FLEXIM

Technical specification

PIOX S721

Process analysis and flow measurement with ultrasound

Non-invasive clamp-on ultrasonic measuring system for continuous monitoring of concentration, density or other process-relevant fluid properties

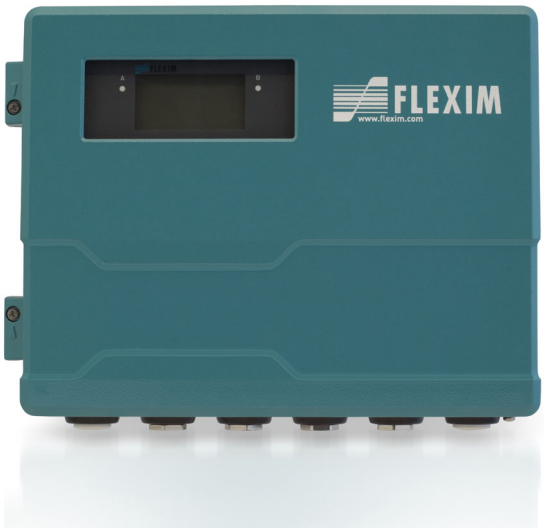
Features

- Time measurement for the accurate and repeatable determination of concentration, density and density-related physical quantities
- Reliable, maintenance-free and repeatable drift-free measurement
- High measurement accuracy even at very low as well as very high flow rates and independent of the flow direction (bidirectional)
- Installation and start-up do not require any pipe work nor any process interruptions
- Non-invasive: no fluid contact, no need of special materials, ideal for aggressive, toxic or abrasive fluids
- 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

Applications

For a wide range of fluids, e.g. H_2SO_4, HF, HCl, HNO_3, sugar solution (Brix), brine in:

- Chemical industry
- Petrochemical industry
- Oil and gas industry
- Pharmaceutical industry
- Semiconductor industry
- Mechanical and electrical industries
- Food industry



PIOX S721**-****A

PIOX S721**-****S

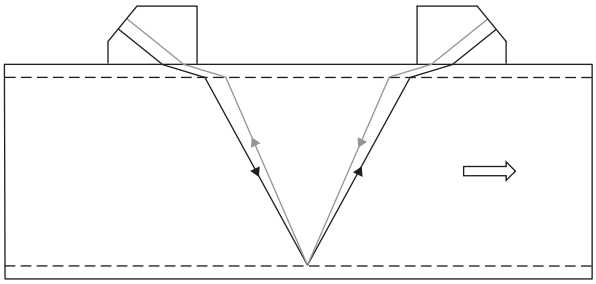
Variofix C

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.

Path of the ultrasonic signal in the flowing fluid

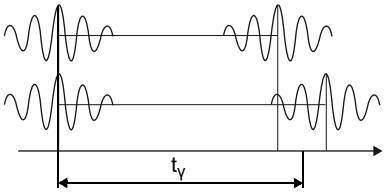


The transmitter determines physical quantities for analysis by using the transit time measurement and physical quantities for flow by means of the transit time difference principle.

Transit time measurement

All physical quantities for analysis are determined from the sound speed. The sound speed is calculated from the average of both ultrasonic signals in the fluid. By using the average, the sound speed is independent of the flow velocity of the fluid.

average of transit times in the flowing fluid



Calculation of sound speed

The sound speed is the quotient of the path of the ultrasonic signal in the fluid and transit time. The transit time is calculated as average of the transit times of both transducer signals in the fluid, corrected by the transit time in the transducer and in the pipe wall.

$$c_y = \frac{l_y}{t_y}$$

$$t_y = \frac{t_1 + t_2}{2}$$

where

c_y - sound speed in the fluid

l_y - sound path in the fluid

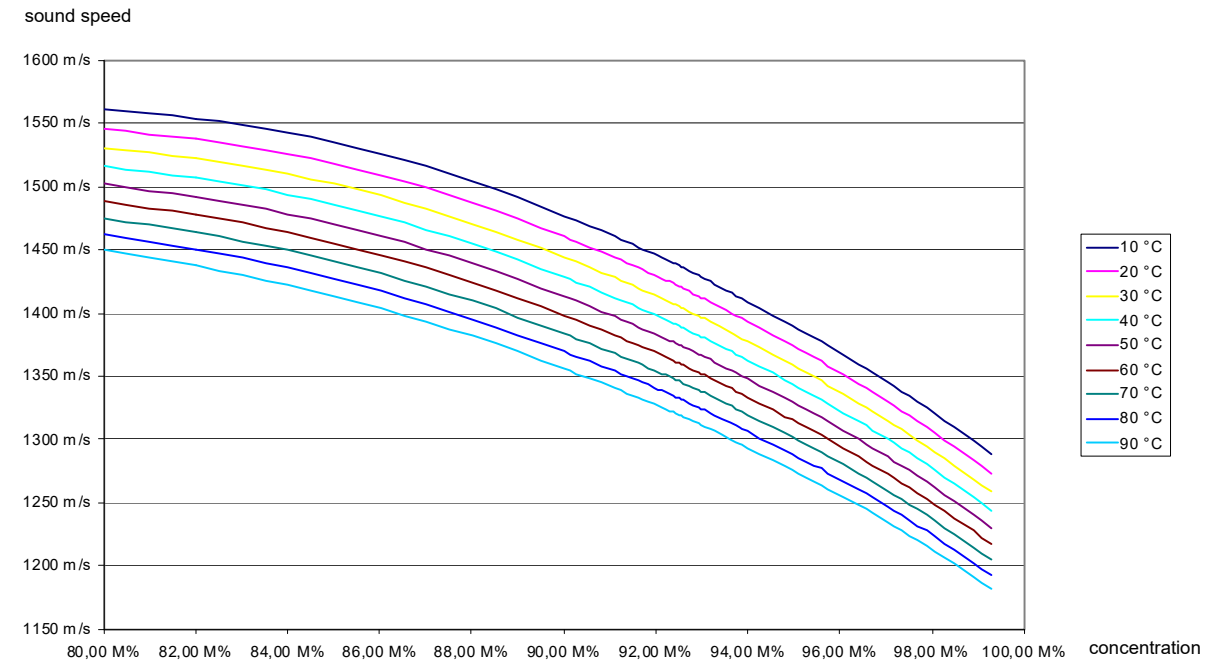
t_y - average of transit times in the fluid

t_1, t_2 - transit time in the fluid

A field calibration is recommended to reduce the influence of the pipe parameters on the accuracy of the measurement.

Further physical quantities, e.g. concentration, density, degree of conversion, can be calculated in dependence on the measured sound speed and fluid temperature in the transmitter. This requires a set of characteristic curves where physical quantity, sound speed and fluid temperature are correlated. The characteristic curves can be prepared by FLEXIM if required.

Example of the dependence of the sound speed of sulfuric acid on concentration and temperature



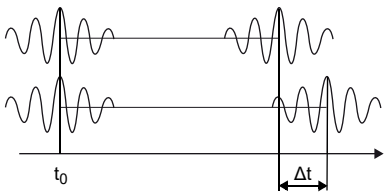
Transit time difference principle

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.

Transit time difference Δt



Calculation of volumetric flow rate

$$\dot{V} = k_{Re} \cdot A \cdot k_a \cdot \frac{\Delta t}{2 \cdot t_\gamma}$$

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_γ - average of transit times in the fluid

Calculation of mass flow rate

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

$\rho = f(K, T)$

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

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

where

- ρ - operating density
- K - concentration
- T - temperature
- $\dot{m}$ - mass flow rate
- $\dot{V}$ - volumetric flow rate

Number of sound paths

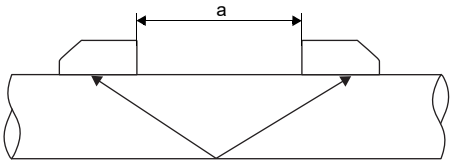
The number of sound paths is the number of transits of the ultrasonic signal through the fluid in the pipe. Depending on the number of sound paths, the following methods of installation exist:

- **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 easy.
- **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.

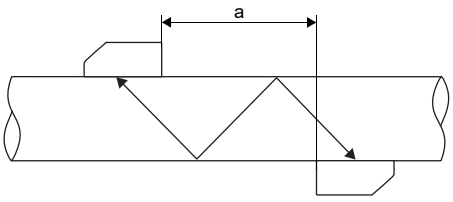
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

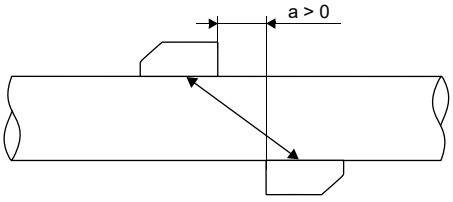
Reflection arrangement, number of sound paths: 2



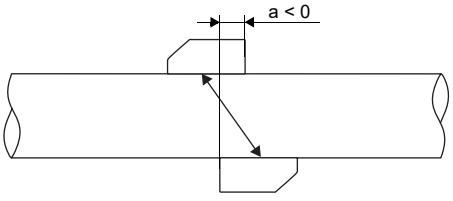
Diagonal arrangement, number of sound paths: 3



Diagonal arrangement, number of sound paths: 1



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



a - transducer distance

Transmitter

Technical data

		PIOX S721**-NN0*A S721**-NN0*S	PIOX S721**-E20*S
		 	
design		standard field device	standard field device zone 2
measurement			
• analysis			
transit time (repeatable)		$1/(50 \cdot f_\alpha) \pm 10^{-4} \cdot t$	
transit time (absolute)		$1/(5 \cdot f_\alpha) \pm 10^{-4} \cdot t$	
		f_α - transducer frequency, t - total transit time e.g. for transducers with transducer frequency M (f_α = 1 MHz): repeatable: 20 ns $\pm 10^{-4} \cdot t$, absolute: 200 ns $\pm 10^{-4} \cdot t$ The total measurement uncertainty of a physical quantity for analysis is supplied order-related as it depends on the fluid, operating range and installation. For the basis of calculation see document TIPIOX-S_uncert_analysis.	
• flow			
measurement principle		transit time difference correlation principle	
flow velocity	m/s	0.01...25	
repeatability		0.15 % MV ±0.005 m/s	
fluid		all acoustically conductive liquids with < 10 % gaseous or solid content in volume	
temperature compensation		corresponding to the recommendations in ANSI/ASME MFC-5.1-2011	
measurement uncertainty		see metrological certificate	
transmitter			
power supply		• 100...230 V/50...60 Hz or • 20...32 V ⎓ or • 11...16 V ⎓	
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)	
housing material		aluminum, powder coated or stainless steel 316L (1.4404)	
degree of protection		IP66	
dimensions	mm	see dimensional drawing	
weight	kg	aluminum housing: 5.4 stainless steel housing: 5.1	
fixation		wall mounting, optional: 2" pipe mounting	
ambient temperature	°C	-40...+60 (< -20 without operation of the display)	
display		128 x 64 pixels, backlight	
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian	
explosion protection			
• TR TS			
transmitter			
marking		-	2Ex nA nC [ic] IIC T4 Gc Ex tb IIIC T120 °C Db от -40 °C до +60 °C
certification		-	EAC Ex TC RU C-DE.BH02.B.00644
measuring functions			
physical quantities		see table below	
totaliser		volume, mass	
calculation functions		average, difference, sum (2 measuring channels necessary)	
diagnostic functions		signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times	

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

		PIOX S721**-NN0*A S721**-NN0*S	PIOX S721**-E20*S
communication interfaces			
service interfaces		measured value transmission, parametrisation of the transmitter: • USB[3] • LAN[3]	
process interfaces		max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	
accessories			
data transmission kit		USB cable	
software		• FluxDiagReader: reading of measured values and parameters, graphical presentation • FluxDiag (optional): reading of measurement data, graphical presentation, report generation, parametrisation of the transmitter	
data logger			
loggable values		all physical quantities, totalised physical quantities and diagnostic values	
capacity		max. 800 000 measured values	
outputs			
		The outputs are galvanically isolated from the transmitter.	
number		on request	
• switchable current output			
		All switchable current outputs are jointly switched to active or passive.	
range	mA	4...20 (3.2...22)	
accuracy		0.04 % MV ±3 µA	
active output		R_{ext} < 350 Ω	
passive output		U_{ext} = 8...30 V, depending on R_{ext} (R_{ext} < 1 kΩ at 30 V)	
• HART			
range	mA	4...20	
accuracy		0.1 % MV ±15 µA	
active output		U_{int} = 24 V, R_{ext} < 500 Ω	
passive output		U_{ext} = 10...24 V ⎓, depending on R_{ext} (R_{ext} < 1 kΩ at 24 V)	
• voltage output			
range	V	0...1 or 0...10	
accuracy		0...1 V: 0.1 % MV ±1 mV 0...10 V: 0.1 % MV ±10 mV	
internal resistance		R_{int} = 500 Ω	
• frequency output			
range	kHz	-	0...5
optorelay		-	24 V/4 mA, R_{int} = 66.5 Ω
• binary output			
optorelay		-	26 V/100 mA
Reed relay		-	48 V/100 mA, R_{int} = 22 Ω
binary output as alarm output			
• functions		-	limit, change of flow direction or error
binary output as pulse output			
• functions		-	mainly for totalising
• pulse value	units	-	0.01...1000
• pulse width	ms	-	optorelay: 1...1000 Reed relay: 80...1000
• digital output			
functions		• frequency output • binary output • pulse output	-
number		3	-
operating parame-ters		5...30 V/< 100 mA	-
frequency output			
• range	kHz	0...5	-
binary output			
• binary output as alarm output		limit, change of flow direction or error	-
pulse output			
• functions		mainly for totalising	-
• pulse value	units	0.01...1000	-
• pulse width	ms	0.05...1000	-

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

		PIOX S721**-NN0*A S721**-NN0*S	PIOX S721**-E20*S
inputs			
		The inputs are galvanically isolated from the transmitter.	
number		max. 4, on request min. 1 input or process interface with inputs necessary for fluid temperature	
• temperature input			
type		Pt100/Pt1000	
connection		4-wire	
range	°C	-150...+560	
resolution	K	0.01	
accuracy		±0.01 % MV ±0.03 K	
• current input			
accuracy		0.1 % MV ±10 µA	
active input • range	 mA	U_{int} = 24 V, R_{int} = 50 Ω, P_{int} < 0.5 W, not short-circuit proof 0...20	
passive input • range	 mA	R_{int} = 50 Ω, P_{int} < 0.3 W -20...+20	
• voltage input			
range	V	0...1	
accuracy		0.1 % MV ±1 mV	
internal resistance		R_{int} = 1 MΩ	
• binary input			
switching signal		5...30 V, 1 mA	
functions		• reset of the measured values • reset of the totalisers • stop of the totalisers • activation of the measuring mode for highly dynamic flows	

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

Physical quantities

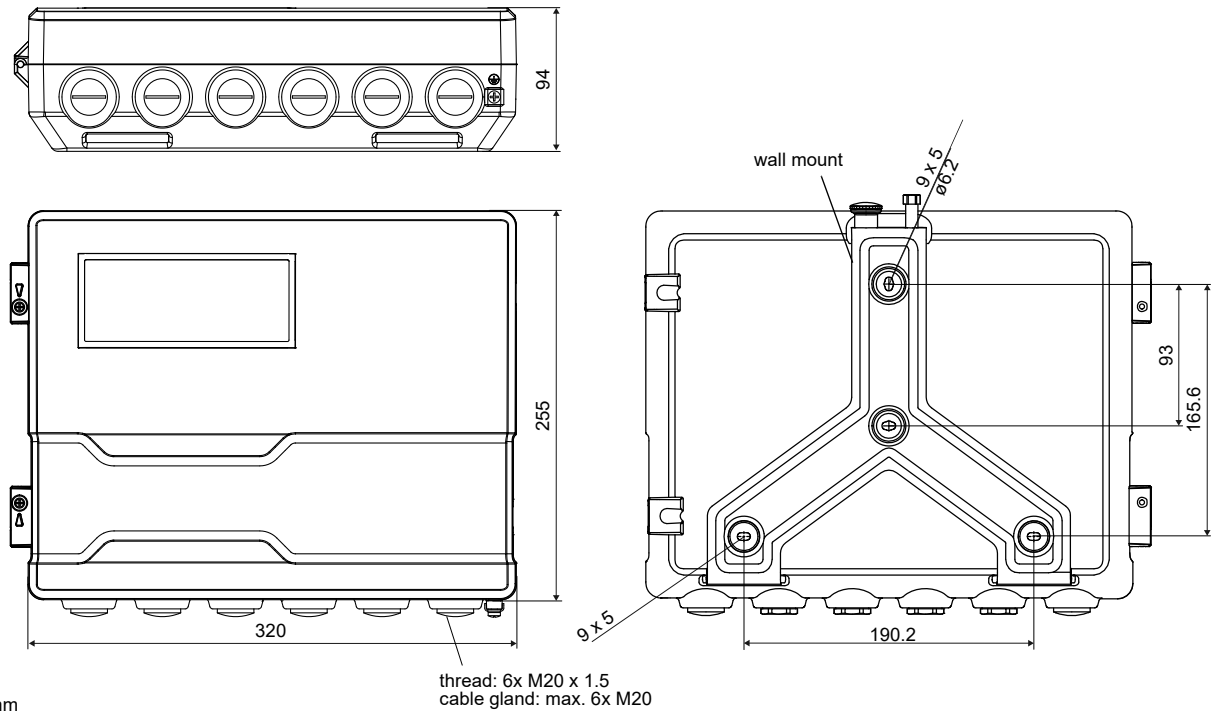
The available physical quantities depend on the fluid data set in the transmitter.

fluid data set		physical quantities	remark
NN	no fluid data set	• sound speed, volumetric flow rate	
MD	standard fluid data set	• analysis[1]: concentration, mass fraction, volume fraction, density, normalised density, normalised sound speed, sound speed • flow: volumetric flow rate, flow velocity, mass flow rate	application-specific fluid data set from FLEXIM database
CU	customised fluid data set	• analysis[1]: concentration, mass fraction, volume fraction, density, normalised density, normalised sound speed, sound speed • flow: volumetric flow rate, flow velocity, mass flow rate • further customised physical quantities[1]	data set developed by FLEXIM in cooperation with the customer

[1] min. 1 input or process interface with inputs necessary for fluid temperature

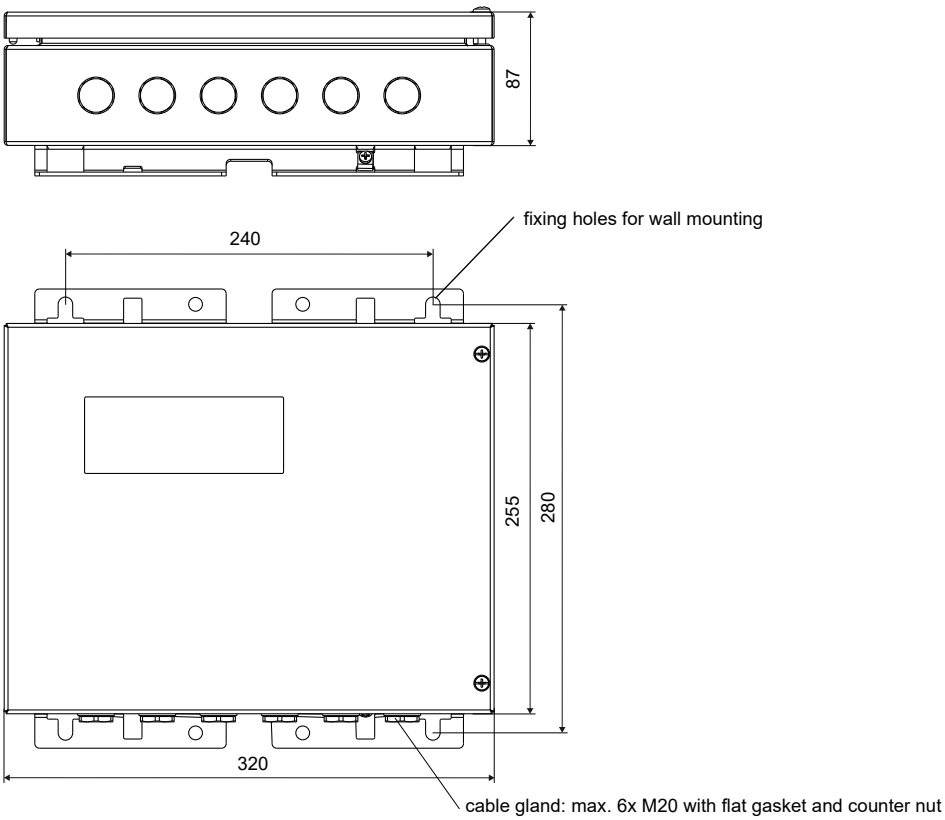
Dimensions

72-****A**



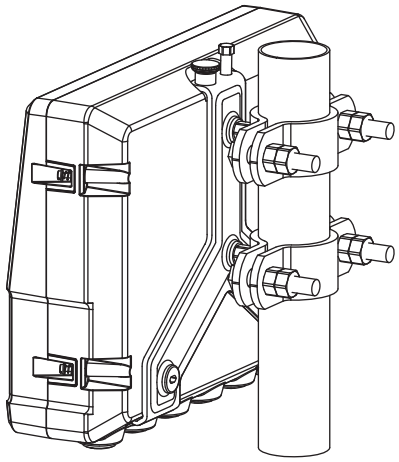
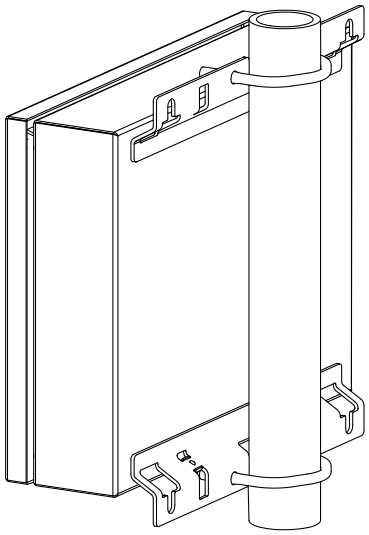
in mm

72-****S**

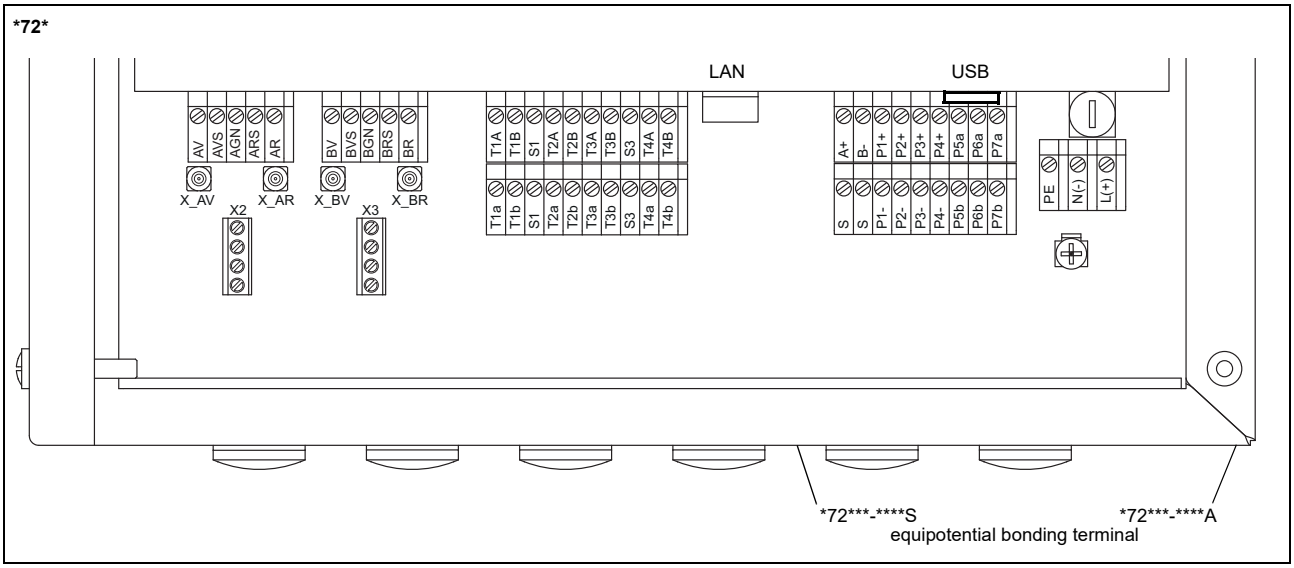


in mm

2" pipe mounting kit

72-****A** 	order code: ACC-PE-*721-/PMK4
72-****S** 	order code: ACC-PE-*721-/PMK6

Terminal assignment



power supply[1]		
terminal	**connection (AC)**	**connection (DC)**
PE	earth	earth
N(-)	neutral	-
L(+)	phase	+

transducers

transducer cable (transducers *****8*, ****LI*), extension cable					transducer cable (transducers *****52)		
measuring channel A		**measuring channel B**			**measuring channel A**	**measuring channel B**	
terminal	**connection**	**terminal**	**connection**	**transducer**	**terminal**		**connection**
AV	signal	BV	signal		X_AV	X_BV	SMB connector
AVS	shield	BVS	shield				
ARS	shield	BRS	shield		X_AR	X_BR	SMB connector
AR	signal	BR	signal				

outputs[1, 2]

terminal	**connection**
P1+...P4+ P1-...P4-	current output, voltage output, frequency output, binary output (Reed relay), HART (P1)
P5a...P7a P5b...P7b	binary output (optorelay), digital output

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

analog inputs[1, 2]

	temperature probe		**passive sensor**	**active sensor**
terminal	**direct connection**	**connection with extension cable**	**connection**	**connection**
T1a...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]

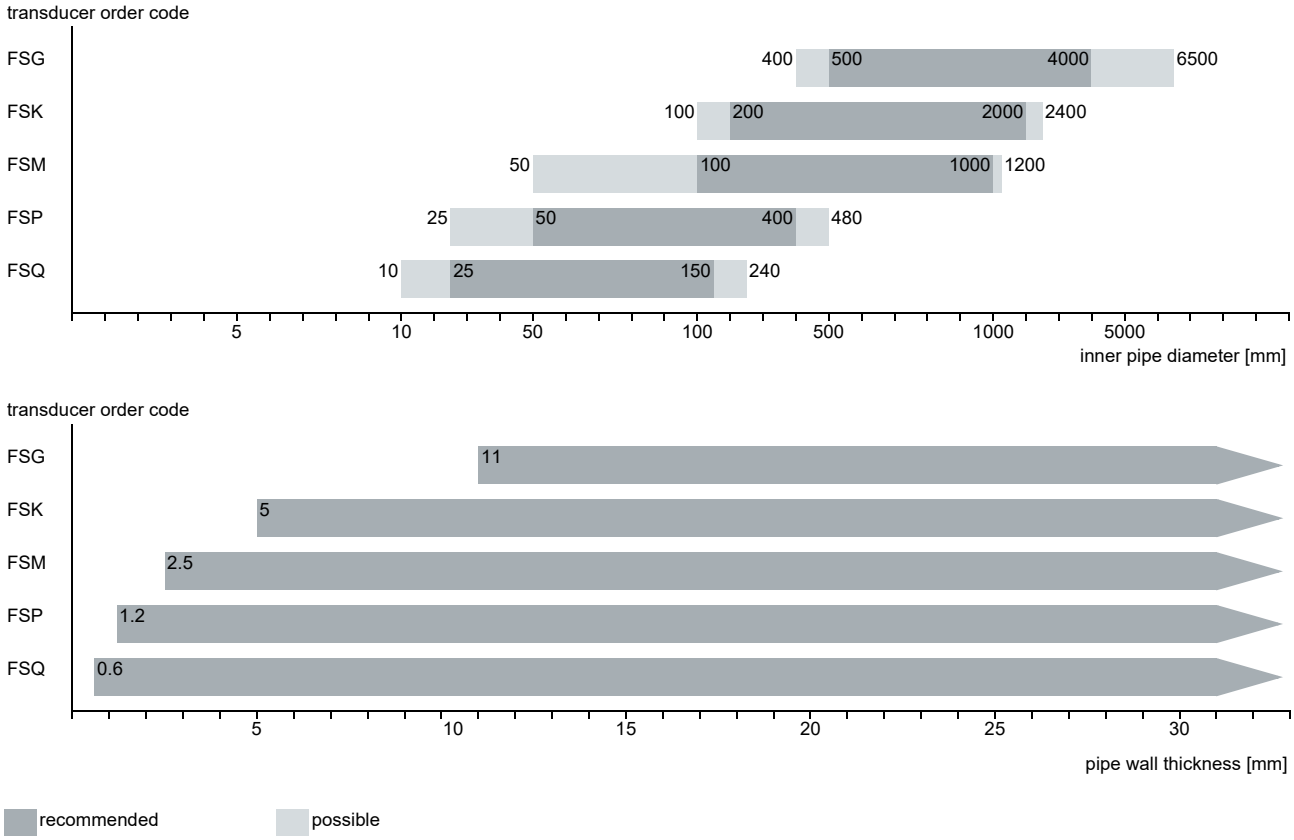
terminal
P1+...P2+, P1-...P2-

[1] cable (by customer):
- e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm^2
- outer diameter of the cable (*72***-****S with ferrite nut): max. 7.6 mm

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

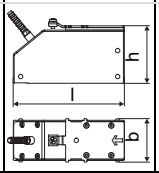
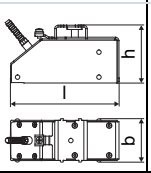
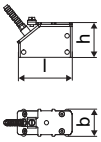
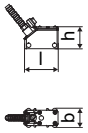
Transducers

Transducer selection

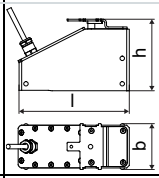
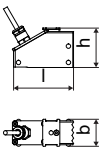


Technical data

Shear wave transducers (zone 2 - nonEx, TS)

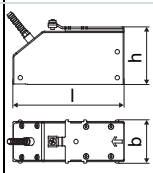
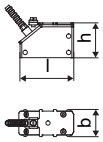
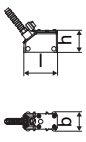
order code		FSG-N**TS/**	FSK-N**TS/**	FSM-N**TS/**	FSP-N**TS/**	FSQ-N**TS/**
technical type		C(DL)G1N52	C(DL)K1N52	C(DL)M2N52	C(DL)P2N52	C(DL)Q2N52
transducer frequency	MHz	0.2	0.5	1	2	4
inner pipe diameter d						
min. extended	mm	400	100	50	25	10
min. recommended	mm	500	200	100	50	25
max. recommended	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 cover 304 (1.4301), ***-*****/OS: 316L (1.4404)				
contact surface		PEEK				
degree of protection		IP67				
transducer cable						
type		1699				
length	m	5		4		3
length (***-*****/LC)	m	9 (not for *L***** with ***-*E***)				
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						
• **TR TS**						
order code		FSG-NE2TS/**	FSK-NE2TS/**	FSM-NE2TS/**	FSP-NE2TS/**	FSQ-NE2TS/**
technical type		CDG1N52	CDK1N52	CDM2N52	CDP2N52	CDQ2N52
marking		2Ex nA IIC T6...T3 Gc Ex tb IIIC T180 °C...T65 °C Db от -55 °C до +180 °C				
certification		EAC Ex TC RU C-DE.BH02.B.00644				

Shear wave transducers (zone 2 - nonEx, T1, IP68)

order code		FSG-N**T1/IP68	FSK-N**T1/IP68	FSM-N**T1/IP68	FSP-N**T1/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 cover 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					
• TR TS					
order code		FSG-NE2T1/IP68	FSK-NE2T1/IP68	-	-
marking		2Ex nA IIC T6...T5 Gc Ex tb IIIC T90 °C...75 °C Db от -40 °C до +90 °C			
certification		EAC Ex TC RU C-DE.BH02.B.00644		-	-

[1] test conditions: 3 months/2 bar (20 m)/20 °C

Shear wave transducers (zone 2 - nonEx, TS, extended temperature range)

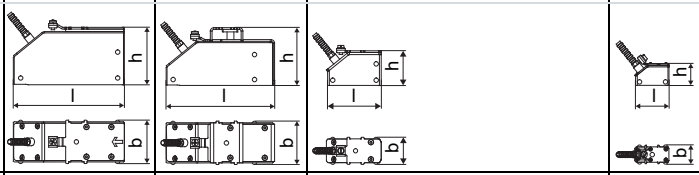
order code		FSG-ENNTS/**	FSK-ENNTS/**	FSM-E**TS/**	FSP-E**TS/**	FSQ-E**TS/**
technical type		C(DL)G1E52	C(DL)K1E52	C(DL)M2E52	C(DL)P2E52	C(DL)Q2E52
transducer frequency	MHz	0.2	0.5	1	2	4
inner pipe diameter d						
min. extended	mm	400	100	50	25	10
min. recommended	mm	500	200	100	50	25
max. recommended	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		PPSU with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)		PI with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)		
contact surface		PPSU		PI		
degree of protection		IP65		IP56		
transducer cable						
type		1699		6111		
length	m	5		4		3
length (***-*****/LC)	m	9		9 (not for *L***** with ***-*E***)		
dimensions						
length l	mm	129.5		64		40
width b	mm	51		32		22
height h	mm	67		40.5		25.5
dimensional drawing						
weight (without cable)	kg	0.82		0.066		0.017
pipe surface temperature						
min.	°C	-40		-30		-30
max.	°C	+180		+240[1]		+200
ambient temperature						
min.	°C	-40		-30		-30
max.	°C	+180		+40 +60[2] +200[3]		+200
temperature compensation		x		x		
explosion protection						
• TR TS						
order code		-	-	FSM-EE2TS/**	FSP-EE2TS/**	FSQ-EE2TS/**
technical type		-	-	CDM2E52	CDP2E52	CDQ2E52
marking		-	-	2Ex nA IIC T6...T2 Gc Ex tb IIIA T215 °C...65 °C Db от -45 °C до +225 °C[1]		
certification		-	-	EAC Ex TC RU C-DE.BH02.B.00644		

[1] > +200 °C:
Variofix C without cover or Variofix L
observe the insulation instruction
Ex: ambient temperature max. +40 °C

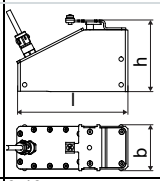
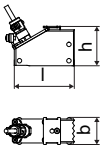
[2] pipe surface temperature +200...+240 °C: Variofix C without cover

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

Shear wave transducers (zone 1, T1)

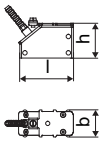
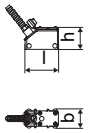
order code		FSG-N*1T1/**	FSK-N*1T1/**	FSM-N*1T1/**	FSP-N*1T1/**	FSQ-N*1T1/**
technical type		CDG1N81	CDK1N81	CDM2N81	CDP2N81	CDQ2N81
transducer frequency	MHz	0.2	0.5	1	2	4
inner pipe diameter d						
min. extended	mm	400	100	50	25	10
min. recommended	mm	500	200	100	50	25
max. recommended	mm	4000	2000	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 cover 304 (1.4301), ***-*****/OS: 316L (1.4404)				
contact surface		PEEK				
degree of protection		IP65	IP66			IP65
transducer cable						
type		1699				
length	m	5		4		3
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						
• TR TS						
order code		FSG-NE1T1/**	FSK-NE1T1/**	FSM-NE1T1/**	FSP-NE1T1/**	FSQ-NE1T1/**
marking		1Ex e q IIC T6...T3 Gb Ex tb IIIC T130 °C Db от -55 °C до +140 °C				
certification		EAC Ex TC RU C-DE.BH02.B.00644				

Shear wave transducers (zone 1, T1, IP68)

order code		FSG-N*1T1/IP68	FSK-N*1T1/IP68	FSM-N*1T1/IP68	FSP-N*1T1/IP68
technical type		CDG1LI1	CDK1LI1	CDM2LI1	CDP2LI1
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 cover 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					
• **TR TS**					
order code		FSG-NE1T1/IP68	FSK-NE1T1/IP68	FSM-NE1T1/IP68	FSP-NE1T1/IP68
marking		1Ex q IIC T6...T3 Gb Ex tb IIIC T130 °C Db от -40 °C до +80 °C			
certification		EAC Ex TC RU C-DE.BH02.B.00644			

[1] test conditions: 3 months/2 bar (20 m)/20 °C

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

order code		FSM-E*1T1/**	FSP-E*1T1/**	FSQ-E*1T1/**
technical type		CDM2E85	CDP2E85	CDQ2E85
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 cover 304 (1.4301), ***-*****/OS: 316L (1.4404)		
contact surface		PI		
degree of protection		IP66		IP56
transducer cable				
type		6111		
length	m	4		3
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 com-pensation		x		
explosion protection				
• TR TS				
order code		FSM-EE1T1/**	FSP-EE1T1/**	FSQ-EE1T1/**
marking		1Ex e q IIC T6...T2 Gb Ex tb IIIA T215 °C...65 °C Db от -45 °C до +225 °C[1]		
certification		EAC Ex TC RU C-DE.BH02.B.00644		

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

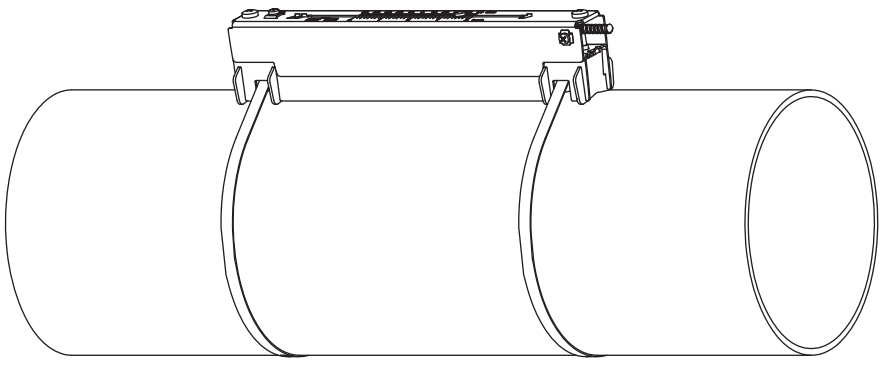
[2] pipe surface temperature max. +200 °C

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**	**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
			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

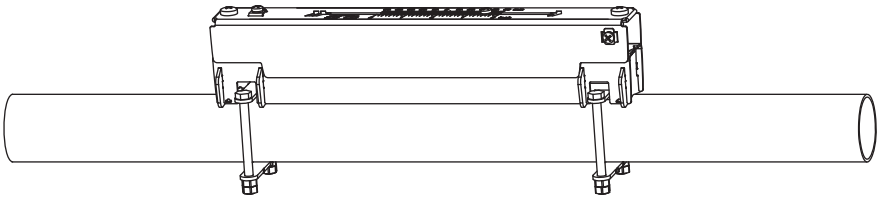
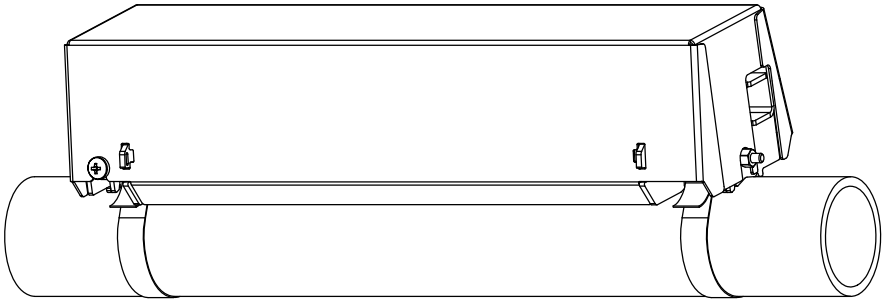
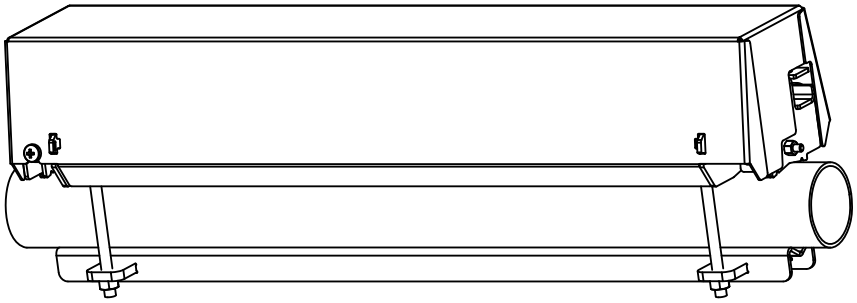
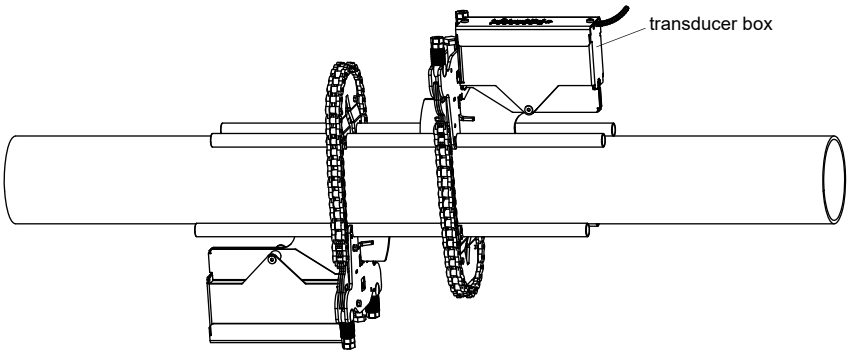
Variofix L (VLK, VLM, VLQ)



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

Variofix L with bolt mounting plates (VL*--B)** 	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
Variofix C (VC) 	material: stainless steel 316Ti (1.4571) inner length: **VCK-*L**: 500 mm **VCK-*S**: 350 mm **VCM**: 400 mm **VCQ**: 250 mm dimensions: **VCK-*L**: 560 x 126 x 125 mm **VCK-*S**: 410 x 126 x 125 mm **VCM**: 460 x 96 x 82 mm **VCQ**: 310 x 85 x 71 mm
Variofix C (VC) with bolt mounting plates (VCM--B, VCQ-**-B)** 	material: stainless steel 316Ti (1.4571) inner length: **VCM**: 400 mm **VCQ**: 250 mm dimensions: **VCM**: 460 x 96 x 82 mm **VCQ**: 310 x 85 x 71 mm outer pipe diameter: **VCM**: max. 46 mm **VCQ**: max. 36 mm
transducer box WI for WaveInjector 	see Technical specification TSWaveInjectorVx-x

Coupling materials for transducers

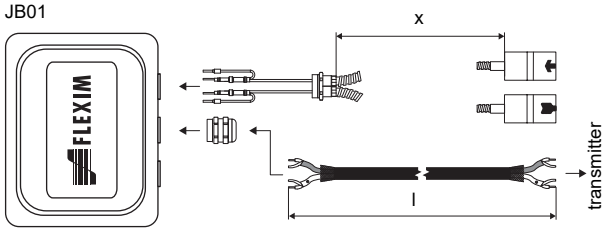
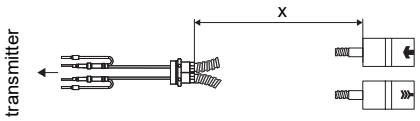
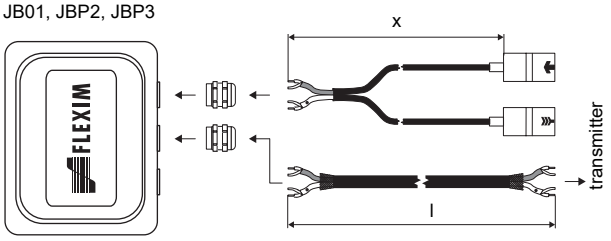
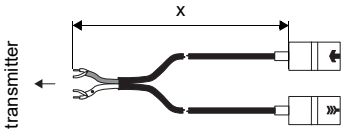
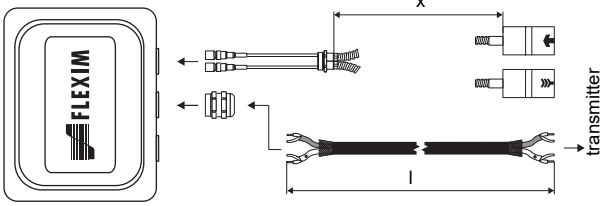
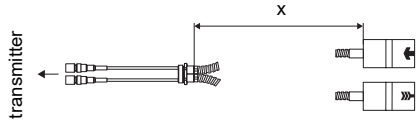
	normal temperature range (4th character of transducer order code = N)		**extended temperature range (4th character of transducer order code = E)**			**WaveInjector WI-400**	
	< 100 °C	< 170 °C	< 150 °C	< 200 °C	200...240 °C	< 280 °C	280...400 °C
< 24 h	coupling compound type N or coupling foil type VT	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	coupling foil type VT	coupling foil type VT	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

type VT: fluid temperature 200 °C: min. 2 years

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 T1		
connection with extension cable	direct connection	transducers technical type
JB01 		*****8*
JB01, JBP2, JBP3 		****LI*
connection system TS		
connection with extension cable	direct connection	transducers technical type
JB02, JB03 		*****52

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

XXX - cable length in m

Cable length

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

x - transducer cable length

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

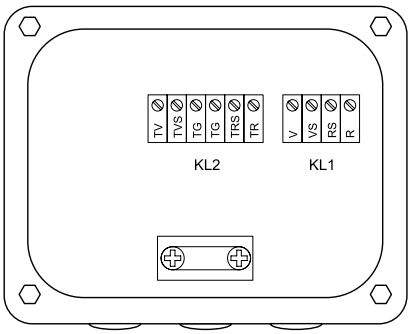
Junction box

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		
• TR TS (zone 1)		
junction box		JB01S4E3M
marking		1Ex e mb II T6...T4 Gb Ex tb IIIC 100°C Db T6: от -40 °C до +70 °C T4, T5: от -40 °C до +80 °C
certification		EAC Ex TC RU C-DE.BH02.B.00644
type of protection		gas: increased safety decoupled network: encapsulation dust: protection by enclosure
• TR TS (zone 2)		
junction box		JBP2
marking		2Ex nA IIC T6...T4 Gc Ex tc IIIC 80°C Dc T6: от -40 °C до +70 °C T4, T5: от -40 °C до +80 °C
certification		EAC Ex TC RU C-DE.BH02.B.00644

Connection



Transducers

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

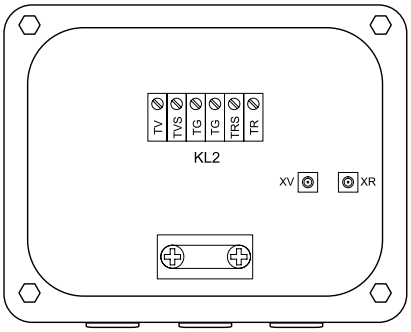
Extension cable

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

JB02, JB03

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		
• TR TS		
junction box		JB02
marking		2Ex nA IIC T6...T4 Gc Ex tc IIIC 80°C Dc T6: от -40 °C до +70 °C T4, T5: от -40 °C до +80 °C
certification		EAC Ex TC RU C-DE.BH02.B.00644

Connection



Transducers

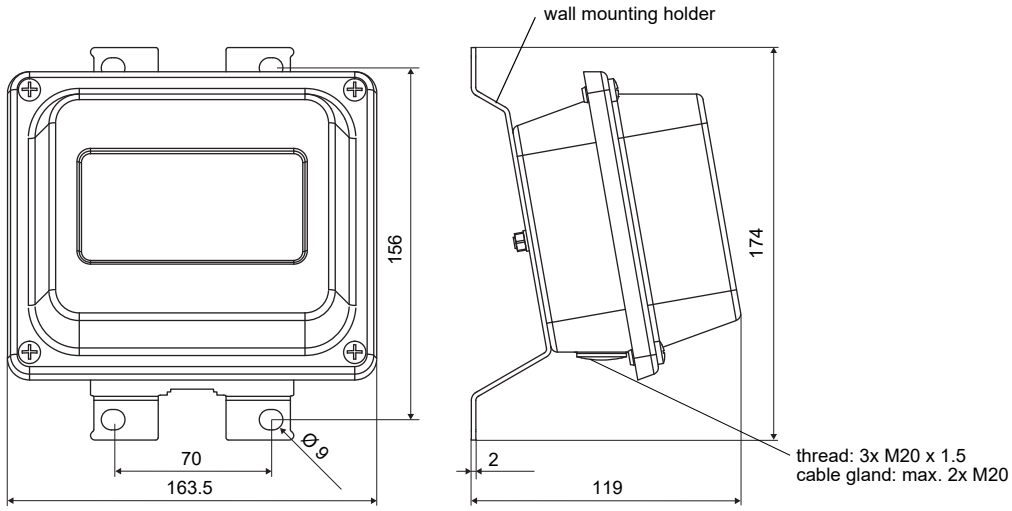
	terminal	connection	transducer
	XV	SMB connector	
	XR	SMB connector	

Extension cable

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

Dimensions

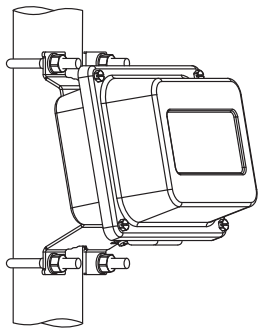
JB0*, JBP*



in mm

2" pipe mounting kit

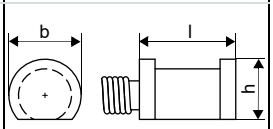
JB**



order code:
ACC-PE-GNNN-/JBPMK4

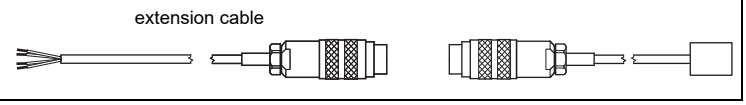
Clamp-on temperature probe (optional)

Technical data

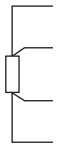
PT12N		
order code		• ACC-PO-#601-/T311 • ACC-PO-#601-/T511 (matched)
design		clamp-on with connector
type		Pt100
connection		4-wire
measuring range	°C	-30...+250
accuracy T		±(0.15 °C + 2 · 10^{-3} · |T [°C]|) class A
accuracy ΔT (2x Pt matched according to EN 1434-1)		≤ 0.1 K (3 K < ΔT < 6 K), more corresponding to EN 1434-1
response time	s	50 (t50, T1 = 25 °C, T2 = 60 °C)
housing		aluminum
degree of protection		IP54
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

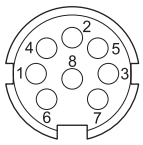
Connection system

direct connection/connection with extension cable



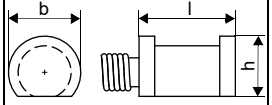
Connection

	temperature probe	extension cable	connector
			pin
	red	grey	2
	red/blue	red	6
	white/blue	blue	1
	white	white	7

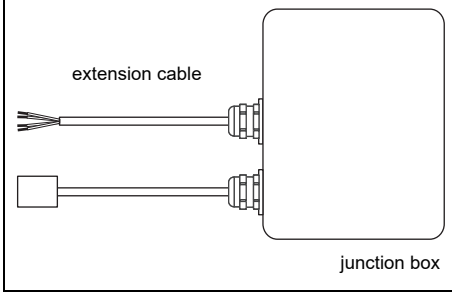


Cable

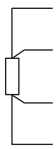
		temperature probe	extension cable
type		4 x 0.22 mm²	LIYCY 8 x 0.14 mm²
standard length	m	3	5/10/25
max. length	m	-	200
ambient temperature	°C	-30...+250	-25...+80
min. bend radius	mm	27	68
cable jacket			
material		PFA	PVC
outer diameter	mm	3.8 ±0.15	4.8 ±2
colour		black	grey

PT12N		
order code		• ACC-PE-GNNN-/T312 • ACC-PE-GNNN-/T512 (matched)
design		clamp-on
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 (t50, T1 = 25 °C, T2 = 60 °C)
housing		aluminum
degree of protection		IP54
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

Connection system

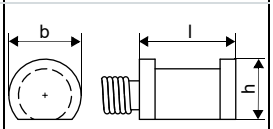
connection with extension cable	direct connection
	

Connection

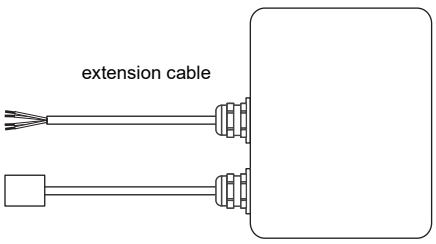
	temperature probe
	red
	red/blue
	white/blue
	white

Cable

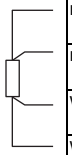
		temperature probe	extension cable
type		4 x 0.22 mm²	LIYCY 8 x 0.14 mm²
standard length	m	3	5/10/25
max. length	m	-	200
ambient temperature	°C	-30...+250	-25...+80
min. bend radius	mm	27	68
cable jacket			
material		PFA	PVC
outer diameter	mm	3.8 ±0.15	4.8 ±2
colour		black	grey

PT12N		
order code		• • ACC-PE-GNNN-/T362 • ACC-PE-GNNN-/T562 (matched)
design		clamp-on TR TS
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		IP67
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		
• TR TS		
marking		2Ex nA IIC T6...T2 Gc от -30°C до +250 °C
certification		EAC Ex RU C-DE.BH02.B.00644

Connection system

connection with extension cable	direct connection
	

Connection

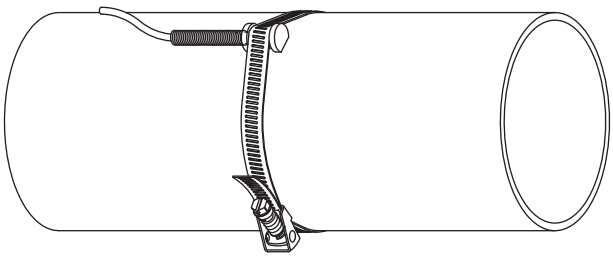
	temperature probe
	red
	red/blue
	white
	white/blue

Cable

		temperature probe	extension cable
type		4 x 0.25 mm²	LIYCY 8 x 0.14 mm²
standard length	m	3	5/10/25
max. length	m	-	200
ambient temperature	°C	-30...+250	-25...+80
min. bend radius	mm	19	68
cable jacket			
material		PTFE	PVC
outer diameter	mm	3.8	4.8 ±2
colour		black	grey

Fixation

tension strap PT12N



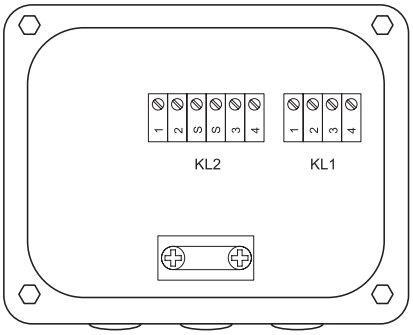
material: stainless steel 301 (1.4310), 410 (1.4006)

thermal insulation necessary

Junction box

JBT2, JBT3		
order code		• JBT2: ACC-PE-GNNN-/JB5 • JBT3: ACC-PE-GNNN-/JB6
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		
• **TR TS**		
junction box		JBT2
marking		2Ex nA IIC T6...T4 Gc Ex tc IIIC 80°C Dc T6: от -40 °C до +70 °C T4, T5: от -40 °C до +80 °C
certification		EAC Ex TC RU C-DE.BH02.B.00644

Connection



Temperature probe

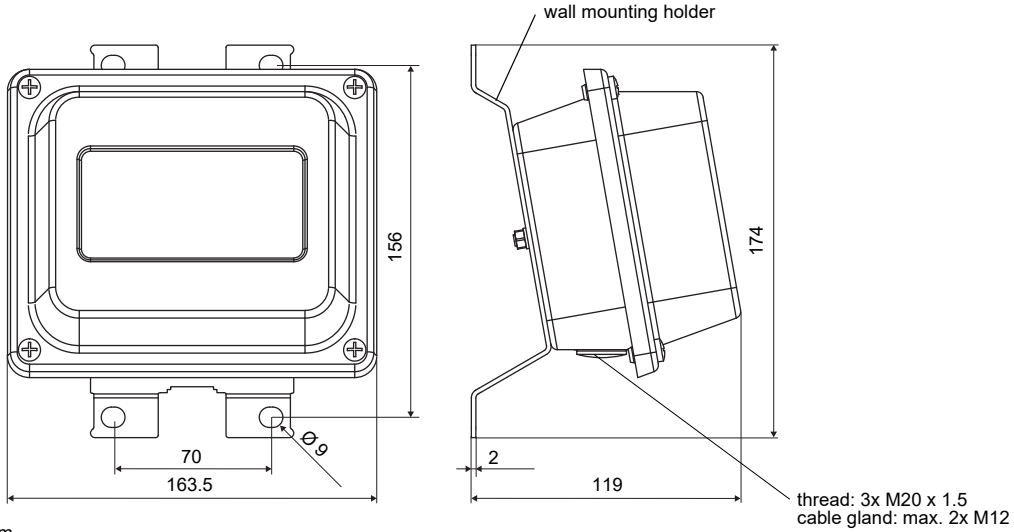
terminal strip	terminal	connection
KL1	1	red
	2	red/blue
	3	white
	4	white/blue

Extension cable

terminal strip	terminal	connection
KL2	1	red
	2	grey
	3	white
	4	blue

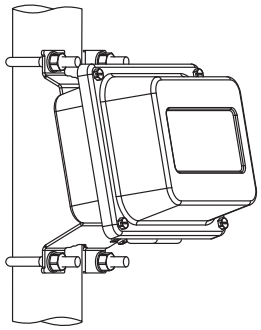
Dimensions

JBT*



in mm

2" pipe mounting kit

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

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