FLEXIM

Technical specification

FLUXUS G831ST-HT

Superheated steam flow measurement

Permanently installed non-invasive ultrasonic measuring system

Features

- Exact and highly reliable measurement of superheated steam up to 400 °C
- 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
- Bi-directional measurement over a wide turndown ratio - up to 25:1
- 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

FLUXUS G831ST-HT

Applications

- Process control
- Consumption metering
- Check metering

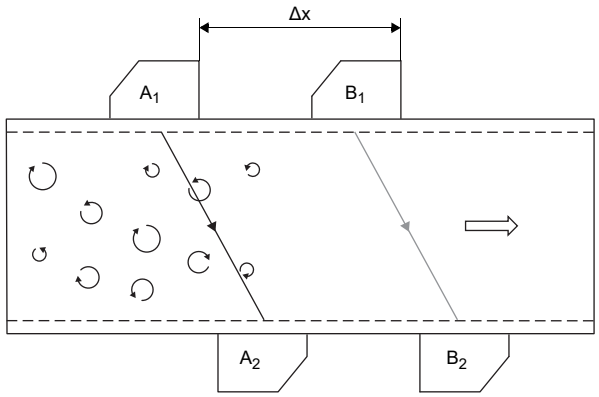
WaveInjector

Function

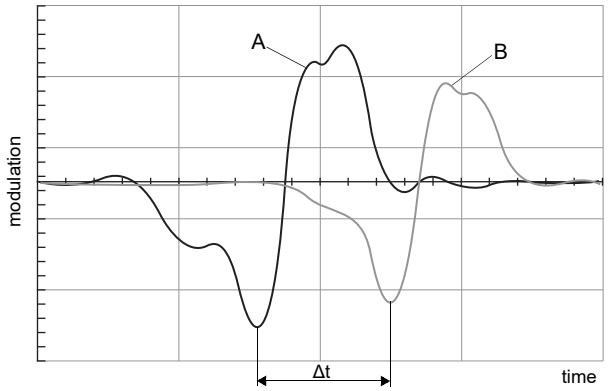
Measurement principle

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 mechanics calibration factor
Δx	-	distance between measuring barriers
Δt	-	time offset of the modulation patterns

Transmitter

Technical data

		FLUXUS G831ST-HT (831-AA1)	FLUXUS G831ST-HT (831-AA2)
			
design		explosion-proof field device zone 1 (intrinsic safety: HART)	explosion-proof field device zone 1 (intrinsic safety: inputs, HART)
application		high-temperature steam measurement[1]	
measurement			
measurement principle		cross correlation principle	
flow velocity	m/s	depending on the application	
repeatability		±1 % MV (Re > 60 000) ±3 % MV (Re 10 000...60 000)	
Reynolds number		Re > 10 000	
fluid		saturated steam, superheated steam	
fluid pressure	bar (a)	1...110	
fluid temperature	°C	100...400	
measurement uncertainty (volumetric flow rate)			
measurement uncertainty at the measuring point		±3 % MV (Re > 60 000) ±4 % MV (Re 10 000...60 000)	
transmitter			
power supply		20...32 V DC, U_m = 120 V	
power consumption	W	< 4	
measuring setup		2 transducer pairs of the same type required (see measuring setup in section Measurement principle)	
damping	s	0...100 (adjustable)	
measuring cycle	Hz	0.7...2 (depending on the application)	
response time	s	10...35 (depending on the application)	
housing material		cast aluminum, special heavy-duty coating	
degree of protection		IP66	
dimensions	mm	see dimensional drawing	
weight	kg	6.5	
fixation		wall mounting, 2" pipe mounting	
ambient temperature	°C	-40...+60 (< -20 without operation of the display)	
display		128 x 64 pixels, backlight	
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian	
explosion protection			
• ATEX/IECEx			
marking		CE 0637 Ex II2G II2D Ex db eb ia IIC T6 Gb Ex tb ia IIIC T100 °C Db T_a -40...+60 °C	CE 0637 Ex II(1)2G II(1)2D Ex db eb ia [ia] IIC T6 Gb Ex tb ia [ia] IIIC T100 °C Db T_a -40...+60 °C
certification ATEX		IBExU20ATEX1103 X	IBExU20ATEX1103 X
certification IECEx		IECEx IBE 20.0015X	IECEx IBE 20.0015X
measuring functions			
physical quantities		operating volumetric flow rate, mass flow rate, flow velocity	
totaliser		volume, mass	
diagnostic functions		crest factor, peak width, symmetry of amplification	
communication interfaces			
service interfaces		measured value transmission, parametrisation of the transmitter: USB[2]	
process interfaces		HART (intrinsic safety, optional)	
accessories			
data transmission kit		USB cable	
software		• FluxDiagReader: reading of measured values and parameters, graphical presentation • FluxDiag (optional): reading of measurement data, graphical presentation, report generation, parametrisation of the transmitter	
data logger			
loggable values		all physical quantities, totalised physical quantities and diagnostic values	
capacity		max. 800 000 measured values	

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

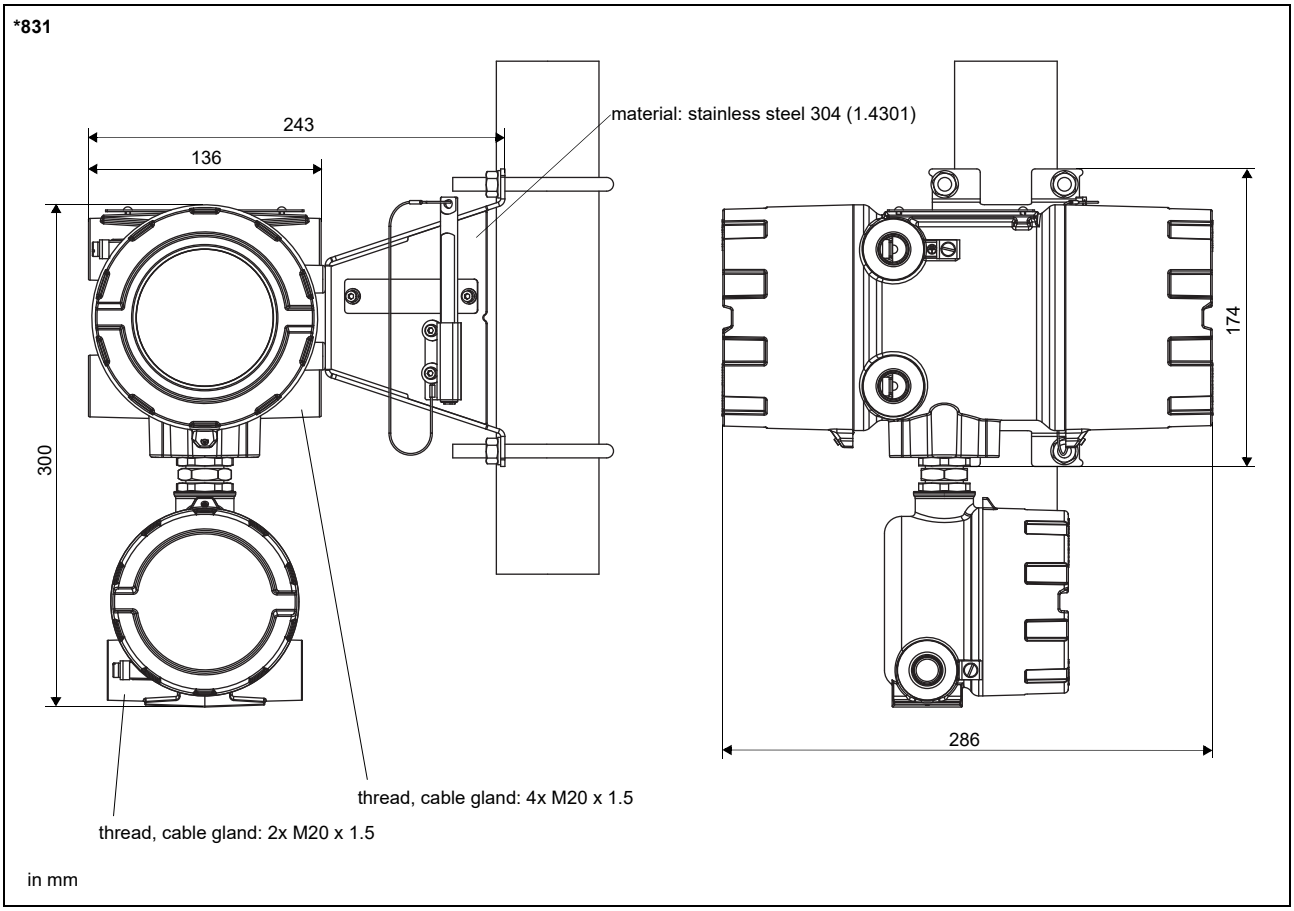
[2] outside the explosive atmosphere (housing cover open)

		FLUXUS G831ST-HT (831-AA1)	FLUXUS G831ST-HT (831-AA2)
outputs			
		The outputs are galvanically isolated from the transmitter.	
• **current output**			
number		1	
range	mA	4...20 (3.2...24)	
accuracy		0.04 % MV ±3 µA	
passive output		U_{ext} ≤ 29 V DC, depending on R_{ext} (R_{ext} < 830 Ω at 29 V)	
current output in HART mode • range • passive output	 mA	 4...20 (3.5...22) U_{ext} = 9...29 V DC	
intrinsic safety parameters		U_i = 29 V I_i = 100 mA P_i = 0.725 W C_i = 1 nF L_i = 50 nH	
inputs			
• **temperature input**			
number		-	max. 1
type		-	Pt100/Pt1000
connection		-	4-wire
range	°C	-	-150...+560
resolution	K	-	0.01
accuracy			
intrinsic safety parameters		-	U_o = 9.2 V I_o = 25 mA P_o = 0.057 W C_o = 4283 nF L_o = 57 mH
• **current input**			
number		-	max. 1
accuracy		-	±0.1 % MV ±0.01 mA
active input • range	 mA	- -	U_{int} < 20 V, R_{int} = 360 Ω 0...20
intrinsic safety parameters		-	U_o = 29.2 V I_o = 88 mA P_o = 0.64 W C_o = 73 nF L_o = 4.1 mH

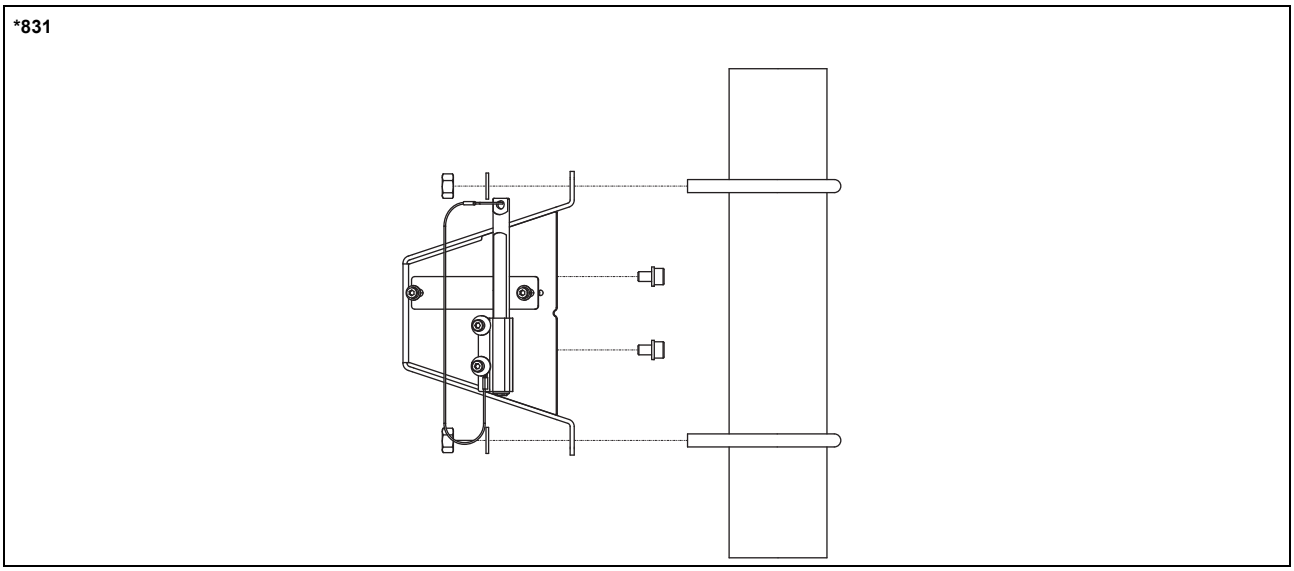
[1] test measurement to validate the application required in advance

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

Dimensions



2" pipe mounting kit

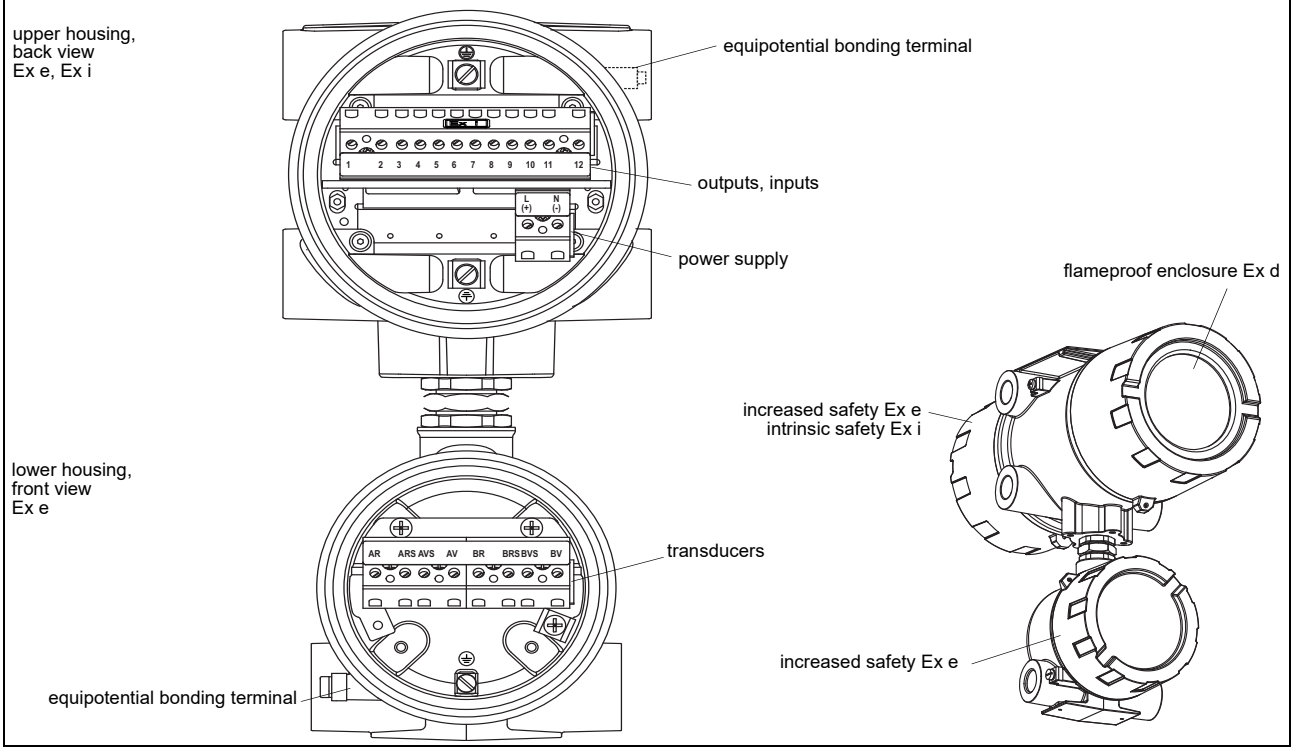


Storage

- store within the original package
- keep all openings closed
- protect against sunlight
- store in a dry and dust-free place
- do not store outdoors
- storing temperature: -40...+60 °C

Terminal assignment

***831 (831-AA1, 831-AA2)**



power supply[1]				
DC				
terminal			**connection**	
(+)			+	
(-)			-	
transducers, extension cable				
measuring channel A		**measuring channel B**		**transducer**
terminal	**connection**	**terminal**	**connection**	
AV	signal	BV	signal	
AVS	internal shield	BVS	internal shield	
ARS	internal shield	BRS	internal shield	
AR	signal	BR	signal	
cable gland	external shield	cable gland	external shield	

outputs[1, 2]		
terminal	**connection**	
11+, 12-	current output, HART	
USB	type C Hi-Speed USB 2.0 Device	service (FluxDiag/FluxDiagReader)

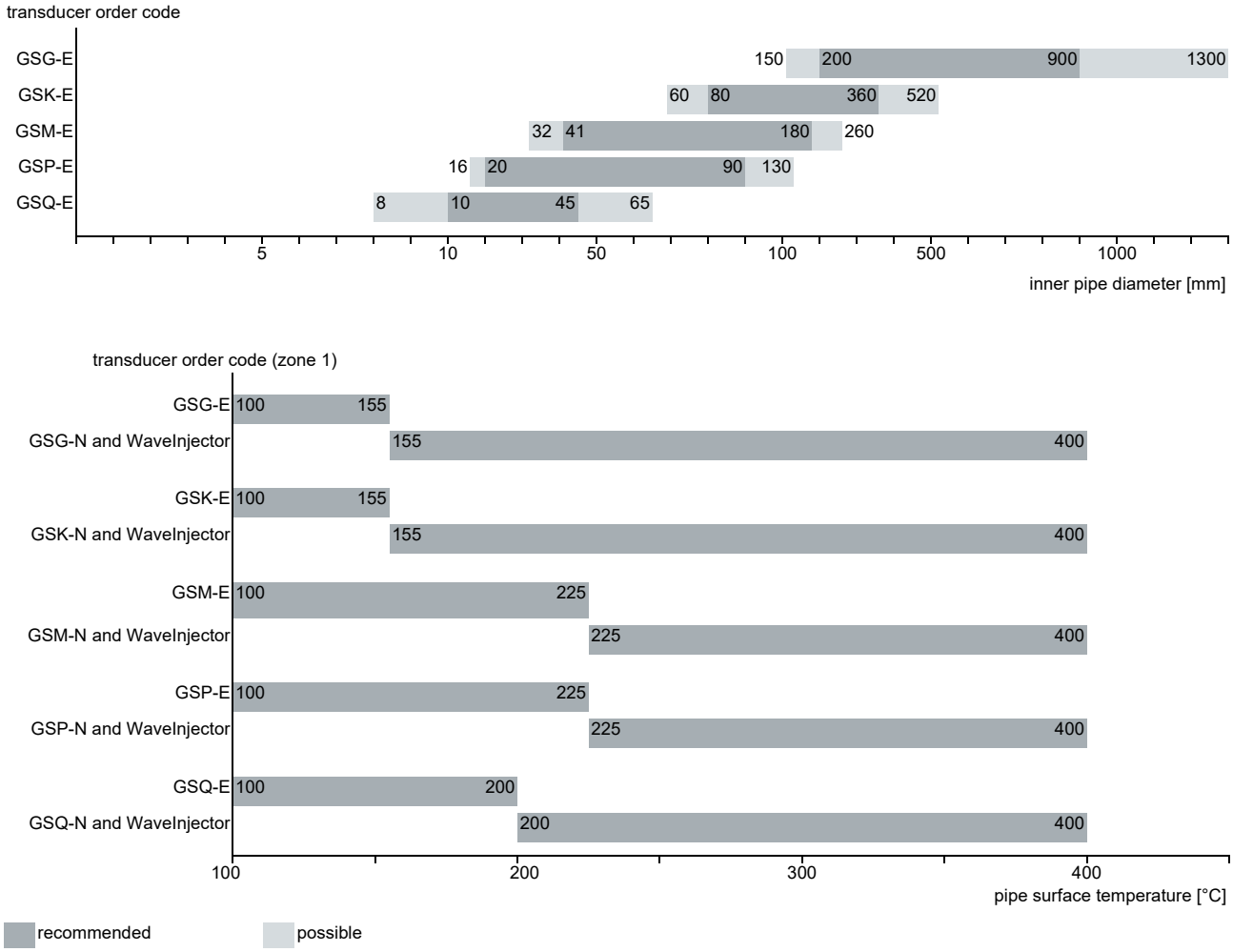
inputs[2]		
temperature probe		
terminal	**direct connection**	**connection with extension cable**
3	red	red
4	red/blue	blue
5	white/blue	grey
6	white	white
current input[1]		
terminal	**connection**	
1	-	
2	+	

[1] cable (by customer): e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm^2

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

Transducers

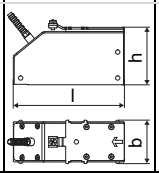
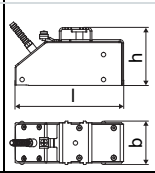
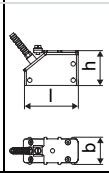
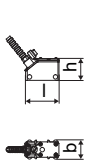
Transducer selection



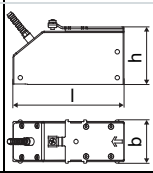
Transducer order code

1, 2	3		4	5, 6	7, 8		9...11			no. of character
transducer	**transducer frequency**	**-**	**ambient temperature**	**explosion protection**	**connection system**	**-**	**extension cable**	**/**	**option**	**description**
GS										set of ultrasonic flow transducers, 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
				NN						not explosion-proof
				A1						ATEX zone 1/IECEx zone 1
					T1					with stripped cable ends
							XXX			0 m: without extension cable > 0 m: with extension cable
									LC	long transducer cable
									OS	housing with stainless steel 316

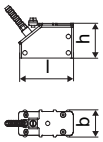
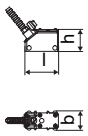
Shear wave transducers (zone 1, T1)

order code		GSG-N*1T1/**	GSK-N*1T1/**	GSM-N*1T1/**	GSP-N*1T1/**	GSQ-N*1T1/**
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
inner pipe diameter d						
min. extended	mm	180	70	37	18	9
min. recommended	mm	240	100	48	24	12
max. recommended	mm	920	370	180	90	46
max. extended	mm	1300	520	260	130	66
pipe wall thickness						
min.	mm	11.1	4.4	2.2	1.1	0.6
material						
housing		PEEK with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)				
contact surface		PEEK				
degree of protection		IP65	IP66			IP65
transducer cable						
type		1699				
length	m	5		4		3
length (***-*****/LC)	m	9				
dimensions						
length l	mm	129.5	126.5	64		40
width b	mm	51	51	32		22
height h	mm	67	67.5	40.5		25.5
dimensional drawing						
weight (without cable)	kg	0.47	0.36	0.066		0.016
pipe surface temperature						
min.	°C	-40				
max.	°C	+130				
ambient temperature						
min.	°C	-40				
max.	°C	+130				
temperature compensation		x				
explosion protection						
• ATEX/IECEx						
order code		GSG-NA1T1/**	GSK-NA1T1/**	GSM-NA1T1/**	GSP-NA1T1/**	GSQ-NA1T1/**
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 T80 °C...T185 °C Db				
certification ATEX		IBExU07ATEX1168 X				
certification IECEx		IECEx IBE 08.0007X				

Shear wave transducers (zone 1, T1, extended temperature range)

order code		GSG-E*1T1/**	GSK-E*1T1/**
technical type		G(DL)G1E83	G(DL)K1E83
transducer frequency	MHz	0.2	0.5
inner pipe diameter d			
min. extended	mm	150	60
min. recommended	mm	200	80
max. recommended	mm	900	360
max. extended	mm	1300	520
pipe wall thickness			
min.	mm	11.1	4.4
material			
housing		PPSU with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)	
contact surface		PPSU	
degree of protection		IP65	
transducer cable			
type		1699	
length	m	5	
length (***-*****/LC)	m	9	
dimensions			
length l	mm	129.5	
width b	mm	51	
height h	mm	67	
dimensional drawing			
weight (without cable)	kg	0.82	
pipe surface temperature			
min.	°C	100	
max.	°C	180	
ambient temperature			
min.	°C	-40	
max.	°C	+180	
temperature compensation		x	
explosion protection			
• **ATEX/IECEx**			
order code		GSG-EA1T1/**	GSK-EA1T1/**
pipe surface temperature (Ex)			
• min.	°C	-50	
• max.	°C	+155	
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC T80 °C...T160 °C Db	
certification ATEX		IBExU07ATEX1168 X	
certification IECEx		IECEx IBE 08.0007X	

Shear wave transducers (zone 1, T1, extended temperature range)

order code		GSM-E*1T1/**	GSP-E*1T1/**	GSQ-E*1T1/**
technical type		G(DL)M2E85	G(DL)P2E85	G(DL)Q2E85
transducer frequency	MHz	1	2	4
inner pipe diameter d				
min. extended	mm	32	16	8
min. recommended	mm	41	20	10
max. recommended	mm	180	90	45
max. extended	mm	260	130	65
pipe wall thickness				
min.	mm	2.2	1.1	0.6
material				
housing		PI with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)		
contact surface		PI		
degree of protection		IP66		IP56
transducer cable				
type		6111		
length	m	4		3
length (***-*****/LC)	m	9		
dimensions				
length l	mm	64		40
width b	mm	32		22
height h	mm	40.5		25.5
dimensional drawing				
weight (without cable)	kg	0.066		0.017
pipe surface temperature				
min.	°C	100		100
max.	°C	240[1]		200
ambient temperature				
min.	°C	-30		-30
max.	°C	+40 +200[2]		+200
temperature com-pensation		x		
explosion protection				
• **ATEX/IECEx**				
order code		GSM-EA1T1/**	GSP-EA1T1/**	GSQ-EA1T1/**
pipe surface temperature (Ex)				
• min.	°C	-45		
• max.	°C	+225[1]		
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T2 Gb Ex tb IIIA T80 °C...T230 °C Db		
certification ATEX		IBExU07ATEX1168 X		
certification IECEx		IECEx IBE 08.0007X		

[1] > +200 °C :
Variofix C
observe the insulation instruction
ambient temperature max. +40 °C

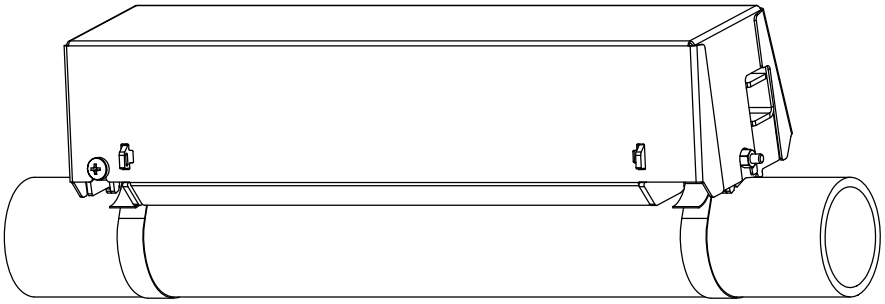
[2] pipe surface temperature max. +200 °C

Transducer mounting fixture

Order code

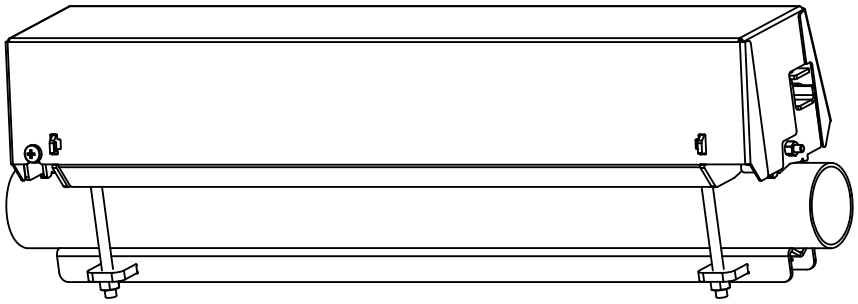
1, 2	3		4	5		6	7...9			no. of character
transducer mounting fixture	**transducer**	**-**	**measurement arrangement**	**size**	**-**	**fixation**	**outer pipe diameter**	**/**	**option**	**description**
VC										Variofix C
WI										transducer box for WaveInjector
	K									transducers with transducer frequency G, K
	M									transducers with transducer frequency M, P
	Q									transducers with transducer frequency Q
			D							diagonal arrangement
				S						small
				L						large
						B				bolts
						S				tension straps
							002			10...20 mm
							004			20...40 mm
							T36			40...360 mm
							013			10...130 mm
							036			130...360 mm
							092			360...920 mm
							200			920...2000 mm
									Z	special design

Variofix C (VC)



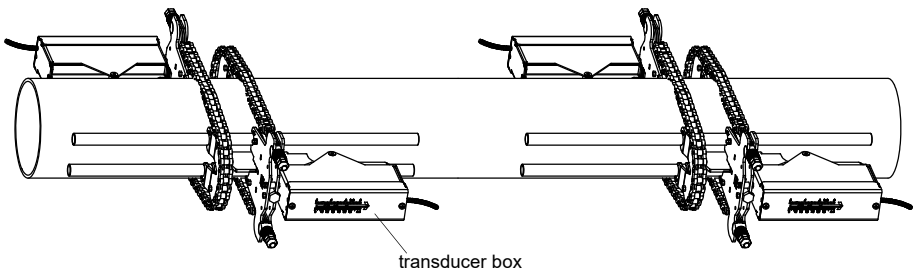
material: stainless steel 316Ti (1.4571)
inner length:
VCK-*L: 500 mm
VCK-*S: 350 mm
VCM: 400 mm
VCQ: 250 mm
dimensions:
VCK-*L:
560 x 126 x 125 mm
VCK-*S:
410 x 126 x 125 mm
VCM: 460 x 96 x 82 mm
VCQ: 310 x 85 x 71 mm

Variofix C (VC) with bolt mounting plates (VCM--B, VCQ-**-B)**



material: stainless steel 316Ti (1.4571)
inner length:
VCM: 400 mm
VCQ: 250 mm
dimensions:
VCM: 460 x 96 x 82 mm
VCQ: 310 x 85 x 71 mm
outer pipe diameter:
VCM: max. 46 mm
VCQ: max. 36 mm

transducer box WI for WaveInjector

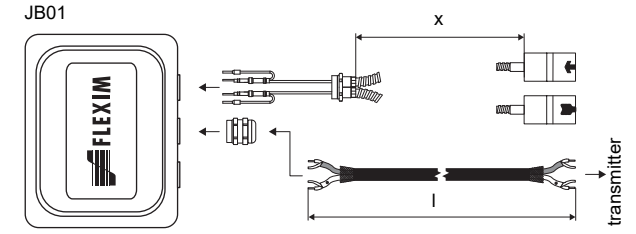
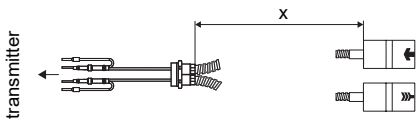


see Technical specification
TSWaveInjectorVx-x

Coupling materials for transducers

type	ambient temperature °C	remark
coupling foil type VT	-10...+200	fluid temperature 200 °C: min. 2 years
coupling foil type TF	200...240	
coupling compound type E	-30...+200	in combination with type VT only
coupling compound type H	-30...+250	in combination with type TF only
coupling foil type A	max. 280	WaveInjector
coupling foil type B	280...400	WaveInjector

Connection systems

connection system T1		
connection with extension cable	direct connection	transducers technical type
		*****8*

Cable

transducer cable		
type		**1699**
weight	kg/m	0.094
ambient temperature	°C	-55...+200
properties		
cable jacket		
material		PTFE
outer diameter	mm	2.9
thickness	mm	0.3
colour		brown
shield		x
material		stainless steel 304 (1.4301) option OS: 316Ti (1.4571)
outer diameter	mm	8

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

XXX - cable length in m

Cable length

transducer frequency		G, K		M, P		Q	
connection system TS							
transducers technical type		x	l	x	l	x	l
*D***8*	m	5	≤ 300	4	≤ 300	3	≤ 90
option LC: *L***8*	m	9	≤ 300	9	≤ 300	9	≤ 90

x - transducer cable length

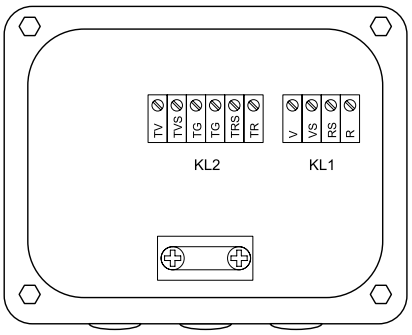
l - max. length of extension cable (depending on the application)

Junction box

Technical data

JB01S4E3M		
weight	kg	1.2 kg
fixation		wall mounting optional: 2" pipe mounting
material		
housing		stainless steel 316L (1.4404)
gasket		silicone
degree of protection		IP67
ambient temperature		
min.	°C	-40
max.	°C	+80
explosion protection		
• ATEX/IECEx		
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

Connection



Transducers

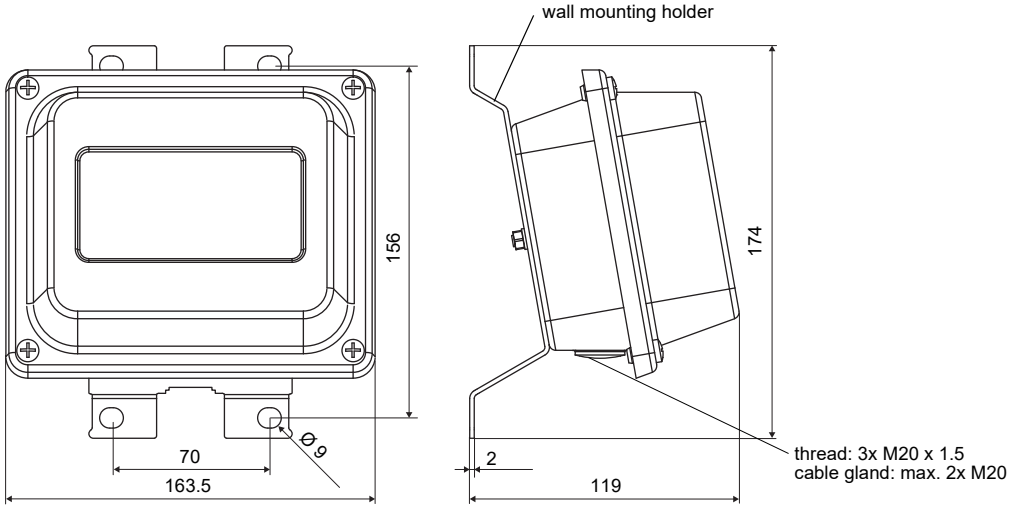
terminal strip	terminal	connection	transducer
KL1	V	signal	
	VS	internal shield	
	RS	internal shield	
	R	signal	

Extension cable

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

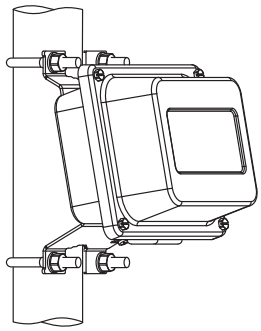
Dimensions

JB0*, JBP*



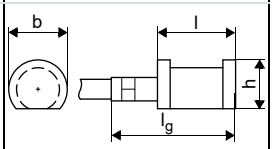
in mm

2" pipe mounting kit

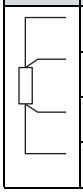
JB** 	order code: ACC-PE-GNNN-/JBPMK4

Clamp-on temperature probe (optional)

Technical data

PT12N		
order code		ACC-PE-xxxx-/T332
design		clamp-on Zone 0 (intrinsic safety)
type		Pt100
connection		4-wire
measuring range	°C	-45...+230
accuracy T		±(0.15 °C + 2 · 10^{-3} · |T [°C]|) class A
housing material		stainless steel 316
degree of protection		IP65/IP68
dimensions		
length l	mm	20 (l_g = 45)
width b	mm	16
height h	mm	11
dimensional drawing		
weight	kg	0.15
explosion protection		
• **ATEX**		
technical type		LEX25
marking		CE 0344 Ex II1G Ex ia IIC T6...T1 Ga
certification		DEKRA17ATEX0123 X
intrinsic safety parameters		U_i = 30 V DC I_i = 75 mA P_i = 500 mW C_i = 0 L_i = 0

Connection

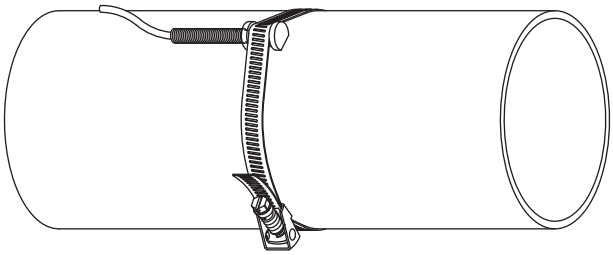
	temperature probe
	red
	red
	white
	white

Cable

		temperature probe
type		4 x 0.22 mm^2
standard length	m	4
ambient temperature	°C	-45...+80
cable jacket		
material		FEP
outer diameter	mm	3.6
colour		black

Fixation

tension strap PT12N



material: stainless steel 301 (1.4310), 410 (1.4006)

thermal insulation necessary

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2021-09-01, TSFLUXUS_G831ST-HTV1-0EN_Leu