

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



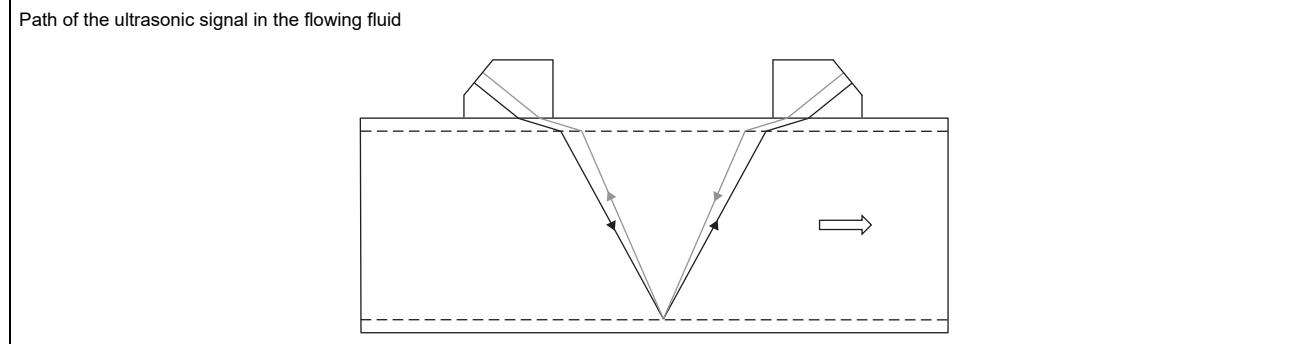
Variofix L

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Function

Measurement principle

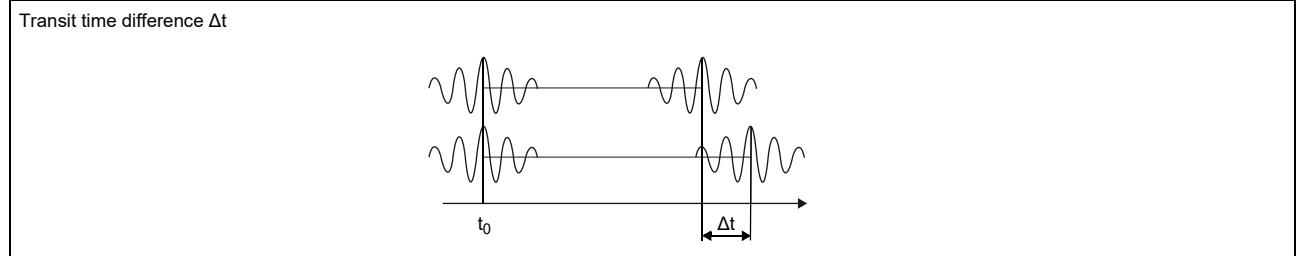
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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

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

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_y - 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.

$$MPE = E_c + E_t + E_f$$

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**

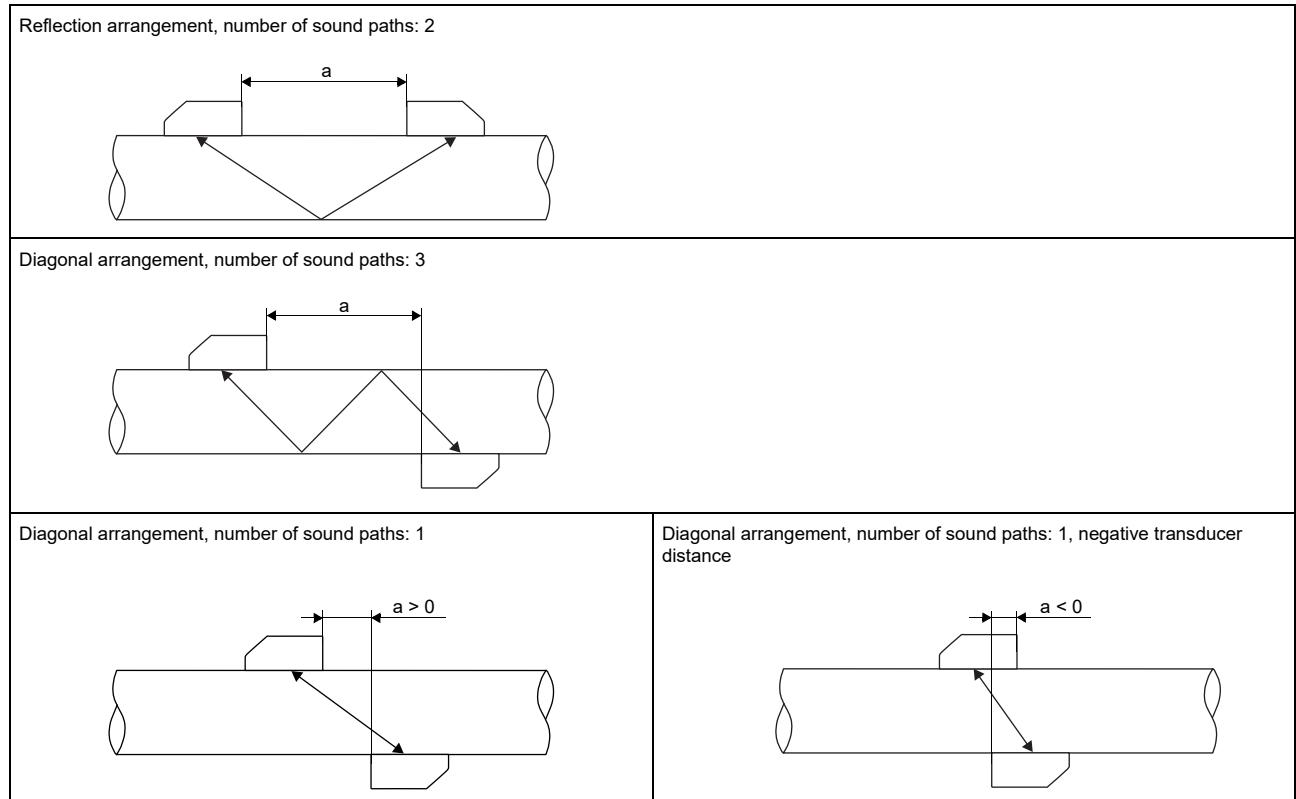
The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easy.

- **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.

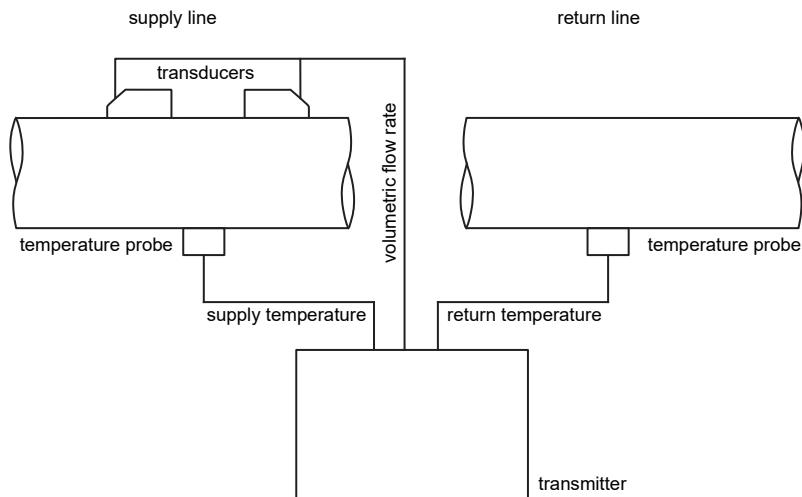
As the transducers can be mounted with the transducer mounting fixture in reflection arrangement or diagonal arrangement, the number of sound paths can be adjusted optimally for the application.



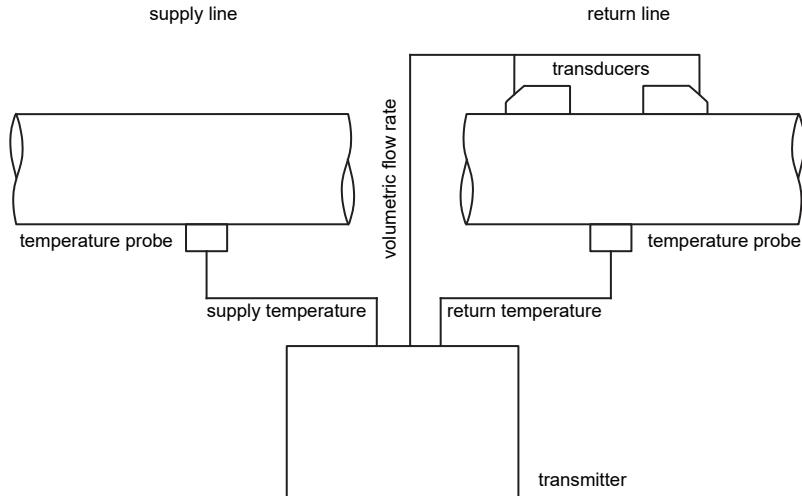
a - transducer distance

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-NNN**-*A F721TE-NNN**-*S	FLUXUS F721TE-A2N**-*A F721TE-A2N**-*S	FLUXUS F721TE-F2N**-*A F721TE-F2N**-*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		
Flussrichtung		bidirektional		
flow	m³/h	$Q_p = 17 \dots 20\,000$		
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 		
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		<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		
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 without operation of the display)		
display		128 x 64 pixels, backlight		
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian		

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-NNN**-*A F721TE-NNN**-*S	FLUXUS F721TE-A2N**-*A F721TE-A2N**-*S	FLUXUS F721TE-F2N**-*A F721TE-F2N**-*S
explosion protection			
• ATEX/IECEx			
marking	-	F721**-A20*A, F721**-A20*S: II3G Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 °C Db T _a -40...+60 °C	-
certification	-	IBExU11ATEX1015, IECEx IBE 11.0008	-
• 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			
number	All switchable current outputs are jointly switched to active or passive.		
range	mA	2 or 4	
accuracy		4...20 (3.2...22)	
active output		0.04 % MV ±3 µA	
passive output	R _{ext} < 250 Ω		
		U _{ext} = 8...30 V, depending on R _{ext} (R _{ext} < 1 kΩ at 30 V)	
• digital output			
functions	frequency output binary output pulse output		
number	3		
operating parameters	5...30 V/< 100 mA		
frequency output			
• range	kHz	0...5	
binary output			
• binary output as alarm output	limit, change of flow direction or error		
pulse output			
• functions	mainly for totalising		
• pulse value	units	0.01...1000	
• pulse width	ms	0.05...1000	

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

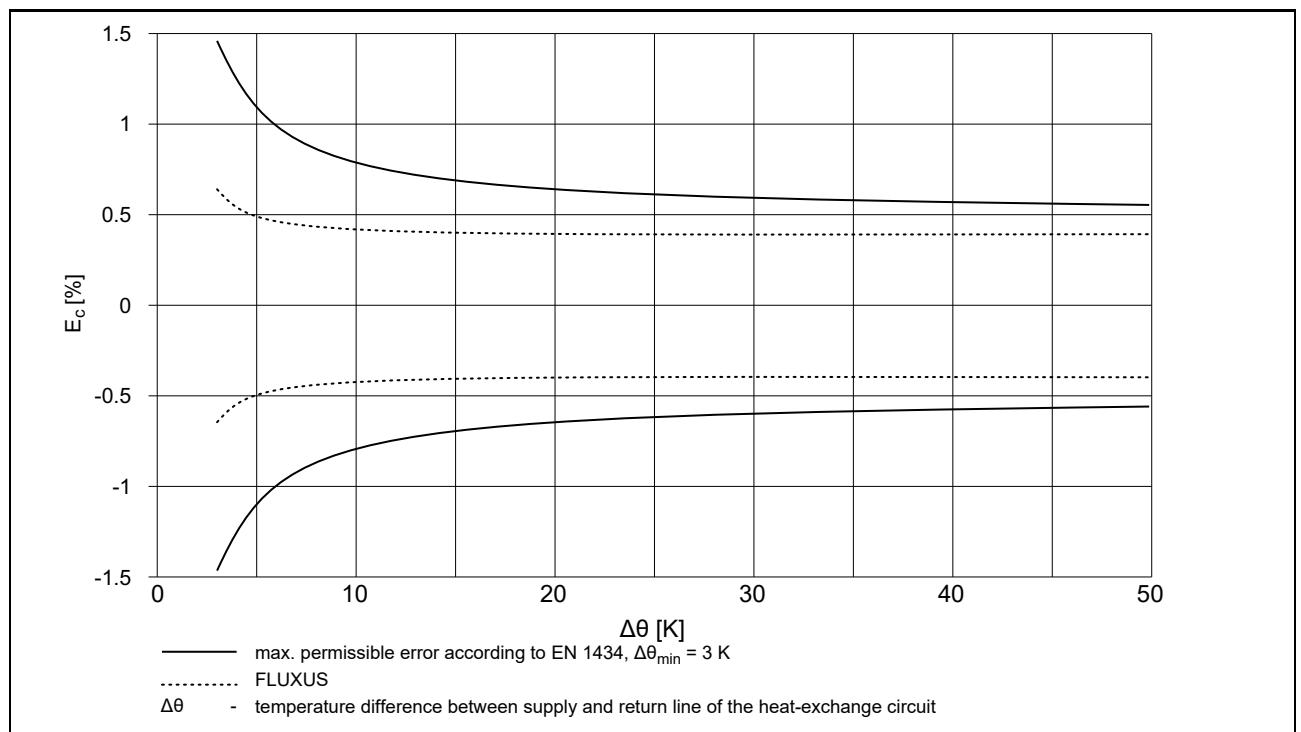
	FLUXUS F721TE-NNN**-A F721TE-NNN**-S	FLUXUS F721TE-A2N**-A F721TE-A2N**-S	FLUXUS F721TE-F2N**-A F721TE-F2N**-S
inputs			
	The inputs are galvanically isolated from the transmitter.		
• temperature input			
number	2 (1 measuring channel), 4 (2 measuring channels)		
type	Pt100/Pt1000		
connection	4-wire		
range	°C -150...+560		
resolution	K 0.01		
accuracy	±0.01 % MV ±0.03 K		

¹ with aperture calibration of the transducers

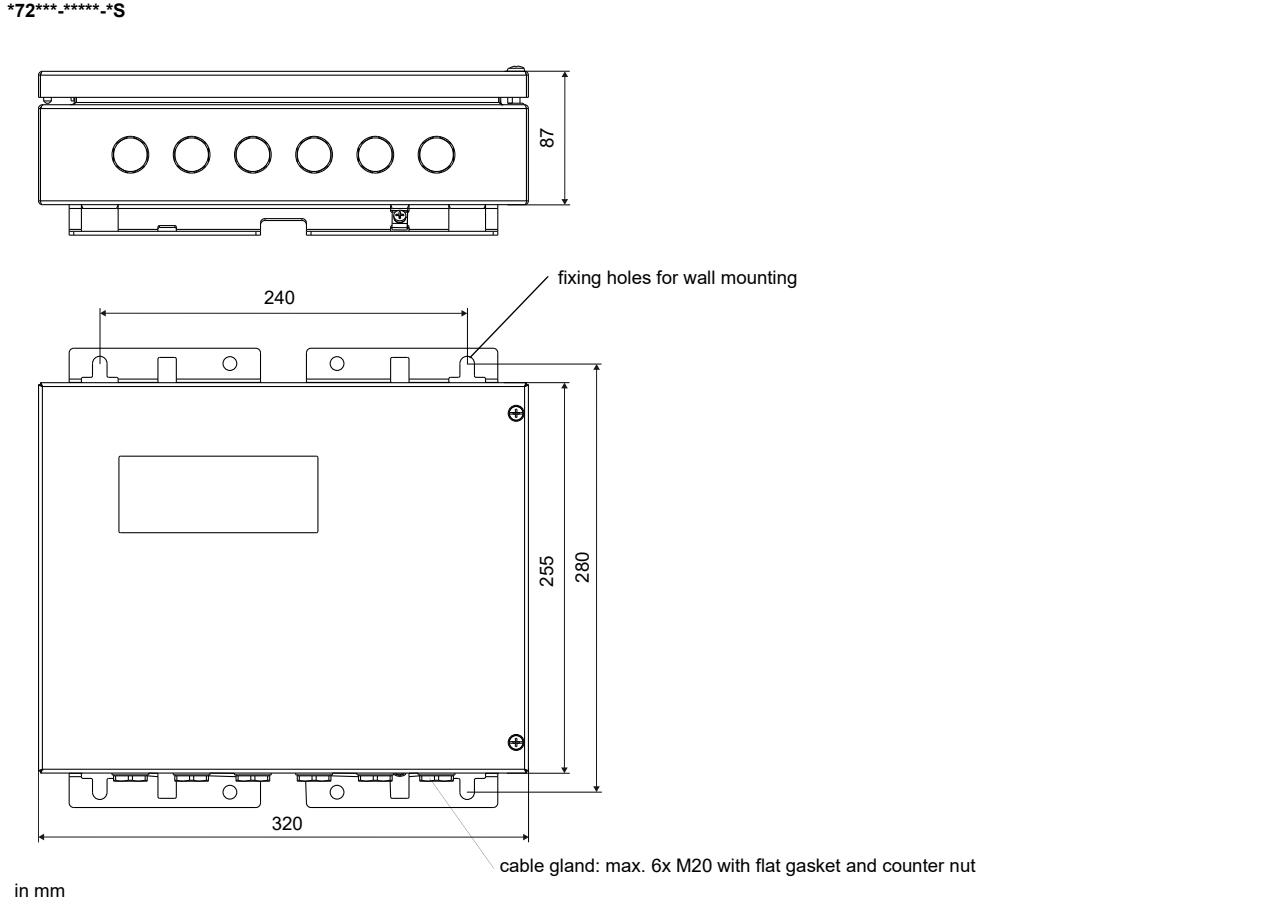
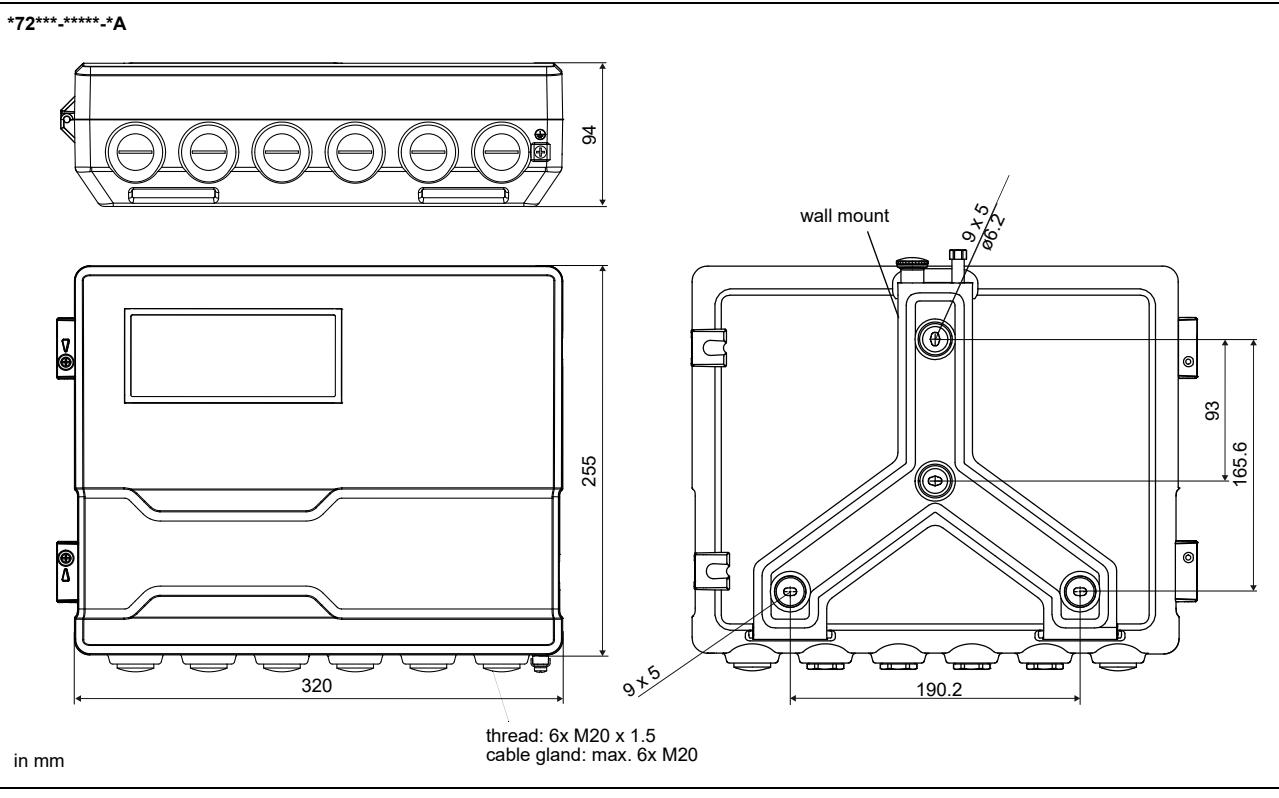
² for transit time difference principle and reference conditions

³ outside the explosive atmosphere (housing cover open)

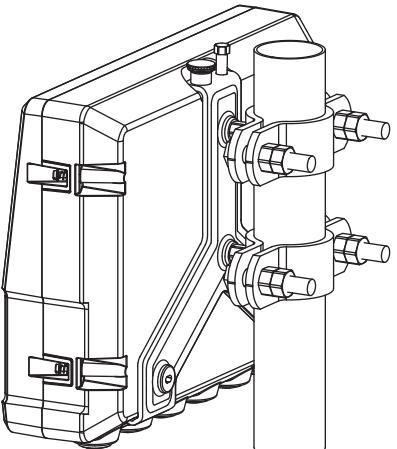
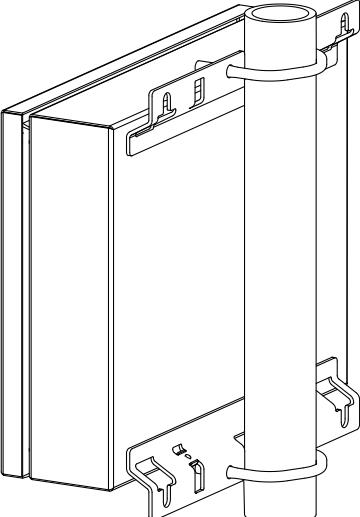
Max. permissible error of the calculator



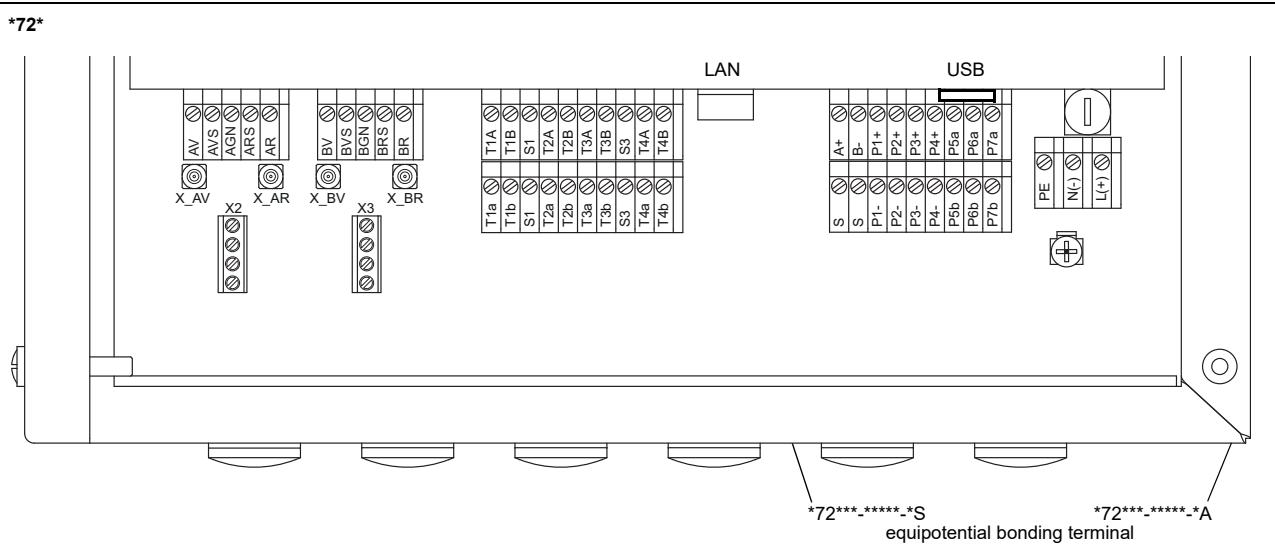
Dimensions



2" pipe mounting kit

*72***-****-*A		item number: 721037-4
*72***-****-*S		item number: 721110-4

Terminal assignment



power supply¹

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

transducers

extension cable		transducer cable		
measuring channel A		measuring channel B	measuring channel A	measuring channel B
terminal	connection	terminal	connection	transducer
AV	signal	BV	signal	↑
AVS	shield	BVS	shield	↑
ARS	shield	BRS	shield	↑
AR	signal	BR	signal	↑

outputs¹

terminal	connection	terminal	connection	communication interface
P1+...P4+	current output	A+	signal +	• RS485 ¹
P1-...P4-		B-	signal -	• Modbus RTU ¹
P5a...P7a	digital output	S	shield	• BACnet MS/TP ¹
P5b...P7b		USB	type B Hi-Speed USB 2.0 Device	• M-Bus ¹
		LAN	RJ45 10/100 Mbps Ethernet	• Profibus PA ¹
				• FF H1 ¹
				• service (FluxDiag/ FluxDiagReader)
				• Modbus TCP
				• BACnet IP

analog inputs^{1, 2}

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

¹ cable (by customer):

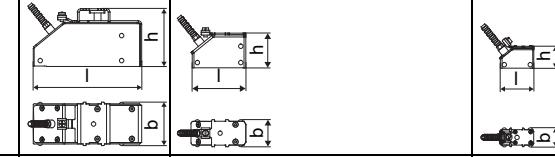
- e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm²
- outer diameter of the cable (*72***-*****-*S with ferrite nut): max. 7.6 mm

² The number, type and terminal assignment are customised.

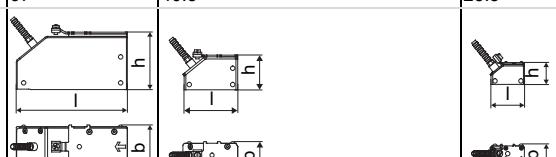
Transducers

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 316L (1.4404)							
contact surface		PEEK							
degree of protection		IP66	IP66/IP67						
transducer cable									
type		1699							
length	m	5	4	3					
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	°C	-40...+130							
ambient temperature	°C	-40...+130							
temperature compensation		x							
explosion protection									
• ATEX/IECEx									
pipe surface temperature (Ex)	°C	gas: -55...+190 dust: -55...+180							
marking		 0637 II3G Ex II2D Ex nA IIC T6...T3 Gc Ex tb IIIC T80 °C...T185 °C Db							
certification		IBExU10ATEX1163 X, IECEx IBE 12.0005X							
• FM									
pipe surface temperature (Ex)	°C	-40...+125		-40...+190					
degree of protection		IP66							
marking		 NI/CI, 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-ENNN-**TS	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 316L (1.4404)	PI with stainless steel cover 316L (1.4404)		
contact surface	PPSU	PI		
degree of protection	IP66	IP66/IP67		
transducer cable				
type	1699	6111		
length	m 5	4		3
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	°C -40...+180	-30...+240 ¹		-30...+200
ambient temperature	°C -40...+180	-30...+40 -30...+60 ² -30...+200 ³		-30...+200
temperature compensation		x		
explosion protection				
• ATEX/IECEx				
order code	-	FSM-EA2*-**TS	FSP-EA2*-**TS	FSQ-EA2*-**TS
pipe surface temperature (Ex)	°C -	gas: -45...+235 ¹ dust: -45...+225 ¹		
marking	-	CE 0637 II2D Ex nA IIC T6...T2 Gc Ex tb IIIA T80 °C...T230 °C Db		
certification	-	IBExU10ATEX1163 X, IECEx IBE 12.0005X		
• FM				
order code	-	FSM-EF2*-**TS	FSP-EF2*-**TS	FSQ-EF2*-**TS
pipe surface temperature (Ex)	°C -	-45...+235 ¹		
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

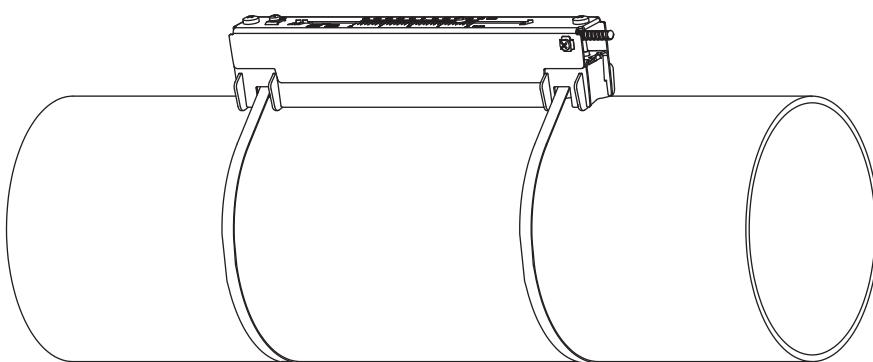
observe the insulation instruction

Ex: ambient temperature max. +40 °C

² pipe surface temperature +200...+240 °C: Variofix C without cover³ pipe surface temperature max. +200 °C

Transducer mounting fixture

Variofix L (VLK, VLM, VLQ)



material: stainless steel 316Ti
(1.4571), 316L (1.4404), 17-7PH
(1.4568)

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

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 measure- ment	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

connection system TS		
connection with extension cable	direct connection	transducers technical type
JB02, JB03, JB04 	transmitter	*****52

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 316Ti (1.4571)	stainless steel 316Ti (1.4571)
outer diameter mm	8	8

extension cable		
type	2615	5245
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

Cable length

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

x - transducer cable length

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

Junction box

Technical data

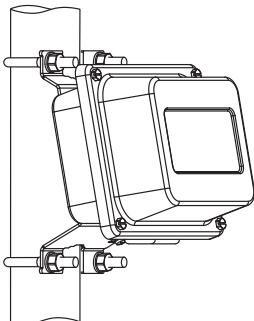
JB02, JB03, JB04			
weight	kg	1.2 kg	
fixation		wall mounting optional: 2" pipe mounting	
material			
housing		stainless steel 316L (1.4404)	
gasket		silicone	
degree of protection		IP67	
ambient temperature			
min.	°C	-40	
max.	°C	+80	
explosion protection			
• ATEX			
junction box		JB02	
marking		II3G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

Dimensions

JB0*, JBP*

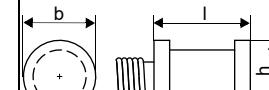
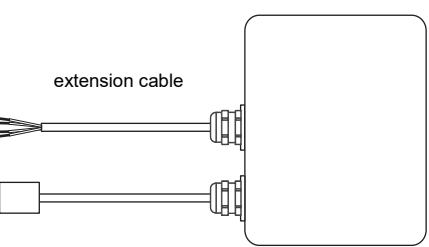
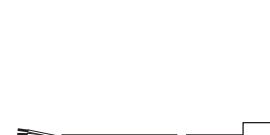
The figure consists of two technical drawings. The left drawing shows a front view of a rectangular junction box with a central opening. Dimensions are: height 156 mm, width 163.5 mm, and a bottom cutout width of 70 mm. A diagonal dimension from the bottom right corner to the top center is labeled θ_9 . The right drawing shows a side view of the box mounted on a wall. It includes a 'wall mounting holder' and indicates a total height of 174 mm. A horizontal dimension at the bottom is 119 mm, and a small dimension 2 is shown near the base. Text at the bottom right specifies 'thread: 3x M20 x 1.5' and 'cable gland: max. 2x M20'. A note 'in mm' is located at the bottom left.

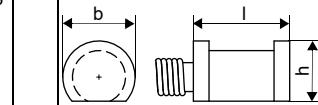
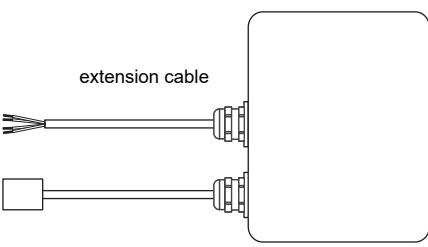
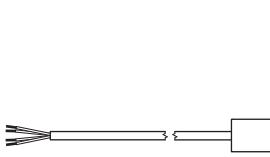
2" pipe mounting kit

JB** 	item number: 751035-2
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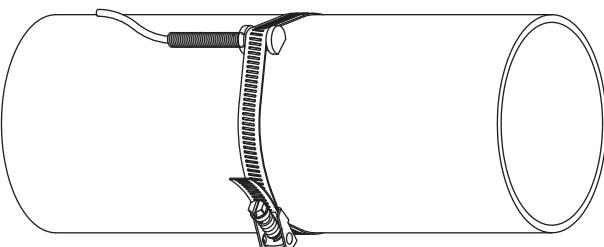
Clamp-on temperature probe (optional)

Technical data

PT12N		
item number		• 770415-1 • 770414-1 (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 material		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
type		4 x 0.22 mm ²
standard length	m	3
max. length	m	-
ambient temperature	°C	-30...+250
min. bend radius	mm	27
cable jacket		extension cable
material		PFA
outer diameter	mm	3.8 ±0.15
colour		black
		PVC
		4.8 ±2
		grey

PT12N			
item number		• 770415-1A2 • 770414-1A2 (matched)	
design		clamp-on ATEX	
type		Pt100	
connection		4-wire	
measuring range	°C	-30...+250	
accuracy T		±(0.15 °C + 2 · 10 ⁻³ · T [°C]) class A	
accuracy ΔT (2x Pt matched according to EN 1434-1)		≤ 0.1 K (3 K < ΔT < 6 K), more corresponding to EN 1434-1	
response time	s	50	
housing material		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		CE Ex II3G 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	
standard length		LIYCY 8 x 0.14 mm ²	
m		3	
max. length		5/10/25	
m		-	
ambient temperature		200	
°C		-30...+250	
min. bend radius		-25...+80	
mm		19	
68			
cable jacket			
material		PTFE	
outer diameter		PVC	
mm		3.8	
4.8 ±2			
colour		black	
		grey	

Fixation

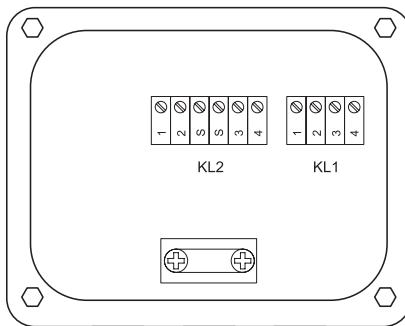
tension strap PT12N		material: stainless steel 301 (1.4310), 410 (1.4006) thermal insulation necessary
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Junction box

JBT2, JBT3

item number		• JBT2:770428-5A2 • JBT3: 751040-36
weight	kg	1.2 kg
fixation		wall mounting optional: 2" pipe mounting
material		
housing		
gasket		
degree of protection		
ambient temperature		
min.	°C	-40
max.	°C	+80
explosion protection		
• ATEX		
junction box		JBT2
marking		CE II3G Ex nA IIC T6...T4 Gc II3D Ex tc IIIC T 100 °C Dc Ta -40...+70/80 °C

Connection



Temperature probe

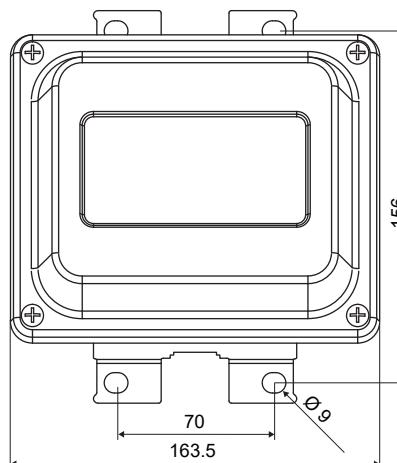
terminal strip	terminal	connection
KL1	1	red
	2	red/blue
	3	white
	4	white/blue

Extension cable

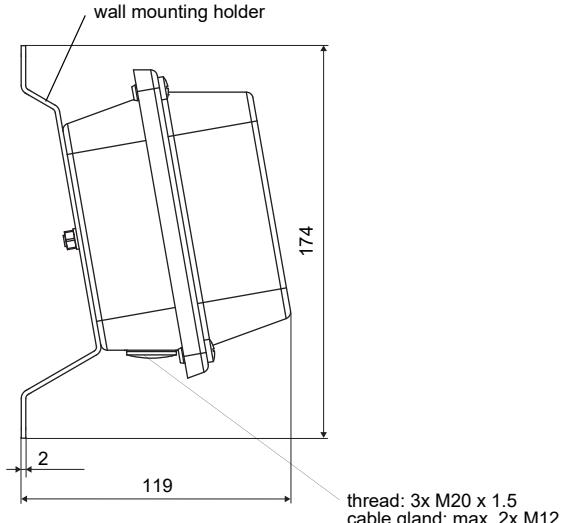
terminal strip	terminal	connection
KL2	1	red
	2	grey
	3	white
	4	blue

Dimensions

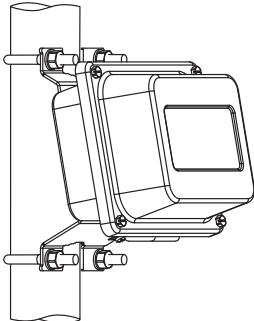
JBT*



in mm



2" pipe mounting kit

JB** 	item number: 751035-2
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Inline temperature probe (optional)

Technical data

PT12N-IT-P PT12N-IU-P		
item number		PT12N-IT-P: <ul style="list-style-type: none"> • 770416-1 (matched, without cable) • 770416-11 (matched, 10 m) • 770416-12 (matched, 20 m) PT12N-IU-P: <ul style="list-style-type: none"> • 770416-2 (matched, without cable) • 770416-21 (matched, 10 m) • 770416-22 (matched, 20 m)
type		2x Pt100 matched according to EN 1434
connection		4-wire
measuring range	°C	-30...+200
accuracy θ		$\pm(0.15^\circ\text{C} + 2 \cdot 10^{-3} T ^\circ\text{C})$ 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

Fixation

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