

## Permanently installed ultrasonic flowmeter for liquids

Transmitter for permanent outdoor wall or pipe mounting

### Features

- Exact and highly reliable bidirectional clamp-on volume and mass flow measurement
- Installation and start-up do not require any pipe work nor any process interruptions
- High measurement accuracy even at very low as well as very high flow rates and independent of the flow direction (bidirectional)
- Possibility to measure thermal energy quantities when using clamp-on or inline temperature probes
- Automatic loading of calibration data and transducer recognition
- Bidirectional communication and support of common bus technologies (Profibus PA, Foundation Fieldbus, HART, Modbus, BACnet, M-Bus)
- Advanced self-diagnosis and possibilities for event-based triggering of data recording for the supervision and control of critical processes
- Transmitter and transducers for use in hazardous areas are available
- Transmitter and transducers are separately calibrated (traceable to national standards)
- Transducers available for a wide range of inner pipe diameters and fluid temperatures -200...+600 °C
- The measurement is zero point stable, drift free and independent of pipe material, process pressure, process temperature and process fluid

### Applications

- Chemical industry
- Petrochemical industry
- Oil and gas industry
- Pharmaceutical industry
- Semiconductor industry
- Manufacturing industries
- Building technology/energy management
- Water and wastewater industry
- Mining industries



FLUXUS F721\*\*\_\*\*\*\*A



FLUXUS F721\*\*\_\*\*\*\*S



Variofix C

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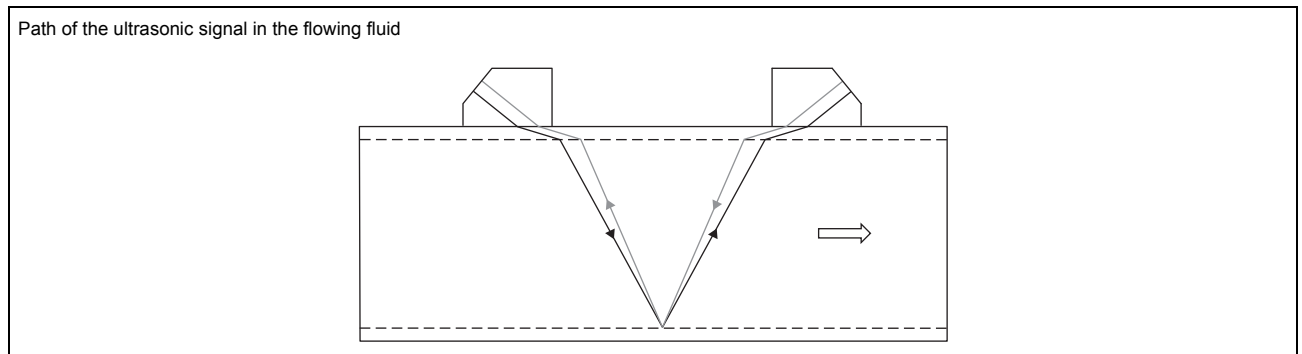
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## Function

### Measurement principle

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

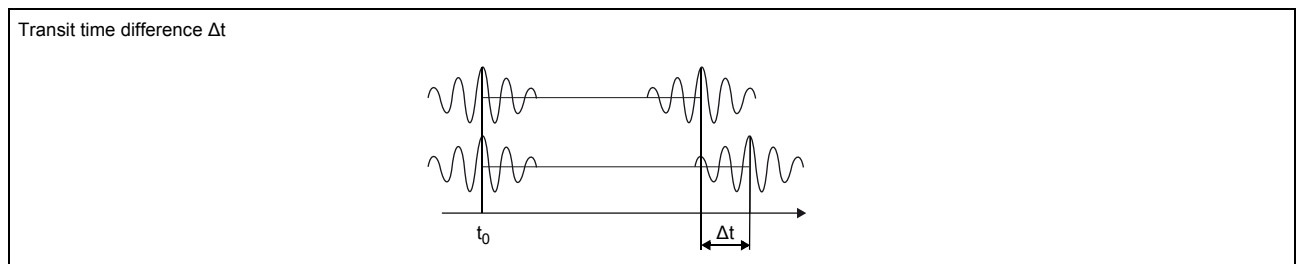


### Transit time difference principle

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  $\Delta t$  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
- $\Delta t$  - 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**

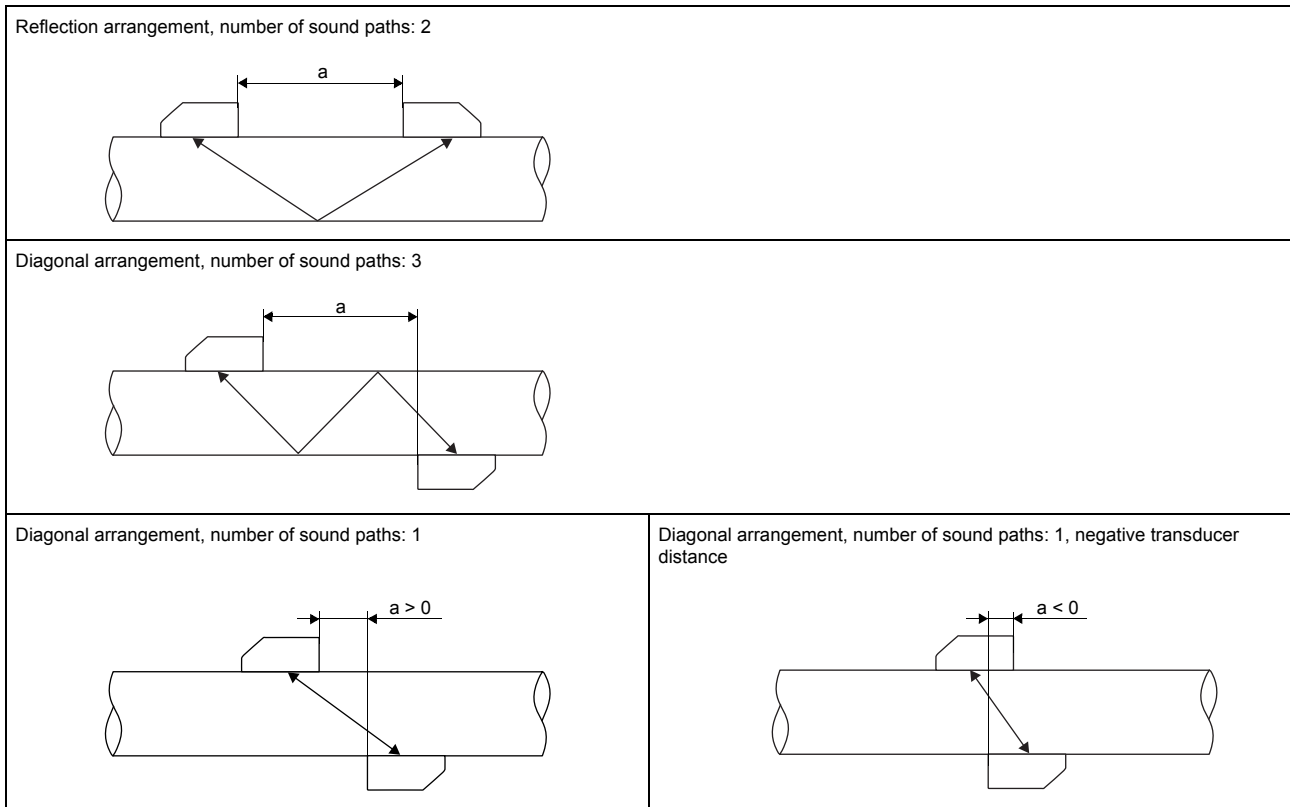
The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easier.

- **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.



a - transducer distance

# Transmitter

## Technical data

	FLUXUS F721**-NN0*A	FLUXUS F721**-NN0*S	FLUXUS F721**-A20*S	FLUXUS F721**-F20*S
				
design	standard field device nonEx	field device with stainless steel housing nonEx	field device with stainless steel housing zone 2	field device with stainless steel housing FM Class I Div. 2
measurement principle	transit time difference correlation principle, 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			
<b>measurement uncertainty (volumetric flow rate)</b>				
measurement uncertainty of measuring system <sup>1</sup>	±0.3 % of reading ±0.005 m/s			
measurement uncertainty at the measuring point <sup>2</sup>	±1 % of reading ±0.005 m/s			
<b>transmitter</b>				
power supply	<ul style="list-style-type: none"> <li>• 100...230 V/50...60 Hz or</li> <li>• 20...32 V DC or</li> <li>• 11...16 V DC</li> </ul>			
power consumption	W < 15			
number of measuring channels	1, optional: 2			
damping	s 0...100 (adjustable)			
measuring cycle	Hz 100...1000 (1 channel)			
response time	s 1 (1 channel), option: 0.02			
housing material	aluminum, powder coated	stainless steel 316L (1.4404)		
degree of protection	IP66	IP66	IP66	IP65
dimensions	mm see dimensional drawing			
weight	kg 5.4	5.1		
fixation	wall mounting, optional: 2" pipe mounting			
ambient temperature	°C -40...+60 (< -20 °C without operation of the display)	-40...+60 (< -20 °C without operation of the display)	-40...+60 (< -20 °C without operation of the display)	-20...+55/60
display	128 x 64 dots, backlight			
menu language	English, German, French, Spanish, Dutch, Russian, Polish, Turkish			
<b>explosion protection</b>				
<b>• ATEX/IECEx</b>				
marking	-	-	CE 0637 Ex II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 °C Db T <sub>a</sub> -40...+60 °C	-
certification ATEX	-	-	IBExU11ATEX1015	-
certification IECEx	-	-	IECEx IBE 11.0008	-
<b>• FM</b>				
marking	-	-	-	F703Z2**1, F703Z2**2:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T5 Ta = 60 °C  F703Z2**9:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T4A Ta = 55 °C

<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> outside of explosive atmosphere (housing cover open)

<sup>4</sup> with inputs and including parametrization of the transmitter

	FLUXUS F721**-NN0*A	FLUXUS F721**-NN0*S	FLUXUS F721**-A20*S	FLUXUS F721**-F20*S
<b>measuring functions</b>				
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 (2 measuring channels necessary)			
diagnostic functions	sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times			
<b>communication interfaces</b>				
service interfaces	measured value transmission, parametrization of the transmitter: • USB <sup>3</sup> • LAN <sup>3</sup>			
process interfaces	max. 1 option: • RS485 (ASCII sender) • Modbus RTU <sup>4</sup> • BACnet MS/TP • M-Bus • HART <sup>4</sup> • Profibus PA <sup>4</sup> • FF H1 <sup>4</sup> • Modbus TCP <sup>4</sup> • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU <sup>4</sup> • BACnet MS/TP • M-Bus • HART <sup>4</sup> • Profibus PA <sup>4</sup> • FF H1 <sup>4</sup> • Modbus TCP <sup>4</sup> • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU <sup>4</sup> • BACnet MS/TP • HART <sup>4</sup> • Profibus PA <sup>4</sup> • FF H1 <sup>4</sup> • Modbus TCP <sup>4</sup> • BACnet IP	
<b>accessories</b>				
serial data kit	USB cable			
software	• FluxDiagReader: download of measured values and parameters, graphical presentation • FluxDiag (optional): download of measurement data, graphical presentation, report generation, parametrization of the transmitter			
<b>data logger</b>				
loggable values	all physical quantities, totalized values and diagnostic values			
capacity	max. 800 000 measured values			
<b>outputs</b>				
	The outputs are galvanically isolated from the transmitter.			
number	on request			
<b>• switchable current output</b>				
	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)		
<b>• HART</b>				
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)		
<b>• voltage output</b>				
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		$R_{int} = 500 \Omega$		
<b>• frequency output</b>				
range	kHz	0...5		
optorelay		24 V/4 mA, $R_{int} = 66.5 \Omega$		
<b>• binary output</b>				
optorelay		26 V/100 mA		
Reed relay		48 V/100 mA, $R_{int} = 22 \Omega$		
binary output as alarm output				
• functions		limit, change of flow direction or error		
binary output as pulse output				
• functions		mainly for totalizing		
• pulse value	units	0.01...1000		
• pulse width	ms	optorelay: 1...1000 Reed relay: 80...1000		

<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> outside of explosive atmosphere (housing cover open)

<sup>4</sup> with inputs and including parametrization of the transmitter

	FLUXUS F721**-NN0*A	FLUXUS F721**-NN0*S	FLUXUS F721**-A20*S	FLUXUS F721**-F20*S
<b>inputs</b>				
	The inputs are galvanically isolated from the transmitter.			
number	max. 4, on request			
<b>• temperature input</b>				
type	Pt100/Pt1000			
connection	4-wire			
range	°C	-150...+560		
resolution	K	0.01		
accuracy	±0.01 % of reading ±0.03 K			
<b>• current input</b>				
accuracy	0.1 % of reading ±10 µA			
active input	U <sub>int</sub> = 24 V, R <sub>int</sub> = 50 Ω, P <sub>int</sub> < 0.5 W, not short-circuit proof			
• range	mA	0...20		
passive input	R <sub>int</sub> = 50 Ω, P <sub>int</sub> < 0.3 W			
• range	mA	-20...+20		
<b>• voltage input</b>				
range	V	0...1		
accuracy	0.1 % of reading ±1 mV			
internal resistance	R <sub>int</sub> = 1 MΩ			
<b>• binary input</b>				
switching signal	5...30 V, 1 mA			5...26 V, 1 mA
functions	<ul style="list-style-type: none"> <li>• resetting the measured values</li> <li>• resetting the totalizers</li> <li>• stopping the totalizers</li> <li>• activation of the measuring mode for highly dynamic flows</li> </ul>			

<sup>1</sup> with aperture calibration of the transducers

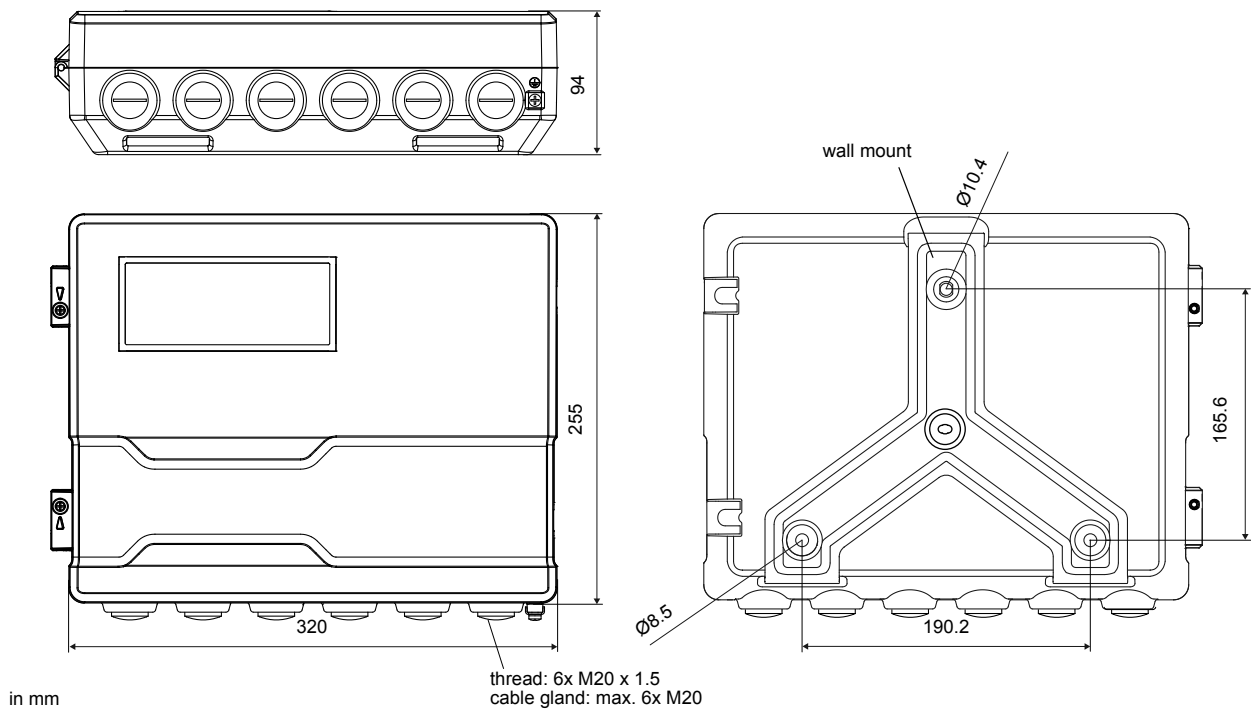
<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> outside of explosive atmosphere (housing cover open)

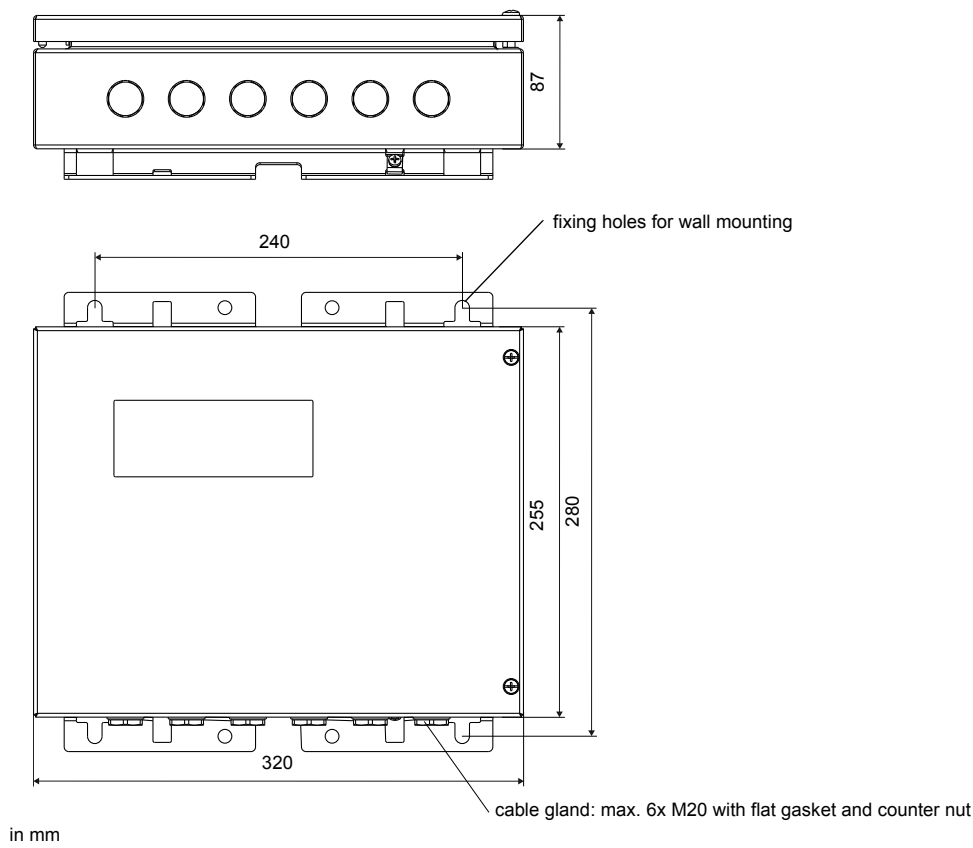
<sup>4</sup> with inputs and including parametrization of the transmitter

### Dimensions

\*721\*\*\_\*\*\*\*A

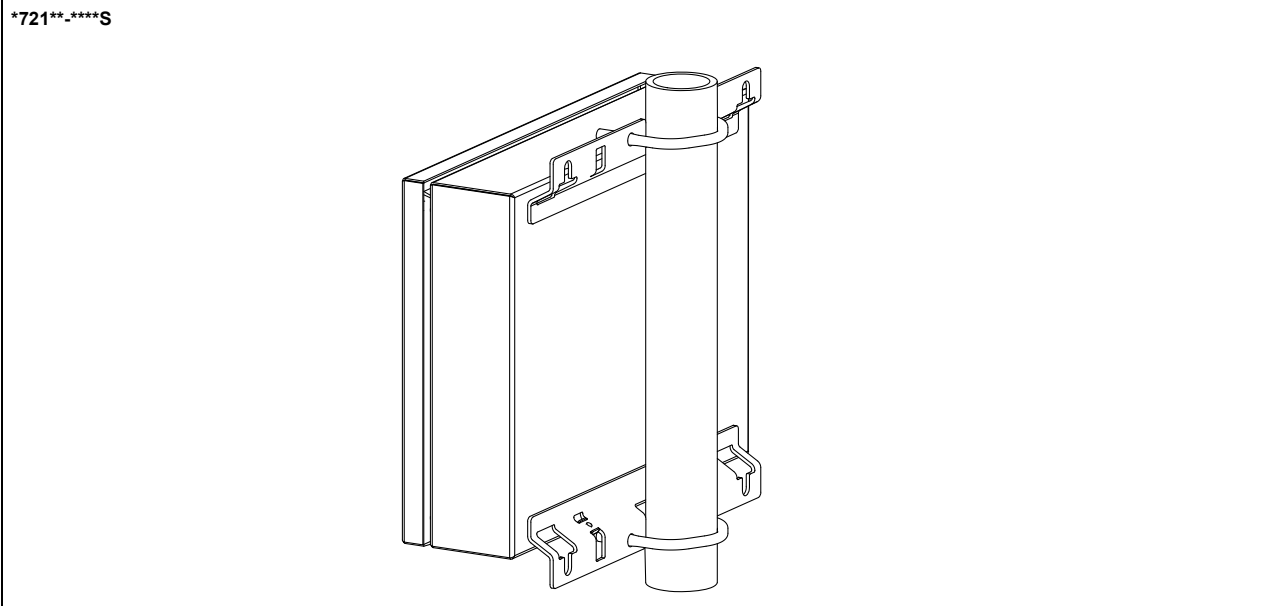
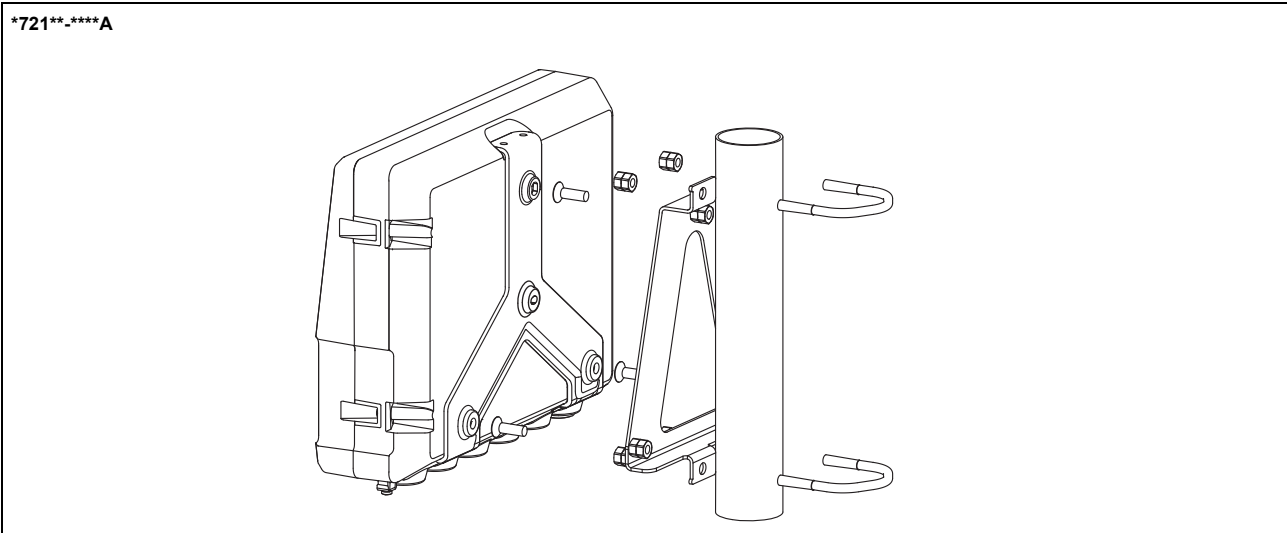


\*721\*\*\_\*\*\*\*S

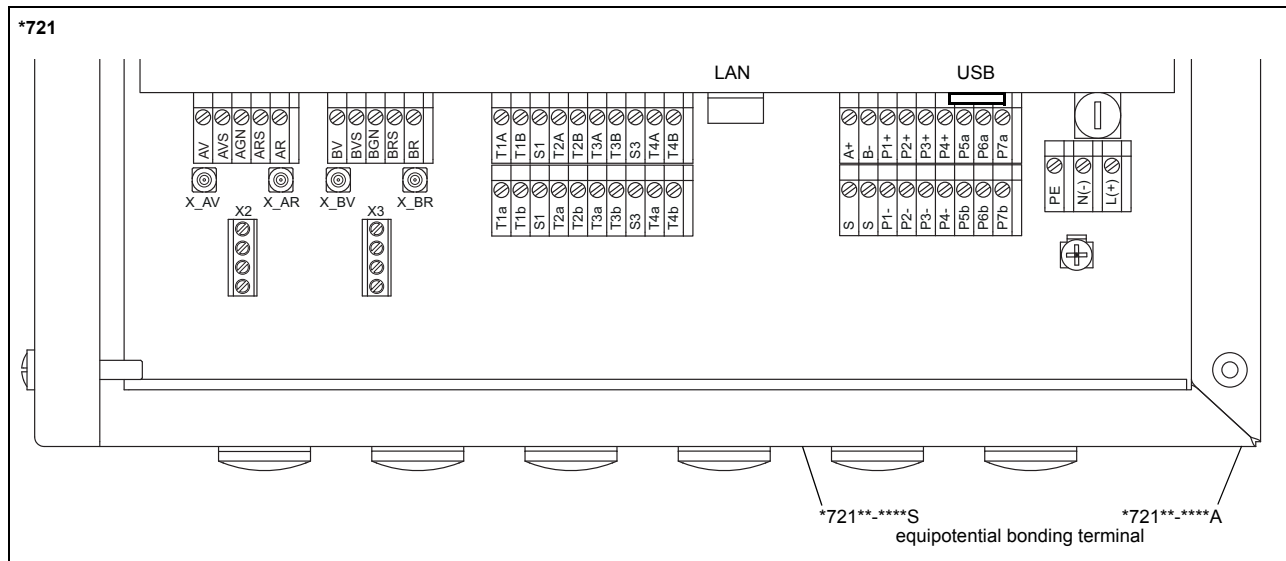




### 2" pipe mounting kit



### Terminal assignment



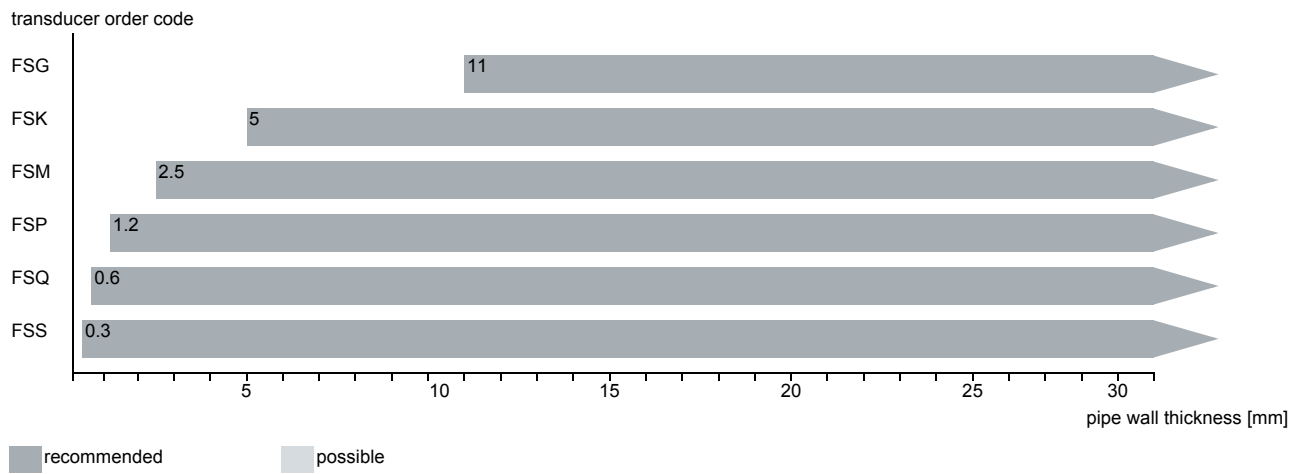
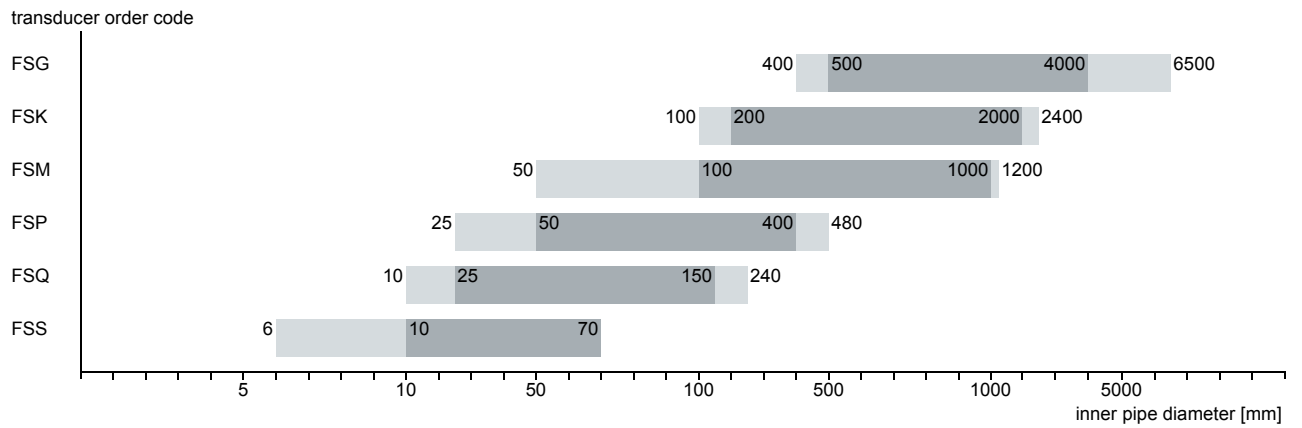
power supply <sup>1</sup>							
terminal		connection (AC)			connection (DC)		
PE		earth			earth		
N(-)		neutral			-		
L(+)		phase			+		
transducers							
transducer cable (transducers ****8*, ****L*), extension cable				transducer cable (transducers ****52)			
measuring channel A		measuring channel B			measuring channel A	measuring channel B	
terminal	connection	terminal	connection	transducer	terminal	terminal	connection
AV	signal	BV	signal	↑	X_AV	X_BV	SMB connector
AVS	shield	BVS	shield				
ARS	shield	BRS	shield	⌋	X_AR	X_BR	SMB connector
AR	signal	BR	signal				
outputs <sup>1, 2</sup>							
terminal	connection	terminal	connection	communication interface			
P1+...P4+ P1-...P4-	current output, voltage output, frequency output, binary output (Reed relay), HART (P1)	A+	signal +	<ul style="list-style-type: none"> <li>• RS485<sup>1</sup></li> <li>• Modbus RTU<sup>1</sup></li> <li>• BACnet MS/TP<sup>1</sup></li> <li>• M-Bus<sup>1</sup></li> <li>• Profibus PA<sup>1</sup></li> <li>• FF H1<sup>1</sup></li> </ul>			
		B-	signal -				
P5a...P7a P5b...P7b	binary output (optorelay)	S	shield				
		USB	type B	<ul style="list-style-type: none"> <li>• service (FluxDiag/FluxDiagReader)</li> <li>• service (FluxDiag/FluxDiagReader)</li> <li>• BACnet IP</li> <li>• Modbus TCP</li> </ul>			
		LAN	RJ45				
analog inputs <sup>1, 2</sup>							
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 <sup>1, 2</sup>							
terminal							
P1+...P2+, P1-...P2-							

<sup>1</sup> cable (by customer):  
 - e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.25...2.5 mm<sup>2</sup>  
 - outer diameter of the cable (\*721\*\*-\*\*\*\*S with ferrite nut): max. 7.6 mm

<sup>2</sup> The number, type and terminal assignment will be customized.

# Transducers

## Transducer selection



### Transducer order code

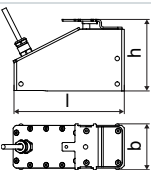
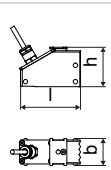

1, 2	3	4	5, 6	7, 8	9...11	no. of character				
transducer	transducer frequency	-	ambient temperature	explosion protection	connection system	-	extension cable	/	option	description
FS										set of ultrasonic flow transducers for liquids measurement, shear wave
	G									0.2 MHz
	K									0.5 MHz
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

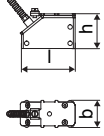
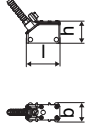

order code		FSG-N**TS/**	FSK-N**TS/**	FSM-N**TS/**	FSP-N**TS/**	FSQ-N**TS/**	FSS-N**TS/**	
technical type		C(DL)G1N52	C(DL)K1N52	C(DL)M2N52	C(DL)P2N52	C(DL)Q2N52	CDS1N52	
transducer frequency	MHz	0.2	0.5	1	2	4	8	
<b>inner pipe diameter d</b>								
min. extended	mm	400	100	50	25	10	6	
min. recommended	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	
<b>pipe wall thickness</b>								
min.	mm	11	5	2.5	1.2	0.6	0.3	
<b>material</b>								
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	
<b>transducer cable</b>								
type		1699						
length	m	5		4		3		
length (***_*****/LC)	m	9						
<b>dimensions</b>								
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	
<b>pipe surface temperature</b>								
min.	°C	-40					-30	
max.	°C	+130					+130	
<b>ambient temperature</b>								
min.	°C	-40					-30	
max.	°C	+130					+130	
temperature compensation		x						
<b>explosion protection</b>								
<b>• ATEX/IECEx</b>								
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  II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db						
certification ATEX		IBExU10ATEX1163 X						
certification IECEx		IECEx IBE 12.0005X						
<b>• FM</b>								
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
<b>inner pipe diameter d</b>					
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
<b>pipe wall thickness</b>					
min.	mm	11	5	2.5	1.2
<b>material</b>					
housing		PEEK with stainless steel cap 316Ti (1.4571)			
contact surface		PEEK			
degree of protection		IP68 <sup>1</sup>			
<b>transducer cable</b>					
type		2550			
length	m	12			
<b>dimensions</b>					
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	
<b>pipe surface temperature</b>					
min.	°C	-40			
max.	°C	+100			
<b>ambient temperature</b>					
min.	°C	-40			
max.	°C	+100			
temperature compensation		x			
<b>explosion protection</b>					
<b>• ATEX/IECEX</b>					
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  I13G I12D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db			
certification ATEX		IBExU10ATEX1163 X			
certification IECEX		IECEX IBE 12.0005X			

<sup>1</sup> 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
<b>inner pipe diameter d</b>				
min. extended	mm	50	25	10
min. recommended	mm	100	50	25
max. recommended	mm	1000	400	150
max. extended	mm	1200	480	240
<b>pipe wall thickness</b>				
min.	mm	2.5	1.2	0.6
<b>material</b>				
housing		PI with stainless steel cap 304 (1.4301), ***-****/OS: 316L (1.4404)		
contact surface		PI		
degree of protection		IP56		
<b>transducer cable</b>				
type		6111		
length	m	4		3
length (***-****/LC)	m	9		
<b>dimensions</b>				
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
<b>pipe surface temperature</b>				
min.	°C	-30		-30
max.	°C	+240 <sup>1</sup>		+200
<b>ambient temperature</b>				
min.	°C	-30		-30
max.	°C	+40 +60 <sup>2</sup> +200 <sup>3</sup>		+200
temperature compensation		x		
<b>explosion protection</b>				
<b>• ATEX/IECEx</b>				
order code		FSM-EA2TS/**	FSP-EA2TS/**	FSQ-EA2TS/**
pipe surface temperature (Ex)		• min. °C -45 • max. °C gas: +235 <sup>1</sup> , dust: +225 <sup>1</sup>		
marking		CE 0637 Ex II 3G II 2D Ex nA IIC T6...T2 Gc Ex tb IIIA TX Db		
certification ATEX		IBExU10ATEX1163 X		
certification IECEx		IECEx IBE 12.0005X		
<b>• FM</b>				
order code		FSM-EF2TS/**	FSP-EF2TS/**	FSQ-EF2TS/**
pipe surface temperature (Ex)		• min. °C -40 • max. °C +235 <sup>1</sup>		
degree of protection		IP66		
marking		 NI/CI. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860		

<sup>1</sup> > +200 °C:

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

<sup>2</sup> pipe surface temperature +200...+240 °C: Variofix C without cover

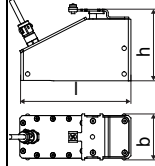
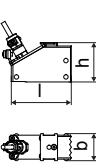
<sup>3</sup> pipe surface temperature max. +200 °C

**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
<b>inner pipe diameter d</b>					
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
<b>pipe wall thickness</b>					
min.	mm 11	5	2.5	1.2	0.6
<b>material</b>					
housing	PEEK with stainless steel cap 304 (1.4301), ***-****/OS: 316L (1.4404)				
contact surface	PEEK				
degree of protection	IP65	IP66			IP65
<b>transducer cable</b>					
type	1699				
length	m 5		4		3
length (**-****/LC)	m 9				
<b>dimensions</b>					
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
<b>pipe surface temperature</b>					
min.	°C -40				
max.	°C +130				
<b>ambient temperature</b>					
min.	°C -40				
max.	°C +130				
temperature compensation	x				
<b>explosion protection</b>					
<b>• ATEX/IECEX</b>					
order code	FSG-NA1TS/**	FSK-NA1TS/**	FSM-NA1TS/**	FSP-NA1TS/**	FSQ-NA1TS/**
pipe surface temperature (Ex)	°C -55 °C +180				
marking	CE 0637 Ex II2G Ex q IIC T6...T3 Gb Ex tb IIIC TX Db				
certification ATEX	IBExU07ATEX1168 X				
certification IECEx	IECEX IBE 08.0007X				

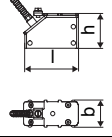
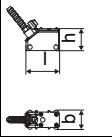



**Shear wave transducers (zone 1, TS, IP68)**

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
<b>inner pipe diameter d</b>					
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
<b>pipe wall thickness</b>					
min.	mm	11	5	2.5	1.2
<b>material</b>					
housing		PEEK with stainless steel cap 316Ti (1.4571)			
contact surface		PEEK			
degree of protection		IP68 <sup>1</sup>			
<b>transducer cable</b>					
type		2550			
length	m	12			
<b>dimensions</b>					
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	
<b>pipe surface temperature</b>					
min.	°C	-40			
max.	°C	+100			
<b>ambient temperature</b>					
min.	°C	-40			
max.	°C	+100			
temperature compensation		x			
<b>explosion protection</b>					
<b>• ATEX/IECEX</b>					
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 II 2G II 2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db			
certification ATEX		IBExU07ATEX1168 X			
certification IECEX		IECEX IBE 08.0007X			

<sup>1</sup> 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
<b>inner pipe diameter d</b>				
min. extended	mm	50	25	10
min. recommended	mm	100	50	25
max. recommended	mm	1000	400	150
max. extended	mm	1200	480	240
<b>pipe wall thickness</b>				
min.	mm	2.5	1.2	0.6
<b>material</b>				
housing		PI with stainless steel cap 304 (1.4301), ***-****/OS: 316L (1.4404)		
contact surface		PI		
degree of protection		IP66		IP56
<b>transducer cable</b>				
type		6111		
length	m	4		3
length (**-****/LC)	m	9		
<b>dimensions</b>				
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
<b>pipe surface temperature</b>				
min.	°C	-30		-30
max.	°C	+240 <sup>1</sup>		+200
<b>ambient temperature</b>				
min.	°C	-30		-30
max.	°C	+40 +200 <sup>2</sup>		+200
temperature compensation		x		
<b>explosion protection</b>				
• ATEX/IECEX				
order code		FSM-EA1TS/**	FSP-EA1TS/**	FSQ-EA1TS/**
pipe surface temperature (Ex)				
• min.	°C	-45		
• max.	°C	+225 <sup>1</sup>		
marking		CE 0637  II2G II2D Ex q IIC T6...T2 Gb Ex tb IIIA TX Db		
certification ATEX		IBExU07ATEX1168 X		
certification IECEx		IECEx IBE 08.0007X		

<sup>1</sup> > +200 °C:

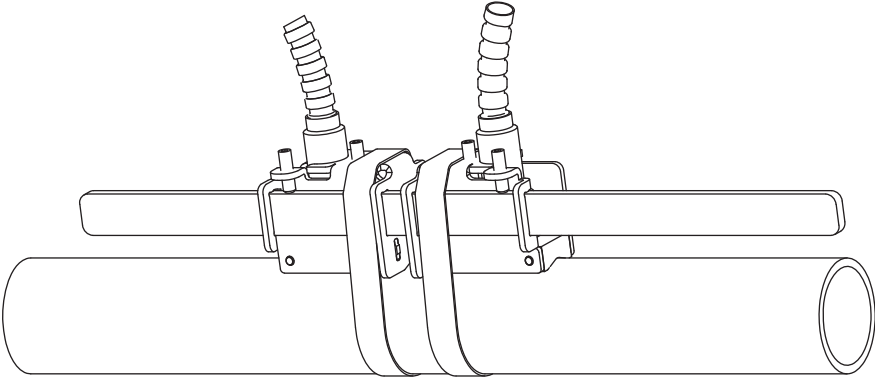
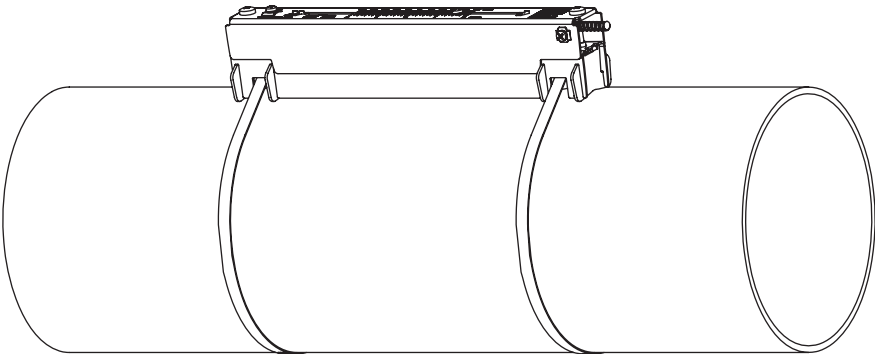
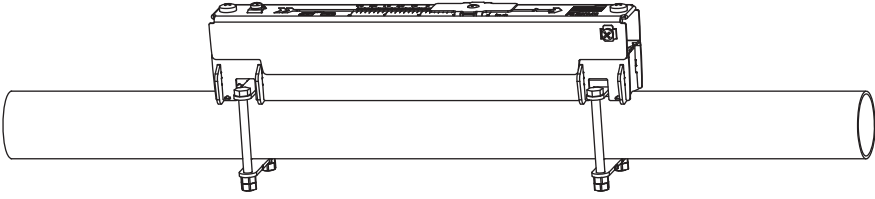
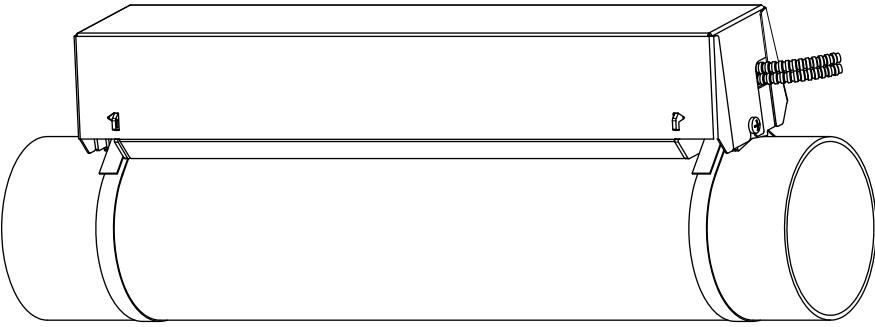
Variofix L or Variofix C  
observe the insulation instruction  
ambient temperature max. +40 °C

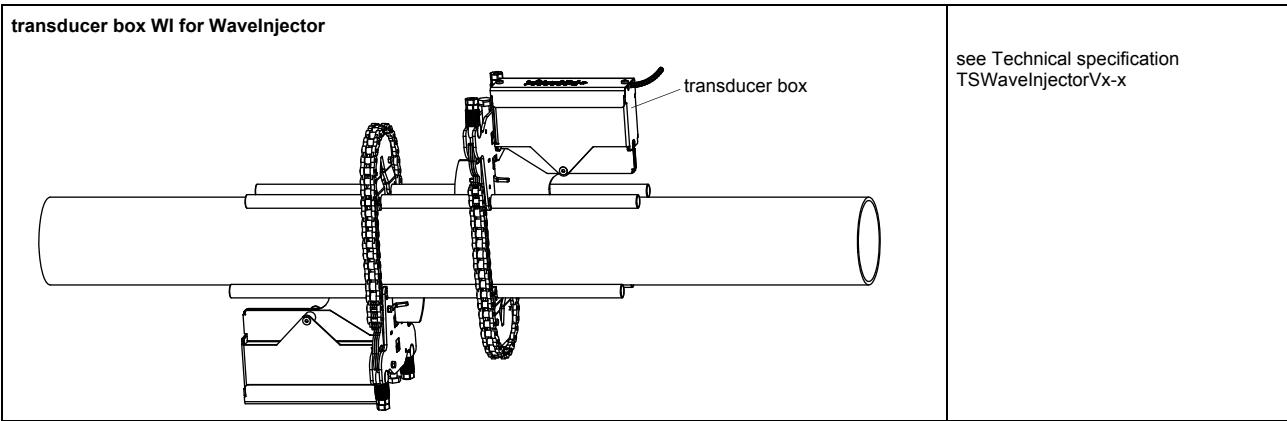
<sup>2</sup> pipe surface temperature max. +200 °C

# 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
VL						Variofix L
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
	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

<p><b>Variofix L (VLS)</b></p> 	<p>transducer frequency: S  material: stainless steel 304 (1.4301), 303 (1.4305)</p>
<p><b>Variofix L (VLK, VLM, VLQ)</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:  <b>VLK:</b> 348 mm,  option IP68: 368 mm  <b>VLM:</b> 234 mm  <b>VLQ:</b> 176 mm  dimensions:  <b>VLK:</b> 423 x 90 x 93 mm  option IP68: 443 x 94 x 105 mm  <b>VLM:</b> 309 x 57 x 63 mm  <b>VLQ:</b> 247 x 43 x 47 mm</p>
<p><b>Variofix L with bolt mounting plates (VL*-**-B)</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:  <b>VLM:</b> 234 mm  <b>VLQ:</b> 176 mm  dimensions:  <b>VLM:</b> 309 x 57 x 63 mm  <b>VLQ:</b> 247 x 43 x 47 mm  outer pipe diameter:  max. 48 mm</p>
<p><b>Variofix C (VC)</b></p> 	<p>material: stainless steel 304 (1.4301), 301 (1.4310)  option OS: 316Ti (1.4571)  inner length:  <b>VCK-*L:</b> 500 mm  <b>VCK-*S:</b> 350 mm  <b>VCM:</b> 400 mm  <b>VCQ:</b> 250 mm  dimensions:  <b>VCK-*L:</b> 560 x 122 x 102 mm,  option IP68: 560 x 126 x 120 mm  <b>VCK-*S:</b> 410 x 122 x 102 mm,  option IP68: 410 x 126 x 120 mm  <b>VCM:</b> 460 x 96 x 80 mm  <b>VCQ:</b> 310 x 85 x 62 mm</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 <sup>1</sup>	coupling foil type VT <sup>2</sup>	coupling foil type VT <sup>1</sup>	coupling foil type VT <sup>2</sup>	coupling foil type TF	coupling foil type A and coupling foil type VT	coupling foil type B and coupling foil type VT

<sup>1</sup> < 5 years

<sup>2</sup> < 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)

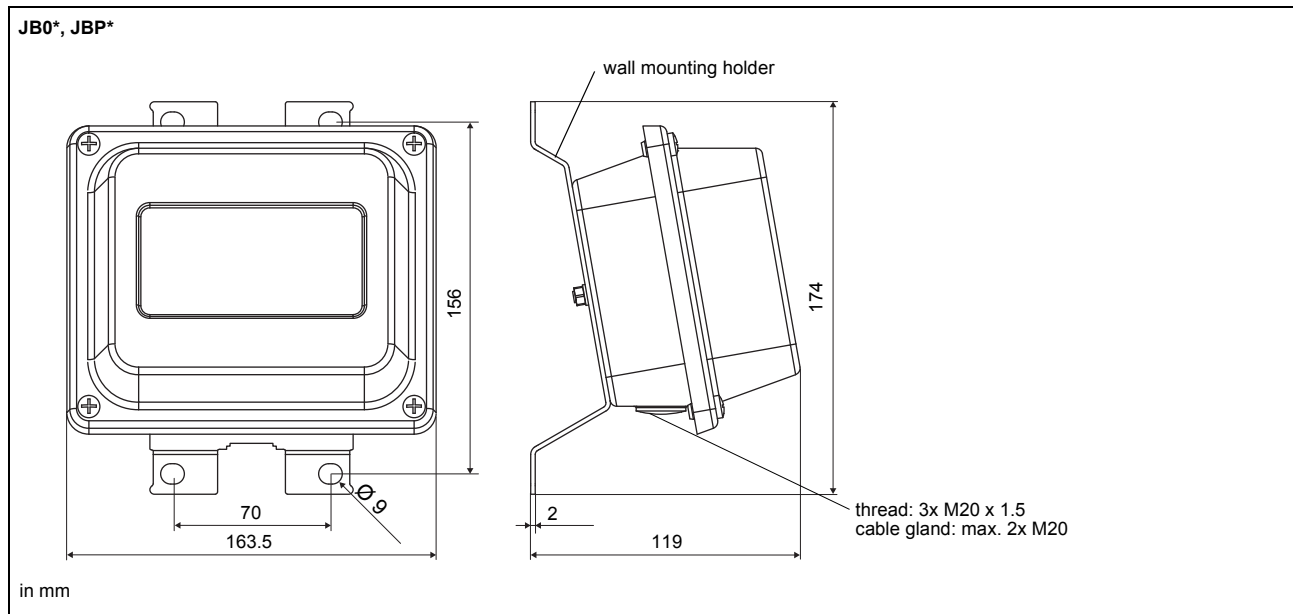


# Junction box

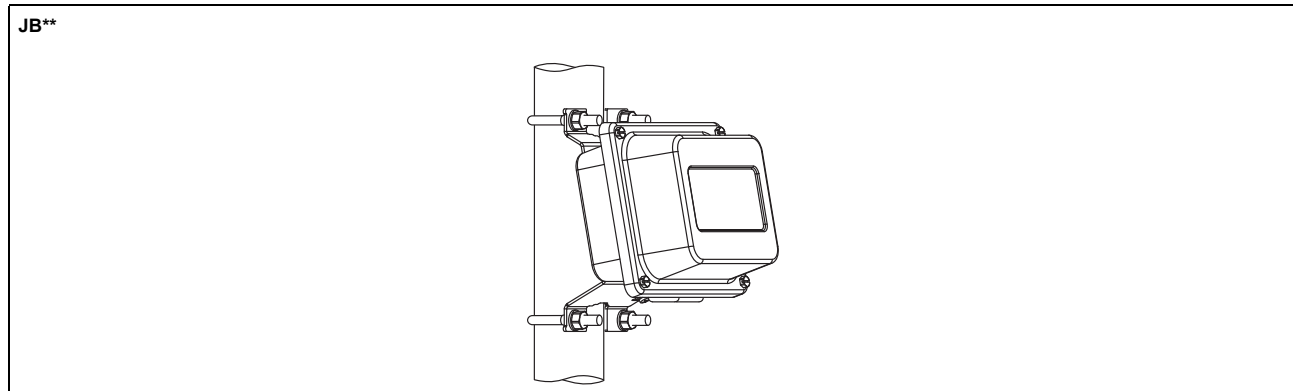
## Technical data

JB01S4E3M, JBP2, JBP3			
weight	kg	1.2 kg	
fixation		wall mounting optional: 2" pipe mounting	
<b>material</b>			
housing		stainless steel 316L (1.4404)	
gasket		silicone	
degree of protection		IP67	
<b>ambient temperature</b>			
min.	°C	-40	
max.	°C	+80	
<b>explosion protection</b>			
• 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	
<b>connection</b>			
<b>transducers</b>			
terminal strip	terminal	connection	transducer
KL1	V	signal	↑
	VS	internal shield	
	RS	internal shield	↕
	R	signal	
<b>extension cable</b>			
terminal strip	terminal	connection	
KL2	TV	signal	
	TVS	internal shield	
	TRS	internal shield	
	TR	signal	
<b>JB02, JB03, JB04</b>			
weight	kg	1.2 kg	
fixation		wall mounting optional: 2" pipe mounting	
<b>material</b>			
housing		stainless steel 316L (1.4404)	
gasket		silicone	
degree of protection		IP67	
<b>ambient temperature</b>			
min.	°C	-40	
max.	°C	+80	
<b>explosion protection</b>			
• 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	
<b>connection</b>			
<b>transducers</b>			
	terminal	connection	transducer
	XV	SMB connector	↑
	XR	SMB connector	
<b>extension cable</b>			
terminal strip	terminal	connection	
KL2	TV	signal	
	TVS	internal shield	
	TRS	internal shield	
	TR	signal	

### Dimensions

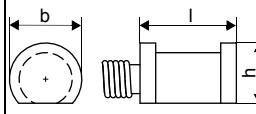
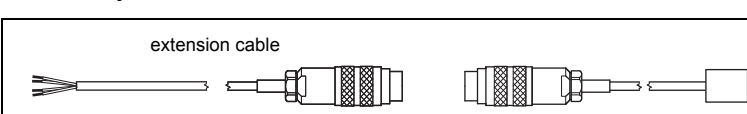
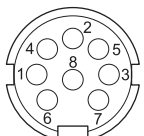
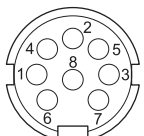
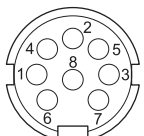
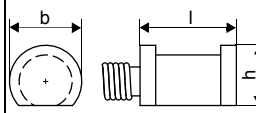

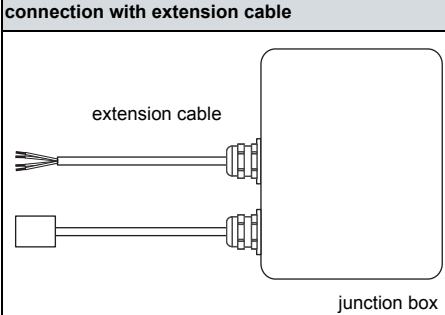
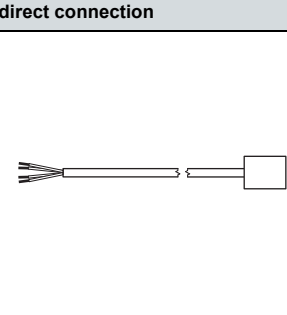
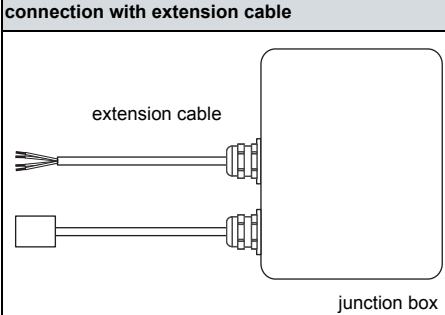
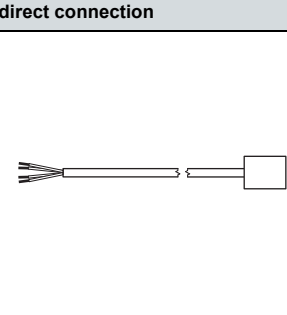
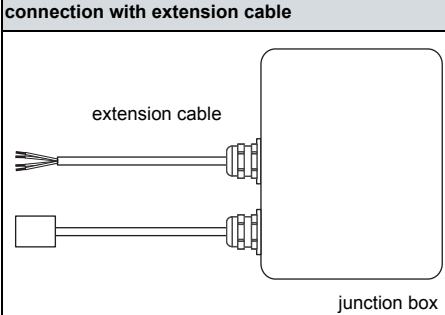
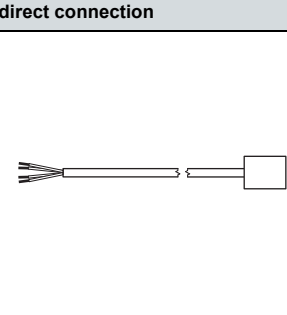


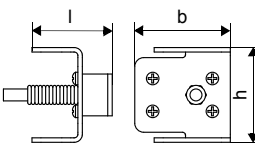
### 2" pipe mounting kit



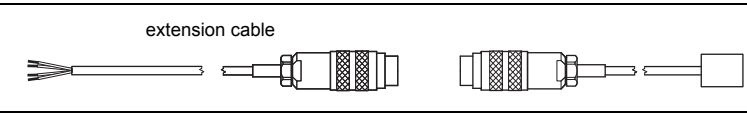
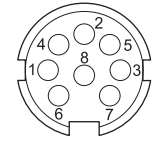
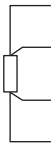
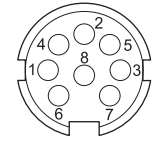
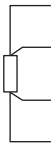
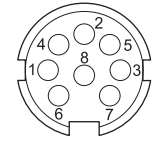
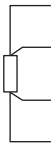
## Clamp-on temperature probe (optional)

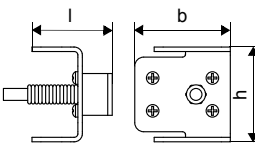
### Technical data

PT12N																				
design	clamp-on with connector																			
type	Pt100																			
connection	4-wire																			
measuring range	°C -30...+250																			
accuracy T	$\pm(0.15\text{ °C} + 2 \cdot 10^{-3} \cdot  T\text{ [°C]} )$ class A																			
accuracy $\Delta T$ (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 50																			
housing	aluminum																			
degree of protection	IP66																			
<b>dimensions</b>																				
length l	mm 20																			
width b	mm 15																			
height h	mm 13																			
dimensional drawing																				
weight	kg 0.25 (without connector)																			
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connection	4-wire																			
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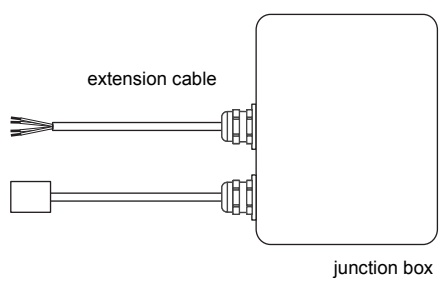
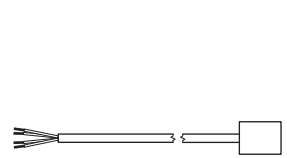
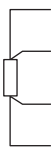
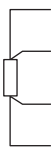
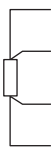
PT12F	
design	clamp-on short response time, with connector
type	Pt100
connection	4-wire
measuring range	-50...+250
accuracy T	$\pm(0.15\text{ }^\circ\text{C} + 2 \cdot 10^{-3} \cdot  T\text{ [}^\circ\text{C]} )$ class A
accuracy $\Delta T$ (2x Pt matched according to EN 1434-1)	$\leq 0.1\text{ K}$ ( $3\text{ K} < \Delta T < 6\text{ K}$ ), more corresponding to EN 1434-1
response time	s 8
housing	PEEK, stainless steel 304 (1.4301), copper
degree of protection	IP66
<b>dimensions</b>	
length l	mm 14
width b	mm 30
height h	mm 27
dimensional drawing	
weight	kg 0.32 (without connector)
<b>accessories</b>	
thermal conductivity paste 200 °C	x
thermal conductivity foil 250 °C	x
plastic protection plate, insulation foam	x

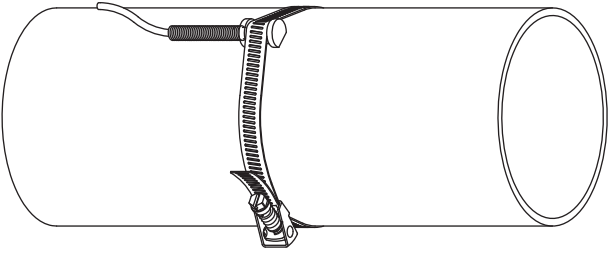
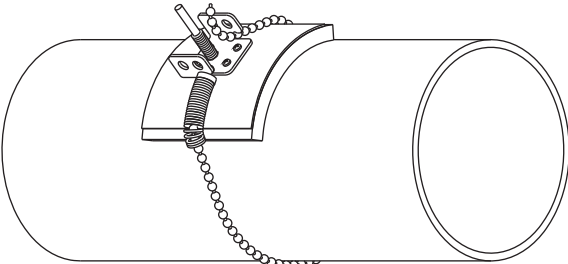
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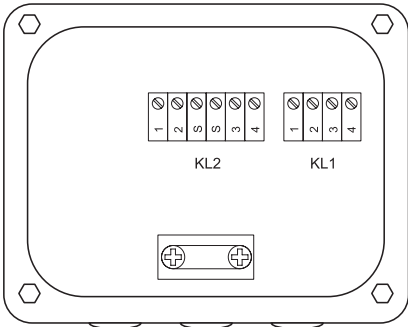

  

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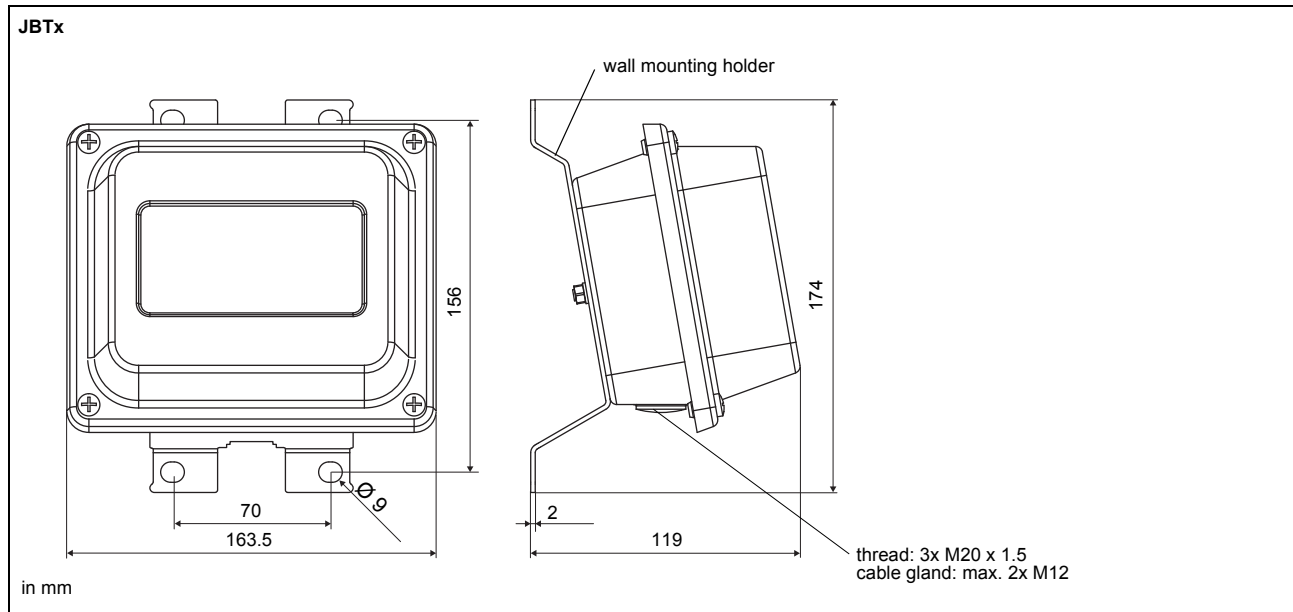
### Fixation

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

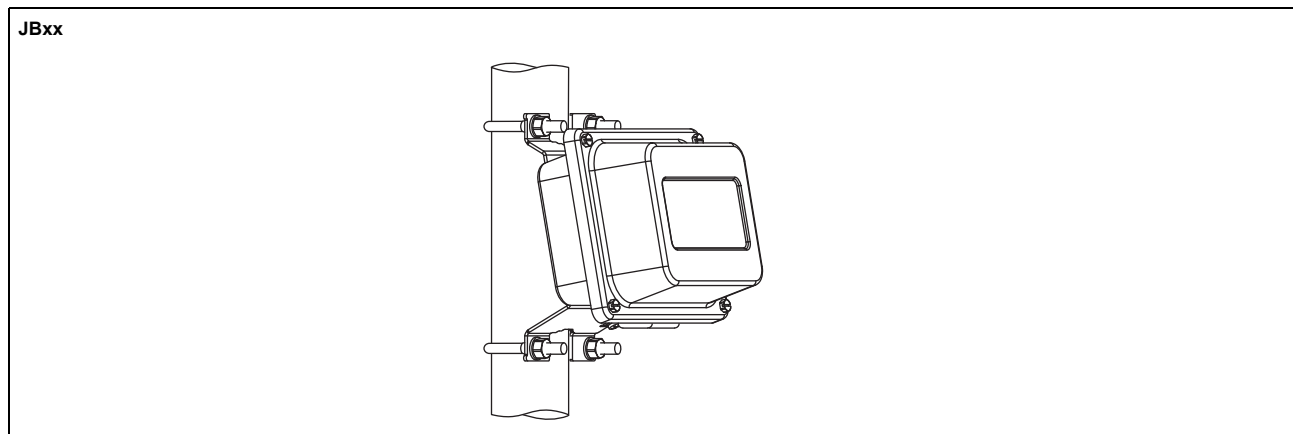
### Junction box

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

### Dimensions



### 2" pipe mounting kit



FLEXIM GmbH  
Boxberger Str. 4  
12681 Berlin  
Germany  
Tel.: +49 (30) 93 66 76 60  
Fax: +49 (30) 93 66 76 80  
internet: [www.flexim.com](http://www.flexim.com)  
e-mail: [info@flexim.com](mailto:info@flexim.com)

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