

Flexim FLUXUS F532WD Ultrasonic Flowmeter



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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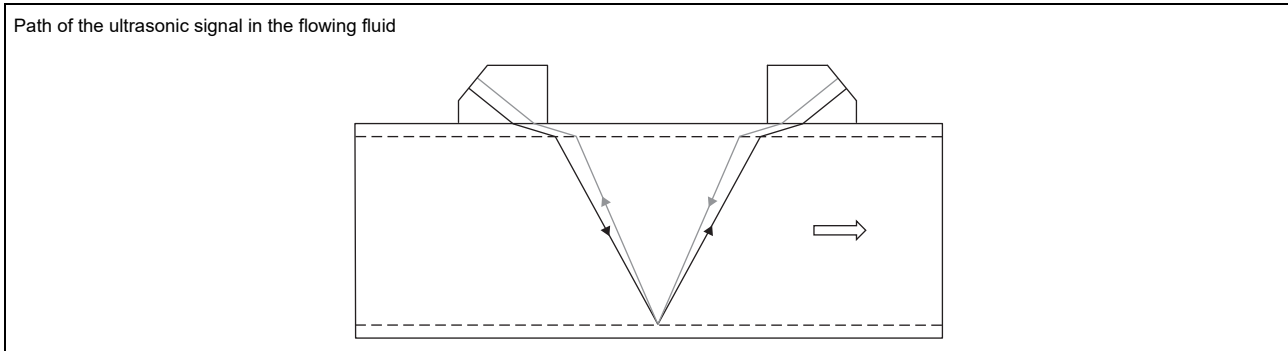
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Function

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.

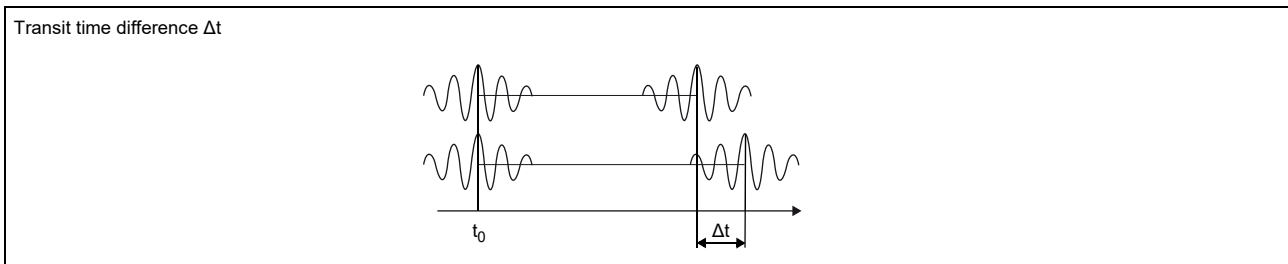


Transit time difference principle

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.



HybridTrek

If the gaseous or solid content in the fluid increases occasionally during measurement, a measurement with the transit time difference principle may no longer be 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

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

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_y - 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:

- **reflect 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**

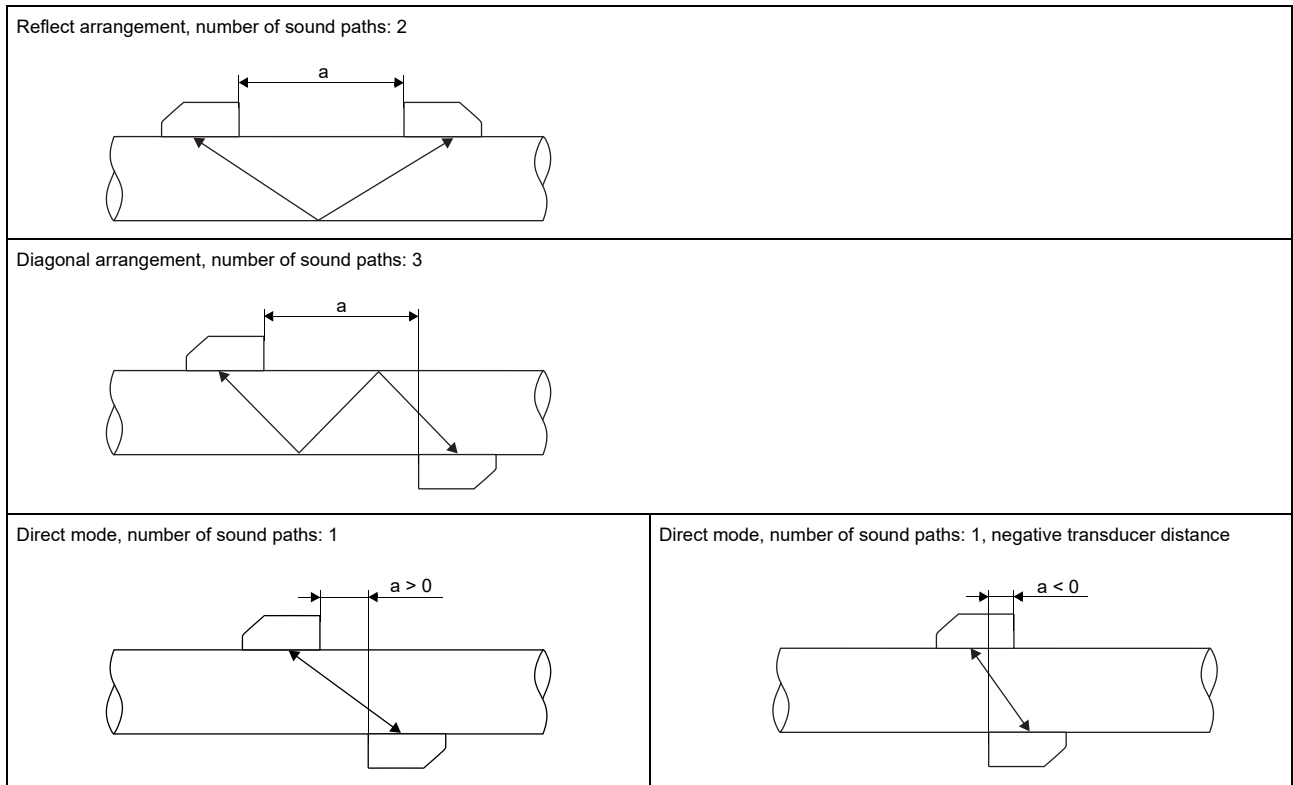
The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe.

- **direct mode**

Diagonal arrangement with 1 sound path. This should be used in the case of a high signal attenuation by the fluid, pipe or coatings.

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 reflect arrangement or diagonal arrangement, the number of sound paths can be adjusted optimally for the application.



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 direction | bidirectional | |
| flow velocity | ft/s | 0.03 to 82 |
| repeatability | 0.15 % MV ±0.02 ft/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 ±0.02 ft/s includes calibration certificate traceable to NIST | |
| measurement uncertainty at the measuring point ² | ±1 % MV ±0.02 ft/s | |
| measurement uncertainty (temperature from sound speed) | | |
| measurement uncertainty at the measuring point ² | ±0.2 K (fluid temperature: 32 to 86 °F, inner pipe diameter: min. 7.9 inch) | |
| transmitter | | |
| power supply | <ul style="list-style-type: none"> • 90 to 250 V/50 to 60 Hz or • 11 to 32 V DC | |
| power consumption | W | < 10 |
| number of measuring channels | 1 | |
| damping | s | 0 to 100 (adjustable) |
| measuring cycle | Hz | 100 to 1000 |
| response time | s | 1 |
| housing material | aluminum, powder coated | |
| degree of protection | IP66 | |
| dimensions | inch | see dimensional drawing |
| weight | lb | 7 |
| fixation | wall mounting, optional: 2" pipe mounting | |
| ambient temperature | °F | -4 to +140 |
| display | 128 x 64 pixels, backlight | |
| menu language | English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian, Chinese | |
| certificates | | |
| use in unclassified (ordinary) locations | optional:  FM23NUS0010 FM23NCA0007 | |
| measuring functions | | |
| physical quantities | volumetric flow rate, mass flow rate, flow velocity | |
| totalizer | volume, mass | |
| diagnostic functions | sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times | |
| communication interfaces | | |
| service interfaces | measured value transmission, parametrization of the transmitter: <ul style="list-style-type: none"> • USB • LAN | measured value transmission, parametrization of the transmitter: <ul style="list-style-type: none"> • USB • LAN |
| process interfaces | - | 1 option: <ul style="list-style-type: none"> • Modbus RTU • BACnet MS/TP • HART • Modbus TCP • BACnet IP |
| accessories | | |
| data transmission kit | USB cable | |
| software | <ul style="list-style-type: none"> • FluxDiagReader: reading of measured values and parameters, graphical representation • FluxDiag (optional): reading of measurement data, graphical representation, report generation, parametrization of the transmitter | |

¹ with aperture calibration of the transducers

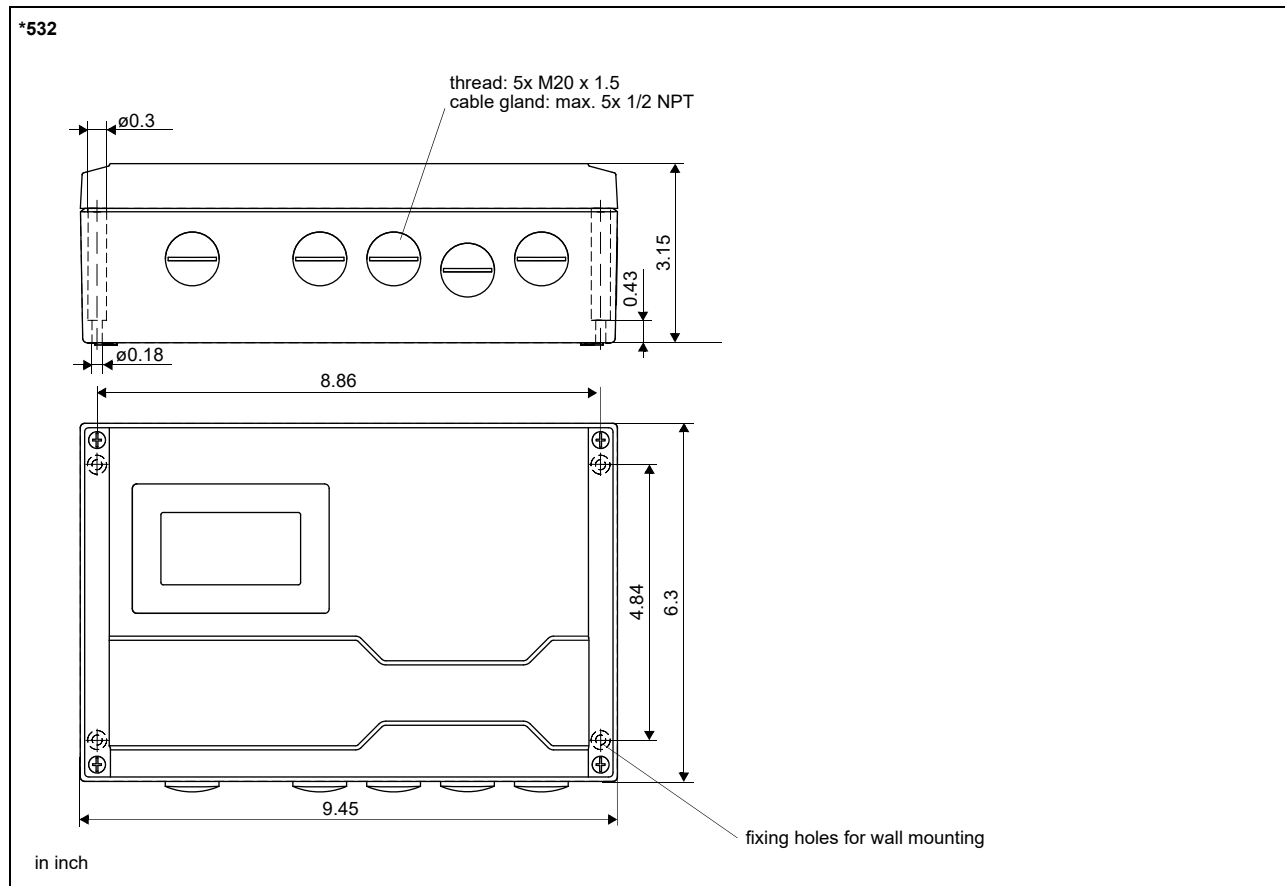
² for transit time difference principle and reference conditions

| | | FLUXUS F532WD (analog outputs) | FLUXUS F532WD (process interface) |
|------------------------------------|-------|--|---|
| data logger | | | |
| loggable values | | all physical quantities and totalized physical quantities | |
| capacity | | max. 800 000 measured values | |
| outputs | | | |
| | | The outputs are galvanically isolated from the transmitter. | |
| • switchable current output | | | |
| | | configurable according to NAMUR NE 43 All switchable current outputs are jointly switched to active or passive. | |
| number | | 1, optional: 2 | optional: 1 (HART) |
| range | mA | 4 to 20 (alarm current: 3.2 to 3.99, 20.01 to 24, hardware fault current: 3.2) | 4 to 20 (alarm current: 3.2 to 3.99, 20.01 to 24, hardware fault current: 3.2) |
| uncertainty | | 0.04 % of output value $\pm 3 \mu\text{A}$ | 0.04 % of output value $\pm 3 \mu\text{A}$ |
| active output | | $R_{\text{ext}} = 250 \text{ to } 530 \Omega$, $U_{\text{opencircuit}} = 28 \text{ V DC}$ | $R_{\text{ext}} = 250 \text{ to } 530 \Omega$, $U_{\text{opencircuit}} = 28 \text{ V DC}$ |
| passive output | | $U_{\text{ext}} = 9 \text{ to } 30 \text{ V DC}$, depending on R_{ext} ($R_{\text{ext}} < 458 \Omega$ at 20 V) | $U_{\text{ext}} = 9 \text{ to } 30 \text{ V DC}$, depending on R_{ext} ($R_{\text{ext}} < 458 \Omega$ at 20 V) |
| current output in HART mode | | | |
| • range | mA | - | 4 to 20 (alarm current: 3.5 to 3.99, 20.01 to 22, hardware fault current: 3.2) |
| • active output | | - | $R_{\text{ext}} = 250 \text{ to } 530 \Omega$, $U_{\text{opencircuit}} = 28 \text{ V DC}$ |
| • passive output | | - | $U_{\text{ext}} = 9 \text{ to } 30 \text{ V DC}$, depending on R_{ext} ($R_{\text{ext}} = 250 \text{ to } 458 \Omega$ at 20 V) |
| • digital output | | | |
| number | | 2, optional: 4 | - |
| functions | | <ul style="list-style-type: none"> • frequency output • binary output • pulse output | - |
| type | | open collector (passive) (IEC 60947-5-6) | - |
| operating parameters | | 5 to 30 V, $I_{\text{max}} = 20 \text{ mA}$, $R_{\text{int}} = 1020 \Omega$ Low: $U < 2 \text{ V}$ at $I_{\text{loop}} = 2 \text{ mA}$ ($R_{\text{ext}} = 11 \text{ k}\Omega$ at $U_{\text{ext}} = 24 \text{ V}$) High: $U > 15 \text{ V}$ ($R_{\text{ext}} = 11 \text{ k}\Omega$ at $U_{\text{ext}} = 24 \text{ V}$) | - |
| frequency output | | | |
| • range | kHz | 0.002 to 10 | - |
| • damping | s | 0 to 999.9 (adjustable) | - |
| • pulse-to-pause ratio | | 1:1 | - |
| binary output | | | |
| • binary output as alarm output | | limit, change of flow direction or error | - |
| pulse output | | | |
| • pulse value | units | 0.01 to 1000 | - |
| • pulse width | ms | 0.05 to 1000 | - |
| • pulse rate | | max. 10 000 pulses | - |

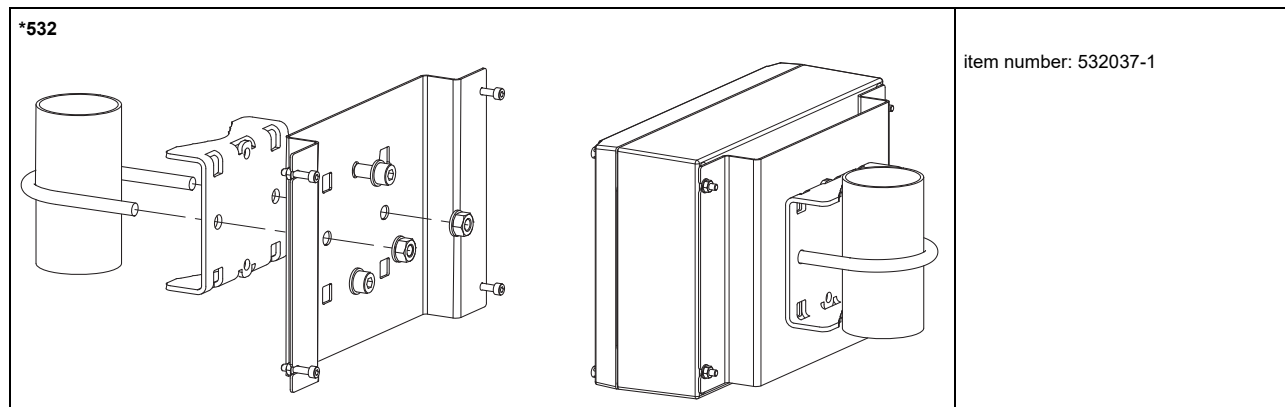
¹ with aperture calibration of the transducers

² for transit time difference principle and reference conditions

Dimensions



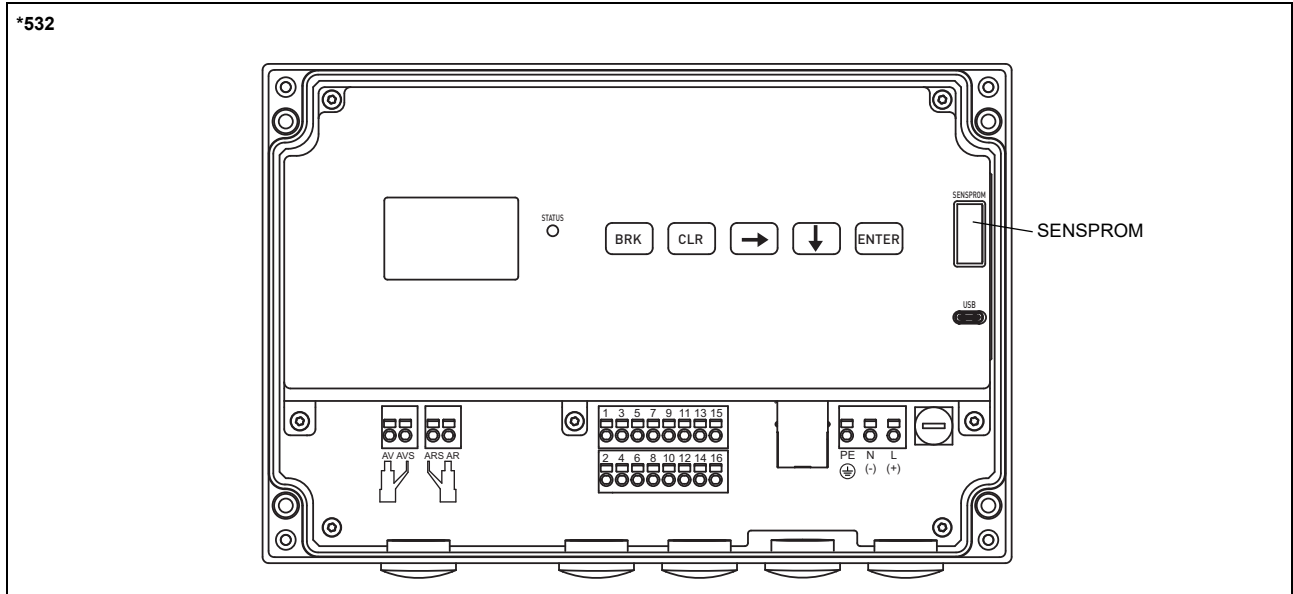
2" pipe mounting kit (optional)



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: -4...+140 °F

Terminal assignment



| power supply ¹ | | | |
|---------------------------|----------------------|----------|----------------------|
| terminal | connection (AC) | terminal | connection (DC) |
| PE | protective conductor | PE | protective conductor |
| N | neutral conductor | (-) | - |
| L | outer conductor | (+) | + |

| 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 |

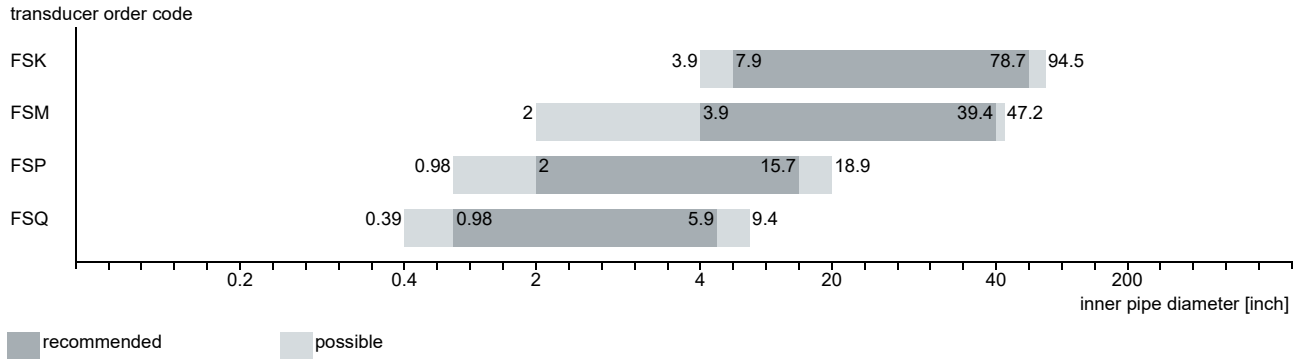
| communication interfaces | | |
|--------------------------|-----------------------------------|--|
| terminal | connection | communication interface |
| 15 | signal + | <ul style="list-style-type: none"> • Modbus RTU¹ • BACnet MS/TP¹ |
| 16 | signal - | |
| USB | type C Hi-Speed USB 2.0 Device | service (FluxDiag/FluxDiagReader) |
| LAN | RJ45 10/100 Mbps Ethernet | <ul style="list-style-type: none"> • service (FluxDiag/FluxDiagReader) • Modbus TCP • BACnet IP |

¹ cable (by customer): e.g., flexible wires, with insulated wire ferrules, wire cross-section: AWG14 to 24

² The number, type and terminal assignment are customized.

Transducers

Transducer selection



Technical data

Shear wave transducers

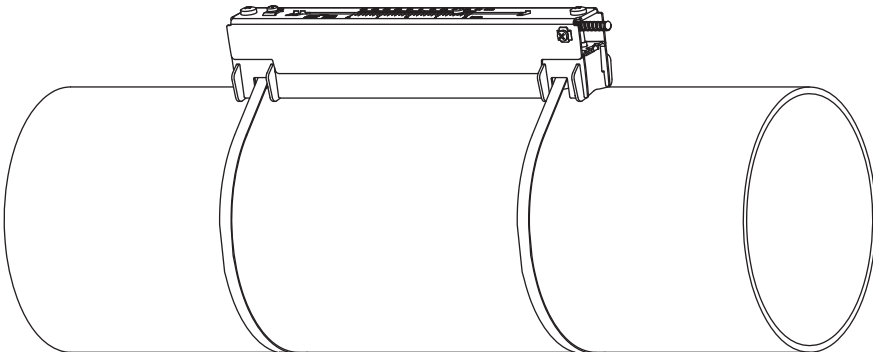
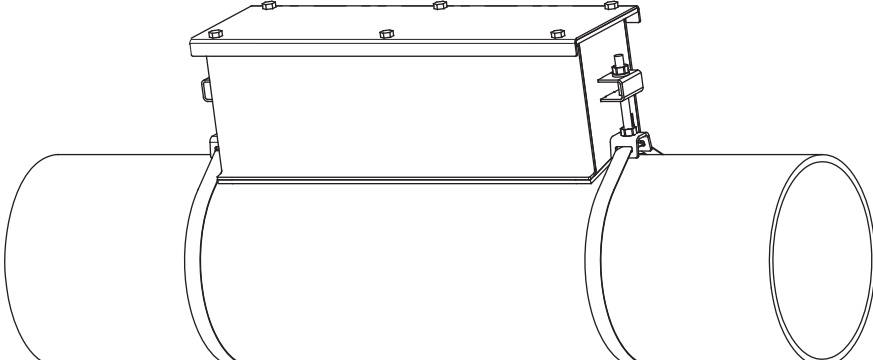
| order code | | FSK-N***_**T1 | FSM-N***_**T1 | FSP-N***_**T1 | FSQ-N***_**T1 |
|------------------------------|------|--------------------------------------|---------------|---------------|---------------|
| technical type | | C(DL)K1N53 | C(DL)M2N53 | C(DL)P2N53 | C(DL)Q2N53 |
| transducer frequency MHz | | 0.5 | 1 | 2 | 4 |
| inner pipe diameter d | | | | | |
| min. extended | inch | 3.9 | 2 | 0.98 | 0.39 |
| min. recommended | inch | 7.9 | 3.9 | 2 | 0.98 |
| max. recommended | inch | 78.7 | 39.4 | 15.7 | 5.9 |
| max. extended | inch | 94.5 | 47.2 | 18.9 | 9.4 |
| pipe wall thickness | | | | | |
| min. | inch | 0.2 | 0.1 | 0.05 | 0.02 |
| material | | | | | |
| housing | | PEEK with stainless steel cover 316L | | | |
| contact surface | | PEEK | | | |
| degree of protection | | IP66 | IP66/IP67 | | |
| transducer cable | | | | | |
| type | | 1699 | | | |
| length | ft | 16 | 13 | 9 | |
| dimensions | | | | | |
| length l | inch | 4.98 | 2.52 | 1.57 | |
| width b | inch | 2.01 | 1.26 | 0.87 | |
| height h | inch | 2.66 | 1.59 | 1 | |
| dimensional drawing | | | | | |
| weight (without cable) | lb | 0.79 | 0.15 | 0.04 | |
| pipe surface temperature | °F | -40 to +266 | | | |
| ambient temperature | °F | -40 to +266 | | | |
| temperature compensation | | x | | | |

Shear wave transducers (IP68)

| order code | | FSK-LNNN-**T1 -***/H68 | FSM-LNNN-**T1 -***/H68 | FSP-LNNN-**T1 -***/H68 |
|------------------------------|------|---------------------------------------|---------------------------|---------------------------|
| technical type | | CDK1LI8 | CDM2LI8 | CDP2LI8 |
| transducer frequency | MHz | 0.5 | 1 | 2 |
| inner pipe diameter d | | | | |
| min. extended | inch | 3.9 | 2 | 0.98 |
| min. recommended | inch | 7.9 | 3.9 | 2 |
| max. recommended | inch | 78.7 | 39.4 | 15.7 |
| max. extended | inch | 94.5 | 47.2 | 18.9 |
| pipe wall thickness | | | | |
| min. | inch | 0.2 | 0.1 | 0.05 |
| material | | | | |
| housing | | PEEK with stainless steel cover 316Ti | | |
| contact surface | | PEEK | | |
| degree of protection | | IP68 ¹ | | |
| transducer cable | | | | |
| type | | 2550 | | |
| length | ft | 39 | | |
| dimensions | | | | |
| length l | inch | 5.12 | 2.76 | |
| width b | inch | 2.13 | 1.26 | |
| height h | inch | 3.29 | 1.81 | |
| dimensional drawing | | | | |
| weight (without cable) | lb | 0.95 | 0.19 | |
| pipe surface temperature | °F | -40 to +212 | | |
| ambient temperature | °F | -40 to +212 | | |
| temperature compensation | | x | | |

¹ test conditions: 3 months/29 psi (65 ft)/36 °F

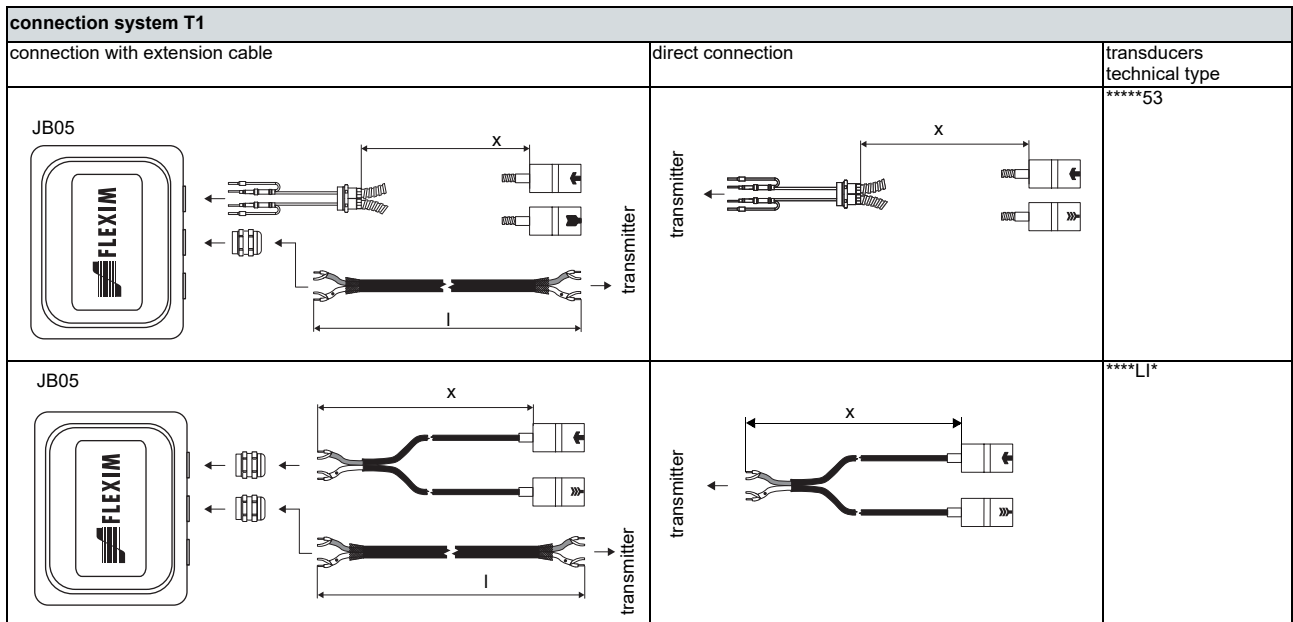
Transducer mounting fixture

| | |
|--|---|
| <p>Variofix L (VL)</p>  | <p>material: stainless steel 316Ti, 316L, 17-7PH inner length: VLK: 13.7 inch, option IP68: 14.5 inch VL(MP): 9.2 inch VLQ: 6.9 inch dimensions: VLK: 16.65 x 3.54 x 3.66 inch option IP68: 17.44 x 3.7 x 4.13 inch VL(MP): 12.17 x 2.24 x 2.48 inch VLQ: 9.72 x 1.69 x 1.85 inch</p> |
| <p>PermaLok (PL)</p>  | <p>material: stainless steel 316 dimensions: PL(GHK)-RL: 19.25 x 3.9 x 3.95 inch PL(GHK)-DS: 13.25 x 3.85 x 3.95 inch PL(MP): 25.25 x 3.08 x 3.15 inch PLQ: 13.37 x 2.68 x 2.4 inch weight: PL(GHK)-RL: 6 lb PL(GHK)-DS: 4.2 lb PL(MP): 6.6 lb PLQ: 2.8 lb</p> |

Coupling materials for transducers

| type | ambient temperature °F |
|----------------------|---------------------------|
| coupling pad type VT | 14 to +392 |

Connection systems



Cable

| transducer cable | | |
|---------------------|-------|--------------------------------------|
| type | | 1699 2550 |
| weight | lb/ft | 0.06 0.02 |
| ambient temperature | °F | -67 to +392 -40 to +212 |
| cable jacket | | |
| material | | PTFE PUR |
| outer diameter | inch | 0.11 0.2 ±0.01 |
| thickness | inch | 0.01 0.04 |
| color | | brown gray |
| shield | | x x |
| sheath | | |
| material | | stainless steel 316Ti - |
| outer diameter | inch | 0.31 - |

| extension cable | |
|---------------------|--|
| type | 2615 |
| weight | lb/ft 0.12 |
| ambient temperature | °F -22 to +158 |
| properties | halogen-free fire propagation test according to IEC 60332-1 combustion test according to IEC 60754-2 |
| cable jacket | |
| material | PUR |
| outer diameter | inch 0.47 |
| thickness | inch 0.08 |
| color | black |
| shield | x |

Cable length

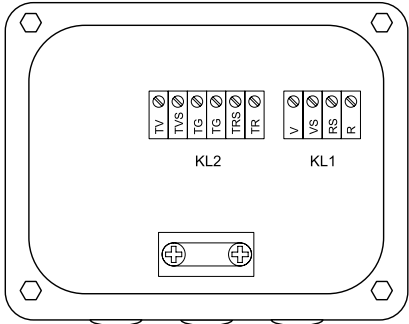
| transducer frequency | | K | | M, P | | Q | |
|----------------------------|----|----|-------|------|-------|----|-------|
| transducers technical type | | x | l | x | l | x | l |
| *D***5* | ft | 16 | ≤ 984 | 13 | ≤ 984 | 9 | ≤ 295 |
| *L***5* | ft | 29 | ≤ 984 | 29 | ≤ 984 | 29 | ≤ 295 |
| ****L* | ft | 39 | ≤ 984 | 39 | ≤ 984 | - | - |

x = transducer cable length

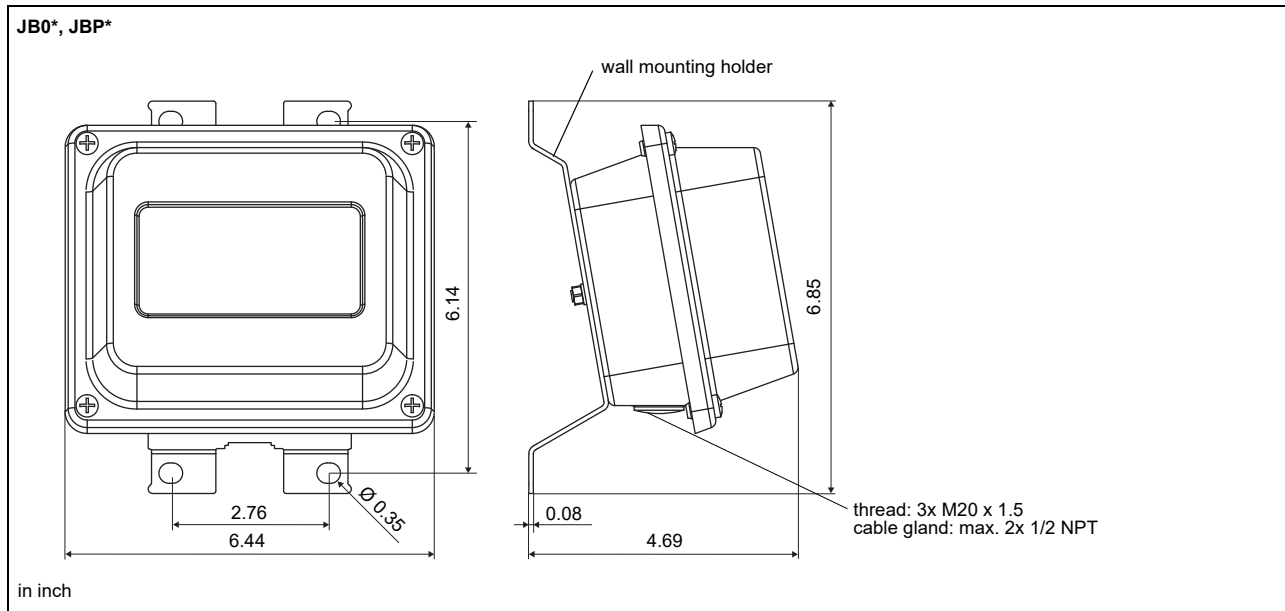
l = max. length of extension cable (depending on the application)

Junction box

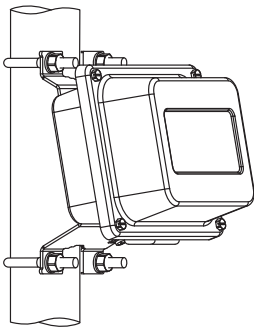
Technical data

| JB05 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|----------|---|----------------|----------|------------|------------|-----|---|--------|---|----|-----------------|----|-----------------|---|---|--------|----------------|----------|------------|-----|----|--------|-----|-----------------|-----|-----------------|----|--------|
| weight | lb | 2.6 lb | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| fixation | | wall mounting optional: 2" pipe mounting | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| material | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| housing | | stainless steel 316L | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| gasket | | silicone | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| degree of protection | | IP66/IP67 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ambient temperature | °F | -40 to +176 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"></div> <div style="width: 65%;"> <p>Connection</p>  <p>Transducers</p> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> <th>transducer</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL1</td> <td>V</td> <td>signal</td> <td rowspan="2">↑</td> </tr> <tr> <td>VS</td> <td>internal shield</td> </tr> <tr> <td>RS</td> <td>internal shield</td> <td rowspan="2">↕</td> </tr> <tr> <td>R</td> <td>signal</td> </tr> </tbody> </table> <p>Extension cable</p> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL2</td> <td>TV</td> <td>signal</td> </tr> <tr> <td>TVS</td> <td>internal shield</td> </tr> <tr> <td>TRS</td> <td>internal shield</td> </tr> <tr> <td>TR</td> <td>signal</td> </tr> </tbody> </table> </div> </div> | | | terminal strip | terminal | connection | transducer | KL1 | V | signal | ↑ | VS | internal shield | RS | internal shield | ↕ | R | signal | terminal strip | terminal | connection | KL2 | TV | signal | TVS | internal shield | TRS | internal shield | TR | signal |
| terminal strip | terminal | connection | transducer | | | | | | | | | | | | | | | | | | | | | | | | | | |
| KL1 | V | signal | ↑ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | VS | internal shield | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | RS | internal shield | ↕ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | R | signal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| terminal strip | terminal | connection | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| KL2 | TV | signal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | TVS | internal shield | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | TRS | internal shield | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | TR | signal | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Dimensions



2" pipe mounting kit

| | |
|---|------------------------------|
| <p>JB**</p>  | <p>item number: 751035-2</p> |
|---|------------------------------|

For more information: **Emerson.com**

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