

Permanently installed ultrasonic flowmeter for liquids

Transmitter for permanent outdoor wall or pipe mounting

Features

- Precise bidirectional and highly dynamic flow measurement with the non-invasive clamp-on technology
- Up to 4 measuring channels to compensate highly disturbed flow profiles and to facilitate more accurate and repeatable measurements
- Best suitable for applications with limited straight runs
- High precision at fast and slow flow rates, high temperature and zero point stability
- Automatic loading of calibration data and transducer detection for a fast and easy set-up (less than 5 min), providing precise and long-term stable results
- User-friendly design
- Transducers available for a wide range of inner pipe diameters and fluid temperatures
- Transmitter and transducers for usage in hazardous areas are available
- HybridTrek automatically switches between transit time and NoiseTrek mode of measurement when high particulate flows are encountered
- Measurement is unaffected by fluid density, viscosity and solid content (max. 10 % of volume)

Applications

- Process and control measurements in oil production, transportation and processing
- Check metering for custody transfer meter and health monitoring
- Balancing and leakage detection
- Crude oil and refined products – tank dewatering
- HPI applications for volume correction, mass flow and fluid identification
- Cryogenic and high temperature applications (-200...+600 °C)
- Water, waste water and sea water measurements
- For application in explosive atmospheres (ATEX, IECEx, FM Class I Div. 2)



FLUXUS F706



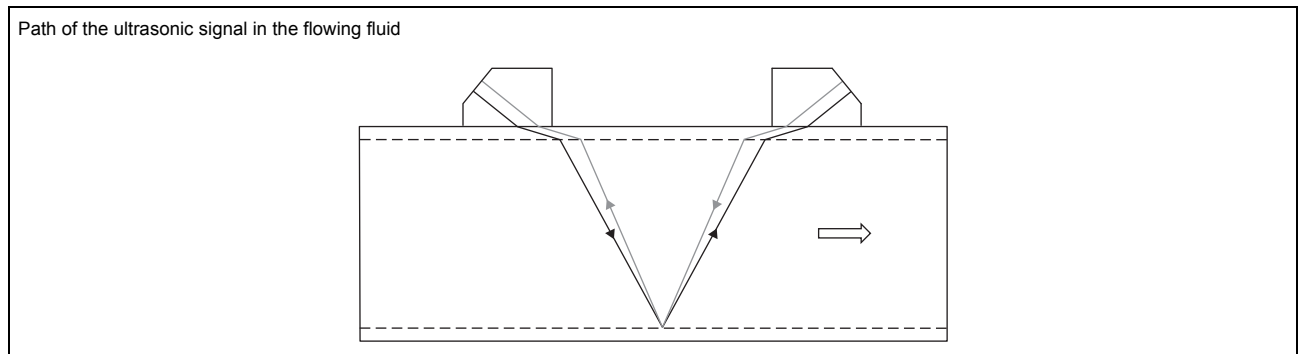
4 transducer pairs at one measuring point

Function	3
Measurement principle	3
Calculation of volumetric flow rate	3
Number of sound paths	4
Transmitter	5
Technical data	5
Dimensions	8
2" pipe mounting kit	8
Terminal assignment	9
Transducers	10
Transducer selection	10
Transducer order code	11
Technical data	12
Transducer mounting fixture	18
Coupling materials for transducers	20
Connection systems	21
Junction box	23
Technical data	23
Dimensions	24
2" pipe mounting kit	24
Clamp-on temperature probe (optional)	25
Technical data	25
Fixation	27
Junction box	27

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.

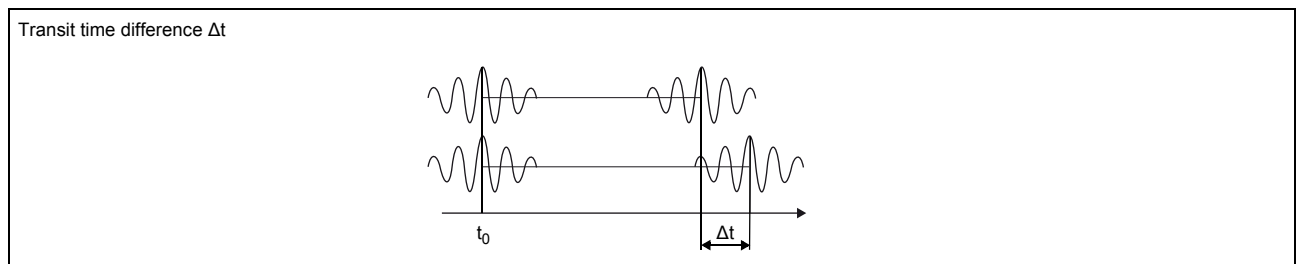


Transit time difference principle

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.



HybridTrek

If the gaseous or solid content in the fluid increases occasionally during measurement, a measurement with the transit time difference principle is no longer possible. NoiseTrek mode will then be selected by the flowmeter. This measurement method allows the flowmeter to achieve a stable measurement even with high gaseous or solid content.

The transmitter can switch automatically between transit time and NoiseTrek mode without any changes to the measurement setup.

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:

- **reflection 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.

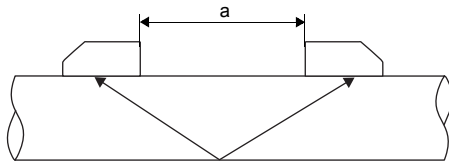
- **diagonal arrangement**

The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe. In the case of a high signal attenuation by the fluid, pipe and coatings, diagonal arrangement with 1 sound path will be used.

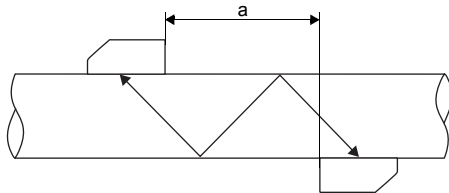
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

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

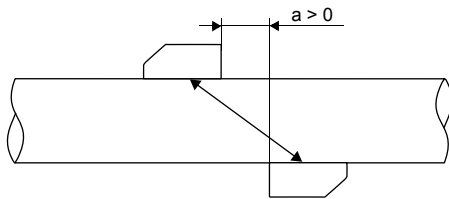
Reflection arrangement, number of sound paths: 2



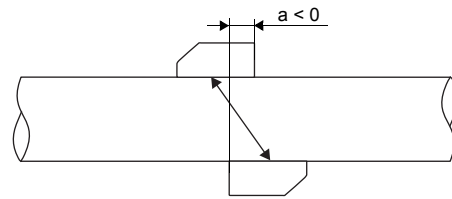
Diagonal arrangement, number of sound paths: 3



Diagonal arrangement, number of sound paths: 1





Diagonal arrangement, number of sound paths: 1, negative transducer distance



a - transducer distance

Transmitter

Technical data

		FLUXUS F706**-NN FLUXUS F706**-A2	FLUXUS F706**-F2
			
design	field device with 4 measuring channels in stainless steel housing		
measurement			
measurement principle	transit time difference correlation principle, automatic NoiseTrek selection for measurements with high gaseous or solid content		
flow velocity	m/s	0.01...25	
repeatability	0.15 % of reading ±0.005 m/s		
fluid	all acoustically conductive liquids with < 10 % gaseous or solid content in volume (transit time difference principle)		
temperature compensation	corresponding to the recommendations in ANSI/ASME MFC-5.1-2011		
measurement uncertainty (volumetric flow rate)¹			
measurement uncertainty of measuring system ¹	±0.3 % of reading ±0.005 m/s		
measurement uncertainty at the measuring point ²	±1 % of reading ±0.005 m/s		
transmitter			
power supply	<ul style="list-style-type: none"> • 100...230 V/50...60 Hz or • 20...32 V DC or • 11...16 V DC 		
power consumption	W	< 20	
number of measuring channels	4		
damping	s	0...100 (adjustable)	
measuring cycle	Hz	100...1000 (1 channel)	
response time	s	1 (1 channel)	
housing material	stainless steel 316L (1.4404)		
degree of protection	IP66		
dimensions	mm	see dimensional drawing	
weight	kg	7.2	
fixation	wall mounting, optional: 2" pipe mounting		
ambient temperature	°C	-40...+60 (< -20 °C without operation of the display)	-20...+55
display	2 x 16 characters, dot matrix, backlight		
menu language	English, German, French, Dutch, Spanish		
explosion protection			
• ATEX/IECEX			
transmitter	F706**-A2		-
marking	CE 0637 Ex II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 °C Db T _a -40...+60 °C		-
certification ATEX	IBExU11ATEX1015		-
certification IECEx	IECEx IBE 11.0008		-
• FM			
marking	-		 NI/CI. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T5 -20°C≤T _a ≤55°C IP64
measuring functions			
physical quantities	volumetric flow rate, mass flow rate, flow velocity, heat flow (if temperature inputs are installed)		
totalizer	volume, mass, optional: heat quantity		
calculation functions	average, difference, sum		
diagnostic functions	sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times		

¹ with aperture calibration of the transducers

² for transit time difference principle and reference conditions

³ outside of explosive atmosphere (housing cover open)

FLUXUS F706**-NN FLUXUS F706**-A2		FLUXUS F706**-F2
communication interfaces		
service interfaces	<ul style="list-style-type: none"> • RS232³ • USB (with adapter)³ 	
process interfaces	max. 1 option: <ul style="list-style-type: none"> • RS485 (ASCII sender) • Modbus RTU • HART • FF H1 • SD card (nonEx) 	max. 1 option: <ul style="list-style-type: none"> • RS485 (ASCII sender) • Modbus RTU • HART • FF H1
accessories		
serial data kit	<ul style="list-style-type: none"> • cable • adapter RS232 RS232 - USB	
software	<ul style="list-style-type: none"> • FluxDiagReader: download of measured values and parameters, graphical presentation • FluxDiag (optional): download of measurement data, graphical presentation, report generation • FluxSubstanceLoader: upload of fluid data sets 	
data logger		
loggable values	all physical quantities, totalized values and diagnostic values	
capacity	> 100 000 measured values	
SD card, removable (nonEx, optional)		
loggable values	all physical quantities and totalized values	
capacity	min. 2 GB	
outputs		
	The outputs are galvanically isolated from the transmitter.	
number	on request active inputs and outputs: max. 4	
• switchable current output		
	The switchable current outputs are menu selectable all together as passive or active.	
range	mA	4...20 (3.2...22)
accuracy		0.04 % of reading ±3 µA
active output		$R_{ext} < 350 \Omega$
passive output		$U_{ext} = 8...30 \text{ V}$, depending on R_{ext} ($R_{ext} < 1 \text{ k}\Omega$ at 30 V)
• HART		
range	mA	4...20
accuracy		0.1 % of reading ±15 µA
active output		$U_{int} = 24 \text{ V}$, $R_{ext} < 500 \Omega$
passive output		$U_{ext} = 10...24 \text{ V DC}$, depending on R_{ext} ($R_{ext} < 1 \text{ k}\Omega$ at 24 V)
• voltage output		
range	V	0...1 or 0...10
accuracy		0...1 V: 0.1 % of reading ±1 mV 0...10 V: 0.1 % of reading ±10 mV
internal resistance		$R_{int} = 500 \Omega$
• frequency output		
range	kHz	0...5
optorelay		24 V/4 mA, $R_{int} = 66.5 \Omega$
• binary output		
optorelay		26 V/100 mA
open collector		24 V/4 mA, P1...P6: $R_{int} = 22 \Omega$
Reed relay		48 V/100 mA, P1...P6: $R_{int} = 22 \Omega$
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...1000
• pulse width	ms	optorelay: 1...1000 Reed relay, open collector: 80...1000

¹ with aperture calibration of the transducers

² for transit time difference principle and reference conditions

³ outside of explosive atmosphere (housing cover open)

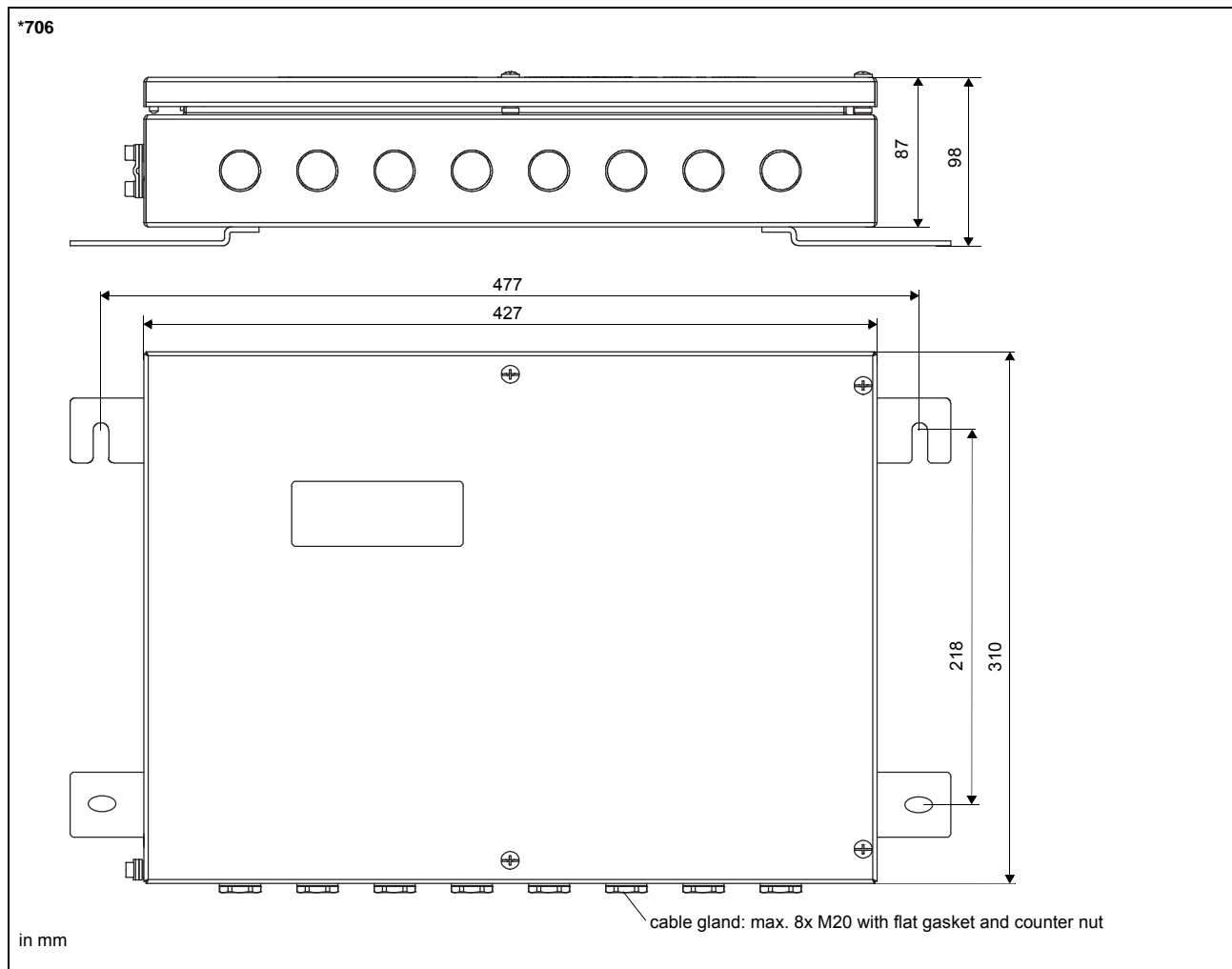
	FLUXUS F706**-NN FLUXUS F706**-A2	FLUXUS F706**-F2
inputs		
	The inputs are galvanically isolated from the transmitter.	
number	max. 4, on request active inputs and outputs: max. 4	
• temperature input		
type	Pt100/Pt1000	
connection	4-wire	
range	°C -150...+560	
resolution	K 0.01	
accuracy	±0.01 % of reading ±0.03 K	
• current input		
accuracy	0.1 % of reading ±10 µ	
active input	U _{int} = 24 V, R _{int} = 50 Ω, P _{int} < 0.5 W, not short-circuit proof	
• range	mA 0...20	
passive input	R _{int} = 50 Ω, P _{int} < 0.3 W	
• range	mA -20...+20	
• voltage input		
range	V	0...1
accuracy	0.1 % of reading ±1 mV	
internal resistance	R _{int} = 1 MΩ	
• binary input		
switching signal	5...30 V, 1 mA	5...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

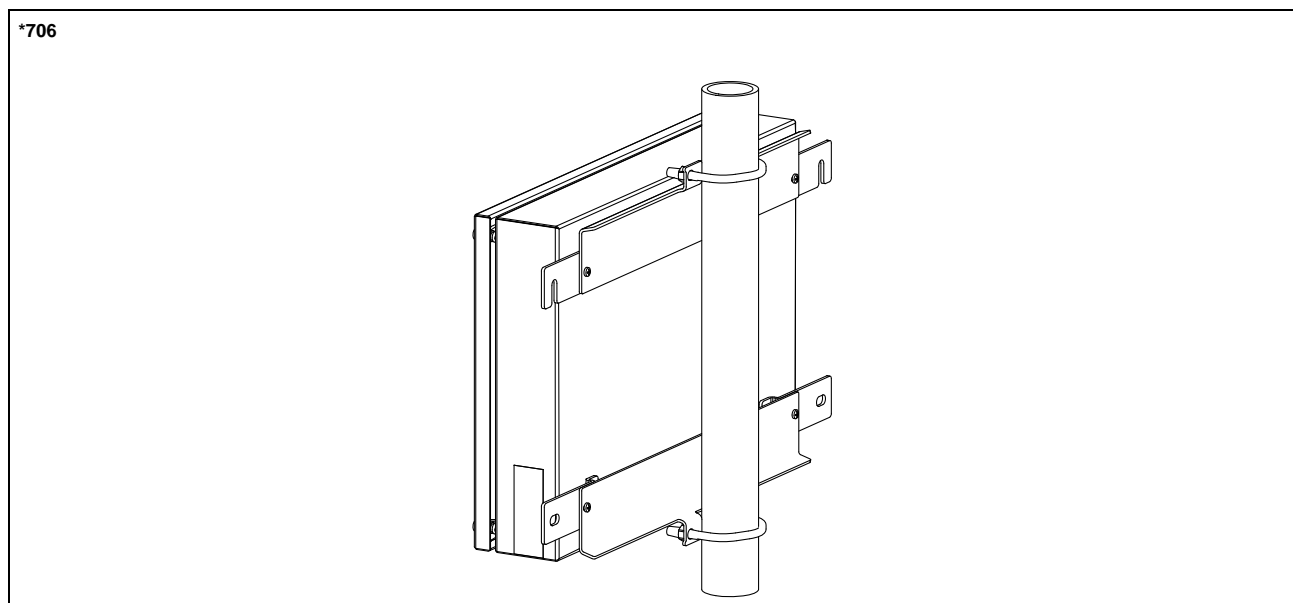
² for transit time difference principle and reference conditions

³ outside of explosive atmosphere (housing cover open)

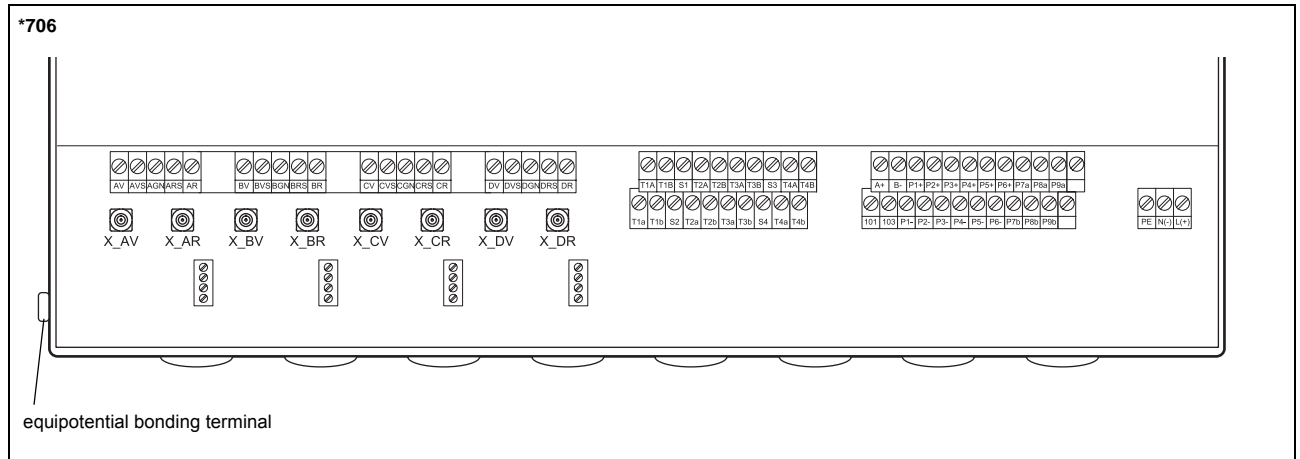
Dimensions



2" pipe mounting kit



Terminal assignment



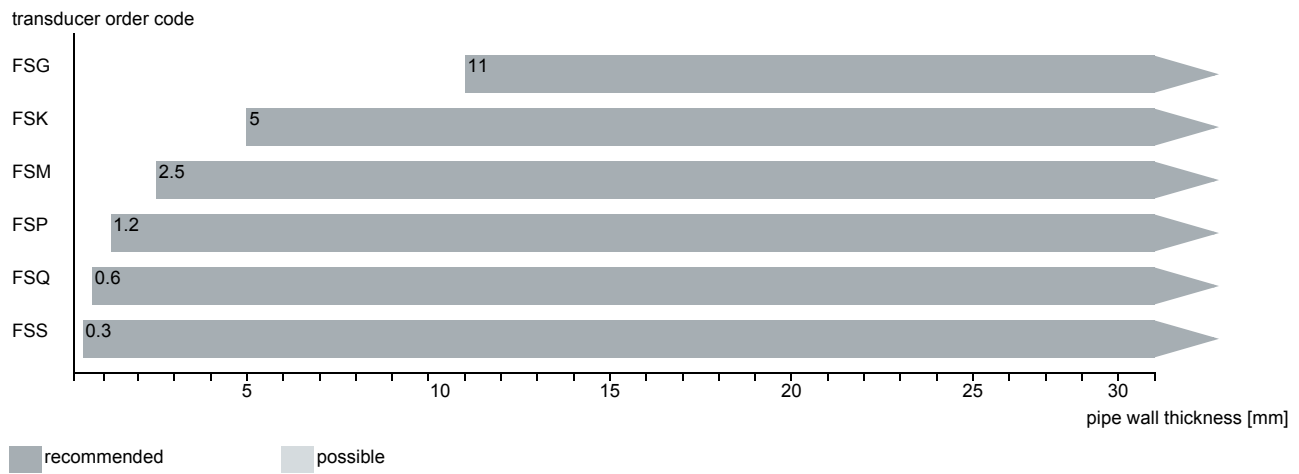
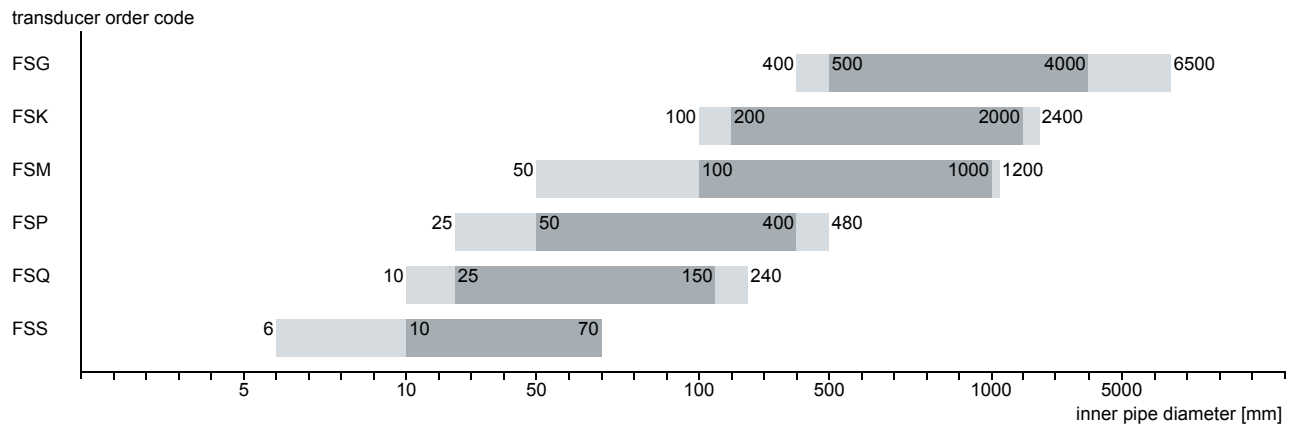
power supply ¹				
terminal	connection (AC)		connection (DC)	
PE	earth		earth	
N(-)	neutral		-	
L(+)	phase		+	
transducers				
transducer cable (transducers ****8*, ****L1*)			transducer cable (transducers ****52)	
extension cable (transducers ****8*, ****L1*, ****52)			measuring channel A, B, C, D	
terminal	connection	transducer	terminal	connection
xV	signal	↑	X_xV	SMB connector
xVS	shield			
xRS	shield	⏏	X_xR	SMB connector
xR	signal			
outputs ^{1, 2}				
terminal	connection	terminal	connection	communication interface
P1+...P6+	current output, voltage output, frequency output, binary output (Reed relay, open collector), HART (P1)	A+	signal +	<ul style="list-style-type: none"> • RS485 • Modbus RTU • FF
P1-...P6-		B-	signal -	
P7a...P9a P7b...P9b	binary output (Reed relay, optorelay)	101	shield	
analog inputs ^{1, 2}				
terminal	temperature probe		passive sensor	active sensor
	direct connection	connection with extension cable	connection	connection
T1a...T4a	red	red	not connected	not connected
T1A...T4A	red/blue	grey	-	+
T1b...T4b	white/blue	blue	+	not connected
T1B...T4B	white	white	not connected	-
S1, S3	shield	shield	not connected	not connected
binary inputs ^{1, 2}				
terminal				
P1+...P2+, P1-...P2-				

¹ cable (by customer):
 - e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.5...1.5 mm²
 - with ferrite nut outer diameter of the cable max. 7.6 mm

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

Transducers

Transducer selection



Transducer order code

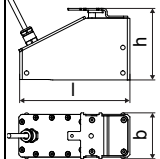
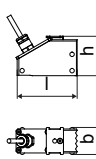
1, 2	3	4	5, 6	7, 8	9...11	no. of character				
transducer	transducer frequency	-	ambient temperature	explosion protection	connection system	-	extension cable	/	option	description
FS										set of ultrasonic flow transducers for liquids measurement, shear wave
	G									0.2 MHz
	K									0.5 MHz
	M									1 MHz
	P									2 MHz
	Q									4 MHz
	S									8 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)

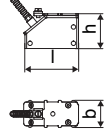
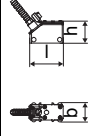


order code	FSG-N**TS/**	FSK-N**TS/**	FSM-N**TS/**	FSP-N**TS/**	FSQ-N**TS/**	FSS-N**TS/**
technical type	C(DL)G1N52	C(DL)K1N52	C(DL)M2N52	C(DL)P2N52	C(DL)Q2N52	CDS1N52
transducer frequency /MHz	0.2	0.5	1	2	4	8
inner pipe diameter d						
min. extended	mm 400	100	50	25	10	6
min. recommended	mm 500	200	100	50	25	10
max. recommended	mm 4000	2000	1000	400	150	70
max. extended	mm 6500	2400	1200	480	240	70
pipe wall thickness						
min.	mm 11	5	2.5	1.2	0.6	0.3
material						
housing	PEEK with stainless steel cap 304 (1.4301), ***-*****/OS: 316L (1.4404)					stainless steel 304 (1.4301)
contact surface	PEEK					PEI
degree of protection	IP67					IP65
transducer cable						
type	1699					
length	m 5	4			3	2
length (***/*****/LC)	m 9	-				
dimensions						
length l	mm 129.5	126.5	64		40	25
width b	mm 51	51	32		22	13
height h	mm 67	67.5	40.5		25.5	17
dimensional drawing						
weight (without cable)	kg 0.47	0.36	0.066		0.016	0.004
pipe surface temperature						
min.	°C -40					-30
max.	°C +130					+130
ambient temperature						
min.	°C -40					-30
max.	°C +130					+130
temperature compensation	x					-
explosion protection						
• ATEX/IECEx						
order code	FSG-NA2TS/**	FSK-NA2TS/**	FSM-NA2TS/**	FSP-NA2TS/**	FSQ-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	FSG-NF2TS/**	FSK-NF2TS/**	FSM-NF2TS/**	FSP-NF2TS/**	FSQ-NF2TS/**	FSS-NF2TS/**
pipe surface temperature (Ex)						-
• min.	°C -40					-
• max.	°C +125	+190				+125
degree of protection	IP66					
marking	NI/CI, I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860					

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

order code	FSG-N**TS/IP68	FSK-N**TS/IP68	FSM-N**TS/IP68	FSP-N**TS/IP68
technical type	CDG1LI8	CDK1LI8	CDM2LI8	CDP2LI8
transducer frequency	MHz 0.2	0.5	1	2
inner pipe diameter d				
min. extended	mm 400	100	50	25
min. recommended	mm 500	200	100	50
max. recommended	mm 4000	2000	1000	400
max. extended	mm 6500	2400	1200	480
pipe wall thickness				
min.	mm 11	5	2.5	1.2
material				
housing	PEEK with stainless steel cap 316Ti (1.4571)			
contact surface	PEEK			
degree of protection	IP68 ¹			
transducer cable				
type	2550			
length	m 12			
dimensions				
length l	mm 130			72
width b	mm 54			32
height h	mm 83.5			46
dimensional drawing				
weight (without cable)	kg 0.43			0.085
pipe surface temperature				
min.	°C -40			
max.	°C +100			
ambient temperature				
min.	°C -40			
max.	°C +100			
temperature compensation	x			
explosion protection				
• ATEX/IECEX				
order code	FSG-NA2TS/IP68	FSK-NA2TS/IP68	FSM-NA2TS/IP68	FSP-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 test conditions: 3 months/2 bar (20 m)/20 °C

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

order code		FSM-E**TS/**	FSP-E**TS/**	FSQ-E**TS/**
technical type		C(DL)M2E52	C(DL)P2E52	C(DL)Q2E52
transducer frequency	MHz	1	2	4
inner pipe diameter d				
min. extended	mm	50	25	10
min. recommended	mm	100	50	25
max. recommended	mm	1000	400	150
max. extended	mm	1200	480	240
pipe wall thickness				
min.	mm	2.5	1.2	0.6
material				
housing		PI with stainless steel cap 304 (1.4301), ***-****/OS: 316L (1.4404)		
contact surface		PI		
degree of protection		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	-30		-30
max.	°C	+240 ¹		+200
ambient temperature				
min.	°C	-30		-30
max.	°C	+40 +60 ² +200 ³		+200
temperature compensation		x		
explosion protection				
• ATEX/IECEx				
order code		FSM-EA2TS/**	FSP-EA2TS/**	FSQ-EA2TS/**
pipe surface temperature (Ex)				
• min.	°C	-45		
• max.	°C	gas: +235 ¹ , dust: +225 ¹		
marking		CE 0637  II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIA TX Db		
certification ATEX		IBExU10ATEX1163 X		
certification IECEx		IECEx IBE 12.0005X		
• FM				
order code		FSM-EF2TS/**	FSP-EF2TS/**	FSQ-EF2TS/**
pipe surface temperature (Ex)				
• min.	°C	-40		
• max.	°C	+235 ¹		
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 > +200 °C:

Variofix L or Variofix C
 observe the insulation instruction

Ex: ambient temperature max. +40 °C

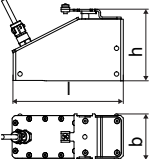
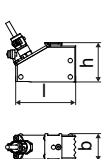
² pipe surface temperature +200...+240 °C: Variofix C without cover

³ pipe surface temperature max. +200 °C

Shear wave transducers (zone 1, TS)

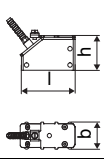
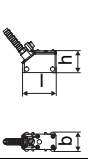
order code	FSG-N*1TS/**	FSK-N*1TS/**	FSM-N*1TS/**	FSP-N*1TS/**	FSQ-N*1TS/**
technical type	C(DL)G1N81	C(DL)K1N81	C(DL)M2N81	C(DL)P2N81	C(DL)Q2N81
transducer frequency	MHz 0.2	0.5	1	2	4
inner pipe diameter d					
min. extended	mm 400	100	50	25	10
min. recommended	mm 500	200	100	50	25
max. recommended	mm 4000	2000	1000	400	150
max. extended	mm 6500	2400	1200	480	240
pipe wall thickness					
min.	mm 11	5	2.5	1.2	0.6
material					
housing	PEEK with stainless steel cap 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	FSG-NA1TS/**	FSK-NA1TS/**	FSM-NA1TS/**	FSP-NA1TS/**	FSQ-NA1TS/**
pipe surface temperature (Ex)	• min. °C -55 • max. °C +180				
marking	CE 0637 (E) II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db				
certification ATEX	IBExU07ATEX1168 X				
certification IECEx	IECEx IBE 08.0007X				

Shear wave transducers (zone 1, TS, IP68)

order code		FSG-N*1TS/IP68	FSK-N*1TS/IP68	FSM-N*1TS/IP68	FSP-N*1TS/IP68
technical type		CDG1L11	CDK1L11	CDM2L11	CDP2L11
transducer frequency	MHz	0.2	0.5	1	2
inner pipe diameter d					
min. extended	mm	400	100	50	25
min. recommended	mm	500	200	100	50
max. recommended	mm	4000	2000	1000	400
max. extended	mm	6500	2400	1200	480
pipe wall thickness					
min.	mm	11	5	2.5	1.2
material					
housing		PEEK with stainless steel cap 316Ti (1.4571)			
contact surface		PEEK			
degree of protection		IP68 ¹			
transducer cable					
type		2550			
length	m	12			
dimensions					
length l	mm	130		72	
width b	mm	54		32	
height h	mm	83.5		46	
dimensional drawing					
weight (without cable)	kg	0.43		0.085	
pipe surface temperature					
min.	°C	-40			
max.	°C	+100			
ambient temperature					
min.	°C	-40			
max.	°C	+100			
temperature compensation		x			
explosion protection					
• ATEX/IECEX					
order code		FSG-NA1TS/IP68	FSK-NA1TS/IP68	FSM-NA1TS/IP68	FSP-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 test conditions: 3 months/2 bar (20 m)/20 °C

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

order code		FSM-E*1TS/**	FSP-E*1TS/**	FSQ-E*1TS/**
technical type		C(DL)M2E85	C(DL)P2E85	C(DL)Q2E85
transducer frequency	MHz	1	2	4
inner pipe diameter d				
min. extended	mm	50	25	10
min. recommended	mm	100	50	25
max. recommended	mm	1000	400	150
max. extended	mm	1200	480	240
pipe wall thickness				
min.	mm	2.5	1.2	0.6
material				
housing		PI with stainless steel cap 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	-30		-30
max.	°C	+240 ¹		+200
ambient temperature				
min.	°C	-30		-30
max.	°C	+40 +200 ²		+200
temperature compensation		x		
explosion protection				
• ATEX/IECEx				
order code		FSM-EA1TS/**	FSP-EA1TS/**	FSQ-EA1TS/**
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 TX Db		
certification ATEX		IBExU07ATEX1168 X		
certification IECEx		IECEx IBE 08.0007X		

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

² pipe surface temperature max. +200 °C

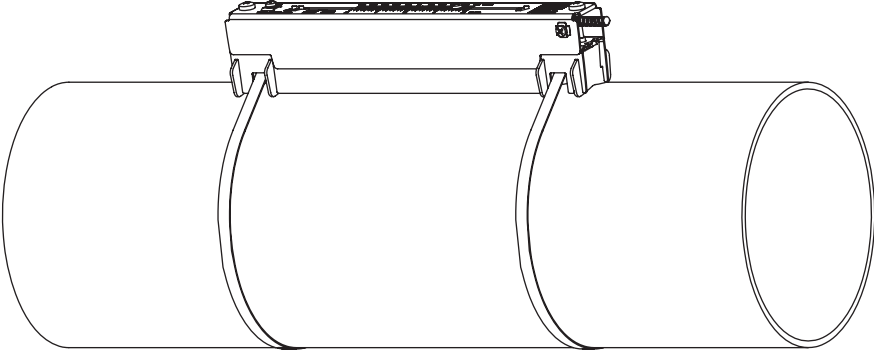
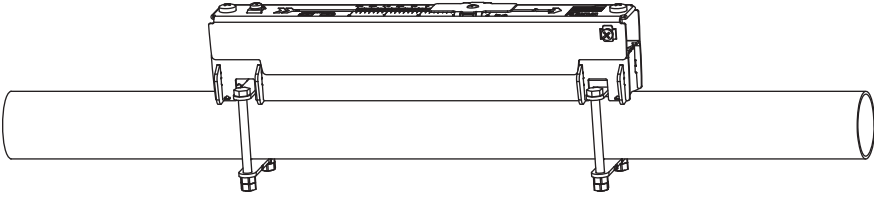
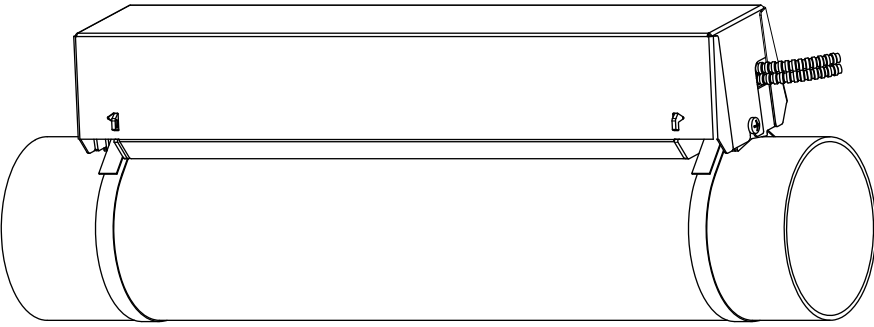
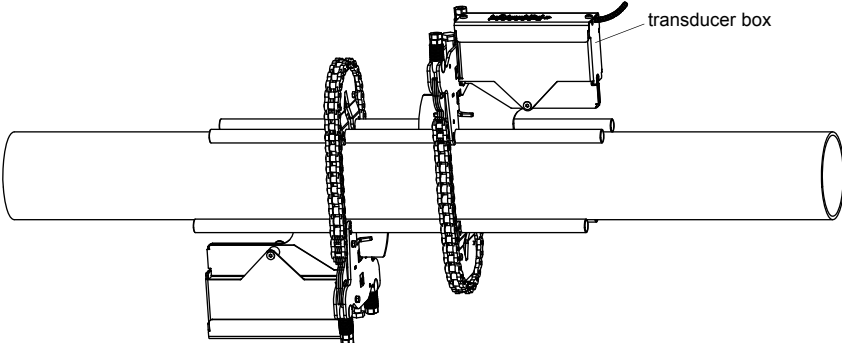
Transducer mounting fixture

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
VL						Variofix L
VC						Variofix C
WI						transducer box for Wavelnjector
	K					transducers with transducer frequency G, K
	M					transducers with transducer frequency M, P
	Q					transducers with transducer frequency Q
	S					transducers with transducer frequency S
		D				reflection arrangement or diagonal arrangement
		R				reflection arrangement
			S			small
			M			medium
			L			large
				B		bolts
				S		tension straps
				W		welding
				N		without fixation
					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
					450	2000...4500 mm
					940	4500...9400 mm
					NDR	any
						IP68 for transducers with degree of protection IP68
						OS housing with stainless steel 316
						Z special design

Variofix L (VLS)

transducer frequency: S
 material: stainless steel 304 (1.4301),
 303 (1.4305)

<p>Variofix L (VLK, VLM, VLQ)</p> 	<p>material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006) option OS: 316Ti (1.4571), 316L (1.4404), 17-7PH (1.4568) inner length: VLK: 348 mm, option IP68: 368 mm VLM: 234 mm VLQ: 176 mm dimensions: VLK: 423 x 90 x 93 mm option IP68: 443 x 94 x 105 mm VLM: 309 x 57 x 63 mm VLQ: 247 x 43 x 47 mm</p>
<p>Variofix L with bolt mounting plates (VL**-B)</p> 	<p>material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006) option OS: 316Ti (1.4571), 316L (1.4404), 17-7PH (1.4568) inner length: VLM: 234 mm VLQ: 176 mm dimensions: VLM: 309 x 57 x 63 mm VLQ: 247 x 43 x 47 mm outer pipe diameter: max. 48 mm</p>
<p>Variofix C (VC)</p> 	<p>material: stainless steel 304 (1.4301), 301 (1.4310) option OS: 316Ti (1.4571) inner length: VCK-*L: 500 mm VCK-*S: 350 mm VCM: 400 mm VCQ: 250 mm dimensions: VCK-*L: 560 x 122 x 102 mm, option IP68: 560 x 126 x 120 mm VCK-*S: 410 x 122 x 102 mm, option IP68: 410 x 126 x 120 mm VCM: 460 x 96 x 80 mm VCQ: 310 x 85 x 62 mm</p>
<p>transducer box WI for WaveInjector</p>  <p style="text-align: right;">transducer box</p>	<p>see Technical specification TSWaveInjectorVx-x</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)			WaveInjector WI-400	
	< 100 °C	< 170 °C	< 150 °C	< 200 °C	200...240 °C	< 280 °C	280...400 °C
< 24 h	coupling compound type N or coupling foil type VT	coupling compound type E or coupling foil type VT	coupling compound type E or coupling foil type VT	coupling compound type E or H or coupling foil type VT	coupling foil type TF	coupling foil type A and coupling foil type VT	coupling foil type B and coupling foil type VT
long time measurement	coupling foil type VT ¹	coupling foil type VT ²	coupling foil type VT ¹	coupling foil type VT ²	coupling foil type TF	coupling foil type A and coupling foil type VT	coupling foil type B and coupling foil type VT

¹ < 5 years

² < 6 months

Technical data

type	ambient temperature °C
coupling compound type N	-30...+130
coupling compound type E	-30...+200
coupling compound type H	-30...+250
coupling foil type A	max. 280
coupling foil type B	280...400
coupling foil type VT	-10...+200
coupling foil type TF	200...240

Connection systems

connection system TS		
connection with extension cable	direct connection	transducers technical type
<p>JB01</p>		<p>*****8*</p>
<p>JB01, JBP2, JBP3</p>		<p>*****L1*</p>
<p>JB02, JB03, JB04</p>		<p>*****52</p>

Cable

transducer cable				
type		1699	2550	6111
weight	kg/m	0.094	0.035	0.092
ambient temperature	°C	-55...+200	-40...+100	-100...+225
properties			longitudinal watertight	
cable jacket				
material		PTFE	PUR	PFA
outer diameter	mm	2.9	5.2 ±0.2	2.7
thickness	mm	0.3	0.9	0.5
colour		brown	grey	white
shield		x	x	x
sheath				
material		stainless steel 304 (1.4301) option OS: 316Ti (1.4571)	-	stainless steel 304 (1.4301) option OS: 316Ti (1.4571)
outer diameter	mm	8	-	8

extension cable			
type		2615	5245
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	12	12
thickness	mm	2	2
colour		black	black
shield		x	x
sheath			
material		-	steel wire braid with copolymer sheath
outer diameter	mm	-	15.6

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*	m	5	≤ 300	4	≤ 300	3	≤ 90	-	-
option LC: *(LT)***8*	m	9	≤ 300	9	≤ 300	9	≤ 90	-	-
*(DR)***5*	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40
option LC: *(LT)***5*	m	9	≤ 300	9	≤ 300	9	≤ 90	-	-
option IP68: ****LJ*	m	12	≤ 300	12	≤ 300	-	-	-	-

x - transducer cable length

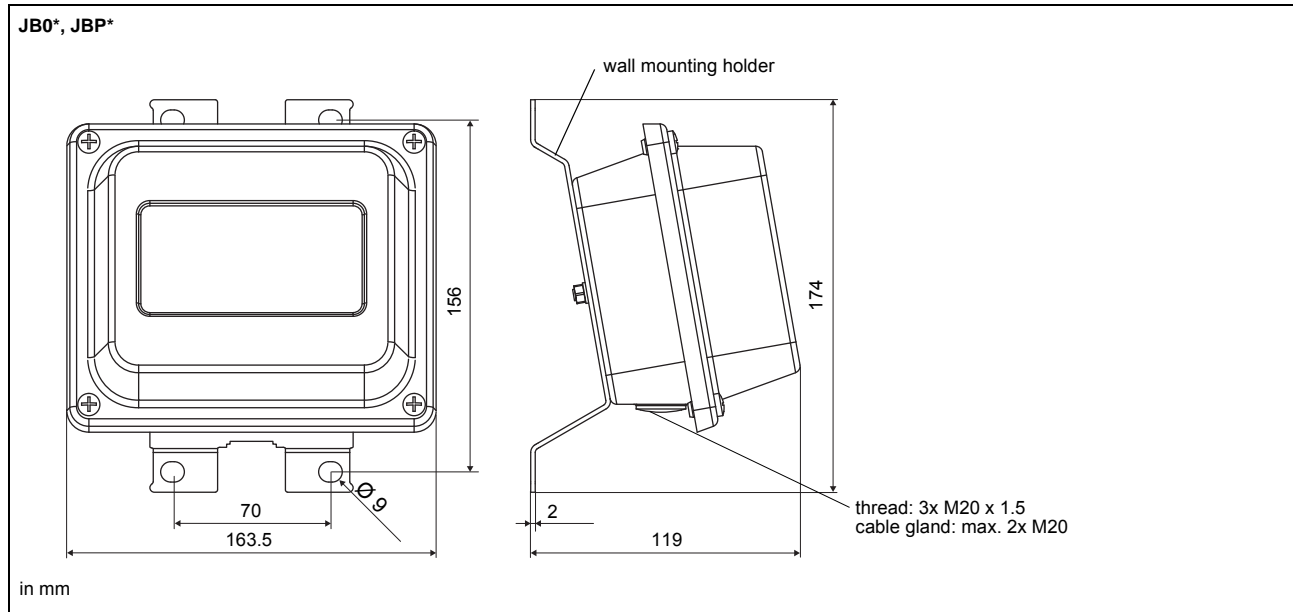
l - max. length of extension cable (depending on application)

Junction box

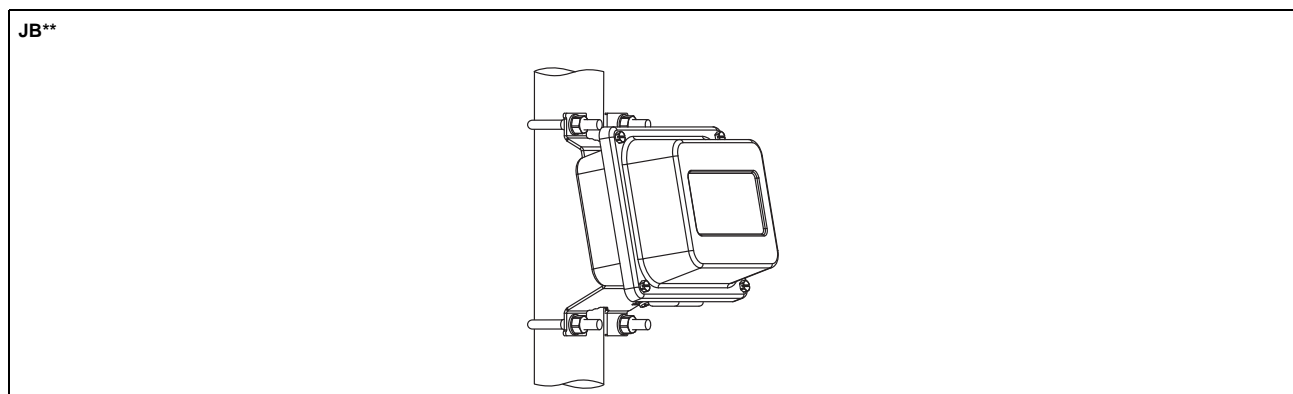
Technical data

JB01S4E3M, JBP2, JBP3			
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 (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	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			
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/Cl. I, II, III/Div. 2 / GP A, B, C, D, E, F, G/ T6 Ta = -40...+60 °C	
Connection			
Transducers			
terminal strip	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

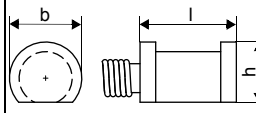
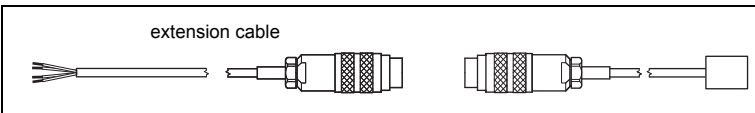
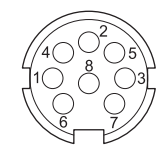
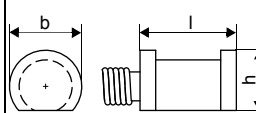

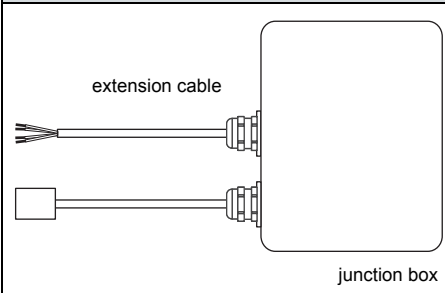
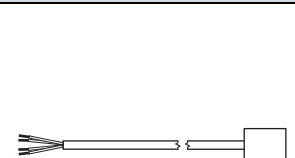


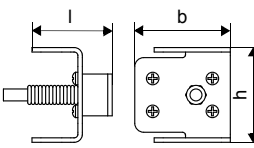
2" pipe mounting kit

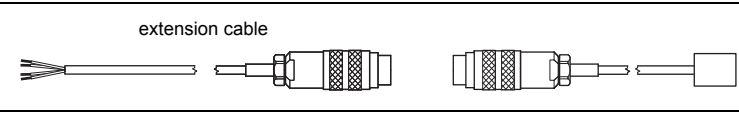
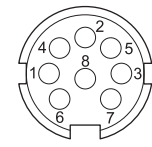


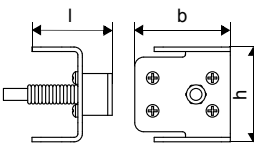
Clamp-on temperature probe (optional)

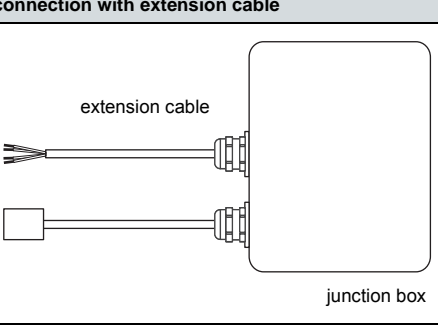
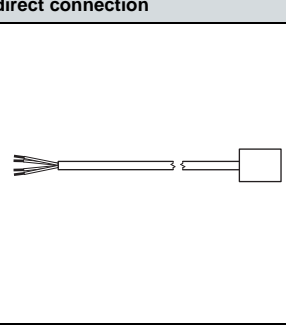
Technical data

PT12N			
design	clamp-on with connector		
type	Pt100		
connection	4-wire		
measuring range	°C -30...+250		
accuracy T	±(0.15 °C + 2 · 10 ⁻³ · T [°C]) class A		
accuracy ΔT (2x Pt matched according to EN 1434-1)	≤ 0.1 K (3 K < ΔT < 6 K), more corresponding to EN 1434-1		
response time	s	50	
housing	aluminum		
degree of protection	IP66		
dimensions			
length l	mm	20	
width b	mm	15	
height h	mm	13	
dimensional drawing			
weight	kg	0.25 (without connector)	
accessories			
thermal conductivity paste 200 °C		x	
thermal conductivity foil 250 °C		x	
Connection system			
			
Connection			
	temperature probe	extension cable	connector
	red	grey	2
	red/blue	red	6
	white/blue	blue	1
	white	white	7
			
Cable			
	temperature probe	extension cable	
type	4 x 0.25 mm ² black	LIYCY 8 x 0.14 mm ² grey	
standard length	m 3	5/10/25	
max. length	m -	200	
cable jacket	PTFE	PVC	
PT12N			
design	clamp-on nonEx or ATEX		
type	Pt100		
connection	4-wire		
measuring range	°C -30...+250		
accuracy T	±(0.15 °C + 2 · 10 ⁻³ · T [°C]) class A		
accuracy ΔT (2x Pt matched according to EN 1434-1)	≤ 0.1 K (3 K < ΔT < 6 K), more corresponding to EN 1434-1		
response time	s	50	
housing	aluminum		
degree of protection	IP66		
dimensions			
length l	mm	20	
width b	mm	15	
height h	mm	13	
dimensional drawing			
weight	kg	0.25	
accessories			
thermal conductivity foil 250 °C		x	
explosion protection (optional)			
• ATEX			
marking	 II3G Ex nA IIC T6...T2 Gc Ta -30...+250 °C		
Connection system			
connection with extension cable		direct connection	
			
Connection			
	temperature probe		
	red		
	red/blue		
	white/blue		
	white		
Cable			
	temperature probe	extension cable	
type	4 x 0.25 mm ² black	LIYCY 8 x 0.14 mm ² grey	
standard length	m 3	5/10/25	
max. length	m -	200	
cable jacket	PTFE	PVC	

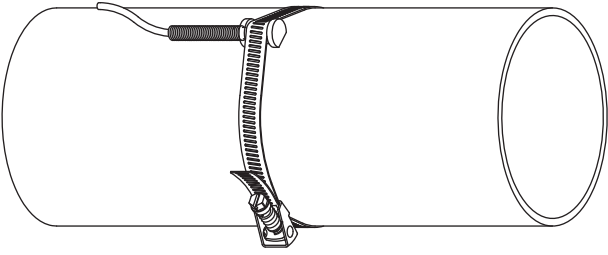
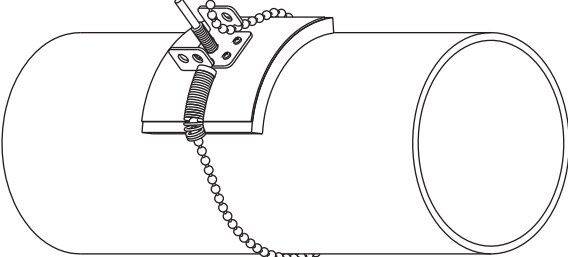
PT12F	
design	clamp-on short response time, with connector
type	Pt100
connection	4-wire
measuring range	°C -50...+250
accuracy T	$\pm(0.15 \text{ }^\circ\text{C} + 2 \cdot 10^{-3} \cdot T \text{ [}^\circ\text{C]})$ class A
accuracy ΔT (2x Pt matched according to EN 1434-1)	$\leq 0.1 \text{ K}$ ($3 \text{ K} < \Delta T < 6 \text{ K}$), more corresponding to EN 1434-1
response time	s 8
housing	PEEK, stainless steel 304 (1.4301), copper
degree of protection	IP66
dimensions	
length l	mm 14
width b	mm 30
height h	mm 27
dimensional drawing	
weight	kg 0.32 (without connector)
accessories	
thermal conductivity paste 200 °C	x
thermal conductivity foil 250 °C	x
plastic protection plate, insulation foam	x

Connection system																
																
Connection																
	<table border="1"> <thead> <tr> <th>temperature probe</th> <th>extension cable</th> <th>connector</th> </tr> </thead> <tbody> <tr> <td>red</td> <td>grey</td> <td>2</td> </tr> <tr> <td>red/blue</td> <td>red</td> <td>6</td> </tr> <tr> <td>white/blue</td> <td>blue</td> <td>1</td> </tr> <tr> <td>white</td> <td>white</td> <td>7</td> </tr> </tbody> </table> 	temperature probe	extension cable	connector	red	grey	2	red/blue	red	6	white/blue	blue	1	white	white	7
temperature probe	extension cable	connector														
red	grey	2														
red/blue	red	6														
white/blue	blue	1														
white	white	7														
Cable																
	<table border="1"> <thead> <tr> <th></th> <th>temperature probe</th> <th>extension cable</th> </tr> </thead> <tbody> <tr> <td>type</td> <td>4 x 0.25 mm² black</td> <td>LIYCY 8 x 0.14 mm² grey</td> </tr> <tr> <td>standard length</td> <td>m 3</td> <td>5/10/25</td> </tr> <tr> <td>max. length</td> <td>m -</td> <td>200</td> </tr> <tr> <td>cable jacket</td> <td>PTFE</td> <td>PVC</td> </tr> </tbody> </table>		temperature probe	extension cable	type	4 x 0.25 mm ² black	LIYCY 8 x 0.14 mm ² grey	standard length	m 3	5/10/25	max. length	m -	200	cable jacket	PTFE	PVC
	temperature probe	extension cable														
type	4 x 0.25 mm ² black	LIYCY 8 x 0.14 mm ² grey														
standard length	m 3	5/10/25														
max. length	m -	200														
cable jacket	PTFE	PVC														

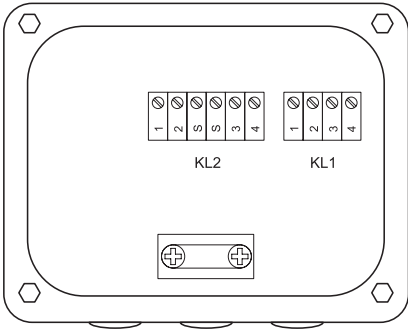
PT12F	
design	clamp-on short response time
type	Pt100
connection	4-wire
measuring range	°C -50...+250
accuracy T	$\pm(0.15 \text{ }^\circ\text{C} + 2 \cdot 10^{-3} \cdot T \text{ [}^\circ\text{C]})$ class A
accuracy ΔT (2x Pt matched according to EN 1434-1)	$\leq 0.1 \text{ K}$ ($3 \text{ K} < \Delta T < 6 \text{ K}$), more corresponding to EN 1434
response time	s 8
housing	PEEK, stainless steel 304 (1.4301), copper
degree of protection	IP66
dimensions	
length l	mm 14
width b	mm 30
height h	mm 27
dimensional drawing	
weight	kg 0.32
accessories	
thermal conductivity paste 200 °C	x
thermal conductivity foil 250 °C	x
plastic protection plate, insulation foam	x

Connection system																
connection with extension cable	direct connection															
																
Connection																
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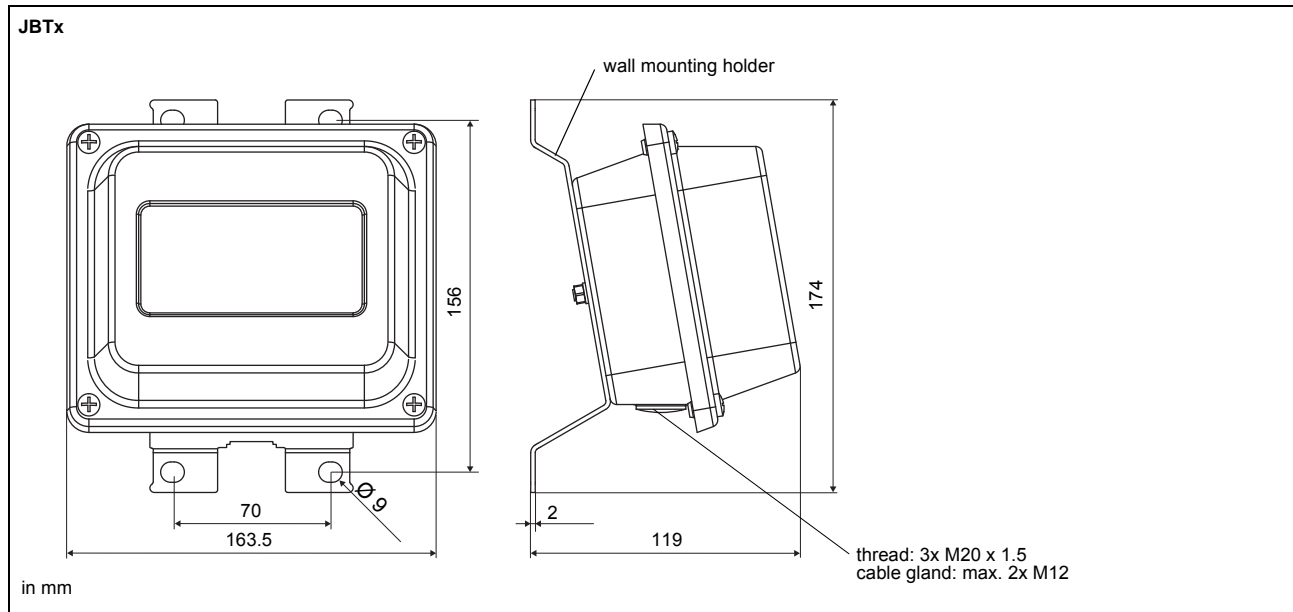
Fixation

<p>tension strap PT12N</p> 	<p>material: stainless steel 301 (1.4310), 410 (1.4006)</p>
<p>ball chain PT12F</p> 	<p>material: stainless steel 316L (1.4404) length: 1 m</p>

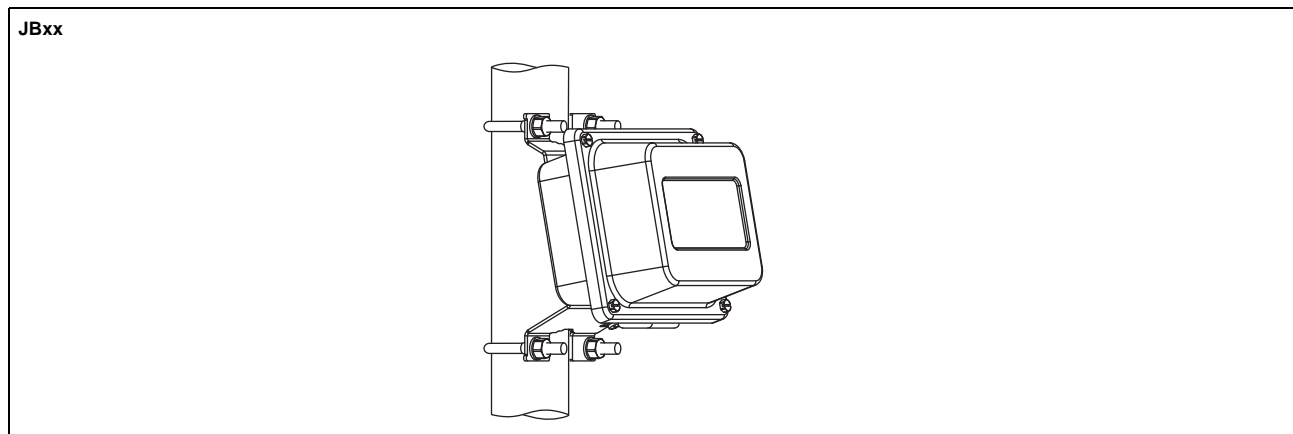
Junction box

<p>JBT2, JBT3</p>		<p>connection</p>
<p>weight</p>	<p>kg 1.2 kg</p>	
<p>fixation</p>	<p>wall mounting optional: 2" pipe mounting</p>	
<p>material</p>		
<p>housing</p>	<p>stainless steel 316L (1.4404)</p>	
<p>gasket</p>	<p>silicone</p>	
<p>degree of protection</p>	<p>IP67</p>	
<p>ambient temperature</p>		
<p>min.</p>	<p>°C -40</p>	
<p>max.</p>	<p>°C +80</p>	
<p>explosion protection</p>		
<p>• ATEX</p>		
<p>junction box</p>	<p>JBT2</p>	
<p>marking</p>	<p>CE Ex II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc III C T 100 °C Dc Ta -40...(70)80 °C</p>	
<p>temperature probe</p>		<p>terminal strip</p>
<p>KL1</p>	<p>1</p>	<p>red</p>
	<p>2</p>	<p>red/blue</p>
	<p>3</p>	<p>white</p>
	<p>4</p>	<p>white/blue</p>
<p>extension cable</p>		<p>terminal strip</p>
<p>KL2</p>	<p>1</p>	<p>red</p>
	<p>2</p>	<p>grey</p>
	<p>3</p>	<p>white</p>
	<p>4</p>	<p>blue</p>

Dimensions



2" pipe mounting kit



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