

Ultrasonic measurement of thermal energy and volume flow rate

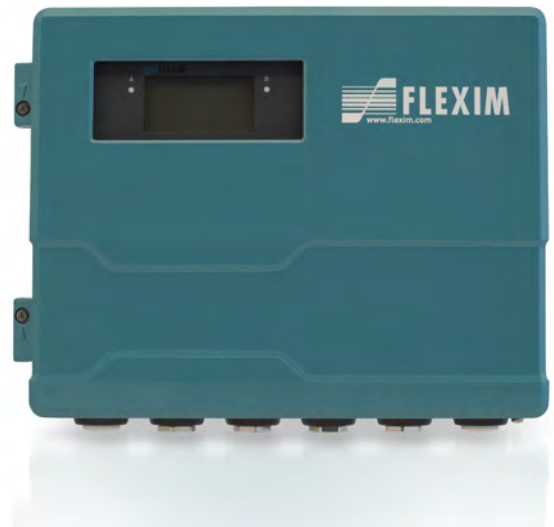
Precise and reliable clamp-on energy measuring system

Features

- Integrated heat, cold and volumetric flow rate measuring system
 - Non-invasive ultrasonic clamp-on principle
 - No shutdown for installation, no wear and tear
 - Perfect for retrofitting
- Suitable for all heat and cooling liquids within industrial or building applications
- Full two channel meter capability – two measuring points with one transmitter
- Smart meter ready with bi-directional communication and fieldbus systems
- The high precision paired temperature probes follow EN 1434 regulations
- Low flow ability down to 0.01 m/s to detect even minimum energy flows
- Extremely high measuring dynamic > 1000 : 1, no running out of flow range
- For pipe diameters of DN 25...DN 1000
- Rugged stainless steel transducer mounting – fit for industrial environments
- Maintenance free permanent acoustic coupling of the ultrasonic transducers – no re-greasing

Applications

- Monitoring and balancing of industrial heating and cooling systems
- Data acquisition for energy management and ISO 50001
- Sub metering in buildings and building complexes
- Heat flow balancing and leakage control in district heating systems



FLUXUS F721TE-****A



FLUXUS F721TE-****S



Variofix L

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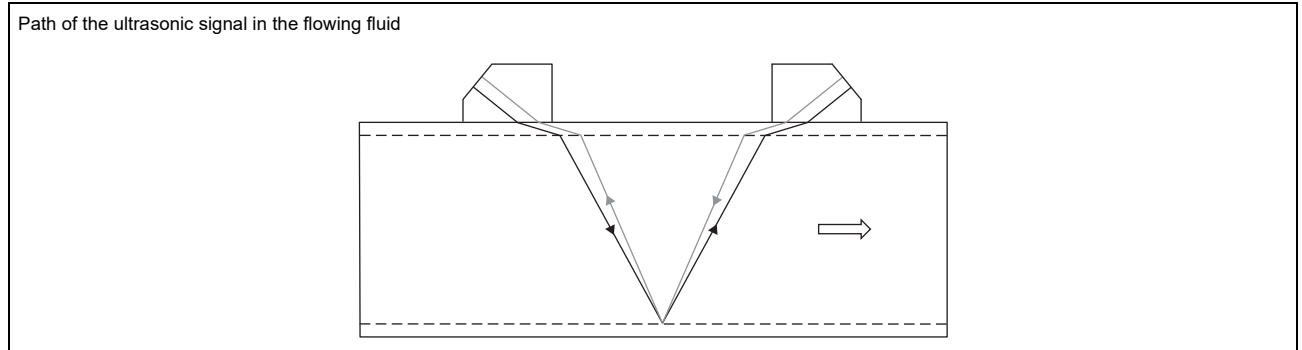
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Function

Measurement principle

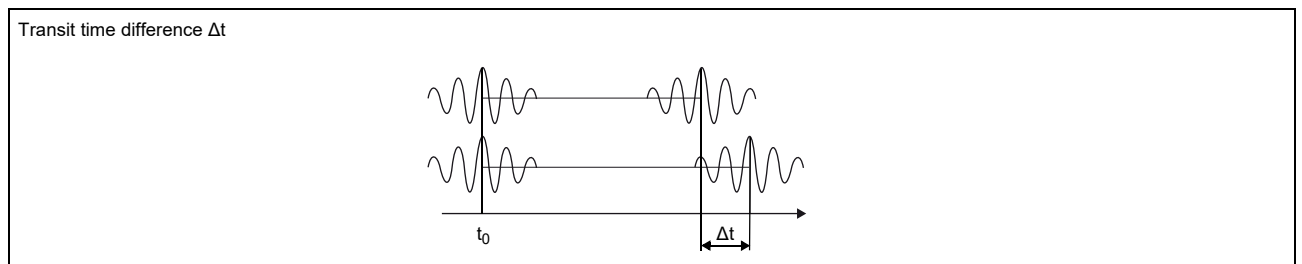
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



As the fluid where the ultrasound propagates is flowing, the transit time of the ultrasonic signal in flow direction is shorter than the one against the flow direction.

The transit time difference Δt is measured and allows the flowmeter to determine the average flow velocity along the propagation path of the ultrasonic signals. A flow profile correction is then performed in order to obtain the area averaged flow velocity, which is proportional to the volumetric flow rate.

The integrated microprocessors control the entire measuring cycle. The received ultrasonic signals are checked for measurement usability and evaluated for their reliability. Noise signals are eliminated.



Calculation of volumetric flow rate

$$\dot{V} = k_{Re} \cdot A \cdot k_a \cdot \frac{\Delta t}{2 \cdot t_{\gamma}}$$

where

- \dot{V} - volumetric flow rate
- k_{Re} - fluid mechanics calibration factor
- A - cross-sectional pipe area
- k_a - acoustical calibration factor
- Δt - transit time difference
- t_{γ} - average of transit times in the fluid

Calculation of thermal energy rate

The thermal energy rate is calculated with the following formula:

$$\Phi = k_i \cdot \dot{V} \cdot (T_V - T_R) \text{ (heating application)}$$

$$\Phi = k_i \cdot \dot{V} \cdot (T_R - T_V) \text{ (cooling application)}$$

where

Φ – thermal energy rate

k_i – thermal coefficient

\dot{V} – volumetric flow rate

T_V – supply temperature

T_R – return temperature

The thermal coefficient k_i results from several thermal energy rate coefficients for the specific enthalpy and density of the fluid. The thermal energy rate coefficients of some fluids are stored in the internal database of the transmitter. Further customised fluids are possible.

Max. permissible error

The max. permissible error MPE of a complete heat meter is according to EN 1434 the arithmetic sum of the max. permissible errors of the subassemblies: calculator, temperature sensor pair and flow sensor.

$$\text{MPE} = E_c + E_t + E_f$$

where

MPE – total max. permissible error

E_c – max. permissible relative error of the calculator

E_t – max. permissible relative error of the temperature sensor pair

E_f – max. permissible relative error of the flow sensor

Number of sound paths

The number of sound paths is the number of transits of the ultrasonic signal through the fluid in the pipe. Depending on the number of sound paths, the following methods of installation exist:

- **reflection arrangement**

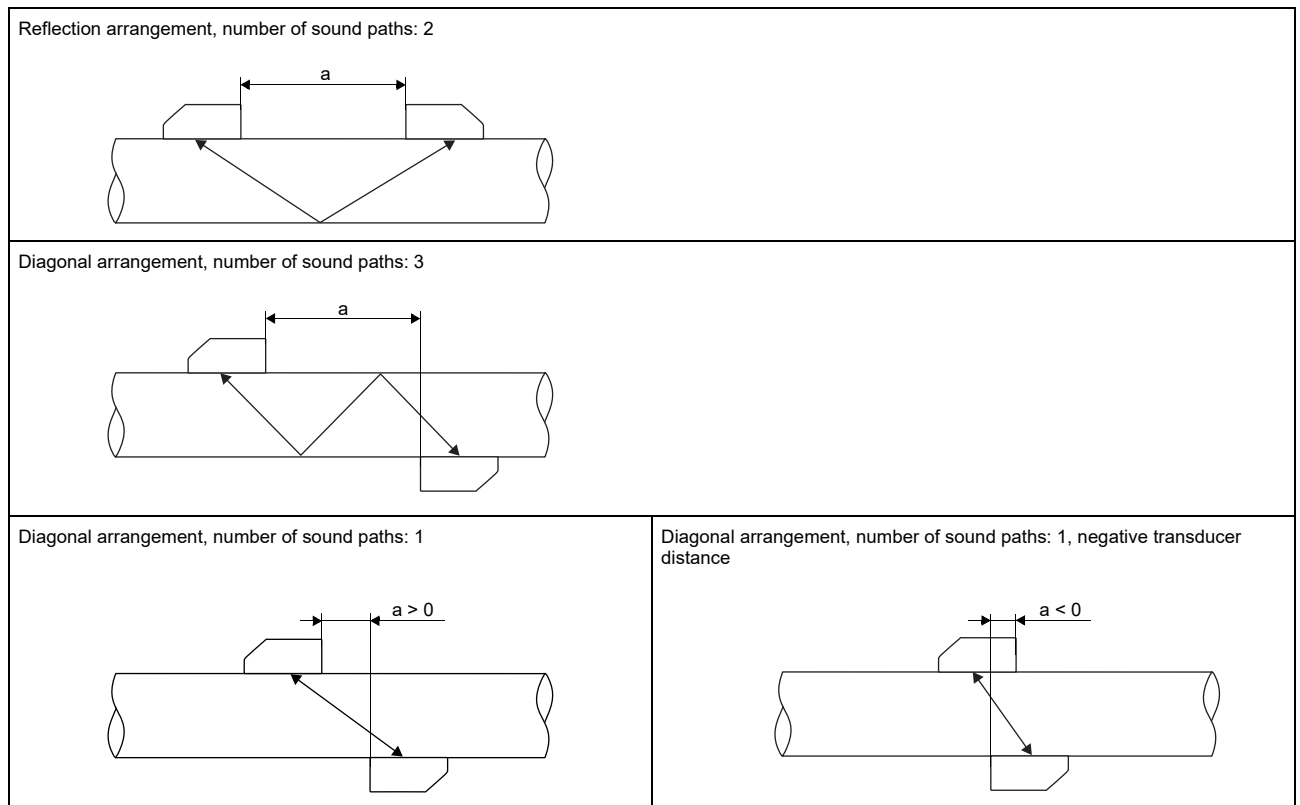
The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easy.

- **diagonal arrangement**

The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe. In the case of a high signal attenuation by the fluid, pipe and coatings, diagonal arrangement with 1 sound path will be used.

The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the transmitter.

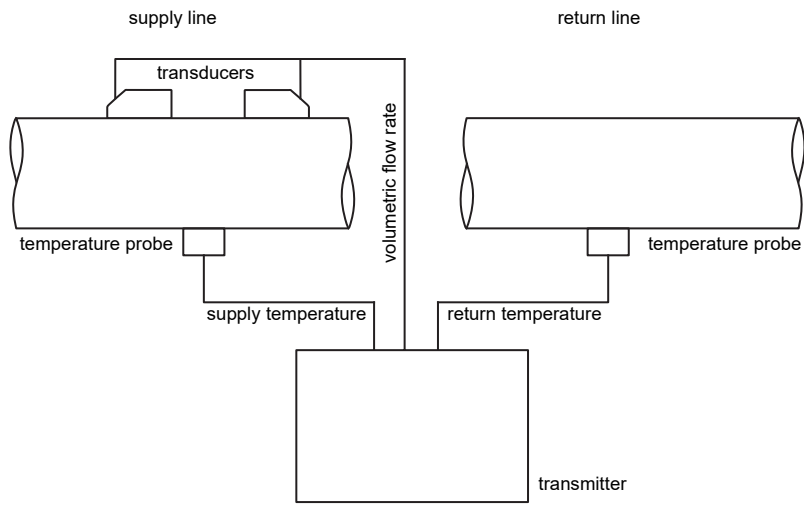
As the transducers can be mounted with the transducer mounting fixture in reflection arrangement or diagonal arrangement, the number of sound paths can be adjusted optimally for the application.



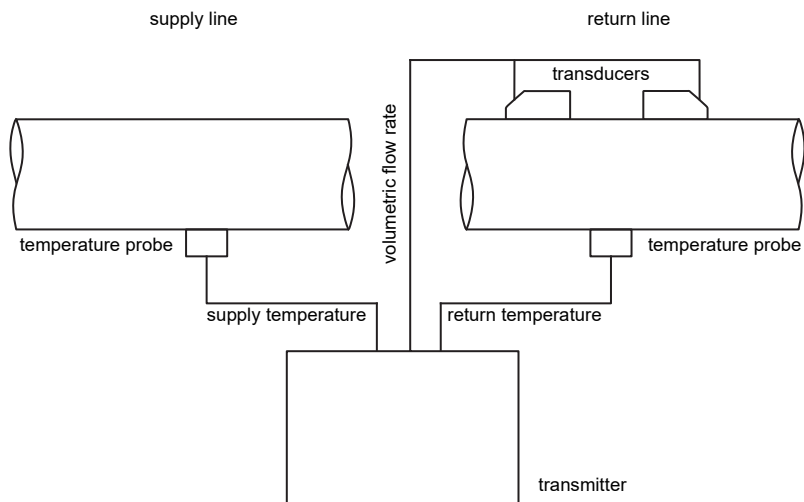
a - transducer distance

Typical measurement setup

Example of a thermal energy rate measurement measuring the volumetric flow rate in the supply line





Example of a thermal energy rate measurement measuring the volumetric flow rate in the return line



Transmitter



Technical data

	FLUXUS F721TE-NN0*A F721TE-NN0*S	FLUXUS F721TE-A20*A F721TE-A20*S	FLUXUS F721TE-F20*A F721TE-F20*S
			
design	standard field device	standard field device zone 2	standard field device FM Class I Div. 2
application	energy meter		
measurement			
• energy			
max. permissible relative error	calculator: $E_c = \pm(0.4 + 1 K/\Delta\theta) \%$		
• temperature			
temperature difference	$\Delta\theta_{\min} = 3 K, \Delta\theta_{\max} = 300 K$		
max. permissible relative error	temperature sensor pair: E_t - depending on type, see Technical data of temperature probes		
• flow			
measurement principle	transit time difference correlation principle		
flow	m ³ /h	$Q_p = 17...20\ 000$	
flow velocity	m/s	0.01...25	
repeatability	0.15 % MV ± 0.005 m/s		
fluid	<ul style="list-style-type: none"> • water • glycol/H₂O: 20 %, 30 %, 40 %, 50 % • thermal fluids: BP Transcal LT, BP Transcal N, R22 Freon, R134 Freon, ammonia, Shell Termina B, Mobiltherm 594, Mobiltherm 603, R407C, R410A • others on request 		
fluid pressure	without influence		
pressure loss	-		
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	$\pm 0.3 \%$ MV ± 0.005 m/s		
measurement uncertainty at the measuring point ²	$\pm 1 \%$ MV ± 0.005 m/s		
transmitter			
power supply	<ul style="list-style-type: none"> • 100...230 V/50...60 Hz or • 20...32 V DC or • 11...16 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		aluminum housing: IP66/NEMA 4X stainless steel housing: IP65
dimensions	mm	see dimensional drawing	
weight	kg	aluminum housing: 5.4 stainless steel housing: 5.1	
fixation	wall mounting, optional: 2" pipe mounting		
ambient temperature	°C	-40...+60 (< -20 °C without operation of the display)	
display	128 x 64 pixels, backlight		
menu language	English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian		
explosion protection			
• ATEX/IECEX			
marking	-	CE 0637  II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 °C Db T _a -40...+60 °C	-
certification ATEX	-	IBExU11ATEX1015	-
certification IECEX	-	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)

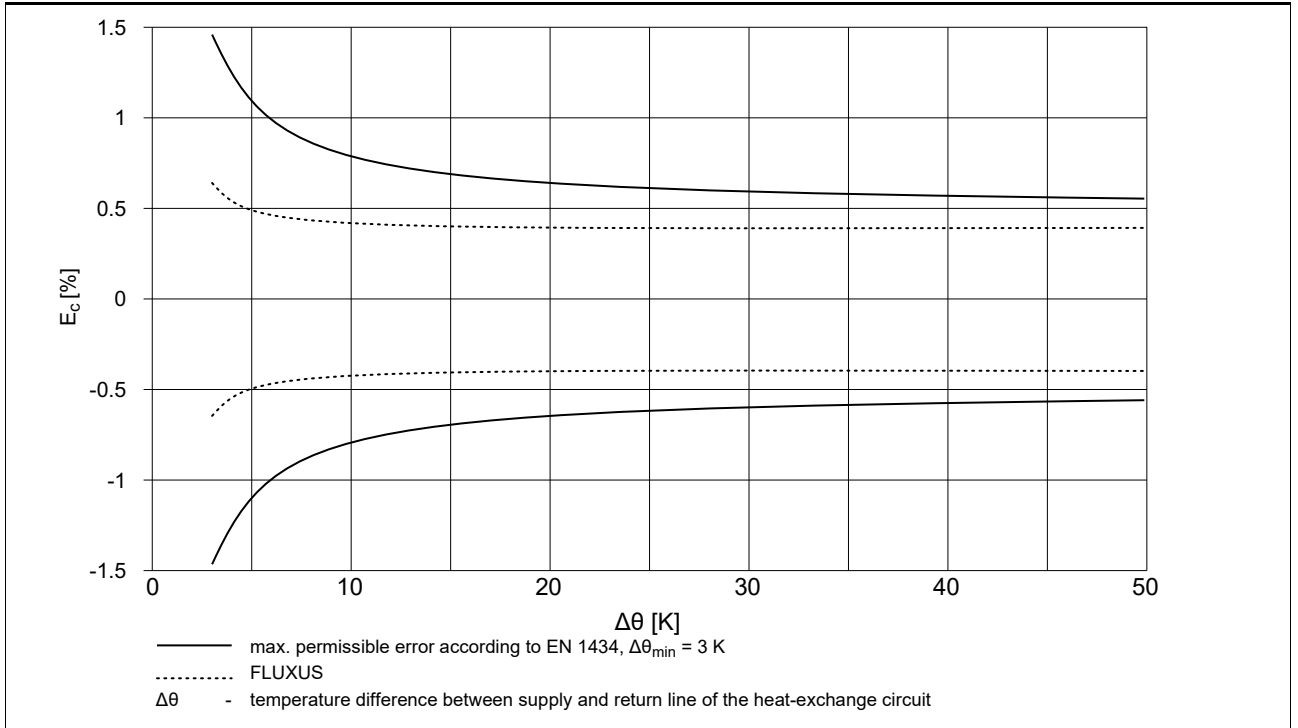
	FLUXUS F721TE-NN0*A F721TE-NN0*S	FLUXUS F721TE-A20*A F721TE-A20*S	FLUXUS F721TE-F20*A F721TE-F20*S
• FM			
marking	-	-	F721**-F20**2, F721**-F20**3:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T5 F721**-F20**1:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T4A
measuring functions			
physical quantities	thermal energy rate, volumetric flow rate, mass flow rate, flow velocity		
totaliser	thermal energy, volume, mass		
calculation functions	average, difference, sum (2 measuring channels necessary)		
diagnostic functions	sound speed, 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: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • M-Bus • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • Profibus PA • FF H1 • Modbus TCP • BACnet IP
accessories			
data transmission kit	USB cable		
software	• FluxDiagReader: reading of measured values and parameters, graphical presentation • FluxDiag (optional): reading of measurement data, graphical presentation, 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			
	All switchable current outputs are jointly switched to active or passive.		
number	2 or 4		
range	mA 4...20 (3.2...22)		
accuracy	0.04 % MV ±3 µA		
active output	$R_{ext} < 350 \Omega$		
passive output	$U_{ext} = 8...30 \text{ V}$, depending on R_{ext} ($R_{ext} < 1 \text{ k}\Omega$ at 30 V)		
• binary output			
number	3		
optorelay	26 V/100 mA		
binary output as alarm output			
• functions	limit, change of flow direction or error		
binary output as pulse output			
• functions	mainly for totalising		
• pulse value	units 0.01...1000		
• pulse width	ms optorelay: 1...1000		
inputs			
	The inputs are galvanically isolated from the transmitter.		
• temperature input			
number	2 (1 measuring channel), 4 (2 measuring channels)		
type	Pt100/Pt1000		
connection	4-wire		
range	°C -150...+560		
resolution	K 0.01		
accuracy	±0.01 % MV ±0.03 K		

¹ with aperture calibration of the transducers

² for transit time difference principle and reference conditions

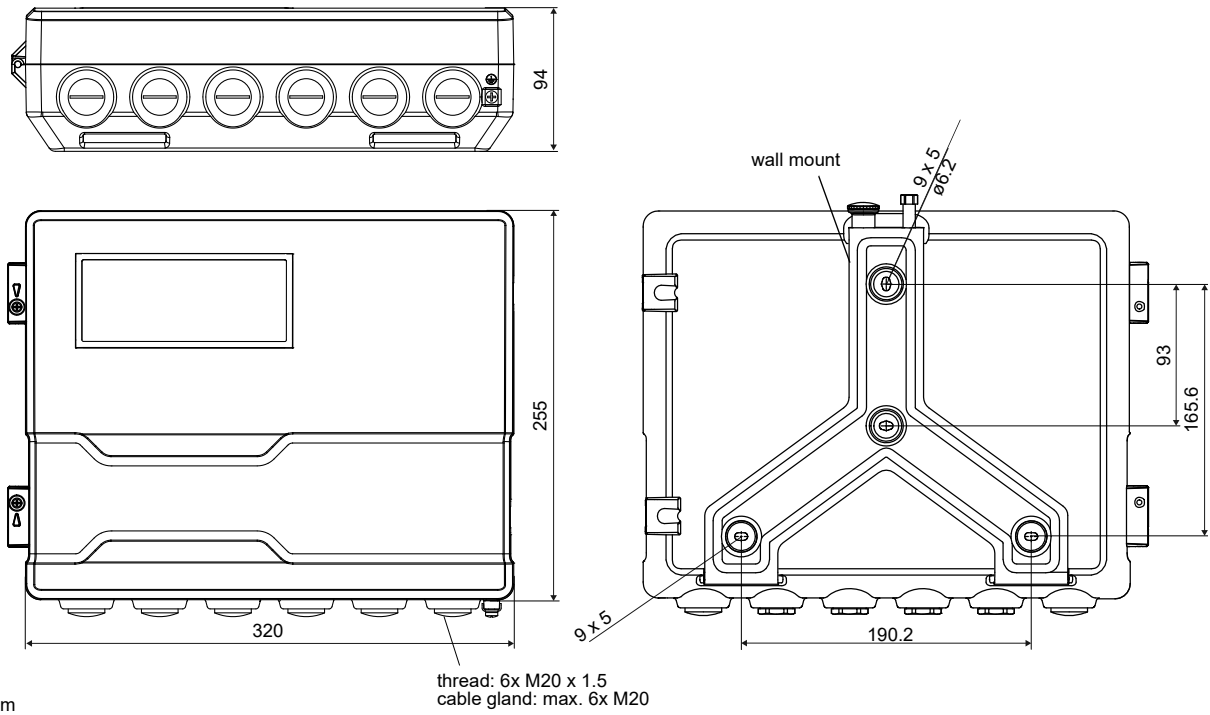
³ outside the explosive atmosphere (housing cover open)

Max. permissible error of the calculator

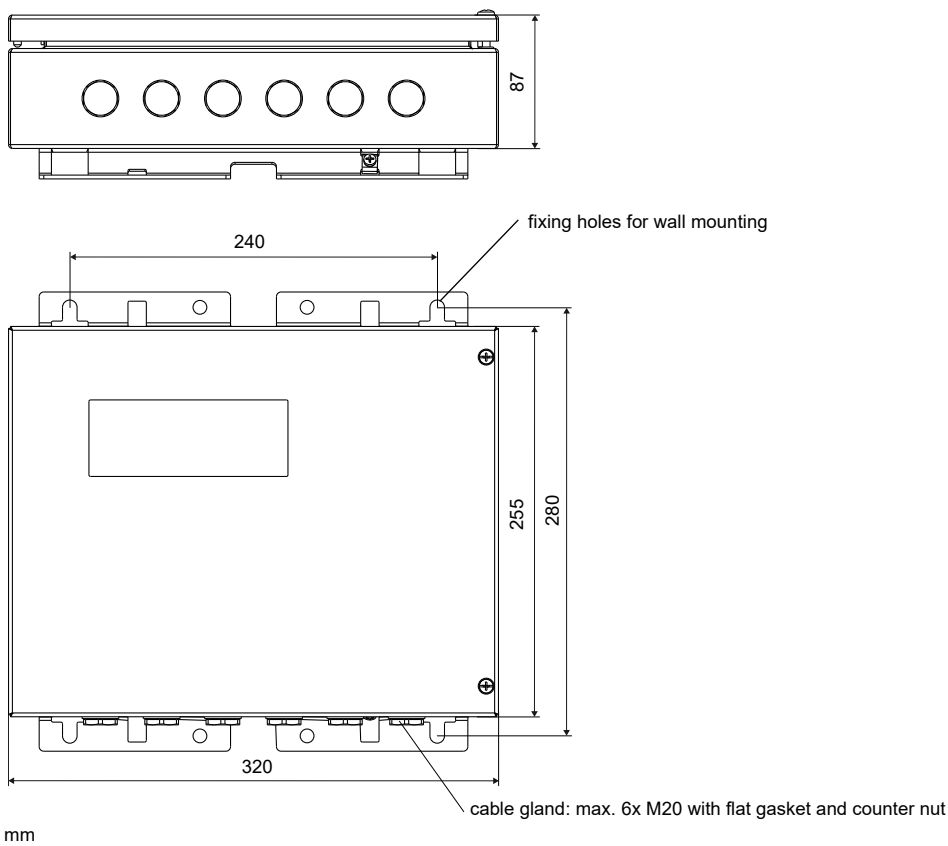


Dimensions

*72***_****A

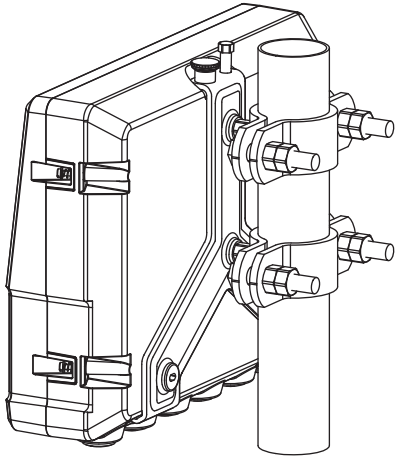


*72***_****S



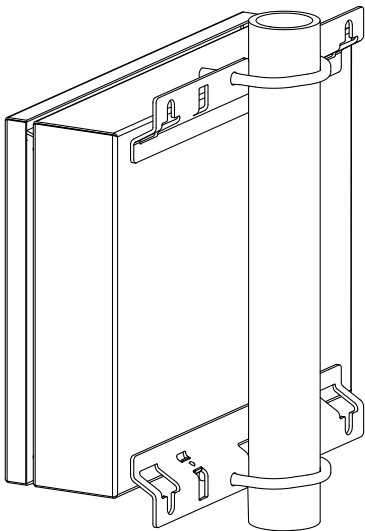
2" pipe mounting kit

*72***-****A



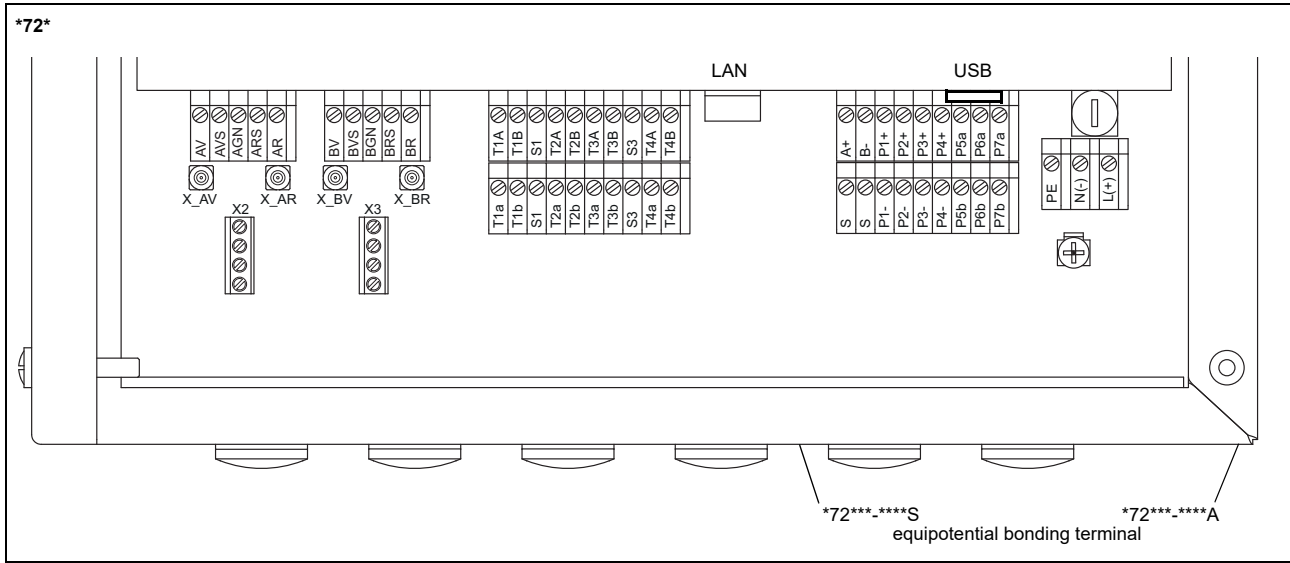
order code:
ACC-PE-*721-/PMK4

*72***-****S



order code:
ACC-PE-*721-/PMK6

Terminal assignment



power supply ¹							
terminal		connection (AC)			connection (DC)		
PE		earth			earth		
N(-)		neutral			-		
L(+)		phase			+		
transducers							
extension cable				transducer cable			
measuring channel A		measuring channel B			measuring channel A	measuring channel B	
terminal	connection	terminal	connection	transducer	terminal	terminal	connection
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							
terminal	connection	terminal	connection	communication interface			
P1+...P4+ P1-...P4-	current output	A+	signal +	<ul style="list-style-type: none"> • RS485¹ • Modbus RTU¹ • BACnet MS/TP¹ • M-Bus¹ • Profibus PA¹ • FF H1¹ 			
		B-	signal -				
P5a...P7a P5b...P7b	binary output	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	connection		
T1a...T4a	red	red	not connected	not connected			
T1A...T4A	red/blue	grey	-	+			
T1b...T4b	white/blue	blue	+	not connected			
T1B...T4B	white	white	not connected	-			
S1, S3	shield	shield	not connected	not connected			

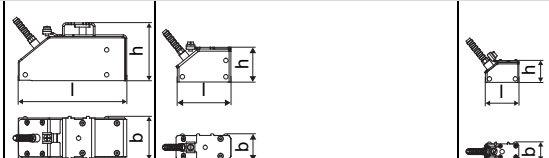

¹ cable (by customer):
 - e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm²
 - outer diameter of the cable (*72***.****S with ferrite nut): max. 7.6 mm

² The number, type and terminal assignment are customised.

Transducers

Technical data

Shear wave transducers (zone 2 - FM Class I Div. 2 - nonEx)

order code		FSK-N**TS/**	FSM-N**TS/**	FSP-N**TS/**	FSQ-N**TS/**
technical type		C(DL)K1N52	C(DL)M2N52	C(DL)P2N52	C(DL)Q2N52
transducer frequency	MHz	0.5	1	2	4
nominal size					
min.		DN 300	DN 200	DN 100	DN 25
max.		DN 1000	DN 600	DN 400	DN 150
material					
housing		PEEK with stainless steel cover 304 (1.4301)			
contact surface		PEEK			
degree of protection		IP67			
transducer cable					
type		1699			
length	m	5	4		3
length (***-*****/LC)	m	9			
dimensions					
length l	mm	126.5	64		40
width b	mm	51	32		22
height h	mm	67.5	40.5		25.5
dimensional drawing					
weight (without cable)	kg	0.36	0.066		0.016
pipe surface temperature					
min.	°C	-40			
max.	°C	+130			
ambient temperature					
min.	°C	-40			
max.	°C	+130			
temperature compensation		x			
explosion protection					
• ATEX/IECEX					
pipe surface temperature (Ex)					
• min.	°C	-55			
• max.	°C	gas: +190, dust: +180			
marking		CE 0637 Ex II 3G II 2D Ex nA IIC T6...T3 Gc Ex tb IIIC T80 °C...T185 °C Db			
certification ATEX		IBExU10ATEX1163 X			
certification IECEX		IECEX IBE 12.0005X			
• FM					
pipe surface temperature (Ex)					
• min.	°C	-40			
• max.	°C	+125 +190			
degree of protection		IP66			
marking		 NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860			

Shear wave transducers (zone 2 - FM Class I Div. 2 - nonEx, TS, extended temperature range)

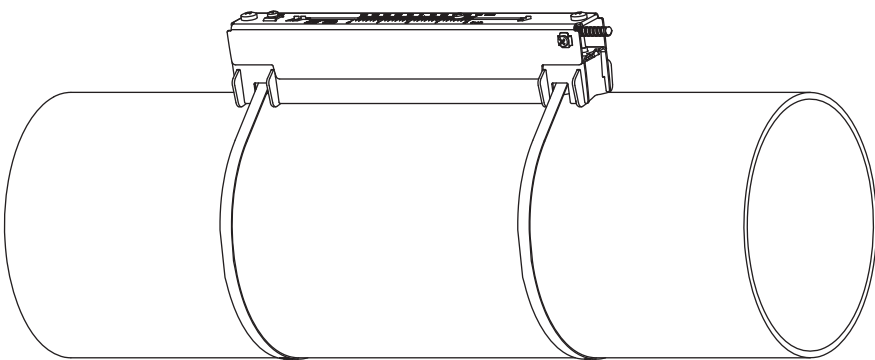
order code		FSK-ENNTS/**	FSM-E**TS/**	FSP-E**TS/**	FSQ-E**TS/**
technical type		C(DL)K1E52	C(DL)M2E52	C(DL)P2E52	C(DL)Q2E52
transducer frequency	MHz	0.5	1	2	4
inner pipe diameter d					
min.		DN 300	DN 200	DN 100	DN 25
max.		DN 1000	DN 600	DN 400	DN 150
pipe wall thickness					
min.	mm	5	2.5	1.2	0.6
material					
housing		PPSU with stainless steel cover 304 (1.4301)	PI with stainless steel cover 304 (1.4301)		
contact surface		PPSU	PI		
degree of protection		IP65	IP56		
transducer cable					
type		1699	6111		
length	m	5	4	3	
length (***_****/LC)	m	9	9		
dimensions					
length l	mm	129.5	64	40	
width b	mm	51	32	22	
height h	mm	67	40.5	25.5	
dimensional drawing					
weight (without cable)	kg	0.82	0.066	0.017	
pipe surface temperature					
min.	°C	-40	-30	-30	
max.	°C	+180	+240 ¹	+200	
ambient temperature					
min.	°C	-40	-30	-30	
max.	°C	+180	+40 +60 ² +200 ³	+200	
temperature compensation		x			
explosion protection					
• ATEX/IECEx					
order code		-	FSM-EA2TS/**	FSP-EA2TS/**	FSQ-EA2TS/**
pipe surface temperature (Ex)		-	-45		
• min.	°C	-	gas: +235 ¹ , dust: +225 ¹		
• max.	°C	-			
marking		-	CE 0637 (Ex) II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIA T80 °C...230 °C Db		
certification ATEX		-	IBExU10ATEX1163 X		
certification IECEx		-	IECEx IBE 12.0005X		
• FM					
order code		-	FSM-EF2TS/**	FSP-EF2TS/**	FSQ-EF2TS/**
pipe surface temperature (Ex)		-	-40		
• min.	°C	-	+235 ¹		
• max.	°C	-			
degree of protection		-	IP66		
marking		-	NI/CI. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860		

¹ > +200 °C:
 Variofix C without cover or Variofix L
 observe the insulation instruction
 Ex: ambient temperature max. +40 °C

² pipe surface temperature +200...+240 °C: Variofix C without cover

³ pipe surface temperature max. +200 °C

Transducer mounting fixture

<p>Variofix L (VLK, VLM, VLQ)</p> 	<p>material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006) inner length: VLK: 348 mm VLM: 234 mm VLQ: 176 mm dimensions: VLK: 423 x 90 x 93 mm VLM: 309 x 57 x 63 mm VLQ: 247 x 43 x 47 mm</p>
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Coupling materials for transducers

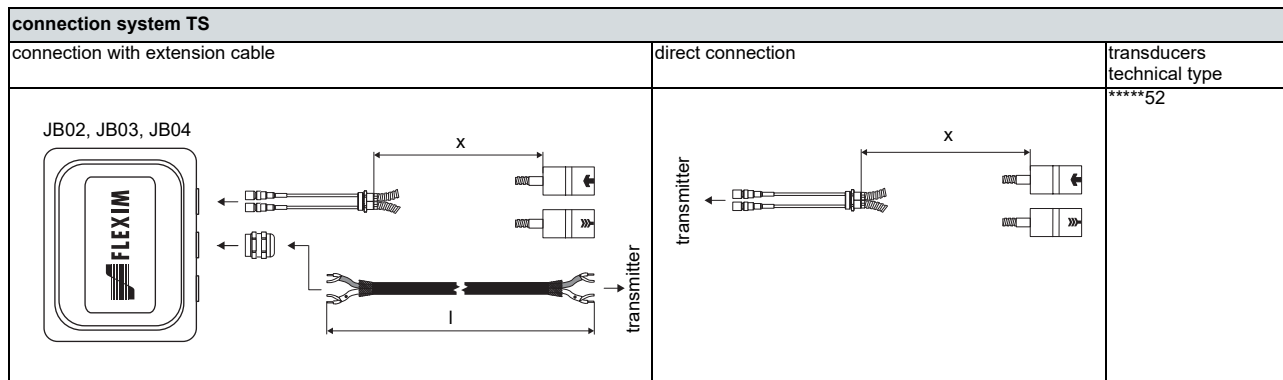
	< 100 °C	< 170 °C	200...240 °C
< 24 h	coupling compound type N or coupling foil type VT	coupling compound type E or coupling foil type VT	coupling foil type TF
long time measurement	coupling foil type VT	coupling foil type VT	coupling foil type TF

type VT: fluid temperature 200 °C: min. 2 years

Technical data

type	ambient temperature °C
coupling compound type N	-30...+130
coupling compound type E	-30...+200
coupling foil type VT	-10...+200
coupling foil type TF	200...240

Connection systems



Cable

transducer cable			
type		1699	6111
weight	kg/m	0.094	0.092
ambient temperature	°C	-55...+200	-100...+225
cable jacket			
material		PTFE	PFA
outer diameter	mm	2.9	2.7
thickness	mm	0.3	0.5
colour		brown	white
shield		x	x
sheath			
material		stainless steel 304 (1.4301) option OS: 316Ti (1.4571)	stainless steel 304 (1.4301) option OS: 316Ti (1.4571)
outer diameter	mm	8	8

extension cable			
type		2615	5245
order code		ACC-PE- GNNN-/EXEXXXX	ACC-PE- GNNN-/EXA1XXX
weight	kg/m	0.18	0.38
ambient temperature	°C	-30...+70	-30...+70
properties		halogen free fire propagation test according to IEC 60332-1 combustion test according to IEC 60754-2	halogen free fire propagation test according to IEC 60332-1 combustion test according to IEC 60754-2
cable jacket			
material		PUR	PUR
outer diameter	mm	max. 12	max. 12
thickness	mm	2	2
colour		black	black
shield		x	x
sheath			
material		-	steel wire braid with copolymer sheath
outer diameter	mm	-	max. 15.5

XXX - cable length in m

Cable length

transducer frequency		F, G, H, K		M, P		Q		S	
connection system TS									
transducers technical type		x	l	x	l	x	l	x	l
*D***5*	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40
option LC: *I***5*	m	9	≤ 300	9	≤ 300	9	≤ 90	-	≤ 40

x - transducer cable length

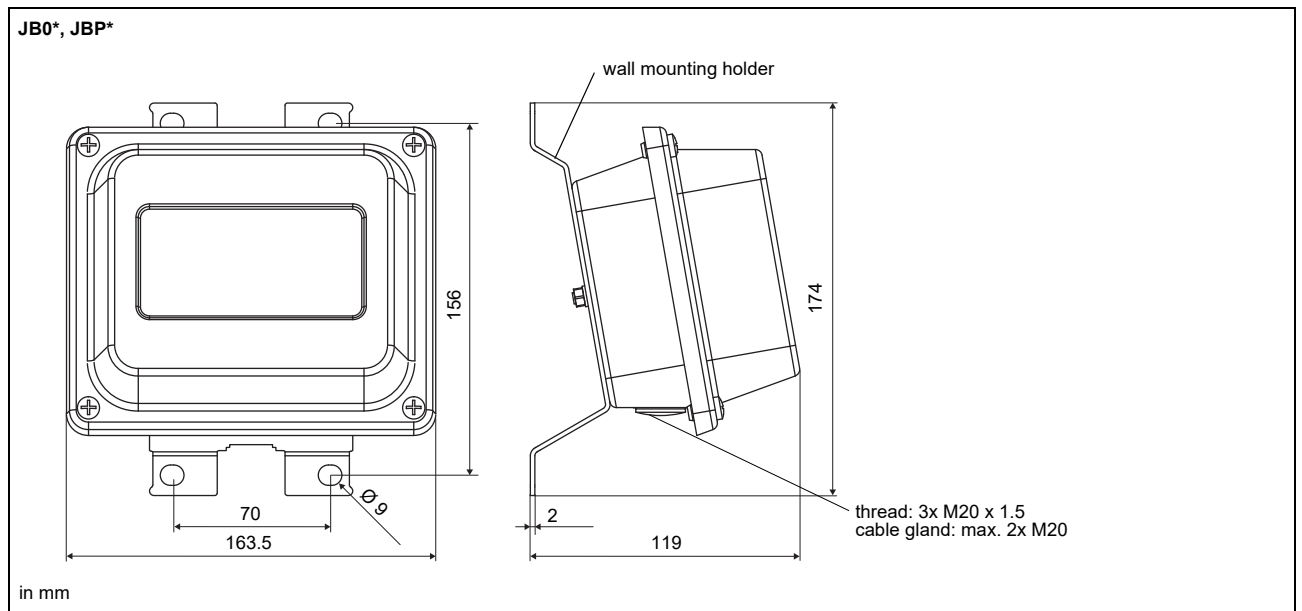
l - max. length of extension cable (depending on the application)

Junction box

Technical data

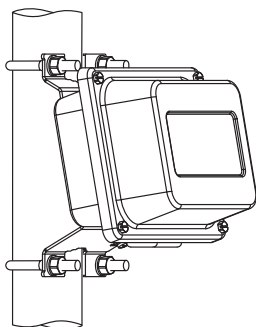
JB02, JB03, JB04													
weight	kg 1.2 kg												
fixation	wall mounting optional: 2" pipe mounting												
material													
housing	stainless steel 316L (1.4404)												
gasket	silicone												
degree of protection	IP67												
ambient temperature													
min.	°C -40												
max.	°C +80												
explosion protection													
• ATEX													
junction box marking	JB02 CE Ex II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc IIIC T 100 °C Dc Ta -40...+(70)80 °C												
• FM													
junction box marking	JB04 FM APPROVED NI/CI. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ T6 Ta = -40...+60 °C												
Connection													
Transducers													
	<table border="1"> <thead> <tr> <th>terminal</th> <th>connection</th> <th>transducer</th> </tr> </thead> <tbody> <tr> <td>XV</td> <td>SMB connector</td> <td>↑</td> </tr> <tr> <td>XR</td> <td>SMB connector</td> <td>⤴</td> </tr> </tbody> </table>	terminal	connection	transducer	XV	SMB connector	↑	XR	SMB connector	⤴			
terminal	connection	transducer											
XV	SMB connector	↑											
XR	SMB connector	⤴											
Extension cable													
	<table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL2</td> <td>TV</td> <td>signal</td> </tr> <tr> <td>TVS</td> <td>internal shield</td> </tr> <tr> <td>TRS</td> <td>internal shield</td> </tr> <tr> <td>TR</td> <td>signal</td> </tr> </tbody> </table>	terminal strip	terminal	connection	KL2	TV	signal	TVS	internal shield	TRS	internal shield	TR	signal
terminal strip	terminal	connection											
KL2	TV	signal											
	TVS	internal shield											
	TRS	internal shield											
	TR	signal											

Dimensions



2" pipe mounting kit

JB**

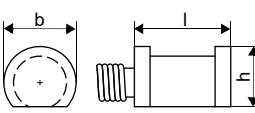

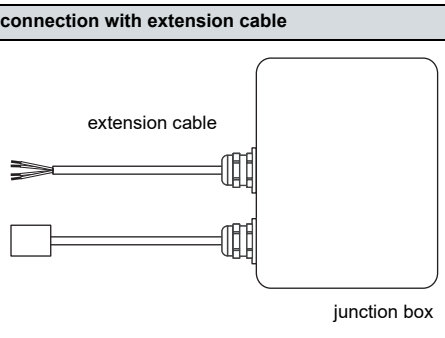
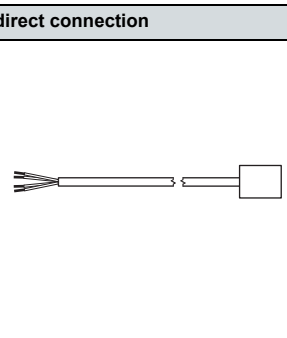
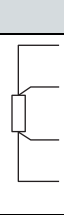


order code:
ACC-PE-GNNN-/JBPMK4

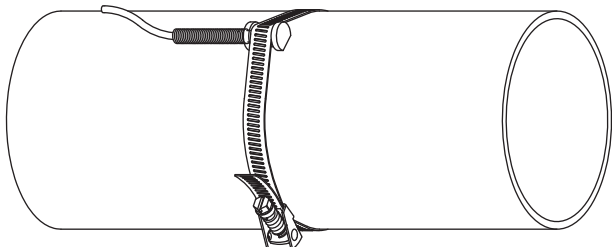
Clamp-on temperature probe (optional)

Technical data

PT12N		
order code	<ul style="list-style-type: none"> ACC-PE-GNNN-/T312 ACC-PE-GNNN-/T512 (matched) 	
design	clamp-on	
type	Pt100	
connection	4-wire	
measuring range	°C -30...+250	
accuracy T	$\pm(0.15 \text{ °C} + 2 \cdot 10^{-3} \cdot T \text{ [°C]})$ class A	
accuracy ΔT (2x Pt matched according to EN 1434-1)	$\leq 0.1 \text{ K}$ ($3 \text{ K} < \Delta T < 6 \text{ K}$), more corresponding to EN 1434-1	
response time	s 50 (t_{50} , $T_1 = 25 \text{ °C}$, $T_2 = 60 \text{ °C}$)	
housing	aluminum	
degree of protection	IP54	
dimensions		
length l	mm 20	
width b	mm 15	
height h	mm 13	
dimensional drawing		
weight	kg 0.25	
accessories		
thermal conductivity foil 250 °C	x	
Connection system		
connection with extension cable	direct connection	
Connection		
	temperature probe	
	red	
	red/blue	
	white/blue	
	white	
Cable		
	temperature probe	extension cable
type	4 x 0.22 mm ²	LIYCY 8 x 0.14 mm ²
standard length	m 3	5/10/25
max. length	m -	200
ambient temperature	°C -30...+250	-25...+80
min. bend radius	mm 27	68
cable jacket		
material	PFA	PVC
outer diameter	mm 3.8 ±0.15	4.8 ±2
colour	black	grey

PT12N		
order code	<ul style="list-style-type: none"> ACC-PE-GNNN-/T322 ACC-PE-GNNN-/T522 (matched) 	
design	clamp-on ATEX	
type	Pt100	
connection	4-wire	
measuring range	°C -30...+250	
accuracy T	$\pm(0.15 \text{ °C} + 2 \cdot 10^{-3} \cdot T [\text{°C}])$ class A	
accuracy ΔT (2x Pt matched according to EN 1434-1)	$\leq 0.1 \text{ K}$ (3 K < ΔT < 6 K), more corresponding to EN 1434-1	
response time	s 50	
housing	aluminum	
degree of protection	IP67	
dimensions		
length l	mm 20	
width b	mm 15	
height h	mm 13	
dimensional drawing		
weight	kg 0.25	
accessories		
thermal conductivity foil 250 °C	x	
explosion protection		
• ATEX		
marking	 II 3G Ex nA IIC T6...T2 Gc Ta -30...+250 °C	
Connection system		
connection with extension cable	direct connection	
		
Connection		
	temperature probe	
	red	
	red/blue	
	white	
	white/blue	
Cable		
	temperature probe	extension cable
type	4 x 0.25 mm ²	LIYCY 8 x 0.14 mm ²
standard length	m 3	5/10/25
max. length	m -	200
ambient temperature	°C -30...+250	-25...+80
min. bend radius	mm 19	68
cable jacket		
material	PTFE	PVC
outer diameter	mm 3.8	4.8 ±2
colour	black	grey

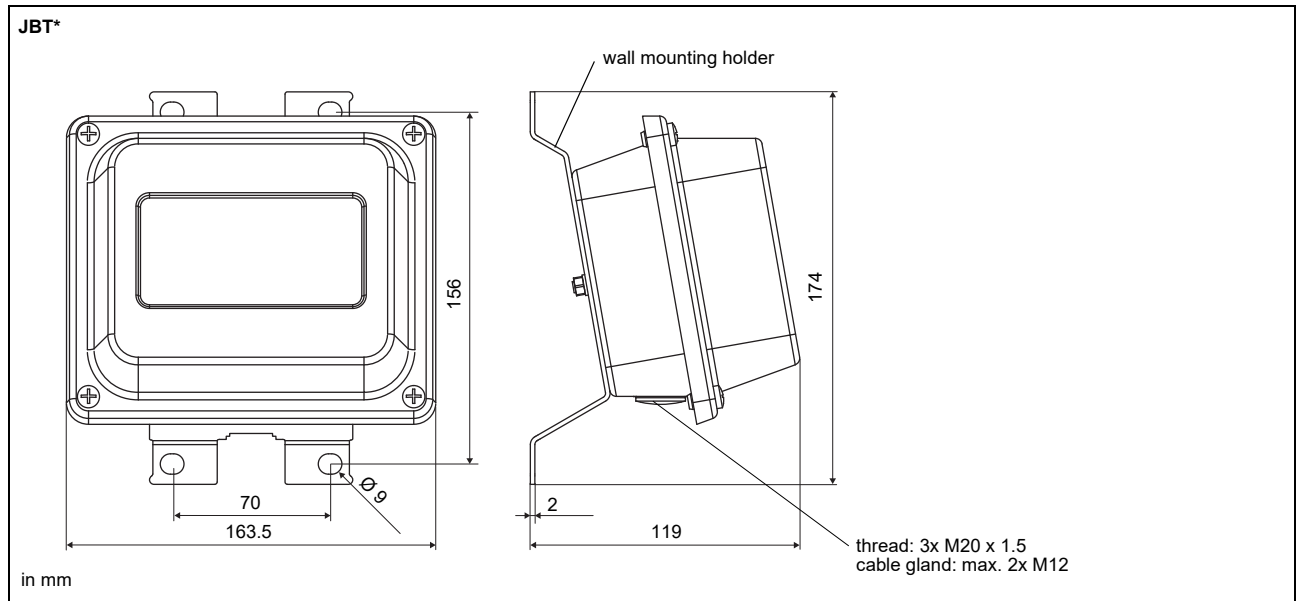
Fixation

tension strap PT12N	
	material: stainless steel 301 (1.4310), 410 (1.4006) thermal insulation necessary

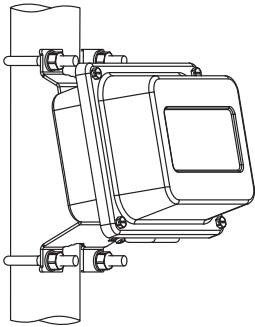
Junction box

JBT2, JBT3																									
order code	<ul style="list-style-type: none"> • JBT2: ACC-PE-GNNN-/JB4 • JBT3: ACC-PE-GNNN-/JB6 																								
weight	kg 1.2 kg																								
fixation	wall mounting optional: 2" pipe mounting																								
material																									
housing	stainless steel 316L (1.4404)																								
gasket	silicone																								
degree of protection	IP67																								
ambient temperature																									
min.	°C -40																								
max.	°C +80																								
explosion protection																									
• ATEX																									
junction box marking	JBT2																								
marking																									
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Connection</p> </div> <div style="width: 45%;"> <p>Temperature probe</p> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL1</td> <td>1</td> <td>red</td> </tr> <tr> <td>2</td> <td>red/blue</td> </tr> <tr> <td>3</td> <td>white</td> </tr> <tr> <td>4</td> <td>white/blue</td> </tr> </tbody> </table> <p>Extension cable</p> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL2</td> <td>1</td> <td>red</td> </tr> <tr> <td>2</td> <td>grey</td> </tr> <tr> <td>3</td> <td>white</td> </tr> <tr> <td>4</td> <td>blue</td> </tr> </tbody> </table> </div> </div>		terminal strip	terminal	connection	KL1	1	red	2	red/blue	3	white	4	white/blue	terminal strip	terminal	connection	KL2	1	red	2	grey	3	white	4	blue
terminal strip	terminal	connection																							
KL1	1	red																							
	2	red/blue																							
	3	white																							
	4	white/blue																							
terminal strip	terminal	connection																							
KL2	1	red																							
	2	grey																							
	3	white																							
	4	blue																							

Dimensions

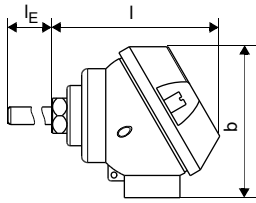


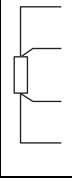
2" pipe mounting kit

<p>JB**</p> 	<p>order code: ACC-PE-GNNN-/JBPMK4</p>
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Inline temperature probe (optional)

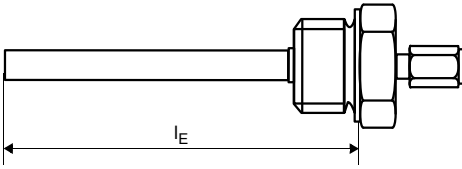
Technical data

PT12N-IT-P PT12N-IU-P	
order code	<p>PT12N-IT-P:</p> <ul style="list-style-type: none"> ACC-PE-GNNN-/T718 (matched, without cable) ACC-PE-GNNN-/T716 (matched, 10 m) ACC-PE-GNNN-/T717 (matched, 20 m) <p>PT12N-IU-P:</p> <ul style="list-style-type: none"> ACC-PE-GNNN-/T818 (matched, without cable) ACC-PE-GNNN-/T816 (matched, 10 m) ACC-PE-GNNN-/T817 (matched, 20 m)
type	2x Pt100 matched according to EN 1434
connection	4-wire
measuring range	°C -30...+200
accuracy θ	$\pm(0.15 \text{ }^\circ\text{C} + 2 \cdot 10^{-3} \cdot T \text{ [}^\circ\text{C]})$ class A
max. permissible relative error	$E_t = \pm 0.9 \cdot (0.5 + 3 \cdot \Delta\theta_{\min}/\Delta\theta)$
response time	s T50: 5, T90: 19
housing	316Ti (1.4571) connecting head J: aluminum
degree of protection	IP65
dimensions	
length l	mm 72 PT12N-IT-P: $l_E = 140$ PT12N-IU-P: $l_E = 230$
width b	mm 51
dimensional drawing	
weight	kg PT12N-IT-P: 0.136 PT12N-IU-P: 0.142

connection											
	<table border="1"> <thead> <tr> <th>temperature probe</th> <th>cable</th> </tr> </thead> <tbody> <tr> <td>red</td> <td>red</td> </tr> <tr> <td>red</td> <td>grey</td> </tr> <tr> <td>white</td> <td>blue</td> </tr> <tr> <td>white</td> <td>white</td> </tr> </tbody> </table>	temperature probe	cable	red	red	red	grey	white	blue	white	white
temperature probe	cable										
red	red										
red	grey										
white	blue										
white	white										

cable	
type	LIYCY 8 x 0.14 mm ² grey
standard length	m 10/20
max. length	m 200
cable jacket	PVC

Fixation

threaded thermowell PT12N-I		PT12N-IT-P	PT12N-IU-P
	mounting length l_E	mm 120	210
material			
threaded thermowell		stainless steel 316L (1.4404)	
clamping nut		galvanised steel 1.0037, PTFE	
weight	kg	0.08	0.091
outer diameter	mm	8	
process connection		G 1/2"	
fluid pressure		PN25 (water)	
max. flow velocity¹			
water, thermal oil	m/s	6.93	4.37
glycol/H ₂ O	m/s	8.4	3.78

¹ max. permissible values for laminar flows; further influences like motors, pumps, valves which provoke turbulences, water hammers, pulsations, oscillations, etc. have to be considered by the customer

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