Flexim FLUXUS G722ST-HT Ultrasonic Flowmeter

Superheated Steam Flow Measurement

Permanently installed non-invasive ultrasonic measuring system

Features

- Exact and highly reliable measurement of superheated steam up to 1166 °F
- Installation and start-up do not require any pipe work nor any process interruptions
- Volumetric and mass flow rate available without additional steam calculator
- Non-invasive and wear-free measurement without pressure loss
- Maintenance-free acoustic coupling using permanent coupling foil
- Bidirectional measurement over a wide turndown ratio - up to 10:1
- Advanced self-diagnosis and possibilities for event-based triggering of data recording
- Bidirectional communication and support of common bus technologies
- Transmitter and transducers are separately calibrated (traceable to national standards)
- The measurement is drift free

Applications

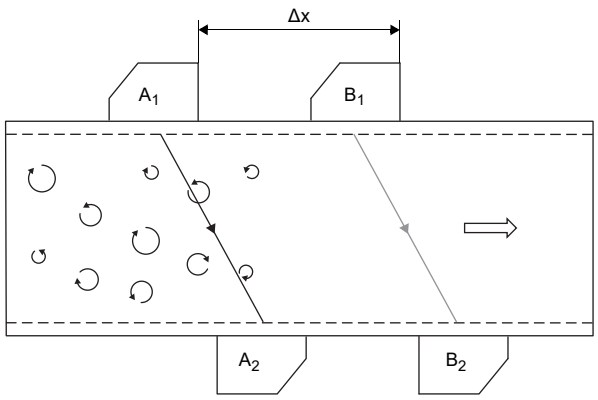
- Process control
- Consumption metering
- Check metering

Function

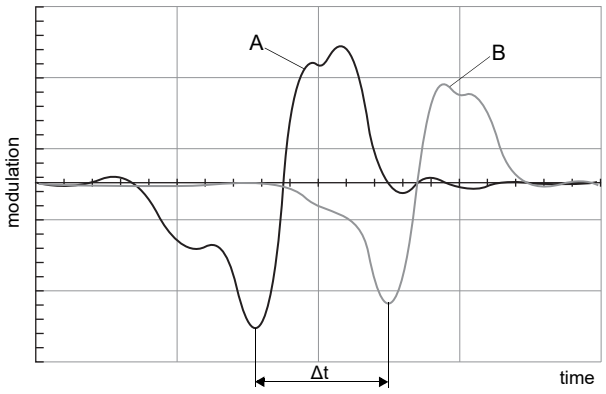
Measurement principle

The flow velocity of the fluid is measured using the correlation principle. 2 pairs of ultrasonic transducers are mounted one after the other at a distance Δx on the pipe. The transducer pairs form the measuring barriers A and B. Ultrasonic signals are alternately emitted by the emitters A_1 and B_1 and received by the respective receivers A_2 and B_2. The ultrasonic signals are modulated regarding amplitude and phase by the swirls of the turbulent flowing fluid. Since the swirls move with the flow, they pass the measuring barriers A und B with a time offset Δt, so that the modulation patterns of the ultrasonic signals of measuring barrier A and B are also offset by Δt. This time offset Δt is measured by means of cross correlation of the modulation signals.

Measuring setup



Time offset of the modulation patterns Δt



Calculation of volumetric flow rate

$$\dot{V} = A \cdot v = A \cdot k_{Re} \cdot \frac{\Delta x}{\Delta t}$$

where

$\dot{V}$ - operating volumetric flow rate

A - cross-sectional pipe area

v - flow velocity

k_{Re} - fluid mechanic calibration factor

Δx - distance between measuring barriers

Δt - time offset of the modulation patterns

Transmitter

Technical data

		FLUXUS G722ST-NNN**-2AL G722ST-NNN**-2ST	FLUXUS G722ST-A2N**-2AL G722ST-A2N**-2ST	FLUXUS G722ST-F2N**-2AL G722ST-F2N**-2ST
				
design		standard field device	standard field device zone 2	standard field device FM Class I Div. 2
application		high-temperature steam measurement[1]		
measurement				
measurement principle		cross correlation principle		
flow direction		bidirectional		
flow velocity	ft/s	depending on the application		
repeatability		±1 % MV (Re > 60 000) ±3 % MV (Re 10 000 to 60 000)		
Reynolds number		Re > 10 000		
fluid		saturated steam, superheated steam		
fluid pressure	psia	15 to 1595		
fluid temperature	°F	212 to 1166		
measurement uncertainty (volumetric flow rate)				
measurement uncertainty at the measuring point		±3 % MV (Re > 60 000) ±4 % MV (Re 10 000 to 60 000)		
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		
measuring setup		2 transducer pairs of the same type required (see measuring setup in section Measurement principle)		
damping	s	0 to 100 (adjustable)		
measuring cycle	Hz	0.5 to 1 (depending on the application)		
response time	s	20 to 50 (depending on the application)		
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		-	G722**-A20*A, G722**-A20*S: CE 0637 Ex II3G II2D 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		-	-	G722**-F20*S2, G722**-F20*S3: NI/Cl. I,II,III/Div. 2/ GP. A,B,C, D,E,F,G/ T5 G722**-F20*S1: NI/Cl. I,II,III/Div. 2/ GP. A,B,C, D,E,F,G/ T4A
measuring functions				
physical quantities		operating volumetric flow rate, mass flow rate, flow velocity		
totalizer		volume, mass		
diagnostic functions		crest factor, peak width, symmetry of amplification		

[1] test measurement to validate the application required in advance

[2] outside the explosive atmosphere (housing cover open)

		FLUXUS G722ST-NNN**-2AL G722ST-NNN**-2ST	FLUXUS G722ST-A2N**-2AL G722ST-A2N**-2ST	FLUXUS G722ST-F2N**-2AL G722ST-F2N**-2ST
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 • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP		
accessories				
data transmission kit		USB cable		
software		• FluxDiagReader: reading of measured values and parameters, graphical 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.		
number		on request		
• switchable current output				
		All switchable current outputs are jointly switched to active or passive.		
range	mA	4 to 20 (3.2 to 22)		
accuracy		0.04 % MV ±3 µA		
active output		R_{ext} < 250 Ω		
passive output		U_{ext} = 8 to 30 V, depending on R_{ext} (R_{ext} < 1 kΩ at 30 V)		
• HART				
range	mA	4 to 20		
accuracy		0.1 % MV ±15 µA		
active output		U_{int} = 24 V, R_{ext} < 500 Ω		
passive output		U_{ext} = 10 to 24 V DC, depending on R_{ext} (R_{ext} < 1 kΩ at 24 V)		
• voltage output				
range	V	0 to 1 or 0 to 10		
accuracy		0 to 1 V: 0.1 % MV ±1 mV 0 to 10 V: 0.1 % MV ±10 mV		
internal resistance		R_{int} = 500 Ω		
• 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		

[1] test measurement to validate the application required in advance

[2] outside the explosive atmosphere (housing cover open)

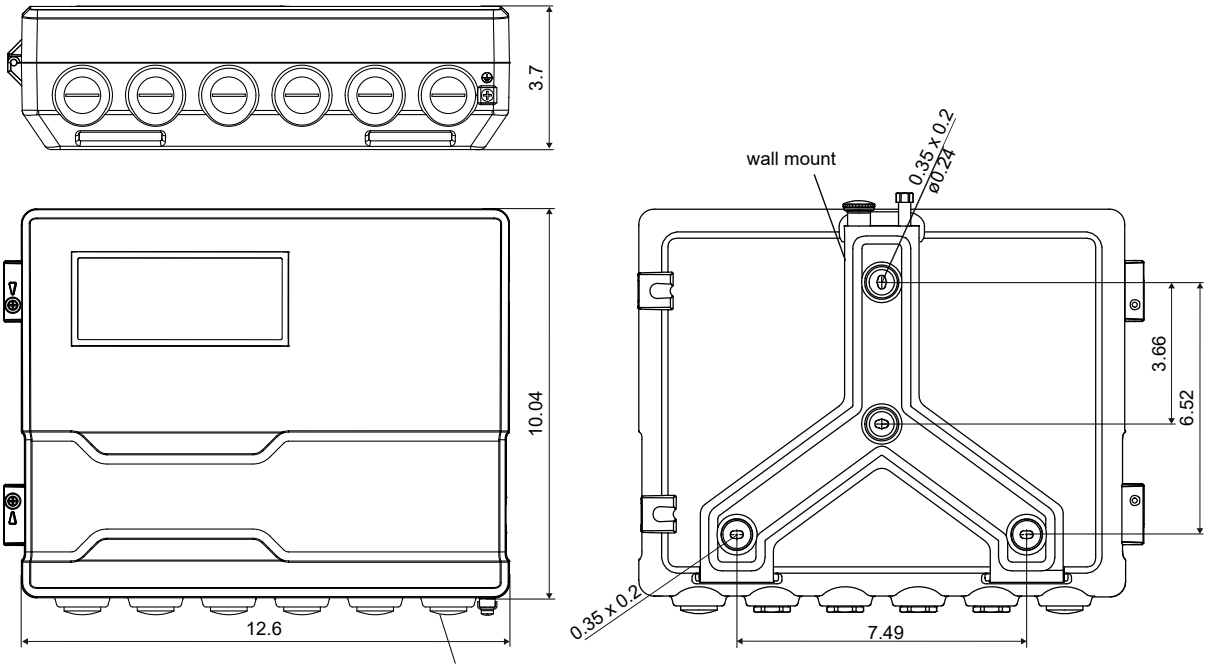
		FLUXUS G722ST-NNN**-2AL G722ST-NNN**-2ST	FLUXUS G722ST-A2N**-2AL G722ST-A2N**-2ST	FLUXUS G722ST-F2N**-2AL G722ST-F2N**-2ST
inputs				
		The inputs are galvanically isolated from the transmitter.		
number		max. 4, on request		
• **temperature input**				
type		Pt100/Pt1000		
connection		4-wire		
range	°F	-238 to +1040		
resolution	K	0.01		
accuracy		±0.01 % MV ±0.03 K		
• **current input**				
accuracy		0.1 % MV ±10 µA		
active input		U_{int} = 24 V, R_{int} = 50 Ω, P_{int} < 0.5 W, not short-circuit proof		
• range	mA	0 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 % MV ±1 mV		
internal resistance		R_{int} = 1 MΩ		

[1] test measurement to validate the application required in advance

[2] outside the explosive atmosphere (housing cover open)

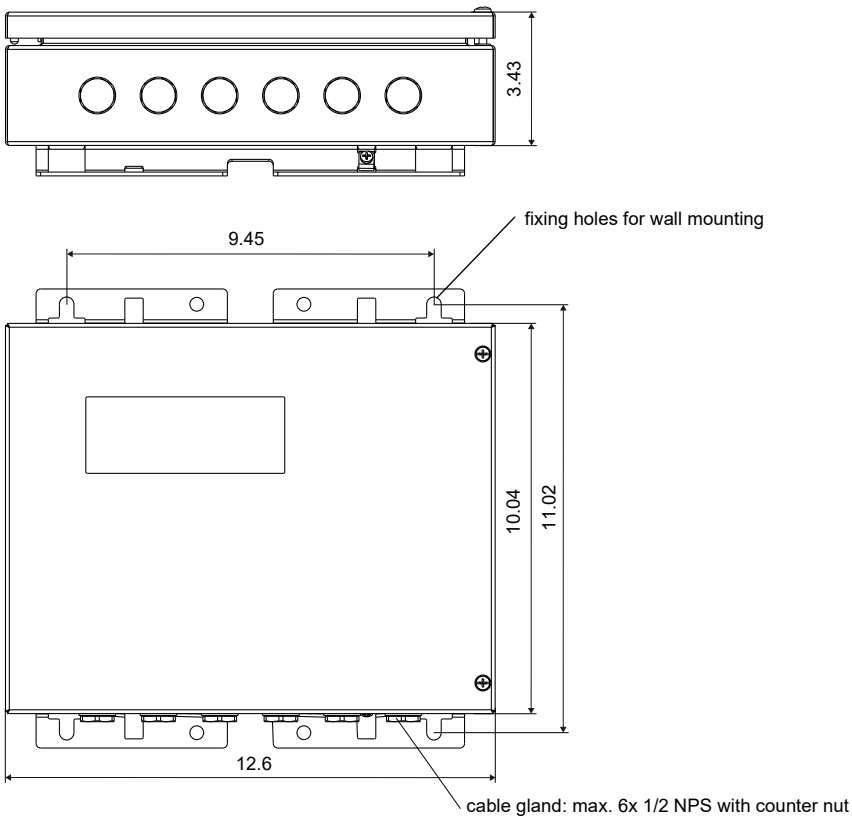
Dimensions

72-*****-*AL**



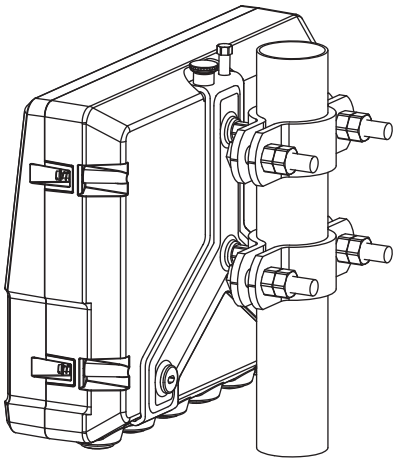
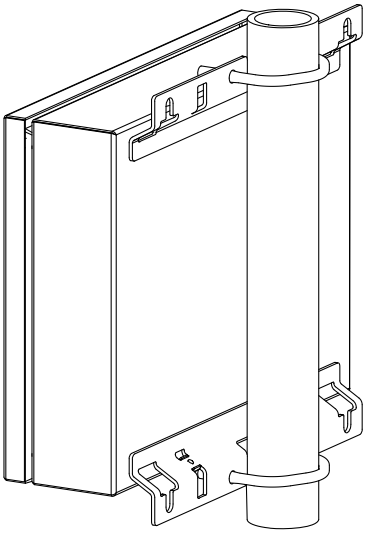
in inch

72-*****-*ST**



in inch

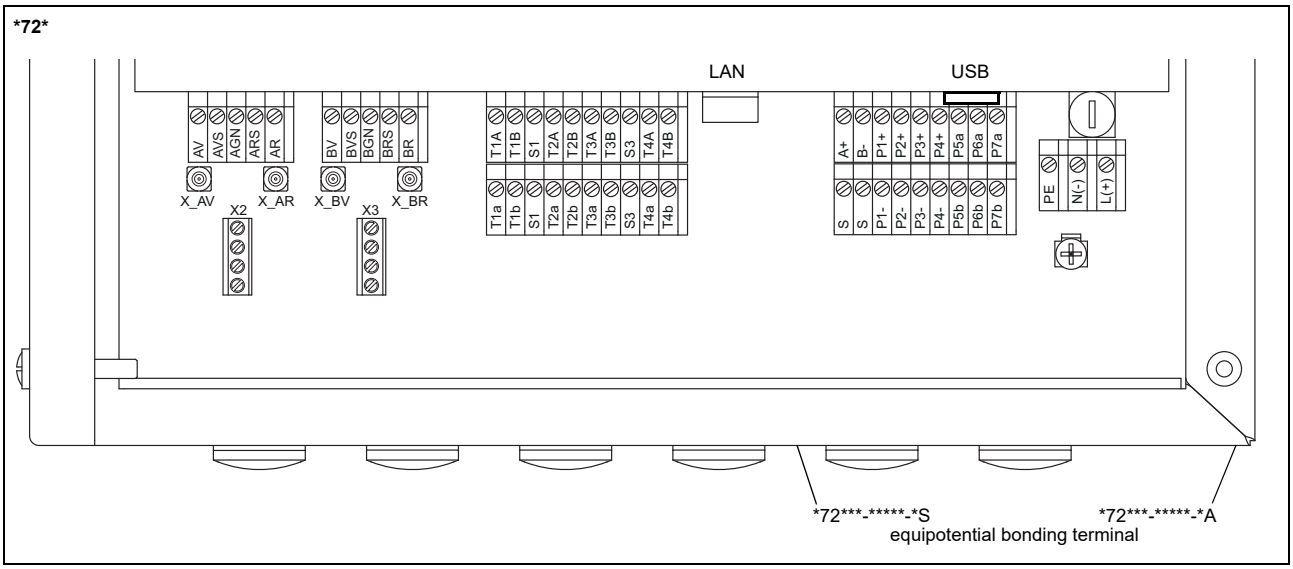
2" pipe mounting kit

72-*****-*AL** 	item number: 721037-4
72-*****-*ST** 	item number: 721110-4

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**			**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**
P1+ to P4+ P1- to P4-	current output, voltage output, HART (P1)
P5a to P7a P5b to P7b	digital output

terminal	**connection**	**communication interface**
A+	signal +	• RS485[1] • Modbus RTU[1] • BACnet MS/TP[1] • Profibus PA[1] • FF H1[1]
B-	signal -	
S	shield	
USB	type B Hi-Speed USB 2.0 Device	• service (FluxDiag/ FluxDiagReader)
LAN	RJ45 10/100 Mbps Ethernet	• service (FluxDiag/ FluxDiagReader) • BACnet IP • Modbus TCP

analog inputs[1, 2]

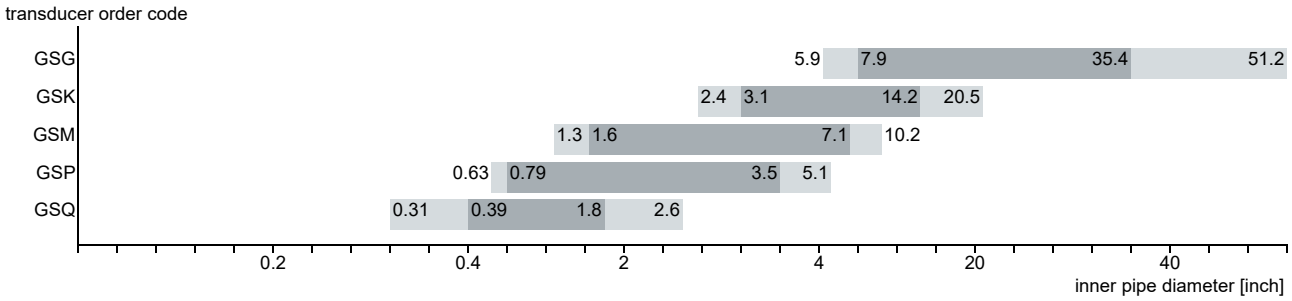
	temperature probe		**passive sensor**	**active sensor**
terminal	**direct connection**	**connection with extension cable**	**connection**	**connection**
T1a to T4a	red	white	not connected	not connected
T1A to T4A	red	black	-	+
T1b to T4b	white	red	+	not connected
T1B to T4B	white	green	not connected	-
S1, S3	shield	shield	not connected	not connected

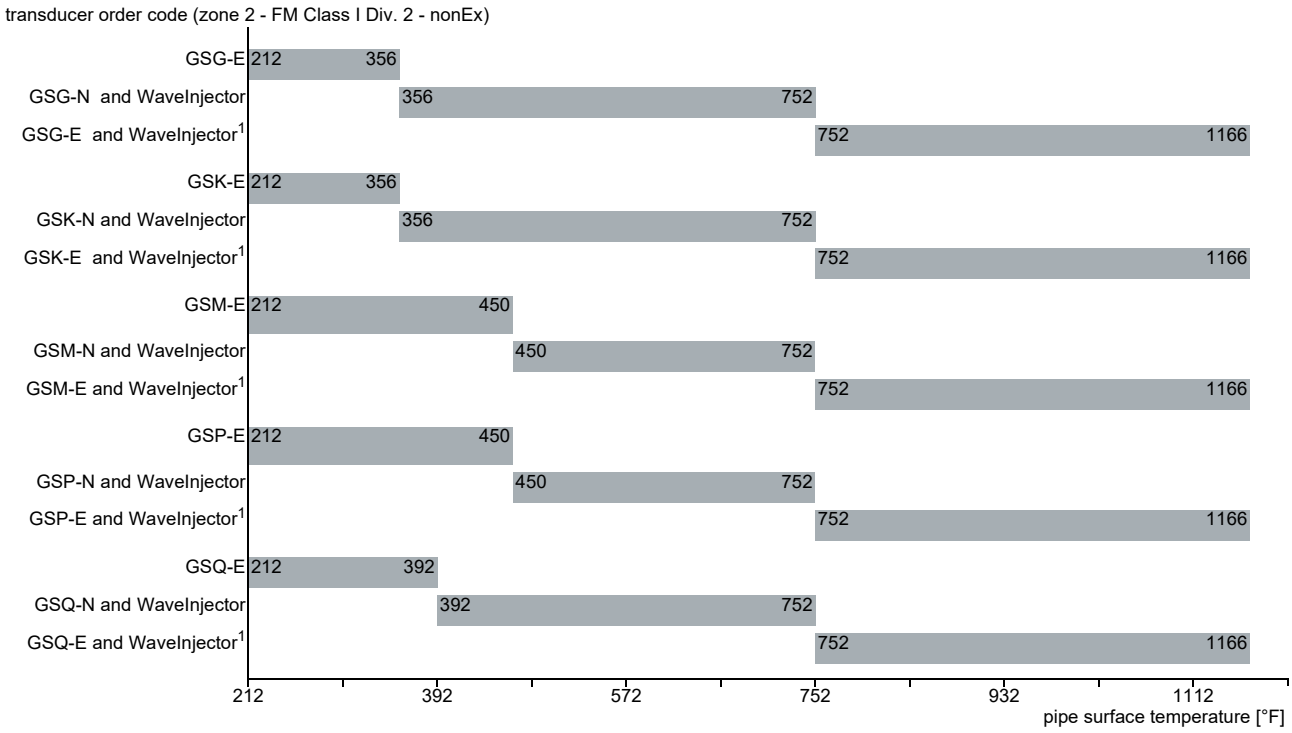
[1] cable (by customer):
- e.g., flexible wires, with insulated wire ferrules, wire cross-section: AWG14 to 24
- outer diameter of the cable (*72***-*****-*S with ferrite nut): max. 0.3 inch

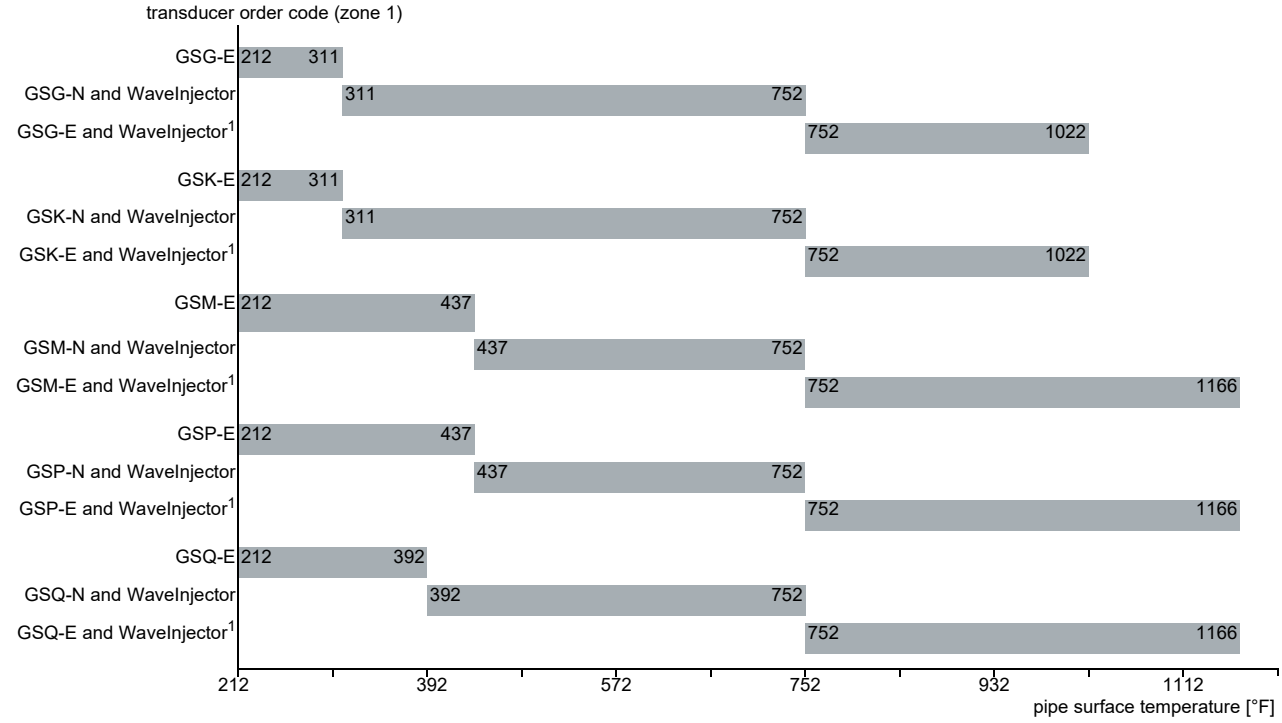
[2] The number, type and terminal assignment are customized.

Transducers

Transducer selection







[1] technical verification to validate the application required in advance

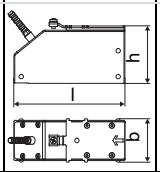
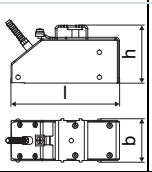
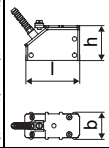
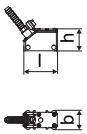
recommended possible

Transducer order code

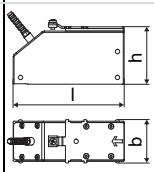
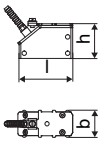
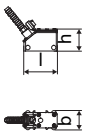
1, 2	3		4	5 to 7		8, 9	10, 11		12 to 14	no. of character
transducer	**transducer frequency**	**-**	**ambient temperature**	**explosion protection**	**-**	**certification**	**connection system**	**-**	**cable length**	**description**
GS										set of ultrasonic flow transducers, shear wave
	G									0.2 MHz
	K									0.5 MHz
	M									1 MHz
	P									2 MHz
	Q									4 MHz
			N							normal temperature range
			E							extended temperature range
				NNN						not explosion-proof
				A2N						ATEX zone 2/IECEx zone 2
				F2N						FM Class I Div. 2
						**				
							TS			with SMB connector
									***	in m

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
inner pipe diameter d						
min. extended	inch	7.1	2.8	1.5	0.71	0.35
min. recommended	inch	9.4	3.9	1.9	0.94	0.47
max. recommended	inch	36.2	14.6	7.1	3.5	1.8
max. extended	inch	51.2	20.5	10.2	5.1	2.6
pipe wall thickness						
min.	inch	0.44	0.17	0.09	0.04	0.02
material						
housing		PEEK with stainless steel cover 316L				
contact surface		PEEK				
degree of protection		IP66		IP66/IP67		
transducer cable						
type		1699				
length	ft	16		13		9
dimensions						
length l	inch	5.1	4.98	2.52		1.57
width b	inch	2.01	2.01	1.26		0.87
height h	inch	2.64	2.66	1.59		1
dimensional drawing						
weight (without cable)	lb	1	0.79	0.15		0.04
pipe surface temperature	°F	-40 to +266				
ambient temperature	°F	-40 to +266				
temperature compensation		x				
explosion protection						
• **ATEX/IECEx**						
order code		GSG-NA2*-**TS	GSK-NA2*-**TS	GSM-NA2*-**TS	GSP-NA2*-**TS	GSQ-NA2*-**TS
pipe surface temperature (Ex)	°C	gas: -55 to +190 dust: -55 to +180				
marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T3 Gc Ex tb IIIC T80 °C...T185 °C Db				
certification		IBExU10ATEX1163 X, IECEx IBE 12.0005X				
• **FM**						
order code		GSG-NF2*-**TS	GSK-NF2*-**TS	GSM-NF2*-**TS	GSP-NF2*-**TS	GSQ-NF2*-**TS
pipe surface temperature (Ex)	°F	-40 to +257		-40 to +374		
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				

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

order code		GSG-ENNN-**TS	GSK-ENNN-**TS	GSM-E***-**TS	GSP-E***-**TS	GSQ-E***-**TS
technical type		G(DL)G1E52	G(DL)K1E52	G(DL)M2E52	G(DL)P2E52	G(DL)Q2E52
transducer frequency	MHz	0.2	0.5	1	2	4
inner pipe diameter d						
min. extended	inch	5.9	2.4	1.3	0.63	0.31
min. recommended	inch	7.9	3.1	1.6	0.79	0.39
max. recommended	inch	35.4	14.2	7.1	3.5	1.8
max. extended	inch	51.2	20.5	10.2	5.1	2.6
pipe wall thickness						
min.	inch	0.44	0.17	0.09	0.04	0.02
material						
housing		PPSU with stainless steel cover 316L		PI with stainless steel cover 316L		
contact surface		PPSU		PI		
degree of protection		IP66		IP66/IP67		
transducer cable						
type		1699		6111		
length	ft	16		13		9
dimensions						
length l	inch	5.1		2.52		1.57
width b	inch	2.01		1.26		0.87
height h	inch	2.64		1.59		1
dimensional drawing						
weight (without cable)	lb	1.8		0.15		0.04
pipe surface temperature	°F	212 to 356		212 to 450[1]		212 to 392
ambient temperature	°F	-40 to +356		-22 to +104 -22 to +140[2] -22 to +392[3]		-22 to +392
temperature compensation		x		x		
explosion protection						
• ATEX/IECEx						
order code		-	-	GSM-EA2*-**TS	GSP-EA2*-**TS	GSQ-EA2*-**TS
pipe surface temperature (Ex)	°C	-	-	gas: -45 to +235[1] dust: -45 to +225[1]		
marking		-	-	CE 0637 Ex II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIA T80 °C...T230 °C Db		
certification		-	-	IBExU10ATEX1163 X, IECEx IBE 12.0005X		
• FM						
order code		-	-	GSM-EF2*-**TS	GSP-EF2*-**TS	GSQ-EF2*-**TS
pipe surface temperature (Ex)	°F	-	-	-40 to +455[1]		
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] > +200 °C/+392 °F:
quick release clasps and tension straps (nonEx)
observe the insulation instruction
Ex: ambient temperature max. +40 °C/+104 °F

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

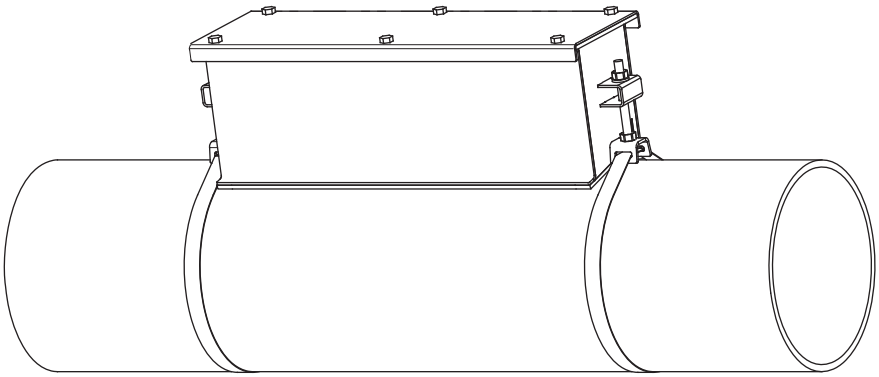
[3] pipe surface temperature max. +200 °C/+392 °F

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**	**/**	**option**	**description**
PL										PermaLok
WN										WaveInjector WI-550
WH										WaveInjector WI-630
	G									transducers with transducer frequency G
	K									transducers with transducer frequency K
	M									transducers with transducer frequency M
	P									transducers with transducer frequency P
	Q									transducers with transducer frequency Q
			D							diagonal arrangement/direct mode
				S						small
				L						large
						S				tension straps
							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

PermaLok (PL)



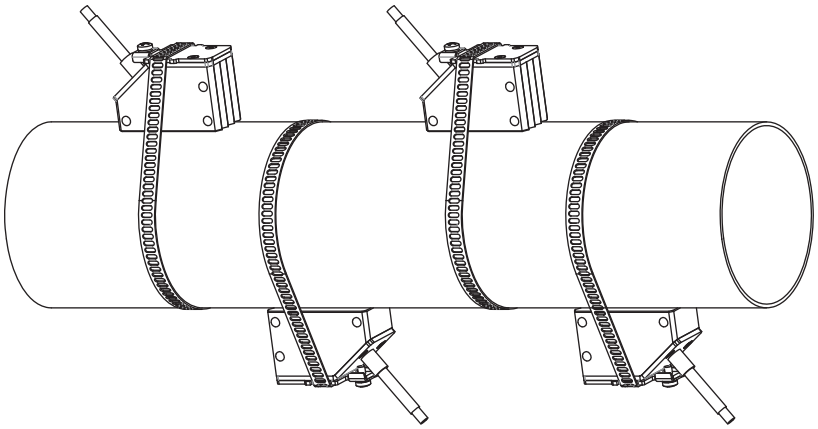
material: stainless steel 316

dimensions:
PL(GHK)-RL:
19.25 x 3.9 x 3.95 inch
PLK-DS: 13.25 x 3.85 x 3.95 inch
PLM: 25.25 x 3.08 x 3.15 inch
PLQ: 13.37 x 2.68 x 2.4 inch

weight:
PLK-RL: 6 lb
PLK-DS: 4.2 lb
PLM: 6.6 lb
PLQ: 2.8 lb

temperature: max. 392 °F

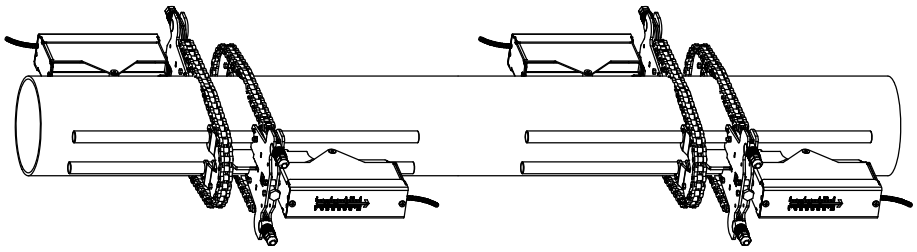
quick release clasps and tension straps



material: stainless steel 410, 200

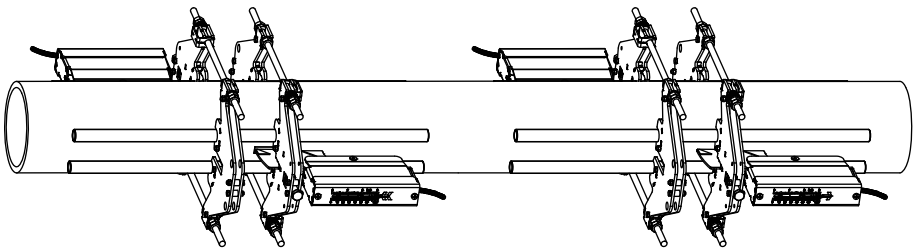
nonEx

WaveInjector with chains



see Technical specification
TSWaveInjectorVx-x

WaveInjector with threaded rods



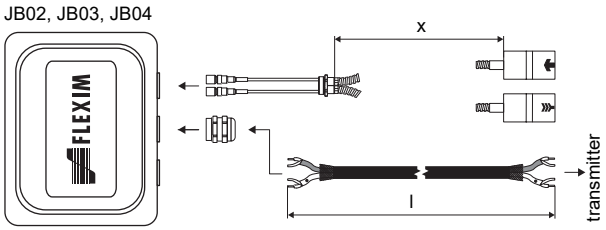
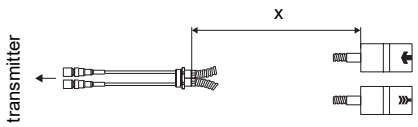
outer pipe diameter:
1.4 to 15 inch

see Technical specification
TSWaveInjectorVx-x

Coupling materials for transducers

type	ambient temperature °F	remark
coupling pad type VT	14 to +392	fluid temperature 392 °F: min. 2 years
coupling pad type TF	392 to 464	
coupling compound type E	-22 to +392	in combination with type VT only
coupling compound type H	-22 to +482	in combination with type TF only
coupling pad type A	max. 536	WaveInjector
coupling pad type B	536 to 1166	WaveInjector

Connection systems

connection system TS		
connection with extension cable	direct connection	transducers technical type
		*****52

Cable

transducer cable			
type		**1699**	**6111**
weight	lb/ft	0.06	0.06
ambient temperature	°F	-67 to +392	-148 to +437
cable jacket			
material		PTFE	PFA
outer diameter	inch	0.11	0.11
thickness	inch	0.01	0.02
color		brown	white
shield		x	x
sheath			
material		stainless steel 316Ti	stainless steel 316Ti
outer diameter	inch	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	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, K**		**M, P**		**Q**	
connection system TS							
transducers technical type		x	l	x	l	x	l
*D***5*	ft	16	≤ 984	13	≤ 984	9	≤ 295
*L***5*	ft	29	≤ 984	29	≤ 984	29	≤ 295

x = transducer cable length

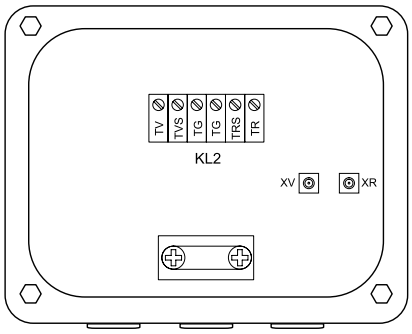
l = max. length of extension cable (depending on the application)

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		JB02
marking		II3G Ex nA IIC T6...T4 Gc II3D Ex tc IIIC T 100 °C Dc -40 ≤ Ta ≤ +70 °C/+80 °C
• **FM**		
junction box		JB04
marking		NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ T6 Ta = -40...+60 °C

Connection



Transducers

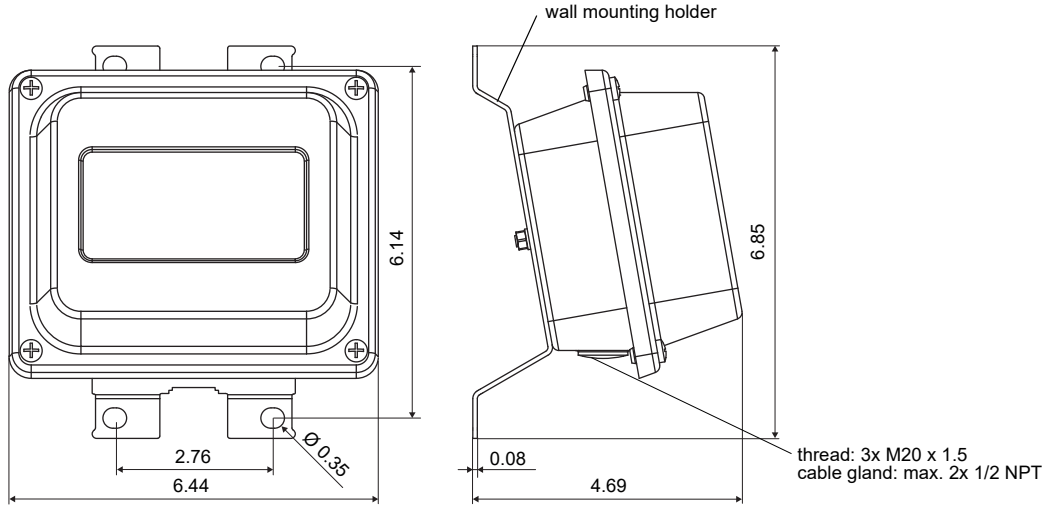
	terminal	connection	transducer
	XV	SMB connector	
	XR	SMB connector	

Extension cable

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

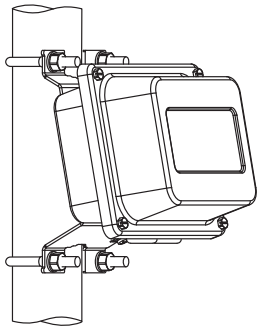
Dimensions

JB0*, JBP*



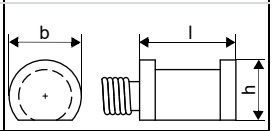
in inch

2" pipe mounting kit

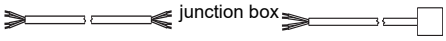
JB** 	item number: 751035-2

Clamp-on temperature probe (optional)

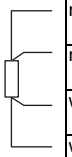
Technical data

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
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

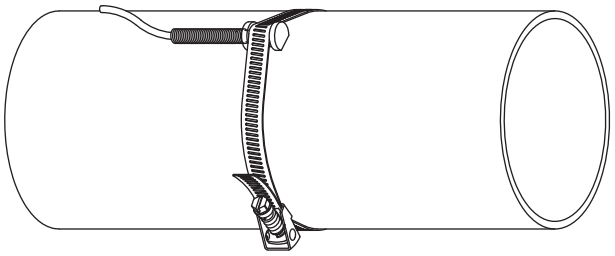
	temperature probe
	red
	red
	white
	white

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

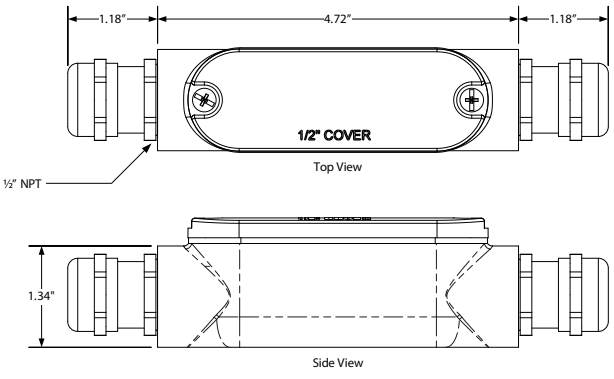
Fixation

tension strap PT13N



material: stainless steel 301, 410
thermal insulation necessary

Junction box



Connection

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

For more information: **Emerson.com**