Technical specification

PIOX S831

Process analysis and flow measurement with ultrasound

Features

- Time measurement for the accurate and repeatable determination of concentration, density and density-related physical quantities
- Certification: ATEX/IECEx zone 1, FM Class I Div. 1+2
- Flameproof/explosion proof housing for hazardous areas
- Intrinsic safe process inputs for the integration of external pressure and temperature sensors
- Bidirectional communication and support of common bus technologies (Profibus PA, Foundation Fieldbus, HART, Modbus, BACnet)
- Two measuring channels

Applications

For a wide range of fluids, e.g. H_2SO_4, HF, HCl, HNO_3, 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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TSPIOX_S831V1-4EN_Leu, 2023-06-12

Transmitter

Technical data

		PIOX S831 (831-AB*, 831-SB*)	PIOX S831 (831-ANN, 831-SNN)	FLUXUS S831**-F1N
				
design		**831-AB*** (aluminum housing): explosion-proof field device or **831-SB*** (stainless steel housing): explosion-proof offshore device zone 1 (intrinsic safety: outputs, inputs, process interfaces)	**831-ANN** (aluminum housing): explosion-proof field device or **831-SNN** (stainless steel housing): explosion-proof offshore device zone 1	aluminum housing: explosion-proof field device FM
measurement				
• analysis				
transit time (repeatable)		$1/(50 \cdot f_\alpha) \pm 10^{-4} \cdot t$		
transit time (absolute)		$1/(5 \cdot f_\alpha) \pm 10^{-4} \cdot t$		
		f_α - transducer frequency, t - total transit time e.g. for transducers with frequency M (f_α = 1 MHz): repeatable: 20 ns $\pm 10^{-4} \cdot t$, absolute: 200 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 TIPIOX-S_uncert_analysis.		
• flow				
measurement principle		transit time difference correlation principle		
flow direction		bidirectional		
flow velocity	m/s	0.01...25		
repeatability		0.15 % MV ±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		
measurement uncertainty (volumetric flow rate)				
measurement uncertainty of the measuring system[1]		±0.3 % MV ±0.005 m/s		
measurement uncertainty at the measuring point[2]		±1 % MV ±0.005 m/s		
transmitter				
power supply		20...32 V DC, U_m = 120 V	• 100...230 V/50...60 Hz or • 20...32 V DC	
power consumption	W	< 4	< 8	
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), option: 0.02		
housing material		aluminum housing: cast aluminum EN AC 44200 mod, special heavy-duty coating (C5 according to EN ISO 12944) stainless steel housing: stainless steel 316/316L (1.4401, 1.4404, 1.4432)		cast aluminum EN AC 44200 mod, special heavy-duty coating (C5 according to EN ISO 12944)
degree of protection		IP66		TYPE 4X/IP66
dimensions	mm	see dimensional drawing		
mounting position		**831-A*F** (Profibus PA, FF H1)**, 831-S****: nameplate faces upwards	-	
weight	kg	aluminum housing: 6.5, stainless steel housing: 15.6		
fixation		wall mounting, 2" pipe mounting		
ambient temperature	°C	aluminum housing: • -40...+60 • **831-A*F** (Profibus PA, FF H1): -40...+50 (< -20 without operation of the display) stainless steel housing: • -20...+60 • **831-S*F** (Profibus PA, FF H1): -20...+50	aluminum housing: -40...+60 (< -20 without operation of the display) stainless steel housing: -20...+60	-40...+60 (< -20 without operation of the display)
display		128 x 64 pixels, backlight		
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian, Chinese		

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] outside the explosive atmosphere (housing cover open)

		PIOX S831 (831-AB*, 831-SB*)	PIOX S831 (831-ANN, 831-SNN)	FLUXUS S831**-F1N
explosion protection				
• ATEX/IECEx				
marking		CE 0637 Ex II(1)2G II(1)2D Ex db eb ia [ia Ga] IIC T6 Gb Ex tb ia [ia Da] IIIC T100 °C Db **831-ABN:** T_a -40...+60 °C **831-SBN:** T_a -20...+60 °C **831-ABF:** T_a -40...+50 °C **831-SBF:** T_a -20...+50 °C	CE 0637 Ex II2G II2D Ex db eb IIC T6 Gb Ex tb IIIC T100 °C Db **831-ANN:** T_a -40...+60 °C **831-SNN:** T_a -20...+60 °C	-
certification		IBExU20ATEX1103 X, IECEx IBE 20.0015X	IBExU20ATEX1103 X, IECEx IBE 20.0015X	-
• FM				
		-	-	FM APPROVED NI, Cl. I, II, III, Div. 2, GP A, B, C, D, F, G / T4A Cl. I Div. 1, GP. A, B, C, D / T6 For Group A, conduit seal of connection compartment is required within 18 inches. Cl. II, Div. 1, GP. E, F, G / T6 Cl. III, Div. 1 / T6 Ta = -40°C to +60°C c FM APPROVED NI, Cl. I, II, III, Div. 2, GP A, B, C, D, F, G / T4A Cl. I Div. 1, GP. B, C, D / T6 Cl. II, Div. 1, GP. E, F, G / T6 Cl. III, Div. 1 / T6 Ta = -40°C to +60°C
measuring functions				
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		
communication interfaces				
service interfaces		measured value transmission, parametrisation of the transmitter: USB[3]		
process interfaces		intrinsic safety, max. 1 option: • HART • Profibus PA • FF H1	max. 1 option: • Modbus RTU/RS485 • HART • Profibus PA • FF H1 • BACnet MS/TP	
intrinsic safety parameters		Profibus PA, FF H1: U_i = 24 V I_i = 174 mA P_i = 1044 mW L_i = 10 µH C_i negligible	-	
accessories				
data transmission kit		USB cable		
software		• FluxDiagReader: reading of measured values and parameters, graphical representation • FluxDiag (optional): reading of measurement data, graphical representation, report generation, parametrisation of the transmitter		
data logger				
loggable values		all physical quantities, totalised physical quantities and diagnostic values		
capacity		max. 800 000 measured values		

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] outside the explosive atmosphere (housing cover open)

		PIOX S831 (831-AB*, 831-SB*)	PIOX S831 (831-ANN, 831-SNN)	FLUXUS S831**-F1N
outputs				
		The outputs are galvanically isolated from the transmitter.		
• switchable current output				
			configurable according to NAMUR NE43 All switchable current outputs are jointly switched to active or passive.	
number		-	max. 3	
range	mA	-	4...20 (alarm current: 3.2...3.99, 20.01...24, hardware fault current: 3.2)	
Unsicherheit		-	0.04 % v. AW ±3 µA	
active output		-	R_{ext} = 250...530 Ω, $U_{opencircuit}$ = 28 V DC	
passive output		-	U_{ext} = 9...30 V DC, depending on R_{ext} (R_{ext} < 458 Ω at 20 V)	
current output in HART mode		-	option	
• range	mA	-	4...20 (alarm current: 3.5...3.99, 20.01...22, hardware fault current: 3.2)	
• active output		-	R_{ext} = 250...530 Ω, $U_{opencircuit}$ = 28 V DC	
• passive output		-	U_{ext} = 9...30 V DC, depending on R_{ext} (R_{ext} = 250...458 Ω at 20 V)	
• current output				
		configurable according to NAMUR NE43		
range	mA	4...20 (alarm current: 3.2...3.99, 20.01...24, hardware fault current: 3.2)	-	
Unsicherheit		0.04 % v. AW ±3 µA	-	
passive output		U_{ext} ≤ 29 V DC, depending on R_{ext} (R_{ext} < 458 Ω at 20 V)	-	
current output in HART mode		option		
• range	mA	4...20 (alarm current: 3.5...3.99, 20.01...22, hardware fault current: 3.2)	-	
• passive output		U_{ext} = 9...29 V DC, depending on R_{ext} (R_{ext} = 250...458 Ω at 20 V)	-	
intrinsic safety parameters		U_i = 29 V I_i = 100 mA P_i = 0.725 W C_i = 1 nF L_i = 50 nH	-	
• digital output				
functions		• frequency output • binary output • pulse output	• frequency output • binary output • pulse output	
type		open collector (passive)	open collector (passive)	
operating parameters		8.2 V/30 mA (NAMUR)	8.2 V/30 mA (NAMUR)	
max. values		8 mA at 29 V DC	8 mA at 29 V DC	
frequency output				
• range	kHz	2...10	2...10	
• damping	s	0...999.9	0...999.9	
• pulse-to-pause ratio		1:1	1:1	
binary output				
• binary output as alarm output		limit, change of flow direction or error	limit, change of flow direction or error	
pulse output				
• pulse value	units	0.01...1000	0.01...1000	
• pulse width	ms	0.05...1000	0.05...1000	
• pulse rate		max. 10 000 pulses	max. 10 000 pulses	
intrinsic safety parameters		U_i = 29 V I_i = 100 mA P_i = 0.725 W C_i = 1 nF L_i = 50 nH	-	

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] outside the explosive atmosphere (housing cover open)

		PIOX S831 (831-AB*, 831-SB*)	PIOX S831 (831-ANN, 831-SNN)	FLUXUS S831**-F1N
inputs				
		not short-circuit proof The inputs are not galvanically isolated from the transmitter.	The inputs are galvanically isolated from the transmitter.	
• temperature input				
number		max. 1	max. 1	
type		Pt100/Pt1000	Pt100/Pt1000	
connection		4-wire	4-wire	
range	°C	-150...+560	-150...+560	
resolution	K	0.01	0.01	
accuracy		±0.01 % MV ±0.03 K at 18...28 °C ±0.01 % MV ±0.03 K ±0.0005 %/K at <18 °C/>28 °C	±0.01 % MV ±0.03 K at 18...28 °C ±0.01 % MV ±0.03 K ±0.0005 %/K at <18 °C/>28 °C	
Kabelwiderstand	Ω	max. 1000	max. 1000	
intrinsic safety parameters		U_o = 9.2 V I_o = 25 mA P_o = 0.057 W C_o = 4283 nF L_o = 57 mH	-	
• switchable current input				
		All switchable current inputs are jointly switched to active or passive.		
number		-	max. 2	
accuracy		-	±0.1 % MV ±0.01 mA at 18...28 °C ±0.1 % MV ±0.01 mA ±0.005 %/K at <18 °C/>28 °C	
resolution	µA	-	0.1	
active input • range	 mA	- -	R_{int} = 75 Ω, I_{max} ≤ 30 mA $U_{opencircuit}$ = 28 V (Leerlauf) U_{min} = 21.4 V at 20 mA 0...20	
passive input • range	 mA	- -	U_{ext} = 24 V, R_{int} = 35 Ω, I_{max} ≤ 24 mA 0...20	
• current input				
number		max. 1	-	
accuracy		±0.1 % MV ±0.01 mA at 18...28 °C ±0.1 % MV ±0.01 mA ±0.005 %/K at <18 °C/>28 °C	-	
resolution	µA	0.1	-	
active input • range	 mA	U_{int} < 20 V, R_{int} ≤ 385 Ω, I_{max} ≤ 40 mA U_{min} = 19.6 V - R_{int} · I 0...20	- -	
intrinsic safety parameters		U_o = 29.2 V I_o = 88 mA P_o = 0.64 W C_o = 73 nF L_o = 4.1 mH	-	

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] outside the explosive atmosphere (housing cover open)

Physical quantities

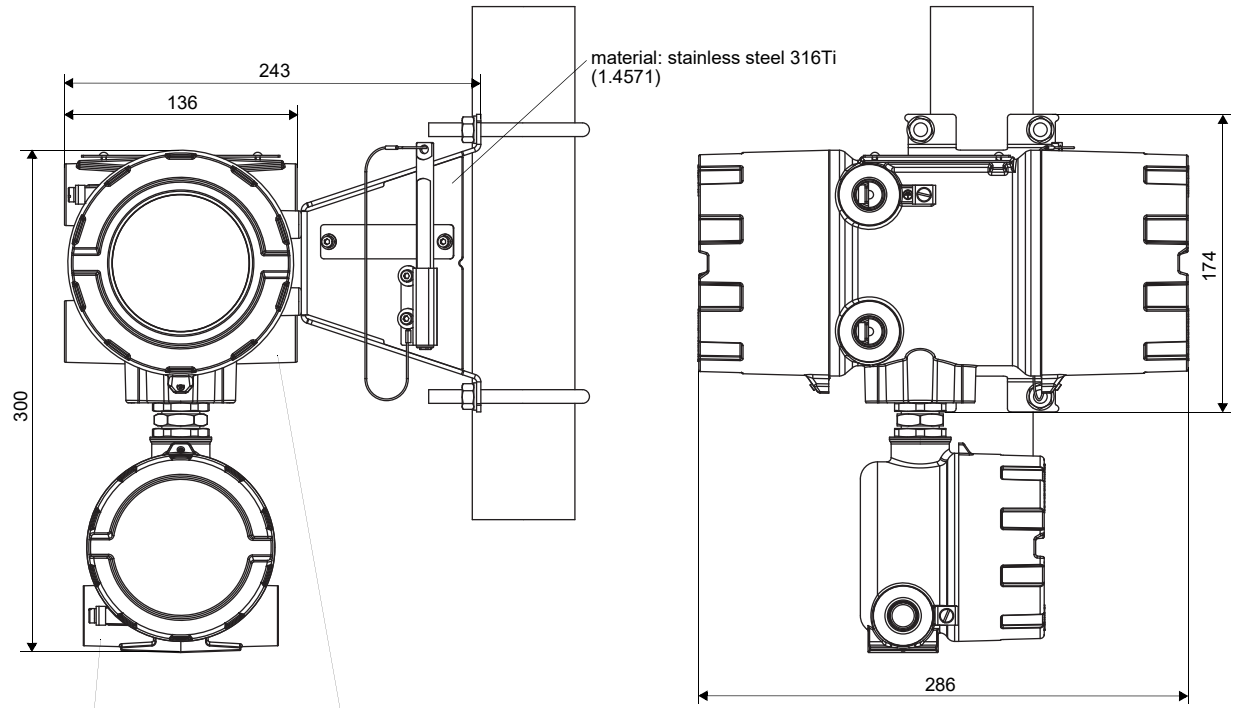
The available physical quantities depend on the fluid data set in the transmitter.

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

[1] min. 1 input or process interface with inputs necessary for fluid temperature

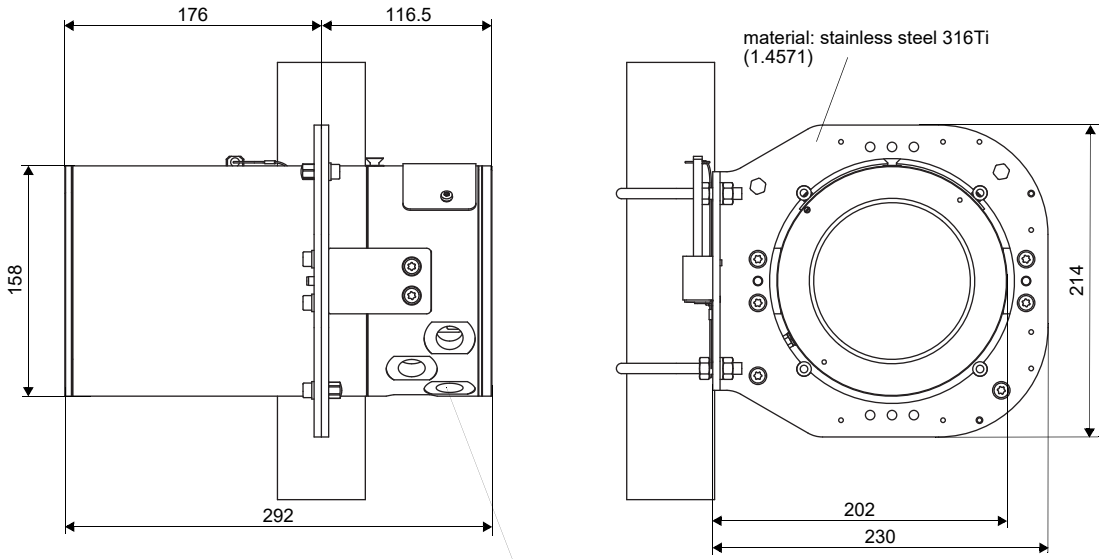
Dimensions

***831 (aluminum housing)**



in mm

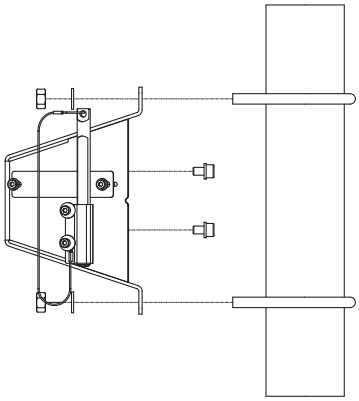
***831 (stainless steel housing)**



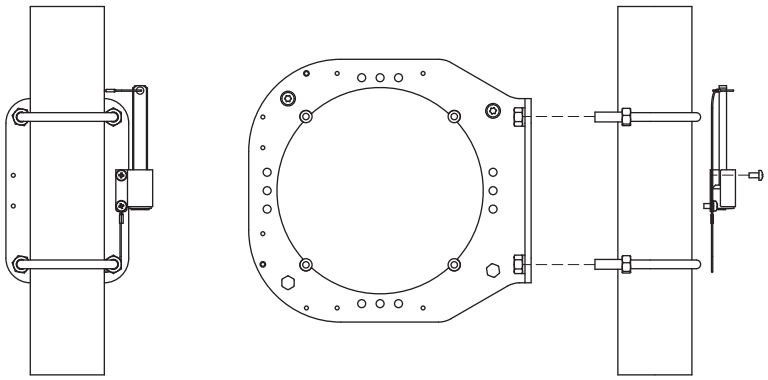
in mm

Wall and 2" pipe mounting kit

***831 (aluminum housing)**



***831 (stainless steel housing)**

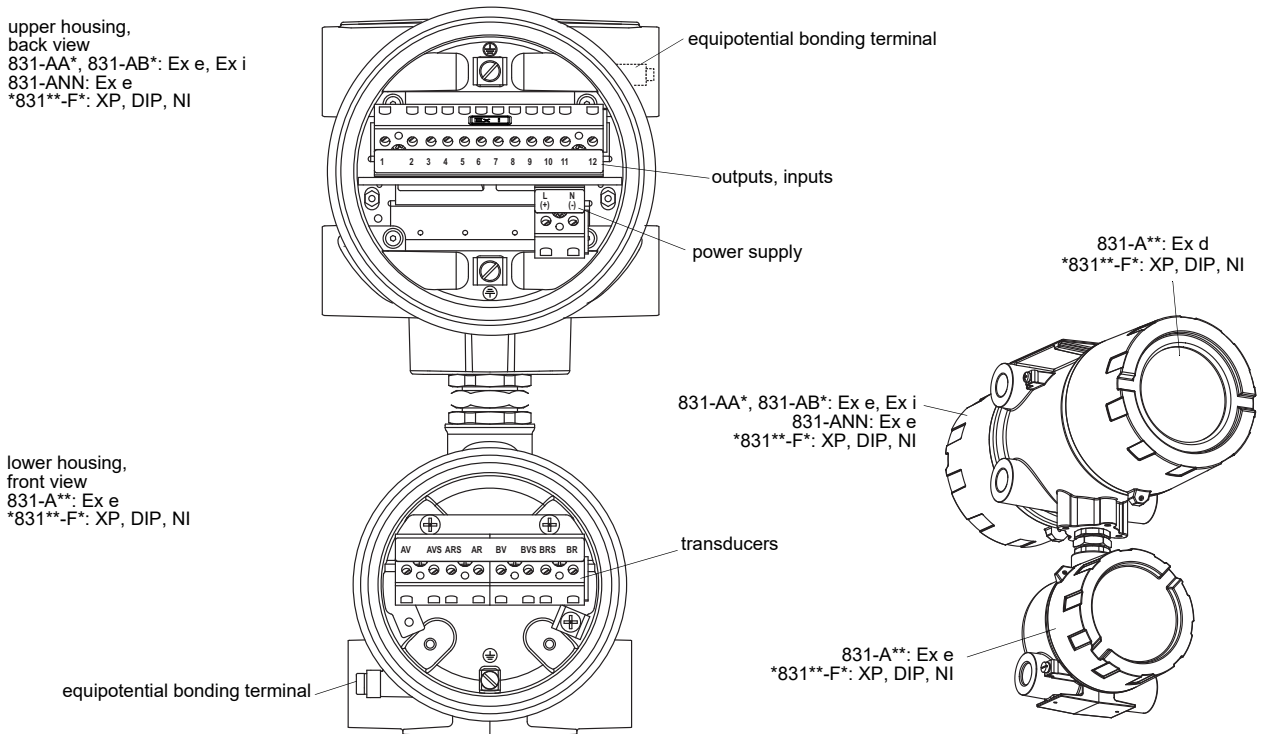


Storage

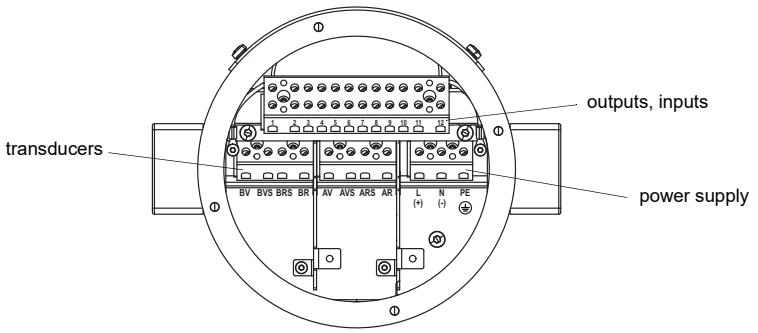
- do not store outdoors
- store within the original package
- store in a dry and dust-free place
- protect against sunlight
- keep all openings closed
- storing temperature:
  - aluminum housing: -40...+60 °C
  - stainless steel housing: -20...+60 °C

Terminal assignment

***831 (aluminum housing)**



***831 (stainless steel housing)**



power supply[1]			
AC		**DC**	
terminal	**connection**	**terminal**	**connection**
L	outer conductor	(+)	+
N	neutral conductor	(-)	-
⏚	protective conductor		

[1] cable (by customer): e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm²

transducers, extension cable				
measuring channel A		**measuring channel B**		**transducer**
terminal	**connection**	**terminal**	**connection**	
AV	signal	BV	signal	↑
AVS	internal shield	BVS	internal shield	
ARS	internal shield	BRS	internal shield	⅄
AR	signal	BR	signal	
cable gland	external shield	cable gland	external shield	↑ ⅄

outputs, inputs[1, 2]		
terminal	**connection**	
depending on configuration	current output, digital output, current input	
3, 4, 5, 6	temperature input	
11+, 12-	passive current output/HART	
11-, 12+	active current output/HART	
11, 12	Modbus RTU, FF H1, Profibus PA, BACnet MS/TP	
temperature probe		
terminal	**direct connection**	**connection with extension cable**
3	red	blue
4	red	grey
5	white	white
6	white	red
USB	type C Hi-Speed USB 2.0 Device	service (FluxDiag/FluxDiagReader)

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

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

Transducers

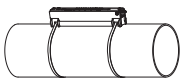
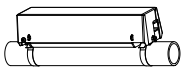
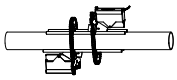
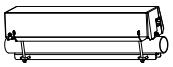
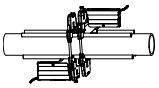
Overview

Shear wave transducers

			technical type				
			G	**K**	**M**	**P**	**Q**
zone 1 normal temperature range			CDG1N81 CLG1N81	CDK1N81 CLK1N81	CDM2N81 CLM2N81	CDP2N81 CLP2N81	CDQ2N81 CLQ2N81
zone 1 IP68			CDG1LI1	CDK1LI1	CDM2LI1	CDP2LI1	
zone 1 extended temperature range			CDG1E83 CLG1E83	CDK1E83 CLK1E83	CDM2E85 CLM2E85	CDP2E85 CLP2E85	CDQ2E85 CLQ2E85
FM Class I Div. 1 normal temperature range			CDG1N62 CLG1N62	CDK1N62 CLK1N62	CDM1N62 CLM1N62	CDP1N62 CLP1N62	CDQ1N62 CLQ1N62
FM Class I Div. 2 normal temperature range			CDG1N53 CLG1N53	CDK1N53 CLK1N53	CDM2N53 CLM2N53	CDP2N53 CLP2N53	CDQ2N53 CLQ2N53
FM Class I Div. 2 extended temperature range					CDM2E53 CLM2E53	CDP2E53 CLP2E53	CDQ2E53 CLQ2E53
inner pipe diameter d							
min. extended	mm		400	100	50	25	10
min. recommended	mm		500	200	100	50	25
max. recommended	mm		4000	2000	1000	400	150
max. extended	mm		6500	2400	1200	480	240
pipe wall thickness							
min.	mm		11	5	2.5	1.2	0.6

for further data see Technical specification TS_F8xx-transducersVx-xXX_Leu

Transducer mounting fixture

Variofix L	**Variofix C**	**PermaFix**	**transducer box WI for WaveInjector with chains**
			
	Variofix C with bolt mounting plates	**PermaFix with bolt mounting plates**	**transducer box WI for WaveInjector with threaded rods**
	 outer pipe diameter: **VCM**: max. 46 mm **VCQ**: max. 36 mm		 outer pipe diameter: 35...380 mm

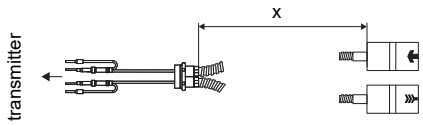
for further data see Technical specification TS_F8xx-transducersVx-xXX_Leu

Coupling materials for transducers

	normal temperature range		**extended temperature range**			**WaveInjector**	
	< 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 measure-ment	coupling foil type VT	coupling foil type VT	coupling foil type VT	coupling foil type VT			

for further data see Technical specification TS_F8xx-transducersVx-xXX_Leu

Connection systems

<table>
<tr><th colspan="3">connection system T1</th></tr>
<tr><td>connection with extension cable</td><td>direct connection</td><td>transducers
technical type</td></tr>
<tr><td></td><td> 
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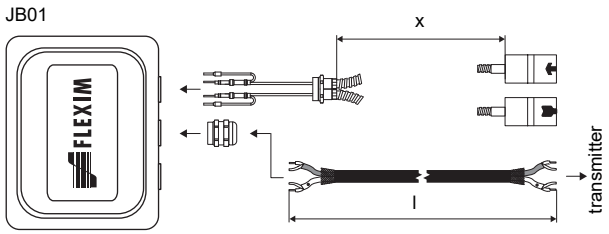
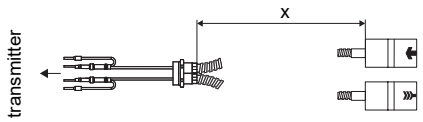
<tr><td> 
</td><td> 
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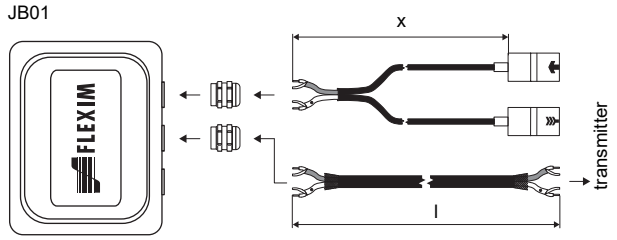
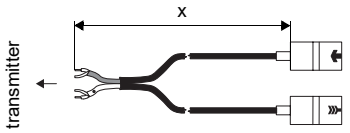
<tr><td> 
</td><td> 
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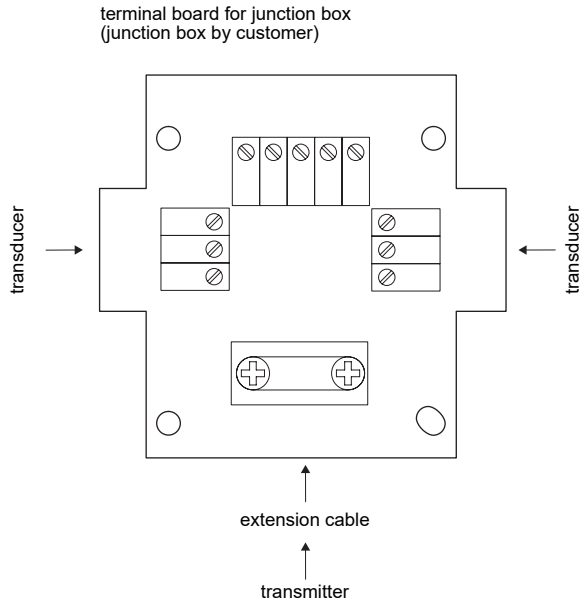
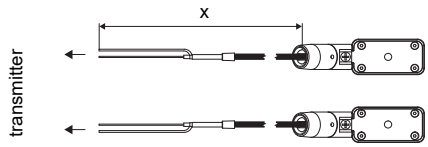
<tr><td> 
</td><td> 
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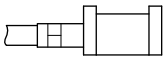
for further data see Technical specification TS_F8xx-transducersVx-xXX_Leu

Temperature probes

PT12N (item number: 770415-6)	PT12N (item number: 770415-7)
• Pt100 • clamp-on • -45...+230 °C • ATEX zone 0/1 (intrinsic safety) • for 831-*B*	• Pt100 • clamp-on • -45...+250 °C • ATEX zone 1 • for 831-*NN
	

see Technical specification TS_PTVx-xXX