Permanent ultrasonic flow meter

FLUXUS® WD

Non-invasive Water Flow and Temperature Monitoring

Outstanding low flow accuracy down to 0.01 m/s

Temperature measurement accuracy of ±0.2 K

Minimal installation costs and zero pipe interference

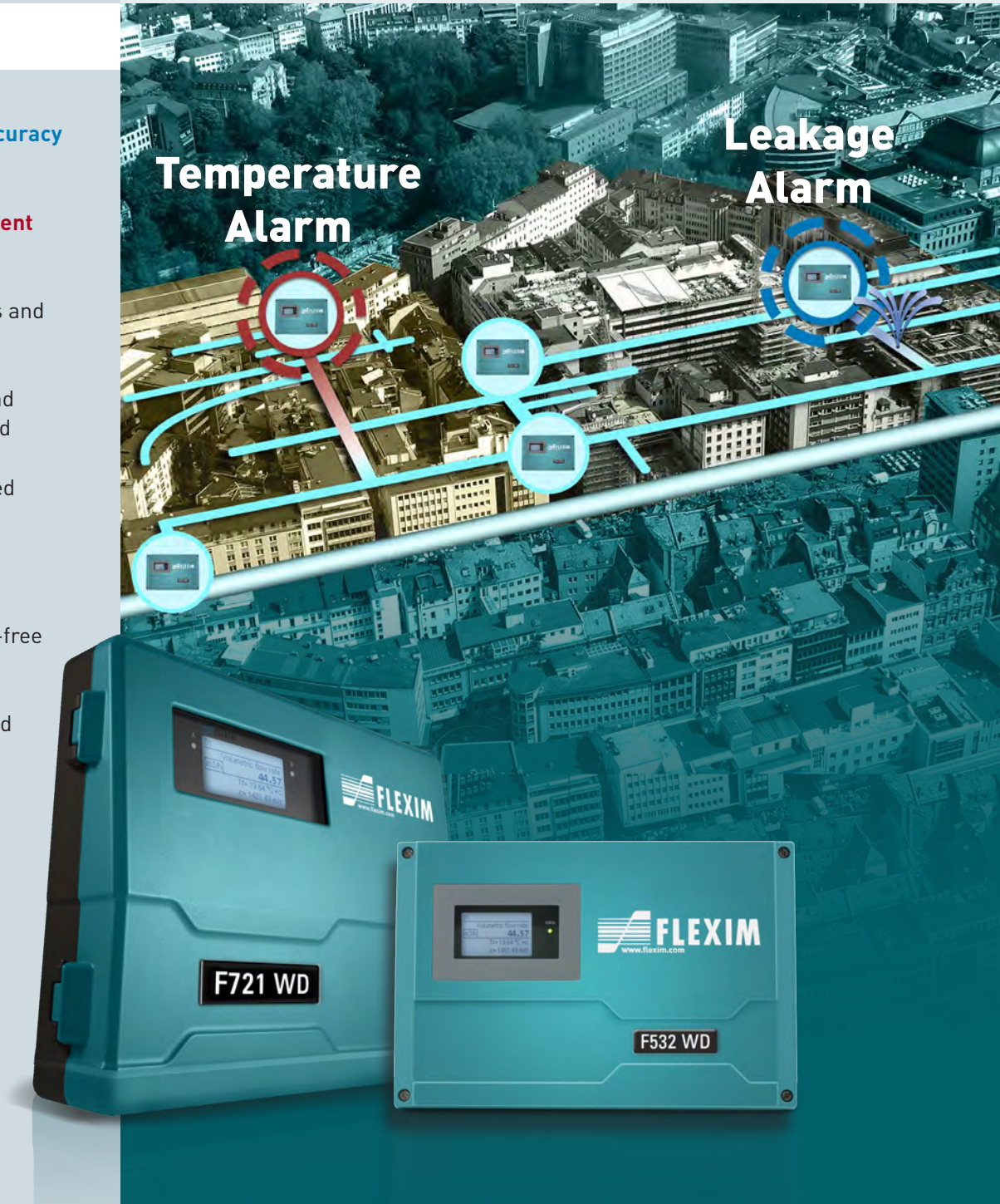
Permanently drift-free and no zero calibration needed

Temperature compensated transducers

IP68 transducers

Permanent maintenance-free coupling pads

Transducers can be buried (no chamber required)



FLEXIM
when measuring matters

Drift-free flow measurement

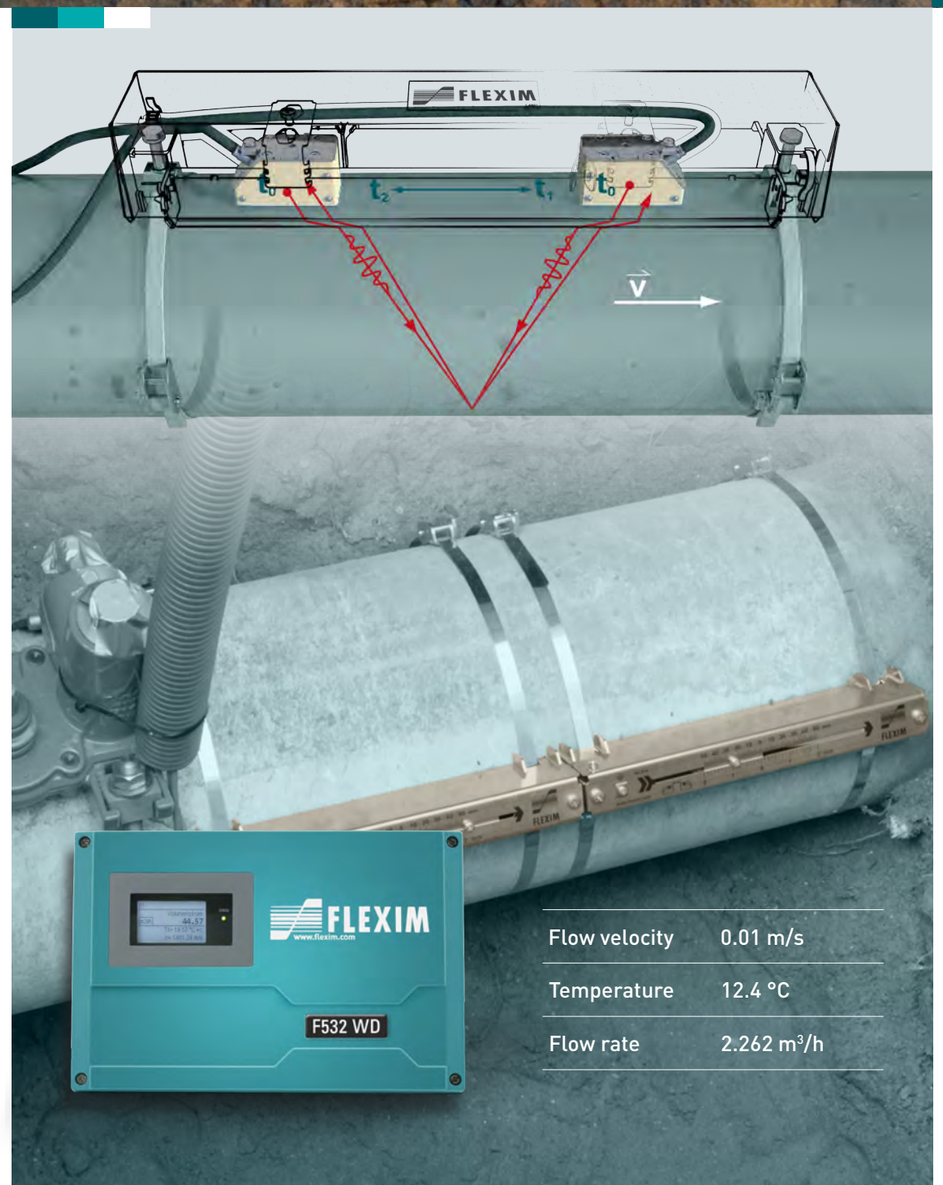
There is no method of zero drift correction for our instruments – because they just don't drift. This also applies to the WD Series that is **installed without zero calibration** and **remains drift-free, permanently.** FLEXIM is the only company that accomplishes this, thanks to its unique combination of matched piezo-transducers and advanced factory calibration.

Outstanding low flow accuracy

The WD Series belongs to the most reliable and accurate ultrasonic clamp-on systems. Furthermore, it **measures flow rates as low as 0.01 m/s.** The inaccuracy of other meter technologies can increase so dramatically in the low flow range, that they are unsuitable for monitoring minimum night flows. But for water suppliers the **precise monitoring of minimum night flows** is an essential part of their leakage detection activities – and the WD Series is the ideal tool for this task.

Non-invasive temperature measurement

Bacterial growth increases in drinking water networks with increasing temperatures. Especially in parts of the network where flow velocities are low, leading to longer residence times, higher water temperatures represent a hygienic risk. The **technology leader FLEXIM** is the first to offer a precise **non-invasive temperature measurement** based on ultrasound technology. Now water suppliers can monitor volume flow, velocity, and temperature with one device.



Low installation costs

When creating a new flow measurement point the main costs are not incurred by the instrument but by the installation work (supply interruption, pipe cutting, pipe flushing, etc.). These costs are significantly reduced using the **clamp-on technology** of the WD Series that does not require any work that affects the integrity of the pipe. This enables a **very simple and cost-effective** installation of further flow measurement points within an existing water supply network.

Built to last

The WD Series comes with the **most robust mounting system** on the market. The transducers are fixed to the pipe with broad stainless steel straps and secured in robust stainless steel housings. The transducers themselves have **IP68 protection** and reinforced transducer cables. They are connected to the pipe with **permanent coupling pads, instead of coupling gel** that can deteriorate or be washed away. All this ensures the durability of the system and makes it **suitable for both installations in chambers and buried installations.**

Works on difficult pipes

The WD Series is available with different transducer types and is suitable for inner diameters ranging from 25 ... 6500 mm. The strong signal output and noise suppression technology make it possible to **use the WD Series on all pipe materials,** even on such challenging ones as fiber-reinforced plastic (FRP) pipes. The **outstanding performance** of FLEXIM is shown by thousands of references worldwide. Contact your local FLEXIM support office for more details.

FLEXIM

More than 30 years of experience

Advanced Meter Verification
Advanced Meter Verification (AMV) allows you to check the health of your FLUXUS® flowmeter in depth directly on site without the need of process interruption.

Technical Data

	F721 WD	F532 WD
Number of measuring channels	1 or 2	1
Transducer for pipe sizes range	50...6500 mm	25 ... 2000 mm
Volumetric flow rate uncertainty	±1% v. MW ±0,005 m/s	
Volumetric flow rate repeatability	0,15% v. MW ±0,005 m/s	
Temperature reading uncertainty	±0,2 K (fluid temperature 0 °C ... 30 °C)	
Power supply	100 ... 230 VAC or 20 ...32 VDC or 11 ... 16 VDC	90 ... 250 VAC or 11 ... 32 VDC
Transducer degree of protection	IP68 or IP67	
Transducer for temperature range	-40 °C ... 130 °C	
Outputs	4 - 20 mA aktive / passive 4 - 20 mA HART aktive / passive pulse / binary	
Digital communication	Modbus RTU/TCP, BACnet MSTP/IP M-Bus, Profibus PA, Foundation Fieldbus	Modbus RTU/TCP, BACnet MSTP/IP M-Bus

For more detailed Information please download the Technical Specifications here: www.flexim.com.

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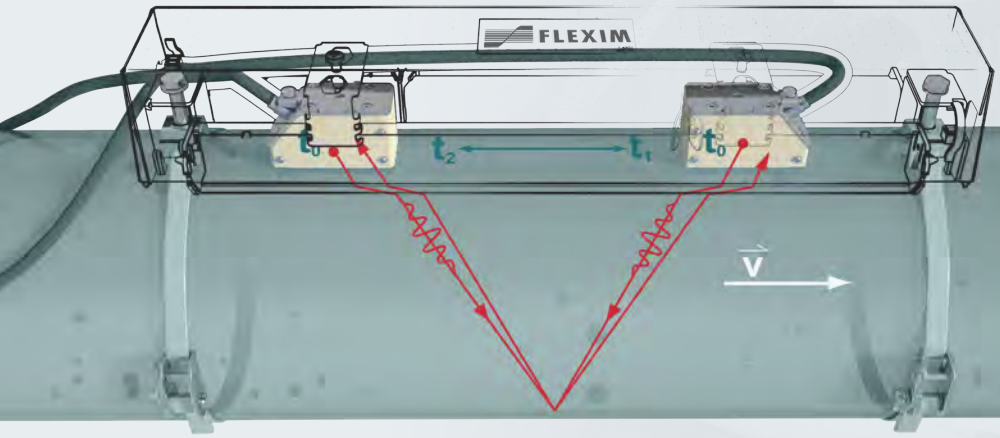
FLUXUS® WD – Significant cost and time saving with buried transducer installations

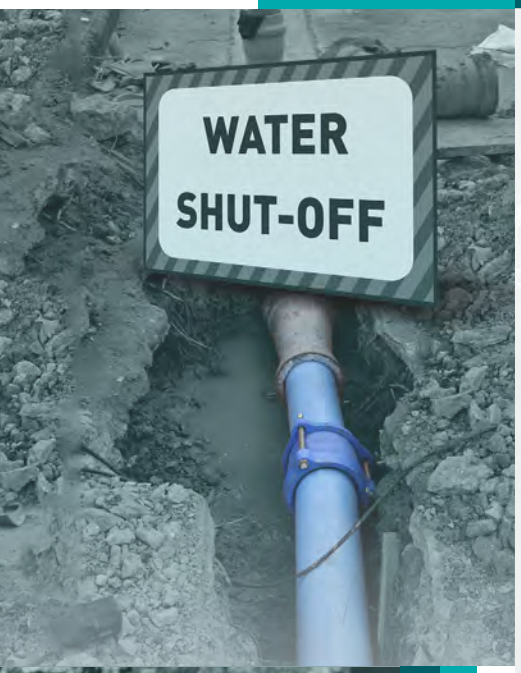
Permanent ultrasonic water flow meter

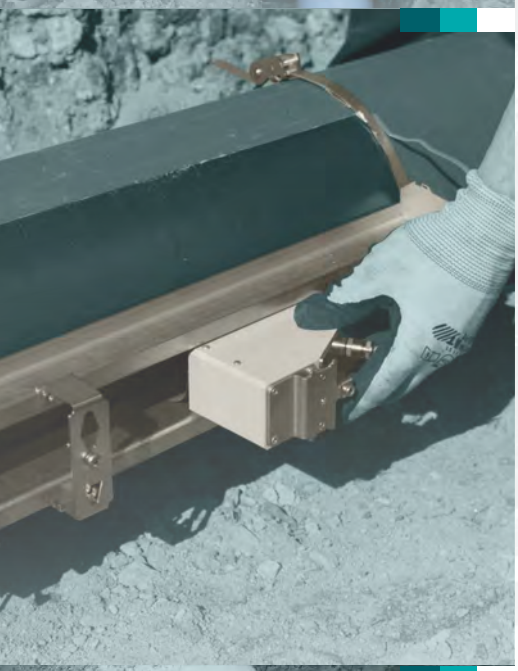
Reducing the overall costs of new flow measurement points

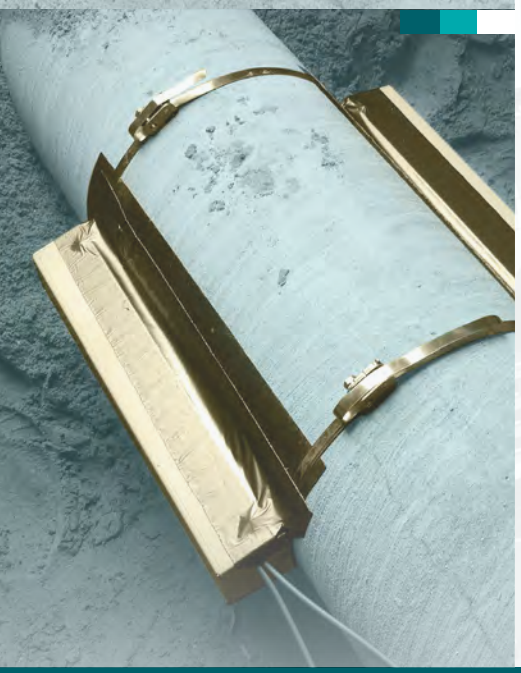
- No supply interruption, pipe cutting, or flushing required
- All earth and road works achievable in one day
- Less bureaucratic work and fewer permissions required
- Significant overall cost and time saving
- No zero calibration needed and no zero drift
- Extremely accurate technology that measures flow rates as low as 0.01 m/s
- For detailed technical information on the FLUXUS® WD series see the product brochure (www.flexim.com)

The FLUXUS® WD is FLEXIM's state-of-the-art ultrasonic flow measurement device for buried transducer installations. It combines absolute durability and robustness of instrumentation with outstanding accuracy and reliability of data. The easy installation process without supply interruption and only minimal excavation work results in significant cost and time savings.









Installation without supply interruption

FLUXUS® WD is installed without the necessity of supply interruption. Suppliers never want to interrupt their system and they have many good reasons for this. A supply interruption can have a range of negative effects. Municipalities are committed to inform everyone whose supply will be cut, which is time-consuming and costly. Furthermore, supply interruptions are a cause of annoyance for residents. Industrial sites might even need an alternative water supply solution, because stopping their processes would result in considerable financial damage.

With the FLUXUS® WD the costs and problems caused by a supply interruption are avoided, as the instrument employs clamp-on transducers and its advanced technology eliminates the need of zero calibration (see FLUXUS® WD brochure for details).

Less earth and road work costs

When creating a new flow measurement point within a water network the main costs are not incurred by the instrument, but by the earth and road work. In order to have enough space to install a magnetic or mechanical flow meter a relatively large excavation has to take place. Thereafter several people and mechanical lifting equipment are required to install the meter. This is a time-consuming task during which parts of the street often have to be blocked. Within cities this can cause severe traffic disruption and therefore permissions are required in advance.

The earth and road works necessary for a buried installation of the FLUXUS® WD transducers are minimal and can usually be completed in one day. This considerably reduces earth and road work costs and minimizes traffic disruption. Furthermore, the installation itself is done single-handedly and no mechanical lifting equipment is needed.

Reliable and accurate data

The FLUXUS® WD Series is capable of measuring flow rates as low as 0.01 m/s, which allows for accurate monitoring of minimum night flows. A further major advantage of the FLUXUS® WD series is that it does not suffer from any measurement drift, so that you can always rely on your data. As FLEXIM supplies the instrument with extensively tested IP68 transducers and the most robust mounting system on the market, you can be assured that there will be no maintenance required after installation. For more technical details please see the product brochure of the FLUXUS® WD series.

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FLUXUS® WD

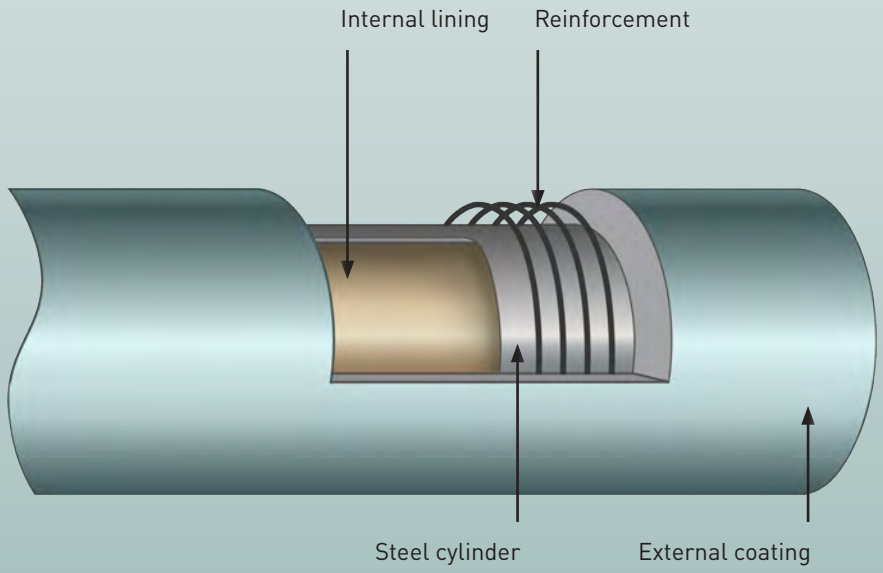
Monitoring flow in Prestressed Concrete Cylinder Pipes (PCCP)

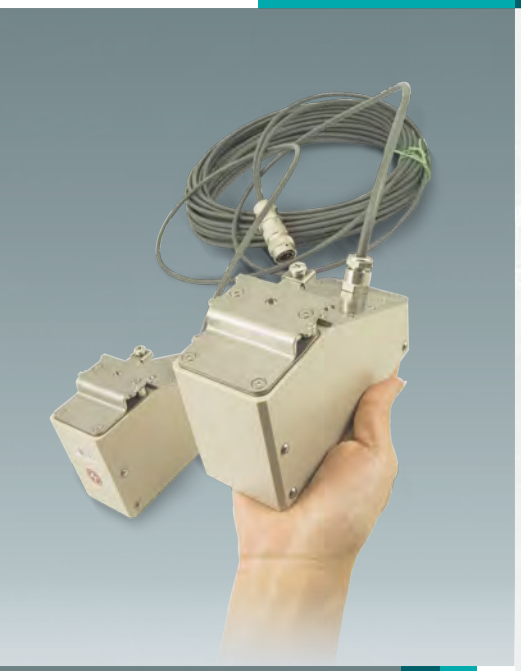
Permanent ultrasonic water flow meter

Extremely powerful ultrasonic transducers for accurate and cost-efficient flow monitoring of PCCP

- No invasive pipe work or supply interruption
- Extremely powerful transducers
- Suitable for higher gas or solid contents
- For detailed technical information on the FLUXUS® WD Series see the product brochure (www.flexim.com)

For monitoring flow in Prestressed Concrete Cylinder Pipes FLEXIM offers two product Series, the FLUXUS® WD for clean water and the for sewage water. These high-performance clamp-on ultrasonic flow meters are capable of penetrating the walls of the most difficult pipes, such as PCCP, and delivering accurate flow data. The non-intrusive technology of FLEXIM is a great advantage for the operator, as there are no negative effects on the integrity of the pipe when installing the flow meter. Other technologies, such as insertion flow meters, require holes to be created in the pipe. This process can damage the structural stability of the pipe, especially if one of the prestressed steel wires is severed in the process.





The challenging structure of PCCP

Prestressed Concrete Cylinder Pipes, sometimes referred to as Bonna pipes, are composed of several layers of different material. The core material of these pipes is concrete, followed by a steel cylinder. The next layer consists of prestressed steel wires that create a consistent compressive pressure. These wires are embedded in a mortar coating that represents the outer material of the pipe.

The complex structure and multi-material buildup of PCCP is a challenge for non-intrusive flow measurement technology. But with extremely powerful clamp-on transducers and advanced evaluation algorithms FLEXIM masters this challenge, delivering accurate and drift-free flow measurement data even on the largest Prestressed Concrete Cylinder Pipes.

Our technological solution

Extreme pipes call for extreme transducers. In order to measure the flow in large PCCP with outer diameters of several meters FLEXIM employs its G Series transducers. The power of these low-frequency and high-amplitude transducers is impressive (and so is their size).

They are capable of sending and receiving signals through the many layers of material encountered in pipes such as PCCP, thereby maintaining sufficient signal quality for exact and reliable flow measurements. Ultrasound signals are sent at 1000 times per second and evaluated by a highly sophisticated digital signal processor that calculates time difference based on cross correlation. This ensures excellent noise suppression and results in high accuracy data, even on difficult pipes.

No zero drift and reliable measurement validation

Data from the FLUXUS® WD Series is very reliable, as its transducers remain drift-free. FLEXIM achieves this by analyzing the characteristics of each individual piezo-transducer and thereafter matching the ideal clamp-on transducer pairs. The perfect acoustic match achieved by this process allows the transducers to remain drift-free after initial factory calibration, which is a crucial advantage over other flow measurement technologies. For more technical details please see the product brochure of the FLUXUS® WD Series.

BUWDV2-0EN-IN-2 2022/12 Subject to change without notification

FLUXUS® WD –
Precise monitoring of district metered areas (DMAs)

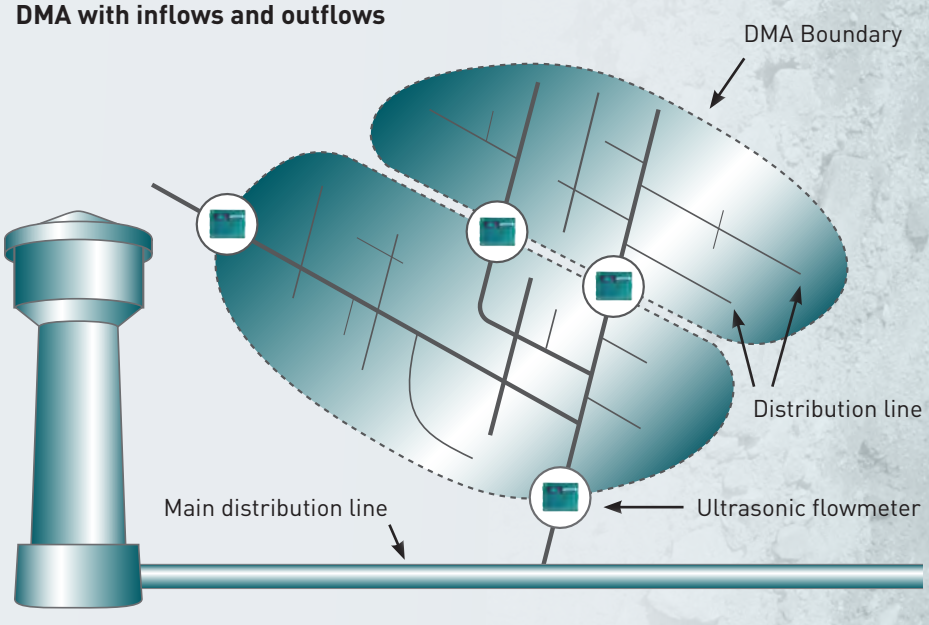
Permanent ultrasonic water flow meter

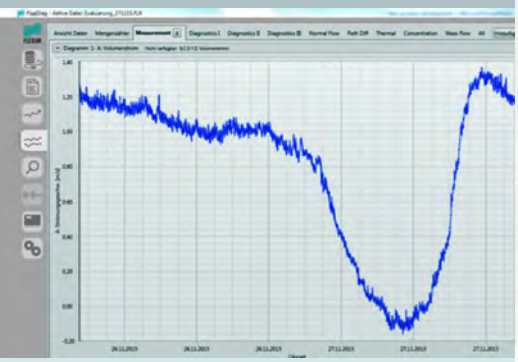
Improving minimum night flow monitoring

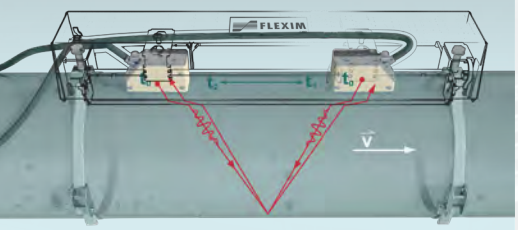
- Ideal for minimum night flow monitoring (down to 0.01 m/s)
- Bidirectional measurements with excellent accuracy and repeatability
- No zero calibration needed and no zero drift
- Fast and very cost-efficient installation procedure
- For detailed technical information on the FLUXUS® WD series see the product brochure (www.flexim.com)

The FLUXUS® WD series is the ideal solution for network monitoring staff, non-revenue water managers, and utilities in general who need more flow measuring points and better low flow accuracy. Creating new district metered areas (DMAs) or reducing their size can be achieved quickly and cost-efficiently with the FLUXUS® WD series, as the installation takes place without supply interruption or pipe work

DMA with inflows and outflows







Monitoring DMA inflows and outflows

Today an increasing amount of utilities are trying to create new DMAs and reduce the size of existing DMAs, allowing them to better monitor their network and, especially, identify districts with changes in consumption. The smaller the DMA is, the more precisely it can be monitored and the more significant the evaluation of measurements such as minimum night flow becomes, which is a key figure for non-revenue water analysis.

But it is often impossible for utilities to separate districts with valves, as this would lead to hydraulic problems in the network (e.g. stagnant water). Furthermore, installing new valves is both expensive and impractical, as it requires supply interruptions and excavation work, which is especially problematic in an urban setting. So instead of installing more valves to physically create new DMAs, many utilities choose to monitor both the inflow and outflow of districts, thereby creating virtual DMAs.

Cost-efficient installation of flow measurement points

The FLUXUS® WD ultrasonic flow meters are the ideal instrument for cost-efficiently creating virtual DMAs, as it is installed without the need for supply interruption or pipe work. When using conventional magnetic or mechanical flow meters the costs of pipe cutting, excavation and road works are usually higher than the instrument costs. This is not the case with ultrasonic flow meters, which can be installed in a shorter time and with less hassle and expense, than with any other flow monitoring technology.

Extremely accurate bidirectional low flow measurements

Flow velocities during the night can become very low. The introduction of water-saving equipment and an increased public desire to save resources has further reduced the amount of water consumed. This often leads to situations where the minimum night flow drops below 0.1 m/s. In some cases during the night, due to changes of the pressure situation within the network, the flow direction is even reversed.

The minimum measurable flow rate of many common technologies is about 0.3 m/s, which often makes them unsuitable for minimum night flow monitoring. For the FLUXUS® WD such low flows are no problem, as it measures flow velocities down to 0.01 m/s. Together with its excellent repeatability, bidirectional flow measurement capability and very large turndown this makes the FLUXUS® WD series perfectly suited for the precise monitoring of DMAs and for non-revenue water analysis.

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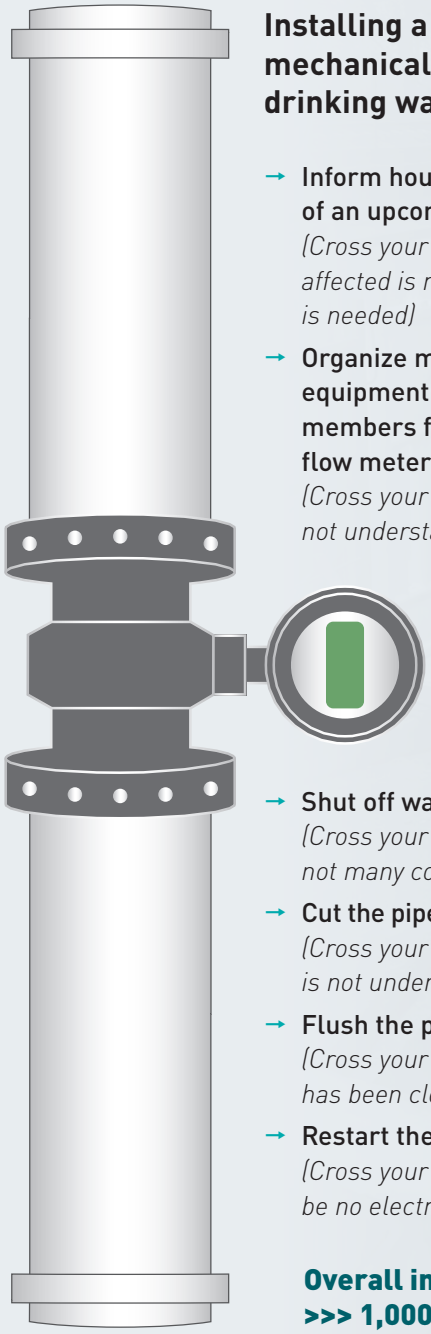
FLUXUS® WD –
The efficient flow monitoring solution

Permanent ultrasonic water flow meter

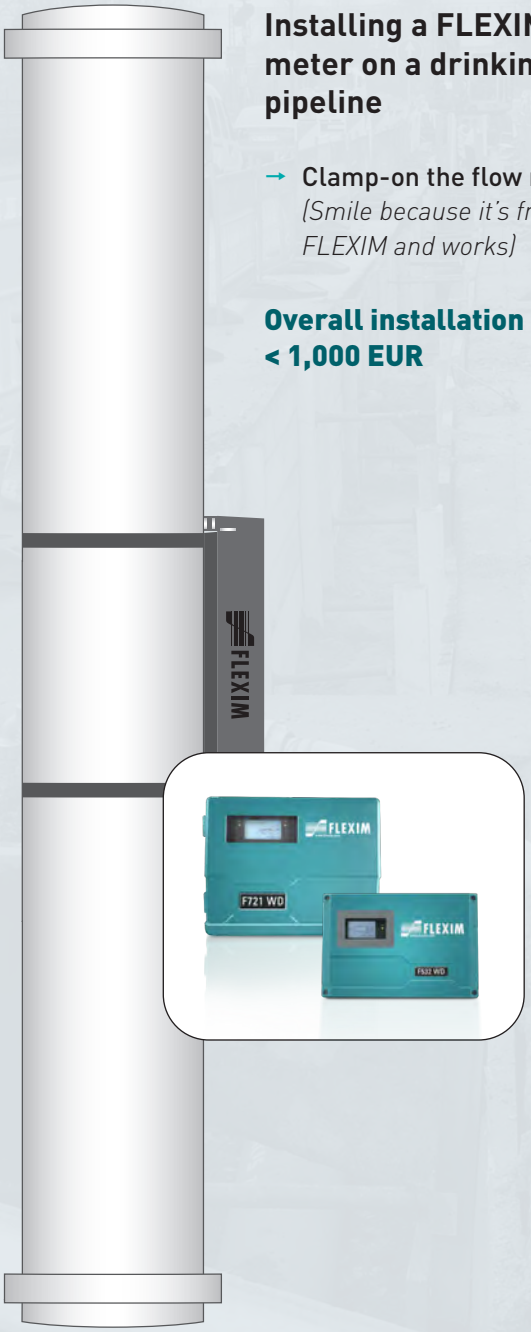
Installation process:
Magnetic or mechanical flow meter vs. FLUXUS® WD



Installing a magnetic or mechanical flow meter on a drinking water pipeline

- → Inform households and companies of an upcoming water shut-off
  (Cross your fingers that the area affected is not too big or a bypass is needed)
- → Organize mechanical lifting equipment and several staff members for handling the heavy flow meter
  (Cross your fingers that you are not understaffed)
- → Shut off water supply
  (Cross your fingers that there are not many complaints)
- → Cut the pipe and install the flow meter
  (Cross your fingers that the pipe is not under tension)
- → Flush the pipe
  (Cross your fingers that the pipe has been cleaned successfully)
- → Restart the water supply
  (Cross your fingers that there will be no electrode fouling)

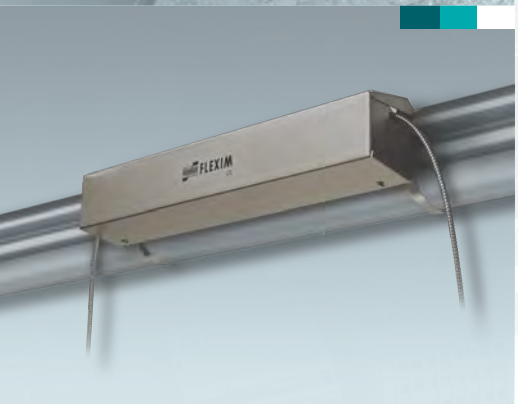
Overall installation costs:
>>> 1,000 EUR



Installing a FLEXIM flow meter on a drinking water pipeline

- → Clamp-on the flow meter
  (Smile because it's from FLEXIM and works)

Overall installation costs:
< 1,000 EUR



The cumbersome process of installing conventional flow meters

For the installation of a magnetic or mechanical flow meter the water supply has to be interrupted. This cannot be done without informing affected customers in advance, which consumes both time and money. But even if customers are informed beforehand shutting of the water supply remains an annoyance for them and reduces customer satisfaction. In some cases a supply interruption will not be acceptable, for example if a hospital or an industrial complex is located within the shut-off area. Then it will be necessary for the water supplier to ensure an alternative water supply, e.g. by creating a temporary bypass. This leads to further considerable costs.

Due to the weight of conventional flow meters it is necessary to have lifting equipment and several staff members during the installation. Special tools and trained personnel are also required for cutting the pipe. Finally, the pipe needs to be flushed, because dirt and pipe material can have entered the pipe during the installation process. All this results in high personnel and equipment costs associated with the installation.

The efficiency of installing a FLEXIM flow meter

The clamp-on ultrasound flow meters of the WD Series are installed without supply interruption, just like every other FLEXIM flow meter. There is no interference with the pipe during the installation process, no lifting or cutting tools are required, and the installation can be done single-handedly.

The overall installation costs of a FLEXIM flow meter are therefore only a fraction of the installation costs of a conventional flow meter. Once the FLEXIM meter is installed it remains permanently drift-free and keeps delivering excellent measurement results, thanks to its outstanding engineering and highly advanced signal evaluation algorithms. For more technical details please see the product brochure of the FLUXUS® WD.

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Technical specification

FLUXUS F532WD

Permanently installed clamp-on measuring system for water and wastewater pipes

Features

- Highly accurate non-invasive flow and temperature 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 and temperature measurement on buried water and wastewater pipes
- Flow and temperature measurement on water and wastewater pipes which can be overflowed

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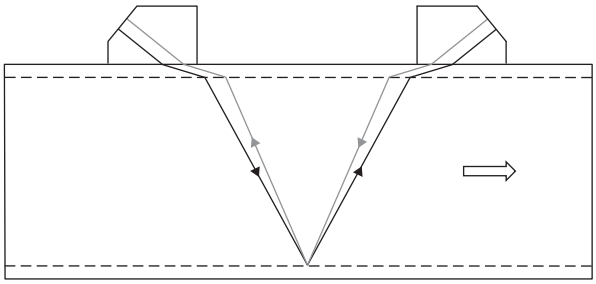
Function

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.

Path of the ultrasonic signal in the flowing fluid



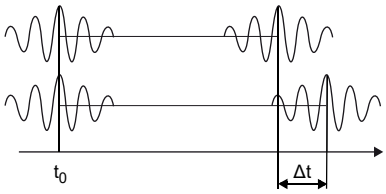
Transit time difference principle

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 automatically toggles between the TransitTime and the NoiseTrek mode without having to change the measuring 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 mechanic calibration factor
- A - cross-sectional pipe area
- k_a - acoustic calibration factor
- Δt - transit time difference
- t_γ - average of transit times in the fluid

Calculation of sound speed and fluid temperature

The fluid sound speed can be determined from the transit times in the fluid and the geometry of the measuring point. The sound speed is fluid specific and temperature dependent. This curve is stored in the fluid data set for water. Thus, the fluid temperature can be determined from the sound speed.

Number of sound paths

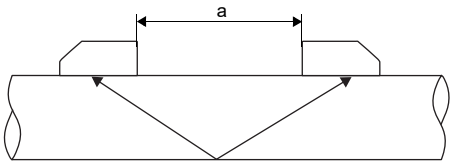
The number of sound paths is the number of transits of the ultrasonic signal through the fluid in the pipe. Depending on the number of sound paths, the following methods of installation exist:

- **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 case of high signal attenuation by the fluid or pipe, diagonal arrangement with 1 sound path is used.

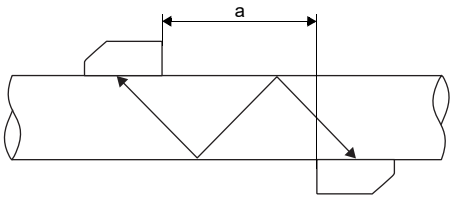
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

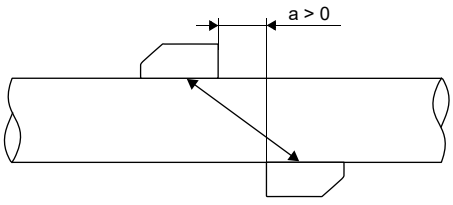
Reflection arrangement, number of sound paths: 2



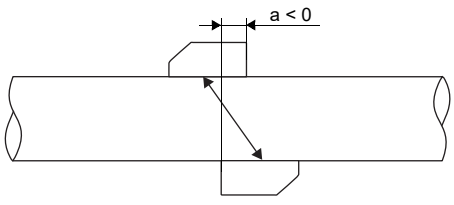
Diagonal arrangement, number of sound paths: 3



Diagonal arrangement, number of sound paths: 1



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



a - transducer distance

Transmitter

Technical data

		FLUXUS F532WD (analog outputs)	FLUXUS F532WD (process interface)
			
design		field device with 1 measuring channel	
application		flow measurement at water pipes	
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 % MV ±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 the measuring system[1]		±0.3 % MV ±0.005 m/s	
measurement uncertainty at the measuring point[2]		±1 % MV ±0.005 m/s	
measurement uncertainty (temperature from sound speed)			
measurement uncertainty at the measuring point[2]		±0.2 K (fluid temperature: 0...30 °C, inner pipe diameter: min. 200 mm)	
transmitter			
power supply		• 90...250 V/50...60 Hz or • 11...32 V DC	
power consumption	W	< 10	
number of measuring channels		1	
damping	s	0...100 (adjustable)	
measuring cycle	Hz	100...1000	
response time	s	1	
housing material		aluminum, powder coated	
degree of protection		IP66	
dimensions	mm	see dimensional drawing	
weight	kg	2.25	
fixation		wall mounting, optional: 2" pipe mounting	
ambient temperature	°C	-20...+60	
display		128 x 64 pixels, backlight	
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian, Chinese	
measuring functions			
physical quantities		volumetric flow rate, mass flow rate, flow velocity	
totaliser		volume, mass	
diagnostic functions		sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times	
communication interfaces			
service interfaces		measured value transmission, parametrisation of the transmitter: • USB • LAN	measured value transmission, parametrisation of the transmitter: • USB • LAN
process interfaces		-	max. 1 option: • Modbus RTU • BACnet MS/TP • M-Bus • HART • Modbus TCP • BACnet IP
accessories			
data transmission kit		USB cable	
software		• FluxDiagReader: reading of measured values and parameters, graphical representation • FluxDiag (optional): reading of measurement data, graphical representation, report generation, parametrisation of the transmitter	
data logger			
loggable values		all physical quantities and totalised physical quantities	
capacity		max. 800 000 measured values	

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

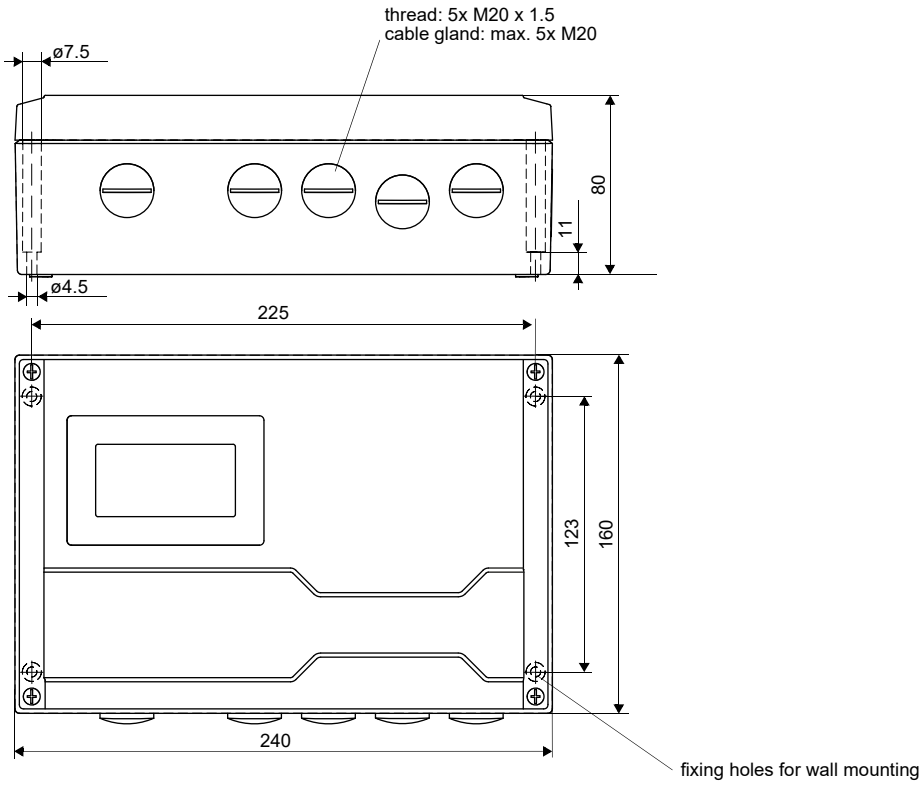
		FLUXUS F532WD (analog outputs)	FLUXUS F532WD (process interface)
outputs			
		The outputs are galvanically isolated from the transmitter.	
• switchable current output			
		configurable according to NAMUR NE43 All switchable current outputs are jointly switched to active or passive.	
number		1, optional: 2	optional: 1 (HART)
range	mA	4...20 (3.2...24)	4...20 (3.2...24)
accuracy		0.04 % MV ±3 µA	0.04 % MV ±3 µA
active output		R_{ext} < 530 Ω	R_{ext} < 530 Ω
passive output		U_{ext} = 9...30 V, depending on R_{ext} (R_{ext} < 458 Ω at 20 V)	U_{ext} = 9...30 V, depending on R_{ext} (R_{ext} < 458 Ω at 20 V)
current output in HART mode			
• range	mA	-	4...20 (3.5...22)
• active output		-	R_{ext} = 250...530 Ω
• passive output		-	U_{ext} = 9...30 V DC
• digital output			
number		2, optional: 4	-
functions		• frequency output • binary output • pulse output	-
operating parameters		U_{ext} = (8.2 ±0.1) V DC	-
frequency output			
• range	kHz	0...10	-
binary output			
• binary output as alarm output		limit, change of flow direction or error	-
pulse output			
• pulse value	units	0.01...1000	-
• pulse width	ms	0.05...1000	-

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

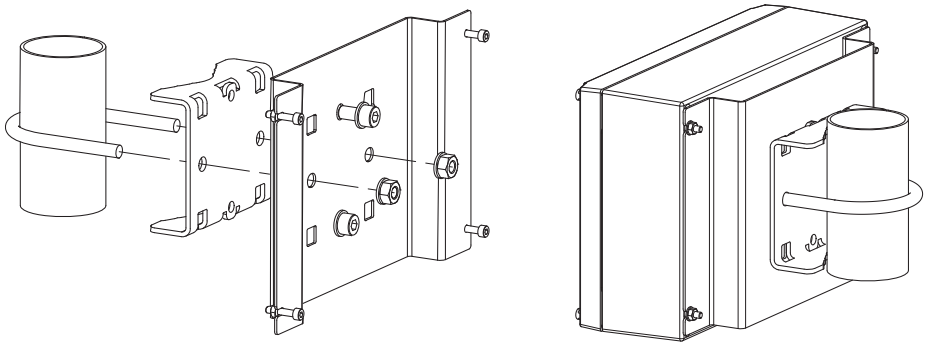
Dimensions

***532**



in mm

2" pipe mounting kit (optional)

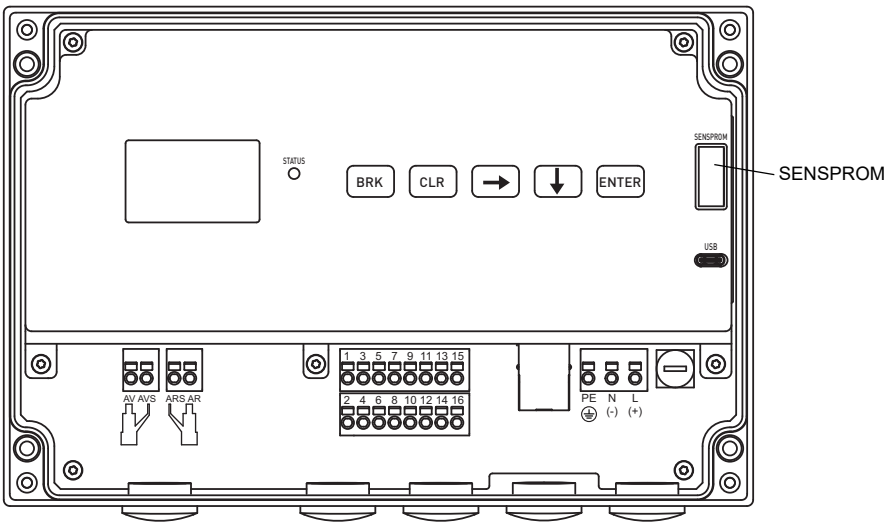
***532** 	order code: ACC-PE-*532-/PMK4

Storage

- do not store outdoors
- store within the original package
- store in a dry and dust-free place
- protect against sunlight
- keep all openings closed
- storing temperature: -20...+60 °C

Terminal assignment

***532**



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

transducers, extension cable		
terminal	**connection**	**transducer**
AV	signal	
AVS	internal shield	
ARS	internal shield	
AR	signal	
cable gland	external shield	

outputs[1, 2]	
terminal	**connection**
5+, 6- 13+, 14-	passive current output
5-, 6+ 13-, 14+	active current output
1+, 2- 3+, 4- 9+, 10- 11+, 12-	digital output
15+, 16-	passive current output/HART
15-, 16+	active current output/HART

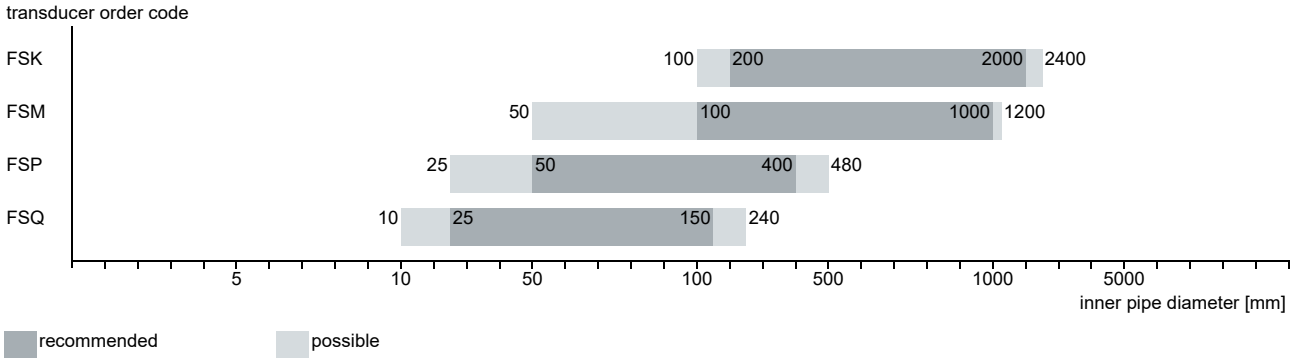
communication interfaces		
terminal	**connection**	**communication interface**
15	signal +	• Modbus RTU[1] • BACnet MS/TP[1] • M-Bus[1]
16	signal -	
USB	type C Hi-Speed USB 2.0 Device	service (FluxDiag/FluxDiagReader)
LAN	RJ45 10/100 Mbps Ethernet	• service (FluxDiag/FluxDiagReader) • Profibus PA • FF H1 • Modbus TCP • BACnet IP

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

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

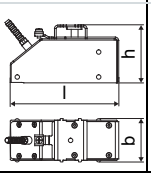
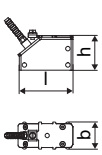
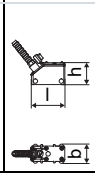
Transducers

Transducer selection

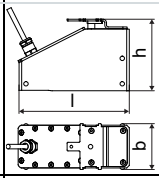
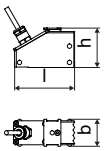


Technical data

Shear wave transducers

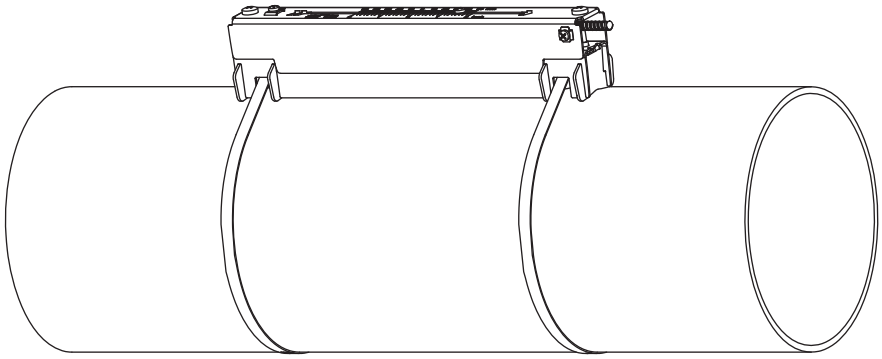
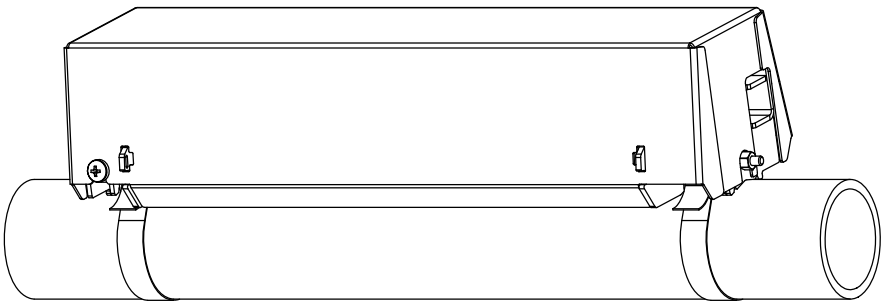
order code		FSK-N**T1	FSM-N**T1	FSP-N**T1	FSQ-N**T1
technical type		CDK1N53	CDM2N53	CDP2N53	CDQ2N53
transducer frequency	MHz	0.5	1	2	4
inner pipe diameter d					
min. extended	mm	100	50	25	10
min. recommended	mm	200	100	50	25
max. recommended	mm	2000	1000	400	150
max. extended	mm	2400	1200	480	240
pipe wall thickness					
min.	mm	5	2.5	1.2	0.6
material					
housing		PEEK with stainless steel cover 316L (1.4404)			
contact surface		PEEK			
degree of protection		IP67			
transducer cable					
type		1699			
length	m	5	4		3
dimensions					
length l	mm	126.5	64		40
width b	mm	51	32		22
height h	mm	67.5	40.5		25.5
dimensional drawing					
weight (without cable)	kg	0.36	0.066		0.016
pipe surface temperature	°C	-40...+130			
ambient temperature	°C	-40...+130			
temperature compensation		x			

Shear wave transducers (IP68)

order code		FSK-N**T1/IP68	FSM-N**T1/IP68	FSP-N**T1/IP68
technical type		CDK1LI8	CDM2LI8	CDP2LI8
transducer frequency	MHz	0.5	1	2
inner pipe diameter d				
min. extended	mm	100	50	25
min. recommended	mm	200	100	50
max. recommended	mm	2000	1000	400
max. extended	mm	2400	1200	480
pipe wall thickness				
min.	mm	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	°C	-40...+100		
ambient temperature	°C	-40...+100		
temperature compensation		x		

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

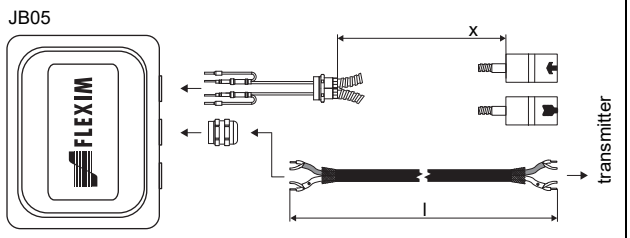
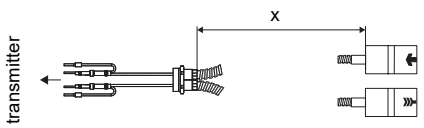
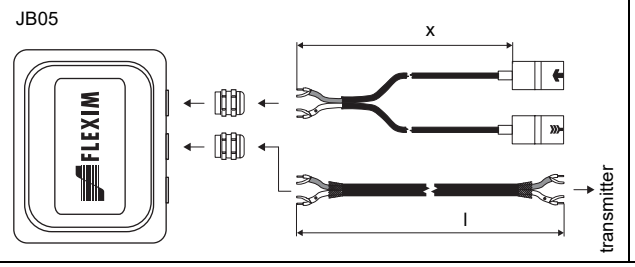
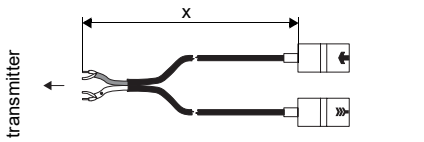
Transducer mounting fixture

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

Coupling materials for transducers

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

Connection systems

connection system T1		
connection with extension cable	direct connection	transducers technical type
		*****53
		****LI*

Cable

transducer cable			
type		**1699**	**2550**
weight	kg/m	0.094	0.035
ambient temperature	°C	-55...+200	-40...+100
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**
order code		ACC-PE- GNNN-/EXEXXXX
weight	kg/m	0.18
ambient temperature	°C	-30...+70
properties		halogen-free fire propagation test according to IEC 60332-1 combustion test according to IEC 60754-2
cable jacket		
material		PUR
outer diameter	mm	12
thickness	mm	2
colour		black
shield		x

XXXX - cable length in m

Cable length

transducer frequency		K		M, P		Q	
transducers technical type		x	l	x	l	x	l
*D***5*	m	5	≤ 300	4	≤ 300	3	≤ 90
****LI*	m	12	≤ 300	12	≤ 300	-	-

x - transducer cable length

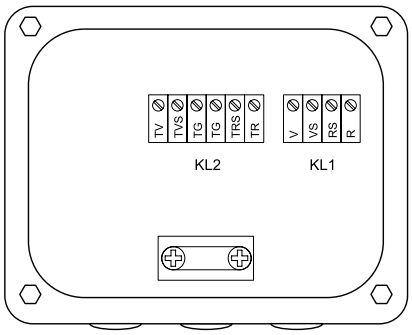
l - max. length of extension cable (depending on the application)

Junction box

Technical data

JB05		
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	°C	-40...+80

Connection



Transducers

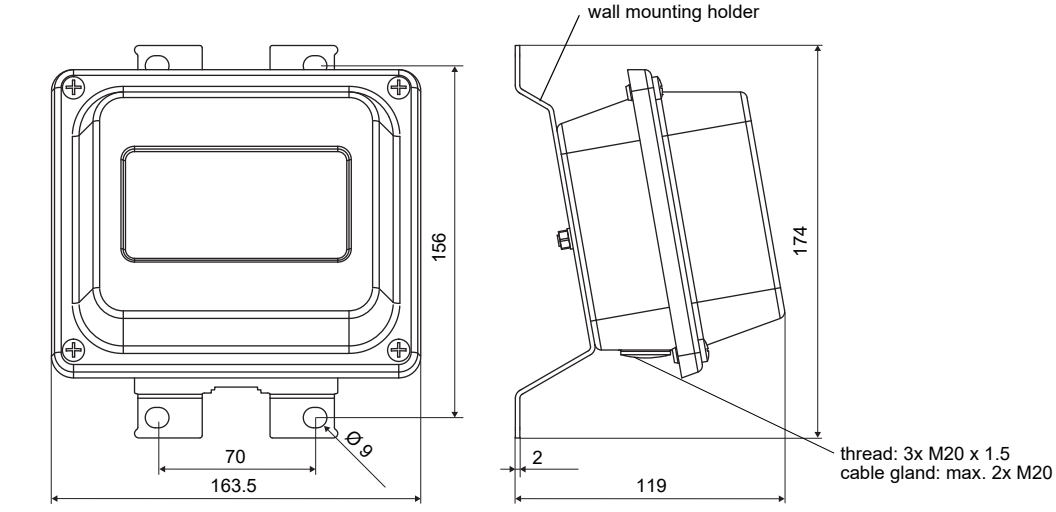
terminal strip	terminal	connection	transducer
KL1	V	signal	
	VS	internal shield	
	RS	internal shield	
	R	signal	

Extension cable

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

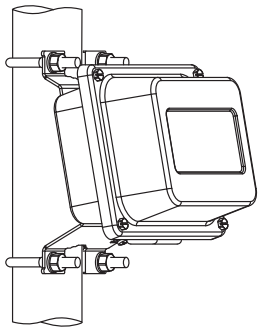
Dimensions

JB0*, JBP*



in mm

2" pipe mounting kit

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

FLEXIM

Technical specification

FLUXUS WD

Non-invasive ultrasonic flow and temperature measurement

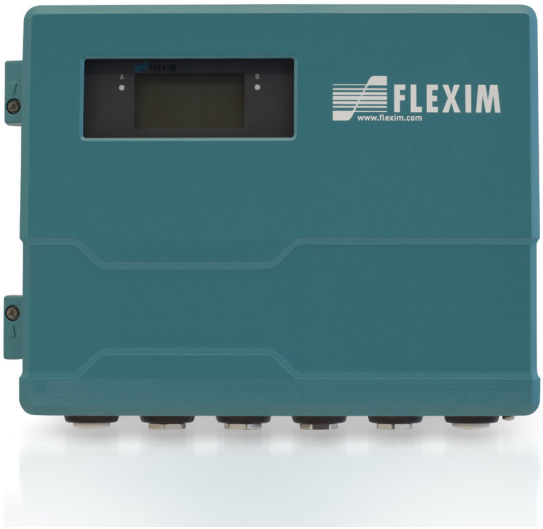
Permanently installed clamp-on measuring system for water and wastewater pipes

Features

- Highly accurate non-invasive flow and temperature 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 and temperature measurement on buried water and wastewater pipes
- Flow and temperature measurement on water and wastewater pipes which can be overflowed



FLUXUS WD

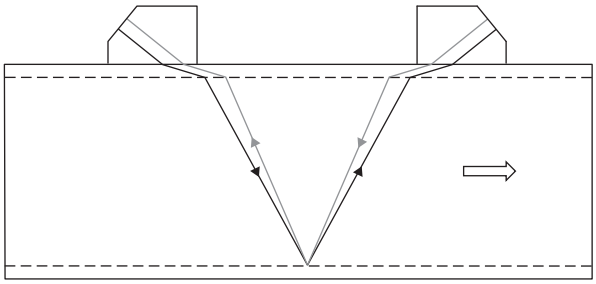
Variofix C

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



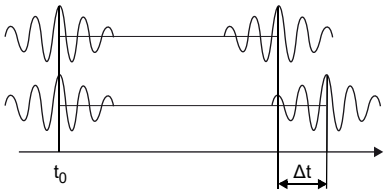
Transit time difference principle

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 automatically toggles between the TransitTime and the NoiseTrek mode without having to change the measuring 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

Calculation of sound speed and fluid temperature

The fluid sound speed can be determined from the transit times in the fluid and the geometry of the measuring point. The sound speed is fluid specific and temperature dependent. This curve is stored in the fluid data set for water. Thus, the fluid temperature can be determined from the sound speed.

Number of sound paths

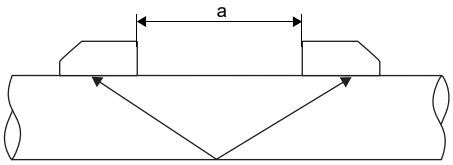
The number of sound paths is the number of transits of the ultrasonic signal through the fluid in the pipe. Depending on the number of sound paths, the following methods of installation exist:

- **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.

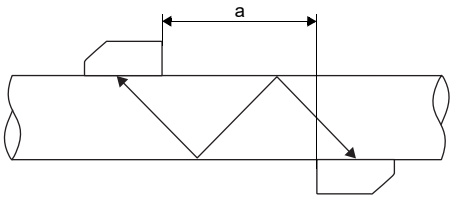
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the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

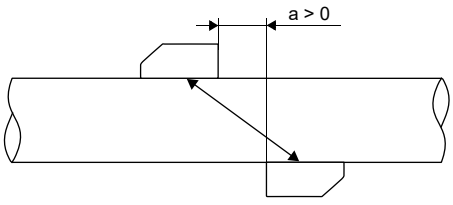
Reflection arrangement, number of sound paths: 2



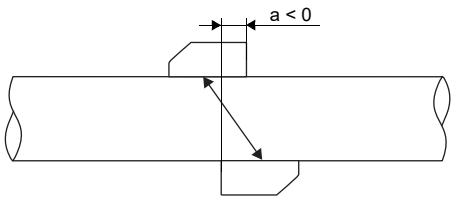
Diagonal arrangement, number of sound paths: 3



Diagonal arrangement, number of sound paths: 1



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



a - transducer distance

Transmitter

Technical data

		FLUXUS WD	FLUXUS WD Extended
		 	
design		standard field device	standard field device with inputs
application		flow measurement on 1 water pipe	flow measurement on 1 or 2 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 % MV ±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 the measuring system[1]		±0.3 % MV ±0.005 m/s	
measurement uncertainty at the measuring point[2]		±1 % MV ±0.005 m/s	
measurement uncertainty (temperature)			
measurement uncertainty at the measuring point[2]		±0.2 K (fluid temperature: 0...30 °C, inner pipe diameter: min. 200 mm)	
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	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 without operation of the display)	
display		128 x 64 pixels, backlight	
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian	
measuring functions			
physical quantities		volumetric flow rate, mass flow rate, flow velocity	
totaliser		volume, mass	
calculation functions		average, difference, sum (2 measuring channels necessary)	
diagnostic functions		sound speed, fluid temperature, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times	
communication interfaces			
service interfaces		measured value transmission, parametrisation of the transmitter: • USB • LAN	
process interfaces		max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • M-Bus • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

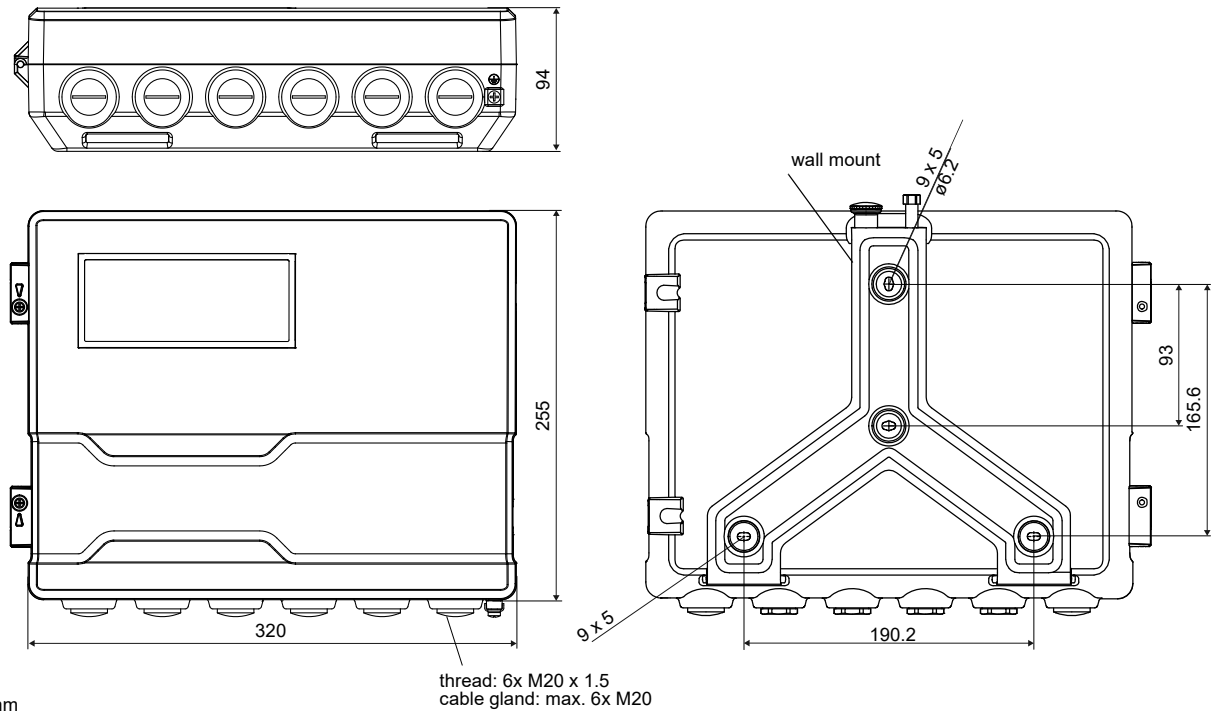
		FLUXUS WD	FLUXUS WD Extended
accessories			
data transmission kit		USB cable	
software		• FluxDiagReader: reading of measured values and parameters, graphical presentation • FluxDiag (optional): reading of measurement data, graphical presentation, report generation, parametrisation of the transmitter	
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		• switchable current output: 2 or (1 and HART) • digital output: 2	• switchable current output: 4 or (2 and HART) • digital output: 3
• switchable current output			
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	
• digital output			
functions		• frequency output • binary output • pulse output	
number		3	
operating parameters		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	
inputs			
		The inputs are galvanically isolated from the transmitter.	
• current input			
number		-	2
accuracy		-	0.1 % MV ±10 µA
active input		-	U_{int} = 24 V, R_{int} = 50 Ω, P_{int} < 0.5 W, not short-circuit proof
• range	mA	-	0...20
passive input		-	R_{int} = 50 Ω, P_{int} < 0.3 W
• range	mA	-	-20...+20

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

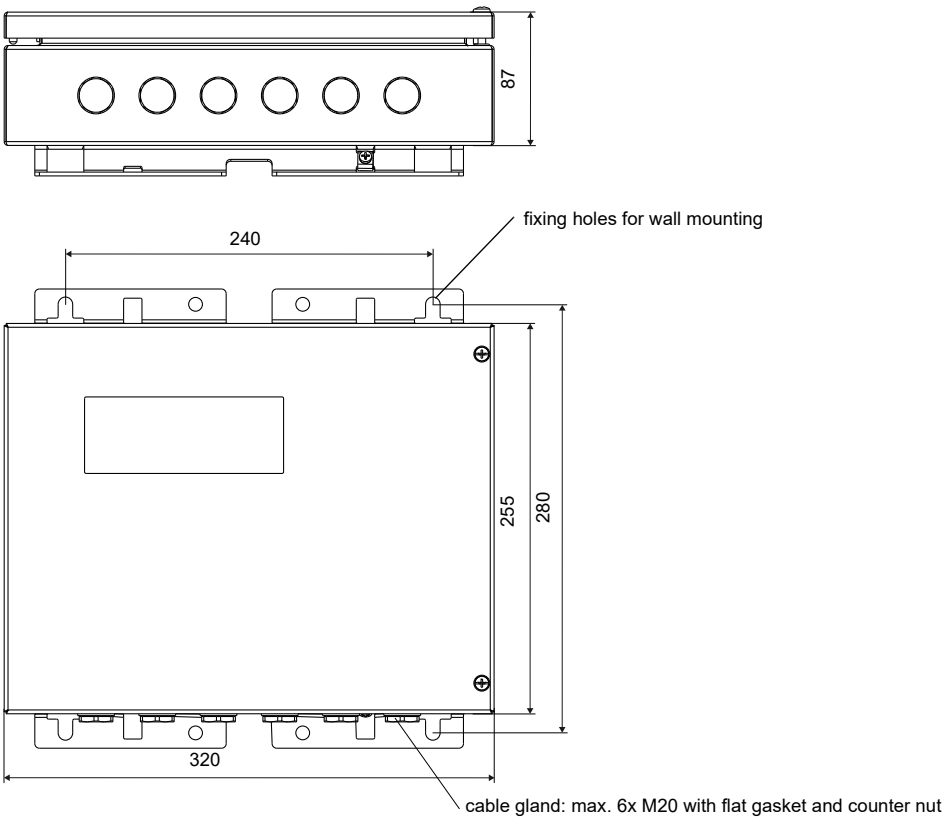
Dimensions

aluminum housing



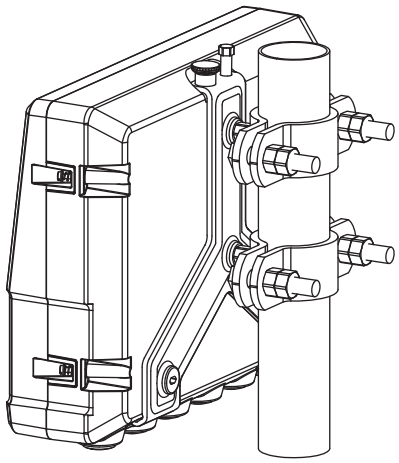
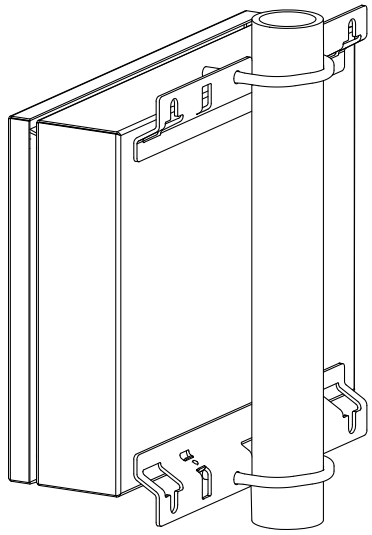
in mm

stainless steel housing

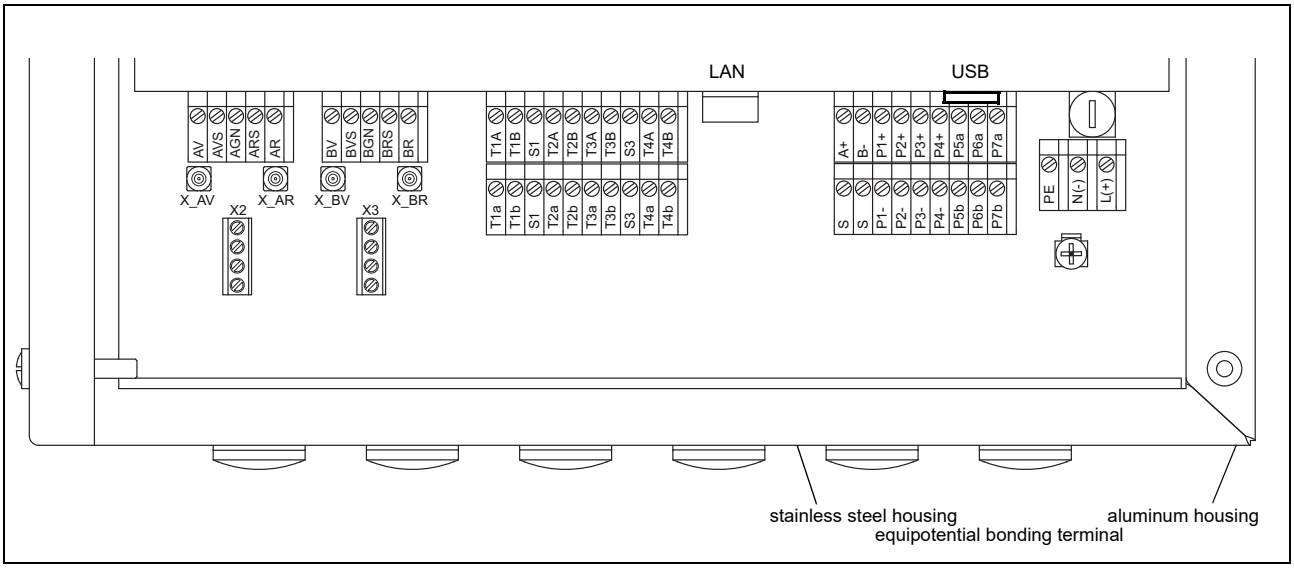


in mm

2" pipe mounting kit

aluminum housing 	order code: ACC-PE-*721-/PMK4
stainless steel housing 	order code: ACC-PE-*721-/PMK6

Terminal assignment



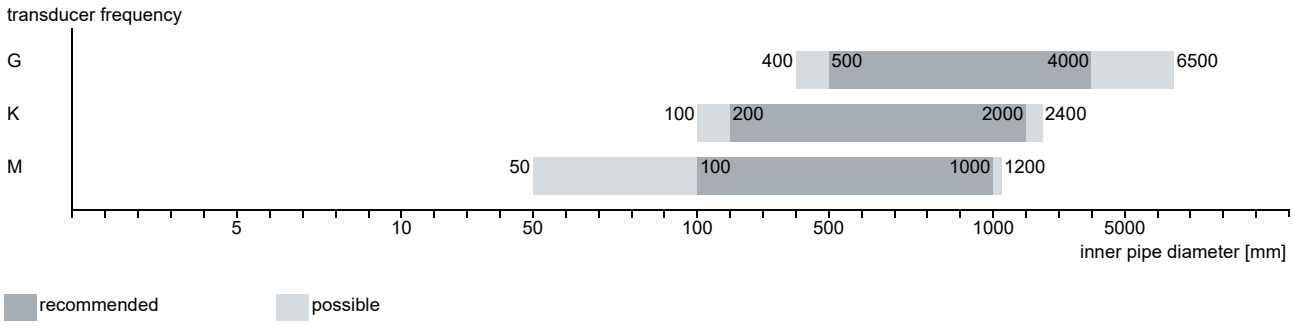
power supply[1]				
terminal		**connection (AC)**		**connection (DC)**
PE		earth		earth
N(-)		neutral		-
L(+)		phase		+
transducers, extension cable				
measuring channel A		**measuring channel B**		**transducer**
terminal	**connection**	**terminal**	**connection**	
AV	signal	BV	signal	
AVS	internal shield	BVS	internal shield	
ARS	internal shield	BRS	internal shield	
AR	signal	BR	signal	

outputs[1]				
terminal	**connection**	**terminal**	**connection**	**communication interface**
P1+...P4+ P1-...P4-	current output, HART (P1)	A+	signal +	• RS485[1] • Modbus RTU[1] • BACnet MS/TP[1] • M-Bus[1] • Profibus PA[1] • FF H1[1]
		B-	signal -	
P5a...P7a P5b...P7b	digital output	S	shield	
		USB	type B Hi-Speed USB 2.0 Device	• service (FluxDiag/ FluxDiagReader)
		LAN	RJ45 10/100 Mbps Ethernet	• service (FluxDiag/ FluxDiagReader) • Modbus TCP • BACnet IP

[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 (stainless steel housing, with ferrite nut): max. 7.6 mm

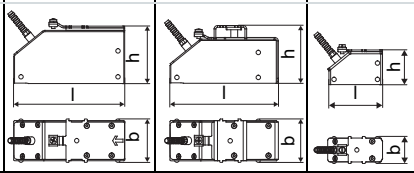
Transducers

Transducer selection

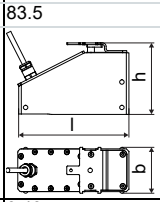
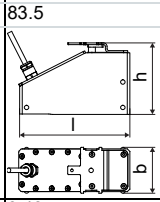
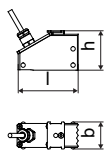


Technical data

Shear wave transducers

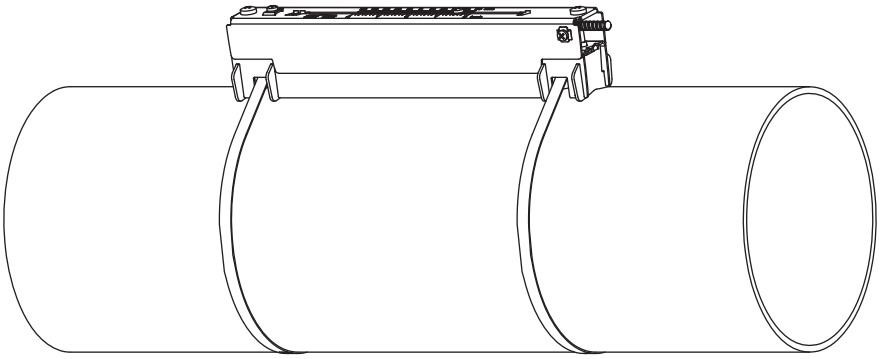
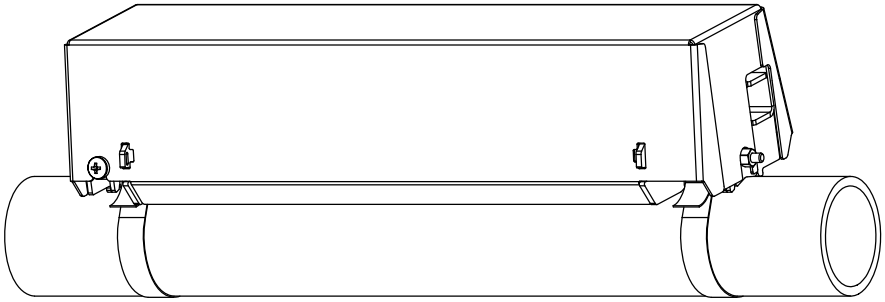
technical type		CDG1N52	CDK1N52	CDM2N52
transducer frequency	MHz	0.2	0.5	1
inner pipe diameter d				
min. extended	mm	400	100	50
min. recommended	mm	500	200	100
max. recommended	mm	4000	2000	1000
max. extended	mm	6500	2400	1200
pipe wall thickness				
min.	mm	11	5	2.5
material				
housing		PEEK with stainless steel cover 316L (1.4404)	PEEK with stainless steel cover 316L (1.4404)	PEEK with stainless steel cover 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 cover 316Ti (1.4571)	PEEK with stainless steel cover 316Ti (1.4571)	PEEK with stainless steel cover 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

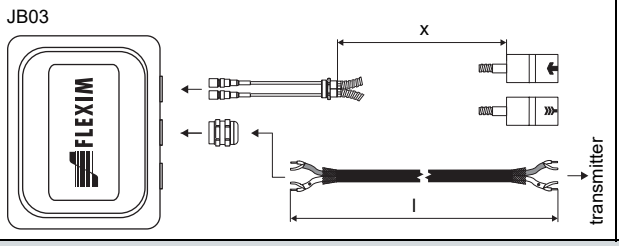
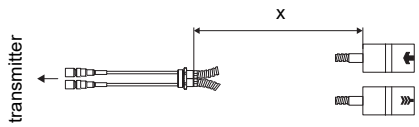
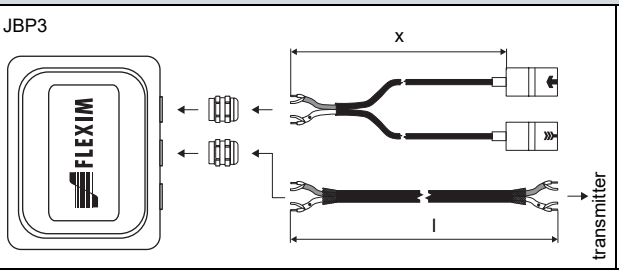
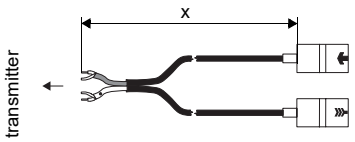
Transducer mounting fixture

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: stainless steel 316Ti (1.4571) inner length: **VCK-*S**: 350 mm **VCM**: 400 mm dimensions: **VCK-*S**: 410 x 126 x 125 mm **VCM**: 460 x 96 x 82 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
		*****52
connection system T1		
		****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**
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
*D***5*	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40
****Ll*	m	12	≤ 300	12	≤ 300	-	-	-	-

x - transducer cable length

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

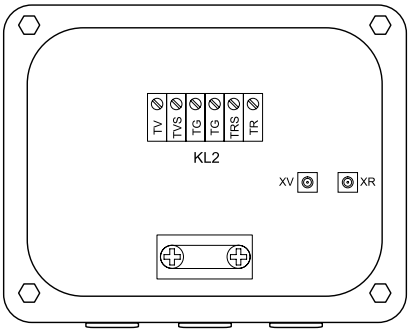
Junction box

Technical data

JB03

order code		ACC-PE-GNNN-/JBS11
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	

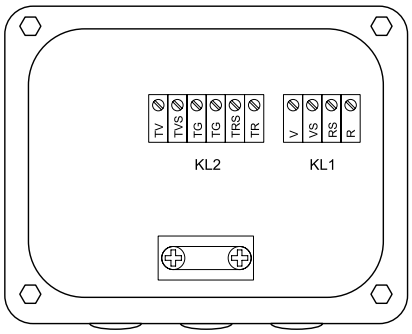
Extension cable

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

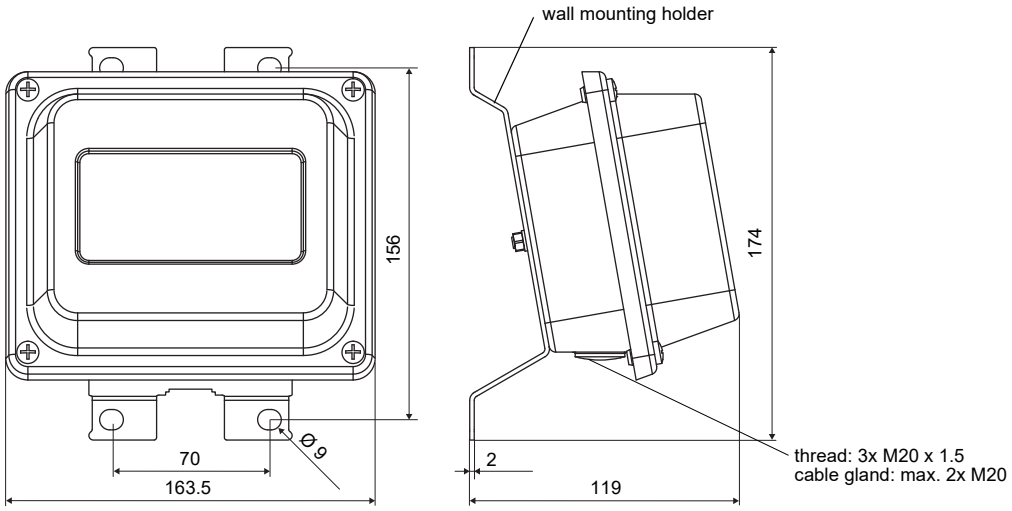
terminal strip	terminal	connection	transducer
KL1	V	signal	
	VS	internal shield	
	RS	internal shield	
	R	signal	

Extension cable

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

Dimensions

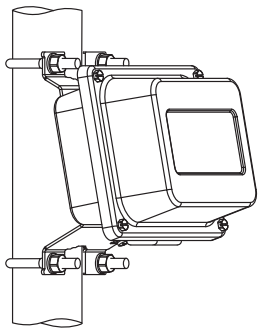
JB0*, JBP*



in mm

2" pipe mounting kit

JB**



order code:
ACC-PE-GNNN-/JBPMK4

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