

Flexim PLOX S731 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




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 S731 nonEx	PIOX S731 ATEX/IECEX	PIOX S731 FM Class I Div. 2
design		DE7-S731GP-NNN**-*AL... (aluminum housing) DE7-S731GP-NNN**-*ST... (stainless steel housing)	DE7-S731GP-A2N**-*AL... (aluminum housing) DE7-S731GP-A2N**-*ST... (stainless steel housing)	DE7-S731GP-F2N**-*AL... (aluminum housing) DE7-S731GP-F2N**-*ST... (stainless steel housing)
				
certification type			aluminum housing: 731-ADN (100...240 V) 731-ANN (11...32 V DC) stainless steel housing: 731-SNN	F731**F2N...
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 ($f_a = 1$ 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 TIPIOX-S_uncert_analysis.		
• flow				
measurement principle		transit time difference correlation principle		
flow direction		bidirectional		
synchronised channel averaging		x (2 measuring channels necessary)		
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		• 100...240 V ± 10 %/50...60 Hz or • 11...32 V DC	• 731-ADN, 731-SNN: 100...240 V ± 10 %/50...60 Hz or • 731-ANN, 731-SNN: 11...32 V DC	• 100...240 V ± 10 %/50...60 Hz or • 11...32 V DC
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), option: 0.02		
housing material		aluminum, powder coated or stainless steel 316L (1.4404)		
degree of protection		IP66		
dimensions	mm	see dimensional drawing		
weight	kg	aluminum housing: 4.5 stainless steel housing: 5.8		
fixation		wall mounting, optional: 2" pipe mounting		
ambient temperature	°C	-40*...+60 aluminum housing and 240 V: -40*...+65 * < -20 without operation of the display	731-ADN: -40*...+65 731-ANN, 731-SNN: -40*...+60 * < -20 without operation of the display	-40...+60 (< -20 without operation of the display)
display		240 x 128 pixels, backlight		
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian, Chinese		
explosion protection				
• ATEX/IECEX				
marking		-	 0637  II 3G Ex ec IIC T4 Gc II 2D Ex tb IIIC T135 °C Db T _a -40...+65 °C (731-ADN) T _a -40...+60 °C (731-ANN) T _a -40...+59/60 °C (731-SNN)	-
certification		-	IBExU24ATEX1014 X, IECEX IBE 23.0024X	-

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

		PIOX S731 nonEx	PIOX S731 ATEX/IECEX	PIOX S731 FM Class I Div. 2
• FM				
marking		-	-	 Cl. I,II,III/Div. 2 / GP: A, B, C, D, F, G / T5 -40 °C ≤ Ta ≤ +60 °C
certification		-	-	FM23US0036, FM23CA0026
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 • LAN ³		
process interfaces		max. 1 option: • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1	max. 1 option: • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP
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.		
number		on request, current inputs and outputs: max. 4		
• switchable current output				
		configurable according to NAMUR NE 43 All switchable current outputs are jointly switched to active or passive.		
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)		
• digital output				
functions		• frequency output • binary output • pulse output		
type		open collector (passive)		
operating parameters		OC30V (IEC 60947-5-6) 5...30 V, I _{max} = 20 mA, R _{int} = 1020 Ω Low: U < 2 V at I _{loop} = 2 mA (R _{ext} = 11 kΩ at U _{ext} = 24 V) High: U > 15 V (R _{ext} = 11 kΩ at U _{ext} = 24 V) or OC30V/100mA 5...30 V, I _{max} = 100 mA, R _{int} = 20 Ω Low: U < 2 V at I _{loop} = 2 mA (R _{ext} = 12 kΩ at U _{ext} = 24 V) High: U > 15 V (R _{ext} = 12 kΩ at U _{ext} = 24 V)		
		OC30V (IEC 60947-5-6) 5...30 V, I _{max} = 20 mA, R _{int} = 1020 Ω Low: U < 2 V at I _{loop} = 2 mA (R _{ext} = 11 kΩ at U _{ext} = 24 V) High: U > 15 V (R _{ext} = 11 kΩ at U _{ext} = 24 V)		
frequency output				
• range	kHz	0.002...10		
• damping	s	0...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...1000		
• pulse width	ms	0.05...1000		
• pulse rate		max. 10 000 pulses		

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

		PIOX S731 nonEx	PIOX S731 ATEX/IECEx	PIOX S731 FM Class I Div. 2
inputs				
		The inputs are galvanically isolated from the transmitter.		
number		on request, current inputs and outputs: max. 4 min. 1 input or process interface with inputs necessary for fluid temperature		
• temperature input				
type		Pt100/Pt1000		
connection		4-wire		
range	°C	-150...+560		
resolution	K	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		
cable resistance	Ω	max. 1000		
• switchable current input				
		All switchable current inputs are jointly switched to active or passive.		
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		R _{int} = 75 Ω, I _{max} ≤ 30 mA U _{opencircuit} = 28 V (open circuit) U _{min} = 21.4 V at 20 mA		
• range	mA	0...20		
passive input		U _{ext} = 24 V, R _{int} = 35 Ω, I _{max} ≤ 24 mA		
• range	mA	0...20		

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

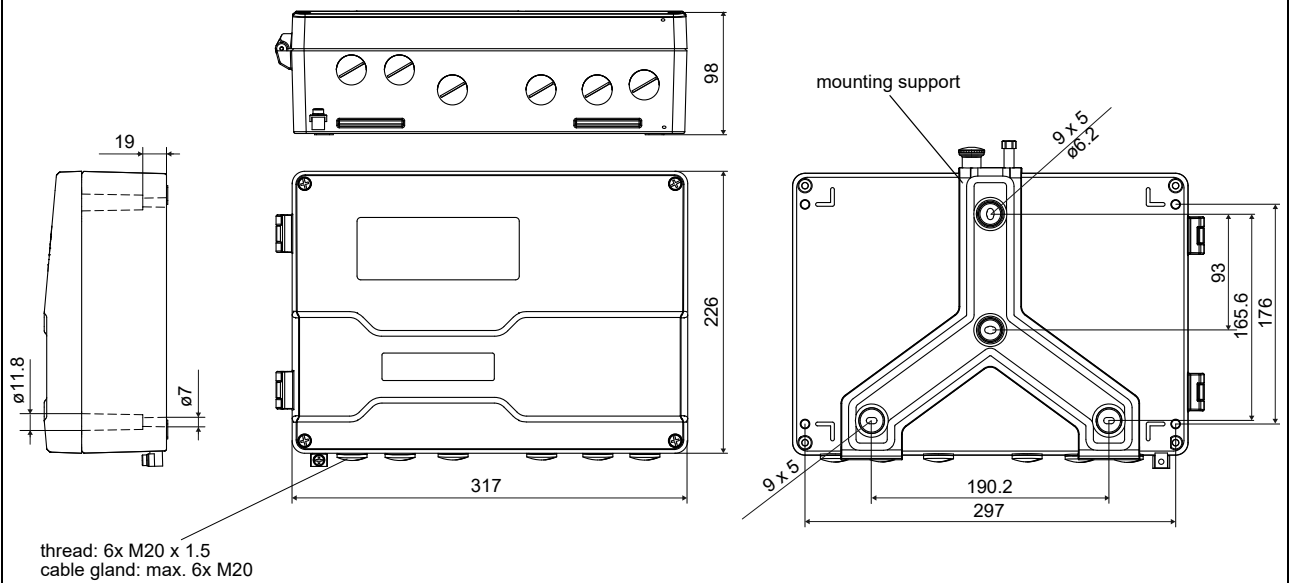
The available physical quantities depend on the fluid data set in the transmitter.

fluid data set	physical quantities	remark
no fluid data set	• sound speed, volumetric flow rate	
SSF 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
SCF 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

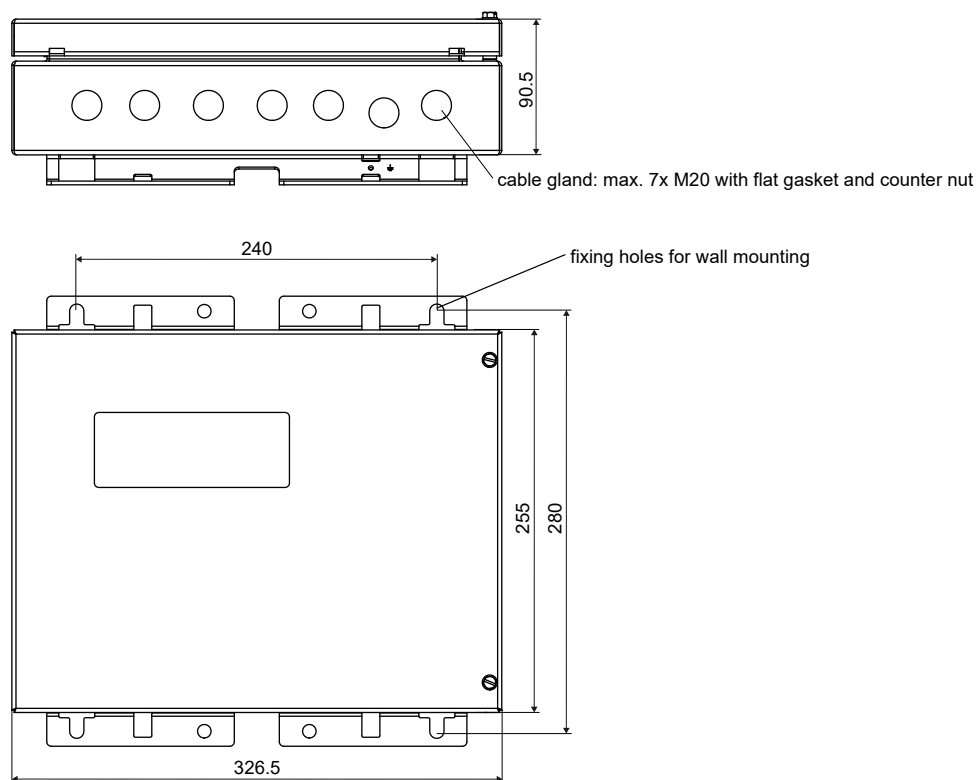
Dimensions

*731 (aluminum housing)



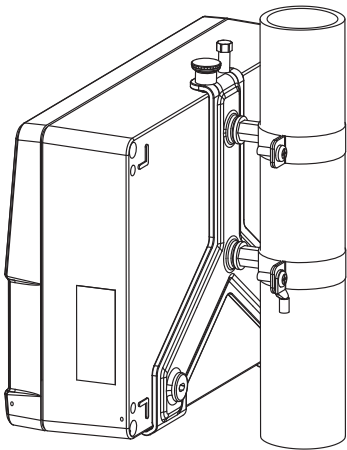
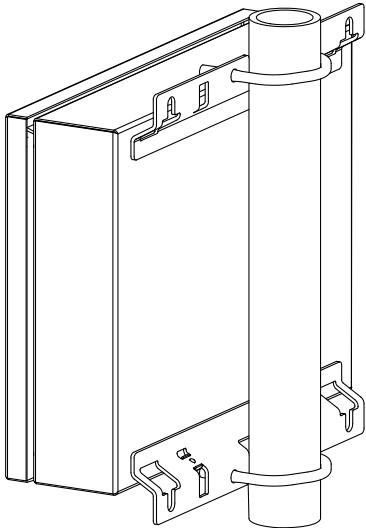
in mm

*731 (stainless steel housing)



in mm

2" pipe mounting kit

<p>*731 (aluminum housing)</p> 	<p>item number: 731037-1</p>
<p>*731 (stainless steel housing)</p> 	<p>item number: 721110-4</p>

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: -40...+60 °C

Terminal assignment

*731

equipotential bonding terminal (aluminum housing)

equipotential bonding terminal (stainless steel housing)

power supply¹

AC		DC	
terminal	connection	terminal	connection
L	line conductor	(+)	+
N	neutral conductor	(-)	-
PE	protective conductor	PE	protective conductor

transducers

transducer cable (transducers *****53, *****8*, ****LI*), extension cable				transducer cable (transducers *****52)			
measuring channel A		measuring channel B		transducer	measuring channel A	measuring channel B	connection
terminal	connection	terminal	connection		terminal		
AV or AV+	signal	BV or BV+	signal		X_AV	X_BV	SMB connector
AVS or AV-	shield	BVS or BV-	shield				
ARS or AR-	shield	BRS or BR-	shield	↗	X_AR	X_BR	SMB connector
AR or AR+	signal	BR or BR+	signal				

outputs, inputs^{1, 2}

terminal	connection
depending on configuration	current output, digital output, current input
1, 2, 3, 4	temperature input
5, 6, 7, 8	
9, 10, 11, 12	
13, 14, 15, 16	
29+, 30-	passive current output/HART
29-, 30+	active current output/HART
29, 30	Modbus RTU, BACnet MS/TP, M-Bus, Profibus PA, FF H1

temperature probe

terminal	direct connection	connection with extension cable
1, 5, 9, 13	red	red
2, 6, 10, 14	white	white
3, 7, 11, 15	red/blue	grey
4, 8, 12, 16	white/blue	blue

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: 0.25...2.5 mm²

² The number, type and terminal assignment are customised.

Transducers

Overview


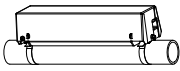
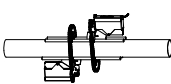
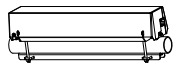

Shear wave transducers

	technical type				
	G	K	M	P	Q
zone 2 - FM Class I Div. 2 - nonEx SMB connector normal temperature range	CDG1N52 CLG1N52	CDK1N52 CLK1N52	CDM2N52 CLM2N52	CDP2N52 CLP2N52	CDQ2N52 CLQ2N52
zone 2 - FM Class I Div. 2 - nonEx with stripped cable ends normal temperature range	CDG1N53 CLG1N53	CDK1N53 CLK1N53	CDM2N53 CLM2N53	CDP2N53 CLP2N53	CDQ2N53 CLQ2N53
zone 2 - nonEx IP68	CDG1LI8	CDK1LI8	CDM2LI8	CDP2LI8	
zone 2 - FM Class I Div. 2 - nonEx SMB connector extended temperature range	CDG1E52 ¹ CLG1E52 ¹	CDK1E52 ¹ CLK1E52 ¹	CDM2E52 CLM2E52	CDP2E52 CLP2E52	CDQ2E52 CLQ2E52
zone 2 - FM Class I Div. 2 - nonEx with stripped cable ends extended temperature range	CDG1E52 ¹ CLG1E52 ¹	CDK1E52 ¹ CLK1E52 ¹	CDM2E52 CLM2E52	CDP2E52 CLP2E52	CDQ2E52 CLQ2E52
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
inner pipe diameter d					
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
pipe wall thickness					
min.	mm	11	5	2.5	1.2
				1.2	0.6

¹ nonEx, FM

for further data see Technical specification TS_F7xx-transducersVx-xxx_Leu

Transducer mounting fixture

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

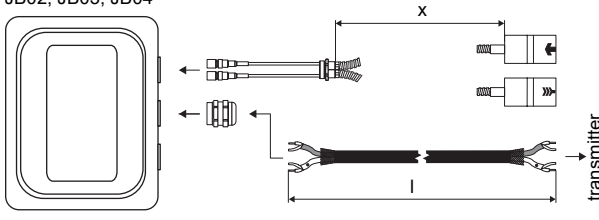
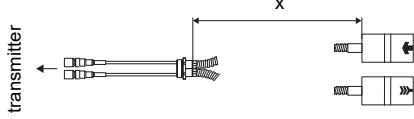
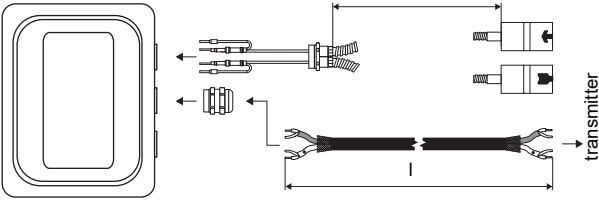
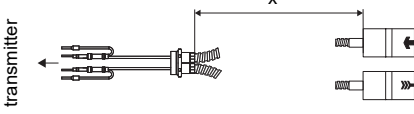
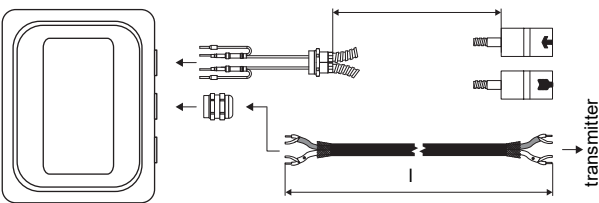
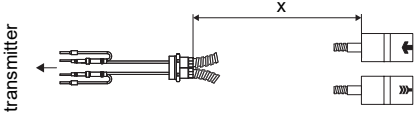
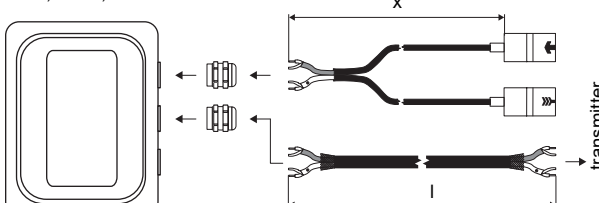
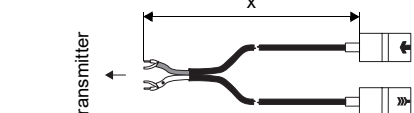
for further data see Technical specification TS_F7xx-transducersVx-xxx_Leu

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)			WaveInjector	
	< 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 type 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

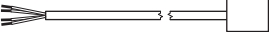
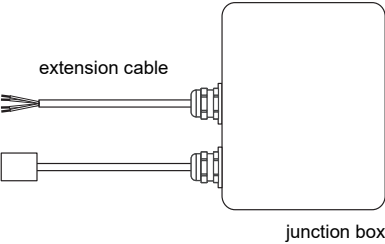
for further data see Technical specification TS_F7xx-transducersVx-xxx_Leu

Connection systems

connection system TS		
connection with extension cable	direct connection	transducers technical type
<p>JB02, JB03, JB04</p> 		<p>****52</p>
connection system T1		
connection with extension cable	direct connection	transducers technical type
<p>JBP2, JBP3, JBP6</p> 		<p>****N53 ****E53 ****S53</p>
<p>JB01</p> 		<p>****8*</p>
<p>JB01, JBP2, JBP3</p> 		<p>****L*</p>

for further data see Technical specification TS_F7xx-transducersVx-xxx_Leu

Temperature Probes

PT12N		PT12F
item number: <ul style="list-style-type: none">• 770415-1• 770414-2 (matched)	item number: <ul style="list-style-type: none">• 770415-1A2• 770414-1A2 (matched)	item number: <ul style="list-style-type: none">• 770415-2
<ul style="list-style-type: none">• Pt100• clamp-on• -30...+250 °C	<ul style="list-style-type: none">• Pt100• clamp-on• -30...+250 °C• ATEX, UKEX	<ul style="list-style-type: none">• Pt100• clamp-on• -45...+250 °C• response time: 8 s
direct connection		
		
connection with extension cable		
		

see Technical specification TS_PTVx-xxx_Leu

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