

Ultrasonic Flow Measurement of Liquids in Explosive Atmosphere

Features

Transducers

- non-invasive (no contact with the medium, no need for expensive materials)
- wearfree
- no pressure drop (no operational costs)
- low installation costs
- certified for ATEX zone 1
- not sensitive to dust or humidity
- advantageous price for large pipe diameters and high pressure stages

Flowmeter

- stationary installation
- flameproof housing with degree of protection IP 66
- FLUXUS ADM 8127 with stainless steel housing for offshore application (seawater proof and corrosion proof)
- operation with magnetic pen (housing closed), PC not required
- simple operation due to clearly structured user dialog

Measurement

- stable and reliable measuring results even under difficult conditions
- precise bi-directional flow measurement with high measurement dynamics
- long-term stable measurement results
- high measurement rate, fast response time



FLUXUS ADM 8027



FLUXUS ADM 8127



Measurement with explosion proof transducers

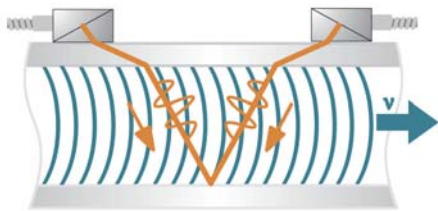
Measuring Principle

For the flow measurement of the medium, ultrasonic signals are used, employing the transit time method. 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.

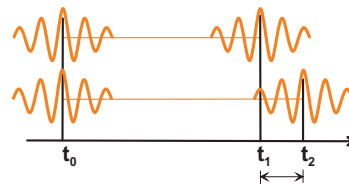
As the medium in which the signals propagate is flowing, the transit time of the ultrasonic signals in flow direction is shorter than against the flow direction.

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.



Path of the ultrasonic signal



Transit time difference Δt

Calculation of the Flow Velocity

$$v = k_{\alpha} \cdot \Delta t / (2 \cdot t_t)$$

with:

v - flow velocity

k_{α} - flowmeter constant

Δt - transit time difference

t_t - transit time of the medium

Number of Sound Paths

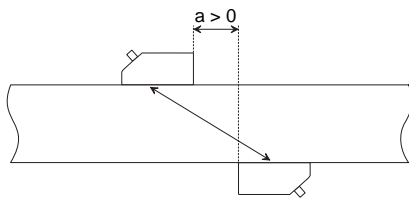
The number of sound paths is the number of transits of the ultrasonic signals through the medium in the pipe.

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

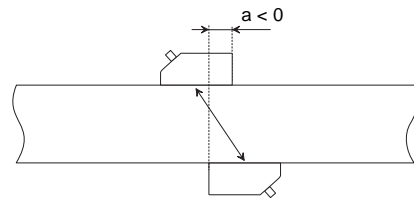
diagonal mode: number of sound paths = odd, the transducers are mounted on opposite sides of the pipe

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.

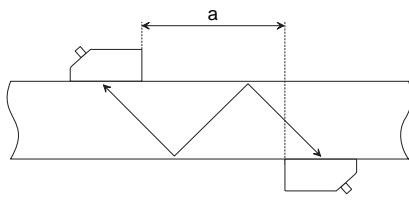
In case of a high signal attenuation by medium, pipe and coatings, diagonal mode with 1 sound path will be used.



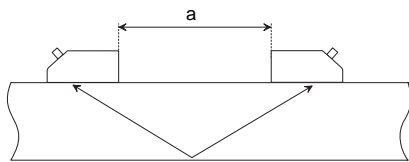
Diagonal mode, 1 sound path



Diagonal mode, 1 sound path, negative transducer distance



Diagonal mode, 3 sound paths





Reflex mode, 2 sound paths

a - transducer distance

Flowmeter

Technical Data

| FLUXUS | ADM 8027 | ADM 8127 |
|--|---|---|
| design | explosion proof field device | explosion proof offshore device |
| |  |  |
| measurement | | |
| measuring principle | transit time difference correlation principle | |
| 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 | |
| flowmeter | | |
| power supply | 100...230 V/50...60 Hz or 20...32 V DC or on request : 11...16 V DC | |
| power consumption | < 15 W | |
| flow 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 | stainless steel 316Ti (1.4571) |
| degree of protection according to EN 60529 | IP 66 | |
| dimensions | see dimensional drawing | |
| weight | 6 kg | 8.5 kg |
| installation | wall mounting, 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 | |
| explosion protection | | |
| ATEX zone marking | 1 | 1 |
| certification | ADM 8027-* : CE 0044; Ex II 2G Ex de IIC T6 T _a -20...+60 °C ADM 8027L-* : CE 0044; Ex II 2G Ex de IIB T6 T _a -20...+60 °C ADM 8027P-* : CE 0044; Ex II 2G Ex de IIC T4 T _a -20...+60 °C ADM 8027LP-* : CE 0044; Ex II 2G Ex de IIB T4 T _a -20...+60 °C IBExU01ATEX1064 | CE 0044; Ex II 2G Ex de IIC T6 T _a -20...+50 °C IBExU05ATEX1078 |
| type of protection | electronics enclosure: flameproof enclosure connection enclosure: increased safety | electronics enclosure: flameproof enclosure connection enclosure: increased safety |

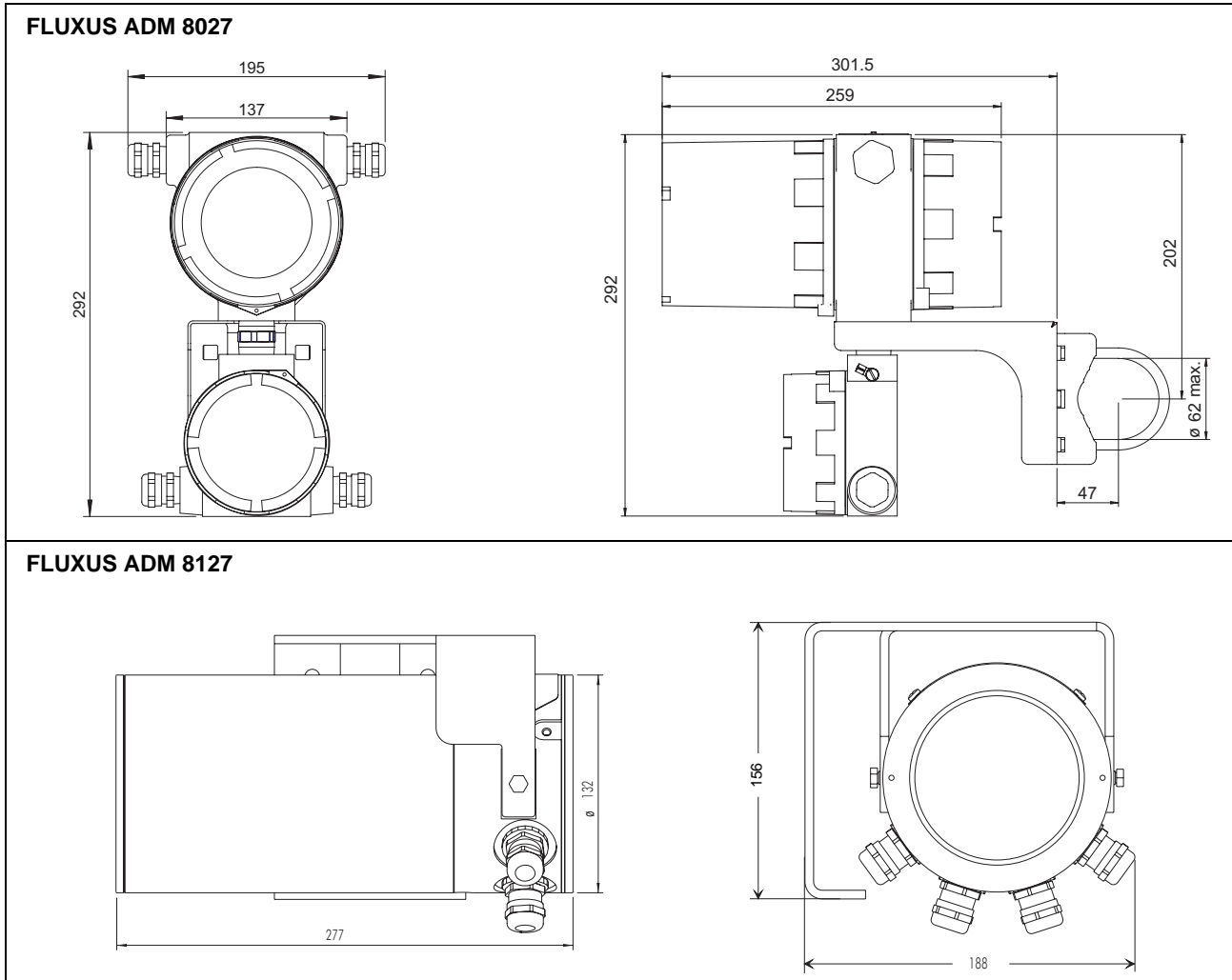
¹ under reference conditions and with v > 0.15 m/s

² reference uncertainty < 0.2 %

| FLUXUS | ADM 8027 | ADM 8127 |
|------------------------------------|--|----------|
| 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 connection: option: RS485 (Modbus, emitter) - diagnosis: RS232 ³ | |
| serial data kit (option) | | |
| software (all Windows™ versions) | - FluxData: download of measured data, graphical presentation, conversion to other formats - FluxKoeff: creating medium data sets | |
| cable | RS232 ³ | |
| adapter | RS232 to USB ³ | |
| outputs | | |
| | The outputs are galvanically isolated from the main device. | |
| current output | | |
| number | 1, option: additionally 1 | |
| range | 0/4...20 mA | |
| accuracy | 0.1 % of reading ±15 µA | |
| active output | R _{ext} < 500 Ω | |
| binary output | | |
| number | 1 OC option: additionally 1 OC and max. 2 relay OR max. 3 OC | |
| Reed relay | 48 V/0.25 A | |
| open collector (OC) | 24 V/4 mA | |
| binary output as limit detector | limit, sign change or error | |
| - function as state output | | |
| binary output (OC) as pulse output | | |
| - value | 0.01...1000 units | |
| - width | 1...1000 ms | |

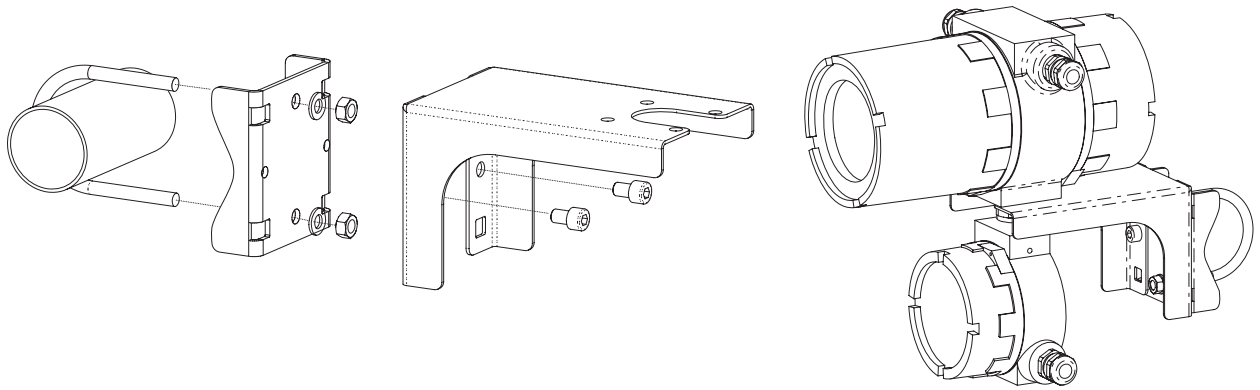
³ connection of the interface RS232 outside of explosive atmosphere (housing cover open)

Dimensions and Mounting Dimensions (in mm)

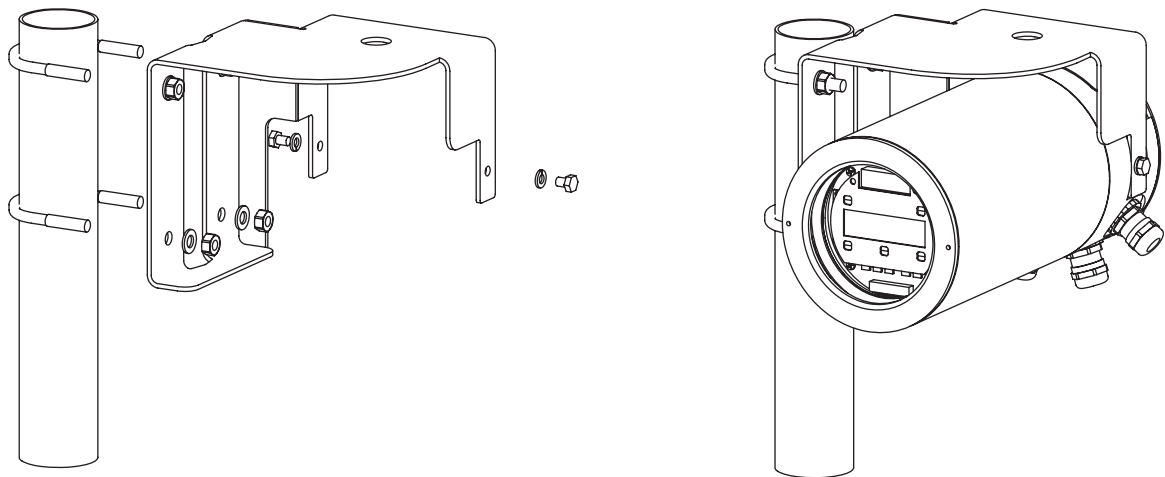


Wall and 2 " Pipe Mounting Kit

FLUXUS ADM 8027



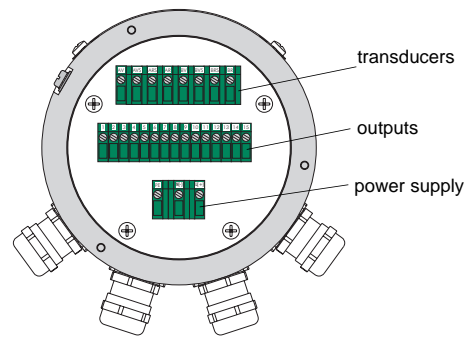
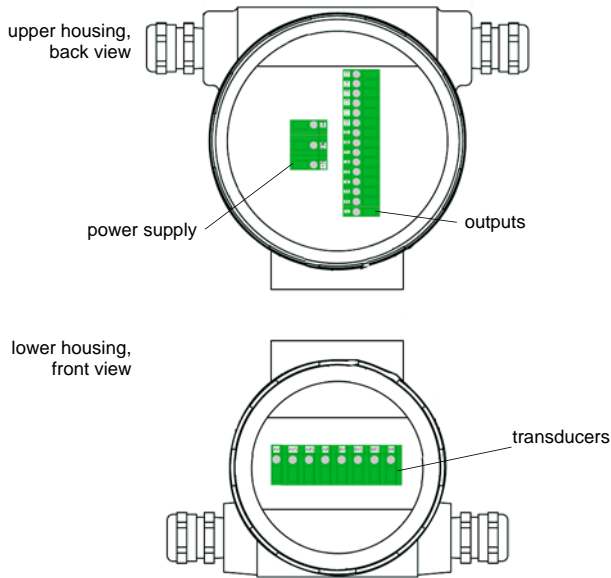
FLUXUS ADM 8127



Terminal Assignment

FLUXUS ADM 8027

FLUXUS ADM 8127



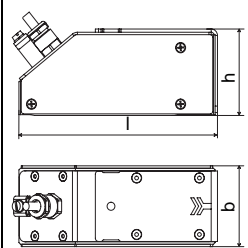
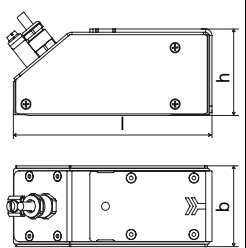
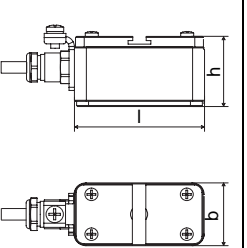
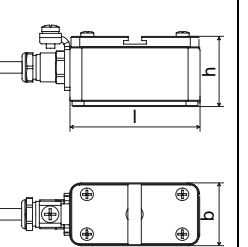
| power supply (terminal strip KL1) | | | |
|-----------------------------------|------------|----------|------------|
| AC | | DC | |
| terminal | connection | terminal | connection |
| PE | earth | | |
| N | neutral | L+ | + |
| L1 | phase | L- | - |

| 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 |

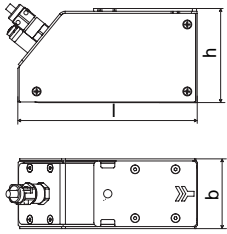
| outputs (terminal strip KL2) | |
|------------------------------|---|
| terminal | connection |
| 1(-), 2(+) | current output I1 |
| 3(-), 4(+) | current output I2 (option) |
| 5(-), 6(+) | binary output B1 (open collector) |
| 7(-), 8(+) | binary output B2 (open collector, option) |
| 9(a), 10(b)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

Transducers

Shear Wave Transducers (for ATEX zone 1)

| technical type | | CDG1N31 | CDK1N31 | CDM1N31 | CDQ1N31 |
|--|-----|---|---|--|---|
| order code | | FSG-NA1TS | FSK-NA1TS | FSM-NA1TS | FSQ-NA1TS |
| transducer frequency | MHz | 0.2 | 0.5 | 1 | 4 |
| outer pipe diameter | | | | | |
| min. extended | mm | 400 | 100 | 50 | 10 |
| min. recommended | mm | 500 | 200 | 100 | 25 |
| max. recommended | mm | 6500 | 3600 | 2500 | 400 |
| max. extended | mm | 6500 | 4500 | 3400 | 400 |
| pipe wall thickness | | | | | |
| min. | mm | - | - | - | - |
| max. | mm | - | - | - | - |
| material | | | | | |
| housing | | PEEK with stainless steel cap | PEEK with stainless steel cap | stainless steel | stainless steel |
| contact surface | | PEEK | PEEK | PEEK | PEEK |
| degree of protection according to EN 60529 | | IP 65 | IP 65 | IP 65 | IP 65 |
| dimensions | | | | | |
| length l | mm | 129.5 | 126.5 | 60 | 60 |
| depth b | mm | 50 | 50 | 30 | 30 |
| height h | mm | 64 | 53.5 | 33.5 | 33.5 |
| dimensional drawing | |  |  |  |  |
| operating temperature | | | | | |
| min. | °C | -40 | -40 | -20 | -20 |
| max. | °C | +130 | +130 | +120 | +120 |
| explosion protection | | | | | |
| ATEX zone | | 1 | 1 | 1 | 1 |
| marking | | CE 0044; Ex q II T6...T3 Ta -40...+180 °C Ex II 2D Ex tD A21 IP65 TX | CE 0044; Ex q II T6...T3 Ta -40...+180 °C Ex II 2D Ex tD A21 IP65 TX | CE 0044; Ex m II T6...T4 Ta -20...+120 °C | CE 0044; Ex m II T6...T4 Ta -20...+120 °C |
| certification | | IBExU04ATEX1011 X | IBExU04ATEX1011 X | IBExU98ATEX1012 X | IBExU98ATEX1012 X |
| type of protection | | powder filling | powder filling | encapsulation | encapsulation |
| FM marking | | - | - | - | - |
| type of protection | | - | - | - | - |

Lamb Wave Transducers (for ATEX Zone 1)

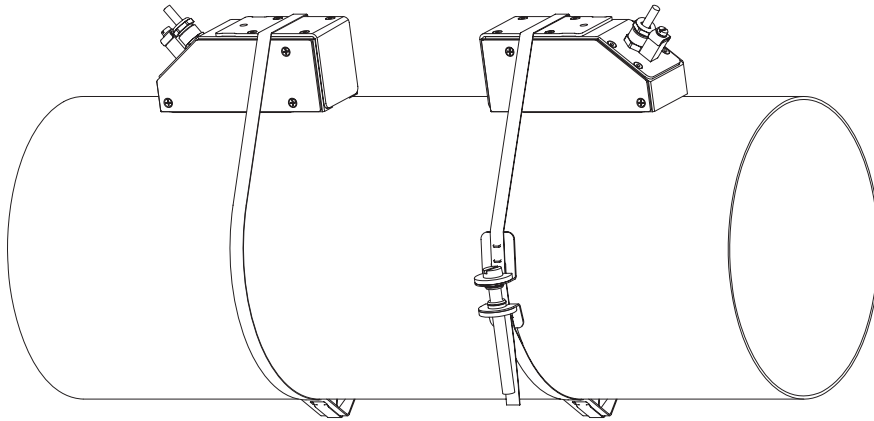
| technical type | | CRG1N33 | CRH1N33 | CRK1N33 |
|--|-----|---|---|---|
| order code | | FLG-NA1TS | FLH-NA1TS | FLK-NA1TS |
| transducer frequency | MHz | 0.2 | 0.3 | 0.5 |
| outer pipe diameter | | | | |
| min. extended | mm | 500 | 400 | 220 |
| min. recommended | mm | 600 | 450 | 250 |
| max. recommended | mm | 5000 | 3500 | 2100 |
| max. extended | mm | 6500 | 5000 | 4500 |
| pipe wall thickness | | | | |
| min. | mm | 14 | 9 | 5 |
| max. | mm | 27 | 18 | 11 |
| material | | | | |
| housing | | PPSU with stainless steel cap | PPSU with stainless steel cap | PPSU with stainless steel cap |
| contact surface | | PPSU | PPSU | PPSU |
| degree of protection according to EN 60529 | | IP 65 | IP 65 | IP 65 |
| dimensions | | | | |
| length l | mm | 128.5 | 128.5 | 128.5 |
| depth b | mm | 50 | 50 | 50 |
| height h | mm | 67.5 | 67.5 | 67.5 |
| dimensional drawing | |  | | |
| operating temperature | | | | |
| min. | °C | -40 | -40 | -40 |
| max. | °C | +140 | +140 | +140 |
| explosion protection | | | | |
| ATEX zone marking | | 1 CE 0044; Ex II 2G Ex q II T6...T3 Ta -40...+140 °C Ex II 2D Ex tD A21 IP65 TX | 1 CE 0044; Ex II 2G Ex q II T6...T3 Ta -40...+140 °C Ex II 2D Ex tD A21 IP65 TX | 1 CE 0044; Ex II 2G Ex q II T6...T3 Ta -40...+140 °C Ex II 2D Ex tD A21 IP65 TX |
| certification | | IBExU04ATEX1011 X | IBExU04ATEX1011 X | IBExU04ATEX1011 X |
| type of protection | | powder filling | powder filling | powder filling |
| FM marking | | - | - | - |
| type of protection | | - | - | - |

Order Code Key for Transducers

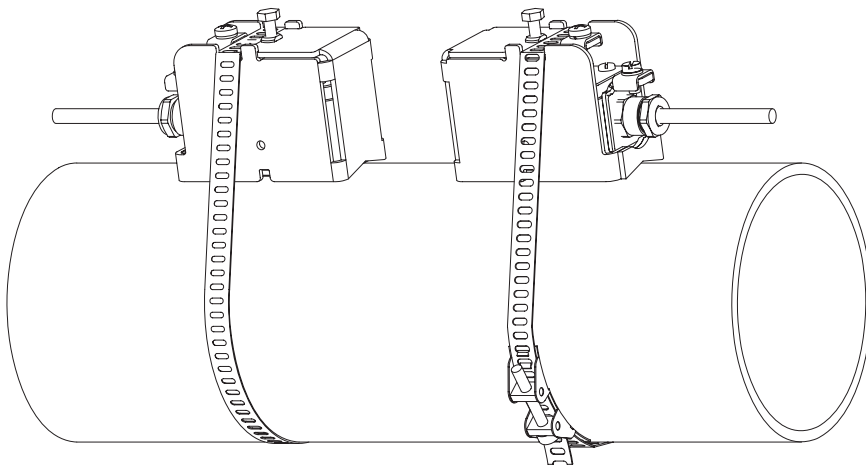
| transducer model | frequency | - | temperature | explosion protection | connection system | - | extension cable | description |
|------------------|-----------|---|-------------|----------------------|-------------------|---|-----------------|--|
| FL | | | | | | | | set of ultrasonic flow transducers for liquids measurement, Lamb wave |
| FS | | | | | | | | set of ultrasonic flow transducers for liquids measurement, shear wave |
| | G | | | | | | | 0.2 MHz |
| | H | | | | | | | 0.3 MHz (Lamb wave only) |
| | K | | | | | | | 0.5 MHz |
| | M | | | | | | | 1 MHz (shear wave only) |
| | Q | | | | | | | 4 MHz (shear wave only) |
| | | | 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 16 |
| | | | | | | | | connection system TS: 0 m: without junction box > 0 m: with junction box JB01 (ATEX zone 1) |
| example | | | | | | | | |
| FS | G | - | N | A1 | TS | - | 030 | shear wave transducer 0.2 MHz, normal temperature range, for ATEX zone 1, connection system TS with junction box JB01 and 30 m extension cable |
| | | - | | | | - | | |

Transducer Pipe Mounting Fixtures

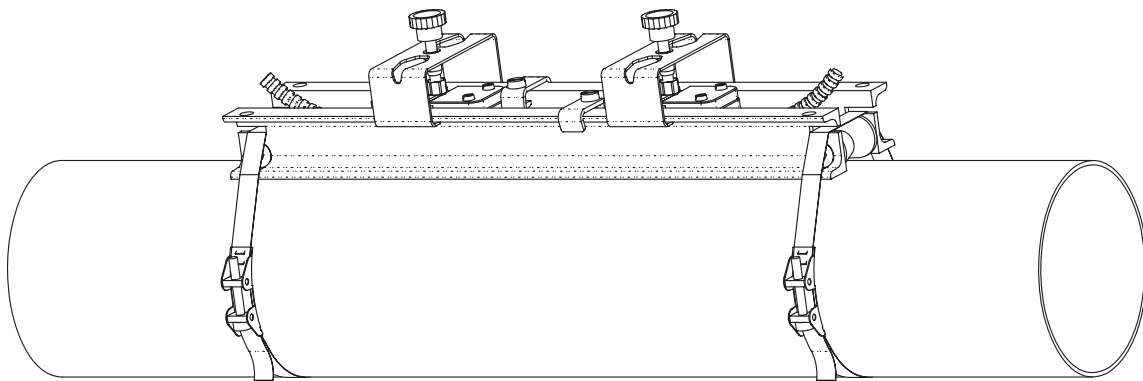
Tension Straps and Clasps



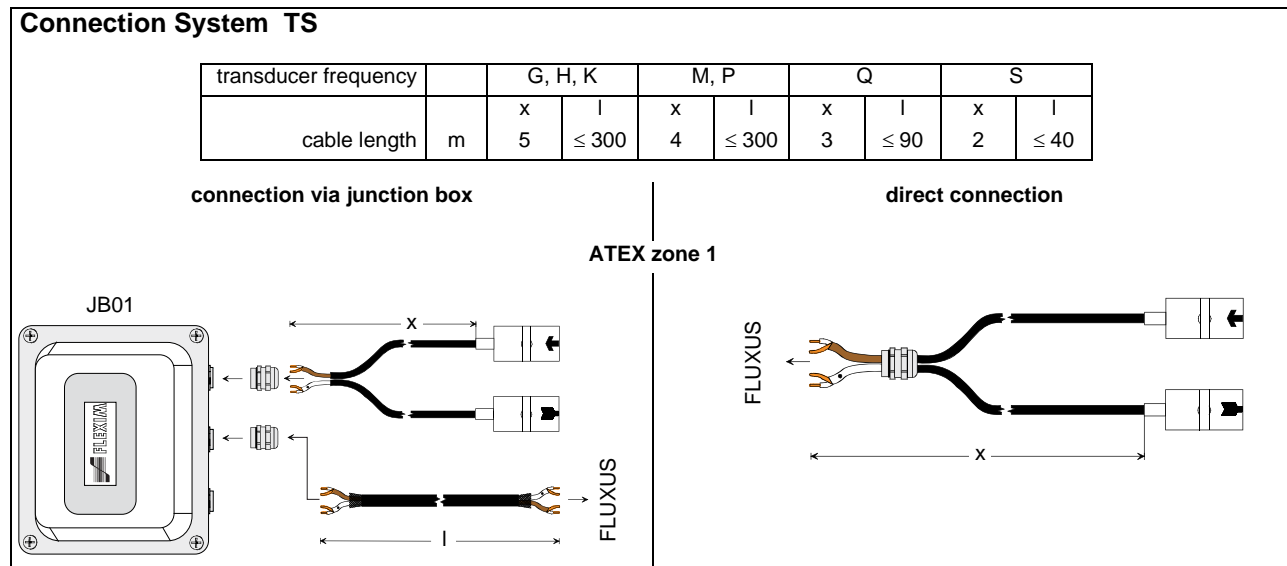
Tension Straps, Clasps and Mounting Shoes



Variofix Mounting Fixture VFX with Tension Straps and Clasps



Connection Systems



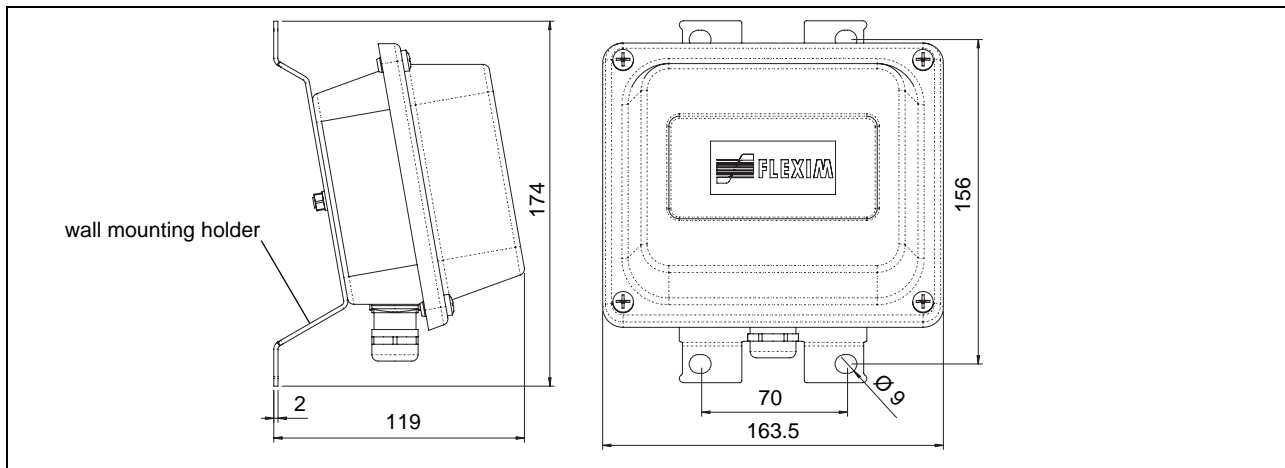
x - transducer cable length
 l - max. length of extension cable

Junction Box

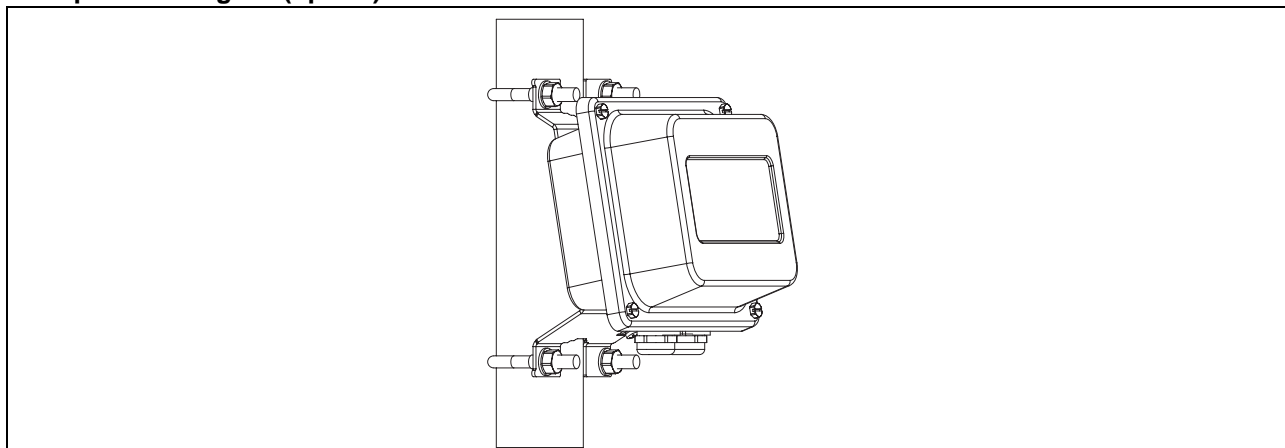
Technical Data

| | | |
|--|--|-----|
| technical type | JB01S4E3M | |
| dimensions | see dimensional drawing | |
| installation | 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 marking | 1 CE 0044 ⊕ II2G Ex e mb II T6...T4 T _a -40...+80 °C | |
| certification | IBExU06ATEX1161 | |
| type of protection | junction box: increased safety decoupled network: encapsulation | |

Dimensions



2 " Pipe Mounting Kit (option)





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