



**FLEXIM**

**Technical specification**

**PIOX S721**

## **Process analysis and flow measurement with ultrasound**

### **Features**

- Time measurement for the accurate and repeatable determination of concentration, density and density-related physical quantities

### **Applications**

For a wide range of fluids, e.g. H<sub>2</sub>SO<sub>4</sub>, HF, HCl, HNO<sub>3</sub>, sugar solution (Brix), brine in:

- Chemical industry
- Petrochemical industry
- Oil and gas industry
- Pharmaceutical industry
- Semiconductor industry
- Mechanical and electrical industries
- Food industry



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## Transmitter

### Technical data

|  | <b>PIOX<br/>S721**-NNN**-*A<br/>S721**-NNN**-*S</b>  | <b>PIOX<br/>S721**-A2N**-*A<br/>S721**-A2N**-*S</b>                   | <b>PIOX<br/>S721**-F2N**-*A<br/>S721**-F2N**-*S</b>   |  |  |  |
|--|--|---|---|--|--|--|
|  |  |   |   |  |  |  |
| design   | standard field device  | standard field device<br>zone 2                                       | standard field device<br>FM Class I Div. 2  |  |  |  |
| <b>measurement</b>   |  |   |   |  |  |  |
| • analysis   |  |   |   |  |  |  |
| transit time<br>(repeatable)                                 | $1/(50 \cdot f_a) \pm 10^{-4} \cdot t$   |   |   |  |  |  |
| transit time<br>(absolute)                                   | $1/(5 \cdot f_a) \pm 10^{-4} \cdot t$  |   |   |  |  |  |
|  | $f_a$ - transducer frequency, $t$ - total transit time<br>e.g. for transducers with frequency $M$ ( $f_a = 1$ MHz):<br>repeatable: $20 \text{ ns} \pm 10^{-4} \cdot t$ , absolute: $200 \text{ ns} \pm 10^{-4} \cdot t$                            |   |   |  |  |  |
|  | The total measurement uncertainty of a physical quantity for analysis is supplied order-related as it depends on the fluid, operating range and installation. For the basis of calculation see document <a href="#">TIPIOX-S_uncert_analysis</a> . |   |   |  |  |  |
| • flow   |  |   |   |  |  |  |
| measurement principle  | transit time difference correlation principle  |   |   |  |  |  |
| flow direction   | bidirectional  |   |   |  |  |  |
| flow velocity  | m/s  | 0.01...25   |   |  |  |  |
| repeatability  |  | 0.15 % MV $\pm 0.005$ m/s   |   |  |  |  |
| fluid  | all acoustically conductive liquids with < 10 % gaseous or solid content in volume   |   |   |  |  |  |
| temperature compensation                                     | corresponding to the recommendations in ANSI/ASME MFC-5.1-2011   |   |   |  |  |  |
| <b>measurement uncertainty (volumetric flow rate)</b>        |  |   |   |  |  |  |
| measurement uncertainty of the measuring system <sup>1</sup> | $\pm 0.3\%$ MV $\pm 0.005$ m/s   |   |   |  |  |  |
| measurement uncertainty at the measuring point <sup>2</sup>  | $\pm 1\%$ MV $\pm 0.005$ m/s   |   |   |  |  |  |
| <b>transmitter</b>   |  |   |   |  |  |  |
| power supply   | <ul style="list-style-type: none"> <li>• 100...230 V/50...60 Hz or</li> <li>• 20...32 V DC or</li> <li>• 11...16 V DC</li> </ul>   |   |   |  |  |  |
| power consumption  | W  | < 15  |   |  |  |  |
| number of measuring channels                                 |  | 1, optional: 2  |   |  |  |  |
| damping  | s  | 0...100 (adjustable)  |   |  |  |  |
| measuring cycle  | Hz   | 100...1000 (1 channel)  |   |  |  |  |
| response time  | s  | 1 (1 channel)   |   |  |  |  |
| housing material   | aluminum, powder coated or stainless steel 316L (1.4404)   |   |   |  |  |  |
| degree of protection   | IP66   | aluminum housing: IP66/NEMA 4X<br>stainless steel housing: IP65       |   |  |  |  |
| dimensions   | mm   | see dimensional drawing   |   |  |  |  |
| weight   | kg   | aluminum housing: 5.4<br>stainless steel housing: 5.1                 |   |  |  |  |
| fixation   |  | wall mounting, optional: 2" pipe mounting                             |   |  |  |  |
| ambient temperature  | °C   | -40...+60<br>(< -20 without operation of the display)                 | aluminum housing: -40...+55/60<br>(< -20 without operation of the display)<br>stainless steel housing: -20...+55/60 |  |  |  |
| display  | 128 x 64 pixels, backlight   |   |   |  |  |  |
| menu language  | English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian   |   |   |  |  |  |
| <b>explosion protection</b>                                  |  |   |   |  |  |  |
| • ATEX/IECEX   |  |   |   |  |  |  |
| marking  | -  | S721**-A20*A, S721**-A20*S:<br><br>IBExU11ATEX1015, IECEx IBE 11.0008 | -   |  |  |  |
| certification  | -  |   | -   |  |  |  |

<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> outside the explosive atmosphere (housing cover open)

|   | <b>PIOX<br/>S721**-NNN**-*A<br/>S721**-NNN**-*S</b>  | <b>PIOX<br/>S721**-A2N**-*A<br/>S721**-A2N**-*S</b> | <b>PIOX<br/>S721**-F2N**-*A<br/>S721**-F2N**-*S</b> |
|---|--|---|---|
| <b>• FM</b>   |  |   |   |
| marking   |  | -   | -   |
|  NI/Cl. I,II,III/Div. 2/<br>GP. A,B,C,D,E,F,G/<br>T5<br><br> NI/Cl. I,II,III/Div. 2/<br>GP. A,B,C,D,E,F,G/<br>T4A |  |   |   |
| <b>measuring functions</b>  |  |   |   |
| physical quantities   | see table below  |   |   |
| totaliser   | volume, mass   |   |   |
| calculation functions   | average, difference, sum (2 measuring channels necessary)  |   |   |
| diagnostic functions  | signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times  |   |   |
| <b>communication interfaces</b>   |  |   |   |
| service interfaces  | measured value transmission, parametrisation of the transmitter:<br>• USB <sup>3</sup><br>• LAN <sup>3</sup>   |   |   |
| process interfaces  | max. 1 option:<br>• RS485 (ASCII sender)<br>• Modbus RTU<br>• BACnet MS/TP<br>• HART<br>• Profibus PA<br>• FF H1<br>• Modbus TCP<br>• BACnet IP  |   |   |
| <b>accessories</b>  |  |   |   |
| data transmission kit   | USB cable  |   |   |
| software  | • FluxDiagReader: reading of measured values and parameters, graphical representation<br>• FluxDiag (optional): reading of measurement data, graphical representation, report generation, parametrisation of the transmitter |   |   |
| <b>data logger</b>  |  |   |   |
| loggable values   | all physical quantities, totalised physical quantities and diagnostic values   |   |   |
| capacity  | max. 800 000 measured values   |   |   |
| <b>outputs</b>  |  |   |   |
|   | The outputs are galvanically isolated from the transmitter.  |   |   |
| number  | on request   |   |   |
| <b>• switchable current output</b>  |  |   |   |
|   | All switchable current outputs are jointly switched to active or passive.  |   |   |
| range   | mA 4...20 (3.2...22)   |   |   |
| accuracy  | 0.04 % MV ±3 µA  |   |   |
| active output   | R <sub>ext</sub> < 250 Ω   |   |   |
| passive output  | U <sub>ext</sub> = 8...30 V, depending on R <sub>ext</sub> (R <sub>ext</sub> < 1 kΩ at 30 V)   |   |   |
| <b>• HART</b>   |  |   |   |
| range   | mA 4...20  |   |   |
| accuracy  | 0.1 % MV ±15 µA  |   |   |
| active output   | U <sub>int</sub> = 24 V, R <sub>ext</sub> < 500 Ω  |   |   |
| passive output  | U <sub>ext</sub> = 10...24 V DC, depending on R <sub>ext</sub> (R <sub>ext</sub> < 1 kΩ at 24 V)   |   |   |
| <b>• voltage output</b>   |  |   |   |
| range   | V 0...1 or 0...10  |   |   |
| accuracy  | 0...1 V: 0.1 % MV ±1 mV<br>0...10 V: 0.1 % MV ±10 mV   |   |   |
| internal resistance   | R <sub>int</sub> = 500 Ω   |   |   |
| <b>• frequency output</b>   |  |   |   |
| range   | kHz 0...5  |   |   |
| optorelay   | 24 V/4 mA, R <sub>int</sub> = 66.5 Ω   |   |   |

<sup>1</sup> with aperture calibration of the transducers<sup>2</sup> for transit time difference principle and reference conditions<sup>3</sup> outside the explosive atmosphere (housing cover open)

|                            | <b>PIOX<br/>S721**-NNN**-*A<br/>S721**-NNN**-*S</b> | <b>PIOX<br/>S721**-A2N**-*A<br/>S721**-A2N**-*S</b>  | <b>PIOX<br/>S721**-F2N**-*A<br/>S721**-F2N**-*S</b> |
|----------------------------|---|--|---|
| <b>• digital output</b>    |   |  |   |
| functions                  |   | • frequency output<br>• binary output<br>• pulse output  |   |
| number                     |   | 3  |   |
| operating parameters       |   | 5...30 V/< 100 mA  |   |
| <b>frequency output</b>    |   |  |   |
| • range                    | kHz   | 0...5  |   |
| <b>binary output</b>       |   | limit, change of flow direction or error   |   |
| <b>pulse output</b>        |   |  |   |
| • functions                |   | mainly for totalising  |   |
| • pulse value              | units   | 0.01...1000  |   |
| • pulse width              | ms  | 0.05...1000  |   |
| <b>inputs</b>              |   |  |   |
|                            |   | The inputs are galvanically isolated from the transmitter.   |   |
| number                     |   | max. 4, on request<br>min. 1 input or process interface with inputs necessary for fluid temperature  |   |
| <b>• temperature input</b> |   |  |   |
| type                       |   | Pt100/Pt1000   |   |
| connection                 |   | 4-wire   |   |
| range                      | °C  | -150...+560  |   |
| resolution                 | K   | 0.01   |   |
| accuracy                   |   | ±0.01 % MV ±0.03 K   |   |
| <b>• current input</b>     |   |  |   |
| accuracy                   |   | 0.1 % MV ±10 µA  |   |
| active input               |   | $U_{int} = 24 \text{ V}$ , $R_{int} = 50 \Omega$ , $P_{int} < 0.5 \text{ W}$ , not short-circuit proof   |   |
| • range                    | mA  | 0...20   |   |
| passive input              |   | $R_{int} = 50 \Omega$ , $P_{int} < 0.3 \text{ W}$  |   |
| • range                    | mA  | -20...+20  |   |
| <b>• voltage input</b>     |   |  |   |
| range                      | V   | 0...1  |   |
| accuracy                   |   | 0.1 % MV ±1 mV   |   |
| internal resistance        |   | $R_{int} = 1 \text{ M}\Omega$  |   |
| <b>• binary input</b>      |   |  |   |
| switching signal           |   | 5...30 V, 1 mA   | 5...26 V, 1 mA                                      |
| functions                  |   | • reset of the measured values<br>• reset of the totalisers<br>• stop of the totalisers<br>• activation of the measuring mode for highly dynamic flows |   |

<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> outside the explosive atmosphere (housing cover open)

## Physical quantities

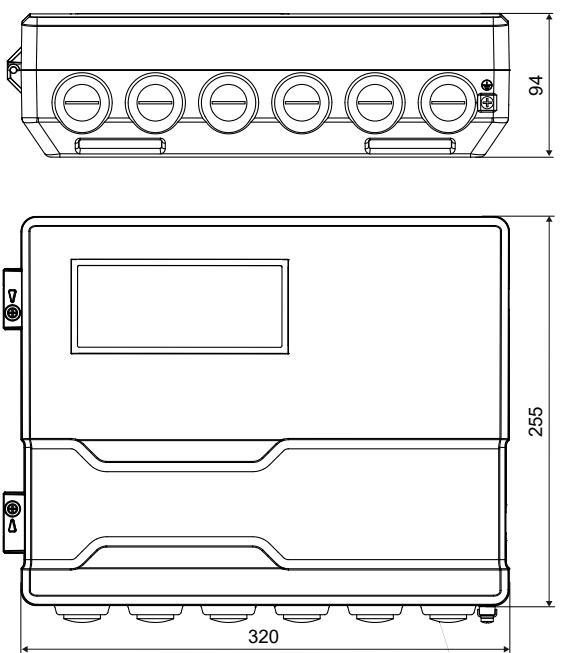
The available physical quantities depend on the fluid data set in the transmitter.

| fluid data set                  | physical quantities   | remark  |
|---------------------------------|---|---|
| NN<br>no fluid data set         | • sound speed, volumetric flow rate   |   |
| MD<br>standard fluid data set   | • analysis <sup>1</sup> : concentration, mass fraction, volume fraction, density, normalised density, normalised sound speed, sound speed<br>• flow: volumetric flow rate, flow velocity, mass flow rate  | application-specific fluid data set from FLEXIM database      |
| CU<br>customised fluid data set | • analysis <sup>1</sup> : concentration, mass fraction, volume fraction, density, normalised density, normalised sound speed, sound speed<br>• flow: volumetric flow rate, flow velocity, mass flow rate<br>• further customised physical quantities <sup>1</sup> | data set developed by FLEXIM in cooperation with the customer |

<sup>1</sup> min. 1 input or process interface with inputs necessary for fluid temperature

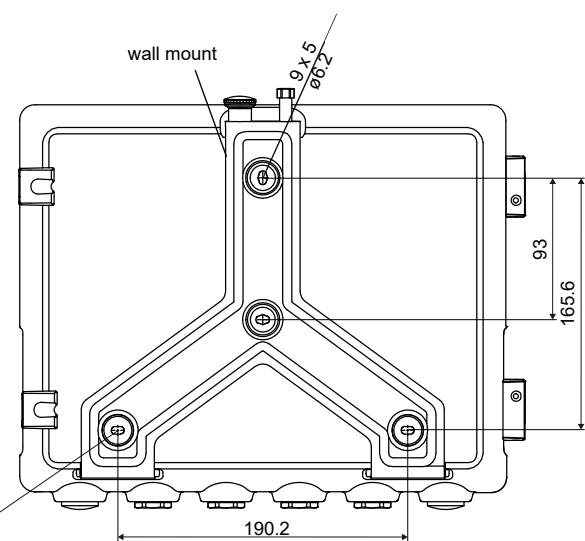
## Dimensions

\*72\*\*\*-\*\*\*\*\*-\*A

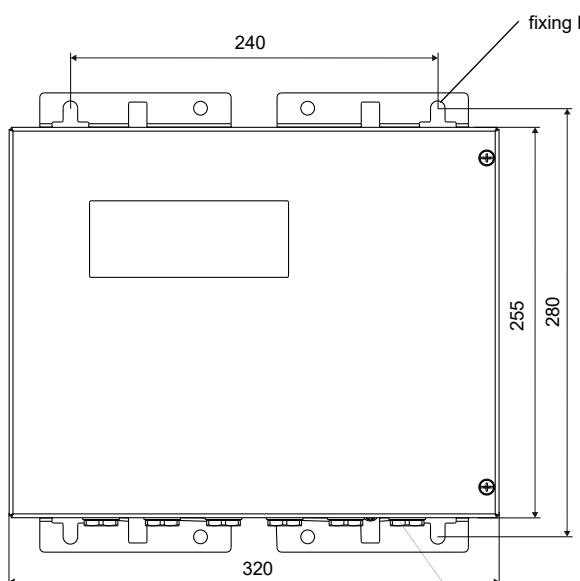
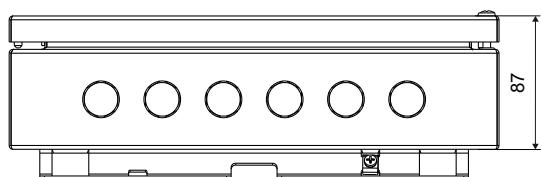


in mm

thread: 6x M20 x 1.5  
cable gland: max. 6x M20



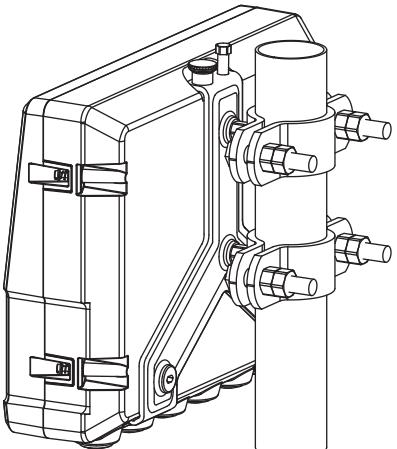
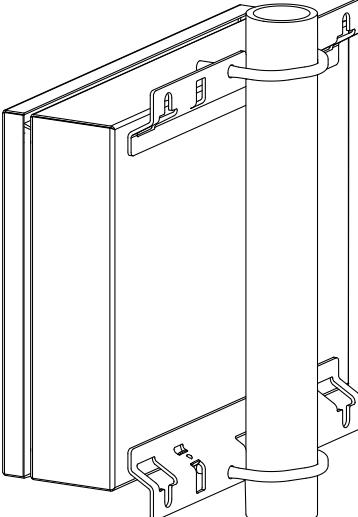
\*72\*\*\*-\*\*\*\*\*-\*S



in mm

\ cable gland: max. 6x M20 with flat gasket and counter nut

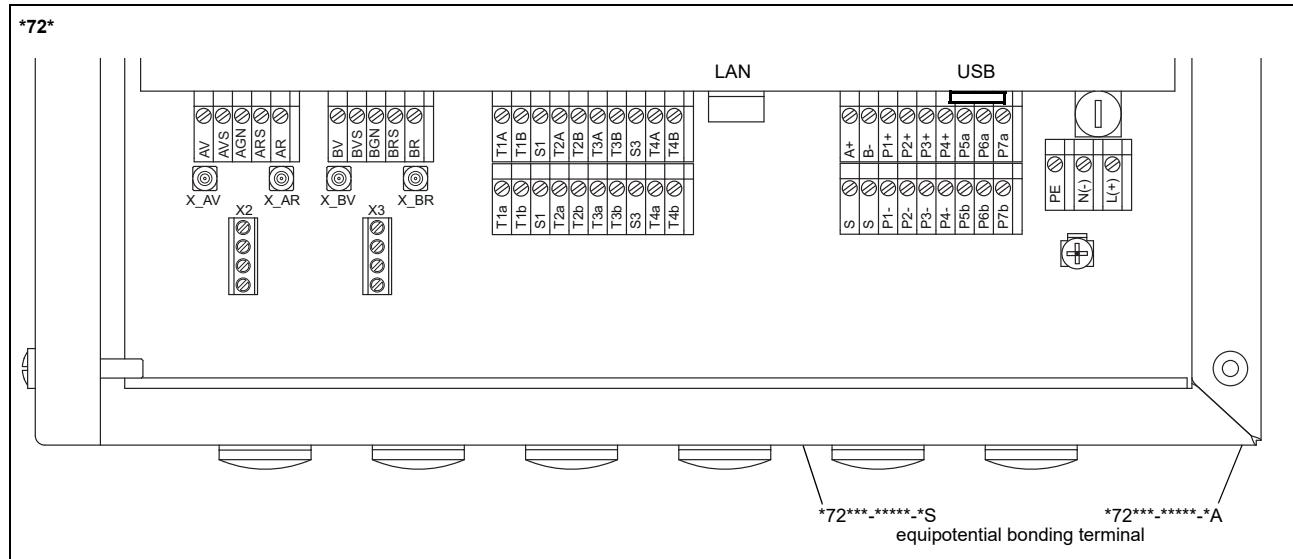
## 2" pipe mounting kit

|                |  |                       |
|----------------|--|-----------------------|
| *72***-****-*A |   | item number: 721037-4 |
| *72***-****-*S |  | item number: 721110-4 |

### 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



| power supply <sup>1</sup>                                       |   |                                 |  |
|---|---|---------------------------------|--|
| terminal  | connection (AC)   |                                 | connection (DC)  |
| PE  | protective conductor  |                                 | protective conductor   |
| N(-)  | neutral conductor   |                                 | -  |
| L(+)  | outer conductor   |                                 | +  |
| transducers   |   |                                 |  |
| transducer cable (transducers ****8*, ****L1*), extension cable |   | measuring channel A             | transducer cable (transducers ****52)  |
| measuring channel A   | measuring channel B   |                                 | 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 <sup>1, 2</sup>   |   |                                 |  |
| terminal  | connection  |                                 | communication interface  |
| P1+...P4+   | current output, voltage output, frequency output, HART (P1) |                                 | A+   |
| P1-...P4-   |   |                                 | signal +   |
| P5a...P7a   | digital output  |                                 | B-   |
| P5b...P7b   |   |                                 | signal -   |
| S   | shield  |                                 | S  |
| USB   | type B Hi-Speed USB 2.0 Device                              |                                 | • RS485 <sup>1</sup><br>• Modbus RTU <sup>1</sup><br>• BACnet MS/TP <sup>1</sup><br>• M-Bus <sup>1</sup><br>• Profibus PA <sup>1</sup><br>• FF H1 <sup>1</sup> |
| LAN   | RJ45 10/100 Mbps Ethernet                                   |                                 | • service (FluxDiag/<br>FluxDiagReader)<br>• BACnet IP<br>• Modbus TCP   |
| analog inputs <sup>1, 2</sup>                                   |   |                                 |  |
| terminal  | temperature probe   | passive sensor                  | active sensor  |
| terminal  | direct connection   | connection with extension cable | connection   |
| T1a...T4a   | red   | red                             | not connected  |
| T1A...T4A   | red/blue  | grey                            | -  |
| T1b...T4b   | white/blue  | blue                            | +  |
| T1B...T4B   | white   | white                           | not connected  |
| S1, S3  | shield  | shield                          | not connected  |
| binary inputs <sup>1, 2</sup>                                   |   |                                 |  |
| terminal  |   |                                 |  |
| P1+...P2+   | P1-...P2-   |                                 |  |

<sup>1</sup> cable (by customer):

- e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm<sup>2</sup>
- outer diameter of the cable (\*72\*\*\*-\*\*\*\*-\*S with ferrite nut): max. 7.6 mm

<sup>2</sup> The number, type and terminal assignment are customised.

## Transducers

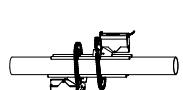
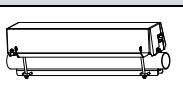
### Overview

#### Shear wave transducers

|  | technical type     |                    |                    |                    |                    |
|--|--------------------|--------------------|--------------------|--------------------|--------------------|
|  | G                  | K                  | M                  | P                  | Q                  |
| zone 2 - FM Class I Div. 2 - nonEx<br>normal temperature range   | CDG1N52<br>CLG1N52 | CDK1N52<br>CLK1N52 | CDM2N52<br>CLM2N52 | CDP2N52<br>CLP2N52 | CDQ2N52<br>CLQ2N52 |
| zone 2 - nonEx<br>IP68   | CDG1L18            | CDK1L18            | CDM2L18            | CDP2L18            |                    |
| zone 2 - FM Class I Div. 2 - nonEx<br>extended temperature range | CDG1E52<br>CLG1E52 | CDK1E52<br>CLK1E52 | CDM2E52<br>CLM2E52 | CDP2E52<br>CLP2E52 | CDQ2E52<br>CLQ2E52 |
| zone 1<br>normal temperature range                               | CDG1N81<br>CLG1N81 | CDK1N81<br>CLK1N81 | CDM2N81<br>CLM2N81 | CDP2N81<br>CLP2N81 | CDQ2N81<br>CLQ2N81 |
| zone 1<br>IP68   | CDG1L11            | CDK1L11            | CDM2L11            | CDP2L11            |                    |
| zone 1<br>extended temperature range                             | CDG1E83<br>CLG1E83 | CDK1E83<br>CLK1E83 | CDM2E85<br>CLM2E85 | CDP2E85<br>CLP2E85 | CDQ2E85<br>CLQ2E85 |
| <b>inner pipe diameter d</b>                                     |                    |                    |                    |                    |                    |
| min. extended  | mm                 | 400                | 100                | 50                 | 25                 |
| min. recommended   | mm                 | 500                | 200                | 100                | 50                 |
| max. recommended   | mm                 | 4000               | 2000               | 1000               | 400                |
| max. extended  | mm                 | 6500               | 2400               | 1200               | 480                |
| <b>pipe wall thickness</b>                                       |                    |                    |                    |                    |                    |
| min.   | mm                 | 11                 | 5                  | 2.5                | 1.2                |
|  |                    |                    |                    |                    | 0.6                |

for further data see Technical specification TS\_F7xx-transducersVx-xXX\_Leu

#### Transducer mounting fixture

|   |   |   |
|---|---|---|
| Variofix L  | Variofix C  | transducer box WI for WavelInjector with chains   |
|  |  |    |
|   | Variofix C with bolt mounting plates  | transducer box WI for WavelInjector with threaded rods  |
|   |  | <br>outer pipe diameter:<br>VCM: max. 46 mm<br>VCQ: max. 36 mm |

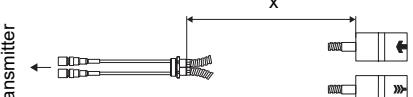
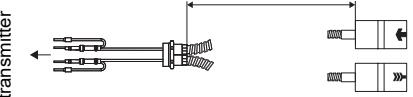
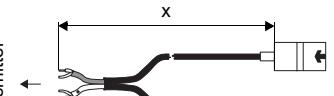
for further data see Technical specification TS\_F7xx-transducersVx-xXX\_Leu

#### Coupling materials for transducers

|                       | normal temperature range                          | extended temperature range                        |   |  | WavelInjector         |  |  |
|-----------------------|---|---|---|--|-----------------------|--|--|
|                       | < 100 °C  | < 170 °C  | < 150 °C  | < 200 °C   | 200...240 °C          | < 280 °C                                       | 280...630 °C                                   |
| < 24 h                | coupling compound type N or coupling foil type VT | coupling compound type E or coupling foil type VT | coupling compound type E or coupling foil type VT | coupling compound type E or H or coupling foil type VT | coupling foil type TF | coupling foil type A and coupling foil type VT | coupling foil type B and coupling foil type VT |
| long time measurement | coupling foil type VT                                  |                       |  |  |

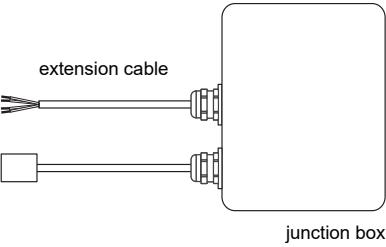
for further data see Technical specification TS\_F7xx-transducersVx-xXX\_Leu

## Connection systems

| connection system TS   |  |                               |
|--|--|-------------------------------|
| connection with extension cable  | direct connection  | transducers<br>technical type |
| JB02, JB03, JB04<br>  | transmitter<br>  | *****52                       |
| connection system T1   |  |                               |
| connection with extension cable  | direct connection  | transducers<br>technical type |
| JB01<br>              | transmitter<br>  | *****8*                       |
| JB01, JBP2, JBP3<br> | transmitter<br> | ***LI*                        |

for further data see Technical specification TS\_F7xx-transducersVx-xXX\_Leu

## Temperature probes

| PT12N   |  | PT12F  |
|---|--|--|
| item number:<br>• 770415-1<br>• 770414-2 (matched)  | item number:<br>• 770415-1A2<br>• 770414-1A2 (matched) | item number:<br>• 770415-2                                       |
| • Pt100<br>• clamp-on<br>• -30...+250 °C  | • Pt100<br>• clamp-on<br>• -30...+250 °C<br>• ATEX     | • Pt100<br>• clamp-on<br>• -45...+250 °C<br>• response time: 8 s |
| direct connection   |  |  |
|    |  |  |
| connection with extension cable   |  |  |
|  <p style="text-align: center;">junction box</p> |  |  |

see Technical specification TS\_PTVx-xXX\_Leu