² shear wave transducer:

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

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

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

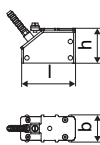
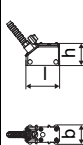
Shear wave transducers (zone 1, TS, extended temperature range)

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

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

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

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

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

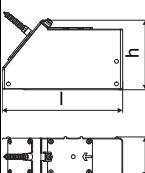
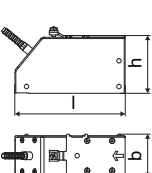
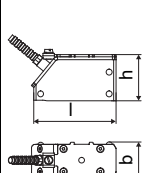
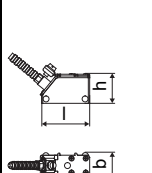
¹ depending on the application, typical absolute value for natural gas, nitrogen, compressed air

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

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

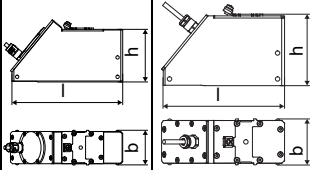
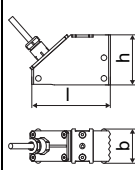
⁴ pipe surface temperature max. +200 °C

Lamb wave transducers (zone 2 - FM Class I Div. 2 - nonEx, TS)

order code		GLF-N**TS/**	GLG-N**TS/**	GLH-N**TS/**	GLK-N**TS/**	GLM-N**TS/**	GLP-N**TS/**	GLQ-N**TS/**
technical type		G(RT)F1N52	G(RT)G1N52	G(RT)H1N52	G(RT)K1N52	G(RT)M1N52	G(RT)P1N52	G(RT)Q1N52
transducer frequency	MHz	0.15	0.2	0.3	0.5	1	2	4
fluid pressure ¹								
min. extended	bar	metal pipe: 10			metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)	metal pipe: 3 (d < 60 mm)	metal pipe: 3 (d < 35 mm)	metal pipe: 3 (d < 15 mm)
min.	bar	metal pipe: 15 plastic pipe: 1			metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1	metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1	metal pipe: 10 (d > 15 mm) 5 (d < 15 mm) plastic pipe: 1
inner pipe diameter d ²								
min. extended	mm	220	180	110	60	30	15	7
min. recommended	mm	270	220	140	80	40	20	10
max. recommended	mm	1200	900	600	300	150	50	22
max. extended	mm	1600	1400	1000	360	180	60	30
pipe wall thickness								
min.	mm	15	11	8	5	2.5	1.2	0.6
max.	mm	32	24	16	10	5	3	1.2
max. extended	mm	35	-	-	-	-	-	-
material								
housing		PPSU with stainless steel cover 316Ti (1.4571)	PPSU with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)					
contact surface		PPSU						
degree of protection		IP54	IP67	IP65				
transducer cable								
type		1699						
length	m	5	4					3
length (***-*****/LC)	m	9						
dimensions								
length l	mm	163	128.5	74			42	
width b	mm	54	51	32			22	
height h	mm	91.3	67.5	40.5			25.5	
dimensional drawing								
weight (without cable)	kg	0.935	0.471	0.077			0.019	
pipe surface temperature								
min.	°C	-40						
max.	°C	+130						
ambient temperature								
min.	°C	-40						
max.	°C	+130						
temperature compensation		x						
explosion protection								
• ATEX/IECEx								
order code		GLF-NA2TS/**	GLG-NA2TS/**	GLH-NA2TS/**	GLK-NA2TS/**	GLM-NA2TS/**	GLP-NA2TS/**	GLQ-NA2TS/**
pipe surface temperature (Ex)								
• min.	°C	-50						
• max.	°C	gas: +165, dust: +155						
marking		CE 0637 Ex II 3G II 2D Ex nA IIC T6...T3 Gc Ex tb IIIA T80 °C...T160 °C Db		CE 0637 Ex II 3G II 2D Ex nA IIC T6...T3 Gc Ex tb IIIC T80 °C...T160 °C Db				
certification ATEX		IBExU10ATEX1163 X						
certification IECEx		IECEx IBE 12.0005X						
• FM								
order code		GLF-NF2TS/**	GLG-NF2TS/**	GLH-NF2TS/**	GLK-NF2TS/**	GLM-NF2TS/**	GLP-NF2TS/**	GLQ-NF2TS/**
pipe surface temperature (Ex)								
• min.	°C	-40						
• max.	°C	+165						
degree of protection		IP66						
marking		 NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860						

¹ depending on the application, typical absolute value for natural gas, nitrogen, compressed air² Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen; pipe diameters for other fluids on request
inner pipe diameter max. recommended: in reflection arrangement (diagonal arrangement) and for a flow velocity of 15 m/s (30 m/s)
inner pipe diameter max. extended: in reflection arrangement (diagonal arrangement) and for a flow velocity of 12 m/s (25 m/s)

Lamb wave transducers (zone 2 - nonEx, TS, IP68)

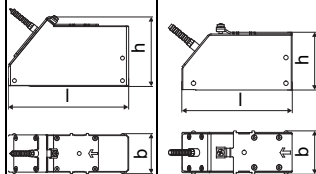
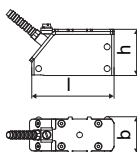
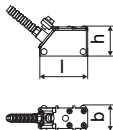
order code		GLF-N**TS/IP68	GLG-N**TS/IP68	GLH-N**TS/IP68	GLK-N**TS/IP68	GLM-N**TS/IP68	GLP-N**TS/IP68
technical type		GRF1LI8	GRG1LI8	GRH1LI8	GRK1LI8	GRM1LI8	GRP1LI8
transducer frequency	MHz	0.15	0.2	0.3	0.5	1	2
fluid pressure ¹							
min. extended	bar	metal pipe: 10			metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)	metal pipe: 3 (d < 60 mm)	metal pipe: 3 (d < 35 mm)
min.	bar	metal pipe: 15 plastic pipe: 1			metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1	metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1
inner pipe diameter d ²							
min. extended	mm	220	180	110	60	30	15
min. recommended	mm	270	220	140	80	40	20
max. recommended	mm	1200	900	600	300	150	50
max. extended	mm	1600	1400	1000	360	180	60
pipe wall thickness							
min.	mm	15	11	8	5	2.5	1.2
max.	mm	32	24	16	10	5	3
max. extended	mm	35	-	-	-	-	-
material							
housing		PPSU with stainless steel cover 316Ti (1.4571)					
contact surface		PPSU					
degree of protection		IP68 ³					
transducer cable							
type		2550					
length	m	12					
dimensions							
length l	mm	173	143.5			73	
width b	mm	54	54			31.6	
height h	mm	91.5	83.5			46	
dimensional drawing							
weight (without cable)	kg	1.36	0.639			0.093	
pipe surface temperature							
min.	°C	-40					
max.	°C	+100					
ambient temperature							
min.	°C	-40					
max.	°C	+100					
temperature compensation		x					
explosion protection							
• ATEX/IECEx							
order code		GLF-NA2TS/IP68	GLG-NA2TS/IP68	GLH-NA2TS/IP68	GLK-NA2TS/IP68	GLM-NA2TS/IP68	GLP-NA2TS/IP68
pipe surface temperature (Ex)							
• min.	°C	-40					
• max.	°C	gas: +90, dust: +80					
marking		CE 0637  II3G II2D Ex nA IIC T6...T5 Gc Ex tb IIIC T80 °C...T85 °C Db					
certification ATEX		IBExU10ATEX1163 X					
certification IECEx		IECEx IBE 12.0005X					

¹ depending on the 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)

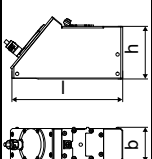
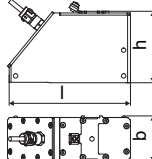
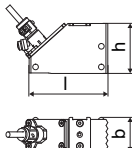
³ test conditions: 3 months/2 bar (20 m)/20 °C

Lamb wave transducers (zone 1, TS)

order code		GLF-N*1TS/**	GLG-N*1TS/**	GLH-N*1TS/**	GLK-N*1TS/**	GLM-N*1TS/**	GLP-N*1TS/**	GLQ-N*1TS/**
technical type		G(RT)F1N83	G(RT)G1N83	G(RT)H1N83	G(RT)K1N83	G(RT)M1N83	G(RT)P1N83	G(RT)Q1N83
transducer frequency	MHz	0.15	0.2	0.3	0.5	1	2	4
fluid pressure ¹								
min. extended	bar	metal pipe: 10			metal pipe: 10 (d > 120 mm) 3 (d < 120 mm)	metal pipe: 3 (d < 60 mm)	metal pipe: 3 (d < 35 mm)	metal pipe: 3 (d < 15 mm)
min.	bar	metal pipe: 15 plastic pipe: 1			metal pipe: 15 (d > 120 mm) 10 (d < 120 mm) plastic pipe: 1	metal pipe: 10 (d > 60 mm) 5 (d < 60 mm) plastic pipe: 1	metal pipe: 10 (d > 35 mm) 5 (d < 35 mm) plastic pipe: 1	metal pipe: 10 (d > 15 mm) 5 (d < 15 mm) plastic pipe: 1
inner pipe diameter d ²								
min. extended	mm	220	180	110	60	30	15	7
min. recommended	mm	270	220	140	80	40	20	10
max. recommended	mm	1200	900	600	300	150	50	22
max. extended	mm	1600	1400	1000	360	180	60	30
pipe wall thickness								
min.	mm	15	11	8	5	2.5	1.2	0.6
max.	mm	32	24	16	10	5	3	1.2
max. extended	mm	35	-	-	-	-	-	-
material								
housing		PPSU with stainless steel cover 304 (1.4301), ***-****/OS: 316L, 316Ti (1.4404, 1.4571)				PPSU with stainless steel cover 304 (1.4301), ***-****/OS: 316L (1.4404)		
contact surface		PPSU						
degree of protection		IP54				IP66		IP65
transducer cable								
type		1699						
length	m	5				4		3
length (***-****/LC)	m	9						
dimensions								
length l	mm	163	128.5			74	42	
width b	mm	54	51			32	22	
height h	mm	91.3	67.5			40.5	25.5	
dimensional drawing								
weight (without cable)	kg	0.935	0.471			0.077	0.019	
pipe surface temperature								
min.	°C	-40						
max.	°C	+130						
ambient temperature								
min.	°C	-40						
max.	°C	+130						
temperature compensation		x						
explosion protection								
• ATEX/IECEx								
order code		GLF-NA1TS/**	GLG-NA1TS/**	GLH-NA1TS/**	GLK-NA1TS/**	GLM-NA1TS/**	GLP-NA1TS/**	GLQ-NA1TS/**
pipe surface temperature (Ex)								
• min.	°C	-50						
• max.	°C	+155						
marking		CE0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIA T80 °C...T160 °C Db			CE0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIC T80 °C...T160 °C Db			
certification ATEX		IBExU07ATEX1168 X						
certification IECEx		IECEx IBE 08.0007X						

¹ depending on the application, typical absolute value for natural gas, nitrogen, compressed air² Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen; pipe diameters for other fluids on request
inner pipe diameter max. recommended: in reflection arrangement (diagonal arrangement) and for a flow velocity of 15 m/s (30 m/s)
inner pipe diameter max. extended: in reflection arrangement (diagonal arrangement) and for a flow velocity of 12 m/s (25 m/s)

Lamb wave transducers (zone 1, TS, IP68)

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

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

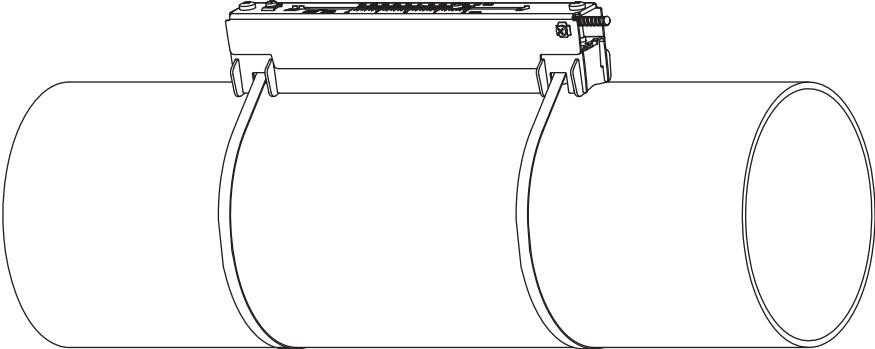
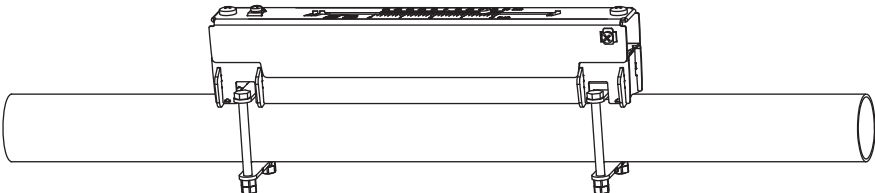
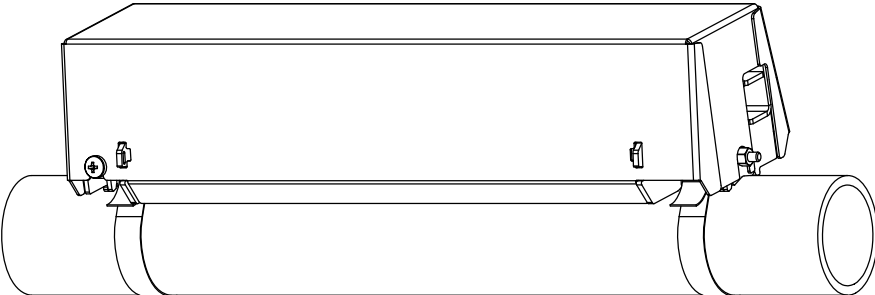
² Lamb wave transducer:
 typical values for natural gas, nitrogen, oxygen; pipe diameters for other fluids on request
 inner pipe diameter max. recommended: in reflection arrangement (diagonal arrangement) and for a flow velocity of 15 m/s (30 m/s)
 inner pipe diameter max. extended: in reflection arrangement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

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

Transducer mounting fixture

Order code

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

Variofix L (VLK, VLM, VLQ) 	material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006) option OS: 316Ti (1.4571), 316L (1.4404), 17-7PH (1.4568) inner length: VLK: 348 mm, option IP68: 368 mm VLM: 234 mm VLQ: 176 mm dimensions: VLK: 423 x 90 x 93 mm option IP68: 443 x 94 x 105 mm VLM: 309 x 57 x 63 mm VLQ: 247 x 43 x 47 mm
Variofix L with bolt mounting plates (VL*-**-B) 	material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006) option OS: 316Ti (1.4571), 316L (1.4404), 17-7PH (1.4568) inner length: VLM: 234 mm VLQ: 176 mm dimensions: VLM: 309 x 57 x 63 mm VLQ: 247 x 43 x 47 mm outer pipe diameter: max. 48 mm
Variofix C (VC) 	material: stainless steel 316Ti (1.4571) inner length: VCF-*L, VCK-*L: 500 mm VCF-*S, VCK-*S: 350 mm VCM: 400 mm VCQ: 250 mm dimensions: VCF-*L, VCK-*L: 560 x 126 x 125 mm VCF-*S, VCK-*S: 410 x 126 x 125 mm VCM: 460 x 96 x 82 mm VCQ: 310 x 85 x 71 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	200...240 °C
< 24 h	coupling compound type N or coupling foil type VT	coupling compound type E or coupling foil type VT	coupling compound type E or coupling foil type VT	coupling compound type E or H or coupling foil type VT	coupling foil type TF
long time measurement	coupling foil type VT	coupling foil type VT	coupling foil type VT	coupling foil type VT	coupling foil type TF

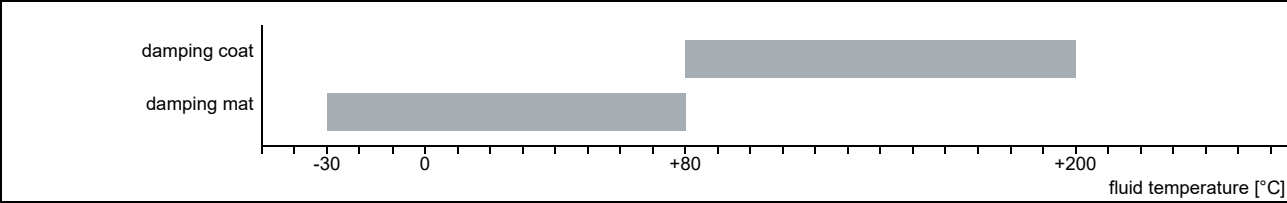
type VT: fluid temperature 200 °C: min. 2 years

Technical data

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

Damping material (optional)

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



Damping mats

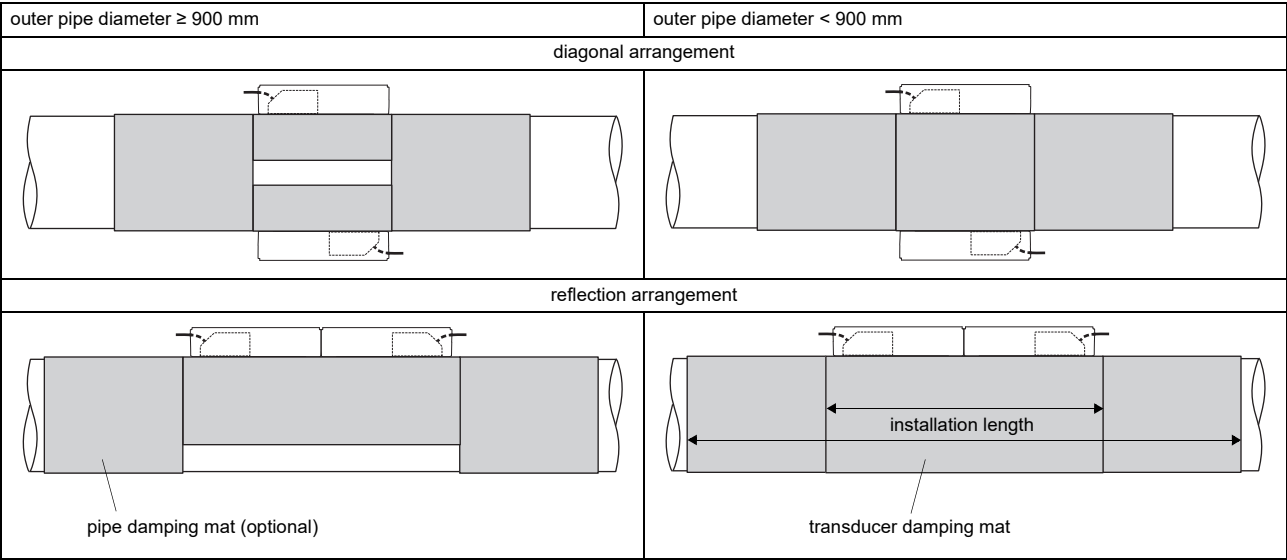
Damping mats will be used for the gas measurement to reduce acoustic noise influences on the measurement.

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

¹ calculation on the base of:

max. installation length (installation of one transducer mounting fixture per transducer in reflection arrangement) and
max. recommended pipe diameter (standard) or max. extended pipe diameter (extended)

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

Damping coat

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

Technical data

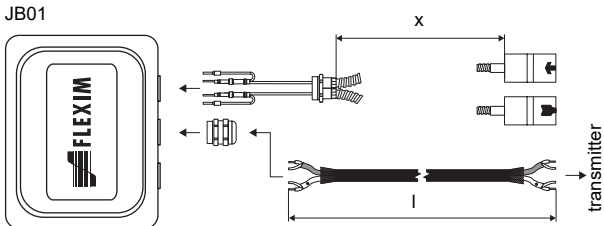
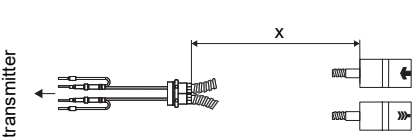
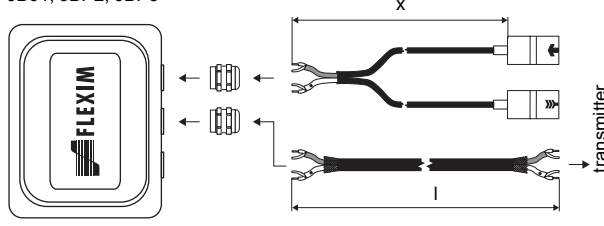
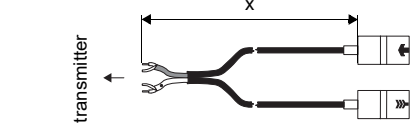
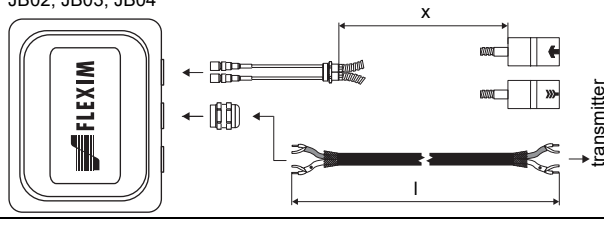
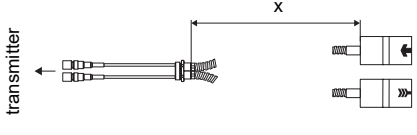
order code		ACC-PE-GNNN-/DPL1
material		multipolymeric matrix/inorganic ceramic coating
packing drum	I	1
properties		heat resistant, inert

Observe installation instructions (TI_DampingCoat).

Dimensioning

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

Connection systems

connection system TS		
connection with extension cable	direct connection	transducers technical type
JB01 		*****8*
JB01, JBP2, JBP3 		*****L*
JB02, JB03, JB04 		*****52

Cable

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

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

XXX - cable length in m

Cable length

transducer frequency		F, G, H, K	M, P	Q	S				
connection system TS									
transducers technical type		x	l	x	l	x	l	x	l
*(DR)***8*	m	5	≤ 300	4	≤ 300	3	≤ 90	-	-
option LC: *(LT)***8*	m	9	≤ 300	9	≤ 300	9	≤ 90	-	-
*(DR)***5*	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40
option LC: *(LT)***5*	m	9	≤ 300	9	≤ 300	9	≤ 90	-	-
option IP68: ****L*	m	12	≤ 300	12	≤ 300	-	-	-	-

x - transducer cable length

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

Junction box

Technical data

JB01S4E3M, JBP2, JBP3		
weight	kg	1.2 kg
fixation		wall mounting optional: 2" pipe mounting
material		
housing		stainless steel 316L (1.4404)
gasket		silicone
degree of protection		IP67
ambient temperature		
min.	°C	-40
max.	°C	+80
explosion protection		
• ATEX/IECEEx (zone 1)		
junction box		JB01S4E3M
marking		CE0637 Ex II2G II2D Ex eb mb IIC T6...T4 Gb Ex tb IIIC T100 °C Db Ta -40...+70/80 °C
certification ATEX		IBExU06ATEX1161
certification IECEEx		IECEEx IBE 08.0006
type of protection		gas: increased safety decoupled network: encapsulation dust: protection by enclosure
• ATEX (zone 2)		
junction box		JBP2
marking		CE Ex II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc IIIC T 100 °C Dc Ta -40...+(70)80 °C

Connection

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

Transducers

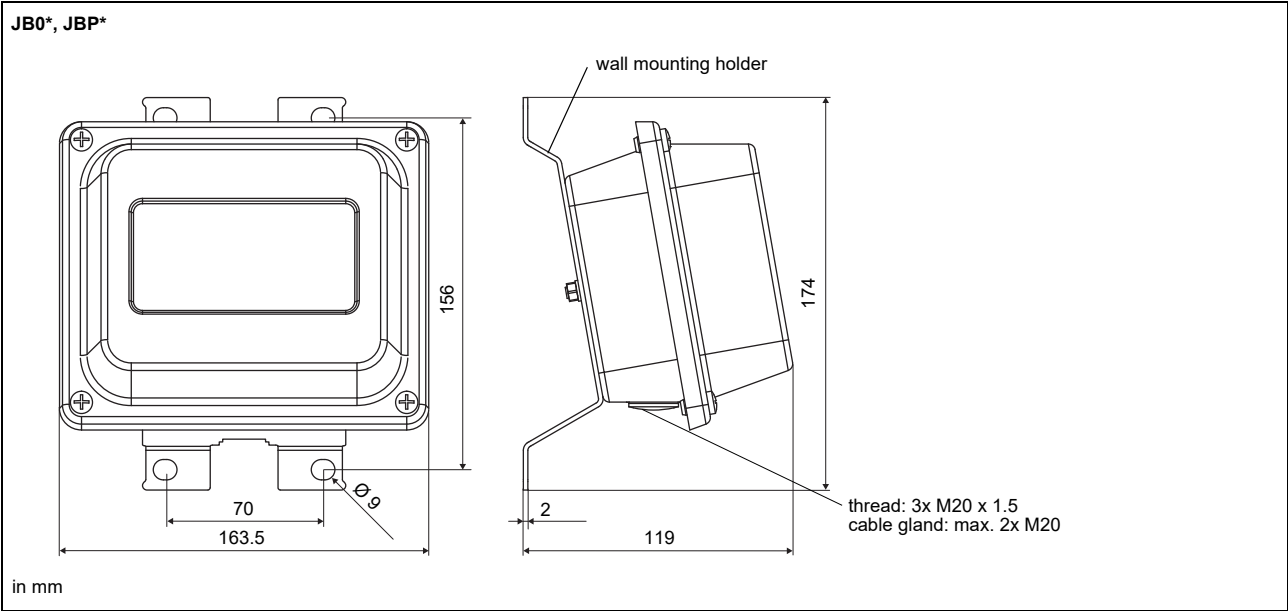
terminal strip	terminal	connection
KL2	TV	signal
	TVS	internal shield
	TRS	internal shield
	TR	signal

Extension cable

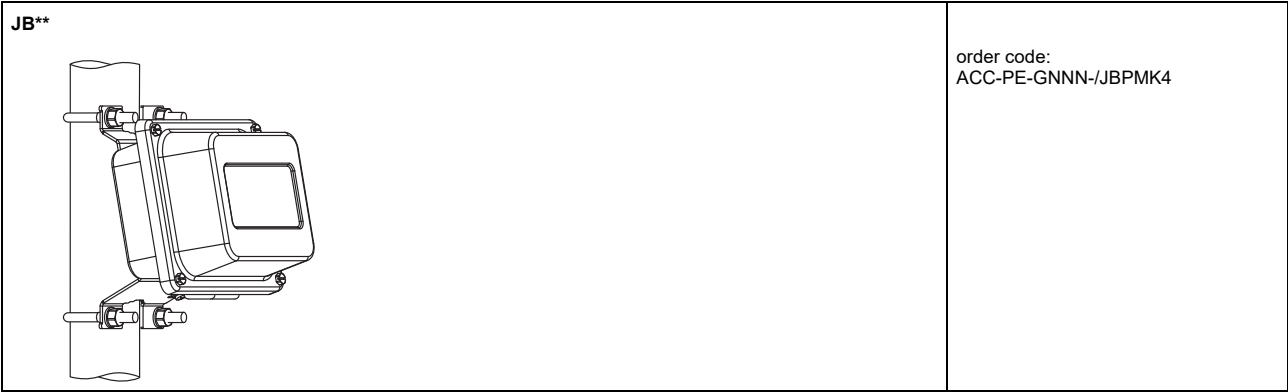
terminal strip	terminal	connection
KL2	TV	signal
	TVS	internal shield
	TRS	internal shield
	TR	signal

JB02, JB03, JB04		
weight	kg	1.2 kg
fixation		wall mounting optional: 2" pipe mounting
material		
housing		stainless steel 316L (1.4404)
gasket		silicone
degree of protection		IP67
ambient temperature		
min.	°C	-40
max.	°C	+80
explosion protection		
• ATEX		
junction box		JB02
marking		CE Ex II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc IIIC T 100 °C Dc Ta -40...+(70)80 °C
• FM		
junction box		JB04
marking		F111

Dimensions

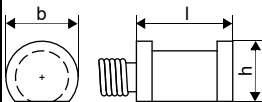


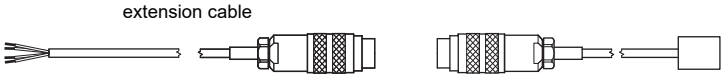
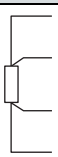
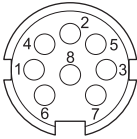
2" pipe mounting kit



Clamp-on temperature probe (optional)

Technical data

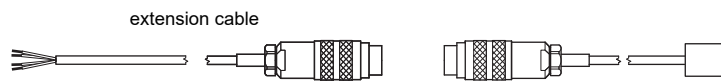
PT12N			
order code		- ACC-PO-#601-/T311 - ACC-PO-#601-/T511 (matched)	
design		clamp-on with connector	
type		Pt100	
connection		4-wire	
measuring range	°C	-30...+250	
accuracy T		$\pm(0.15\text{ °C} + 2 \cdot 10^{-3} \cdot T\text{ [°C]})$ class A	
accuracy ΔT (2x Pt matched according to EN 1434-1)		≤ 0.1 K (3 K < ΔT < 6 K), more corresponding to EN 1434-1	
response time	s	50 (t ₅₀ , T ₁ = 25 °C, T ₂ = 60 °C)	
housing		aluminum	
degree of protection		IP54	
dimensions			
length l	mm	20	
width b	mm	15	
height h	mm	13	
dimensional drawing			
weight	kg	0.25 (without connector)	
accessories			
thermal conductivity paste 200 °C		x	
thermal conductivity foil 250 °C		x	

Connection system				
direct connection/connection with extension cable				
				
Connection				
	temperature probe	extension cable	connector	
	red	grey	2	
	red/blue	red	6	
	white/blue	blue	1	
	white	white	7	

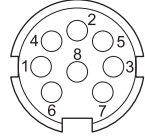
Cable			
		temperature probe	extension cable
type		4 x 0.22 mm ²	LIYCY 8 x 0.14 mm ²
standard length	m	3	5/10/25
max. length	m	-	200
ambient temperature	°C	-30...+250	-25...+80
min. bend radius	mm	27	68
cable jacket			
material		PFA	PVC
outer diameter	mm	3.8 ±0.15	4.8 ±2
colour		black	grey

Connection system

direct connection/connection with extension cable



Connection

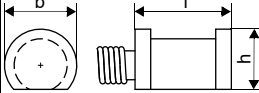
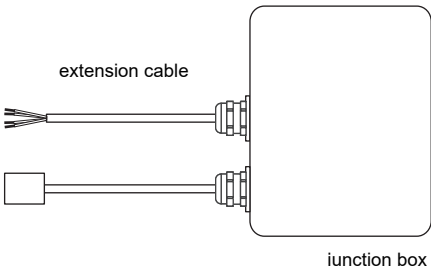
	temperature probe	extension cable	connector	
			pin	
	red	grey	2	
	red/blue	red	6	
	white/blue	blue	1	
	white	white	7	

Cable

		temperature probe	extension cable
type		4 x 0.22 mm ²	LIYCY 8 x 0.14 mm ²
standard length	m	3	5/10/25
max. length	m	-	200
ambient temperature	°C	-30...+250	-25...+80
min. bend radius	mm	27	68

cable jacket

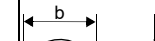
material		PFA	PVC
outer diameter	mm	3.8 ± 0.15	4.8 ± 2
colour		black	grey

PT12N						
order code		- ACC-PE-GNNN-/T312 - ACC-PE-GNNN-/T512 (matched)				
design		clamp-on				
type		Pt100				
connection		4-wire				
measuring range	°C	-30...+250				
accuracy T		±(0.15 °C + 2 · 10 ⁻³ · T [°C]) class A				
accuracy ΔT (2x Pt matched according to EN 1434-1)		≤ 0.1 K (3 K < ΔT < 6 K), more corresponding to EN 1434-1				
response time	s	50 (t50, T1 = 25 °C, T2 = 60 °C)				
housing		aluminum				
degree of protection		IP54				
dimensions						
length l	mm	20				
width b	mm	15				
height h	mm	13				
dimensional drawing						
weight	kg	0.25				
accessories						
thermal conductivity foil 250 °C		x				
				Connection system		
				connection with extension cable 		direct connection 
				Connection		
				temperature probe red red/blue white/blue white		
				Cable		
				temperature probe 4 x 0.22 mm² extension cable LIYCY 8 x 0.14 mm²		
				type standard length m 3 max. length m - ambient temperature °C -30...+250 min. bend radius mm 27		
				cable jacket material PFA outer diameter mm 3.8 ±0.15 colour black		
				extension cable 5/10/25 200 -25...+80 68		
PVC 4.8 ±2 grey						

PT12N

order code		• ACC-PE-GNNN-/T322 • ACC-PE-GNNN-/T522 (matched)
design		clamp-on ATEX
type		Pt100
connection		4-wire
measuring range	°C	-30...+250
accuracy T		$\pm(0.15^{\circ}\text{C} + 2 \cdot 10^{-3} \cdot T [^{\circ}\text{C}])$ class A
accuracy ΔT (2x Pt matched according to EN 1434-1)		$\leq 0.1 \text{ K}$ ($3 \text{ K} < \Delta T < 6 \text{ K}$), more corresponding to EN 1434-1
response time	s	50
housing		aluminum
degree of protection		IP67

dimensions

length l	mm	20
width b	mm	15
height h	mm	13
dimensional drawing		
weight	kg	0.25

weight
accessories

thermal conductivity foil 250 °C		x
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explosion protection	
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- ATEX

marking	  IIIG Ex nA IIC T6...T2 Gc Ta -30...+250 °C
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Connection system

connection with extension cable	direct connection
 extension cable junction box	 direct connection

Connection

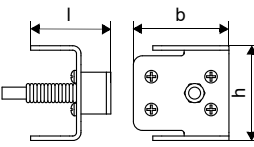
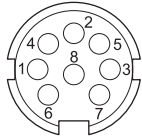
	temperature probe
	red
	red/blue
	white
	white/blue

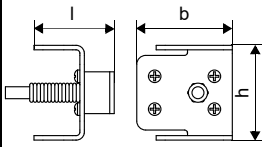
Cable

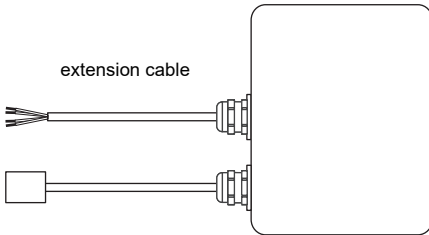
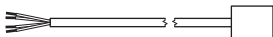
		temperature probe	extension cable
type		4 x 0.25 mm²	LIYCY 8 x 0.14 mm²
standard length	m	3	5/10/25
max. length	m	-	200
ambient temperature	°C	-30...+250	-25...+80
min. bend radius	mm	19	68

cable jacket

material		PTFE	PVC
outer diameter	mm	3.8	4.8 ±2
colour		black	grey

PT12F			
order code		• ACC-PO-#601-/T111 • ACC-PO-#601-/T211 (matched)	
design		clamp-on short response time, with connector	
type		Pt100	
connection		4-wire	
measuring range	°C	-50...+250	
accuracy T		±(0.15 °C + 2 · 10 ⁻³ · T [°C]) class A	
accuracy ΔT (2x Pt matched according to EN 1434-1)		≤ 0.1 K (3 K < ΔT < 6 K), more corresponding to EN 1434-1	
response time	s	8 (t50, T1 = 25 °C, T2 = 60 °C)	
housing		PEEK, stainless steel 304 (1.4301), copper	
degree of protection		IP54	
dimensions			
length l	mm	14	
width b	mm	30	
height h	mm	27	
dimensional drawing			
weight	kg	0.32 (without connector)	
accessories			
thermal conductivity paste 200 °C		x	
thermal conductivity foil 250 °C		x	
plastic protection plate, insulation foam		x	
Connection system			
			
Connection			
	temperature probe	extension cable	connector
			pin
	red	grey	2
	red/blue	red	6
	white/blue	blue	1
	white	white	7
			
Cable			
		temperature probe	extension cable
type		4 x 0.22 mm ²	LIYCY 8 x 0.14 mm ²
standard length	m	3	5/10/25
max. length	m	-	200
ambient temperature	°C	-50...+250	-25...+80
min. bend radius	mm	27	68
cable jacket			
material		PFA	PVC
outer diameter	mm	3.8 ±0.15	4.8 ±2
colour		black	grey

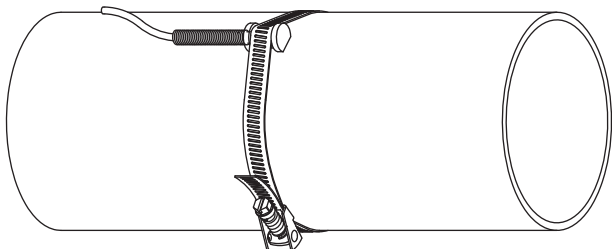
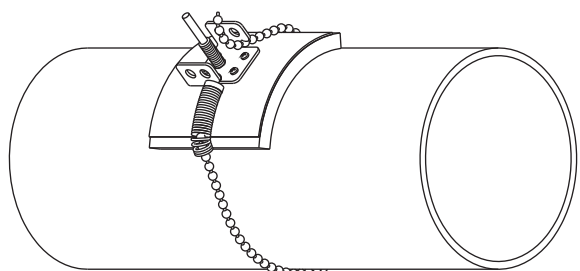
PT12F		
order code		• ACC-PE-GNNN-/T112
design		clamp-on short response time
type		Pt100
connection		4-wire
measuring range	°C	-50...+250
accuracy T		±(0.15 °C + 2 · 10 ⁻³ · T [°C]) class A
response time	s	8 (t50, T1 = 25 °C, T2 = 60 °C)
housing		PEEK, stainless steel 304 (1.4301), copper
degree of protection		IP54
dimensions		
length l	mm	14
width b	mm	30
height h	mm	27
dimensional drawing		
weight	kg	0.32
accessories		
thermal conductivity paste 200 °C		x
thermal conductivity foil 250 °C		x
plastic protection plate, insulation foam		x

Connection system	
connection with extension cable	direct connection
	
junction box	

Connection	
	temperature probe
	red
	red/blue
	white/blue
	white

Cable		
	temperature probe	extension cable
type	4 x 0.22 mm ²	LIYCY 8 x 0.14 mm ²
standard length	m	3
max. length	m	-
ambient temperature	°C	-50...+250
min. bend radius	mm	27
cable jacket		
material	PFA	PVC
outer diameter	mm	3.8 ±0.15
colour	black	grey

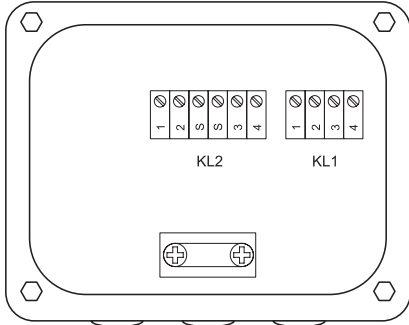
Fixation

tension strap PT12N 	material: stainless steel 301 (1.4310), 410 (1.4006) thermal insulation necessary
ball chain PT12F 	material: stainless steel 316L (1.4404) length: 1 m

Junction box

JBT2, JBT3		
order code		• JBT2: ACC-PE-GNNN-/JB4 • JBT3: ACC-PE-GNNN-/JB6
weight	kg	1.2 kg
fixation		wall mounting optional: 2" pipe mounting
material		
housing		stainless steel 316L (1.4404)
gasket		silicone
degree of protection		IP67
ambient temperature		
min.	°C	-40
max.	°C	+80
explosion protection		
• ATEX		
junction box		JBT2
marking		CE  II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc IIIC T 100 °C Dc Ta -40...+(70)80 °C

Connection



The diagram shows a rectangular junction box with four mounting holes at the corners. Inside, there are two terminal strips: KL2 on the left and KL1 on the right. Each strip has four terminals labeled 1, 2, 3, and 4. Below the terminal strips is a temperature probe connection symbol, consisting of a rectangle with two circles inside, each containing a cross.

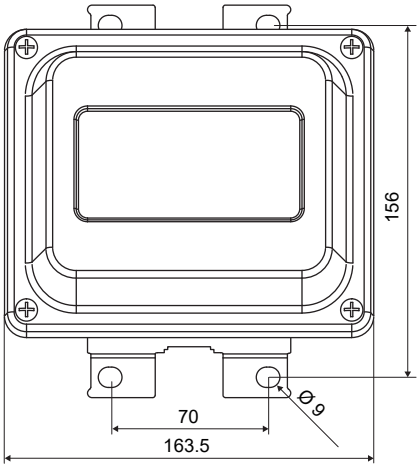
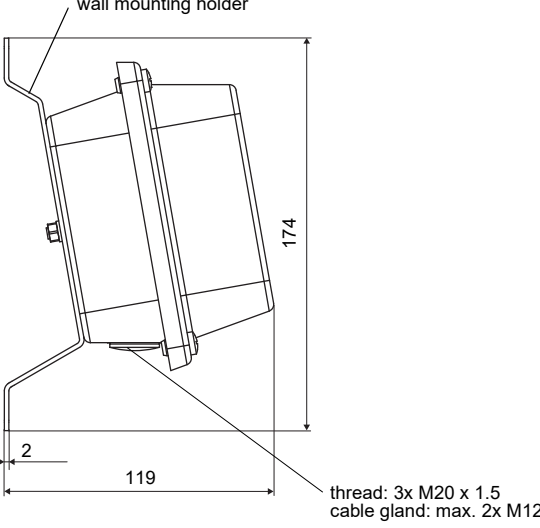
Temperature probe

terminal strip	terminal	connection
KL1	1	red
	2	red/blue
	3	white
	4	white/blue

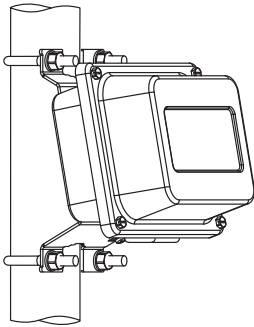
Extension cable

terminal strip	terminal	connection
KL2	1	red
	2	grey
	3	white
	4	blue

Dimensions

JBT*	
 in mm	 thread: 3x M20 x 1.5 cable gland: max. 2x M12

2" pipe mounting kit

JB** 	order code: ACC-PE-GNNN-/JBPMK4
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