

Ultrasonic Flowmeters for Liquids for Permanent Installation in Hazardous Areas

Especially designed for the stationary use in hazard areas (ATEX Zone 1 and 2)

Features

- Non-invasive measurement using the clamp-on method for precise bi-directional, highly dynamic flow measurement
- All stainless steel and seawater resistant FLUXUS ADM 8127 is ATEX certified and thus suited for off-shore applications
- ATEX certified FLUXUS ADM 8027 is presented in a flameproof housing (IP 66) and can be operated by a magnet pen without opening the housing
- Automatic loading of calibration data and transducer detection, reduces set-up times and provides precise, long-term stable results
- Proven clamp-on method; transducers are certified for ATEX zone 1 and available for a wide range of rated diameters (DN 10...6500) and temperatures in the range of -40...+400 °C; resistant to dust and humidity
- User-friendly design
- Transducers for the use in ATEX zone 1 and 2 as well as for FM Div. 2 available

Applications

- Chemical industry
- Petrochemical industry
- Oil extraction and exploration
- Natural gas extraction and processing
- Refineries



FLUXUS ADM 8027



FLUXUS ADM 8127



Measurement with explosion proof transducers

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Function

Measuring Principle

Transit Time Difference Principle

For the flow measurement of the medium, ultrasonic signals are used, employing the transit time difference principle. Ultrasonic signals are emitted by a transducer installed on one side of a pipe, reflected on the opposite side and received by a second transducer. These signals are emitted alternatively in flow direction and against it.

As the medium in which the signals propagate is flowing, the transit time of the ultrasonic signals in flow direction is shorter than against the flow direction.

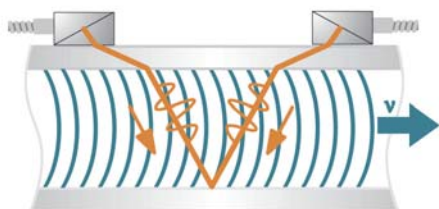
The transit time difference Δt is measured and allows to determine the average flow velocity on the propagation path of the ultrasonic signals. A flow profile correction is then performed in order to obtain the area average of the flow velocity, which is proportional to the volume flow.

The received ultrasonic signals will be checked for their usefulness for the measurement and the plausibility of the measured values will be evaluated. The complete measuring cycle is controlled by the integrated microprocessors. Disturbance signals will be eliminated.

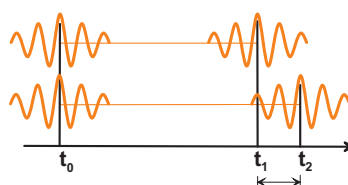
HybridTrek

If the gaseous or solid content of the medium increases occasionally during measurement, a measurement with the transit time difference principle will be no longer possible. Instead NoiseTrek will be selected, a method achieving a stable measurement even with a high gaseous or solid content.

The flowmeter switches automatically between transit time difference principle and NoiseTrek during measurement, the measurement setup does not need to be changed.



Path of the ultrasonic signal



Transit time difference Δt

Calculation of the Volume Flow

$$Q = k_{Re} \cdot A \cdot k_{\alpha} \cdot \Delta t / (2 \cdot t_t)$$

with:

Q - volume flow

k_{Re} - fluid mechanics correction factor

A - cross-sectional area of the pipe

k_{α} - flowmeter constant

Δt - transit time difference

t_t - transit time of the medium

Number of Sound Paths

The number of sound paths is the number of transits of the ultrasonic signals through the medium in the pipe.

reflection mode: number of sound paths = even, the transducers are mounted on the same side of the pipe, correct positioning of the transducers easier

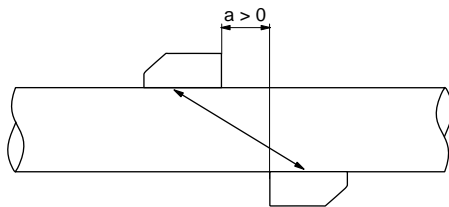
diagonal mode: number of sound paths = odd, the transducers are mounted on opposite sides of the pipe

The mode to be used depends on the application. If the number of sound paths is increased, the accuracy of the measurement will be better, but the signal attenuation is increased.

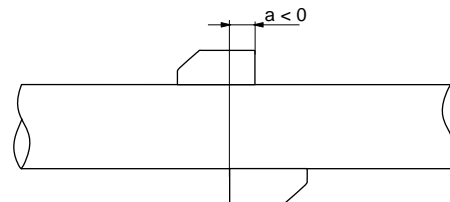
In case of a high signal attenuation by medium, pipe and coatings, diagonal mode with 1 sound path will be used.

The optimum number of sound paths for the parameters of the application will be determined automatically by the flowmeter

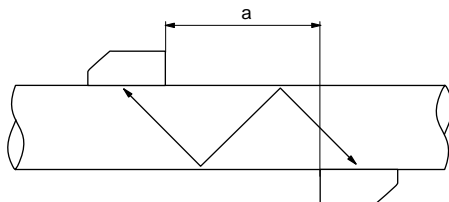
As the transducers can be mounted with the transducer mounting fixture (option) in reflection mode or diagonal mode the number of sound paths can be adjusted optimally to the application.



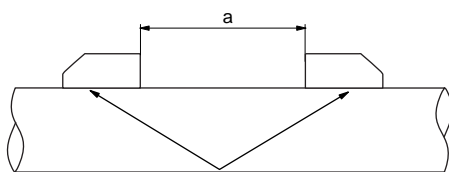
Diagonal mode, 1 sound path



Diagonal mode, 1 sound path, negative transducer distance



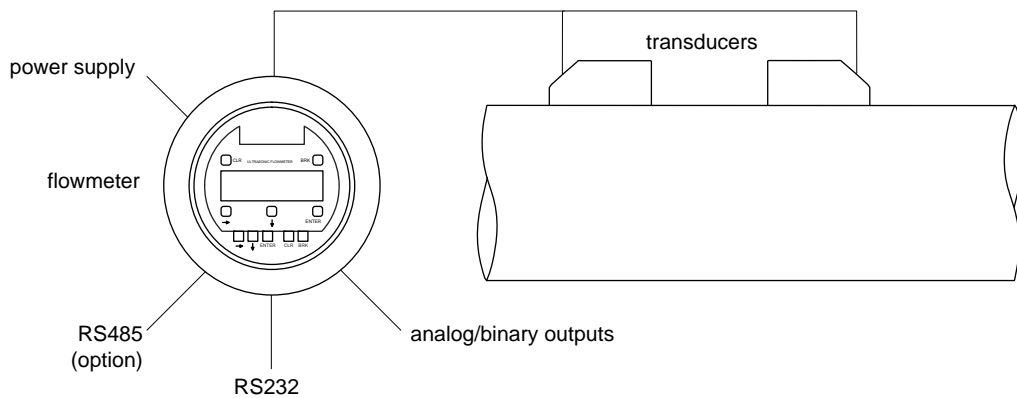
Diagonal mode, 3 sound paths



Reflex mode, 2 sound paths

a - transducer distance



Typical Measurement Setup



Example for a measurement setup in reflection mode with FLUXUS ADM 8127

Flowmeter

Technical Data

FLUXUS	ADM 8027 ADM 8027L ADM 8027P ADM 8027LP	ADM 8027C24 ADM 8027LC24	ADM 8127 ADM 8127P	ADM 8127C24
design	explosion proof field device		explosion proof offshore device	
				
measurement				
measuring principle	transit time difference correlation principle, automatic NoiseTrek selection for measurements with high gaseous or solid content			
flow velocity	0.01...25 m/s			
repeatability	0.15 % of reading ±0.01 m/s			
accuracy ¹				
with standard calibration	±1.6 % of reading ±0.01 m/s			
with extended calibration (option)	±1.2 % of reading ±0.01 m/s			
with field calibration ²	±0.5 % of reading ±0.01 m/s			
medium	all acoustically conductive liquids with < 10 % gaseous or solid content in volume (transit time difference principle)			
flowmeter				
power supply	100...240 V/50...60 Hz or 20...32 V DC on request: 11...16 V DC	24 V DC ±10 %	100...240 V/50...60 Hz or 20...32 V DC on request: 11...16 V DC	24 V DC ±10 %
power consumption	< 15 W	< 4 W	< 15 W	< 4 W
number of flow measuring channels	1, option: 2			
signal damping	0...100 s, adjustable			
measuring cycle (1 channel)	100...1000 Hz			
response time	1 s (1 channel), option: 70 ms			
material	cast aluminum ADM 8027, ADM 8027P: powder coated ADM 8027L, ADM 8027LP: 4 special coatings		stainless steel 316Ti (1.4571)	
degree of protection according to EN 60529	IP 66			
dimensions	see dimensional drawing			
weight	6 kg		8.5 kg	
fixation	wall mounting, option: 2 " pipe mounting			
operating temperature	-20...+60 °C		-20...+50 °C	
display	2 x 16 characters, dot matrix, backlit			
menu language	English, German, French, Dutch, Spanish			

¹ for transit time difference principle, reference conditions and v > 0.15 m/s

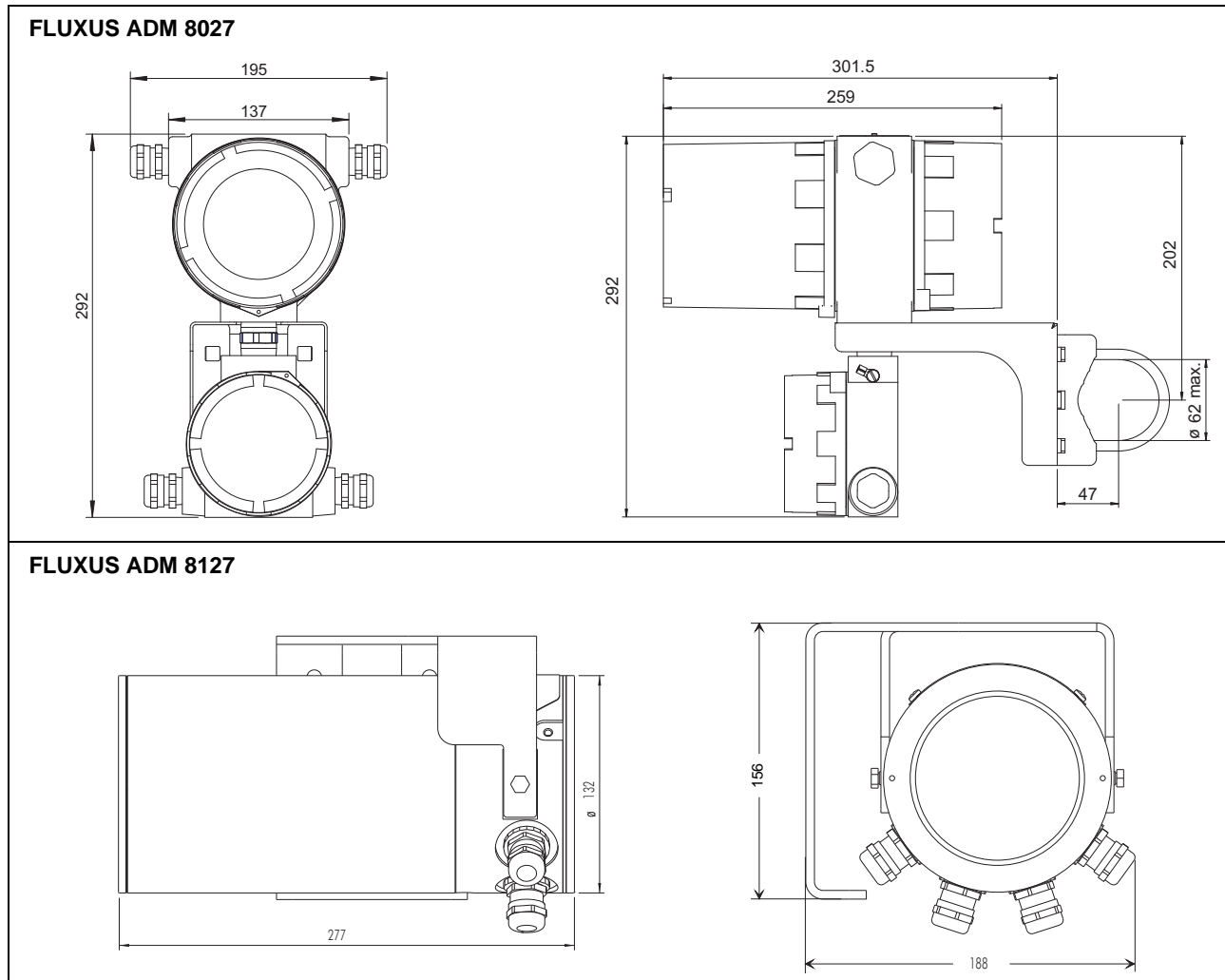
² reference uncertainty < 0.2 %

FLUXUS	ADM 8027 ADM 8027L ADM 8027P ADM 8027LP	ADM 8027C24 ADM 8027LC24	ADM 8127 ADM 8127P	ADM 8127C24
explosion protection				
ATEX zone marking	1 ADM 8027: CE 0044; II 2G Ex de IIC T6 T _a -20...+60 °C ADM 8027L: CE 0044; II 2G Ex de IIB T6 T _a -20...+60 °C ADM 8027P: CE 0044; II 2G Ex de IIC T4 T _a -20...+60 °C ADM 8027LP: CE 0044; II 2G Ex de IIB T4 T _a -20...+60 °C	1 ADM 8027C24: CE 0044; II 2G Ex de [ib] IIC T4 T _a -20...+50 °C ADM 8027LC24: CE 0044; II 2G Ex de [ib] IIB T4 T _a -20...+50 °C	1 ADM 8127: CE 0044; II 2G Ex de IIC T6 T _a -20...+50 °C ADM 8127P: CE 0044; II 2G Ex de IIC T4 T _a -20...+50 °C	1 CE 0044; II 2G Ex de [ib] IIC T4 T _a -20...+50 °C
certification	IBExU01ATEX1064	IBExU01ATEX1064	IBExU05ATEX1078	IBExU05ATEX1078
type of protection	electronics enclosure: flameproof enclosure connection enclosure: increased safety	electronics enclosure: flameproof enclosure connection enclosure: increased safety output circuits: intrinsic safety	electronics enclosure: flameproof enclosure connection enclosure: increased safety	electronics enclosure: flameproof enclosure connection enclosure: increased safety output circuits: intrinsic safety
measuring functions				
physical quantities	volume flow, mass flow, flow velocity			
totalizers	volume, mass			
calculation functions	average, difference, sum			
data logger				
loggable values	all physical quantities and totalized values			
capacity	> 100 000 measured values			
communication				
interface	- process integration: option: RS485 (Modbus, emitter) - diagnosis: RS232 ³	- diagnosis: RS232 ³	- process integration: option: RS485 (Modbus, emitter) - diagnosis: RS232 ³	- diagnosis: RS232 ³
serial data kit (option)				
software (all Windows™ versions)	- FluxData: download of measured data, graphical presentation, conversion to other formats (e.g. for Excel™) - FluxKoeff: creating medium data sets			
cable	RS232 ³			
adapter	RS232 - USB ³			

³ connection of the interface RS232 outside of explosive atmosphere (housing cover open)

FLUXUS	ADM 8027 ADM 8027L ADM 8027P ADM 8027LP	ADM 8027C24 ADM 8027LC24	ADM 8127 ADM 8127P	ADM 8127C24
outputs (option)				
The outputs are galvanically isolated from the flowmeter.				
current output				
number	1, option: additionally 1	1	1, option: additionally 1	1
range	0/4...20 mA	4...20 mA	0/4...20 mA	4...20 mA
accuracy	0.1 % of reading ±15 µA	0.1 % of reading ±15 µA	0.1 % of reading ±15 µA	0.1 % of reading ±15 µA
active output	$R_{ext} < 500 \Omega$	-	$R_{ext} < 500 \Omega$	-
passive output	ADM 8027P, ADM 8027LP: $U_{ext} = 4...26.4 V,$ dependent on R_{ext} $R_{ext} < 1 k\Omega$	$U_i = 26.4 V$ $P_i = 0.7 W$	ADM 8127P: $U_{ext} = 4...26.4 V,$ dependent on R_{ext} $R_{ext} < 1 k\Omega$	$U_i = 26.4 V$ $P_i = 0.7 W$
binary output				
number	1 OC option: additionally 1 OC and max. 2 relay OR max. 3 OC	1	1 OC option: additionally 1 OC and max. 2 relay OR max. 3 OC	1
Reed relay	48 V/0.25 A	-	48 V/0.25 A	-
open collector (OC)	24 V/4 mA	-	24 V/4 mA	-
passive output	-	$U_i = 26.4 V$ $P_i = 0.7 W$	-	$U_i = 26.4 V$ $P_i = 0.7 W$
binary output as alarm output - functions	limit, change of flow direction or error	limit, change of flow direction or error	limit, change of flow direction or error	limit, change of flow direction or error
binary output as pulse output - pulse value	0.01...1000 units	0.01...1000 units	0.01...1000 units	0.01...1000 units
- pulse width	1...1000 ms	1...1000 ms	1...1000 ms	1...1000 ms

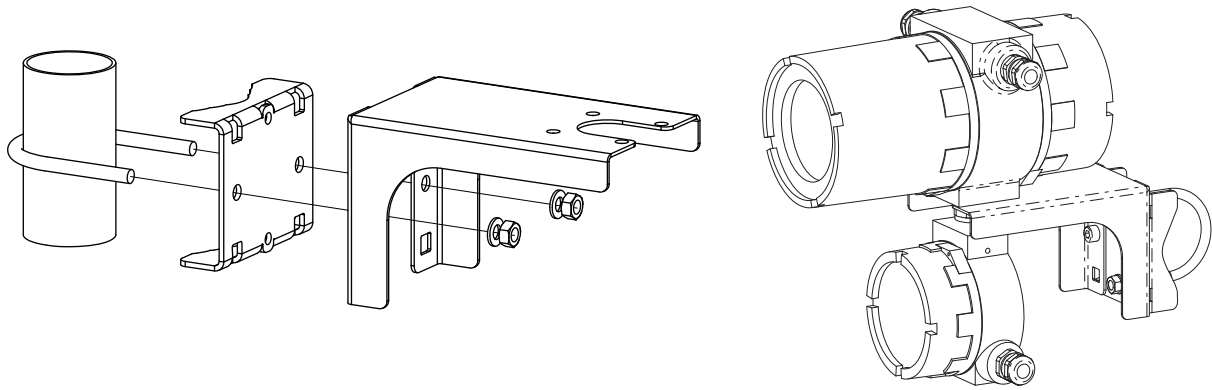
Dimensions and Fixation



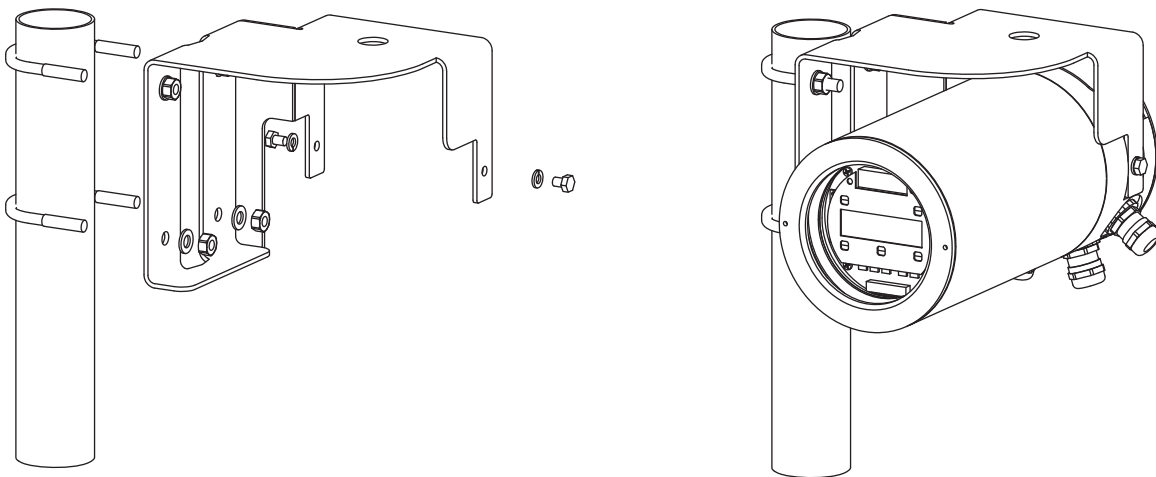
in mm

Wall and 2 " Pipe Mounting Kit

FLUXUS ADM 8027

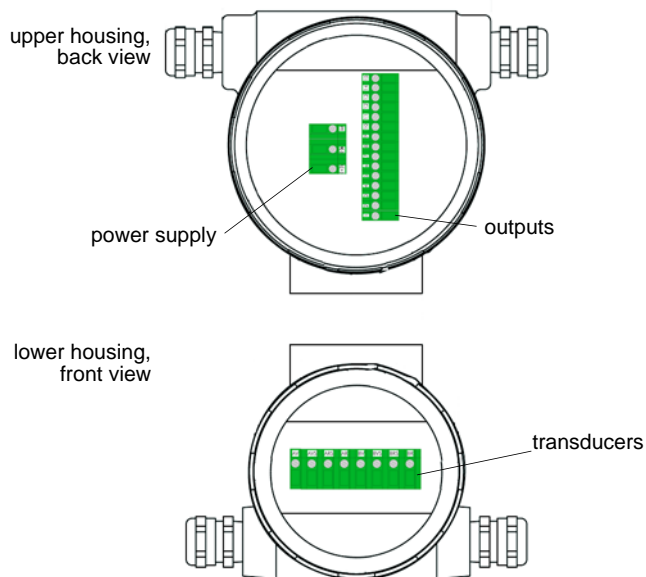


FLUXUS ADM 8127

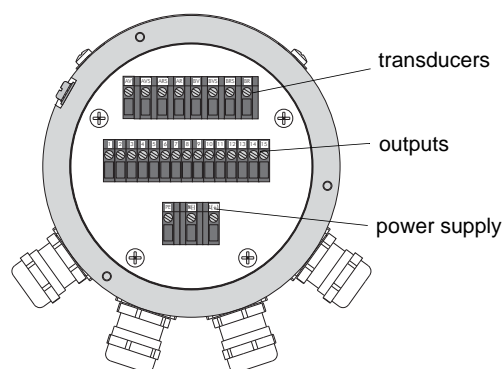


Terminal Assignment

FLUXUS ADM 8027



FLUXUS ADM 8127



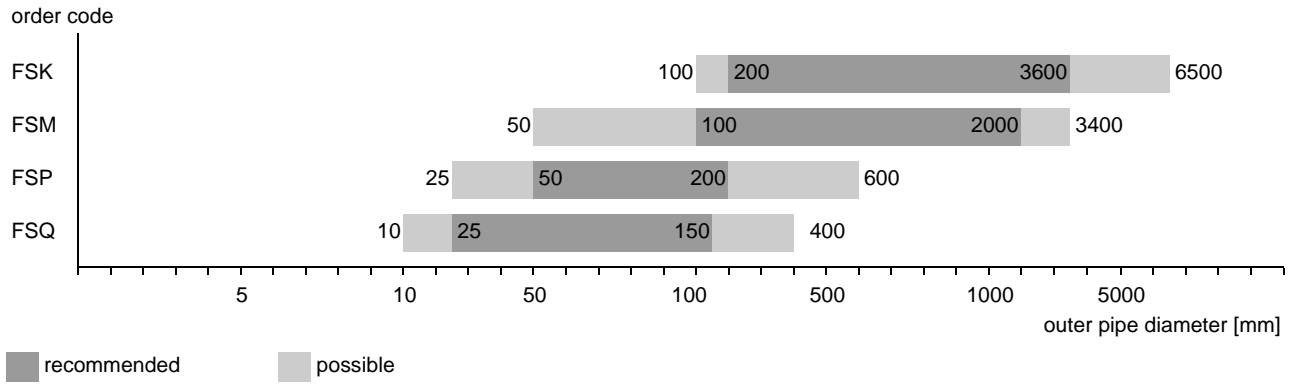
power supply (terminal strip KL1)			
AC		DC	
terminal	connection	terminal	connection
PE	earth		
N	neutral	L+	+
L1	phase	L-	-

transducers (terminal strip KL3)			
measuring channel A		measuring channel B	
terminal	connection	terminal	connection
AV	signal	BV	signal
AVS	shield	BVS	shield
ARS	shield	BRS	shield
AR	signal	BR	signal

outputs (terminal strip KL2)	
terminal	connection
1(-), 2(+)	current output I1
3(-), 4(+)	current output I2 (option)
5(-), 6(+)	binary output B1 (open collector)
7(-), 8(+)	binary output B2 (open collector, option)
9(a), 10(b)	binary output B2 (Reed relay, option)
11(a), 12(b)	binary output B2 (Reed relay, option)
13(B-), 14(A+)	RS485 (option)

Transducers

Transducer Selection



Order Code Key for Transducers

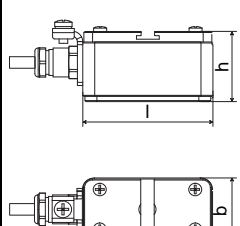
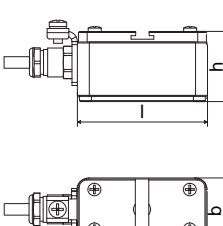
1, 2	3	4	5, 6	7, 8	9...11	no. of character		
transducer model	transducer frequency	-	temperature	explosion protection	connection system	-	extension cable	description
FS								set of ultrasonic flow transducers for liquids measurement, shear wave
K								0.5 MHz
M								1 MHz
P								2 MHz
Q								4 MHz
N								normal temperature range
A1								ATEX zone 1 (with connection system TS)
TS								direct connection or connection via junction box
						XXX	cable length in m, for max. length of extension cable see page 20	
							connection system TS: 0 m: without junction box > 0 m: with junction box JB01 (ATEX zone 1)	
example								
FS	M	-	N	A1	TS	-	030	shear wave transducer 1 MHz, normal temperature range, for ATEX zone 1, connection system TS with junction box JB01 and 30 m extension cable
		-				-		

Technical Data

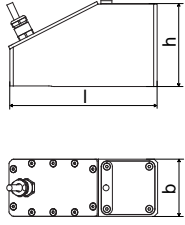
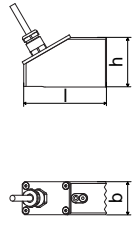
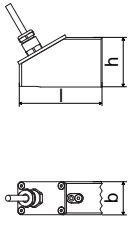
Shear Wave Transducers (for ATEX zone 1)

technical type		CDK1N31	CDM1N31	
order code		FSK-NA1TS	FSM-NA1TS	
transducer frequency	MHz	0.5	1	
outer pipe diameter				
min. extended	mm	100	50	
min. recommended	mm	200	100	
max. recommended	mm	3600	2000	
max. extended	mm	6500	3400	
pipe wall thickness				
min.	mm	-	-	
max.	mm	-	-	
material				
housing		PEEK with stainless steel cap304 (1.4301)	stainless steel 316 Ti (1.4571)	
contact surface		PEEK	PEEK	
degree of protection according to EN 60529		IP 65	IP 65	
transducer cable				
type		2549	2549	
length	m	5	4	
dimensions				
length l	mm	126.5	60	
width b	mm	50	30	
height h	mm	53.5	33.5	
dimensional drawing				
operating temperature				
min.	°C	-40	-40	
max.	°C	+130	+130	
explosion protection				
A T E X	transducer	FSK-NA1TS	FSM-NA1TS	
	zone	1	1	
	explosion protection temperature			
	min.	°C	-40	-20
	max.	°C	+180	+120
	marking		CE 0044; II 2G Ex q II T6...T3 Ta -40...+180 °C II 2D Ex tD A21 IP65 TX	CE 0044; II 2G EEx m II T6...T4 Ta -20...+120 °C
	certification		IBExU04ATEX1011 X	IBExU98ATEX1012 X
	type of protection		powder filling	encapsulation
	transducer shoe necessary		-	-

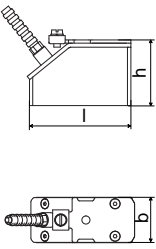
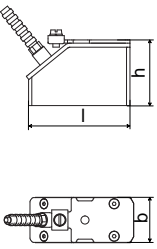
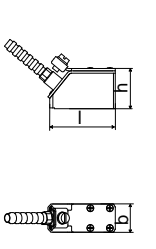
Shear Wave Transducers (for ATEX zone 1)

technical type		CDP1N31	CDQ1N31	
order code		FSP-NA1TS	FSQ-NA1TS	
transducer frequency	MHz	2	4	
outer pipe diameter				
min. extended	mm	25	10	
min. recommended	mm	50	25	
max. recommended	mm	200	150	
max. extended	mm	600	400	
pipe wall thickness				
min.	mm	-	-	
max.	mm	-	-	
material				
housing		stainless steel 316 Ti (1.4571)	stainless steel 316 Ti (1.4571)	
contact surface		PEEK	PEEK	
degree of protection according to EN 60529		IP 65	IP 65	
transducer cable				
type		2549	2549	
length	m	4	3	
dimensions				
length l	mm	60	60	
width b	mm	30	30	
height h	mm	33.5	33.5	
dimensional drawing				
operating temperature				
min.	°C	-40	-40	
max.	°C	+130	+130	
explosion protection				
A T E X	transducer		FSP-NA1TS	FSQ-NA1TS
	zone		1	1
	explosion protection temperature			
	min.	°C	-20	-20
	max.	°C	+120	+120
	marking		CE 0044; II 2G EEx m II T6...T4 Ta -20...+120 °C	CE 0044; II 2G EEx m II T6...T4 Ta -20...+120 °C
	certification		IBExU98ATEX1012 X	IBExU98ATEX1012 X
	type of protection		encapsulation	encapsulation
	transducer shoe necessary		-	-

Shear Wave Transducers (for ATEX zone 1, IP 68)

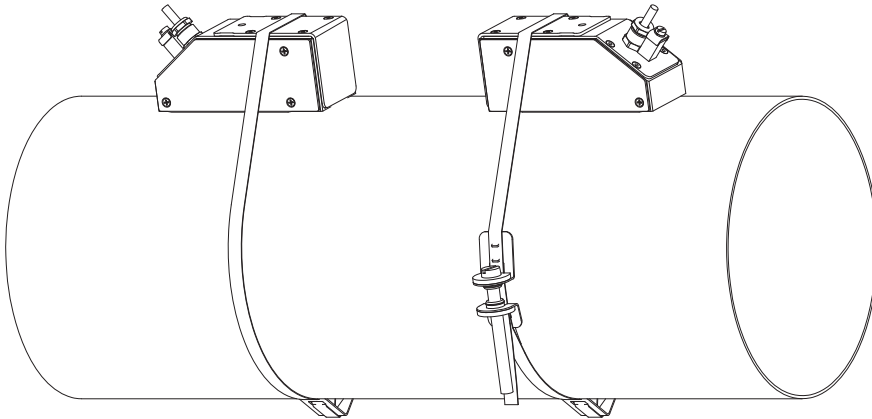
technical type		CDK1L11	CDM2L11	CDP2L11
order code		FSK-NA1TS/IP68	FSM-NA1TS/IP68	FSP-NA1TS/IP68
transducer frequency	MHz	0.5	1	2
outer pipe diameter				
min. extended	mm	100	50	25
min. recommended	mm	200	100	50
max. recommended	mm	3600	2000	200
max. extended	mm	6500	3400	600
pipe wall thickness				
min.	mm	-	-	-
max.	mm	-	-	-
material				
housing		PEEK with stainless steel cap316Ti (1.4571)	PEEK with stainless steel cap316Ti (1.4571)	PEEK with stainless steel cap316Ti (1.4571)
contact surface		PEEK	PEEK	PEEK
degree of protection according to EN 60529		IP 68	IP 68	IP 68
transducer cable				
type		2550	2550	2550
length	m	12	12	12
dimensions				
length l	mm	128.5	70	70
width b	mm	50	28	28
height h	mm	72	42	42
dimensional drawing				
operating temperature				
min.	°C	-40	-40	-40
max.	°C	+100	+100	+100
explosion protection				
transducer		FSK-NA1TS/IP68	FSM-NA1TS/IP68	FSP-NA1TS/IP68
zone		1	1	1
explosion protection temperature				
min.	°C	-55	-55	-55
max.	°C	+180	+180	+180
ATEX	marking	CE 0044; II 2G Ex q II T6...T3 Ta -55...+180 °C II 2D Ex tD A21 IP68 TX	CE 0044; II 2G Ex q II T6...T3 Ta -55...+180 °C II 2D Ex tD A21 IP68 TX	CE 0044; II 2G Ex q II T6...T3 Ta -55...+180 °C II 2D Ex tD A21 IP68 TX
	certification	IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	type of protection	powder filling	powder filling	powder filling
	transducer shoe necessary	x	x	x

Shear Wave Transducers (for ATEX zone 1/2 (gas/dust), high temperature)

technical type		CDM2E85	CDP2E85	CDQ2E85	
order code		FSM-EA1TS	FSP-EA1TS	FSQ-EA1TS	
transducer frequency	MHz	1	2	4	
outer pipe diameter					
min. extended	mm	50	25	10	
min. recommended	mm	100	50	25	
max. recommended	mm	2000	200	150	
max. extended	mm	3400	600	400	
pipe wall thickness					
min.	mm	-	-	-	
max.	mm	-	-	-	
material					
housing		PI with stainless steel cap304 (1.4301)	PI with stainless steel cap304 (1.4301)	PI with stainless steel cap304 (1.4301)	
contact surface		PI	PI	PI	
degree of protection according to EN 60529		IP 56	IP 56	IP 56	
transducer cable					
type	m	6111	6111	6111	
length	m	4	4	3	
dimensions					
length l	mm	69.5	69.5	39	
width b	mm	32.5	32.5	18	
height h	mm	61	61	24.5	
dimensional drawing					
operating temperature					
min.	°C	-30	-30	-30	
max.	°C	+200	+200	+200	
explosion protection					
ATEX	transducer	FSM-EA1TS	FSP-EA1TS	FSQ-EA1TS	
	zone	1	1	1	
	explosion protection temperature				
	min.	°C	-45	-45	-45
	max.	°C	+225	+225	+225
	marking		CE 0044; Ex II 2G Ex eq II T6...T2 Ta -45...+225 °C II 3D Ex tD A22 IP56 TX	CE 0044; Ex II 2G Ex eq II T6...T2 Ta -45...+225 °C II 3D Ex tD A22 IP56 TX	CE 0044; Ex II 2G Ex eq II T6...T2 Ta -45...+225 °C II 3D Ex tD A22 IP56 TX
	certification		IBExU07ATEX1168 X	IBExU07ATEX1168 X	IBExU07ATEX1168 X
	type of protection		powder filling	powder filling	powder filling
	transducer shoe necessary		x	x	x
	necessary				

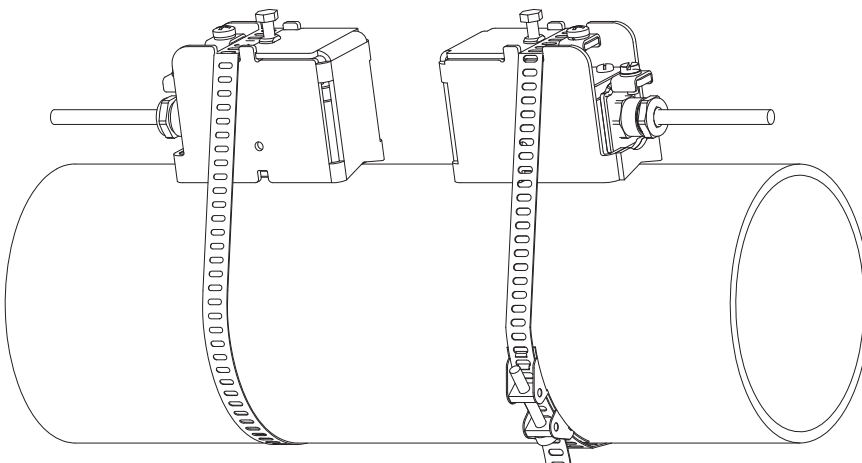
Transducer Mounting Fixtures

Tension Straps and Clasps



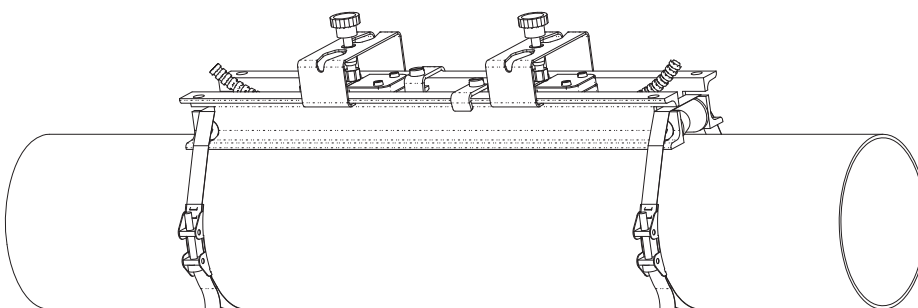
material: stainless steel 304
(1.4301), 303 (1.4305)
length: 10/20 m

Tension Straps, Clasps and Mounting Shoes



material: stainless steel 304
(1.4301), 303 (1.4305)
length: 10/20 m

Variofix Rail VFX with Tension Straps and Clasps¹



material: stainless steel 304
(1.4301), 303 (1.4305)
dimensions: 220/320/520/1020 x
b x h mm
(b - transducer width + 30 mm
h - dependent on transducer)
length: 10/20 m

¹ on request

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	100...170 °C	< 150 °C	150...200 °C	< 280 °C	280...400 °C
< 2 h		coupling compound type N	coupling compound type E	coupling compound type E	coupling compound type E or H	coupling foil type A	coupling foil type B
< 24 h		coupling compound type N	coupling compound type E	coupling compound type E	coupling foil type VT	coupling foil type A	coupling foil type B
long time measurement	indoor	coupling compound type N	coupling compound type E	coupling foil type VT ¹	coupling foil type VT ²	coupling foil type A	coupling foil type B
	outdoor	coupling foil type VT	coupling foil type VT	coupling foil type VT ¹	coupling foil type VT ²	coupling foil type A	coupling foil type B

¹ < 5 years

² < 6 months

Technical Data

type	order code	temperature °C	material	remark
coupling compound type N	990739-1	-30...+130	mineral grease paste	
coupling compound type E	990739-2	-30...+200	silicone paste	
coupling compound type H	990739-3	-30...+250	fluoropolymer paste	
coupling foil type A	990739-7	max. 280	Pb	
coupling foil type B	990739-8	> 280...400	Ag	
coupling foil type VT	990739-0	-10...+150, peak max. 200 °C	fluoroelastomer	for transducers with transducer frequency G, H, K
	990739-6			for transducers with transducer frequency M, P
	990739-5			for transducers with transducer frequency Q
	990739-10			for transducers with transducer frequency S

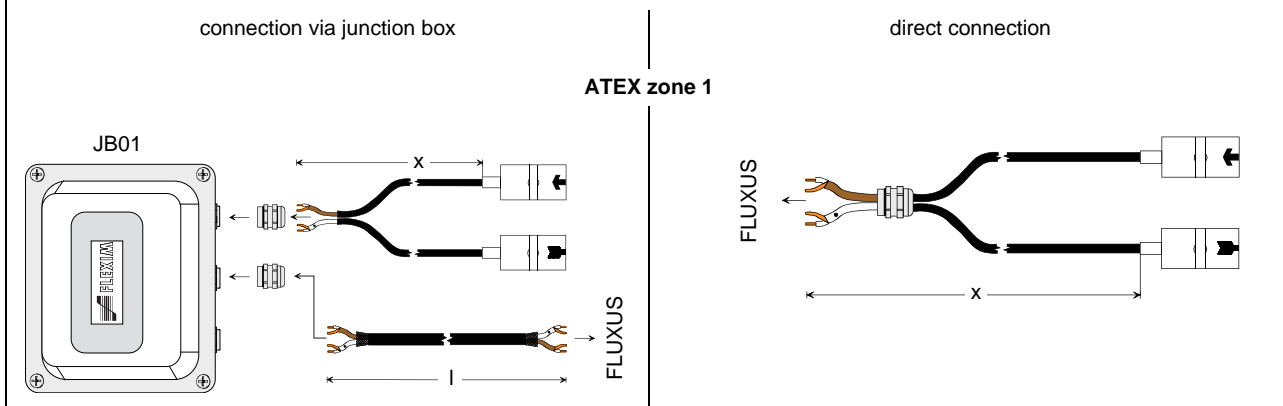
Connection Systems

Connection System TS

transducer frequency (3rd character of transducer order code)		G, H, K		M, P		Q		S	
cable length	m	x 5	l ≤ 300	x 4	l ≤ 300	x 3	l ≤ 90	x 2	l ≤ 40

connection via junction box

direct connection



x - transducer cable length

l - max. length of extension cable

Transducer Cables

Technical Data

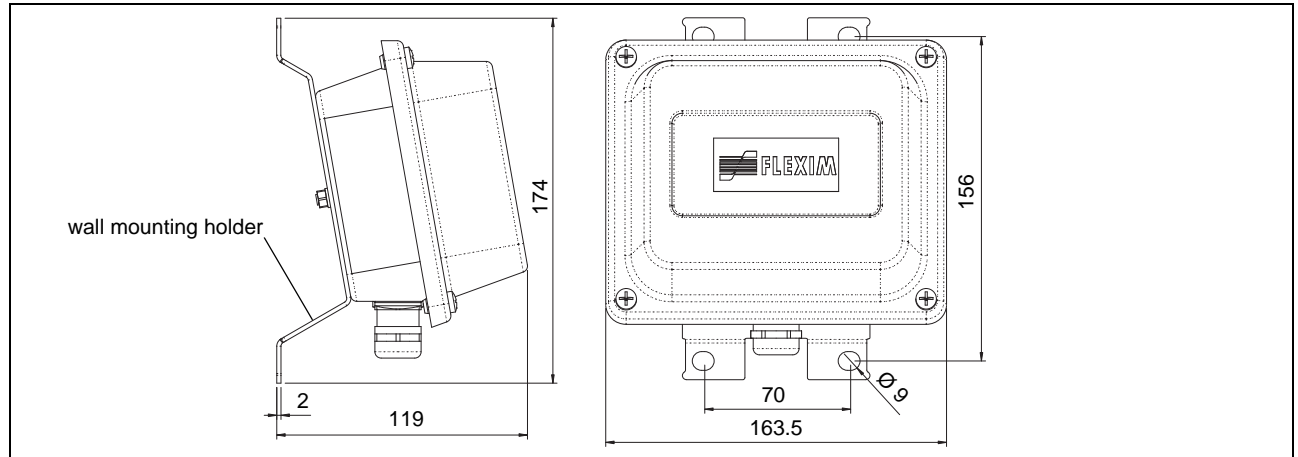
		transducer cable		extension cable	
item number		1699	2549	2552	2615
application		ATEX zone 2, FM and not ex- plosion proof transducers	ATEX zone 1	connection system TS	connection system TS
standard length	m	see table above		-	-
max. length	m	-	-	see table above	see table above
temperature	°C	-55...+200	-100...+200	< 80	-40...+70
properties					halogen free fire propaga- tion test according to IEC 60332-1 combustion test according to IEC 60754-2
sheath					
material		stainless steel 304 (1.4301)	-	-	-
outer diameter	mm	8	-	-	-
cable jacket					
material		PTFE	PTFE	TPV	PUR
outer diameter	mm	2.9	5.3	12	12
thickness	mm	0.3	0.5		2
color		brown	black	black	black
shield		x	x	x	x

Junction Box

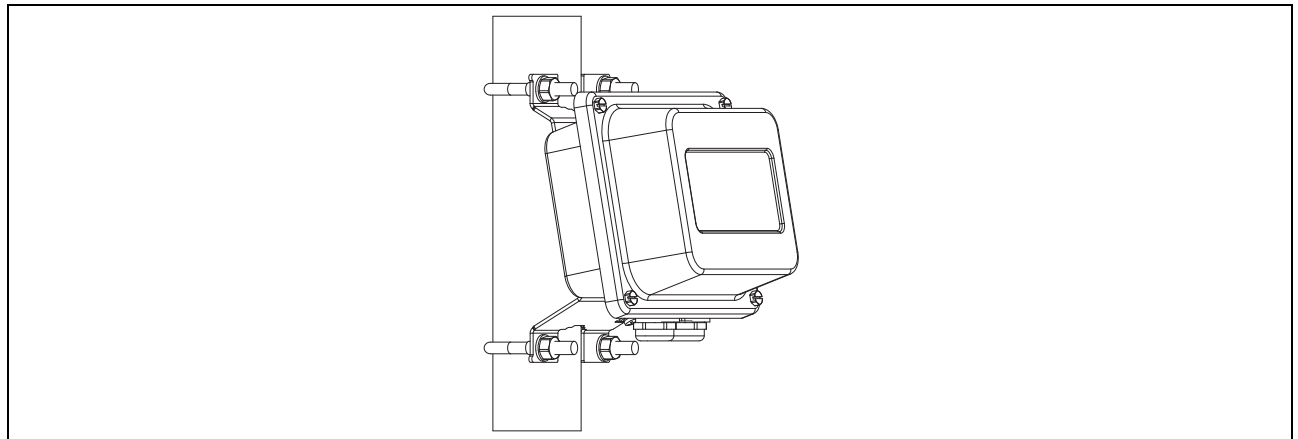
Technical Data

technical type	JB01S4E3M	
dimensions	see dimensional drawing	
fixation	wall mounting option: 2 " pipe mounting	
material		
housing	stainless steel 316L (1.4404)	
gasket	silicone	
degree of protection according to EN 60529	IP 67	
operating temperature		
min.	°C	-40
max.	°C	+80
explosion protection		
ATEX zone	1	
marking	CE 0044 II 2G Ex e mb II (T6)...T4 T _a -40...+(70) 80 °C II 2D Ex tD A21 IP 67 T 100 °C	
certification	IBExU06ATEX1161	
type of protection	junction box: increased safety decoupled network: encapsulation	

Dimensions



2 " Pipe Mounting Kit (option)



Terminal Assignment

JB01

Transducers
terminal strip KL1

terminal	connection
V	signal
VS	shield
RS	shield
R	signal

Extension Cable (Flowmeter)
terminal strip KL2

terminal	connection
TV	signal
TVS	shield
TRS	shield
TR	signal



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