

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



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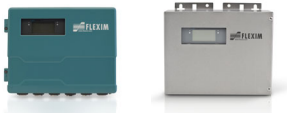

TSPIOX_S721V3-0-1US_Lus, 2023-10-01

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Transmitter

Technical data

	PIOX S721**-NNN**.*AL S721**-NNN**.*ST	PIOX S721**-A2N**.*AL S721**-A2N**.*ST	PIOX S721**-F2N**.*AL S721**-F2N**.*ST
			
design	standard field device	standard field device zone 2	standard field device FM Class I Div. 2
measurement			
• analysis			
transit time (repeatability)	$1/(50 \cdot f_a) \pm 10^{-4} \cdot t$		
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		
flow velocity	ft/s	0.03 to 82	
repeatability	0.15 % MV \pm 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 \pm 0.02 ft/s includes calibration certificate traceable to NIST		
measurement uncertainty at the measuring point ²	± 1 % MV \pm 0.02 ft/s		
transmitter			
power supply	<ul style="list-style-type: none"> • 100 to 230 V/50 to 60 Hz or • 20 to 32 V DC or • 11 to 16 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)	
housing material	aluminum, powder coated or stainless steel 316L		
degree of protection	IP66		aluminum housing: IP66/NEMA 4X stainless steel housing: IP65
dimensions	inch	see dimensional drawing	
weight	lb	aluminum housing: 11.9 stainless steel housing: 11.2	
fixation	wall mounting, optional: 2" pipe mounting		
ambient temperature	°F	-40 to +140 (< -4 without operation of the display)	aluminum housing: -40 to +131/140 (< -4 without operation of the display) stainless steel housing: -4 to +131/140
display	128 x 64 pixels, backlight		
menu language	English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian, Chinese		
explosion protection			
• ATEX/IECEx			
marking	-	S721**-A20*A, S721**-A20*S: CE 0637  II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 °C Db T _a -40...+60 °C	-
certification	-	IBExU11ATEX1015, IECEx IBE 11.0008	-

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 S721**-NNN**.*AL S721**-NNN**.*ST	PIOX S721**-A2N**.*AL S721**-A2N**.*ST	PIOX S721**-F2N**.*AL S721**-F2N**.*ST
• FM			
marking	-	-	S721**-F20*S2, S721**-F20*S3:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T5 S721**-F20*S1:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T4A
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: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP		
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, parametrization of the transmitter		
data logger			
loggable values	all physical quantities, totalized physical quantities and diagnostic values		
capacity	max. 800 000 measured values		
outputs			
	The outputs are galvanically isolated from the transmitter.		
number	on request		
• switchable current output			
	All switchable current outputs are jointly switched to active or passive.		
range	mA	4 to 20 (3.2 to 22)	
accuracy		0.04 % MV ±3 µA	
active output		$R_{ext} < 250 \Omega$	
passive output		$U_{ext} = 8 \text{ to } 30 \text{ V}$, depending on R_{ext} ($R_{ext} < 1 \text{ k}\Omega$ at 30 V)	
• HART			
range	mA	4 to 20	
accuracy		0.1 % MV ±15 µA	
active output		$U_{int} = 24 \text{ V}$, $R_{ext} < 500 \Omega$	
passive output		$U_{ext} = 10 \text{ to } 24 \text{ V DC}$, depending on R_{ext} ($R_{ext} < 1 \text{ k}\Omega$ at 24 V)	
• voltage output			
range	V	0 to 1 or 0 to 10	
accuracy		0 to 1 V: 0.1 % MV ±1 mV 0 to 10 V: 0.1 % MV ±10 mV	
internal resistance		$R_{int} = 500 \Omega$	
• frequency output			
range	kHz	0 to 5	
optorelay		24 V/4 mA, $R_{int} = 66.5 \Omega$	

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• digital output			
functions	<ul style="list-style-type: none"> • frequency output • binary output • pulse output 		
number	3		
operating parameters	5 to 30 V/< 100 mA		
frequency output			
• range	kHz	0 to 5	
binary output			
• binary output as alarm output		limit, change of flow direction or error	
pulse output			
• functions		mainly for totalizing	
• pulse value	units	0.01 to 1000	
• pulse width	ms	0.05 to 1000	
inputs			
		The inputs are galvanically isolated from the transmitter.	
number		max. 4, on request 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	
• current input			
accuracy		0.1 % MV ±10 µA	
active input		U _{int} = 24 V, R _{int} = 50 Ω, P _{int} < 0.5 W, not short-circuit proof	
• range	mA	0 to 20	
passive input		R _{int} = 50 Ω, P _{int} < 0.3 W	
• range	mA	-20 to +20	
• voltage input			
range	V	0 to 1	
accuracy		0.1 % MV ±1 mV	
internal resistance		R _{int} = 1 MΩ	
• binary input			
switching signal		5 to 30 V, 1 mA	5 to 26 V, 1 mA
functions		<ul style="list-style-type: none"> • reset of the measured values • reset of the totalizers • stop of the totalizers • activation of the measuring mode for highly dynamic flows 	

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

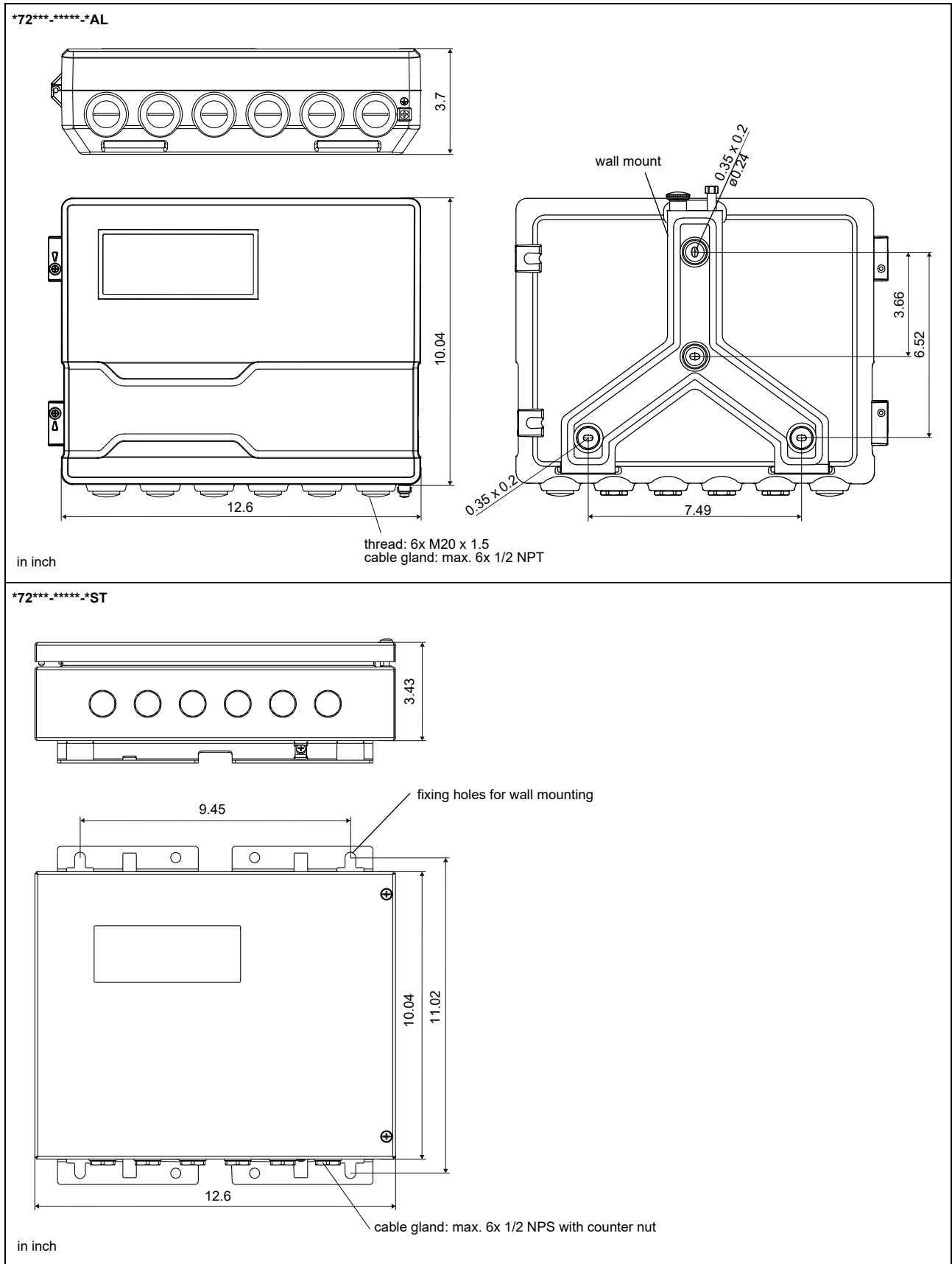
Physical quantities

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

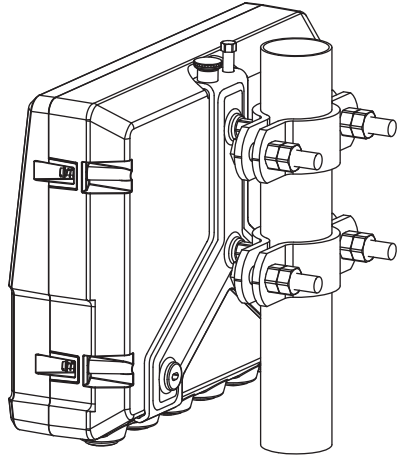
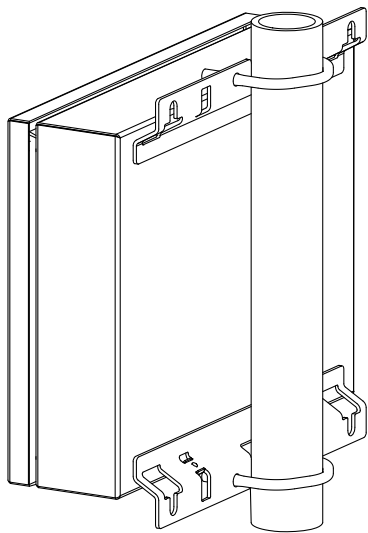
fluid data set	physical quantities	remark
no fluid data set	• sound speed, volumetric flow rate	
SSF standard fluid data set	<ul style="list-style-type: none"> • analysis¹: concentration, mass fraction, volume fraction, density, normalized density, normalized sound speed, sound speed • flow: volumetric 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



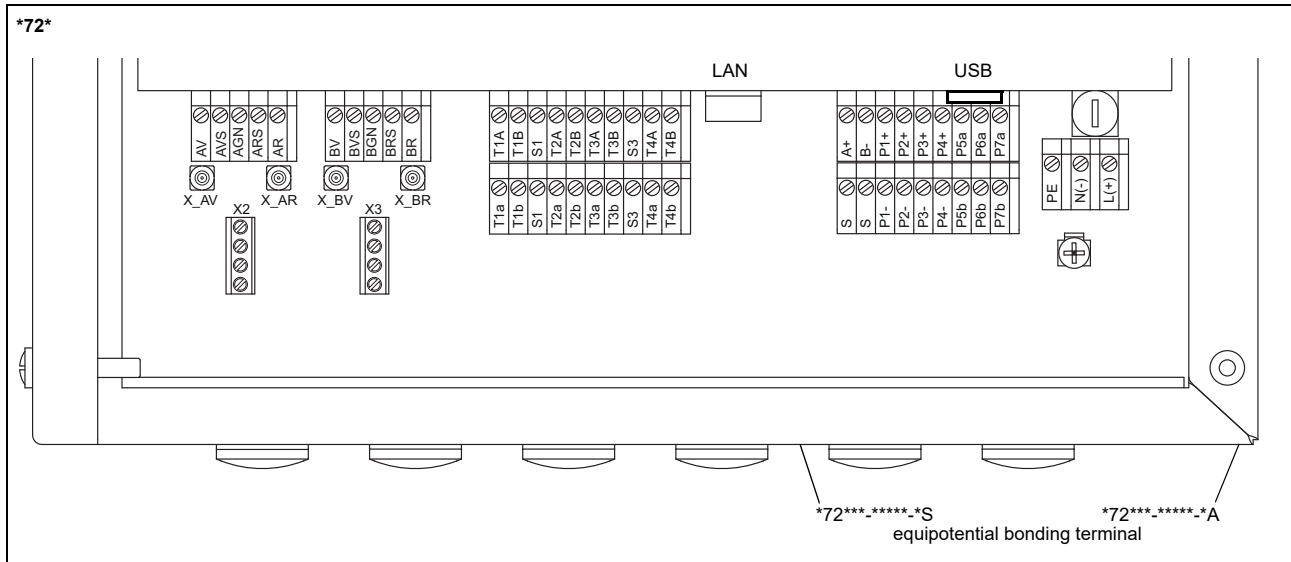
2" pipe mounting kit

<p>*72***_*****_AL</p> 	<p>item number: 721037-4</p>
<p>*72***_*****_ST</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: -4...+140 °F

Terminal assignment



power supply¹

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

transducers

transducer cable (transducers ****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	terminal	
AV	signal	BV	signal	↑	X_AV	X_BV	SMB connector
AVS	shield	BVS	shield				
ARS	shield	BRS	shield	↗	X_AR	X_BR	SMB connector
AR	signal	BR	signal				

outputs^{1, 2}

terminal	connection	terminal	connection	communication interface
P1+ to P4+ P1- to P4-	current output, voltage output, frequency output, HART (P1)	A+	signal +	<ul style="list-style-type: none"> RS485¹ Modbus RTU¹ BACnet MS/TP¹ Profibus PA¹ FF H1¹
P5a to P7a P5b to P7b	digital output	B-	signal -	
		S	shield	
		USB	type B Hi-Speed USB 2.0 Device	<ul style="list-style-type: none"> service (FluxDiag/FluxDiagReader)
		LAN	RJ45 10/100 Mbps Ethernet	

analog inputs^{1, 2}

terminal	temperature probe		passive sensor	active sensor
	direct connection	connection with extension cable	connection	connection
T1a to T4a	red	red/white	not connected	not connected
T1A to T4A	red/blue	gray/black	-	+
T1b to T4b	white/blue	blue/red	+	not connected
T1B to T4B	white	white/green	not connected	-
S1, S3	shield	shield	not connected	not connected

binary inputs^{1, 2}

terminal
P1+ to P2+, P1- to P2-

¹ cable (by customer):
 - e.g., flexible wires, with insulated wire ferrules, wire cross-section: AWG14 to 24
 - outer diameter of the cable (*72***-*****-S with ferrite nut): max. 0.3 inch

² The number, type and terminal assignment are customized.

Transducers

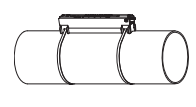
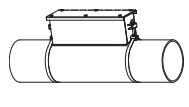
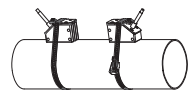
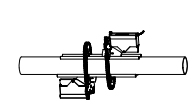
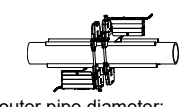
Overview

Shear wave transducers

	technical type					
	G	K	M	P	Q	
zone 2 - FM Class I Div. 2 - nonEx normal temperature range	CDG1N52 CLG1N52	CDK1N52 CLK1N52	CDM2N52 CLM2N52	CDP2N52 CLP2N52	CDQ2N52 CLQ2N52	
zone 2 - nonEx IP68	CDG1L18	CDK1L18	CDM2L18	CDP2L18		
zone 2 - FM Class I Div. 2 - nonEx extended temperature range	CDG1E52 CLG1E52	CDK1E52 CLK1E52	CDM2E52 CLM2E52	CDP2E52 CLP2E52	CDQ2E52 CLQ2E52	
zone 1 normal temperature range	CDG1N81 CLG1N81	CDK1N81 CLK1N81	CDM2N81 CLM2N81	CDP2N81 CLP2N81	CDQ2N81 CLQ2N81	
zone 1 IP68	CDG1L11	CDK1L11	CDM2L11	CDP2L11		
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

for further data see Technical specification TS_F7xx-transducersVx-xxx_Lus

Transducer mounting fixture

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

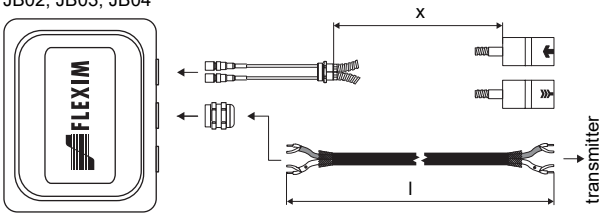
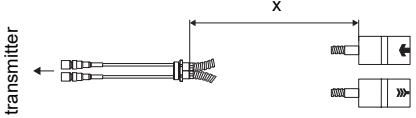
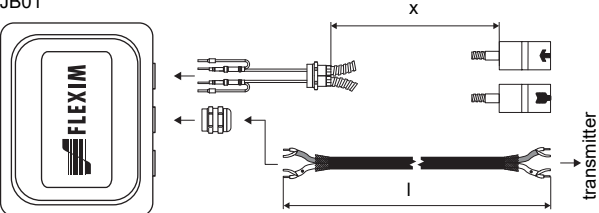
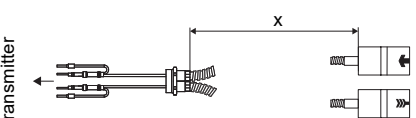
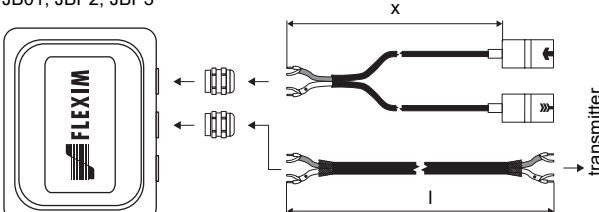
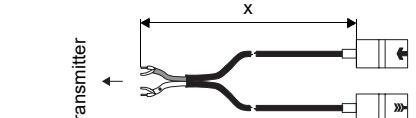
for further data see Technical specification TS_F7xx-transducersVx-xxx_Lus

Coupling materials for transducers

	normal temperature range		extended temperature range			Wavinjector	
	< 212 °F	< 338 °F	< 302 °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 E or coupling pad type VT	coupling compound type E or coupling pad type VT	coupling compound type E or H or 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
long time measurement	coupling pad type VT	coupling pad type VT	coupling pad type VT	coupling pad type VT			

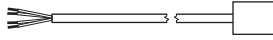
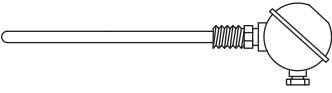
for further data see Technical specification TS_F7xx-transducersVx-xxx_Lus

Connection systems

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