

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



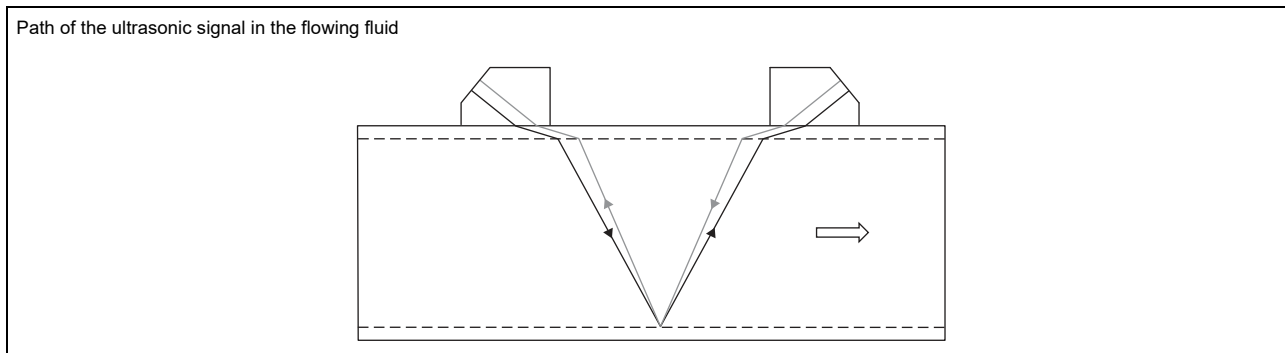
PermaRail

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Function

Measurement principle

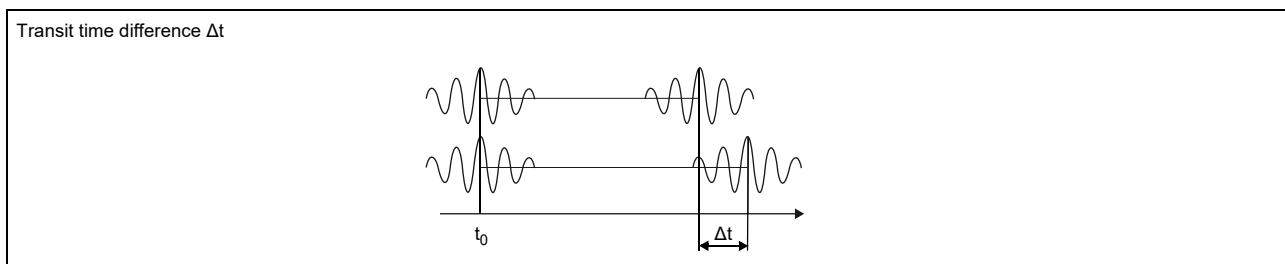
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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

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**

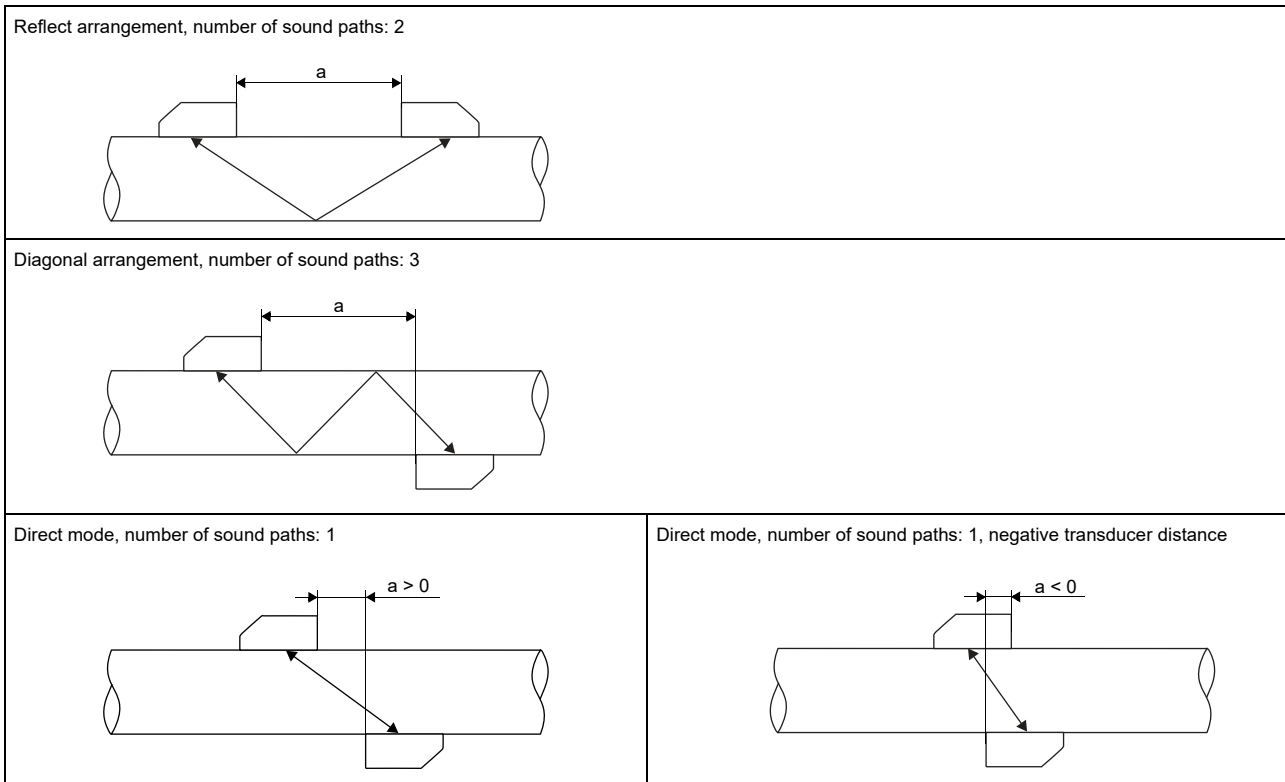
The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe.

- **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.



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 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 ± 0.02 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)				
measurement uncertainty of measuring system ¹	± 0.3 % of reading ± 0.02 ft/s includes calibration certificate traceable to NIST calibration facility ISO 17025 accredited			
measurement uncertainty at the measuring point	± 1 to 3 % of reading ± 0.02 ft/s, contact FLEXIM for an application specific uncertainty evaluation			
transmitter				
power supply	<ul style="list-style-type: none"> • 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	$^{\circ}\text{F}$ -4 to +131/140	-4 to +131/140	-40 to +140 (< -4 $^{\circ}\text{F}$ without operation of the display)	-4 to +131/140
display	128 x 64 dots, backlight			
menu language	English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian			
explosion protection				
• ATEX/IECEx				
marking	-	-	CE 0637  II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 $^{\circ}\text{C}$ Db T_a -40...+60 $^{\circ}\text{C}$	-
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 $^{\circ}\text{C}$ G703Z2**9:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T4A Ta = 55 $^{\circ}\text{C}$

¹ with aperture calibration of the transducers

² outside of explosive atmosphere (housing cover open)

³ 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 ² • LAN ²			
process interfaces	max. 1 option: • RS485 (ASCII sender) • Modbus RTU ³ • BACnet MS/TP • HART ³ • Profibus PA ³ • FF H1 ³ • Modbus TCP ³ • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU ³ • BACnet MS/TP • HART ³ • Profibus PA ³ • FF H1 ³ • Modbus TCP ³ • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU ³ • BACnet MS/TP • HART ³ • Profibus PA ³ • FF H1 ³ • Modbus TCP ³ • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU ³ • BACnet MS/TP • HART ³ • Profibus PA ³ • FF H1 ³ • Modbus TCP ³ • BACnet IP
accessories				
serial data kit	USB cable			
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		$U_{ext} = 8 \text{ to } 30 \text{ V}$, depending on R_{ext} ($R_{ext} < 1 \text{ k}\Omega$ at 30 V)		
• HART				
range	mA	4 to 20		
accuracy		0.1 % of reading ±15 µA		
active output		$U_{int} = 24 \text{ V}$, $R_{ext} < 500 \Omega$		
passive output		$U_{ext} = 10 \text{ to } 24 \text{ V DC}$, depending on R_{ext} ($R_{ext} < 1 \text{ k}\Omega$ 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		
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 with aperture calibration of the transducers

² outside of explosive atmosphere (housing cover open)

³ with inputs and including parametrization of the transmitter

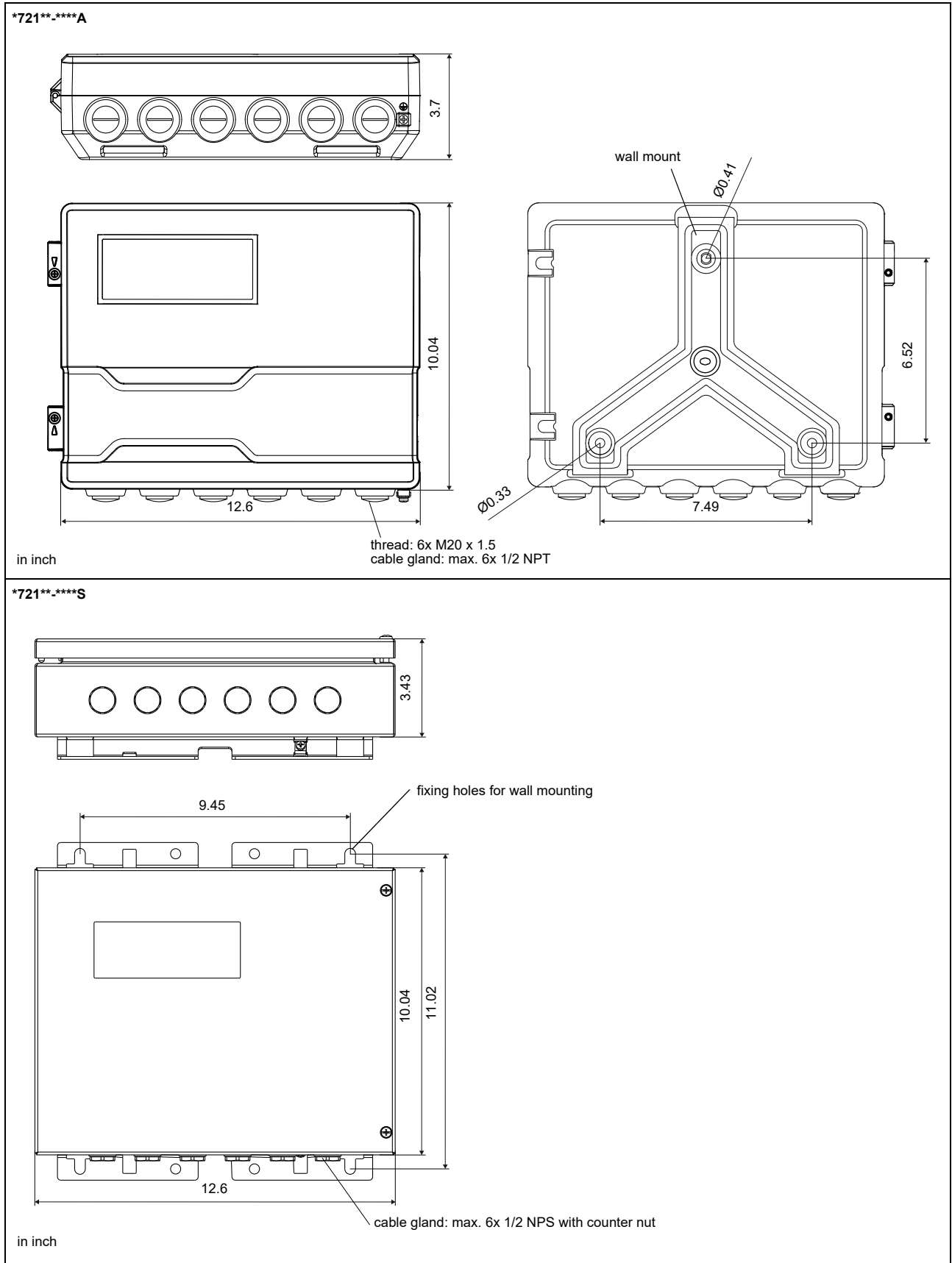
	FLUXUS G721**-NN0*A	FLUXUS G721**-NN0*S	FLUXUS G721**-A20*S	FLUXUS G721**-F20*S
inputs				
	The inputs are galvanically isolated from the transmitter.			
number	max. 4, on request			
• temperature input				
type	Pt100/Pt1000			
connection	4-wire			
range	°F	-238 to +1040		
resolution	K	0.01		
accuracy	±0.01 % of reading ±0.03 K			
• current input				
accuracy	0.1 % of reading ±10 µA			
active input		U _{int} = 24 V, R _{int} = 50 Ω, P _{int} < 0.5 W, not short-circuit proof		
• range	mA	0 to 20		
passive input		R _{int} = 50 Ω, P _{int} < 0.3 W		
• range	mA	-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 26 V, 1 mA
functions		<ul style="list-style-type: none"> • resetting the measured values • resetting the totalizers • stopping the totalizers • activation of the measuring mode for highly dynamic flows 		

¹ with aperture calibration of the transducers

² outside of explosive atmosphere (housing cover open)

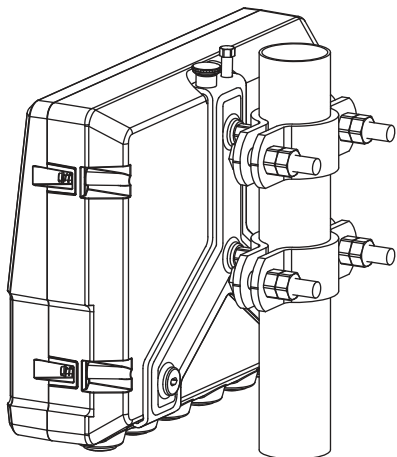
³ with inputs and including parametrization of the transmitter

Dimensions

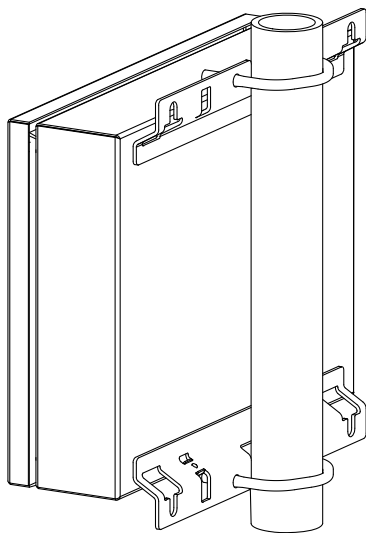


2" pipe mounting kit

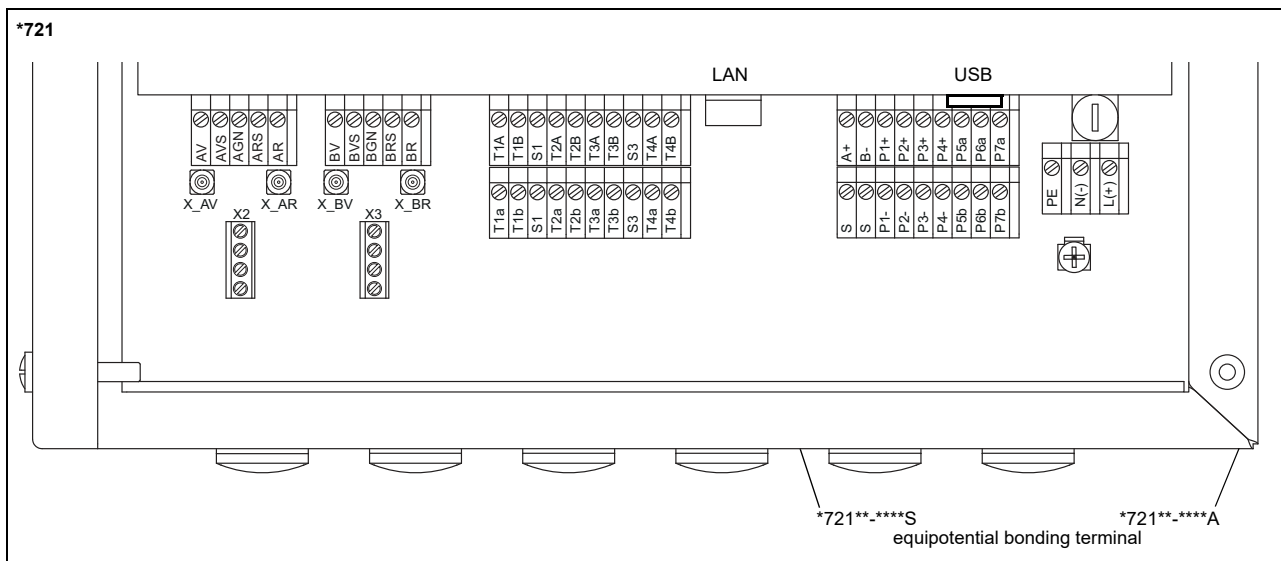
*721**-****A



*721**-****S



Terminal assignment



power supply¹

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

transducers

transducer cable (transducers ****L*), extension cable				transducer cable (transducers ****S2)			
measuring channel A		measuring channel B			measuring channel A	measuring channel B	
terminal	connection	terminal	connection	transducer	terminal	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 +	<ul style="list-style-type: none"> • RS485¹ • Modbus RTU¹ • BACnet MS/TP¹ • Profibus PA¹ • FF H1¹
		B-	signal -	
P5a to P7a P5b to P7b	binary output (optorelay)	S	shield	
		USB	type B	<ul style="list-style-type: none"> • service (FluxDiag/FluxDiagReader)
		LAN	RJ45	<ul style="list-style-type: none"> • service (FluxDiag/FluxDiagReader) • BACnet IP • Modbus TCP

analog inputs^{1,2}

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

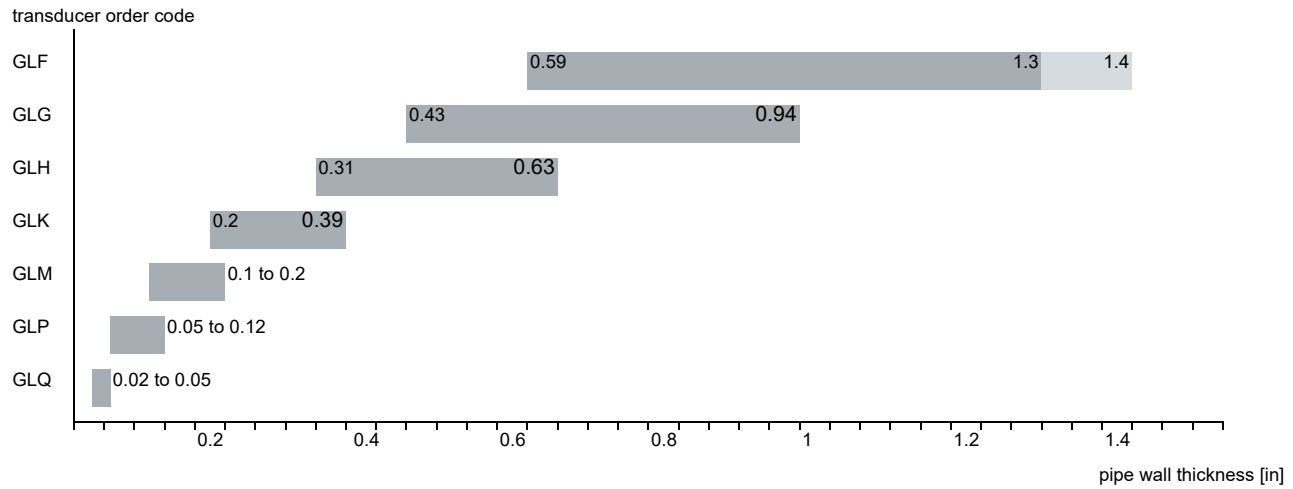
² The number, type and terminal assignment will be customized.

Transducers

Transducer selection

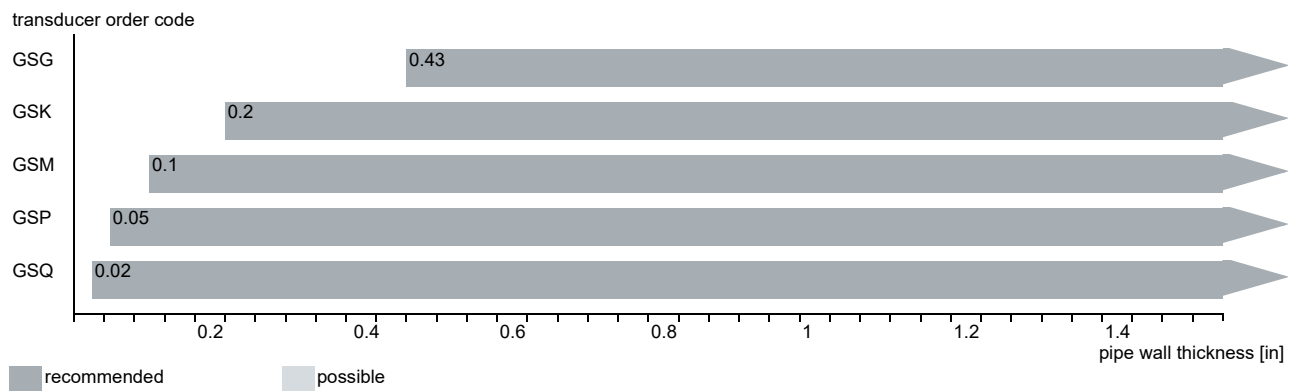
Step 1a

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

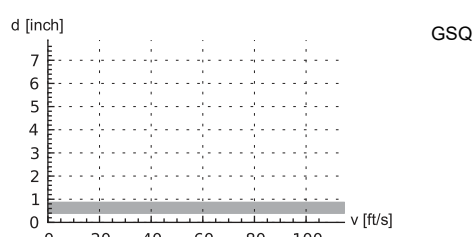
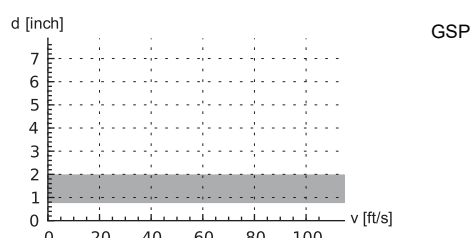
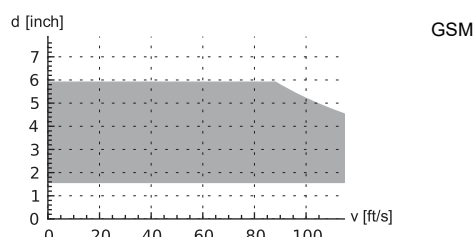
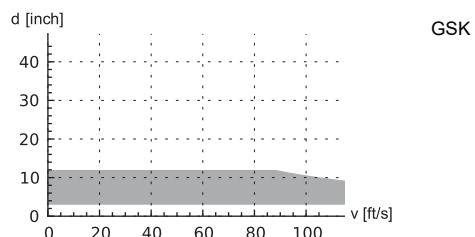
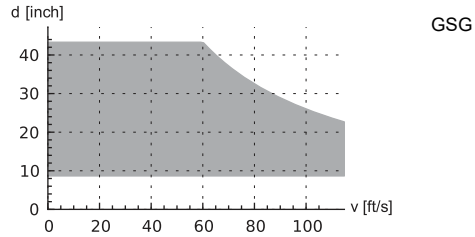
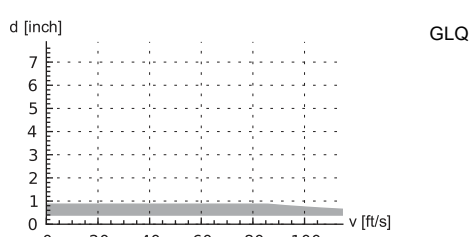
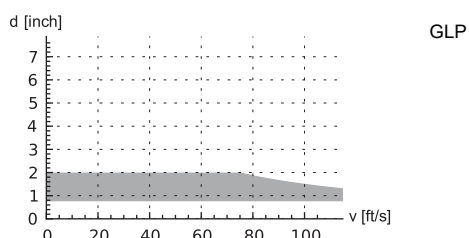
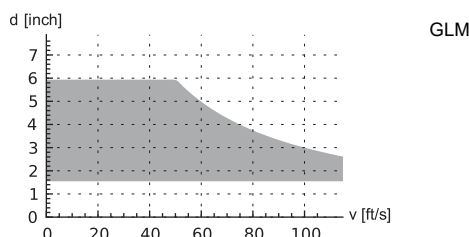
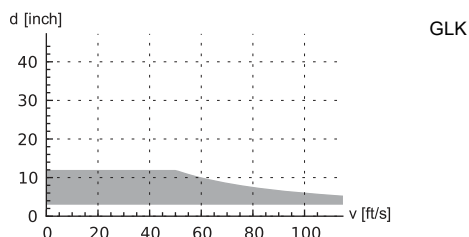
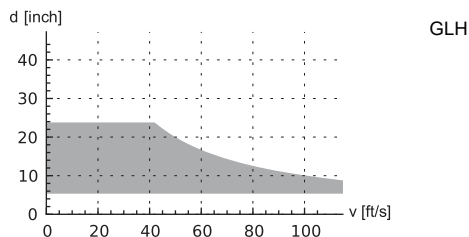
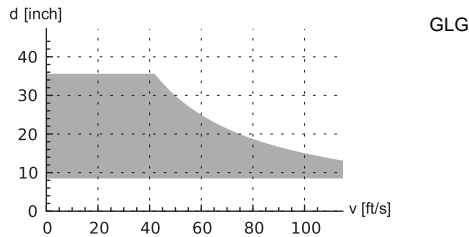
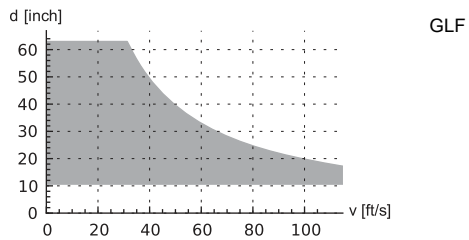
inner pipe diameter d dependent on the flow velocity v of the fluid in the pipe

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 transducer¹

shear wave transducer¹



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

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

d = inner pipe diameter

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

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

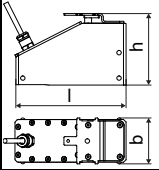
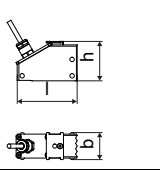
Shear wave transducers (zone 2 - FM Class I Div. 2 - nonEx, TS)

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 pressure¹						
min. extended	psi	metal pipe: 290				
min.	psi	metal pipe: 435, plastic pipe: 15				
inner pipe diameter d²						
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		NEMA 6				
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
pipe surface temperature						
min.	°F	-40				
max.	°F	+266				
ambient temperature						
min.	°F	-40				
max.	°F	+266				
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...T2 Gc Ex tb IIIC TX 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.	°F	-40				
• max.	°F	+257 +374				
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 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)

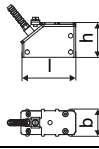
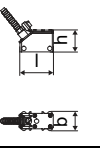

order code		GSG-N**TS/IP68	GSK-N**TS/IP68	GSM-N**TS/IP68	GSP-N**TS/IP68
technical type		GDG1LI8	GDK1LI8	GDM2LI8	GDP2LI8
transducer frequency	MHz	0.2	0.5	1	2
fluid pressure¹					
min. extended	psi	metal pipe: 290			
min.	psi	metal pipe: 435, plastic pipe: 15			
inner pipe diameter d²					
min. extended	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	
pipe surface temperature					
min.	°F	-40			
max.	°F	+212			
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
pipe surface temperature (Ex)					
• 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 pressure¹				
min. extended	psi	metal pipe: 290		
min.	psi	metal pipe: 435, plastic pipe: 15		
inner pipe diameter d²				
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
pipe surface temperature				
min.	°F	-22		-22
max.	°F	+450 ³		+392
ambient temperature				
min.	°F	-22		-22
max.	°F	+104 +140 ⁴ +392 ⁵		+392
temperature compensation		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 TX 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. °F -40 • max. °F +455 ³		
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 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 > +200 °C/+392 °F:

Variofix L (nonEx, Ex) or quick release clasps and tension straps (nonEx)

observe the insulation instruction

Ex: ambient temperature max. +40 °C/+104 °F

⁴ pipe surface temperature +200 to +232 °C/+392 to +450 °F: quick release clasps and tension straps

⁵ pipe surface temperature max. +200 °C/+392 °F

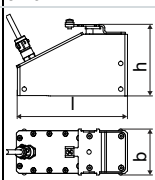
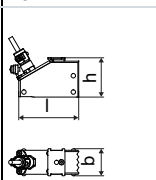
Shear wave transducers (zone 1, TS)

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 pressure¹						
min. extended	psi	metal pipe: 290				
min.	psi	metal pipe: 435, plastic pipe: 15				
inner pipe diameter d²						
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
pipe surface temperature						
min.	°F	-40				
max.	°F	+266				
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/**
pipe surface temperature (Ex)						
• 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		GDG1L11	GDK1L11	GDM2L11	GDP2L11
transducer frequency	MHz	0.2	0.5	1	2
fluid pressure¹					
min. extended	psi	metal pipe: 290			
min.	psi	metal pipe: 435, plastic pipe: 15			
inner pipe diameter d²					
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
pipe surface temperature					
min.	°F	-40			
max.	°F	+212			
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
pipe surface temperature (Ex)					
• min.	°C	-55			
• max.	°C	+80			
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			


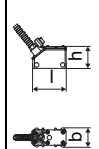
¹ depending on application, typical absolute value for natural gas, nitrogen, compressed air

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 pressure¹				
min. extended	psi	metal pipe: 290		
min.	psi	metal pipe: 435, plastic pipe: 15		
inner pipe diameter d²				
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
pipe surface temperature				
min.	°F	-22		-22
max.	°F	+450 ³		+392
ambient temperature				
min.	°F	-22		-22
max.	°F	+104 +392 ⁴		+392
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 Ex II2G II2D Ex q IIC T6...T2 Gb Ex tb IIIA TX Db		
certification ATEX		IBExU07ATEX1168 X		
certification IECEX		IECEX IBE 08.0007X		

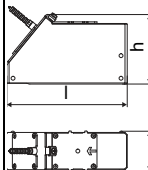
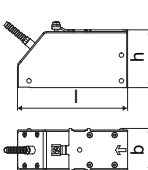
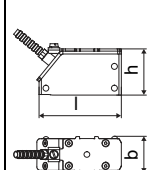
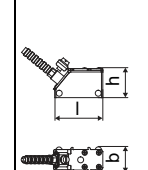

¹ depending on application, typical absolute value for natural gas, nitrogen, compressed air

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

³ > +200 °C/+392 °F:
 Variofix L
 observe the insulation instruction
 ambient temperature max. +40 °C/+104 °F

⁴ pipe surface temperature max. +200 °C/+392 °F

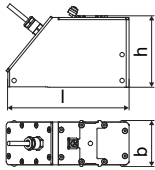
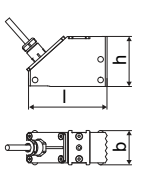
Lamb wave transducers (zone 2 - FM Class I Div. 2 - nonEx, TS)

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 pressure¹									
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 d²									
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	
pipe surface temperature									
min.	°F	-40							
max.	°F	+302				+338			
ambient temperature									
min.	°F	-40							
max.	°F	+302				+338			
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)		-55							
• min.	°C	gas: +150, dust: +140							
• max.	°C								
marking		CE 0637 Ex II 3G II 2D Ex nA IIC T6...T2 Gc Ex tb IIC 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/**	
pipe surface temperature (Ex)		-40							
• min.	°F	+329							
• max.	°F								
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 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 2 - 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 pressure¹						
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 d²						
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	
pipe surface temperature						
min.	°F	-40				
max.	°F	+212				
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
pipe surface temperature (Ex)						
• min.	°C	-40				
• max.	°C	gas: +90, dust: +80				
marking		CE 0637 Ex II 3G II 2D 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

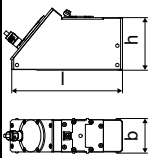
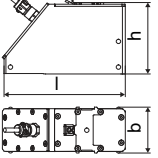
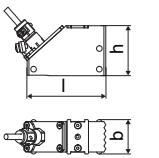
Lamb wave transducers (zone 1, TS)

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		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 pressure¹								
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 d²								
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
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
pipe surface temperature								
min.	°F	-40						
max.	°F	+302					+338	
ambient temperature								
min.	°F	-40						
max.	°F	+302					+338	
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	-55						
• max.	°C	+140						
marking		CE 0637 Ex II 2G II 2D 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 pressure¹							
min. extended	psi	metal pipe: 145	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 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 d²							
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	PPSU with stainless steel cap 316Ti				
contact surface		PPSU	PPSU				
degree of protection		IP68 ³	IP68 ³				
transducer cable							
type		2550	2550				
length	ft	39	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	
pipe surface temperature							
min.	°F	-40	-40				
max.	°F	+212	+212				
ambient temperature							
min.	°F	-40	-40				
max.	°F	+212	+212				
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	-55					
• max.	°C	+80					
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

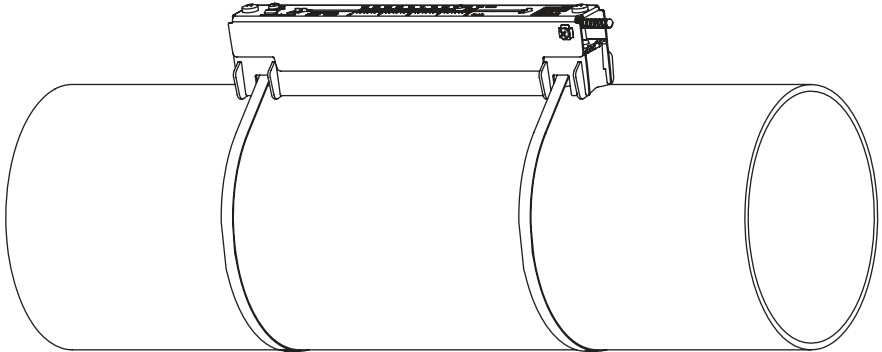
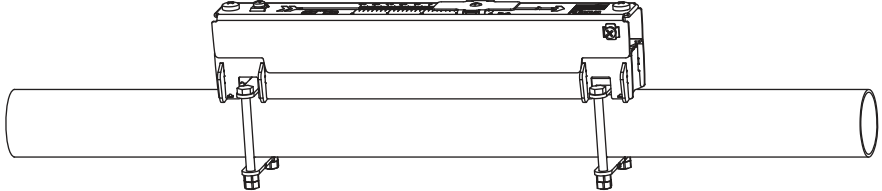
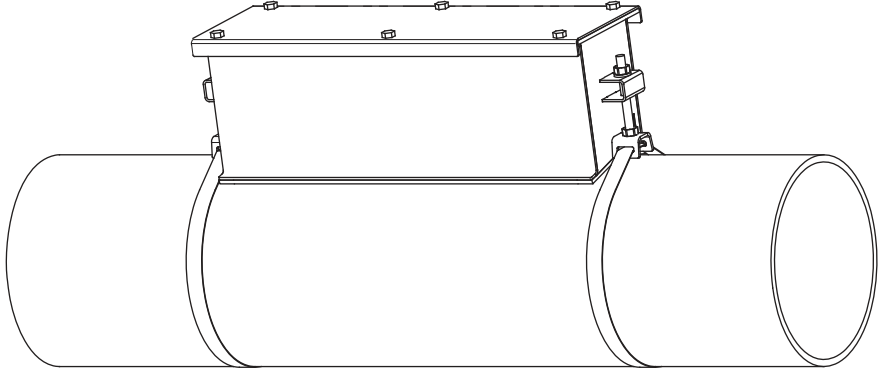
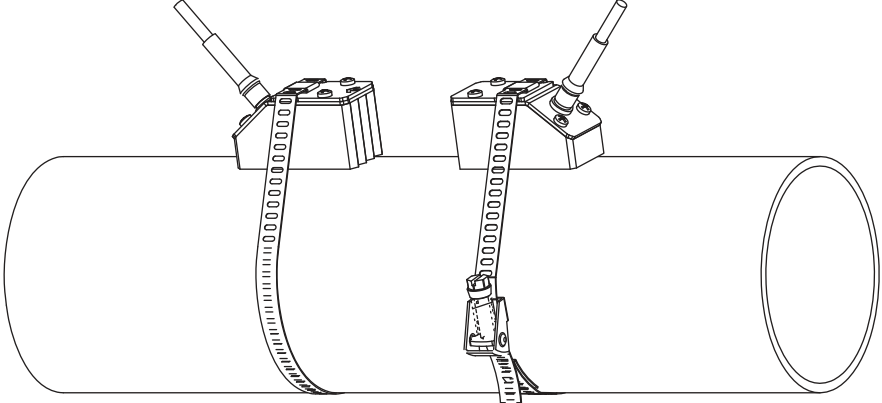
² Lamb wave transducer:
 typical values for natural gas, nitrogen, oxygen, pipe diameters for other fluids on request
 inner pipe diameter max. recommended: in reflect arrangement (diagonal arrangement) and for a flow velocity of 49 ft/s (98 ft/s)
 inner pipe diameter max. extended: in reflect arrangement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

<p>PermaRail (VLK, VLM, VLQ)</p> 	<p>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</p>
<p>PermaRail with bolt mounting plates (VL*-**B)</p> 	<p>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</p>
<p>PermaLok PL</p> 	<p>material: stainless steel 316</p>
<p>quick release clasp and tension straps</p> 	<p>material: stainless steel 410, 200</p>

Coupling materials for transducers

	normal temperature range (4th character of transducer order code = N)		extended temperature range (4th character of transducer order code = E)		
	< 212 °F	< 338 °F	< 302 °F	< 392 °F	392 to 464 °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	coupling pad type TF
long time measurement	coupling pad type VT ¹	coupling pad type VT ²	coupling pad type VT ¹	coupling pad type VT ²	coupling pad type TF

¹ < 5 years

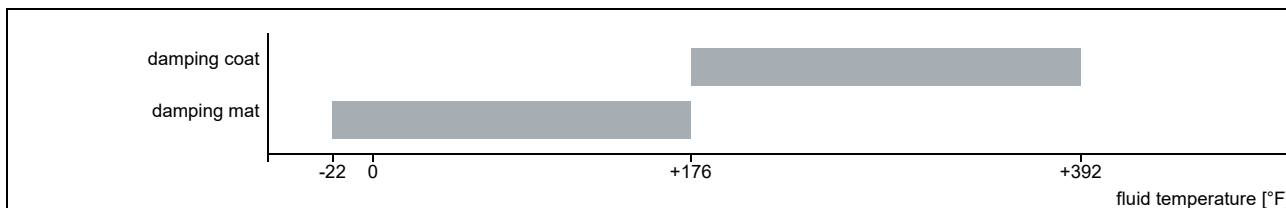
² < 6 months

Technical data

type	ambient temperature °F
coupling compound type N	-22 to +266
coupling compound type E	-22 to +392
coupling compound type H	-22 to +482
coupling pad type VT	14 to +392
coupling pad type TF	392 to 464

Damping material (optional)

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



Damping mats

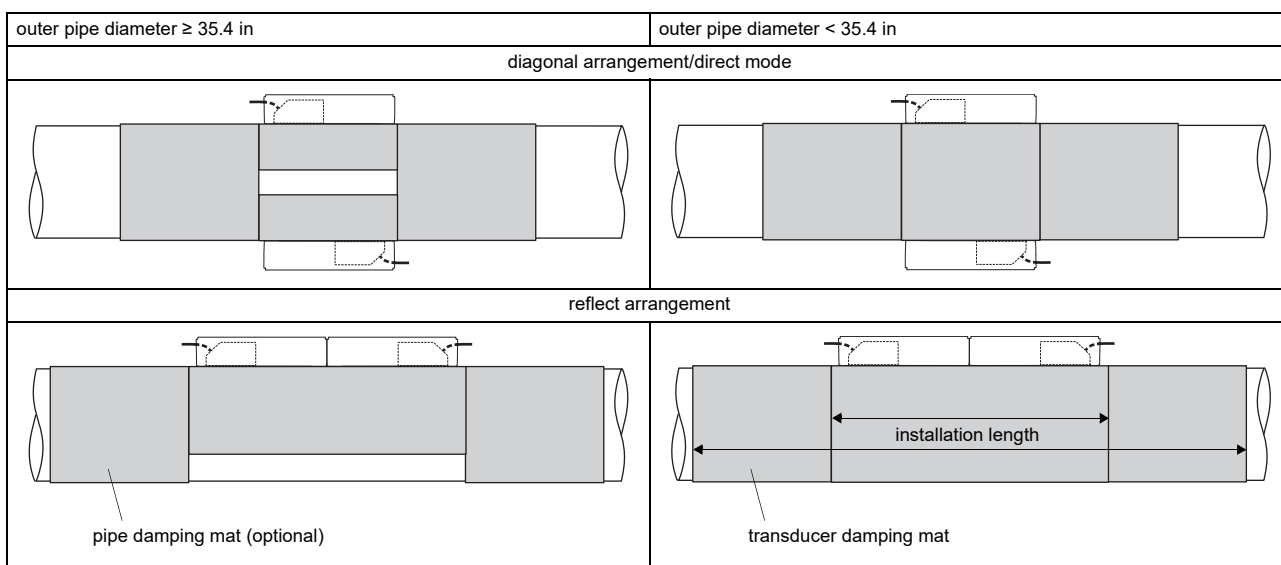
Damping mats will be used for the gas measurement to reduce acoustic noise influences on the measurement.

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 [in]	number of rolls ¹		max. installation length [in]	number of rolls ¹	
					standard ²	extended ²		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
<p>JB01</p>		<p>*****8*</p>
<p>JBP3</p>		<p>****L *</p>
<p>JB02, JB03, JB04</p>		<p>*****52</p>

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: ****L*	ft	39	≤ 984	39	≤ 984	-	-	-	-

x = transducer cable length

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

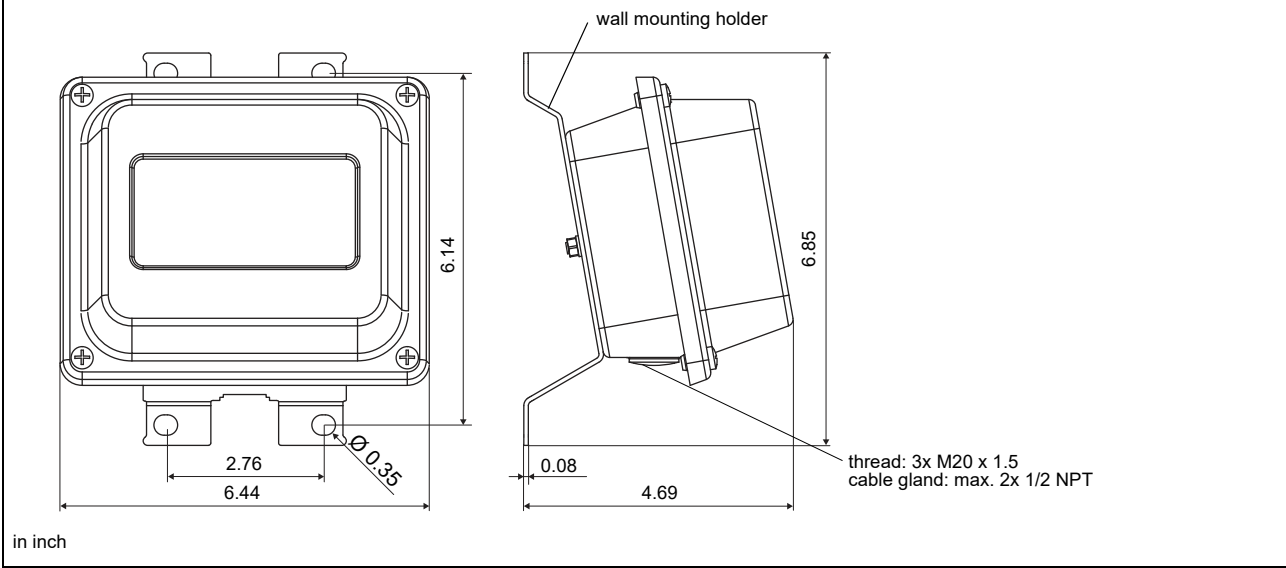
Junction box

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 eb mb IIC T6...T4 Gb Ex tb IIIC T100 °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	NI/CI. 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	

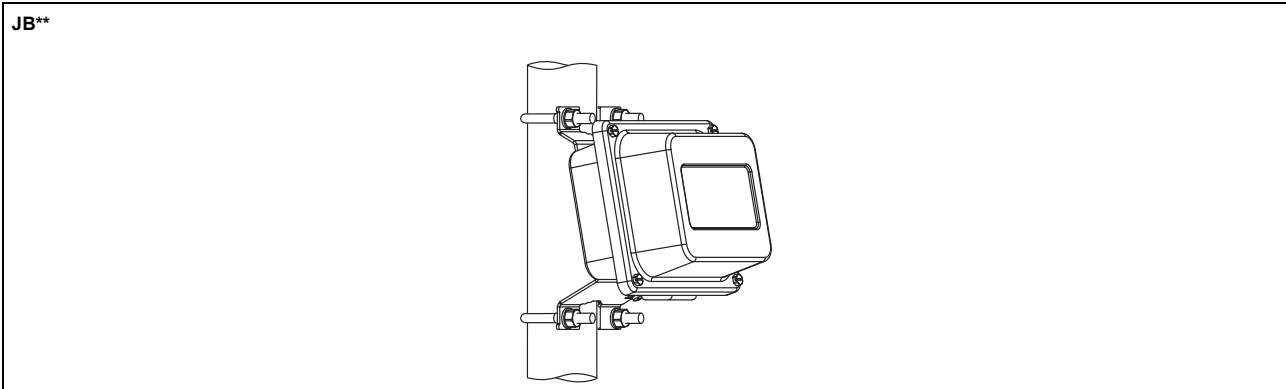
Dimensions

JB0*, JBP*



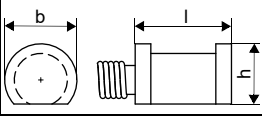
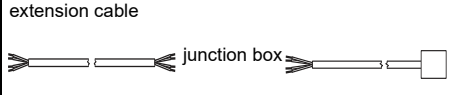
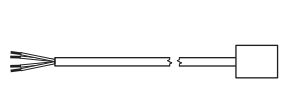
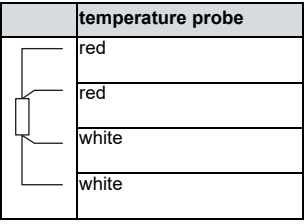
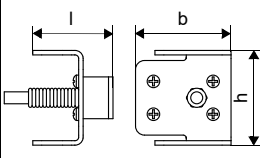
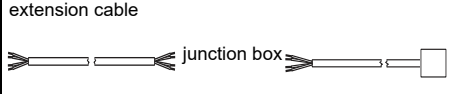
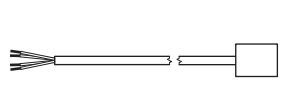
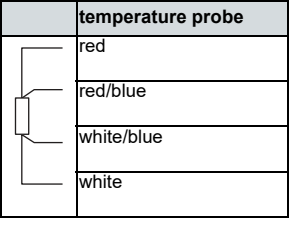
2" pipe mounting kit

JB**



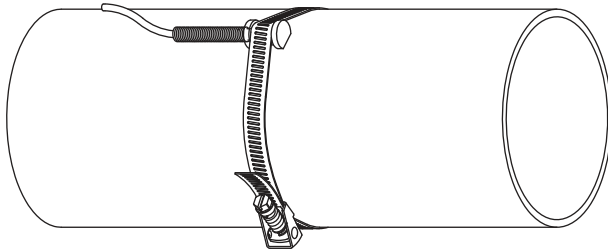
Clamp-on temperature probe (optional)

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
		
connection		
		
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
		
connection		
		
cable		
	temperature probe	extension cable
type	4 x 0.25 mm ² black	4 x 18 AWG
standard length	ft 9	-
max. length	ft -	656
cable jacket	PTFE	PVC

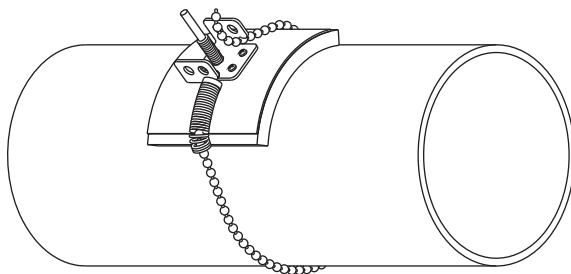
Fixation

tension strap PT13N



material: stainless steel 301, 410

ball chain PT13F



material: stainless steel 316L
length: 3 ft

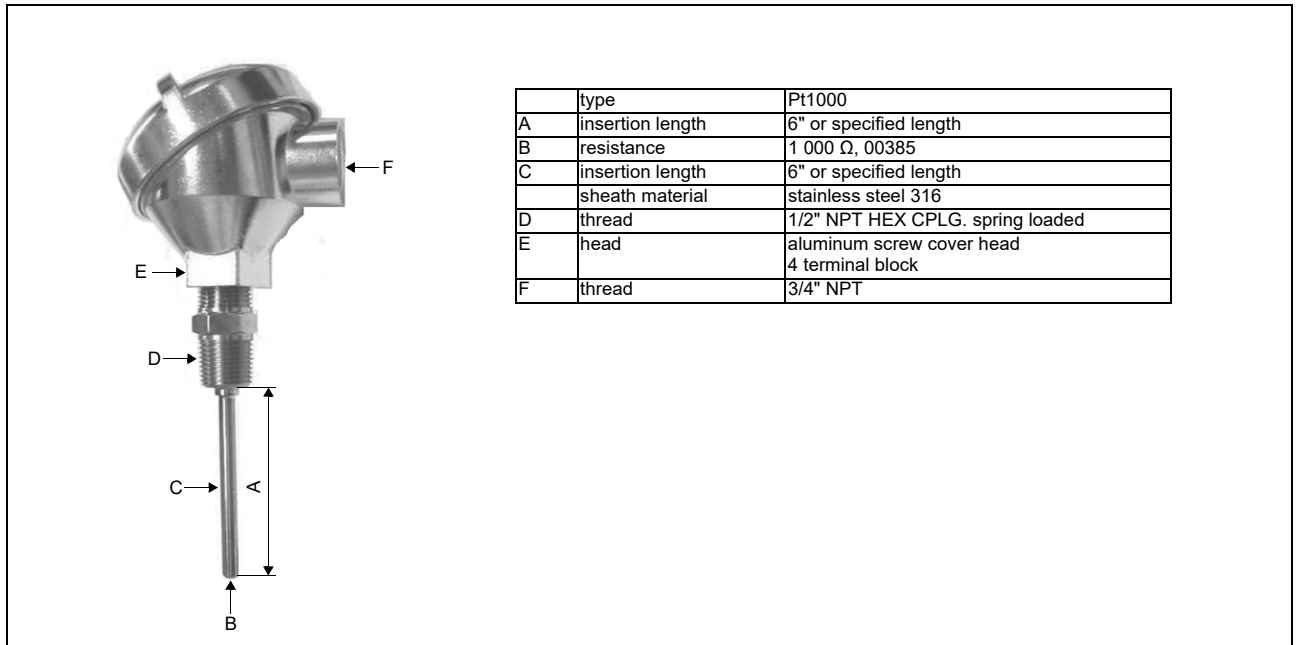
Junction box

The junction box is shown in two views: Top View and Side View. The top view shows a cylindrical body with a central section labeled "1/2" COVER". Dimensions are provided: 1.18" for the distance from the center to each end, 4.72" for the length of the central cover section, and 1.18" for the distance from the center to the center of each end. The side view shows a height of 1.34". A label "1/2" NPT" points to the connection ports on the left side.

connection

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

Inline temperature probe (optional)



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