

Flexim PLOX S831 Ultrasonic Flowmeter



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/IECEEx 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

Transmitter

Technical data

		PIOX S831 (ATEX/IECEx intrinsically safe inputs/ outputs Ex ia)	PIOX S831 (ATEX/IECEx no intrinsically safe inputs/outputs)	PIOX S831 (FM Class I Div. 1)
				
design		• intrinsically safe outputs • intrinsically safe inputs • intrinsically safe process interface (optional)	• outputs: no intrinsic safety • inputs: no intrinsic safety • process interface (optional): no intrinsic safety	
certification type		831-ABF, 831-ABN, 831-SBF, 831-SBN	831-ANN 831-SNN	S831**-F1N...
measurement				
• analysis				
transit time (repeatable)		$1/(50 \cdot f_a) \pm 10^{-4} \cdot t$		
transit time (absolute)		$1/(5 \cdot f_a) \pm 10^{-4} \cdot t$		
		f_a - transducer frequency, t - total transit time e.g. for transducers with frequency M ($f_a = 1 \text{ MHz}$): 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 TIPIX-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 $\pm 0.005 \text{ m/s}$		
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		$\pm 0.3 \text{ % MV} \pm 0.005 \text{ m/s}$		
measurement uncertainty at the measuring point ²		$\pm 1 \text{ % MV} \pm 0.005 \text{ m/s}$		

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 (ATEX/IECEx intrinsically safe inputs/ outputs Ex ia)	PIOX S831 (ATEX/IECEx no intrinsically safe inputs/outputs)	PIOX S831 (FM Class I Div. 1)
transmitter				
power supply		20...32 V DC, $U_m = 120$ V	• 100...240 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*...+65** • 831-A*F (Profibus PA, FF H1): - 40*...+50 stainless steel housing: • -20...+60 • 831-S*F (Profibus PA, FF H1): -20...+50 * < -20 without operation of the display **outside the explosive atmosphere	aluminum housing: • -40*...+65** • -40*...+60 active current output or HART active or > 1 passive current output and current input or HART passive and current input stainless steel housing: • -20...+60 * < -20 without operation of the display **outside the explosive atmosphere	-40*...+65** • -40*...+60 active current output or HART active or > 1 passive current output and current input or HART passive and current input * < -20 without operation of the display **outside the explosive atmosphere
display		128 x 64 pixels, backlight		
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian, Chinese		
explosion protection				
• ATEX/IECEx				
marking		 0637  II(1)2G UK CA 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	 0637  II2G UK CA 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				
		-	-	 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  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

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 (ATEX/IECEx intrinsically safe inputs/ outputs Ex ia)	PIOX S831 (ATEX/IECEx no intrinsically safe inputs/outputs)	PIOX S831 (FM Class I Div. 1)
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	• FluxDiag Reader: 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		
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	-	max. 3	
range	mA	4...20 (alarm current: 3.2...3.99, 20.01...24, hardware fault current: 3.2)	
uncertainty	-	0.04 % of output value ±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 NE 43	
range	mA	4...20 (alarm current: 3.2...3.99, 20.01...24, hardware fault current: 3.2)	
uncertainty	-	0.04 % of output value ±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	-	

¹ with aperture calibration of the transducers² for transit time difference principle and reference conditions³ outside the explosive atmosphere (housing cover open)

		PIOX S831 (ATEX/IECEx intrinsically safe inputs/ outputs Ex ia)	PIOX S831 (ATEX/IECEx no intrinsically safe inputs/outputs)	PIOX S831 (FM Class I Div. 1)
• digital output				
functions		- frequency output - binary output - pulse output	- frequency output - binary output - pulse output	
type		open collector (passive) (IEC 60947-5-6)	open collector (passive) (IEC 60947-5-6)	
operating parameters		6...29 V, $I_{\max} = 15 \text{ mA}$, $R_{\text{int}} = 1020 \Omega$ 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 $U_{\text{ext}} = 24 \text{ V}$)	5...30 V, $I_{\max} = 20 \text{ mA}$, $R_{\text{int}} = 1020 \Omega$ 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...10	0.002...10	
• damping	s	0...999.9 (adjustable)	0...999.9 (adjustable)	
• 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		$U_i = 29 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 0.725 \text{ W}$ $C_i = 1 \text{ nF}$ $L_i = 50 \text{ nH}$	-	
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		$\pm 0.01 \text{ \% MV} \pm 0.03 \text{ K}$ at $18...28 \text{ }^\circ\text{C}$ $\pm 0.01 \text{ \% MV} \pm 0.03 \text{ K} \pm 0.0005 \text{ \% / K}$ at $<18 \text{ }^\circ\text{C} / >28 \text{ }^\circ\text{C}$	$\pm 0.01 \text{ \% MV} \pm 0.03 \text{ K}$ at $18...28 \text{ }^\circ\text{C}$ $\pm 0.01 \text{ \% MV} \pm 0.03 \text{ K} \pm 0.0005 \text{ \% / K}$ at $<18 \text{ }^\circ\text{C} / >28 \text{ }^\circ\text{C}$	
cable resistance	Ω	max. 1000	max. 1000	
intrinsic safety parameters		$U_o = 9.2 \text{ V}$ $I_o = 25 \text{ mA}$ $P_o = 0.057 \text{ W}$ $C_o = 4283 \text{ nF}$ $L_o = 57 \text{ mH}$	-	
• switchable current input				
		All switchable current inputs are jointly switched to active or passive.		
number		-	max. 2	
accuracy		-	$\pm 0.1 \text{ \% MV} \pm 0.01 \text{ mA}$ at $18...28 \text{ }^\circ\text{C}$ $\pm 0.1 \text{ \% MV} \pm 0.01 \text{ mA} \pm 0.005 \text{ \% / K}$ at $<18 \text{ }^\circ\text{C} / >28 \text{ }^\circ\text{C}$	
resolution	μA	-	0.1	
active input		-	$R_{\text{int}} = 75 \Omega$, $I_{\max} \leq 30 \text{ mA}$ $U_{\text{opencircuit}} = 28 \text{ V}$ (open circuit) $U_{\min} = 21.4 \text{ V}$ at 20 mA	
• range	mA	-	0...20	
passive input		-	$U_{\text{ext}} = 24 \text{ V}$, $R_{\text{int}} = 35 \Omega$, $I_{\max} \leq 24 \text{ mA}$	
• range	mA	-	0...20	
• current input				
number		max. 1	-	
accuracy		$\pm 0.1 \text{ \% MV} \pm 0.01 \text{ mA}$ at $18...28 \text{ }^\circ\text{C}$ $\pm 0.1 \text{ \% MV} \pm 0.01 \text{ mA} \pm 0.005 \text{ \% / K}$ at $<18 \text{ }^\circ\text{C} / >28 \text{ }^\circ\text{C}$	-	
resolution	μA	0.1	-	
active input		$U_{\text{int}} < 20 \text{ V}$, $R_{\text{int}} \leq 385 \Omega$, $I_{\max} \leq 40 \text{ mA}$ $U_{\min} = 19.6 \text{ V} - R_{\text{int}} \cdot I$	-	
• range	mA	0...20	-	
intrinsic safety parameters		$U_o = 29.2 \text{ V}$ $I_o = 88 \text{ mA}$ $P_o = 0.64 \text{ W}$ $C_o = 73 \text{ nF}$ $L_o = 4.1 \text{ mH}$	-	

¹ with aperture calibration of the transducers² for transit time difference principle and reference conditions³ outside the explosive atmosphere (housing cover open)

Physical quantities

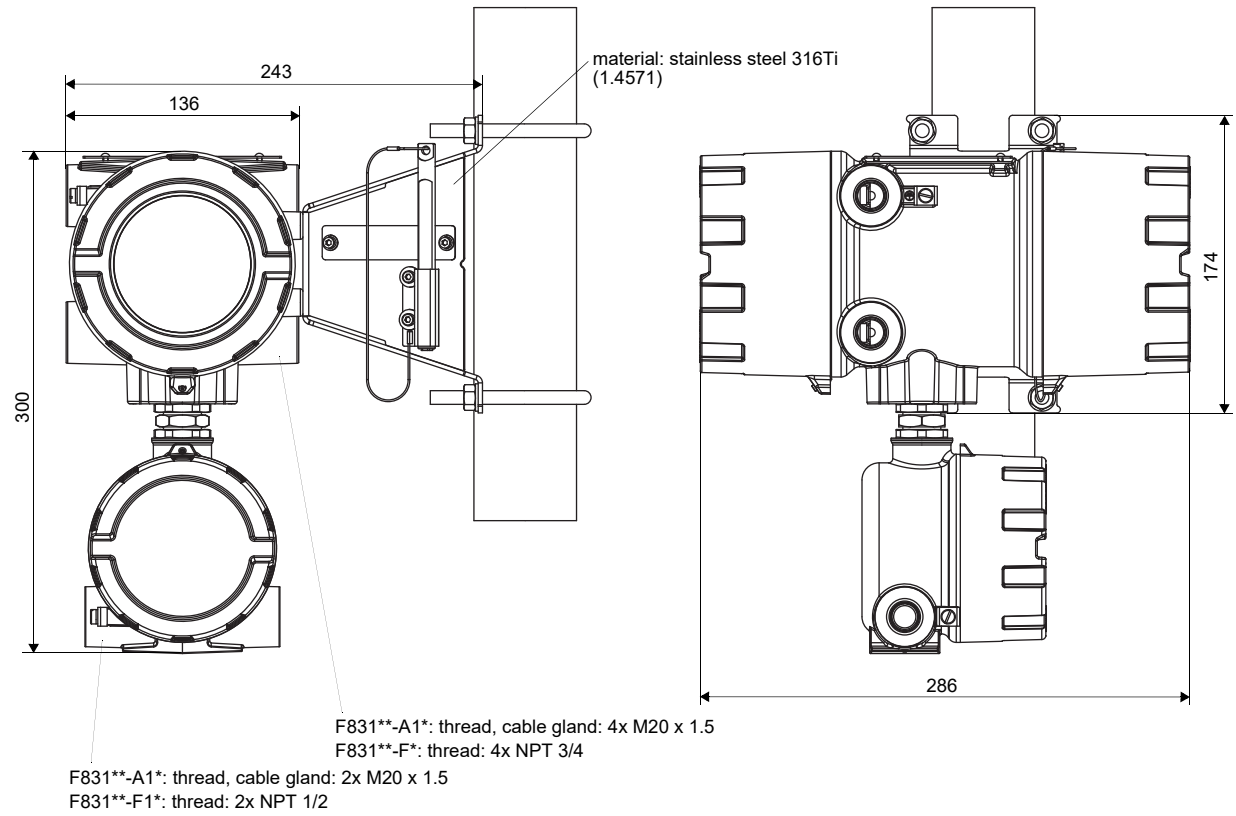
The available physical quantities depend on the fluid data set in the transmitter.

fluid data set		physical quantities	remark
	no fluid data set	• sound speed, volumetric flow rate	
SSF	standard fluid data set	• analysis¹: 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
SCF	customised fluid data set	• analysis¹: 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 quantities¹	data set developed by FLEXIM in cooperation with the customer

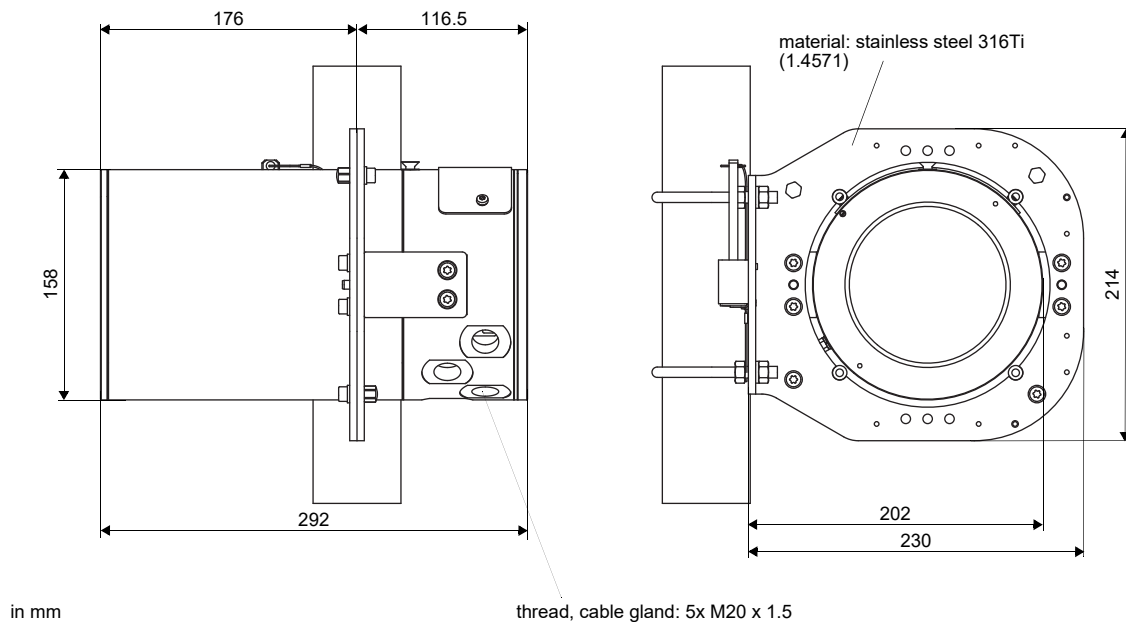
¹ min. 1 input or process interface with inputs necessary for fluid temperature

Dimensions

*831 (aluminum housing)

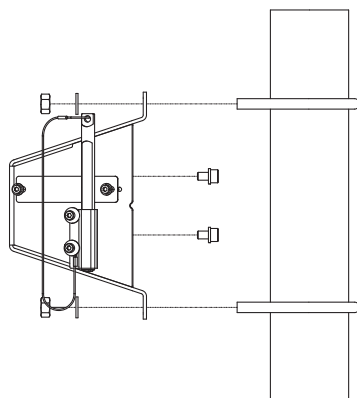


*831 (stainless steel housing)

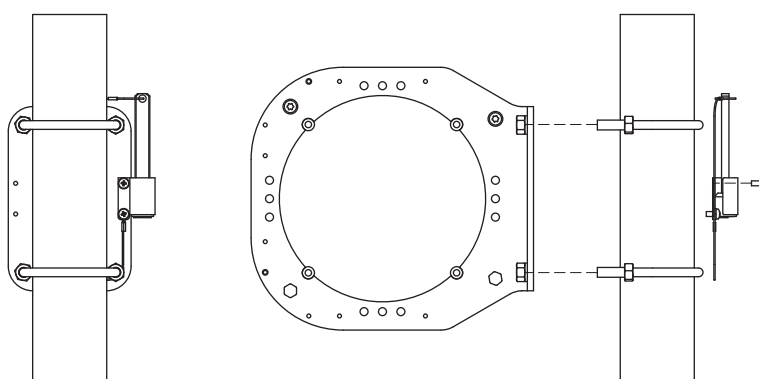


Wall and 2" pipe mounting kit

*831 (aluminum housing)

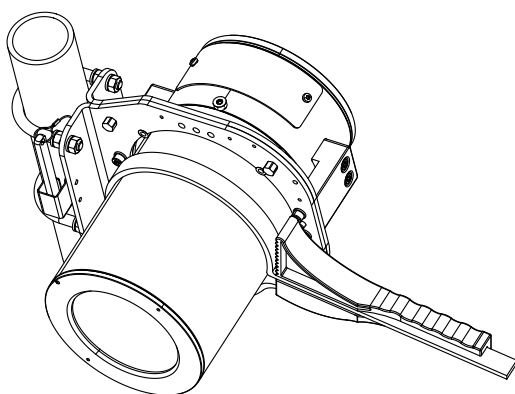


*831 (stainless steel housing)



Strap wrench

*831 strap wrench (stainless steel housing)



item number: 990224-6

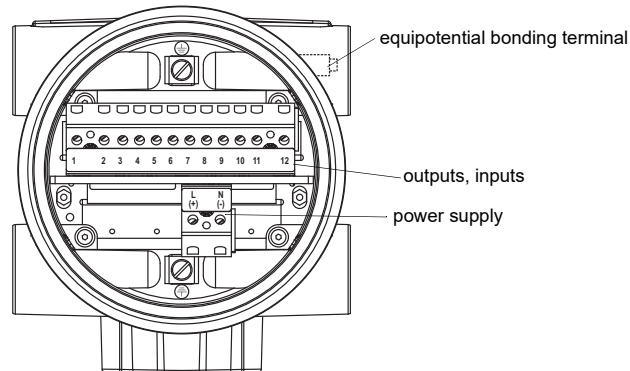
Storage

- 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

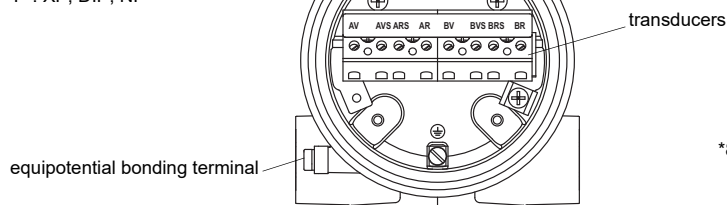
Terminal assignment

*831 (aluminum housing)

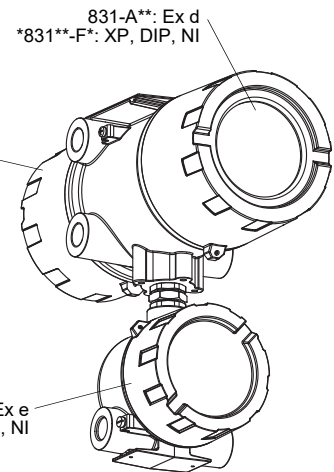
upper housing,
back view
831-AA*, 831-AB*: Ex e, Ex i
831-ANN: Ex e
*831**-F*: XP, DIP, NI



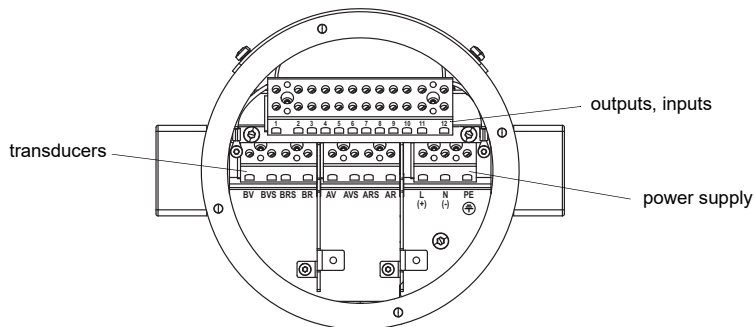
lower housing,
front view
831-A**: Ex e
*831**-F*: XP, DIP, NI



831-AA*, 831-AB*: Ex e, Ex i
831-ANN: Ex e
*831**-F*: XP, DIP, NI



*831 (stainless steel housing)



power supply¹

AC		DC	
terminal	connection	terminal	connection
L	line conductor	(+)	+
N	neutral conductor	(-)	-
PE	protective conductor	PE	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	white	grey
5	red	white
6	white	red
USB	type C Hi-Speed USB 2.0 Device	service (FluxDiag/FluxDiag Reader)

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

² The number, type and terminal assignment are customised.

Transducers

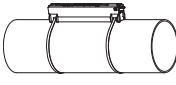
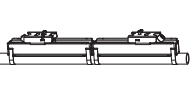
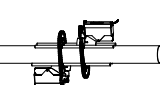
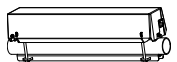
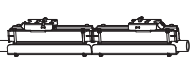
Overview

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			CDG1E53 CLG1E53	CDK1E53 CLK1E53	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	Wavelnjector with chains
			
	Variofix C with bolt mounting plates	PermaFix with bolt mounting plates	Wavelnjector with threaded rods
	 outer pipe diameter: VCN : max. 46 mm VCQ : max. 36 mm		 outer pipe diameter: 35...380 mm

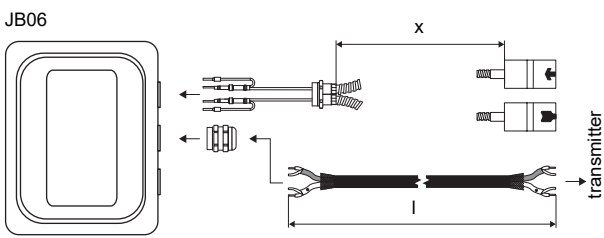
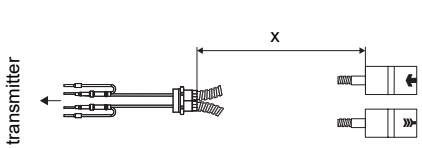
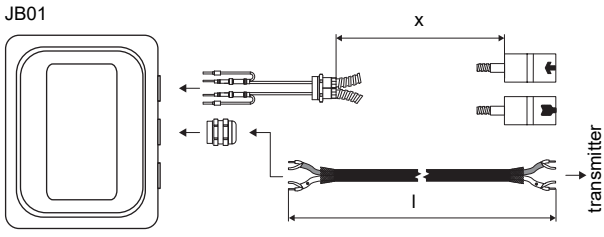
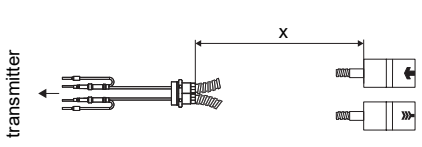
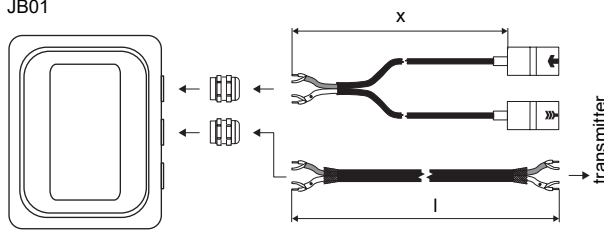
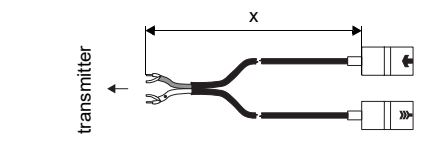
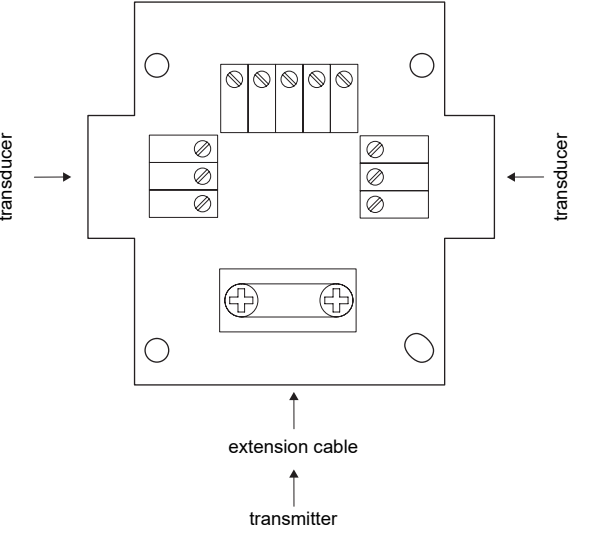
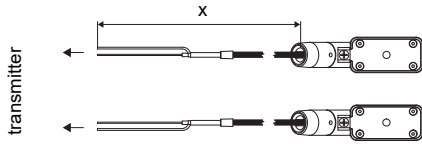
for further data see Technical specification TS_F8xx-transducersVx-xxx_Leu

Coupling materials for transducers

	normal temperature range (4th character of transducer order code = N)		extended temperature range higher temperatures (4th character of transducer order code = E, S)			Wavelnjector	
	< 100 °C	< 130 °C	< 180 °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 N or E 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 H or 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	coupling foil type VT	coupling foil type VT	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

for further data see Technical specification TS_F8xx-transducersVx-xxx_Leu

Connection systems

connection system T1		
connection with extension cable	direct connection	transducers technical type
JB06 		*****53
JB01 		*****6*
JB01 		*****L *
terminal board for junction box (junction box by customer) 		*****62

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 • ATEX zone 0/1 (intrinsic safety) • for 831-*B*	• Pt100 • clamp-on • ATEX zone 1 • for 831-*NN
	

see Technical specification TS_PTVx-xXX

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