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
- Installation and startup do not require any pipe work nor any process interruptions
- High measurement accuracy even at very low as well as very high flow rates and independent of the flow direction (bidirectional)
- Automatic loading of calibration data and transducer recognition
- Bidirectional communication and support of common bus technologies (Profibus PA, Foundation Fieldbus, HART, Modbus, BACnet)
- Advanced self-diagnosis and possibilities for event based triggering of data recording for the supervision and control of critical processes
- Transmitter and transducers for use in hazardous areas are available
- Transmitter and transducers are separately calibrated (traceable to national standards)
- 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 process pressure (min. 45 to 100 psi 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)

Applications

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

FLUXUS G721**-****A

FLUXUS G721**-****S

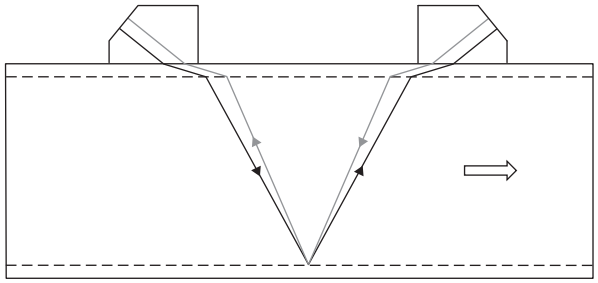
PermaRail

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.

Path of the ultrasonic signal in the flowing fluid

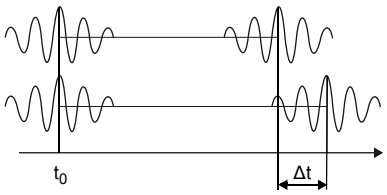


As the fluid where the ultrasound propagates is flowing, the transit time of the ultrasonic signal in flow direction is shorter than the one against the flow direction.

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.

Transit time difference Δt



Calculation of volumetric flow rate

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

where

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

Number of sound paths

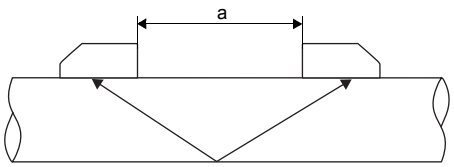
The number of sound paths is the number of transits of the ultrasonic signal through the fluid in the pipe. Depending on the number of sound paths, the following methods of installation exist:

- **reflect arrangement**
  The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easier.
- **diagonal arrangement**
  The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe.
- **direct mode**
  Diagonal arrangement with 1 sound path. This should be used in the case of a high signal attenuation by the fluid, pipe or coatings.

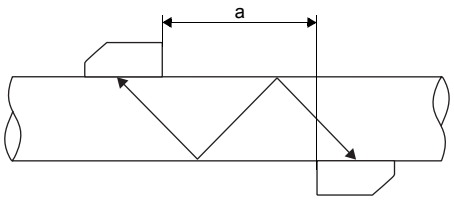
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

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

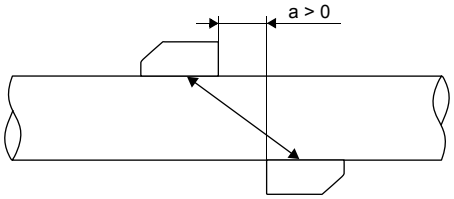
Reflect arrangement, number of sound paths: 2



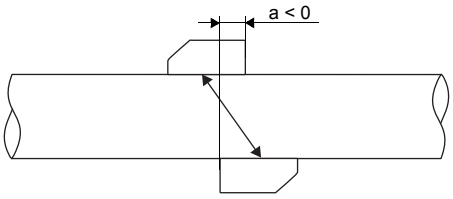
Diagonal arrangement, number of sound paths: 3



Direct mode, number of sound paths: 1



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



a - transducer distance

Standard volumetric flow rate

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

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

where

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

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

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

Transmitter

Technical data

		FLUXUS G721**-NN0*A	FLUXUS G721**-NN0*S	FLUXUS G721**-A20*S	FLUXUS G721**-F20*S
					
design		standard field device nonEx	field device with stainless steel housing nonEx	field device with stainless steel housing zone 2	field device with stainless steel housing FM Class I Div. 2
measurement					
measurement principle		transit time difference correlation principle			
flow velocity	ft/s	0.03 to 115 ft/s, depending on pipe diameter			
repeatability		0.15 % of reading ±0.03 ft/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		±1 to 3 % of reading ±0.03 ft/s contact Flexim for an application specific uncertainty evaluation ±0.5 % of reading ±0.03 ft/s with field calibration			
transmitter					
power supply		• 100 to 230 V/50 to 60 Hz or • 20 to 32 V DC or • 11 to 16 V DC			
power consumption	W	< 15			
number of measuring channels		1, optional: 2			
damping	s	0 to 100 (adjustable)			
measuring cycle	Hz	100 to 1000 (1 channel)			
response time	s	1 (1 channel), option: 0.02			
housing material		aluminum, powder coated	stainless steel 316L		
degree of protection		IP65	IP65	IP66	IP65
dimensions	in	see dimensional drawing			
weight	lb	11.9	11.2		
fixation		wall mounting, optional: 2" pipe mounting			
ambient temperature	°F	-4 to +131/140 °F	-4 to +131/140 °F	-40 to +140 °F (< -4 °F without operation of the display)	-4 to +131/140 °F
display		128 x 64 dots, backlight			
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish			
explosion protection					
• 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 to +60 °C	-
certification ATEX		-	-	IBExU11ATEX1015	-
certification IECEx		-	-	IECEx IBE 11.0008	-
• FM					
marking		-	-	-	G703Z2**1, G703Z2**2: NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T5 Ta = 60 °C G703Z2**9: NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T4A Ta = 55 °C

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

[2] with inputs and including parametrization of the transmitter

		FLUXUS G721-NN0*A**	**FLUXUS G721**-NN0*S**	**FLUXUS G721**-A20*S**	**FLUXUS G721**-F20*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			
communication interfaces					
service interfaces		measured value transmission, parametrization of the transmitter: • USB[1] • LAN[1]			
process interfaces		max. 1 option: • RS485 (ASCII sender) • Modbus RTU[2] • BACnet MS/TP • HART[2] • Profibus PA[2] • FF H1[2] • Modbus TCP[2] • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU[2] • BACnet MS/TP • HART[2] • Profibus PA[2] • FF H1[2] • Modbus TCP[2] • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU[2] • BACnet MS/TP • HART[2] • Profibus PA[2] • FF H1[2] • Modbus TCP[2] • BACnet IP	
accessories					
serial data kit		USB cable[1]			
software		• FluxDiagReader: download of measured values and parameters, graphical presentation • FluxDiag (optional): download of measurement data, graphical presentation, report generation, parametrization of the transmitter			
data logger					
loggable values		all physical quantities, totalized values and diagnostic values			
capacity		max. 800 000 measured values			
outputs					
		The outputs are galvanically isolated from the transmitter.			
number		on request			
• switchable current output					
		The switchable current outputs are menu selectable all together as passive or active.			
range	mA	4 to 20 (3.2 to 22)			
accuracy		0.04 % of reading ±3 μA			
active output		$R_{ext} < 350\ \Omega$			
passive output		U_{ext} = 8 to 30 V, depending on R_{ext} ($R_{ext} < 1\ k\Omega$ at 30 V)			
• HART					
range	mA	4 to 20			
accuracy		0.1 % of reading ±15 μA			
active output		$U_{int} = 24\ V$, $R_{ext} < 500\ \Omega$			
passive output		U_{ext} = 10 to 24 V DC, depending on R_{ext} ($R_{ext} < 1\ k\Omega$ at 24 V)			
• voltage output					
range	V	0 to 1 or 0 to 10			
accuracy		0 to 1 V: 0.1 % of reading ±1 mV 0 to 10 V: 0.1 % of reading ±10 mV			
internal resistance		$R_{int} = 500\ \Omega$			
• frequency output					
range	kHz	0 to 5			
optorelay		24 V/4 mA, $R_{int} = 66.5\ \Omega$			
• binary output					
optorelay		26 V/100 mA, $R_{int} = 22\ \Omega$			
Reed relay		48 V/100 mA, $R_{int} = 22\ \Omega$			
binary output as alarm output					
• functions		limit, change of flow direction or error			
binary output as pulse output					
• functions		mainly for totalizing			
• pulse value	units	0.01 to 1000			
• pulse width	ms	optorelay: 1 to 1000 Reed relay: 80 to 1000			

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

[2] with inputs and including parametrization of the transmitter

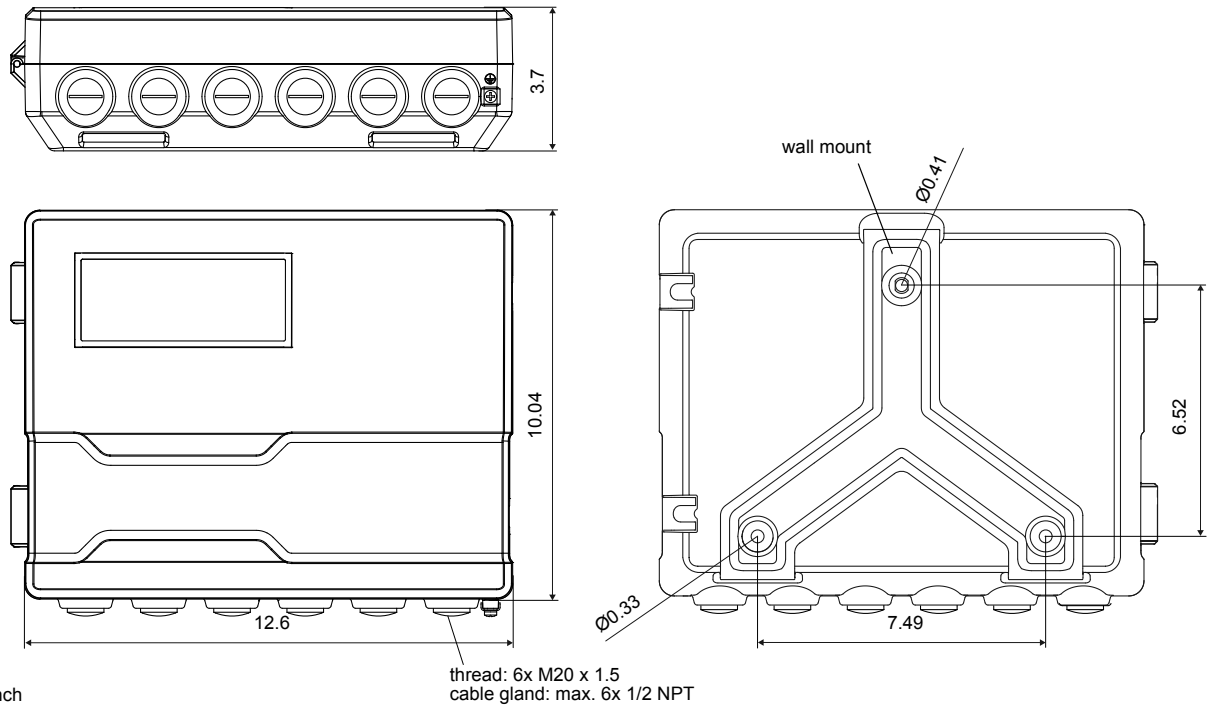
		FLUXUS G721**-NN0*A	FLUXUS G721**-NN0*S	FLUXUS G721**-A20*S	FLUXUS G721**-F20*S
inputs					
		The inputs are galvanically isolated from the transmitter.			
number		max. 4, on request			
• temperature input					
type		Pt100/Pt1000			
connection		4-wire			
range	°F	-238 to +1040			
resolution	K	0.01			
accuracy		±0.01 % of reading ±0.03 K			
• current input					
accuracy		0.1 % of reading ±10 µA			
active input • range	 mA	U_{int} = 24 V, R_{int} = 50 Ω, P_{int} < 0.5 W, not short-circuit proof 0 to 20			
passive input • range	 mA	R_{int} = 50 Ω, P_{int} < 0.3 W -20 to +20			
• voltage input					
range	V	0 to 1			
accuracy		0.1 % of reading ±1 mV			
internal resistance		R_{int} = 1 MΩ			
• binary input					
switching signal		5 to 30 V, 1 mA	5 to 30 V, 1 mA		5 to 26 V, 1 mA
functions		• resetting the measured values • resetting the totalizers • stopping the totalizers • activation of the measuring mode for highly dynamic flows			

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

[2] with inputs and including parametrization of the transmitter

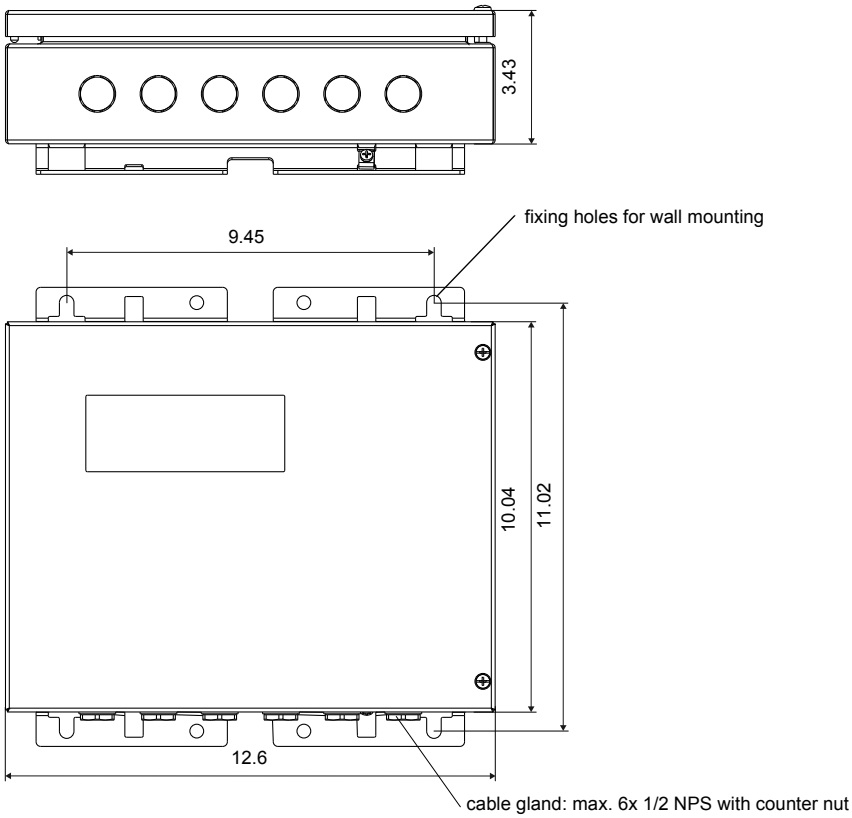
Dimensions

721**-*A**



in inch

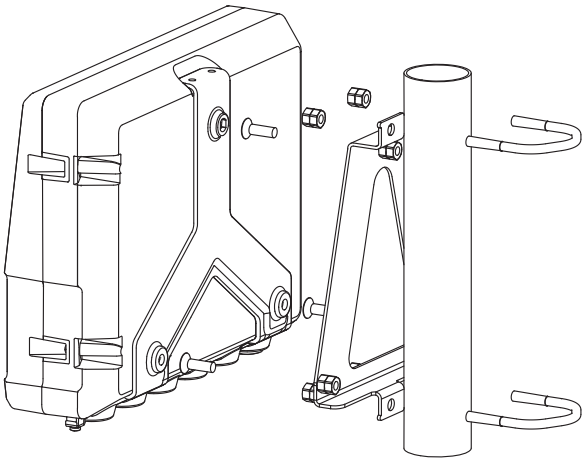
721**-*S**



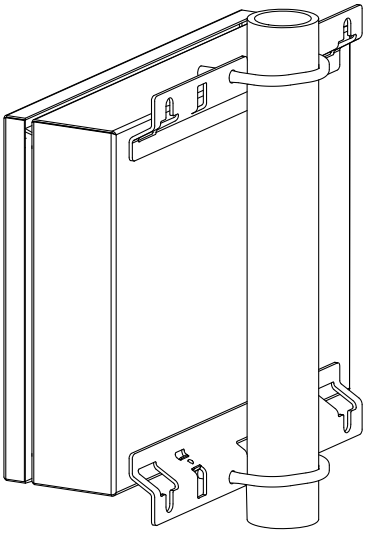
in inch

2" pipe mounting kit

721**-*A**

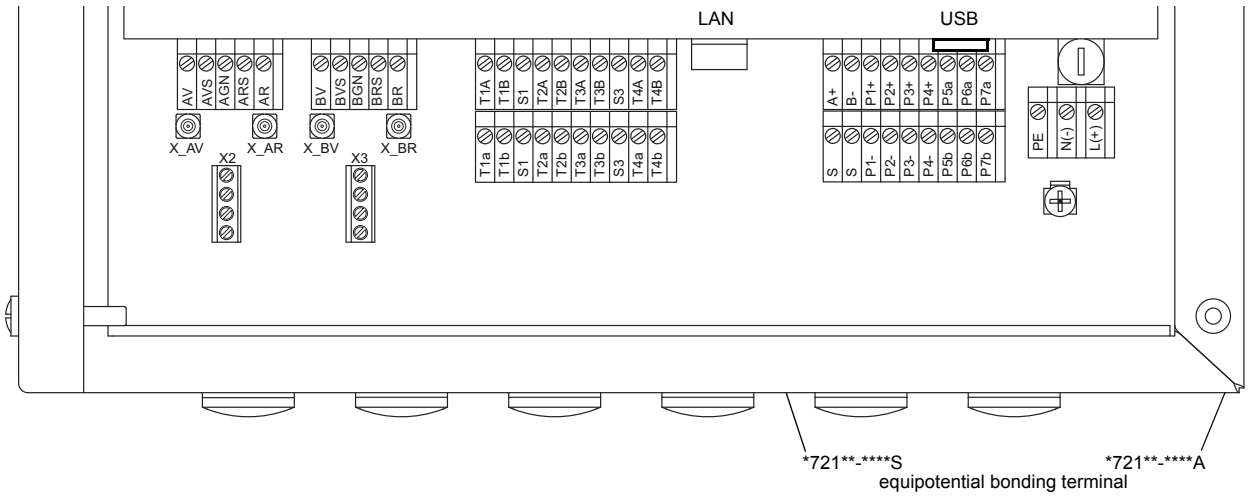


721**-*S**



Terminal assignment

***721**



power supply[1]		
terminal	**connection (AC)**	**connection (DC)**
PE	earth	earth
N(-)	neutral	-
L(+)	phase	+

transducers							
transducer cable (transducers ****LI*), extension cable					transducer cable (transducers *****52)		
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+ to P4+ P1- to P4-	current output, voltage output, frequency output, binary output (Reed relay), HART (P1)	A+	signal +	• RS485[1] • Modbus RTU[1] • BACnet MS/TP[1] • Profibus PA[1] • FF H1[1]
		B-	signal -	
P5a to P7a P5b to P7b	binary output (optorelay)	S	shield	
		USB	type B	• service (FluxDiag/ FluxDiagReader)
		LAN	RJ45	• service (FluxDiag/ FluxDiagReader) • BACnet IP • Modbus TCP

analog inputs[1, 2]						
	temperature probe				**passive sensor**	**active sensor**
terminal	**with connector**		**without connector**		**connection**	**connection**
	direct connection	**connection with extension cable**	**direct connection**	**connection with extension cable**		
T1a to T4a	red	red	red	white	not connected	not connected
T1A to T4A	red/blue	gray	red	black	-	+
T1b to T4b	white/blue	blue	white	red	+	not connected
T1B to T4B	white	white	white	green	not connected	-
S1, S3	shield	shield	-	-	not connected	not connected

Binary inputs[1, 2]
terminal
P1+ to P2+, P1- to P2-

[1] cable (by customer):
- e.g., flexible leads, with insulated wire end ferrules, lead cross sectional area: AWG14 to 24
- outer diameter of the cable (*721**-****S with ferrite nut): max. 0.3 in

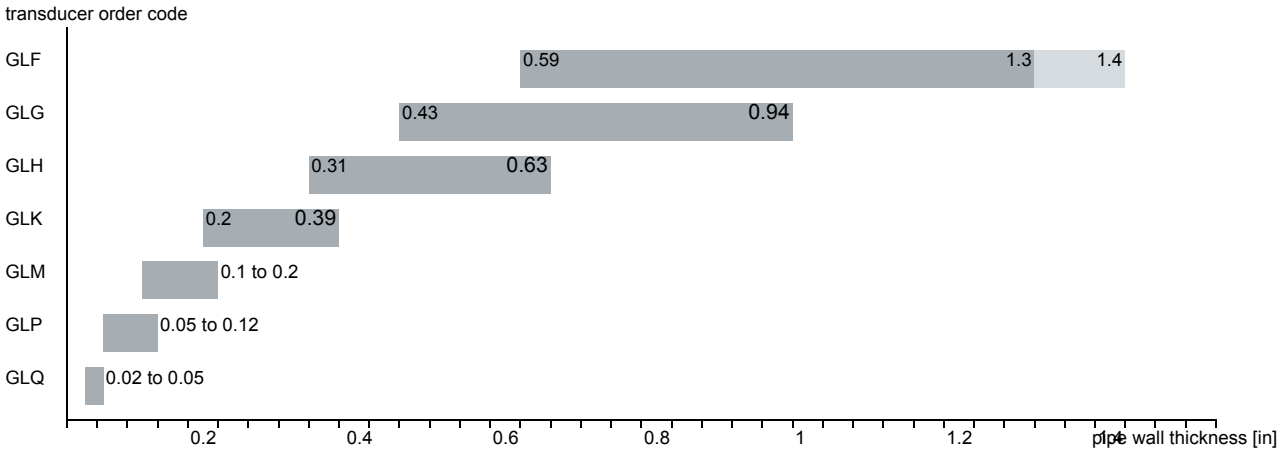
[2] The number, type and terminal assignment will be customized.

Transducers

Transducer selection

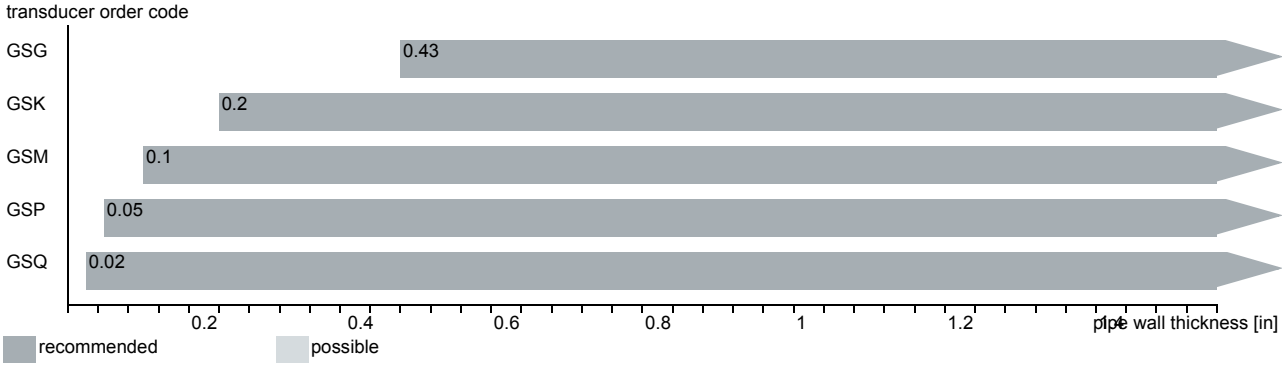
Step 1a

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:



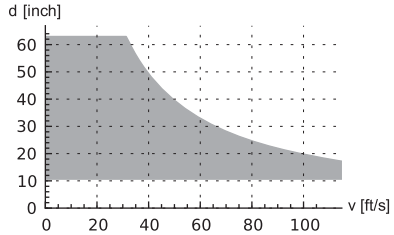
Step 2

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

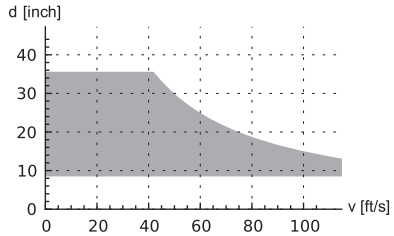
The transducers are selected from the characteristics (see next page). Lamb wave transducers are selected from the left column, shear wave transducers from the right column.

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.

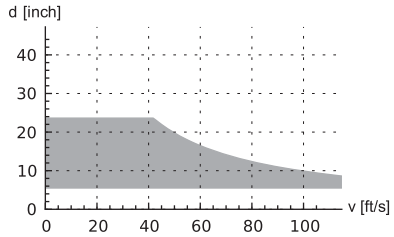
Lamb wave transducer[1]



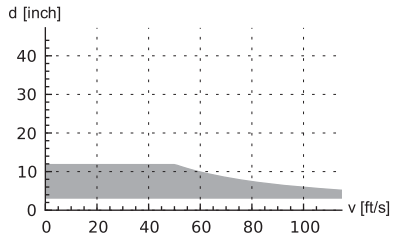
GLF



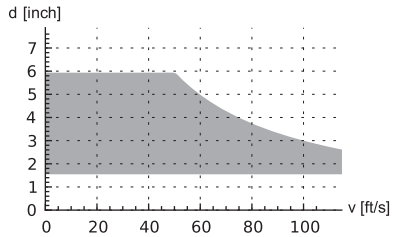
GLG



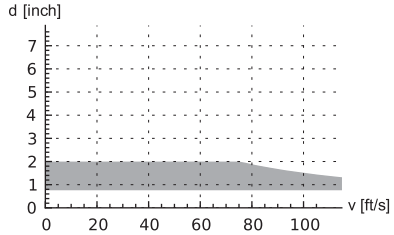
GLH



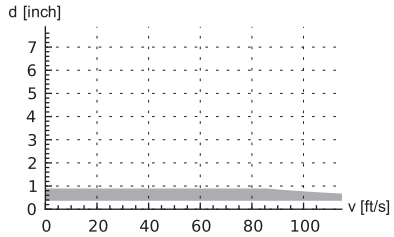
GLK



GLM

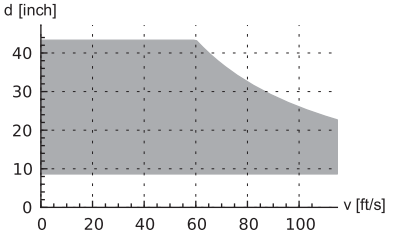


GLP

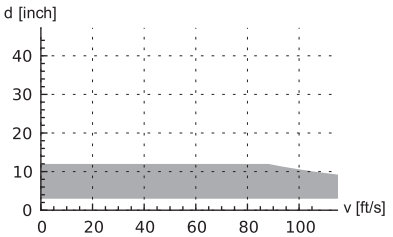


GLQ

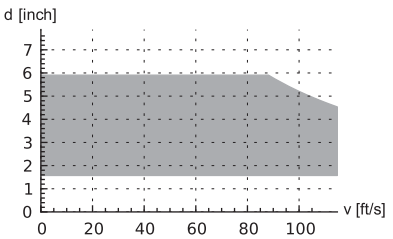
shear wave transducer[1]



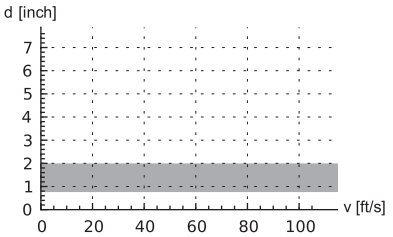
GSG



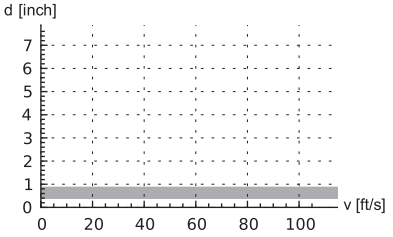
GSK



GSM



GSP



GSQ

[1] inner pipe diameter and max. flow velocity for a typical application with natural gas, nitrogen, oxygen in reflect 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] [psi]		
	metal pipe		plastic pipe
	min.	min. extended	min.
GLF	218	145	15
GLG	218	145	15
GLH	218	145	15
GLK	218 (d > 4.7 in) 145 (d < 4.7 in)	145 (d > 4.7 in) 44 (d < 4.7 in)	15
GLM	145 (d > 2.4 in) 73 (d < 2.4 in)	44 (d < 2.4 in)	15
GLP	145 (d > 1.4 in) 73 (d < 1.4 in)	44 (d < 1.4 in)	15
GLQ	145 (d > 0.59 in) 73 (d < 0.59 in)	44 (d < 0.59 in)	15

shear wave transducer			
transducer order code	fluid pressure[1] [psi]		
	metal pipe		plastic pipe
	min.	min. extended	min.
GSG	435	290	15
GSK	435	290	15
GSM	435	290	15
GSP	435	290	15
GSQ	435	290	15

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

d = inner pipe diameter

Example

step					
1	pipe wall thickness	in	0.56	0.34	1.5
	selected transducer		GLG or GLH	GLH or GLK	GS
2	inner pipe diameter	in	22.9	3.8	5.6
	max. flow velocity	ft/s	49	98	98
	selected transducer		GLG	GLK	GSK
3	min. fluid pressure	psi	290	218	580
	selected transducer		GLG	GLK	GSK

Step 4

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

Step 5

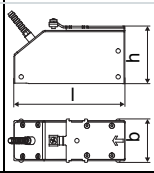
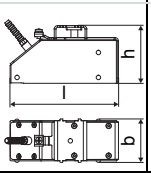
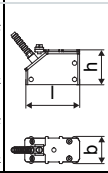
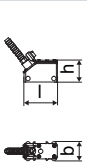
for the technical data of the selected transducer see page 16 et seqq.

Transducer order code

1, 2	3		4	5, 6	7, 8		9 to 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

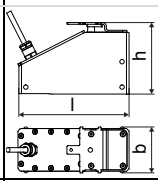
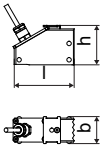
Shear wave transducers (zone 2 - FM Class I Div. 2 - nonEx, TS)

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	psi	metal pipe: 290		metal pipe: 290		
min.	psi	metal pipe: 435, plastic pipe: 15		metal pipe: 435, plastic pipe: 15		
inner pipe diameter d[2]						
min. extended	in	7.1	2.4	1.2	0.59	0.28
min. recommended	in	8.7	3.1	1.6	0.79	0.39
max. recommended	in	35.4	11.8	5.9	2	0.87
max. extended	in	43.3	14.2	7.1	2.4	1.2
pipe wall thickness						
min.	in	0.43	0.2	0.1	0.05	0.02
material						
housing		PEEK with stainless steel cap 304, ***-*****/OS: 316L		PEEK with stainless steel cap 304, ***-*****/OS: 316L		
contact surface		PEEK		PEEK		
degree of protection		NEMA 6		NEMA 6		
transducer cable						
type		1699		1699		
length	ft	16		13		9
length (***-*****/LC)	ft	29		29		29
dimensions						
length l	in	5.1	4.98	2.52		1.57
width b	in	2.01	2.01	1.26		0.87
height h	in	2.64	2.66	1.59		1
dimensional drawing						
weight (without cable)	lb	1	0.79	0.15		0.04
ambient temperature						
min.	°F	-40		-40		
max.	°F	+266		+266		
temperature compensation		x				
explosion protection						
• ATEX/IECEx						
order code		GSG-NA2TS/**	GSK-NA2TS/**	GSM-NA2TS/**	GSP-NA2TS/**	GSQ-NA2TS/**
explosion protection temperature (pipe surface)						
• min.	°C	-55		-55		
• max.	°C	gas: +190, dust: +180		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		
• FM						
order code		GSG-NF2TS/**	GSK-NF2TS/**	GSM-NF2TS/**	GSP-NF2TS/**	GSQ-NF2TS/**
explosion protection temperature						
• min.	°F	-40		-40		
• max.	°F	+257		+374		
degree of protection		IP66		IP66		
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		

[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 reflect arrangement and for a flow velocity of 49 ft/s

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

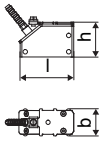
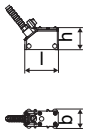
order code		GSG-N**TS/IP68	GSK-N**TS/IP68	GSM-N**TS/IP68	GSP-N**TS/IP68
technical type		GDG1LI8	GDK1LI8	GDM2LI8	GDP2LI8
transducer frequency	MHz	0.2	0.5	1	2
fluid pressure[1]					
min. extended	psi	metal pipe: 290			
min.	psi	metal pipe: 435, plastic pipe: 15			
inner pipe diameter d[2]					
min. extended	in	7.1	2.4	1.2	0.59
min. recommended	in	8.7	3.1	1.6	0.79
max. recommended	in	35.4	11.8	5.9	2
max. extended	in	43.3	14.2	7.1	2.4
pipe wall thickness					
min.	in	0.43	0.2	0.1	0.05
material					
housing		PEEK with stainless steel cap 316Ti			
contact surface		PEEK			
degree of protection		IP68[3]			
transducer cable					
type		2550			
length	ft	39			
dimensions					
length l	in	5.12		2.76	
width b	in	2.13		1.26	
height h	in	3.29		1.81	
dimensional drawing					
weight (without cable)	lb	0.95		0.19	
ambient temperature					
min.	°F	-40			
max.	°F	+212			
temperature compensation		x			
explosion protection					
• ATEX/IECEx					
order code		GSG-NA2TS/IP68	GSK-NA2TS/IP68	GSM-NA2TS/IP68	GSP-NA2TS/IP68
explosion protection temperature (pipe surface)					
• min.	°C	-40			
• max.	°C	gas: +90, dust: +80			
marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db			
certification ATEX		IBExU10ATEX1163 X			
certification IECEx		IECEx IBE 12.0005X			

[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 reflect arrangement and for a flow velocity of 49 ft/s

[3] test conditions: 3 months/29 psi (65 ft)/36 °F

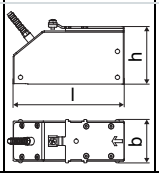
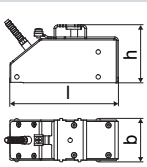
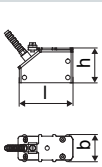
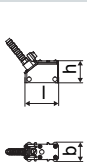
Shear wave transducers (zone 2 - FM Class I Div. 2 - nonEx, TS, extended temperature range)

order code		GSM-E**TS/**	GSP-E**TS/**	GSQ-E**TS/**
technical type		G(DL)M2E52	G(DL)P2E52	G(DL)Q2E52
transducer frequency	MHz	1	2	4
fluid pressure[1]				
min. extended	psi	metal pipe: 290		
min.	psi	metal pipe: 435, plastic pipe: 15		
inner pipe diameter d[2]				
min. extended	in	1.2	0.59	0.28
min. recommended	in	1.6	0.79	0.39
max. recommended	in	5.9	2	0.87
max. extended	in	7.1	2.4	1.2
pipe wall thickness				
min.	in	0.1	0.05	0.02
material				
housing		PI with stainless steel cap 304, ***-*****/OS: 316L		
contact surface		PI		
degree of protection		NEMA 4		
transducer cable				
type		6111		
length	ft	13		9
length (***-*****/LC)	ft	29		
dimensions				
length l	in	2.52		1.57
width b	in	1.26		0.87
height h	in	1.59		1
dimensional drawing				
weight (without cable)	lb	0.15		0.04
ambient temperature				
min.	°F	-22		
max.	°F	+392		
temperature compensation		x		
explosion protection				
• ATEX/IECEx				
order code		GSM-EA2TS/**	GSP-EA2TS/**	GSQ-EA2TS/**
explosion protection temperature (pipe surface)				
• min.	°C	-45		
• max.	°C	gas: +235, dust: +225		
marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIA TX Db		
certification ATEX		IBExU10ATEX1163 X		
certification IECEx		IECEx IBE 12.0005X		
• FM				
order code		GSM-EF2TS/**	GSP-EF2TS/**	GSQ-EF2TS/**
explosion protection temperature				
• min.	°F	-40		
• max.	°F	+455		
degree of protection		IP66		
marking		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860		

[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 reflect arrangement and for a flow velocity of 49 ft/s

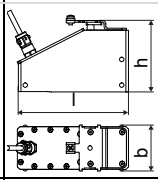
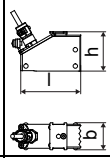
Shear wave transducers (zone 1, TS)

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	psi	metal pipe: 290				
min.	psi	metal pipe: 435, plastic pipe: 15				
inner pipe diameter d[2]						
min. extended	in	7.1	2.4	1.2	0.59	0.28
min. recommended	in	8.7	3.1	1.6	0.79	0.39
max. recommended	in	35.4	11.8	5.9	2	0.87
max. extended	in	43.3	14.2	7.1	2.4	1.2
pipe wall thickness						
min.	in	0.43	0.2	0.1	0.05	0.02
material						
housing		PEEK with stainless steel cap 304 , ***-*****/OS: 316L				
contact surface		PEEK				
degree of protection		IP65	IP66			IP65
transducer cable						
type		1699				
length	ft	16		13		9
length (***-*****/LC)	ft	29				
dimensions						
length l	in	5.1	4.98	2.52		1.57
width b	in	2.01	2.01	1.26		0.87
height h	in	2.64	2.66	1.59		1
dimensional drawing						
weight (without cable)	lb	1	0.79	0.15		0.04
ambient temperature						
min.	°F	-40				
max.	°F	+266				
temperature compensation		x				
explosion protection						
• **ATEX/IECEx**						
order code		GSG-NA1TS/**	GSK-NA1TS/**	GSM-NA1TS/**	GSP-NA1TS/**	GSQ-NA1TS/**
explosion protection temperature (pipe surface)						
• min.	°C	-55				
• max.	°C	+180				
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db				
certification ATEX		IBExU07ATEX1168 X				
certification IECEx		IECEx IBE 08.0007X				

[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 reflect arrangement and for a flow velocity of 49 ft/s

Shear wave transducers (zone 1, TS, IP68)

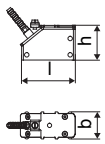
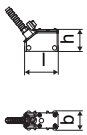
order code		GSG-N*1TS/IP68	GSK-N*1TS/IP68	GSM-N*1TS/IP68	GSP-N*1TS/IP68
technical type		GDG1LI1	GDK1LI1	GDM2LI1	GDP2LI1
transducer frequency	MHz	0.2	0.5	1	2
fluid pressure[1]					
min. extended	psi	metal pipe: 290			
min.	psi	metal pipe: 435, plastic pipe: 15			
inner pipe diameter d[2]					
min. extended	in	7.1	2.4	1.2	0.59
min. recommended	in	8.7	3.1	1.6	0.79
max. recommended	in	35.4	11.8	5.9	2
max. extended	in	43.3	14.2	7.1	2.4
pipe wall thickness					
min.	in	0.43	0.2	0.1	0.05
material					
housing		PEEK with stainless steel cap 316Ti			
contact surface		PEEK			
degree of protection		IP68[3]			
transducer cable					
type		2550			
length	ft	39			
dimensions					
length l	in	5.12		2.76	
width b	in	2.13		1.26	
height h	in	3.29		1.81	
dimensional drawing					
weight (without cable)	lb	0.95		0.19	
ambient temperature					
min.	°F	-40			
max.	°F	+212			
temperature compensation		x			
explosion protection					
• ATEX/IECEx					
order code		GSG-NA1TS/IP68	GSK-NA1TS/IP68	GSM-NA1TS/IP68	GSP-NA1TS/IP68
explosion protection temperature (pipe surface)					
• min.	°C	-55			
• max.	°C	+180			
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db			
certification ATEX		IBExU07ATEX1168 X			
certification IECEx		IECEx IBE 08.0007X			

[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 reflect arrangement and for a flow velocity of 49 ft/s

[3] test conditions: 3 months/29 psi (65 ft)/36 °F

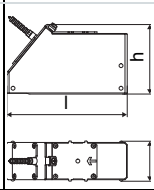
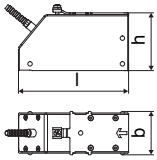
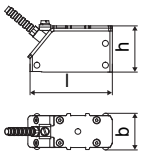
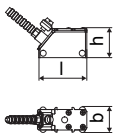
Shear wave transducers (zone 1, TS, extended temperature range)

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	psi	metal pipe: 290		
min.	psi	metal pipe: 435, plastic pipe: 15		
inner pipe diameter d[2]				
min. extended	in	1.2	0.59	0.28
min. recommended	in	1.6	0.79	0.39
max. recommended	in	5.9	2	0.87
max. extended	in	7.1	2.4	1.2
pipe wall thickness				
min.	in	0.1	0.05	0.02
material				
housing		PI with stainless steel cap 304, ***-*****/OS: 316L		
contact surface		PI		
degree of protection		IP66		IP56
transducer cable				
type		6111		
length	ft	13		9
length (***-*****/LC)	ft	29		
dimensions				
length l	in	2.52		1.57
width b	in	1.26		0.87
height h	in	1.59		1
dimensional drawing				
weight (without cable)	lb	0.15		0.04
ambient temperature				
min.	°F	-22		
max.	°F	+392		
temperature compensation		x		
explosion protection				
• **ATEX/IECEx**				
order code		GSM-EA1TS/**	GSP-EA1TS/**	GSQ-EA1TS/**
explosion protection temperature (pipe surface)				
• min.	°C	-45		
• max.	°C	+225		
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T2 Gb Ex tb IIIA TX Db		
certification ATEX		IBExU07ATEX1168 X		
certification IECEx		IECEx IBE 08.0007X		

[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 reflect arrangement and for a flow velocity of 49 ft/s

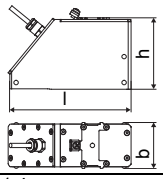
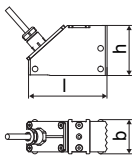
Lamb wave transducers (zone 2 - FM Class I Div. 2 - nonEx, TS)

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	psi	metal pipe: 145			metal pipe: 145 (d > 4.7 in) 44 (d < 4.7 in)	metal pipe: 44 (d < 2.4 in)	metal pipe: 44 (d < 1.4 in)	metal pipe: 44 (d < 0.59 in)
min.	psi	metal pipe: 218 plastic pipe: 15			metal pipe: 218 (d > 4.7 in) 145 (d < 4.7 in) plastic pipe: 15	metal pipe: 145 (d > 2.4 in) 73 (d < 2.4 in) plastic pipe: 15	metal pipe: 145 (d > 1.4 in) 73 (d < 1.4 in) plastic pipe: 15	metal pipe: 145 (d > 0.59 in) 73 (d < 0.59 in) plastic pipe: 15
inner pipe diameter d[2]								
min. extended	in	8.7	7.1	4.3	2.4	1.2	0.59	0.28
min. recommended	in	10.6	8.7	5.5	3.1	1.6	0.79	0.39
max. recommended	in	47.2	35.4	23.6	11.8	5.9	2	0.87
max. extended	in	63	55.1	39.4	14.2	7.1	2.4	1.2
pipe wall thickness								
min.	in	0.59	0.43	0.31	0.2	0.1	0.05	0.02
max.	in	1.3	0.94	0.63	0.39	0.2	0.12	0.05
max. extended		1.4	-	-	-	-	-	-
material								
housing		PPSU with stainless steel cap 316Ti	PPSU with stainless steel cap 304, ***-*****/OS: 316L					
contact surface		PPSU						
degree of protection		NEMA 4	NEMA 6			NEMA 4		
transducer cable								
type		1699						
length	ft	16				13		9
length (***-*****/LC)	ft	29						
dimensions								
length l	in	6.42	5.06			2.91		1.65
width b	in	2.13	2.01			1.26		0.87
height h	in	3.59	2.66			1.59		1
dimensional drawing								
weight (without cable)	lb	2.1	1			0.17		0.04
ambient temperature								
min.	°F	-40						
max.	°F	+338						
temperature compensation		x						
explosion protection								
• **ATEX/IECEx**								
order code		GLF-NA2TS/**	GLG-NA2TS/**	GLH-NA2TS/**	GLK-NA2TS/**	GLM-NA2TS/**	GLP-NA2TS/**	GLQ-NA2TS/**
explosion protection temperature (pipe surface)								
• min.	°C	-55						
• max.	°C	gas: +150, dust: +140						
marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX 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/**
explosion protection temperature								
• min.	°F	-40						
• max.	°F	+329						
degree of protection		IP66						
marking		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860						

[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 reflect arrangement (diagonal arrangement) and for a flow velocity of 49 ft/s (98 ft/s)
inner pipe diameter max. extended: in reflect arrangement (diagonal arrangement) and for a flow velocity of 39 ft/s (82 ft/s)

Lamb wave transducers (- nonEx, TS, IP68)

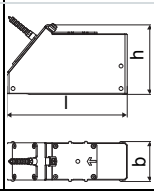
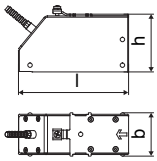
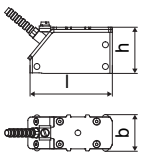
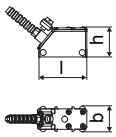
order code		GLG-N**TS/IP68	GLH-N**TS/IP68	GLK-N**TS/IP68	GLM-N**TS/IP68	GLP-N**TS/IP68
technical type		GRG1LI8	GRH1LI8	GRK1LI8	GRM1LI8	GRP1LI8
transducer frequency	MHz	0.2	0.3	0.5	1	2
fluid pressure[1]						
min. extended	psi	metal pipe: 145		metal pipe: 145 (d > 4.7 in) 44 (d < 4.7 in)	metal pipe: 44 (d < 2.4 in)	metal pipe: 44 (d < 1.4 in)
min.	psi	metal pipe: 218 plastic pipe: 15		metal pipe: 218 (d > 4.7 in) 145 (d < 4.7 in) plastic pipe: 15	metal pipe: 145 (d > 2.4 in) 73 (d < 2.4 in) plastic pipe: 15	metal pipe: 145 (d > 1.4 in) 73 (d < 1.4 in) plastic pipe: 15
inner pipe diameter d[2]						
min. extended	in	7.1	4.3	2.4	1.2	0.59
min. recommended	in	8.7	5.5	3.1	1.6	0.79
max. recommended	in	35.4	23.6	11.8	5.9	2
max. extended	in	55.1	39.4	14.2	7.1	2.4
pipe wall thickness						
min.	in	0.43	0.31	0.2	0.1	0.05
max.	in	0.94	0.63	0.39	0.2	0.12
material						
housing		PPSU with stainless steel cap 316Ti				
contact surface		PPSU				
degree of protection		IP68[3]				
transducer cable						
type		2550				
length	ft	39				
dimensions						
length l	in	5.65			2.87	
width b	in	2.13			1.24	
height h	in	3.29			1.81	
dimensional drawing						
weight (without cable)	lb	1.4			0.21	
ambient temperature						
min.	°F	-40				
max.	°F	+212				
temperature compensation		x				
explosion protection						
• ATEX/IECEx						
order code		GLG-NA2TS/IP68	GLH-NA2TS/IP68	GLK-NA2TS/IP68	GLM-NA2TS/IP68	GLP-NA2TS/IP68
explosion protection temperature (pipe surface)						
• min.	°C	-40				
• max.	°C	gas: +90, dust: +80				
marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db				
certification ATEX		IBExU10ATEX1163 X				
certification IECEx		IECEx IBE 12.0005X				

[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 reflect arrangement (diagonal arrangement) and for a flow velocity of 49 ft/s (98 ft/s)
inner pipe diameter max. extended: in reflect arrangement (diagonal arrangement) and for a flow velocity of 39 ft/s (82 ft/s)

[3] test conditions: 3 months/29 psi (65 ft)/36 °F

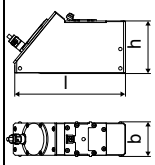
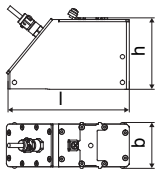
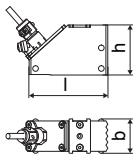
Lamb wave transducers (zone 1, TS)

order code		GLF-N*1TS/**	GLG-N*1TS/**	GLH-N*1TS/**	GLK-N*1TS/**	GLM-N*1TS/**	GLP-N*1TS/**	GLQ-N*1TS/**
technical type		GRF1N83	GRG1N83	GRH1N83	GRK1N83	GRM1N83	GRP1N83	GRQ1N83
transducer frequency	MHz	0.15	0.2	0.3	0.5	1	2	4
fluid pressure[1]								
min. extended	psi	metal pipe: 145			metal pipe: 145 (d > 4.7 in) 44 (d < 4.7 in)	metal pipe: 44 (d < 2.4 in)	metal pipe: 44 (d < 1.4 in)	metal pipe: 44 (d < 0.59 in)
min.	psi	metal pipe: 218 plastic pipe: 15			metal pipe: 218 (d > 4.7 in) 145 (d < 4.7 in) plastic pipe: 15	metal pipe: 145 (d > 2.4 in) 73 (d < 2.4 in) plastic pipe: 15	metal pipe: 145 (d > 1.4 in) 73 (d < 1.4 in) plastic pipe: 15	metal pipe: 145 (d > 0.59 in) 73 (d < 0.59 in) plastic pipe: 15
inner pipe diameter d[2]								
min. extended	in	8.7	7.1	4.3	2.4	1.2	0.59	0.28
min. recommended	in	10.6	8.7	5.5	3.1	1.6	0.79	0.39
max. recommended	in	47.2	35.4	23.6	11.8	5.9	2	0.87
max. extended	in	63	55.1	39.4	14.2	7.1	2.4	1.2
pipe wall thickness								
min.	in	0.59	0.43	0.31	0.2	0.1	0.05	0.02
max.	in	1.3	0.94	0.63	0.39	0.2	0.12	0.05
max. extended		1.4	-	-	-	-	-	-
material								
housing		PPSU with stainless steel cap 304, ***-*****/OS: 316L, 316Ti				PPSU with stainless steel cap 304, ***-*****/OS: 316L		
contact surface		PPSU						
degree of protection		NEMA 4	NEMA 4			NEMA 4		
transducer cable								
type		1699						
length	ft	16				13		9
dimensions								
length l	in	6.42	5.06			2.91		1.65
width b	in	2.13	2.01			1.26		0.87
height h	in	3.59	2.66			1.59		1
dimensional drawing								
weight (without cable)	lb	2.1	1			0.17		0.04
ambient temperature								
min.	°F	-40						
max.	°F	+338						
temperature compensation		x						
explosion protection								
• **ATEX/IECEx**								
order code		GLF-NA1TS/**	GLG-NA1TS/**	GLH-NA1TS/**	GLK-NA1TS/**	GLM-NA1TS/**	GLP-NA1TS/**	GLQ-NA1TS/**
explosion protection temperature (pipe surface)								
• min.	°C	-55						
• max.	°C	+140						
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db						
certification ATEX		IBExU07ATEX1168 X						
certification IECEx		IECEx IBE 08.0007X						

[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 reflect arrangement (diagonal arrangement) and for a flow velocity of 49 ft/s (98 ft/s)
inner pipe diameter max. extended: in reflect arrangement (diagonal arrangement) and for a flow velocity of 39 ft/s (82 ft/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	psi	metal pipe: 145			metal pipe: 145 (d > 4.7 in) 44 (d < 4.7 in)	metal pipe: 44 (d < 2.4 in)	metal pipe: 44 (d < 1.4 in)
min.	psi	metal pipe: 218 plastic pipe: 15			metal pipe: 218 (d > 4.7 in) 145 (d < 4.7 in) plastic pipe: 15	metal pipe: 145 (d > 2.4 in) 73 (d < 2.4 in) plastic pipe: 15	metal pipe: 145 (d > 1.4 in) 73 (d < 1.4 in) plastic pipe: 15
inner pipe diameter d[2]							
min. extended	in	8.7	7.1	4.3	2.4	1.2	0.59
min. recommended	in	10.6	8.7	5.5	3.1	1.6	0.79
max. recommended	in	47.2	35.4	23.6	11.8	5.9	2
max. extended	in	63	55.1	39.4	14.2	7.1	2.4
pipe wall thickness							
min.	in	0.59	0.43	0.31	0.2	0.1	0.05
max.	in	1.3	0.94	0.63	0.39	0.2	0.12
max. extended		1.4	-	-	-	-	-
material							
housing		PPSU with stainless steel cap 316Ti					
contact surface		PPSU					
degree of protection		IP68[3]					
transducer cable							
type		2550					
length	ft	39					
dimensions							
length l	in	6.81	5.65			2.877	
width b	in	2.13	2.13			1.24	
height h	in	3.6	3.29			1.81	
dimensional drawing							
weight (without cable)	lb		1.4			0.21	
ambient temperature							
min.	°F	-40					
max.	°F	+212					
temperature compensation		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
explosion protection temperature (pipe surface)							
• min.	°C	-55					
• max.	°C	+140					
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db					
certification ATEX		IBExU07ATEX1168 X					
certification IECEx		IECEx IBE 08.0007X					

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

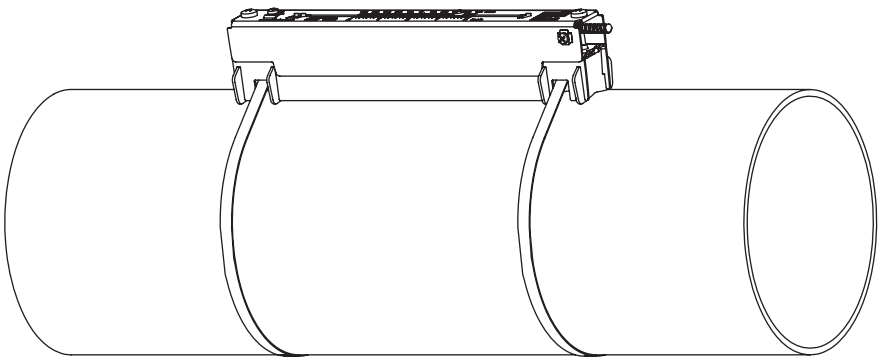
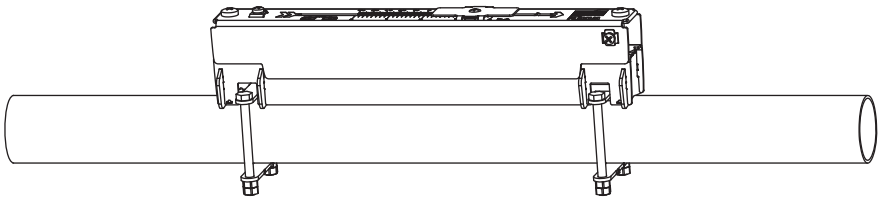
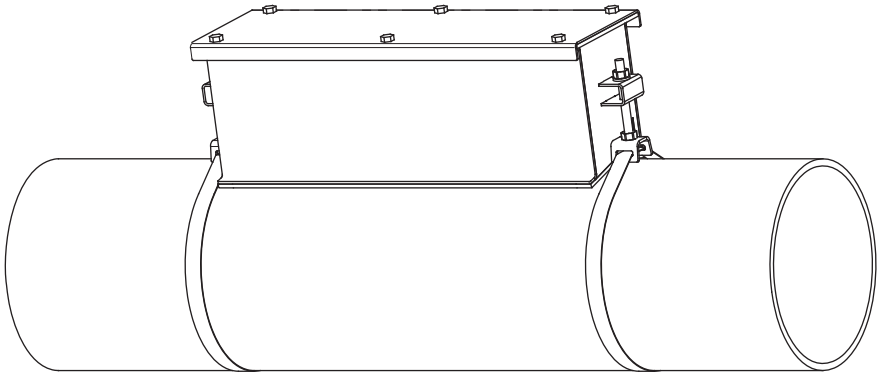
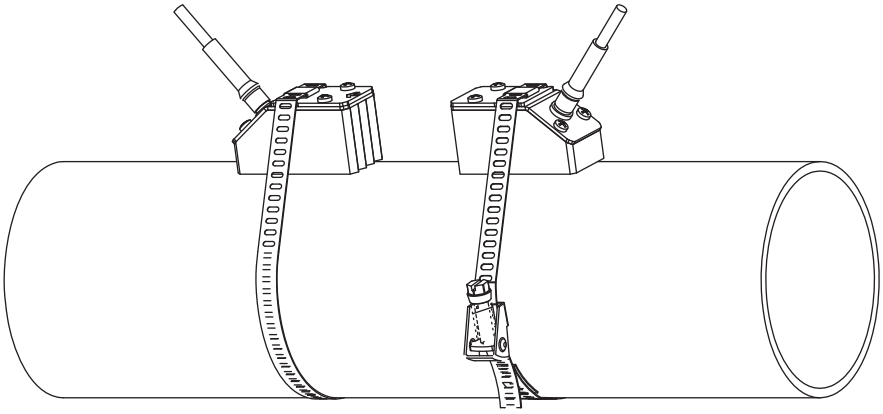
[2] Lamb wave transducer:
typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
inner pipe diameter max. recommended: in reflect arrangement (diagonal arrangement) and for a flow velocity of 49 ft/s (98 ft/s)
inner pipe diameter max. extended: in reflect arrangement (diagonal arrangement) and for a flow velocity of 39 ft/s (82 ft/s)

[3] test conditions: 3 months/29 psi (65 ft)/36 °F

Transducer mounting fixture

Order code

1, 2	3		4	5		6	7 to 9			no. of character
transducer mounting fixture	**transducer**	**,**	**measurement arrangement**	**size**	**,**	**fixation**	**outer pipe diameter**	**/**	**option**	**description**
PL										PermaLok
VL										PermaRail
	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							reflect arrangement or diagonal arrangement/direct mode
			R							reflect arrangement
				S						small
				M						medium
				L						large
						B				bolts
						S				tension straps
						W				welding
						N				without fixation
							SK1			0.5 to 2.5 in
							SK2			3 to 6 in
							SK3			8 to 10 in
							SK4			12 to 18 in
							SK5			20 to 36 in
							SK6			42 to 100 in
									IP68	for transducers with degree of protection IP68
									OS	housing with stainless steel 316
									Z	special design

PermaRail (VLK, VLM, VLQ) 	material: stainless steel 304, 301, 410 option OS: 316Ti, 316L, 17-7PH inner length: **VLK**: 13.7 in, option IP68: 14.5 in **VLM**: 9.2 in **VLQ**: 6.9 in dimensions: **VLK**: 16.65 x 3.54 x 3.66 in option IP68: 17.44 x 3.7 x 4.13 in **VLM**: 12.17 x 2.24 x 2.48 in **VLQ**: 9.72 x 1.69 x 1.85 in
PermaRail with bolt mounting plates (VL*--B)** 	material: stainless steel 304, 301, 410 option OS: 316Ti, 316L, 17-7PH inner length: **VLM**: 9.2 in **VLQ**: 6.9 in dimensions: **VLM**: 12.17 x 2.24 x 2.48 in **VLQ**: 9.72 x 1.69 x 1.85 in outer pipe diameter: max. 1.9 in
PermaLok PL 	material: stainless steel 316
quick release clasp and tension straps 	material: stainless steel 410, 200

Coupling materials for transducers

	normal temperature range (4th character of transducer order code = N)		**extended temperature range (4th character of transducer order code = E)**	
	< 212 °F	< 338 °F	< 302 °F	< 392 °F
< 24 h	coupling compound type N or coupling pad type VT	coupling compound type E or coupling pad type VT	coupling compound type E or coupling pad type VT	coupling compound type E or H or coupling pad type VT
long time measurement	coupling pad type VT[1]	coupling pad type VT[2]	coupling pad type VT[1]	coupling pad type VT[2]

[1] < 5 years

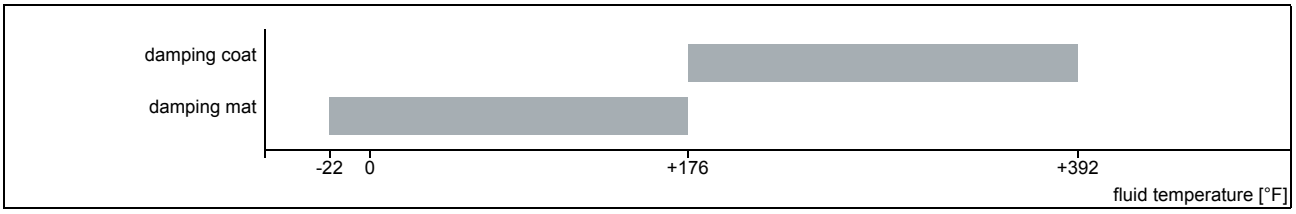
[2] < 6 months

Technical data

type	**ambient temperature** °F	**material**
coupling compound type N	-22 to +266	mineral grease paste
coupling compound type E	-22 to +392	silicone paste
coupling compound type H	-22 to +482	fluoropolymer paste
coupling pad type VT	14 to +392	fluoroelastomer

Damping material (optional)

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



Damping mats

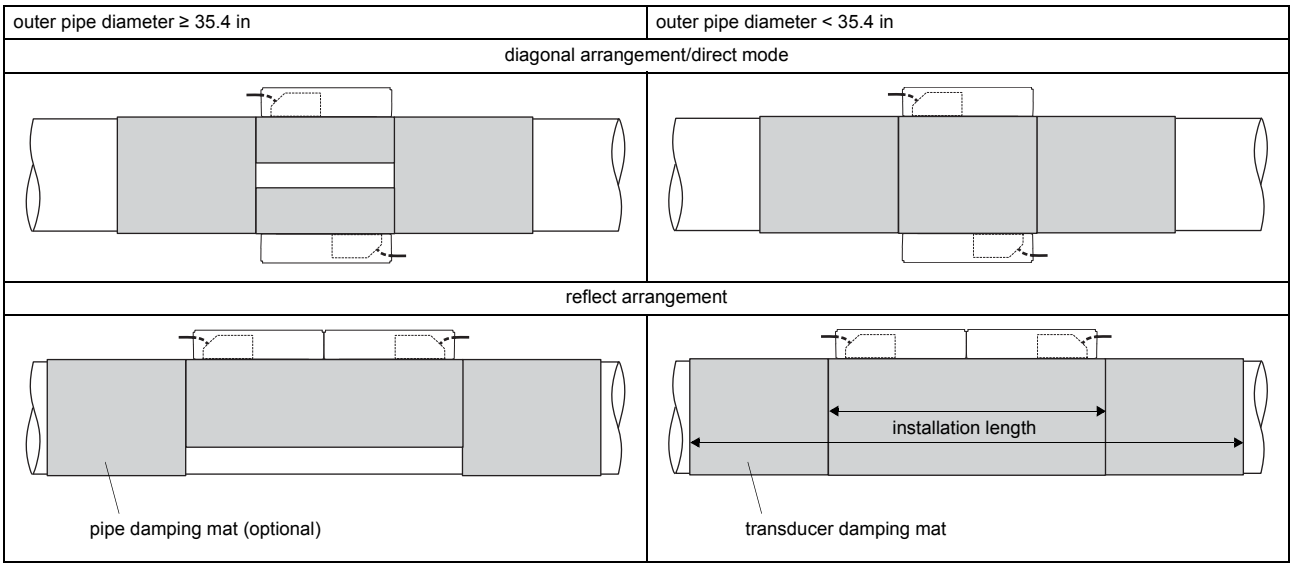
Damping mats will be used for the gas measurement to reduce acoustic noise influences on the measurement.

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
width	in	8.9	2
thickness	in	0.03	
length (per roll)	ft	32	
weight	lb/ft^2	2.2	
ambient temperature	°F	-22 to +1760	
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	number of rolls[1]		max. installation length	number of rolls[1]	
				[in]	standard[2]	extended[2]	[in]	standard	extended
PermaRail									
VLK	GLG	E30R4	3	35	4	4	72	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	36	5	5	75.2	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	26	1	1	53.5	2	2
	GSM		1		1	1		2	2
	GLP		1		1	1		1	1
	GSP		1		1	1		1	1
VLQ	GLQ	E30R3	1	21.3	1	1	44.1	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 reflect arrangement) and
max. recommended pipe diameter (standard) or max. extended pipe diameter (extended)

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

Damping coat

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

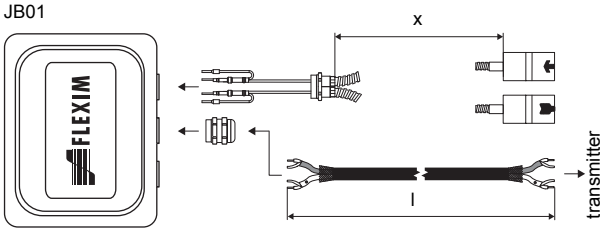
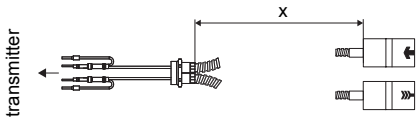
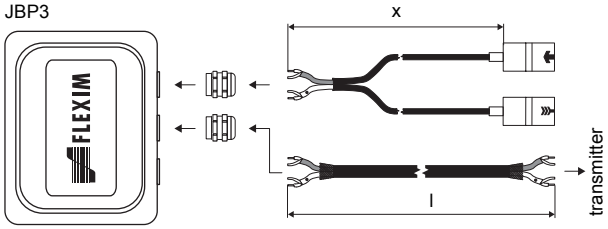
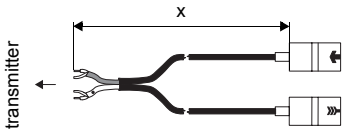
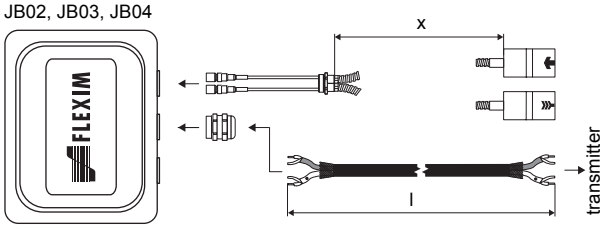
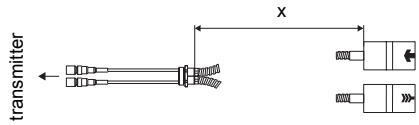
Technical data

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

Dimensioning

transducer	number of packing drums		
	outer pipe diameter		
	≤15.7	≤23.6	≤31.5
	in		
F	1	2	2
G	1	1	2
H	1	1	1
K	1	-	-
M	1	-	-
P	1	-	-
Q	1	-	-

Connection systems

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

Cable

transducer cable				
type		**1699**	**2550**	**6111**
weight	lb/ft	0.06	0.02	0.06
ambient temperature	°F	-67 to +392	-40 to +212	-148 to +437
properties			longitudinal watertight	
cable jacket				
material		PTFE	PUR	PFA
outer diameter	in	0.11	0.2 ±0.01	0.11
thickness	in	0.01	0.04	0.02
color		brown	gray	white
shield		x	x	x
sheath				
material		stainless steel 304 option OS: 316Ti	-	stainless steel 304 option OS: 316Ti
outer diameter	in	0.31	-	0.31

extension cable			
type		**2615**	**5245**
weight	lb/ft	0.12	0.26
ambient temperature	°F	-22 to +158	-22 to +158
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	in	0.47	0.47
thickness	in	0.08	0.08
color		black	black
shield		x	x
sheath			
material		-	steel wire braid with copolymer sheath
outer diameter	in	-	0.61

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*	ft	16	≤ 984	13	≤ 984	9	≤ 295	-	-
option LC: *(LT)***8*	ft	29	≤ 984	29	≤ 984	29	≤ 295	-	-
*(DR)***5*	ft	16	≤ 984	13	≤ 984	9	≤ 295	6	≤ 131
option LC: *(LT)***5*	ft	29	≤ 984	29	≤ 984	29	≤ 295	-	-
option IP68: ****LI*	ft	39	≤ 984	39	≤ 984	-	-	-	-

x = transducer cable length

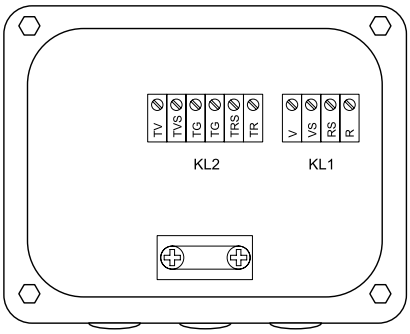
l = max. length of extension cable (depending on application)

Junction box

Technical data

JB01S4E3M, JBP2, JBP3		
weight	lb	2.6 lb
fixation		wall mounting optional: 2" pipe mounting
material		
housing		stainless steel 316L
gasket		silicone
degree of protection		NEMA 6
ambient temperature		
min.	°F	-40
max.	°F	+176
explosion protection		
• ATEX/IECEx (zone 1)		
junction box		JB01S4E3M
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
certification ATEX		IBExU06ATEX1161
certification IECEx		IECEx 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



transducers

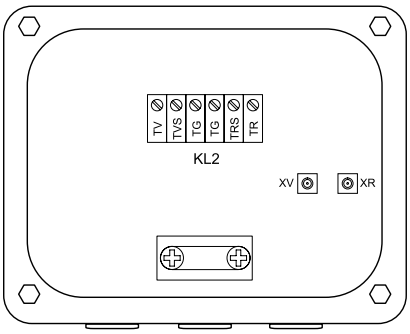
terminal strip	terminal	connection	transducer
KL1	V	signal	
	VS	internal shield	
	RS	internal shield	
	R	signal	

extension cable

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

JB02, JB03, JB04		
weight	lb	2.6 lb
fixation		wall mounting optional: 2" pipe mounting
material		
housing		stainless steel 316L
gasket		silicone
degree of protection		IP67
ambient temperature		
min.	°F	-40
max.	°F	+176
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		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ T6 Ta = -40...+60 °C

connection



transducers

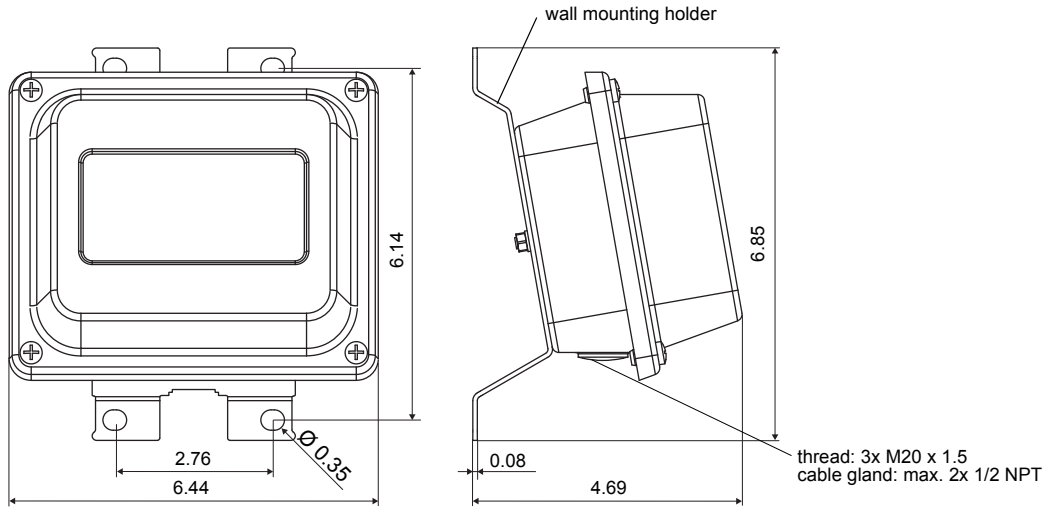
	terminal	connection	transducer
	XV	SMB connector	
	XR	SMB connector	

extension cable

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

Dimensions

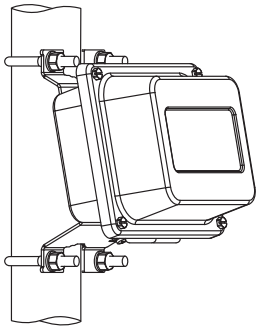
JB0*, JBP*



in inch

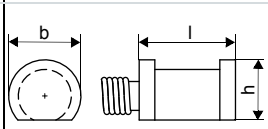
2" pipe mounting kit

JB**

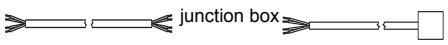
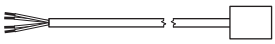


Clamp-on temperature probe (optional)

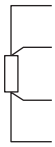
Technical data

PT13N		
design		clamp-on
type		Pt1000
connection		4-wire
measuring range	°F	-40 to +392
accuracy T		±(0.27 °F + 2 · 10^{-3} · (|T [°F]| - 32 °F)) class A
accuracy ΔT (2x Pt matched according to EN 1434-1)		≤ 0.03 °F (at 50 °F)
housing		360 brass alloy
degree of protection		NEMA 4
dimensions		
length l	in	0.79
width b	in	0.59
height h	in	0.49
dimensional drawing		
weight	lb	0.437
accessories		
thermal conductivity foil 482 °F		x

connection system

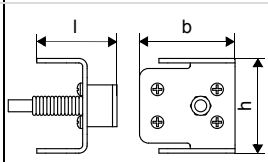
connection with extension cable	direct connection
extension cable 	

connection

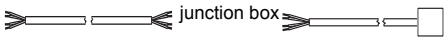
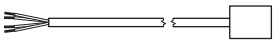
	temperature probe	extension cable
	red	red
	red	red
	white	white
	white	white

cable

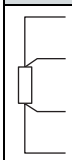
		temperature probe	extension cable
type		4 x 24 AWG	4 x 18 AWG
standard length	ft	20	-
max. length	ft	-	656
cable jacket		PTFE	LS PVC

PT13F		
design		clamp-on short response time
type		Pt1000
connection		4-wire
measuring range	°F	-58 to +482
accuracy T		±(0.27 °F + 2 · 10^{-3} · (|T [°F]| - 32 °F)) 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
response time	s	8
housing		PEEK, stainless steel 304, copper
degree of protection		NEMA 4
dimensions		
length l	in	0.55
width b	in	1.18
height h	in	1.06
dimensional drawing		
weight	lb	0.7
accessories		
thermal conductivity paste 392 °F		x
thermal conductivity foil 482 °F		x
plastic protection plate, insulation foam		x

connection system

connection with extension cable	direct connection
extension cable 	

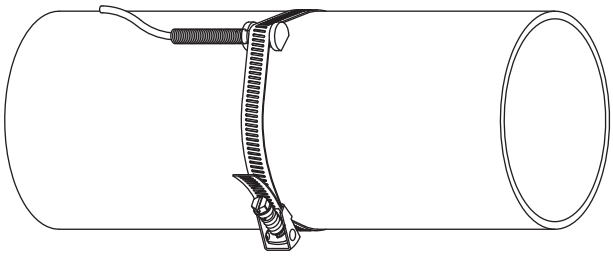
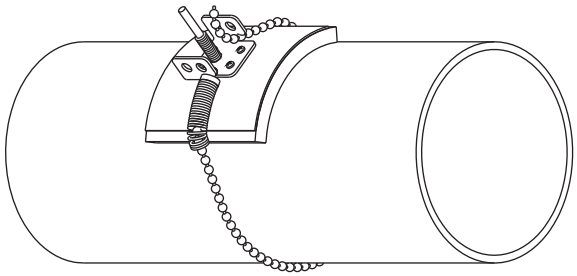
connection

	temperature probe
	red
	red/blue
	white/blue
	white

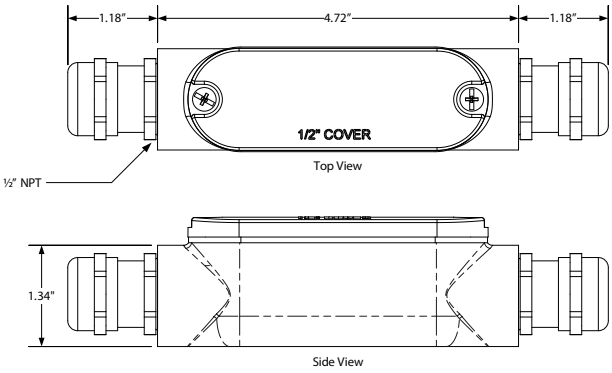
cable

		temperature probe	extension cable
type		4 x 0.25 mm² black	4 x 18 AWG
standard length	ft	9	-
max. length	ft	-	656
cable jacket		PTFE	PVC

Fixation

tension strap PT13N 	material: stainless steel 301, 410
ball chain PT13F 	material: stainless steel 316L length: 3 ft

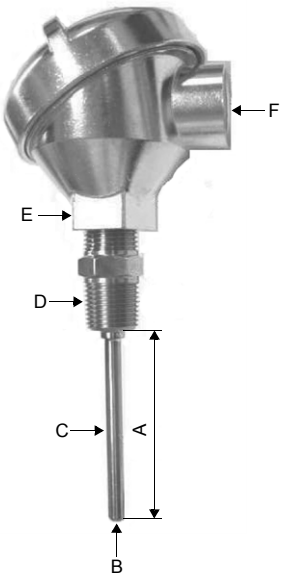
Junction box



connection

temperature probe	extension cable
red	white
red	black
white	green
white	red

Inline temperature probe (optional)



	type	Pt1000
A	insertion length	6" or specified length
B	resistance	1 000 Ω, 00385
C	insertion length	6" or specified length
	sheath material	stainless steel 316
D	thread	1/2" NPT HEX CPLG. spring loaded
E	head	aluminum screw cover head 4 terminal block
F	thread	3/4" NPT

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