FLEXIM

Technical specification

FLUXUS WD

Non-invasive ultrasonic flow measurement

Permanently installed clamp-on ultrasonic flow measurement system for water and wastewater pipes

Features

- Highly accurate non-invasive flow measurement irrespective of the flow direction (bidirectional), with outstanding measurement dynamics, excellent zero-point stability and high repeatability of the measurement results
- Submersible ultrasonic transducers (IP68) provide a reliable and durable solution for flow measurement on buried pipes or for applications where the measuring point can be overflowed
- Simple retrofitting on existing water networks without interruption of supply and disposal and without the need for shaft construction and pipe intrusion, thus saving time and cost

Applications

- Flow measurement on buried water and wastewater pipes
- Flow measurement on water and wastewater pipes which can be overflowed

FLUXUS WD

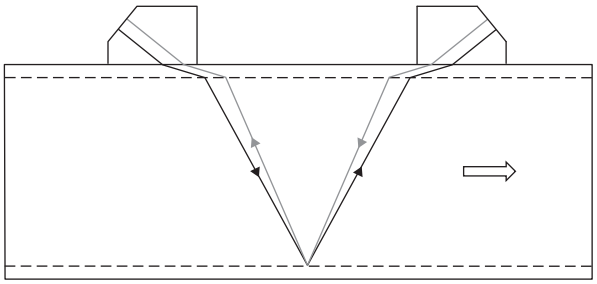
Variofix C

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



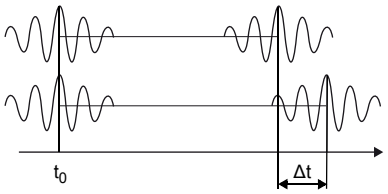
Transit time difference principle

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



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

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

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

Number of sound paths

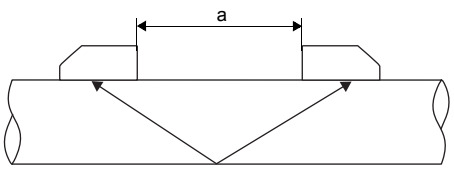
The number of sound paths is the number of transits of the ultrasonic signal through the fluid in the pipe. Depending on the number of sound paths, the following methods of installation exist:

- **reflection arrangement**
  The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easier.
- **diagonal arrangement**
  The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe. In the case of a high signal attenuation by the fluid, pipe and coatings, diagonal arrangement with 1 sound path will be used.

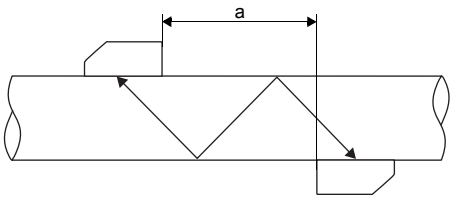
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

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

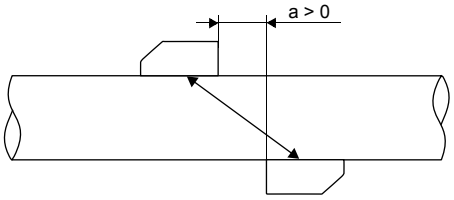
Reflection arrangement, number of sound paths: 2



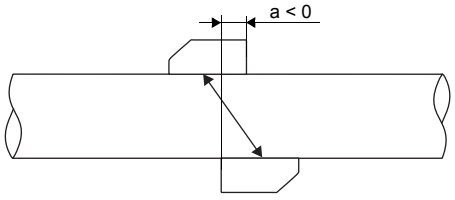
Diagonal arrangement, number of sound paths: 3



Diagonal arrangement, number of sound paths: 1



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



a - transducer distance

Transmitter

Technical data

		FLUXUS WD
		 
application		flow measurement at water pipes
transducers		WD6500: CDG1LI8 or CDG1N52 WD1200: CDK1LI8 or CDK1N52 WD400: CDM2LI8 or CDM2N52
measurement		
measurement principle		transit time difference correlation principle, automatic NoiseTrek selection for measurements with high gaseous or solid content
flow velocity	m/s	0.01...25
repeatability		0.15 % of reading ±0.005 m/s
fluid		water
temperature compensation		corresponding to the recommendations in ANSI/ASME MFC-5.1-2011
measurement uncertainty (volumetric flow rate)		
measurement uncertainty of measuring system[1]		±0.3 % of reading ±0.005 m/s
measurement uncertainty at the measuring point[2]		±1 % of reading ±0.005 m/s
transmitter		
power supply		• 100...230 V/50...60 Hz or • 20...32 V DC or • 11...16 V DC
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 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 °C without operation of the display)
display		128 x 64 dots, backlight
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish
measuring functions		
physical quantities		volumetric flow rate, mass flow rate, flow velocity
totalizer		volume, mass
calculation functions		average, difference, sum (2 measuring channels necessary)
diagnostic functions		sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times
communication interfaces		
service interfaces		measured value transmission, parametrization of the transmitter: • USB • LAN
process interfaces		max. 1 option: • RS485 (ASCII sender) • Modbus RTU[3] • BACnet MS/TP • M-Bus • HART[3] • Profibus PA[3] • FF H1[3] • Modbus TCP[3] • BACnet IP

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] including parametrization of the transmitter

		FLUXUS WD
accessories		
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
data logger		
loggable values		all physical quantities, totalized values and diagnostic values
capacity		max. 800 000 measured values
outputs		
		The outputs are galvanically isolated from the transmitter.
number		• switchable current output: 1 oder HART • binary output: 2
• switchable current output		
range	mA	4...20 (3.2...22)
accuracy		0.04 % of reading ±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 % of reading ±15 µA
active output		U_{int} = 24 V, R_{ext} < 500 Ω
• binary output		
number		2
optorelay		26 V/100 mA
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	1...1000

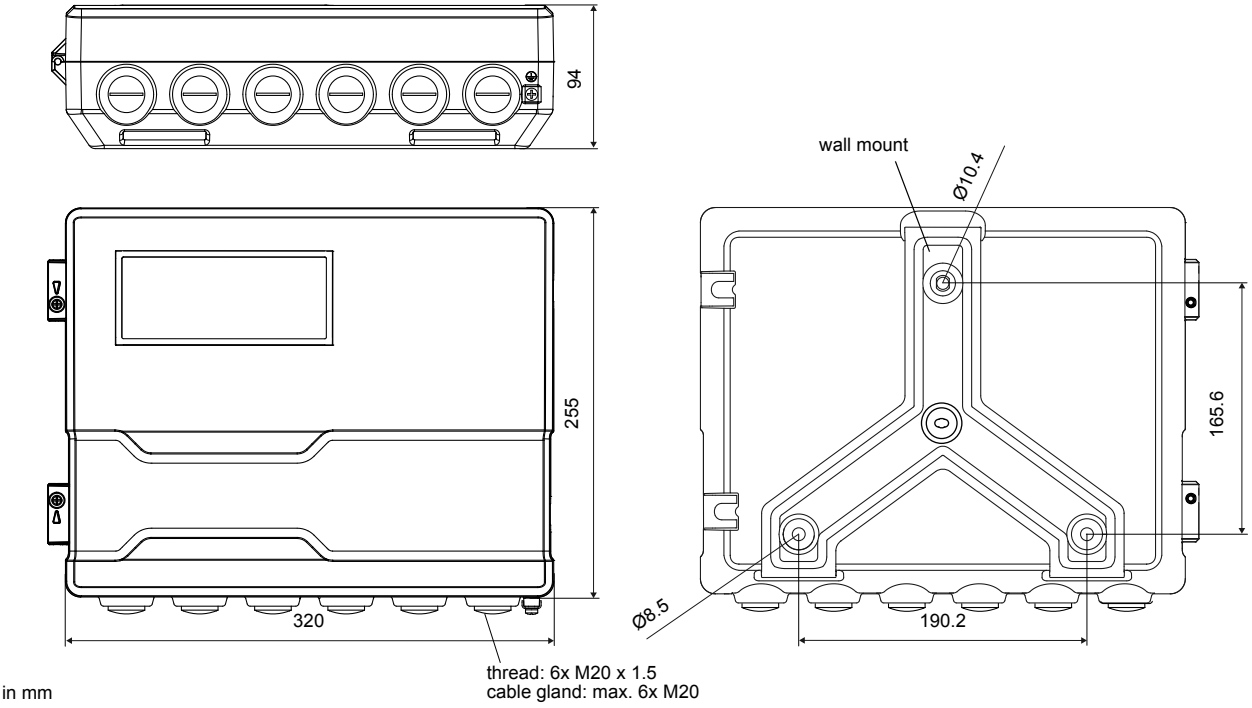
[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] including parametrization of the transmitter

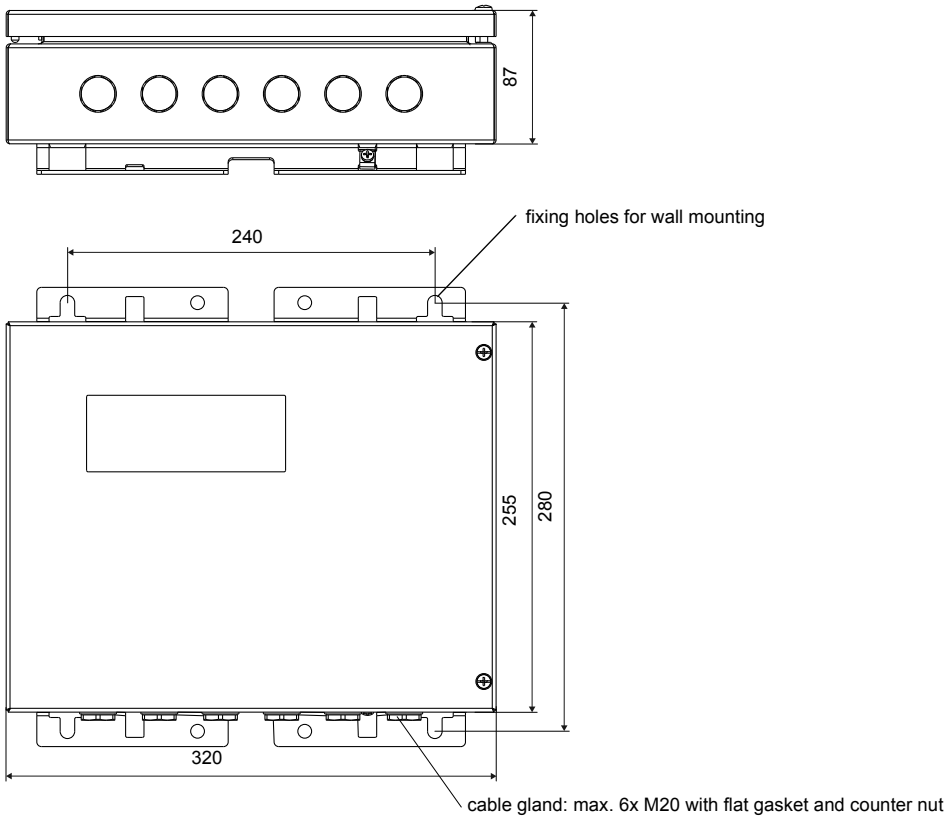
Dimensions

aluminum housing



in mm

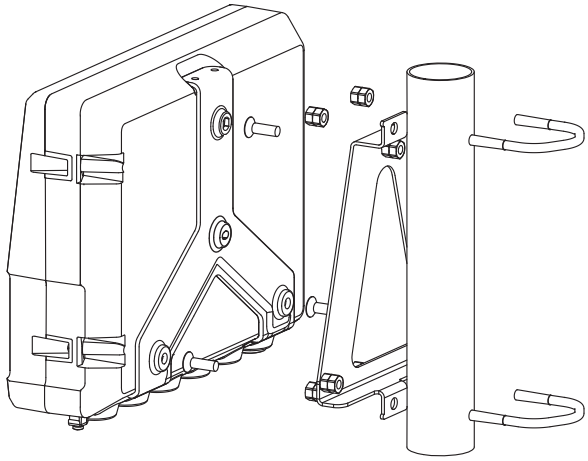
stainless steel housing



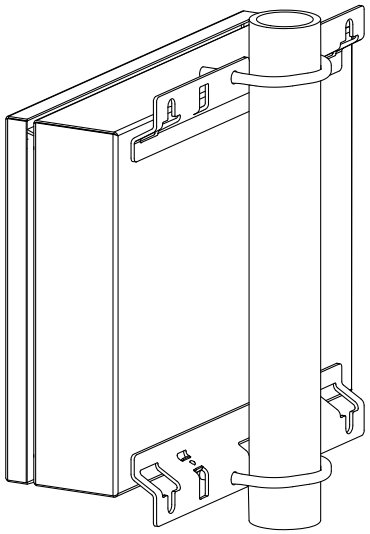
in mm

2" pipe mounting kit

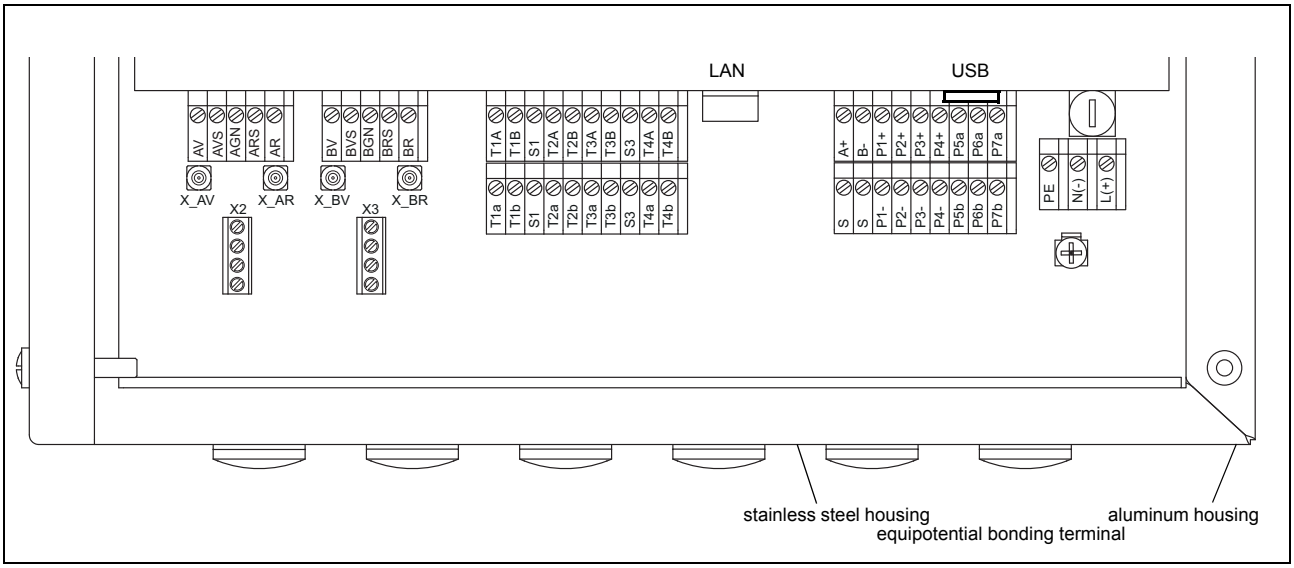
aluminum housing



stainless steel housing



Terminal assignment



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

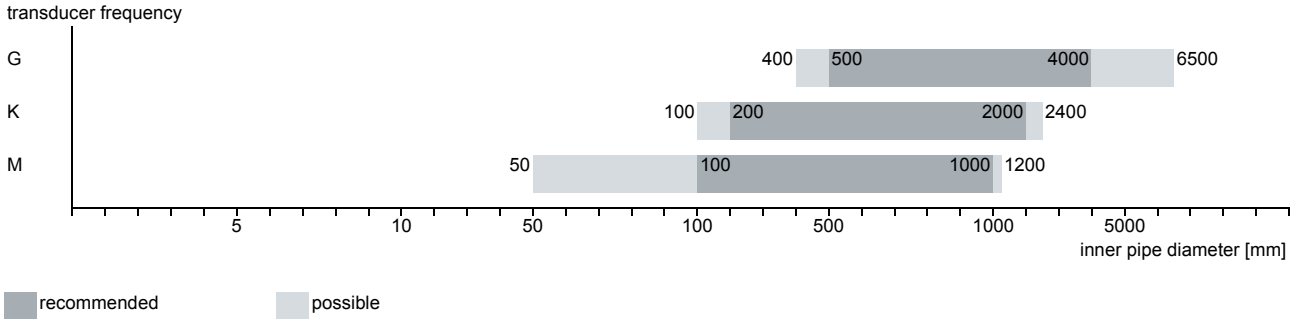
transducers, extension cable				
measuring channel A		**measuring channel B**		**transducer**
terminal	**connection**	**terminal**	**connection**	
AV	signal	BV	signal	
AVS	internal shield	BVS	internal shield	
ARS	internal shield	BRS	internal shield	
AR	signal	BR	signal	

outputs[1]				
terminal	**connection**	**terminal**	**connection**	**communication interface**
P1+ P1-	current output, HART	A+	signal +	• RS485[1] • Modbus RTU[1] • BACnet MS/TP[1] • M-Bus[1] • Profibus PA[1] • FF H1[1]
		B-	signal -	
P5a...P6a P5b...P6b	binary output	S	shield	
		USB	type B	• service (FluxDiag/ FluxDiagReader)
		LAN	RJ45	• service (FluxDiag/ FluxDiagReader) • Modbus TCP • BACnet IP

[1] cable (by customer):
- e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.25...2.5 mm^2
- outer diameter of the cable (stainless steel housing, with ferrite nut): max. 7.6 mm

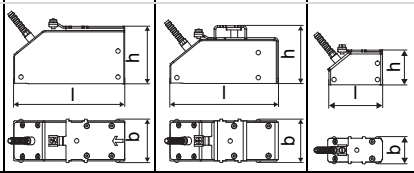
Transducers

Transducer selection

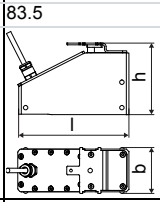
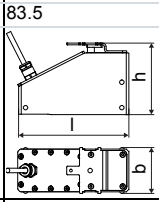
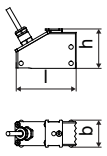


Technical data

Shear wave transducers

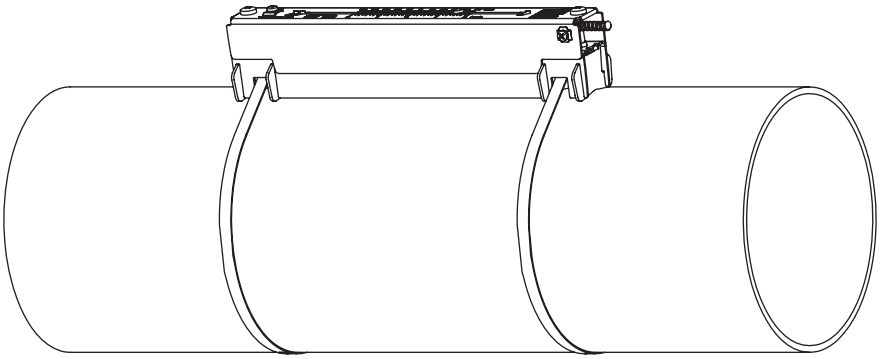
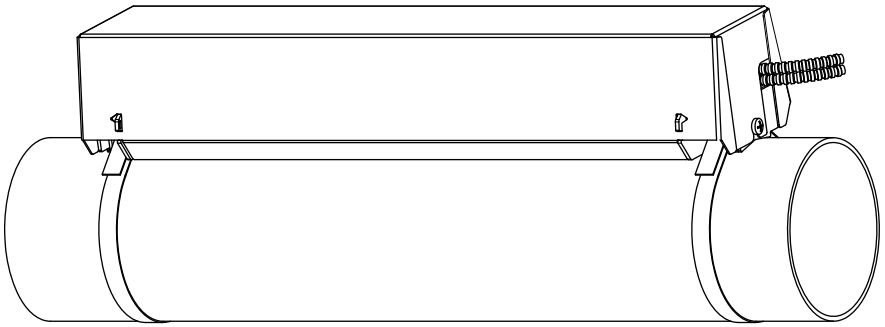
technical type		CDG1N52	CDK1N52	CDM2N52
transducer frequency	MHz	0.2	0.5	1
inner pipe diameter d				
min. extended	mm	400	100	50
min. recommended	mm	500	200	100
max. recommended	mm	4000	2000	1000
max. extended	mm	6500	2400	1200
pipe wall thickness				
min.	mm	11	5	2.5
material				
housing		PEEK with stainless steel cap 316L (1.4404)	PEEK with stainless steel cap 316L (1.4404)	PEEK with stainless steel cap 316L (1.4404)
contact surface		PEEK	PEEK	PEEK
degree of protection		IP67	IP67	IP67
transducer cable				
type		1699	1699	1699
length	m	5	5	4
dimensions				
length l	mm	129.5	126.5	64
width b	mm	51	51	32
height h	mm	67	67.5	40.5
dimensional drawing				
weight (without cable)	kg	0.47	0.36	0.066
pipe surface temperature				
min.	°C	-40	-40	-40
max.	°C	+130	+130	+130
ambient temperature				
min.	°C	-40	-40	-40
max.	°C	+130	+130	+130
temperature compensation		x	x	x

Shear wave transducers (IP68)

technical type		CDG1LI8	CDK1LI8	CDM2LI8
transducer frequency	MHz	0.2	0.5	1
inner pipe diameter d				
min. extended	mm	400	100	50
min. recommended	mm	500	200	100
max. recommended	mm	4000	2000	1000
max. extended	mm	6500	2400	1200
pipe wall thickness				
min.	mm	11	5	2.5
material				
housing		PEEK with stainless steel cap 316Ti (1.4571)	PEEK with stainless steel cap 316Ti (1.4571)	PEEK with stainless steel cap 316Ti (1.4571)
contact surface		PEEK	PEEK	PEEK
degree of protection		IP68[1]	IP68[1]	IP68[1]
transducer cable				
type		2550	2550	2550
length	m	12	12	12
dimensions				
length l	mm	130	130	72
width b	mm	54	54	32
height h	mm	83.5	83.5	46
dimensional drawing				
weight (without cable)	kg	0.43	0.43	0.085
pipe surface temperature				
min.	°C	-40	-40	-40
max.	°C	+100	+100	+100
ambient temperature				
min.	°C	-40	-40	-40
max.	°C	+100	+100	+100
temperature compensation		x	x	x

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

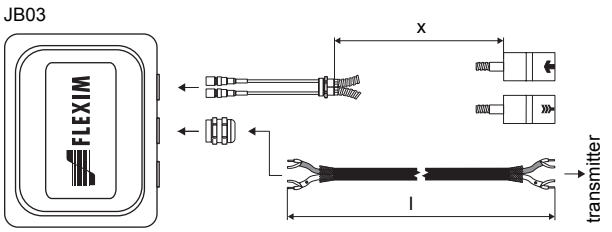
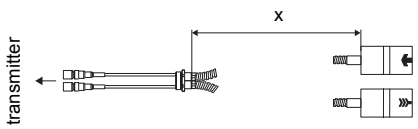
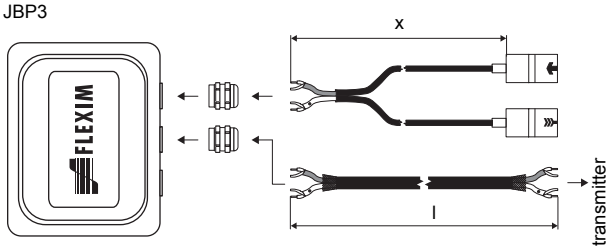
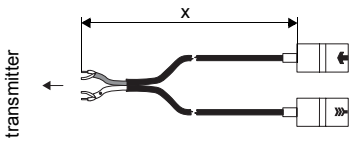
Transducer mounting fixture

Variofix L (VLK, VLM) 	material: 316Ti (1.4571), 316L (1.4404), 17-7PH (1.4568) inner length: **VLK**: 348 mm, option IP68: 368 mm **VLM**: 234 mm dimensions: **VLK**: 423 x 90 x 93 mm option IP68: 443 x 94 x 105 mm **VLM**: 309 x 57 x 63 mm
Variofix C (VCK, VCM) 	material: 316Ti (1.4571) inner length: **VCK-*S**: 350 mm **VCM**: 400 mm dimensions: **VCK-*S** (*****52): 410 x 122 x 102 mm, **VCK-*S** (****LI8): 410 x 126 x 120 mm **VCM**: 460 x 96 x 80 mm

Coupling materials for transducers

type	**ambient temperature** °C
coupling foil type VT	-10...+200

Connection systems

connection system TS		
connection with extension cable	direct connection	transducers technical type
JB03 		*****52
JBP3 		****LI*

Cable

transducer cable			
type		**1699**	**2550**
weight	kg/m	0.094	0.035
ambient temperature	°C	-55...+200	-40...+100
properties			longitudinal watertight
cable jacket			
material		PTFE	PUR
outer diameter	mm	2.9	5.2 ±0.2
thickness	mm	0.3	0.9
colour		brown	grey
shield		x	x
sheath			
material		stainless steel 316Ti (1.4571)	-
outer diameter	mm	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	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

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
*D***5*	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40
****LI*	m	12	≤ 300	12	≤ 300	-	-	-	-

x - transducer cable length

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

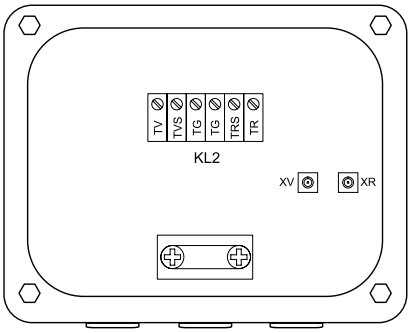
Junction box

Technical data

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

Connection



Transducers

	terminal	connection	transducer
	XV	SMB connector	
	XR	SMB connector	

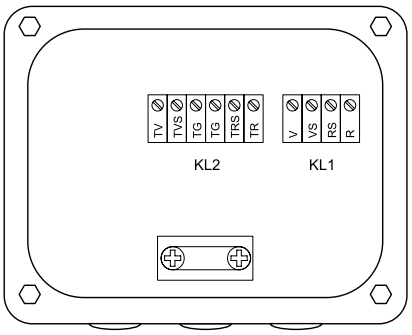
Extension cable

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

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

Connection



Transducers

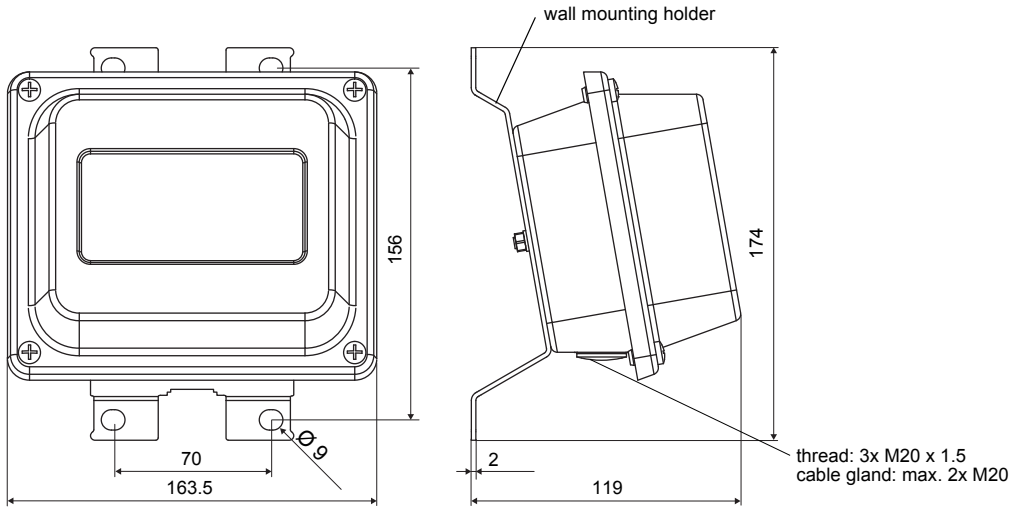
terminal strip	terminal	connection	transducer
KL1	V	signal	
	VS	internal shield	
	RS	internal shield	
	R	signal	

Extension cable

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

Dimensions

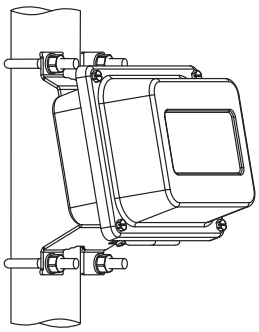
JB0*, JBP*



in mm

2" pipe mounting kit

JB**



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2019-05-01, TSFLUXUS_WDV2-3EN_Leu