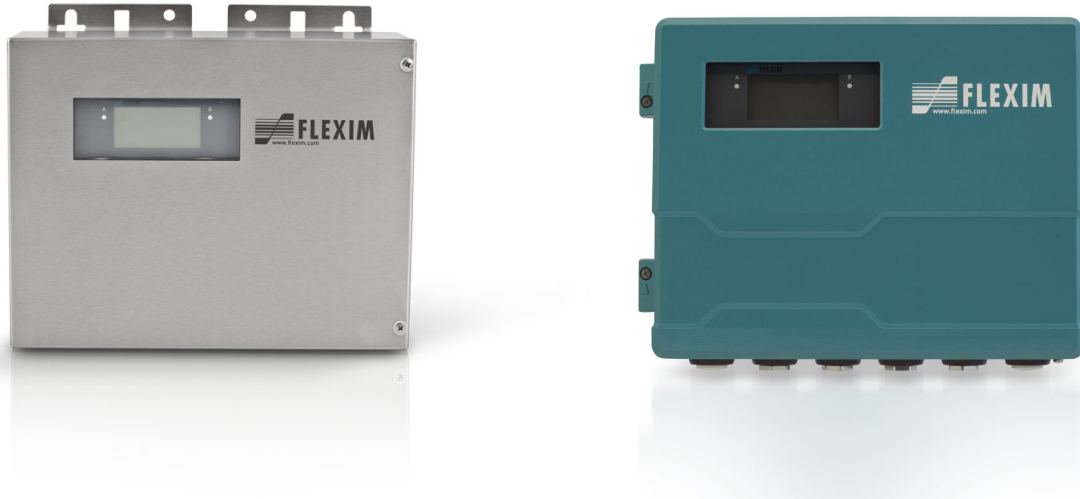


Flexim FLUXUS G721ST Ultrasonic Flowmeter



Steam Ultrasonic Flowmeter for Permanent Installation

Transmitter for Permanent Outdoor Wall or Pipe Mounting

Features

- Exact and highly reliable measurement of saturated and superheated steam for temperatures up to max. 356 °F by means of the clamp-on principle
- Physical quantities volumetric flow rate and mass flow rate available in a transmitter without additional steam calculator
- Installation and start-up do not require any pipe work and are carried out without any process interruptions and cooling down of the steam system
- Non-invasive, wear-free and pressure constant measurement
- Maintenance-free acoustic coupling using permanent coupling foil
- High measurement accuracy even at very low as well and 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 (Modbus, Profibus PA, Foundation Fieldbus, 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)
- The measurement is zero point stable and drift free

Applications

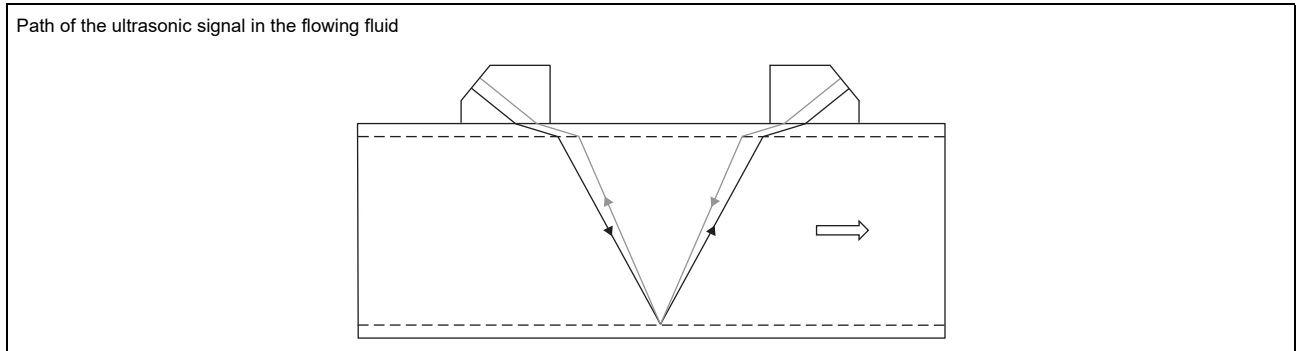
- Food and beverage industry
- Pharmaceutical industry
- Chemical industry
- Manufacturing industries

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Function

Measurement principle

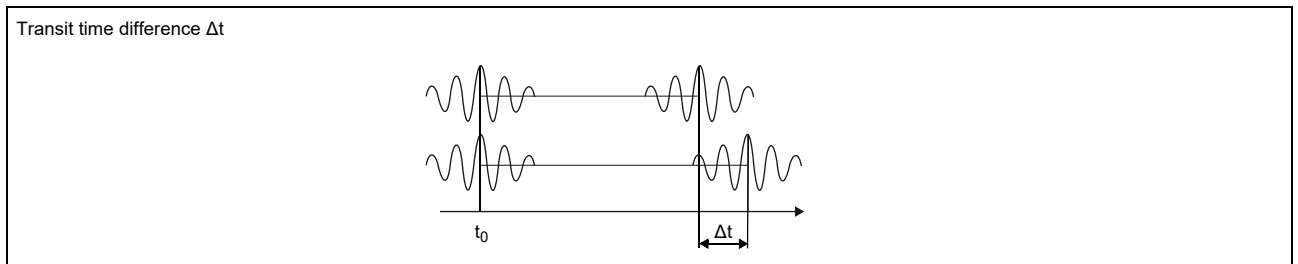
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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 mechanic calibration factor
- A - cross-sectional pipe area
- k_a - acoustic calibration factor
- Δt - transit time difference
- t_y - average of transit times in the fluid

Calculation of mass flow rate

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

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

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

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

where

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

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 easy.

- **diagonal arrangement**

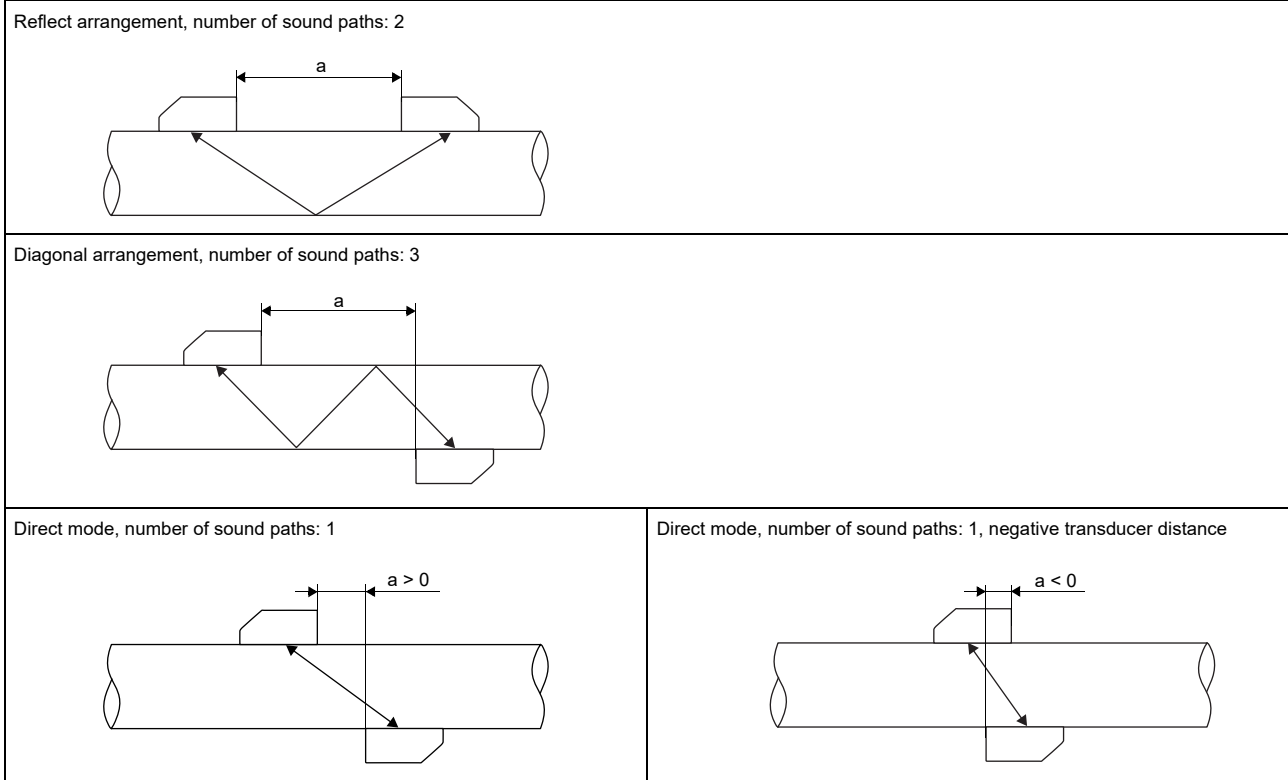
The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe.

- **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.

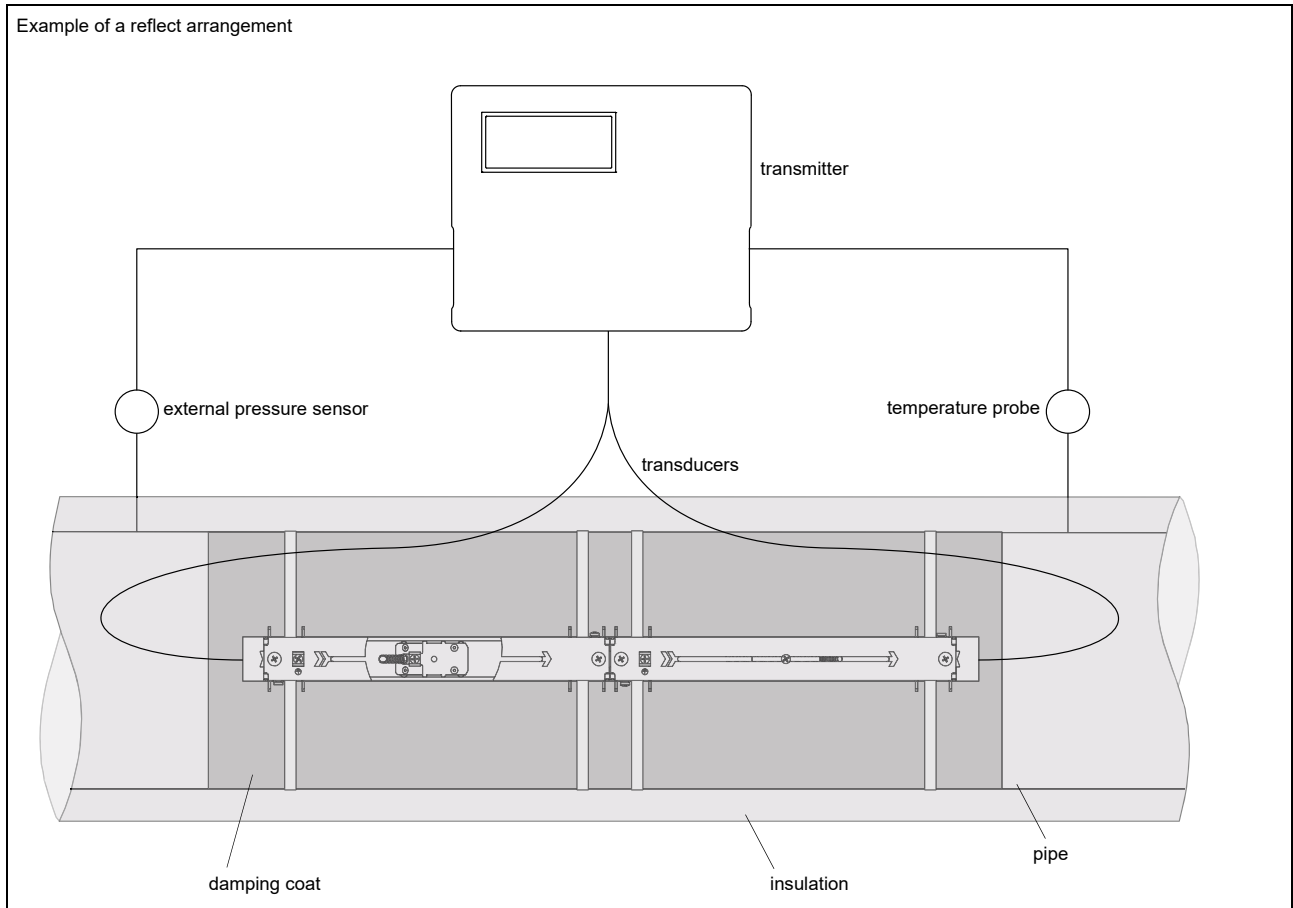
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

Typical measurement setup



Transmitter

Technical data

	FLUXUS G721ST-NNN**.*AL G721ST-NNN**.*ST	FLUXUS G721ST-A2N**.*AL G721ST-A2N**.*ST	FLUXUS G721ST-F2N**.*AL G721ST-F2N**.*ST
			
design	standard field device	standard field device zone 2	standard field device FM Class I Div. 2
application	steam measurement ²		
measurement			
measurement principle	transit time difference correlation principle		
flow direction	bidirectional		
flow velocity	ft/s depending on pipe diameter and transducer, see diagrams		
repeatability	0.15 % MV ±0.02 ft/s		
fluid	saturated steam, superheated steam		
fluid pressure	psia 44 to 145		
fluid temperature	°F 275 to 356	275 to 311 (see pipe surface temperature (Ex) of selected transducer)	275 to 329
temperature compensation	corresponding to the recommendations in ANSI/ASME MFC-5.1-2011		
measurement uncertainty (volumetric flow rate)			
measurement uncertainty of the measuring system ¹	±0.3 % MV ±0.02 ft/s includes calibration certificate traceable to NIST		
measurement uncertainty at the measuring point	±1 to 3 % MV ±0.02 ft/s, depending on the application		
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 or stainless steel 316L	
degree of protection		IP66	aluminum housing: IP66/NEMA 4X stainless steel housing: IP65
dimensions	inch	see dimensional drawing	
weight	lb	aluminum housing: 11.9 stainless steel housing: 11.2	
fixation		wall mounting, optional: 2" pipe mounting	
ambient temperature	°F	-40 to +140 (< -4 without operation of the display)	aluminum housing: -40 to +131/140 (< -4 without operation of the display) stainless steel housing: -4 to +131/140
display		128 x 64 pixels, backlight	
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian, Chinese	
explosion protection			
• ATEX/IECEx			
marking	-	G721**-A20*A, G721**-A20*S: CE 0637 Ex II 3G II 2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 °C Db T _a -40...+60 °C	-
certification	-	IBExU11ATEX1015, IECEx IBE 11.0008	-
• FM			
marking	-	-	G721**-F20*S2, G721**-F20*S3:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T5 G721**-F20*S1:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T4A

¹ with aperture calibration of the transducers

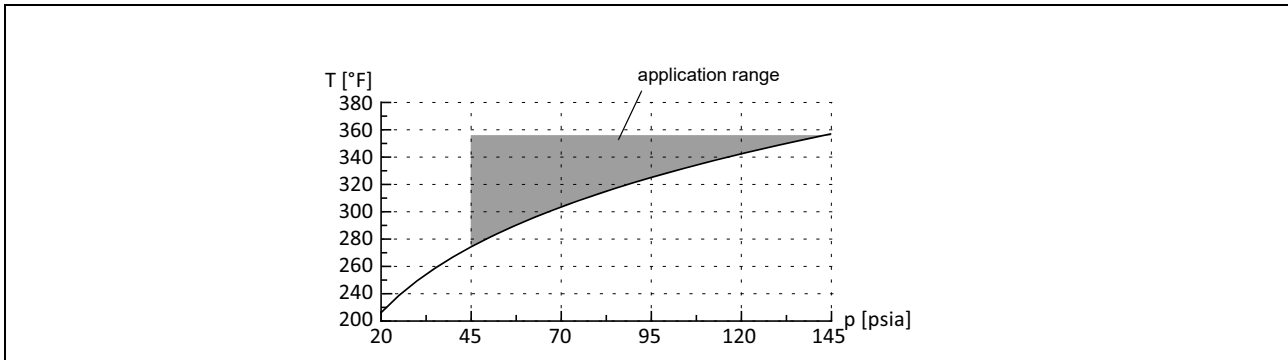
² test measurement to validate the application required in advance

	FLUXUS G721ST-NNN**.*AL G721ST-NNN**.*ST	FLUXUS G721ST-A2N**.*AL G721ST-A2N**.*ST	FLUXUS G721ST-F2N**.*AL G721ST-F2N**.*ST
measuring functions			
physical quantities	operating 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 • LAN		
process interfaces	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • Profibus PA • FF H1 • Modbus TCP • BACnet IP		
accessories			
data transmission kit	USB cable		
software	• FluxDiagReader: reading of measured values and parameters, graphical representation • FluxDiag (optional): reading of measurement data, graphical representation, report generation, parametrization of the transmitter		
data logger			
loggable values	all physical quantities, totalized physical quantities and diagnostic values		
capacity	max. 800 000 measured values		
outputs			
	The outputs are galvanically isolated from the transmitter.		
• switchable current output			
	All switchable current outputs are jointly switched to active or passive.		
number	2 (1 measuring channel), optional: 4 (2 measuring channels)		
range	mA	4 to 20 (3.2 to 22)	
accuracy	0.04 % MV ±3 µA		
active output	$R_{ext} < 250 \Omega$		
passive output	$U_{ext} = 8 \text{ to } 30 \text{ V}$, depending on R_{ext} ($R_{ext} < 1 \text{ k}\Omega$ at 30 V)		
• digital output			
functions	• frequency output • binary output • pulse output		
number	3		
operating parameters	5 to 30 V / < 100 mA		
frequency output			
• range	kHz	0 to 5	
binary output			
• binary output as alarm output	limit, change of flow direction or error		
pulse output			
• functions	mainly for totalizing		
• pulse value	units	0.01 to 1000	
• pulse width	ms	0.05 to 1000	
inputs			
	The inputs are galvanically isolated from the transmitter.		
• temperature input			
number	1 (1 measuring channel), optional: 2 (2 measuring channels)		
type	Pt100/Pt1000		
connection	4-wire		
range	°F	-238 to +1040	
resolution	K	0.01	
accuracy	±0.01 % MV ±0.03 K		
• current input			
number	1 (1 measuring channel), optional: 2 (2 measuring channels)		
accuracy	0.1 % MV ±10 µA		
active input	$U_{int} = 24 \text{ V}$, $R_{int} = 50 \Omega$, $P_{int} < 0.5 \text{ W}$, not short-circuit proof		
• range	mA	0 to 20	
passive input	$R_{int} = 50 \Omega$, $P_{int} < 0.3 \text{ W}$		
• range	mA	-20 to +20	

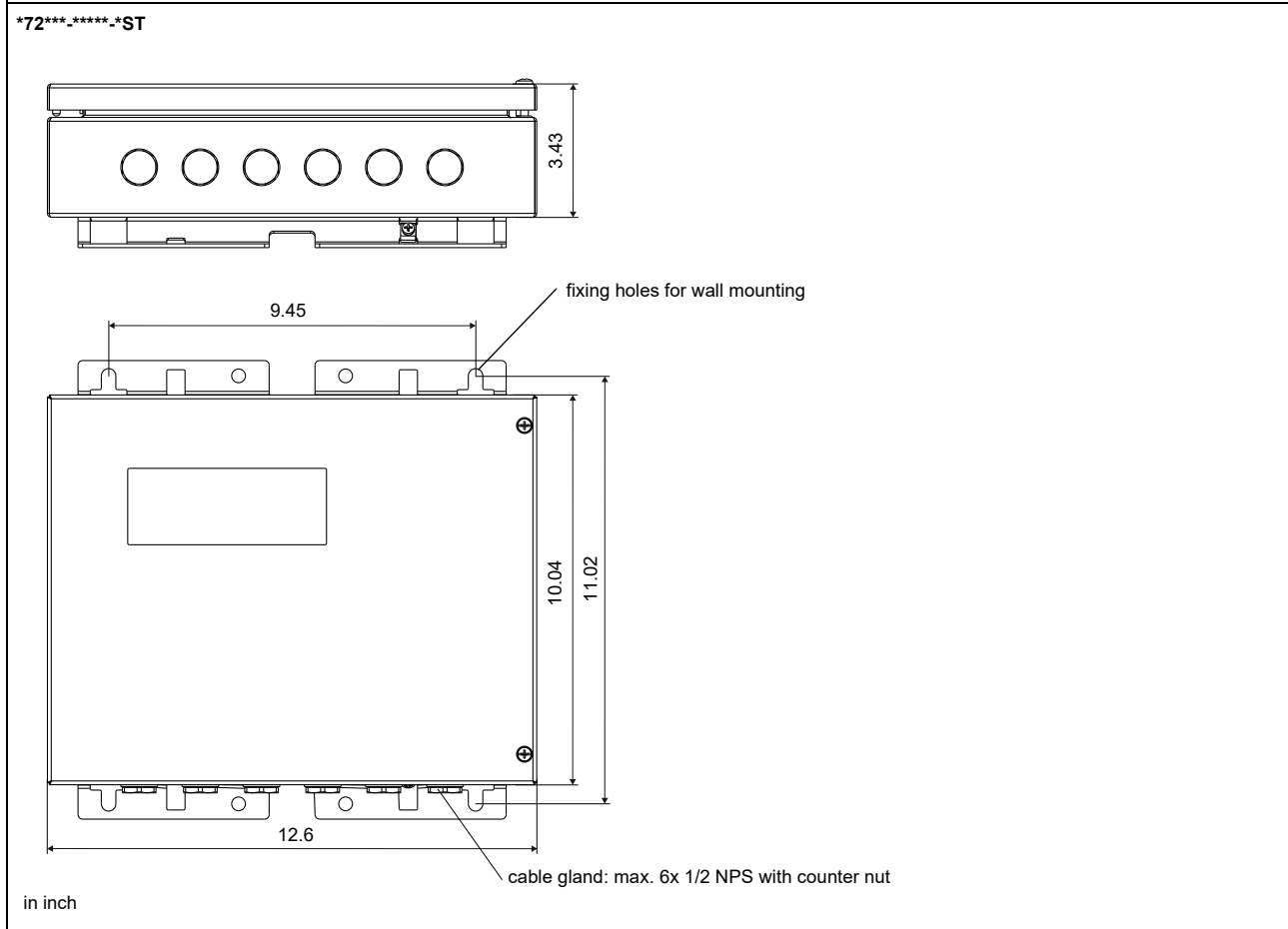
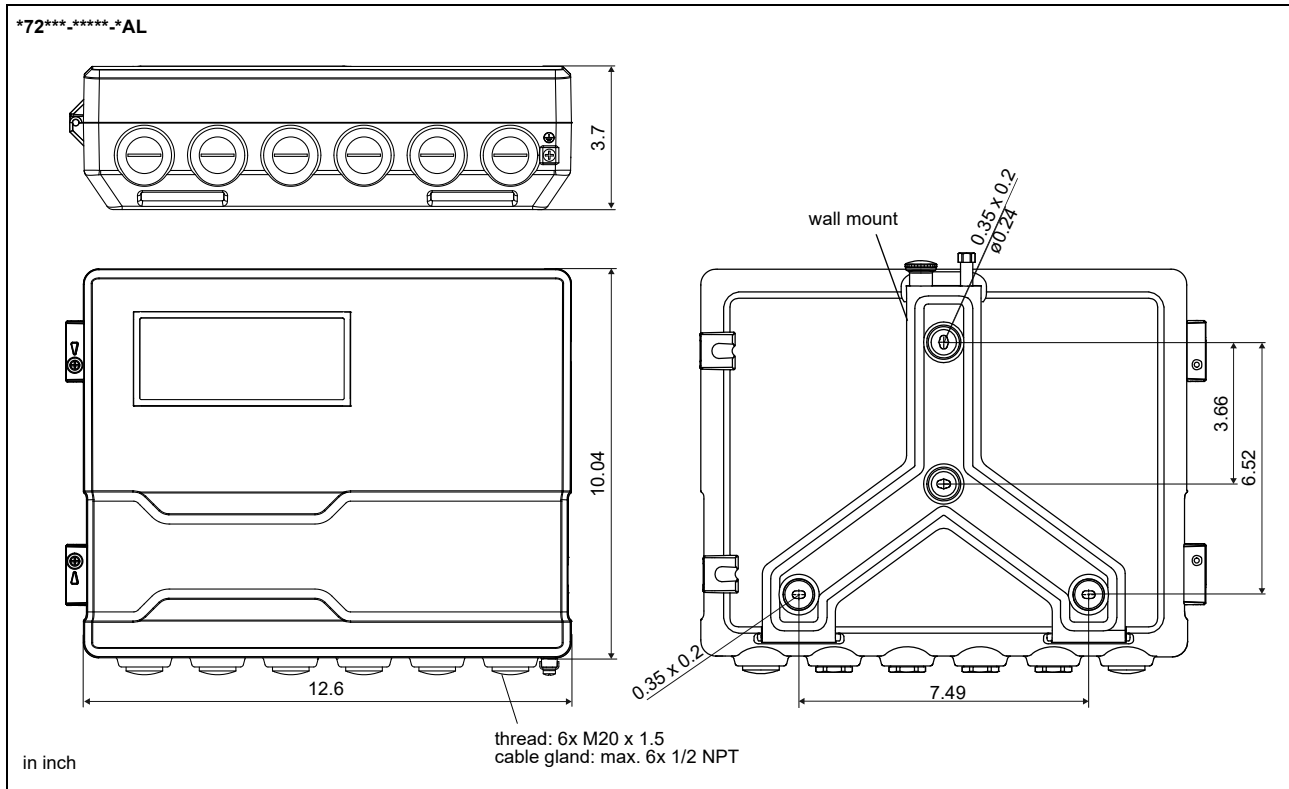
¹ with aperture calibration of the transducers

² test measurement to validate the application required in advance

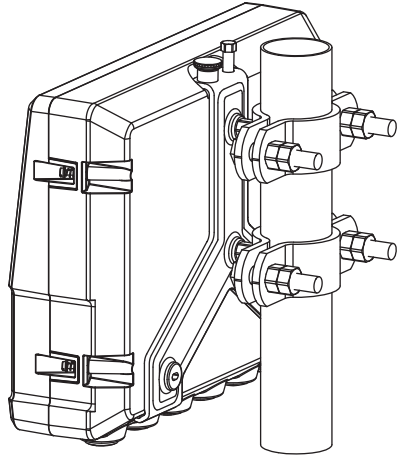
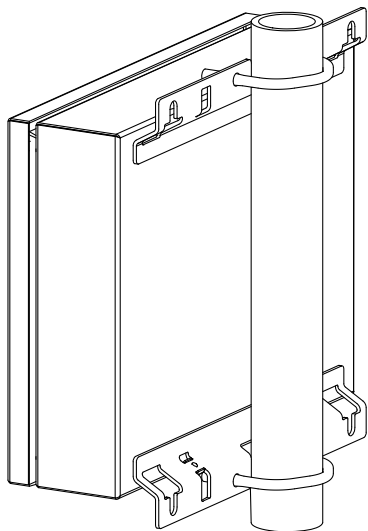
Saturated steam pressure curve



Dimensions



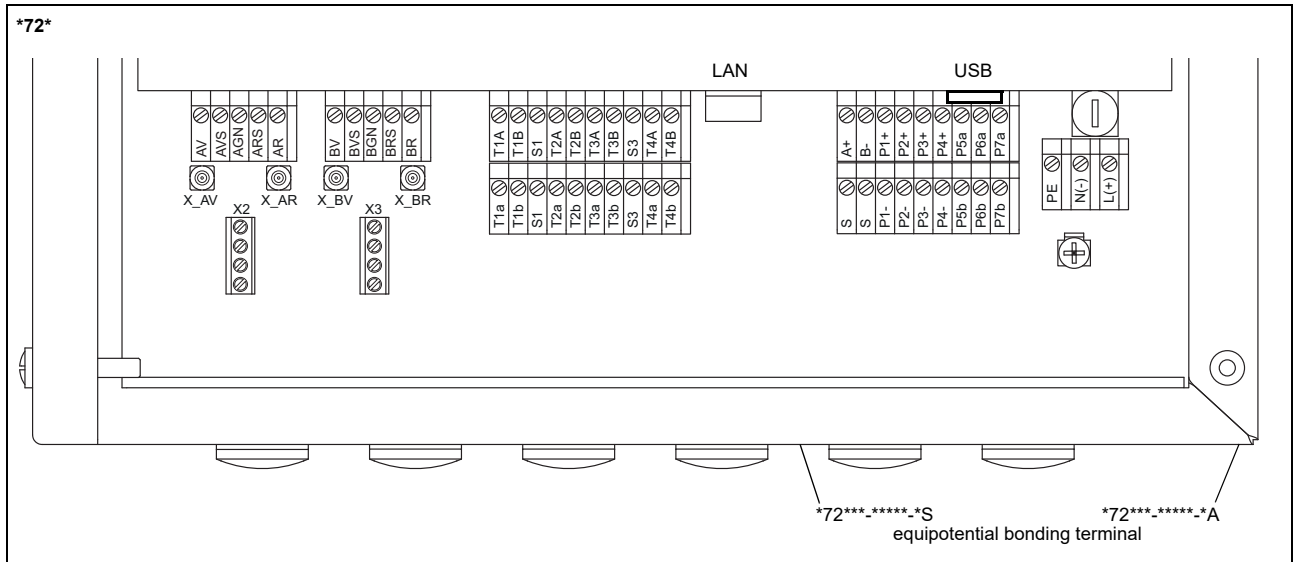
2" pipe mounting kit

<p>*72***_*****_AL</p> 	<p>item number: 721037-4</p>
<p>*72***_*****_ST</p> 	<p>item number: 721110-4</p>

Storage

- do not store outdoors
- store within the original package
- store in a dry and dust-free place
- protect against sunlight
- keep all openings closed
- storing temperature: -4...+140 °F

Terminal assignment



power supply ¹							
terminal		connection (AC)			connection (DC)		
PE		protective conductor			protective conductor		
N(-)		neutral conductor			-		
L(+)		outer conductor			+		
transducers							
extension cable				transducer cable			
measuring channel A				measuring channel B			
terminal	connection	terminal	connection	transducer	measuring channel A	measuring channel B	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							
terminal	connection	terminal	connection	communication interface			
P1+ to P4+ P1- to P4-	current output	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	digital output	101	shield				
		USB	type B Hi-Speed USB 2.0 Device	<ul style="list-style-type: none"> • service (FluxDiag/FluxDiagReader) 			
		LAN	RJ45 10/100 Mbps Ethernet	<ul style="list-style-type: none"> • service (FluxDiag/FluxDiagReader) • BACnet IP • Modbus TCP 			
analog inputs ¹							
		temperature probe		passive sensor		active sensor	
terminal	direct connection	connection with extension cable	connection	connection	connection	connection	connection
T1a to T2a	red	white	not connected	not connected	not connected	not connected	not connected
T1A to T2A	red	black	-	-	+	+	+
T1b to T2b	white	red	+	+	not connected	not connected	not connected
T1B to T2B	white	green	not connected	not connected	-	-	-
S1, S3	shield	shield	not connected	not connected	not connected	not connected	not connected

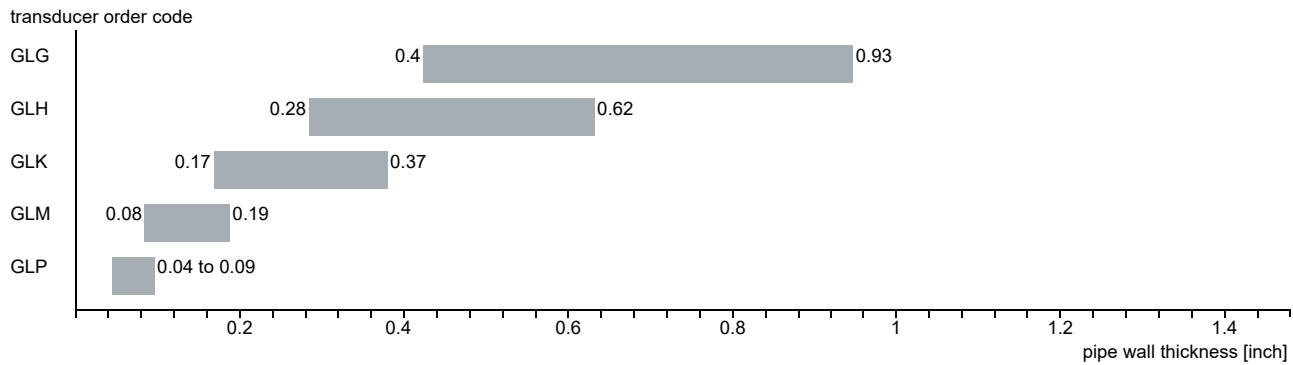
¹ cable (by customer):
 - e.g., flexible wires, with insulated wire ferrules, wire cross-section: AWG14 to 24
 - outer diameter of the cable (*72***-*****-*S with ferrite nut): max. 0.3 inch

Transducers

Transducer selection

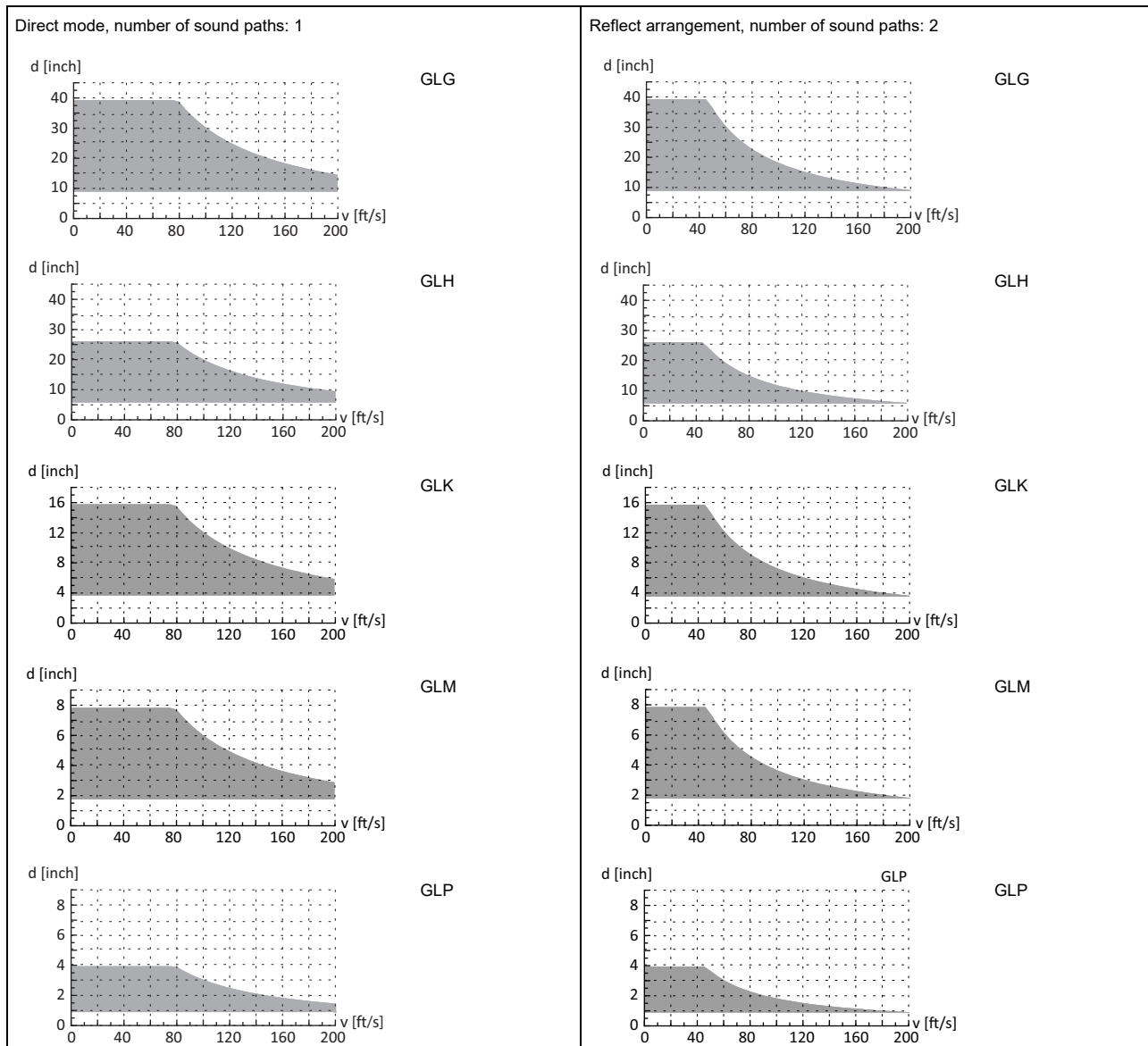
Step 1

pipe wall thickness



Step 2

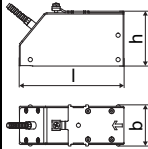
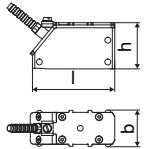


inner pipe diameter d dependent on the flow velocity v of the fluid in the pipe



inner pipe diameter and max. flow velocity for a steam application

Technical data

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

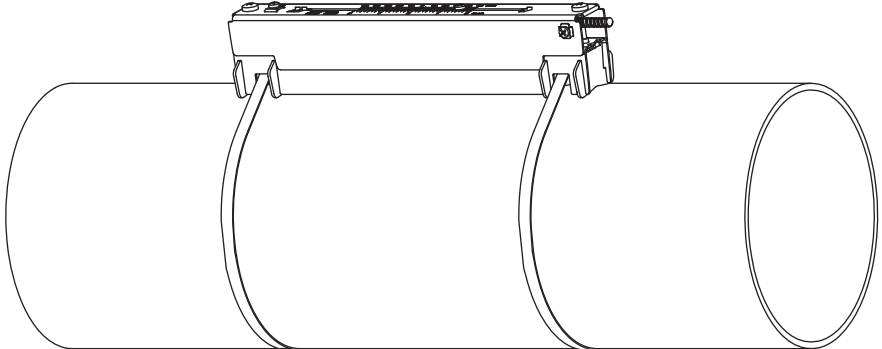
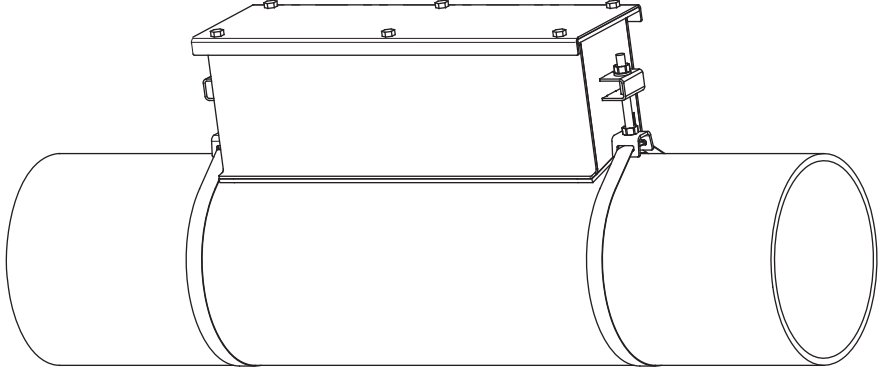
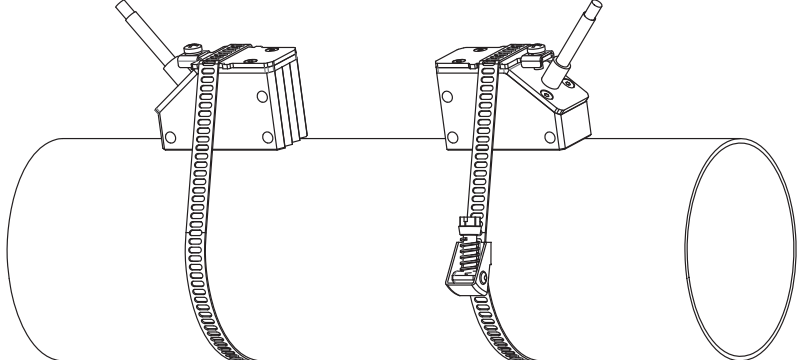
order code		GLG-S***-**TS	GLH-S***-**TS	GLK-S***-**TS	GLM-S***-**TS	GLP-SNNN-**TS
technical type		G(RT)G1S52	G(RT)H1S52	G(RT)K1S52	G(RT)M1S52	G(RT)P1S52
transducer frequency	MHz	0.2	0.3	0.5	1	2
fluid pressure		see saturated steam pressure curve				
inner pipe diameter d						
min.	inch	8.9	5.9	3.5	1.8	0.91
max.	inch	39.4	26.3	15.7	7.9	3.9
pipe wall thickness						
min.	inch	0.42	0.28	0.17	0.08	0.04
max.	inch	0.93	0.62	0.37	0.19	0.09
material						
housing		PPSU with stainless steel cover 316Ti				
contact surface		PPSU				
degree of protection		IP66				
transducer cable						
type		1699				
length	ft	16				13
dimensions						
length l	inch	5.06			2.91	
width b	inch	2.01			1.3	
height h	inch	2.66			1.59	
dimensional drawing						
weight (without cable)	lb	1.8			0.35	
storing temperature						
storing temperature	°F	-40 to +311				
operating temperature	°F	212 to 356 (nonEx)				
warm-up time	h	3			1	
temperature compensation		x				
explosion protection						
• ATEX/IECEx						
order code		GLG-SA2*-**TS	GLH-SA2*-**TS	GLK-SA2*-**TS	GLM-SA2*-**TS	-
pipe surface temperature (Ex)	°C	gas: -50 to +165 dust: -50 to +155				-
marking		CE 0637  II3G II2D Ex nA IIC T6...T3 Gc Ex tb IIIC T80 °C...T160 °C Db				-
certification		IBExU10ATEX1163 X, IECEx IBE 12.0005X				-
• FM						
order code		GLG-SF2*-**TS	GLH-SF2*-**TS	GLK-SF2*-**TS	GLM-SF2*-**TS	-
pipe surface temperature (Ex)	°F	-40 to +329				-
degree of protection		IP66				-
marking		 NI/CI, I, II, III/Div. 2 / GP A, B, C, D, E, F, G/ Temp. Codes dwg 3860				-

completely thermally insulated transducer installation necessary

Transducer mounting fixture

Order code

1, 2	3	4	5	6	7 to 10	no. of character		
transducer mounting fixture	transducer	-	measurement arrangement	size	-	fixation	outer pipe diameter	description
PL								PermaLok
VL								PermaRail
	G							transducers with transducer frequency G
	H							transducers with transducer frequency H
	K							transducers with transducer frequency K
	M							transducers with transducer frequency M
	P							transducers with transducer frequency P
		D						reflect arrangement or diagonal arrangement/direct mode
		R						reflect arrangement
			S					small
			L					large
				S				tension straps
					T360			1.6 to 14.2 inch
					0130			0.39 to 5.1 inch
					0360			5.1 to 14.2 inch
					0920			14.2 to 36.2 inch
					2000			36.2 to 78.7 inch
					4500			78.7 to 177.2 inch
					SSK1			0.5 to 2.5 inch
					SSK2			3 to 6 inch
					SSK3			8 to 10 inch
					SSK4			12 to 18 inch
					SSK5			20 to 36 inch
					NODR			any

<p>PermaRail (VL)</p> 	<p>material: stainless steel 316Ti, 316L, 17-7PH inner length: VL(GHK): 13.7 inch, VL(MP): 9.2 inch dimensions: VL(GHK): 16.65 x 3.54 x 3.66 inch VL(MP): 12.17 x 2.24 x 2.48 inch</p>
<p>PermaLok (PL)</p> 	<p>material: stainless steel 316 dimensions: PL(GHK)-RL: 19.25 x 3.9 x 3.95 inch PL(GHK)-DS: 13.25 x 3.85 x 3.95 inch PL(MP): 25.25 x 3.08 x 3.15 inch weight: PL(GHK)-RL: 6 lb PL(GHK)-DS: 4.2 lb PL(MP): 6.6 lb</p>
<p>quick release clasps and tension straps</p> 	<p>material: stainless steel 410, 200</p>

Coupling materials for transducers

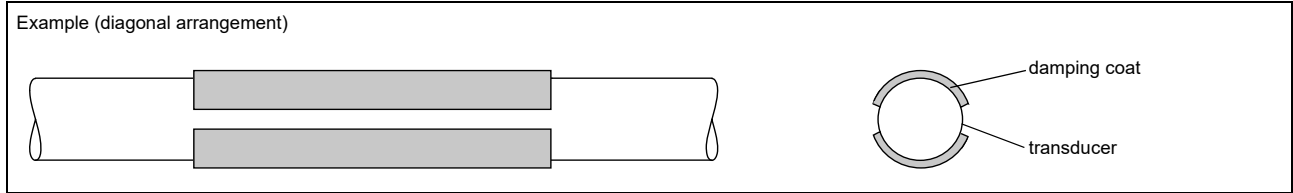
type	ambient temperature °F
coupling pad type VT ¹	14 to +392
coupling compound type E ²	-22 to +392

¹ fluid temperature 392 °F: min. 2 years

² in combination with type VT only

Damping coat

The damping coat will be used to reduce acoustic noise influences on the measurement.



Technical data

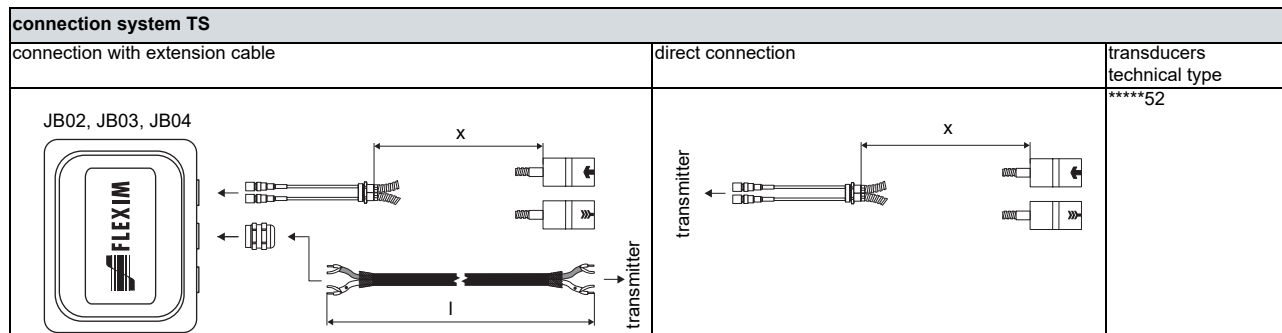
item number	992080-13	
material	multipolymeric matrix/inorganic ceramic coating	
packing drum	gal	1
properties	heat-resistant, inert	
fluid temperature when applying	°F	50 to 392
drying time (example)	approx. 3 h at 68 °F approx. 15 min at 302 °F	
temperature resistance in dry state	°F	max. 1202
durability of the packing drum (unopened)	2 years	

Observe installation instructions (TI_DampingCoat).

Dimensioning

transducer frequency	number of packing drums		
	outer pipe diameter		
	≤11.8	≤19.7	≤27.6
	inch		
G	1	1	2
H	1	1	1
K	1	1	-
M	1	-	-
P	1	-	-

Connection systems



Cable

transducer cable		
type		1699
weight	lb/ft	0.06
ambient temperature	°F	-67 to +392
cable jacket		
material		PTFE
outer diameter	inch	0.11
thickness	inch	0.01
color		brown
shield		x
sheath		
material		stainless steel 316Ti
outer diameter	inch	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	inch	max. 0.47	max. 0.47
thickness	inch	0.08	0.08
color		black	black
shield		x	x
sheath			
material		-	steel wire braid with copolymer sheath
outer diameter	inch	-	max. 0.61

Cable length

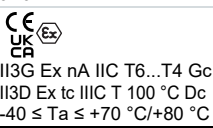
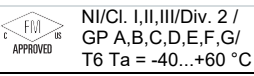
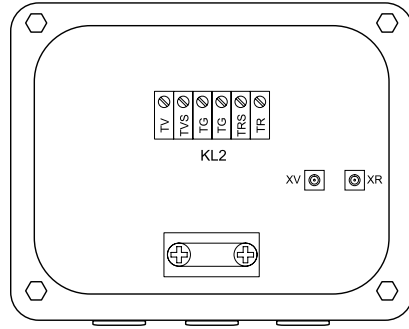
transducer frequency		G, H, K		M, P	
transducers technical type		x	l	x	l
*R***5*	ft	16	≤ 984	13	≤ 984
*T***5*	ft	29	≤ 984	29	≤ 984

x = transducer cable length

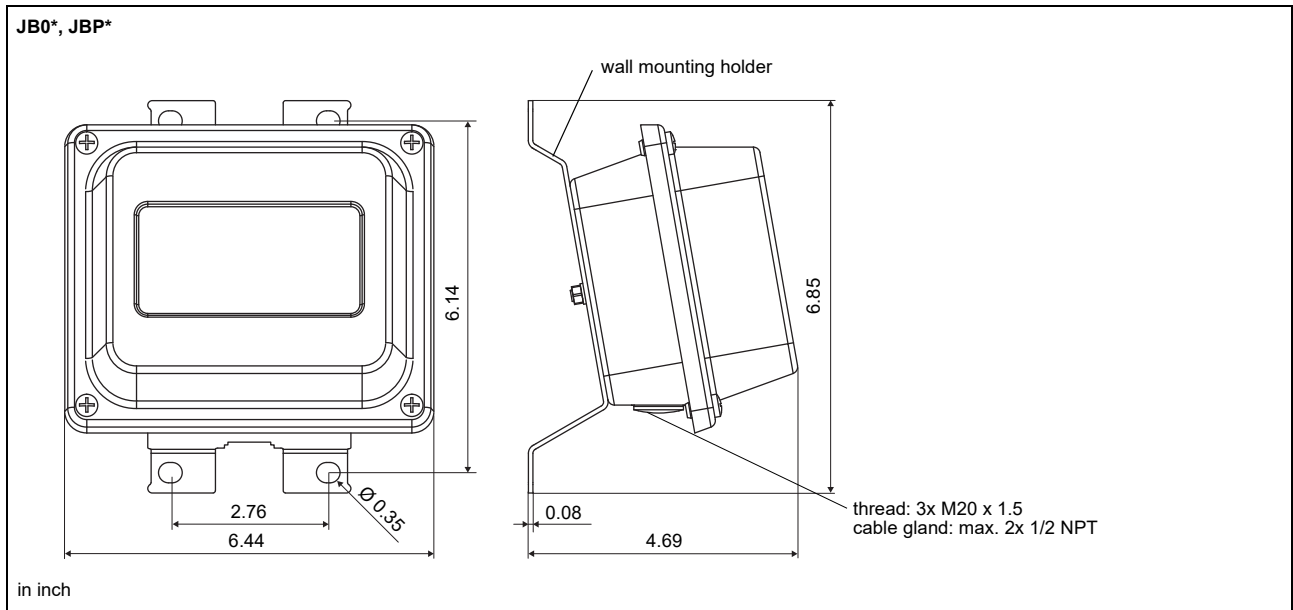
l = max. length of extension cable (depending on the application)

Junction box

Technical data

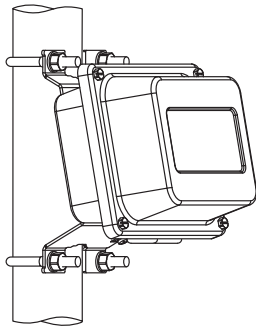
JB02, JB03, JB04													
weight	lb 2.6 lb												
fixation	wall mounting optional: 2" pipe mounting												
material													
housing	stainless steel 316L												
gasket	silicone												
degree of protection	JB02, JB03: IP66/IP67 JB04: Type 4X, IP66												
ambient temperature													
min.	°F -40												
max.	°F +176												
explosion protection													
• ATEX													
junction box marking	JB02 												
• FM													
junction box marking	JB04 												
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Connection</p>  </div> <div style="width: 45%;"> <p>Transducers</p> <table border="1"> <thead> <tr> <th></th> <th>terminal</th> <th>connection</th> <th>transducer</th> </tr> </thead> <tbody> <tr> <td></td> <td>XV</td> <td>SMB connector</td> <td>↑</td> </tr> <tr> <td></td> <td>XR</td> <td>SMB connector</td> <td>⤴</td> </tr> </tbody> </table> </div> </div>			terminal	connection	transducer		XV	SMB connector	↑		XR	SMB connector	⤴
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terminal strip	terminal	connection											
KL2	TV	signal											
	TVS	internal shield											
	TRS	internal shield											
	TR	signal											

Dimensions



2" pipe mounting kit

JB**



item number: 751035-2

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 material	360 brass alloy	
degree of protection	NEMA 4	
dimensions		
length l	inch	0.79
width b	inch	0.59
height h	inch	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	
	red	
	red	
	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

Fixation

<p>tension strap PT13N</p>	<p>material: stainless steel 301, 410 thermal insulation necessary</p>
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Junction box

	<p>Connection</p> <table border="1"> <thead> <tr> <th>temperature probe</th> <th>extension cable</th> </tr> </thead> <tbody> <tr> <td>red</td> <td>white</td> </tr> <tr> <td>red</td> <td>black</td> </tr> <tr> <td>white</td> <td>green</td> </tr> <tr> <td>white</td> <td>red</td> </tr> </tbody> </table>	temperature probe	extension cable	red	white	red	black	white	green	white	red
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