

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 to 240 V) 731-ANN (11 to 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 TIPIX-S_uncert_analysis.		
• flow				
measurement principle		transit time difference correlation principle		
flow direction		bidirectional		
synchronized channel averaging		x (2 measuring channels necessary)		
flow velocity	ft/s	0.03 to 82		
repeatability		0.15 % MV ± 0.02 ft/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 ± 0.02 ft/s includes calibration certificate traceable to NIST		
measurement uncertainty at the measuring point ²		± 1 % MV ± 0.02 ft/s		
transmitter				
power supply		• 100 to 240 V ± 10 %/50 to 60 Hz or • 11 to 32 V DC	• 731-ADN, 731-SNN: 100 to 240 V ± 10 %/50 to 60 Hz or • 731-ANN, 731-SNN: 11 to 32 V DC	• 100 to 240 V ± 10 %/50 to 60 Hz or • 11 to 32 V DC
power consumption	W	< 15		
number of measuring channels		1, optional: 2		
damping	s	0 to 100 (adjustable)		
measuring cycle	Hz	100 to 1000 (1 channel)		
response time	s	1 (1 channel), option: 0.02		
housing material		aluminum, powder coated or stainless steel 316L		
degree of protection		IP66		
dimensions	inch	see dimensional drawing		
weight	lb	aluminum housing: 9.9 stainless steel housing: 12.8		
fixation		wall mounting, optional: 2" pipe mounting		
ambient temperature	°F	-40* to +140 aluminum housing and 240 V: -40* to +149 * < -4 without operation of the display	731-ADN: -40* to +149 731-ANN, 731-SNN: -40* to +140 * < -4 without operation of the display	-40 to +140 (< -4 without operation of the display)
display		240 x 128 pixels, backlight		
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian, Chinese		
certificates				
use in unclassified (ordinary) locations		optional:  FM25US0185 FM25CA0073 ambient temperature: -40* to +140 °F	-	-

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 S731 nonEx	PIOX S731 ATEX/IECEX	PIOX S731 FM Class I Div. 2
explosion protection			
• ATEX/IECEX			
marking	-	CE 0637 II3G Ex ec IIC T4 Gc II2D Ex tb IIC 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	-
• 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		
totalizer	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, parametrization 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, parametrization of the transmitter		
data logger			
loggable values	all physical quantities, totalized 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 S731 nonEx	PIOX S731 ATEX/IECEx	PIOX S731 FM Class I Div. 2
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 to 20 (alarm current: 3.2 to 3.99, 20.01 to 24, hardware fault current: 3.2)		
uncertainty		0.04 % of output value ±3 µA		
active output		R _{ext} = 250 to 530 Ω, U _{opencircuit} = 28 V DC		
passive output		U _{ext} = 9 to 30 V DC, depending on R _{ext} (R _{ext} < 458 Ω at 20 V)		
current output in HART mode		option		
• range	mA	4 to 20 (alarm current: 3.5 to 3.99, 20.01 to 22, hardware fault current: 3.2)		
• active output		R _{ext} = 250 to 530 Ω, U _{opencircuit} = 28 V DC		
• passive output		U _{ext} = 9 to 30 V DC, depending on R _{ext} (R _{ext} = 250 to 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 to 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 to 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 to 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 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		
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	°F	-238 to +1040		
resolution	K	0.01		
accuracy		±0.01 % MV ±0.03 K at 64 to 82 °F ±0.01 % MV ±0.03 K ±0.0005 %/K at <64 °F/>82 °F		
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 64 to 82 °F ±0.1 % MV ±0.01 mA ±0.005 %/K at <64 °F/>82 °F		
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 to 20		
passive input		U _{ext} = 24 V, R _{int} = 35 Ω, I _{max} ≤ 24 mA		
• range	mA	0 to 20		

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

Physical quantities

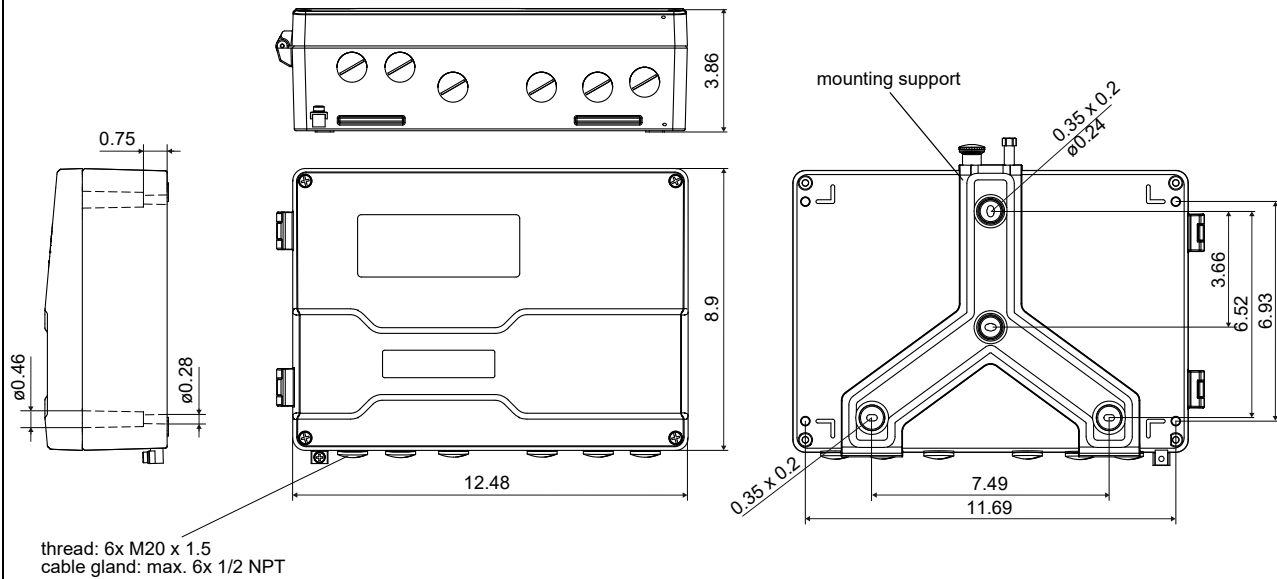
The available physical quantities depend on the fluid data set in the transmitter.

fluid data set		physical quantities	remark
	no fluid data set	<ul style="list-style-type: none"> • sound speed, volumetric flow rate 	
SSF	standard fluid data set	<ul style="list-style-type: none"> • analysis¹: concentration, mass fraction, volume fraction, density, normalized density, normalized sound speed, sound speed • flow: volumetric flow rate, flow velocity, mass flow rate 	application-specific fluid data set from FLEXIM database
SCF	customized fluid data set	<ul style="list-style-type: none"> • analysis¹: concentration, mass fraction, volume fraction, density, normalized density, normalized sound speed, sound speed • flow: volumetric flow rate, flow velocity, mass flow rate • further customized 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

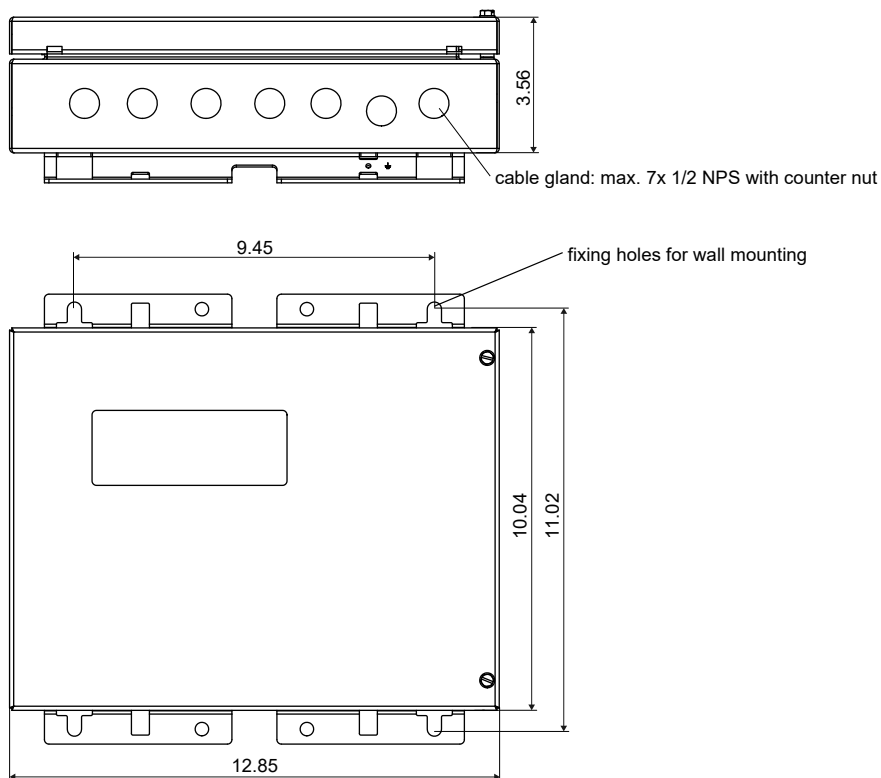
Dimensions

*731 (aluminum housing)



in inch

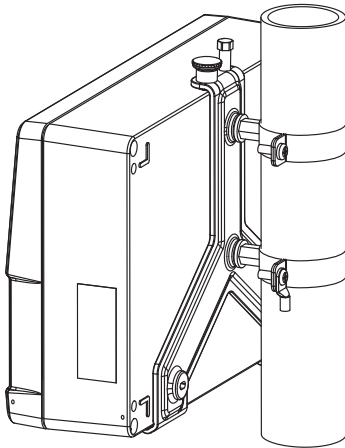
*731 (stainless steel housing)



in inch

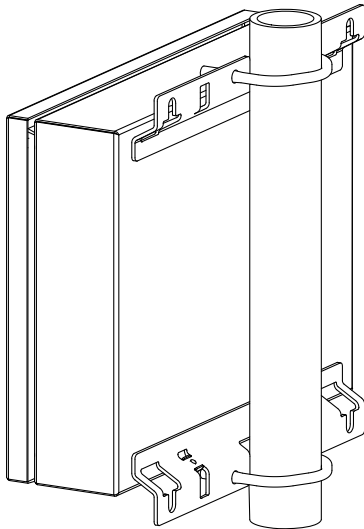
2" pipe mounting kit

*731 (aluminum housing)



item number: 731037-1

*731 (stainless steel housing)



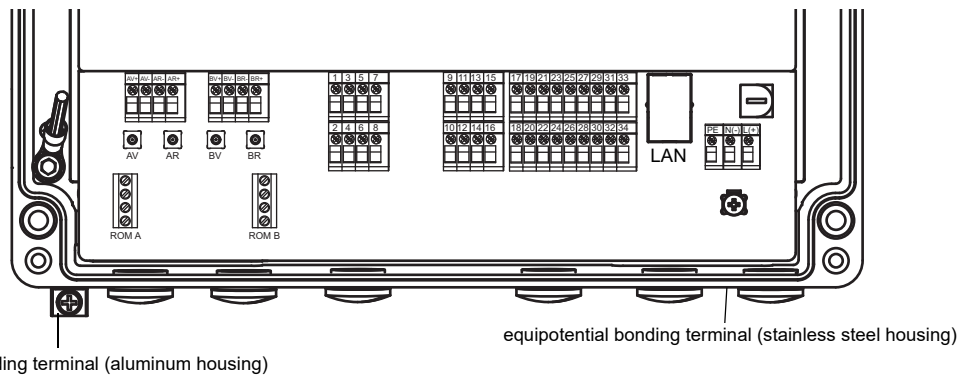
item number: 721110-4

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: -40...+140 °F

Terminal assignment

*731



power supply¹

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

transducers

measuring channel A		measuring channel B		transducer
terminal	connection	terminal	connection	
AV or AV+	signal	BV or BV+	signal	↑
AVS or AV-	shield	BVS or BV-	shield	
ARS or AR-	shield	BRS or BR-	shield	⬇
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, Profibus PA, FF H1

temperature probe

terminal	direct connection	connection with extension cable, inline temperature probe
1, 5, 9, 13	red	white
2, 6, 10, 14	white	red
3, 7, 11, 15	red	black
4, 8, 12, 16	white	green
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

Overview

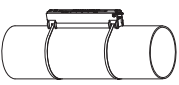
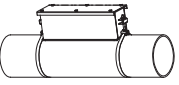
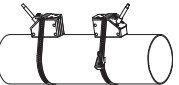
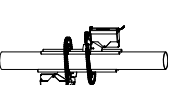
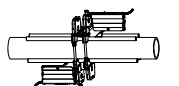
Shear wave transducers

			technical type				
			G	K	M	P	Q
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 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	inch		15.7	3.9	2	0.98	0.39
min. recommended	inch		19.7	7.9	3.9	2	0.98
max. recommended	inch		157.5	78.7	39.4	15.7	5.9
max. extended	inch		255.9	94.5	47.2	18.9	9.4
pipe wall thickness							
min.	inch		0.43	0.2	0.1	0.05	0.02

¹ nonEx, FM

for further data see Technical specification TS_F7xx-transducersVx-xxx_Lus

Transducer mounting fixture

Variofix L	PermaLok	quick release clasps and tension straps	Wavelnjector with chains
		 transducer frequency M, P, Q	
			Wavelnjector with threaded rods
			 outer pipe diameter: 1.4 to 15 inch

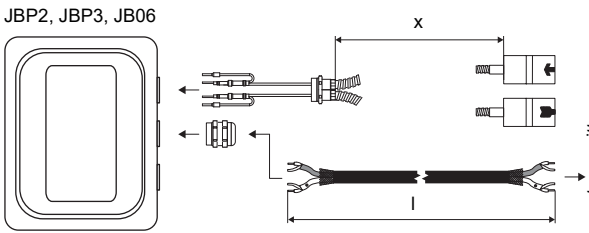
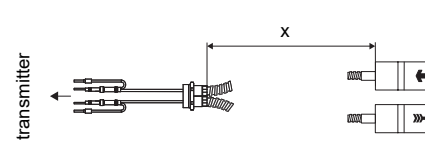
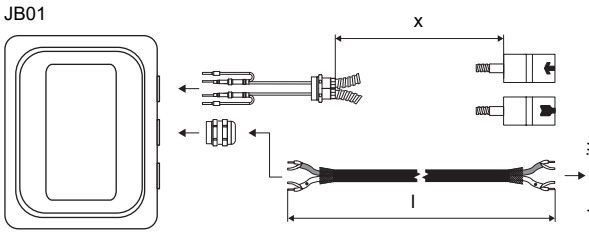
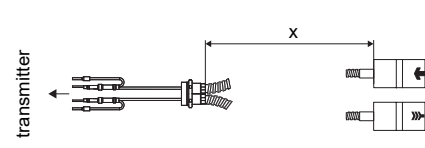
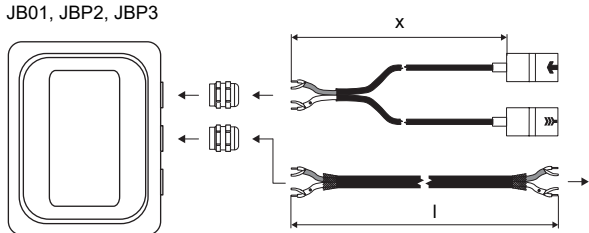
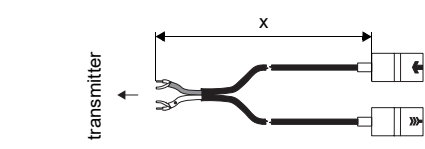
for further data see Technical specification TS_F7xx-transducersVx-xxx_Lus

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	
	< 212 °F	< 266 °F	< 356 °F	< 392 °F	392 to 464 °F	< 536 °F	536 to 1166 °F
< 24 h	coupling compound type N or coupling pad type VT	coupling compound type N or type E or coupling pad type VT	coupling compound type E or coupling pad type VT	coupling compound type E or coupling pad type VT	coupling compound type H or coupling pad type TF	coupling pad type A and coupling pad type VT	coupling pad type B and coupling pad type VT
long time measurement	coupling pad type VT	coupling pad type VT	coupling pad type VT	coupling pad type VT	coupling pad type TF	coupling pad type A and coupling pad type VT	coupling pad type B and coupling pad type VT

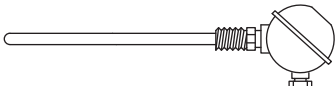
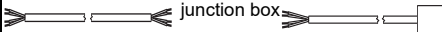
for further data see Technical specification TS_F7xx-transducersVx-xxx_Lus

Connection systems

connection system T1		
connection with extension cable	direct connection	transducers technical type
<div>JBP2, JBP3, JB06</div> 		****N53 ****E53 ****S53
<div>JB01</div> 		****8*
<div>JB01, JBP2, JBP3</div> 		****L *

for further data see Technical specification TS_F7xx-transducersVx-xxx_Lus

Temperature Probes

PT13N	PT13F	A2179
<ul style="list-style-type: none">• Pt1000• clamp-on• -40 to +392 °F	<ul style="list-style-type: none">• Pt1000• clamp-on• response time: 8 s• -49 to +482 °F	<ul style="list-style-type: none">• Pt1000• inline• -58 to +500 °F
direct connection		
connection with extension cable		
extension cable		
		

For more information: **Emerson.com**

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