

Flexim FLUXUS F731TE Ultrasonic Flowmeter



Ultrasonic Measurement of Thermal Energy and Volumetric Flow Rate

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
- 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

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

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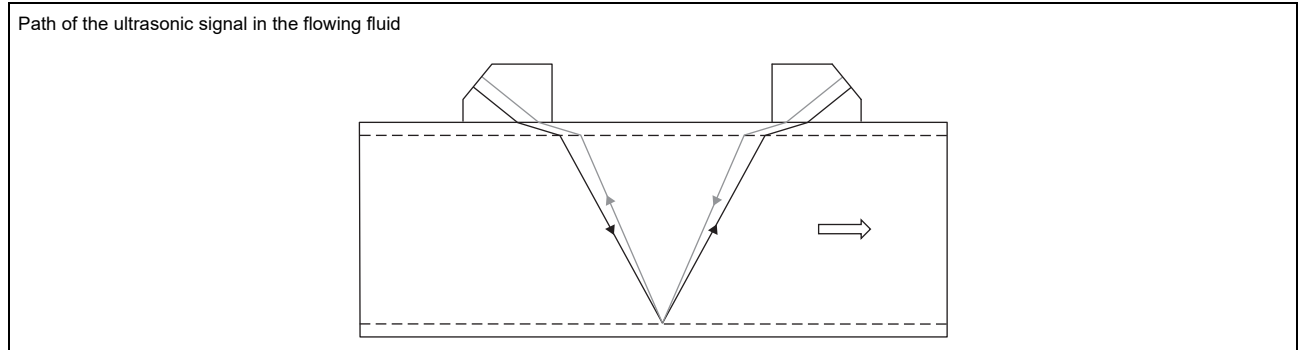
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Function

Measurement principle

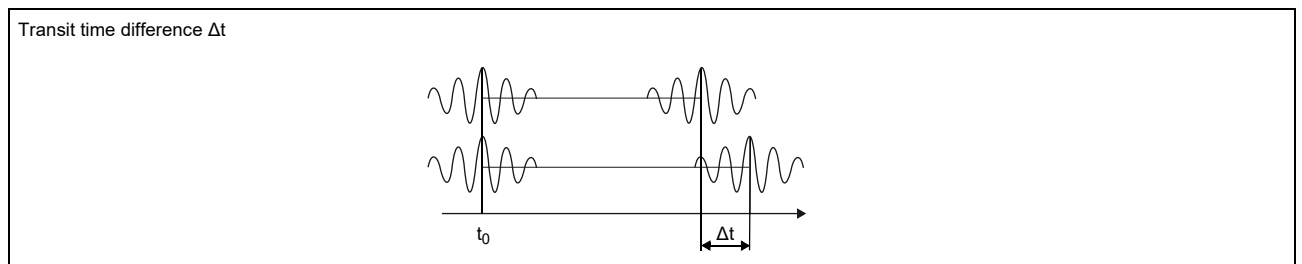
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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 mechanic calibration factor
- A - cross-sectional pipe area
- k_a - acoustic 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**

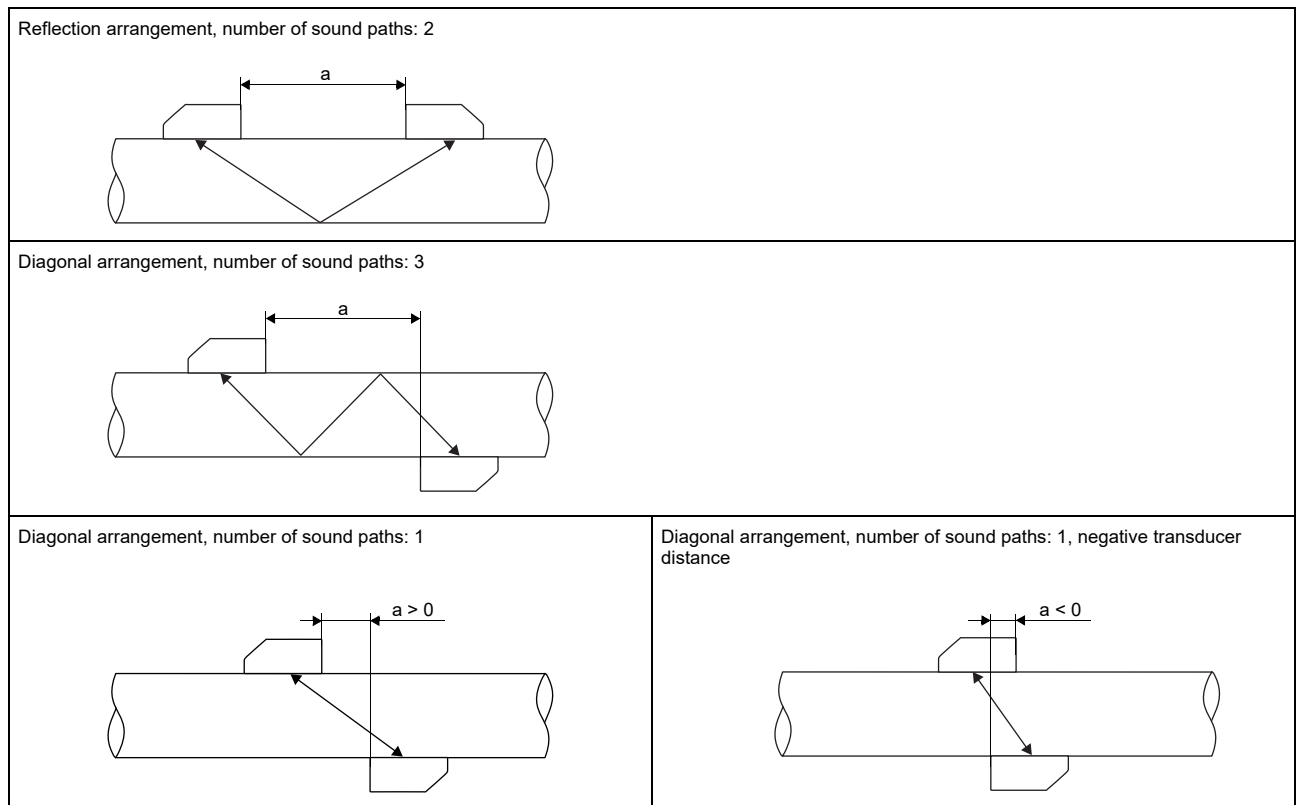
The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easy.

- **diagonal arrangement**

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

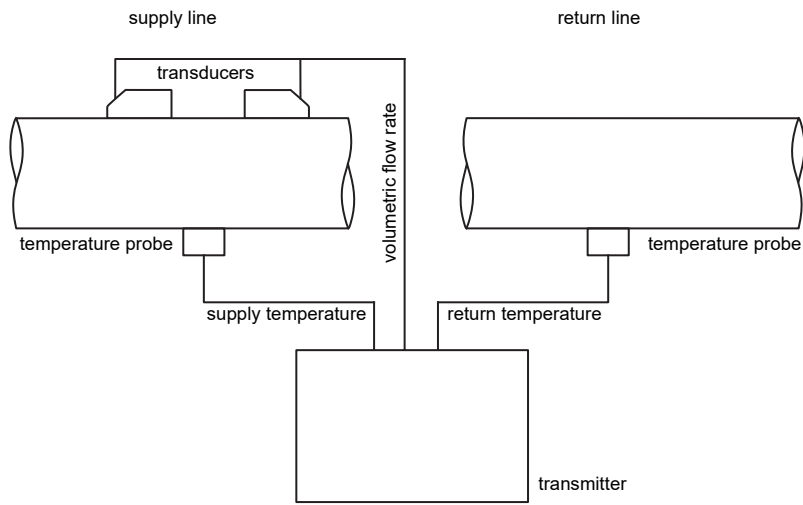
As the transducers can be mounted with the transducer mounting fixture in reflection arrangement or diagonal arrangement, the number of sound paths can be adjusted optimally for the application.



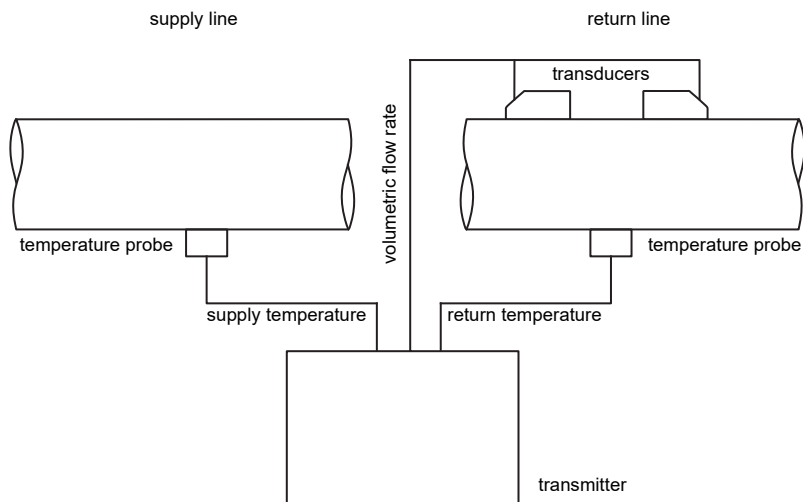
a - transducer distance

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 F731TE-NNN**-*AL F731TE-NNN**-*ST	FLUXUS F731TE-A2N**-*ST
		
design	standard field device	standard field device zone 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 direction	bidirectional	
synchronised channel averaging	x (2 measuring channels necessary)	
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 	
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...240 V ± 10 %/50...60 Hz or • 11...32 V DC 	
power consumption	W	< 15
number of measuring channels		1, optional: 2
damping	s	0...100 (adjustable)
measuring cycle	Hz	100...1000 (1 channel)
response time	s	1 (1 channel), option: 0.02
housing material		aluminum, powder coated or stainless steel 316L (1.4404) stainless steel 316L (1.4404)
degree of protection		IP66
dimensions	mm	see dimensional drawing
weight	kg	aluminum housing: 4.5 stainless steel housing: 5.8
fixation		wall mounting, optional: 2" pipe mounting
ambient temperature	°C	-40...+60 (< -20 without operation of the display)
display		240 x 128 pixels, backlight
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian, Chinese
explosion protection		
• ATEX		
marking		-    II3G Ex ec IIC T4 Gc T _a -40...+59/60 °C
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

¹ with aperture calibration of the transducers

² for transit time difference principle and reference conditions

³ outside the explosive atmosphere (housing cover open)

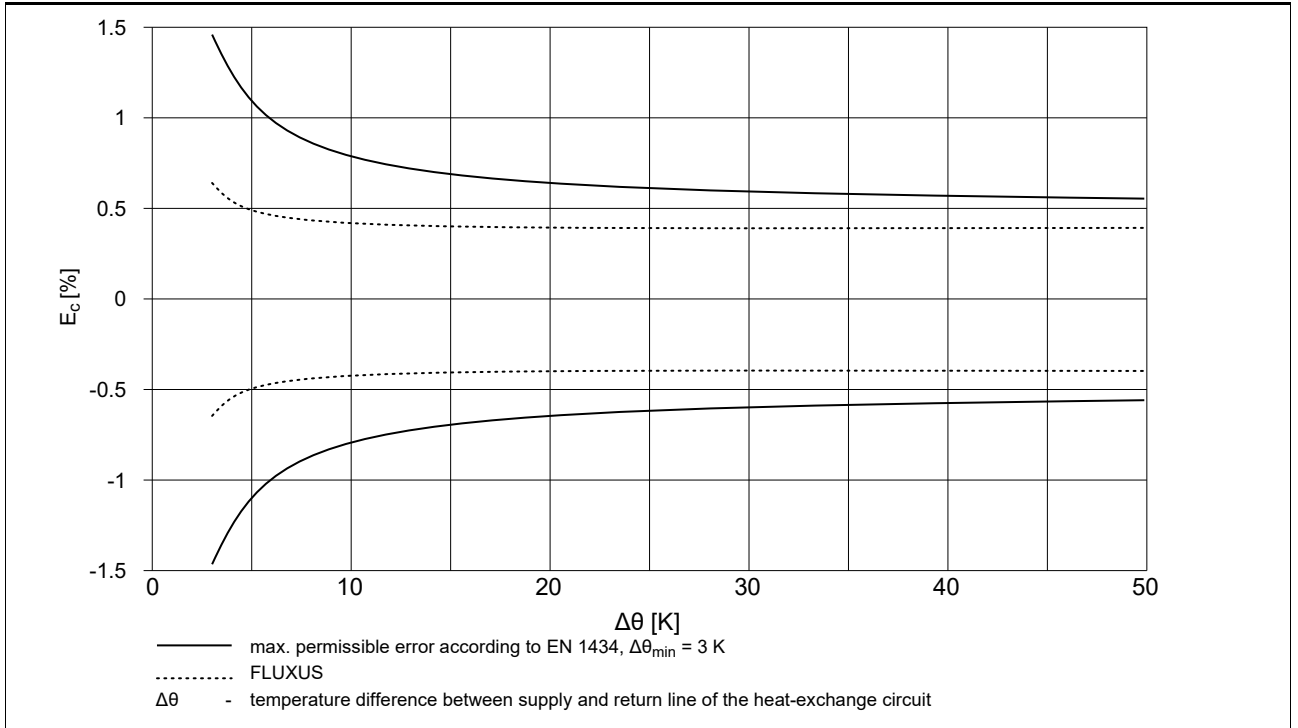
FLUXUS F731TE-NNN**-*AL F731TE-NNN**-*ST		FLUXUS F731TE-A2N**-*ST
communication interfaces		
service interfaces	measured value transmission, parametrisation of the transmitter: • USB ³ • LAN ³	
process interfaces	max. 1 option: • Modbus RTU • BACnet MS/TP • M-Bus • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1
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, 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		
	configurable according to NAMUR NE 43 All switchable current outputs are jointly switched to active or passive.	
number	max. 4	
range	mA 4...20 (alarm current: 3.2...3.99, 20.01...24, hardware fault current: 3.2)	
uncertainty	0.04 % of output value ±3 µA	
active output	$R_{ext} = 250...530 \Omega$, $U_{opencircuit} = 28 \text{ V DC}$	
passive output	$U_{ext} = 9...30 \text{ V DC}$, depending on R_{ext} ($R_{ext} < 458 \Omega$ at 20 V)	
current output in HART mode	option	
• range	mA 4...20 (alarm current: 3.5...3.99, 20.01...22, hardware fault current: 3.2)	
• active output	$R_{ext} = 250...530 \Omega$, $U_{opencircuit} = 28 \text{ V DC}$	
• passive output	$U_{ext} = 9...30 \text{ V DC}$, depending on R_{ext} ($R_{ext} = 250...458 \Omega$ at 20 V)	
• digital output		
number	max. 4	
functions	• frequency output • binary output • pulse output	
type	open collector (passive)	
operating parameters	OC30V/100mA 5...30 V, $I_{max} = 100 \text{ mA}$, $R_{int} = 20 \Omega$ Low: $U < 2 \text{ V}$ at $I_{loop} = 2 \text{ mA}$ ($R_{ext} = 12 \text{ k}\Omega$ at $U_{ext} = 24 \text{ V}$) High: $U > 15 \text{ V}$ ($R_{ext} = 12 \text{ k}\Omega$ at $U_{ext} = 24 \text{ V}$)	
frequency output		
• range	kHz	0.002...10
• damping	s	0...999.9 (adjustable)
• pulse-to-pause ratio		1:1
binary output		
• binary output as alarm output	limit, change of flow direction or error	
pulse output		
• pulse value	units	0.01...1000
• pulse width	ms	0.05...1000
• pulse rate		max. 10 000 pulses
inputs		
The inputs are galvanically isolated from the transmitter.		
• temperature input		
number	max. 4	
type	Pt100/Pt1000	
connection	4-wire	
range	°C	-150...+560
resolution	K	0.01
accuracy	±0.01 % MV ±0.03 K at 18...28 °C ±0.01 % MV ±0.03 K ±0.0005 %/K at <18 °C/>28 °C	
cable resistance	Ω	max. 1000

¹ with aperture calibration of the transducers

² for transit time difference principle and reference conditions

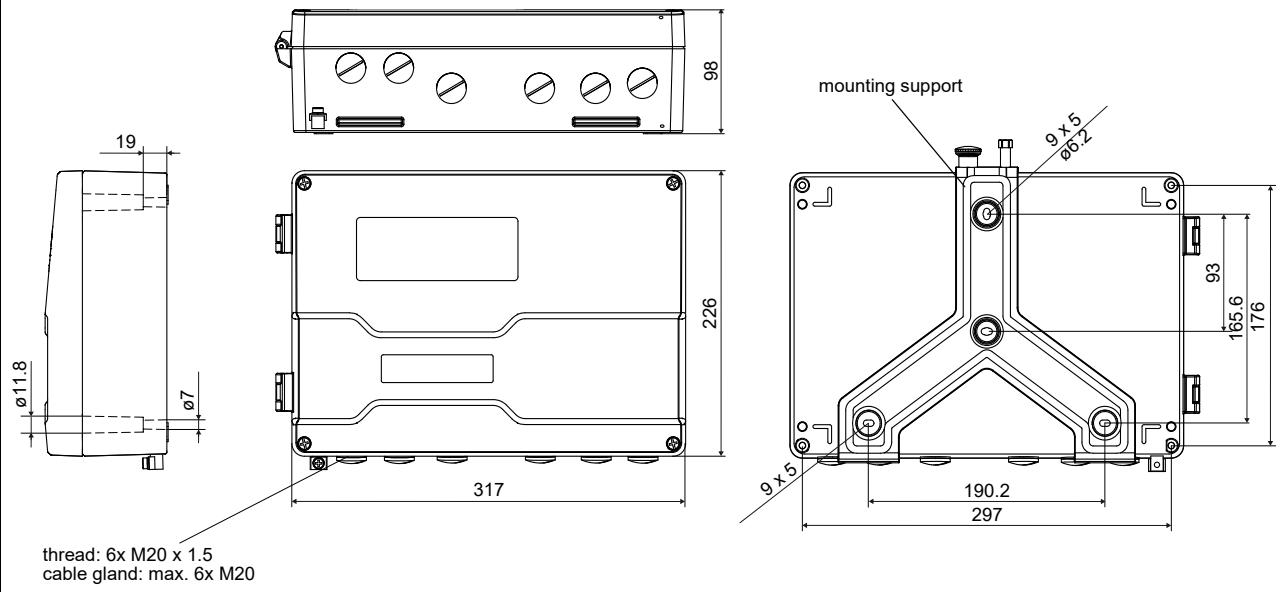
³ outside the explosive atmosphere (housing cover open)

Max. permissible error of the calculator



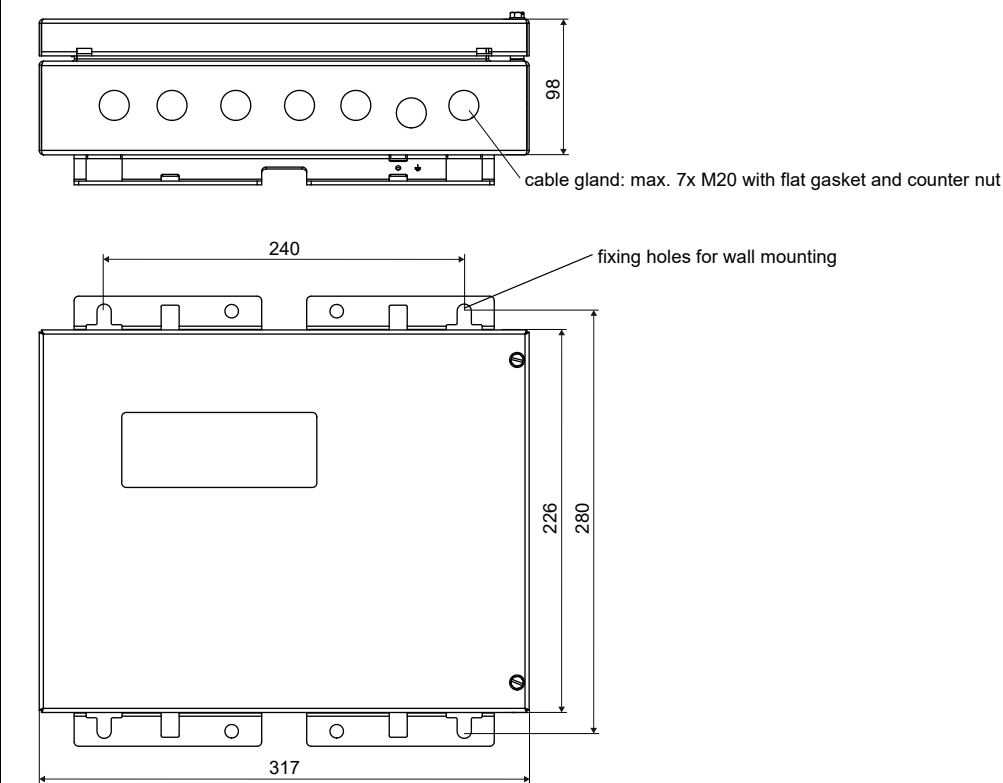
Dimensions

*731**_*****_AL



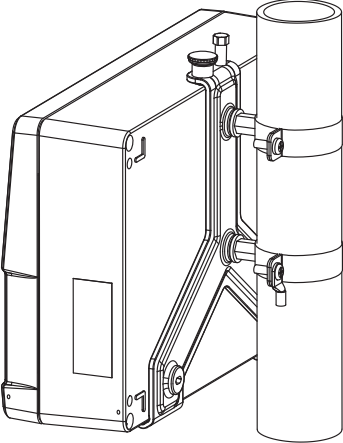
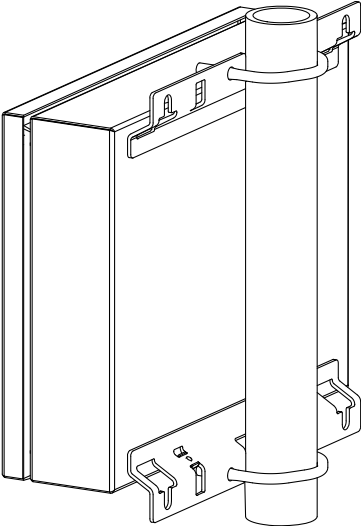
in mm

*731**_*****_ST



in mm

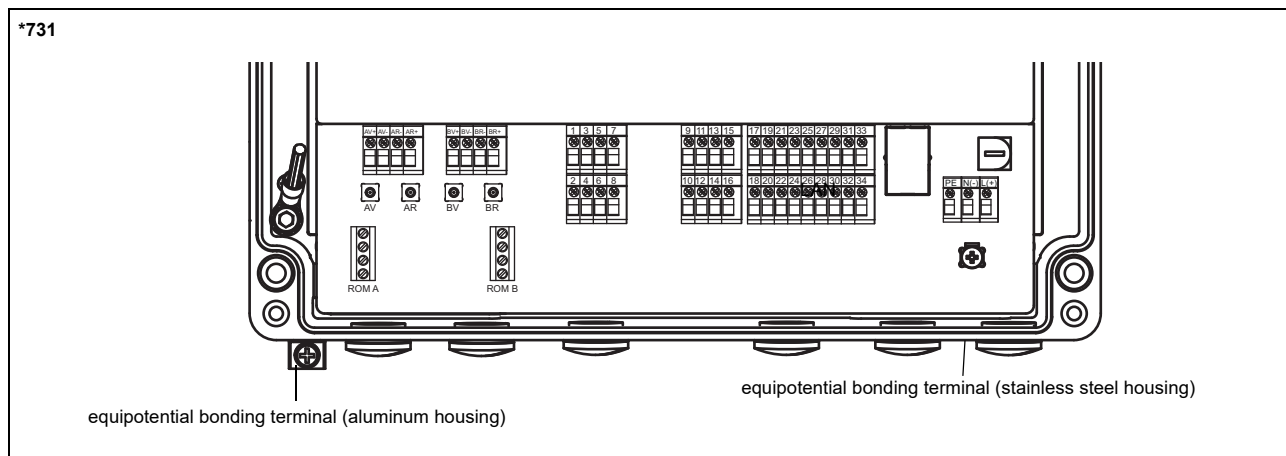
2" pipe mounting kit

<p>*731**_****_*AL</p> 	<p>item number: 731067-1</p>
<p>*731**_****_*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: -40...+60 °C

Terminal assignment



power supply ¹								
AC				DC				
terminal		connection		terminal		connection		
L		line conductor		(+)		+		
N		neutral conductor		(-)		-		
PE		protective conductor		PE		protective conductor		
transducers								
transducer cable (transducers ****53), extension cable				transducer cable (transducers ****52)				
measuring channel A		measuring channel B		transducer	measuring channel A		measuring channel B	
terminal	connection	terminal	connection		terminal	terminal	connection	connection
AV or AV+	signal	BV	signal	↑	X_AV	X_BV	SMB connector	
AVS or AV-	shield	BVS	shield	↕	X_AR	X_BR	SMB connector	
ARS or AR-	shield	BRS	shield					
AR or AR+	signal	BR	signal					
outputs, inputs ^{1, 2}								
terminal				connection				
depending on configuration				current output, digital output				
1, 2, 3, 4 5, 6, 7, 8 9, 10, 11, 12 13, 14, 15, 16				temperature input				
29+, 30-				passive current output/HART				
29-, 30+				active current output/HART				
29, 30				Modbus RTU, BACnet MS/TP, M-Bus, Profibus PA, FF H1				
temperature probe								
terminal		direct connection			connection with extension cable			
1, 5, 9, 13		red			red			
2, 6, 10, 14		white			white			
3, 7, 11, 15		red/blue			grey			
4, 8, 12, 16		white/blue			blue			
USB		type C Hi-Speed USB 2.0 Device			service (FluxDiag/FluxDiagReader)			
LAN		RJ45 10/100 Mbps Ethernet			<ul style="list-style-type: none"> • service (FluxDiag/FluxDiagReader) • Modbus TCP • BACnet IP 			

¹ cable (by customer): e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm²

² The number, type and terminal assignment are customised.

Transducers

Technical data

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

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
inner pipe diameter d					
min. extended	mm	100	50	25	10
min. recommended	mm	200	100	50	25
max. recommended	mm	2000	1000	400	150
max. extended	mm	2400	1200	480	240
pipe wall thickness					
min.	mm	5	2.5	1.2	0.6
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		CE 0637 Ex II 3G II 2D 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/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, T1)

order code		FSK-N***-**T1	FSM-N***-**T1	FSP-N***-**T1	FSQ-N***-**T1
technical type		C(DL)K1N53	C(DL)M2N53	C(DL)P2N53	C(DL)Q2N53
transducer frequency	MHz	0.5	1	2	4
inner pipe diameter d					
min. extended	mm	100	50	25	10
min. recommended	mm	200	100	50	25
max. recommended	mm	2000	1000	400	150
max. extended	mm	2400	1200	480	240
pipe wall thickness					
min.	mm	5	2.5	1.2	0.6
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					
order code		FSK-NA2*-**T1	FSM-NA2*-**T1	FSP-NA2*-**T1	FSQ-NA2*-**T1
pipe surface temperature (Ex)	°C	gas: -55...+190 dust: -55...+180			
marking		CE 0637 II 3G II 2D Ex nA IIC T6...T3 Gc Ex tb IIIC T80 °C...T185 °C Db			
certification		IBExU10ATEX1163 X, IECEx IBE 12.0005X			
• FM					
order code		FSK-NF2*-**T1	FSM-NF2*-**T1	FSP-NF2*-**T1	FSQ-NF2*-**T1
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-E***-**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. extended	mm	100	50	25	10
min. recommended	mm	200	100	50	25
max. recommended	mm	2000	1000	400	150
max. extended	mm	2400	1200	480	240
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 dust: -45...+225		
marking		-	CE 0637 Ex II 3G II 2D Ex nA IIC T6...T2 Gc Ex tb IIIA T80 °C...T230 °C Db		
certification		-	IBExU10ATEX1163 X, IECEx IBE 12.0005X		
• FM					
order code		FSK-EF2*-**TS	FSM-EF2*-**TS	FSP-EF2*-**TS	FSQ-EF2*-**TS
pipe surface temperature (Ex)	°C	-40...+165	-45...+235		
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

Shear wave transducers (zone 2 - FM Class I Div. 2 - nonEx, T1, extended temperature range)

order code		FSK-E***-**T1	FSM-E***-**T1	FSP-E***-**T1	FSQ-E***-**T1
technical type		C(DL)K1E53	C(DL)M2E53	C(DL)P2E53	C(DL)Q2E53
transducer frequency	MHz	0.5	1	2	4
inner pipe diameter d					
min. extended	mm	100	50	25	10
min. recommended	mm	200	100	50	25
max. recommended	mm	2000	1000	400	150
max. extended	mm	2400	1200	480	240
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*-**T1	FSP-EA2*-**T1	FSQ-EA2*-**T1
pipe surface temperature (Ex)	°C	-	gas: -45...+235 dust: -45...+225		
marking		-	CE 0637 (Ex) II 3G II 2D Ex nA IIC T6...T2 Gc Ex tb IIIA T80 °C...T230 °C Db		
certification		-	IBExU10ATEX1163 X, IECEx IBE 12.0005X		
• FM					
order code		FSK-EF2*-**T1	FSM-EF2*-**T1	FSP-EF2*-**T1	FSQ-EF2*-**T1
pipe surface temperature (Ex)	°C	-40...+165	-45...+235		
degree of protection		IP66			
marking		NI/CI. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860			

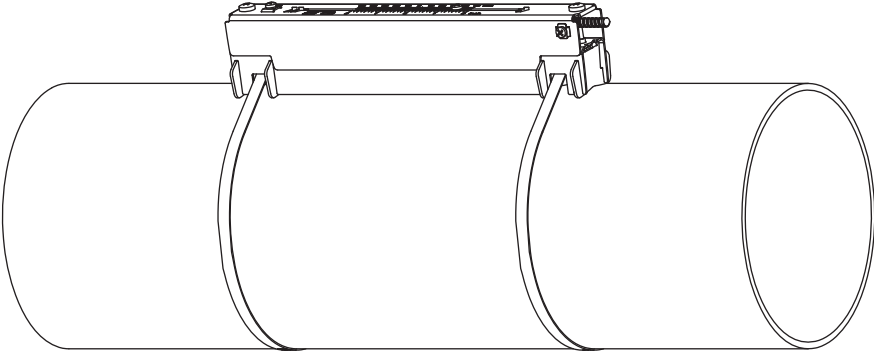
¹ > +200 °C:

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 (VL)</p> 	<p>material: stainless steel 316Ti (1.4571), 316L (1.4404), 17-7PH (1.4568) inner length: VLK: 348 mm VL(MP): 234 mm VLQ: 176 mm dimensions: VLK: 423 x 90 x 93 mm VL(MP): 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

connection system T1		
connection with extension cable	direct connection	transducers technical type
<p>JBP2, JBP3, JB06</p>	<p>transmitter</p>	*****53
connection system TS		
connection with extension cable	direct connection	transducers technical type
<p>JB02, JB03, JB04</p>	<p>transmitter</p>	*****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



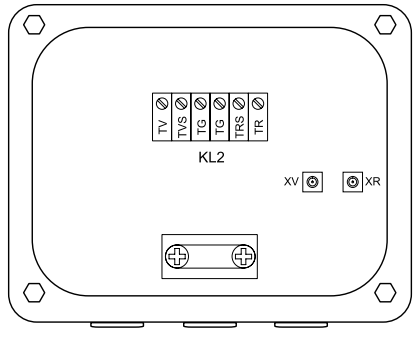


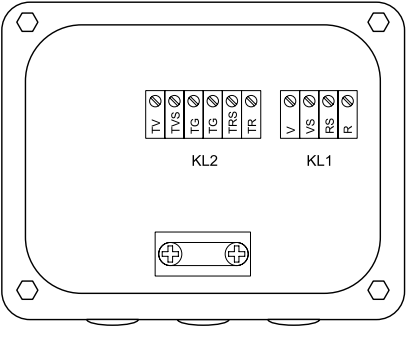
transducer frequency		F, G, H, K		M, P		Q		S	
connection system TS									
transducers technical type		x	l	x	l	x	l	x	l
*D***5*	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40
*L***5*	m	9	≤ 300	9	≤ 300	9	≤ 90	-	≤ 40

x - transducer cable length

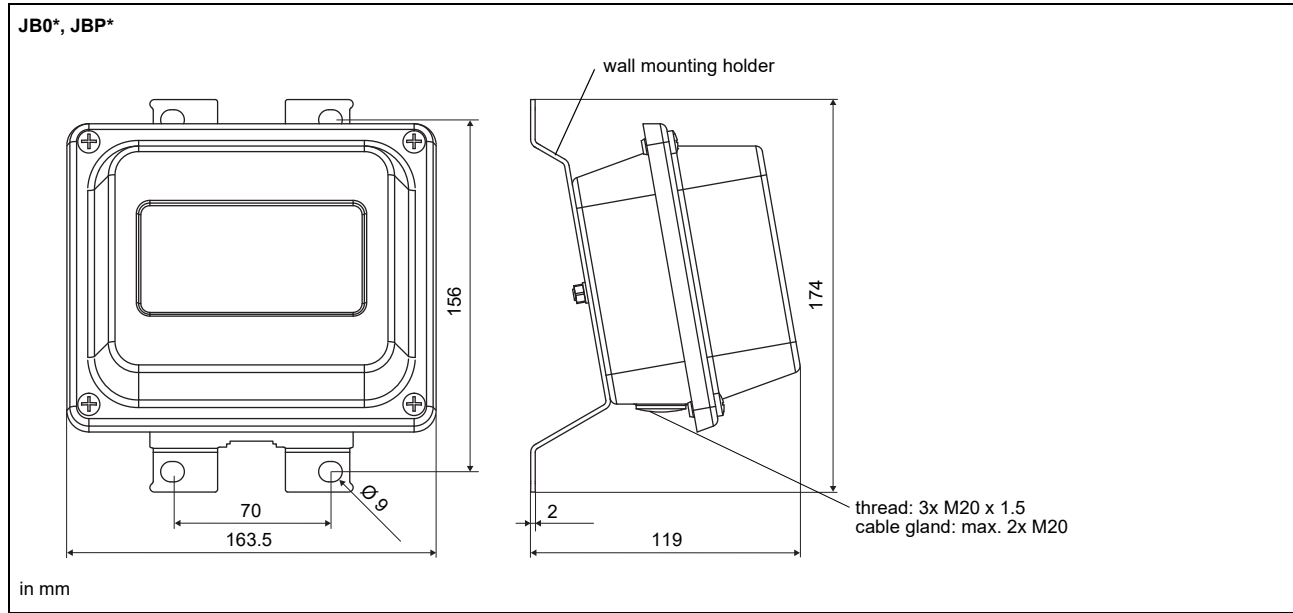
l - max. length of extension cable (depending on the application)

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		JB02, JB03: IP66/IP67 JB04: Type 4X, IP66	
ambient temperature °C		-40...+80	
explosion protection			
• ATEX			
junction box		JB02	
marking		 II3G Ex nA IIC T6...T4 Gc II3D Ex tc IIIC T 100 °C Dc -40 ≤ Ta ≤ +70 °C/+80 °C	
• FM			
junction box		JB04	
certification type		JBC24	
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	
JBP2, JBP3, JB06			
weight	kg	1.2 kg	
fixation		wall mounting optional: 2" pipe mounting	
material			
housing		stainless steel 316L (1.4404)	
gasket		silicone	
degree of protection		JBP2, JBP3: IP66/IP67 JB06: Type 4X, IP66	
ambient temperature °C		-40...+80	
explosion protection			
• ATEX			
junction box		JBP2	
marking		 II3G Ex nA IIC T6...T4 Gc II3D Ex tc IIIC T 100 °C Dc -40 ≤ Ta ≤ +70 °C/+80 °C	
• FM			
junction box		JB06	
certification type		JBC23	
marking		 NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ T6 Ta = -40...+60 °C	
Connection			
			
Transducers			
terminal strip	terminal	connection	transducer
KL1	V	signal	↑
	VS	internal shield	
	RS	internal shield	↕
	R	signal	
Extension cable			
terminal strip	terminal	connection	
KL2	TV	signal	
	TVS	internal shield	
	TRS	internal shield	
	TR	signal	

Dimensions

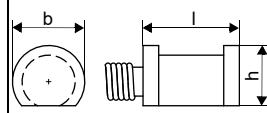
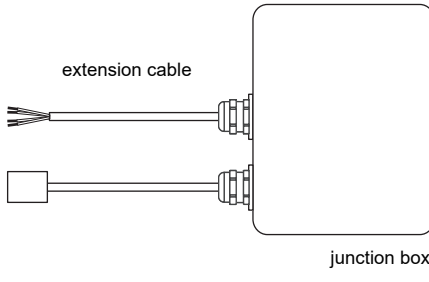
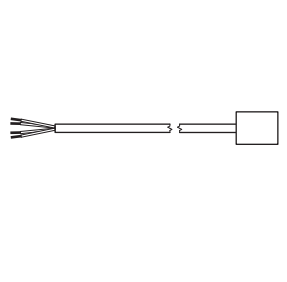
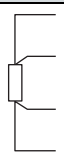


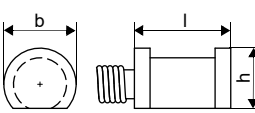

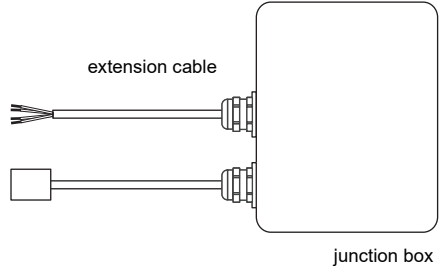
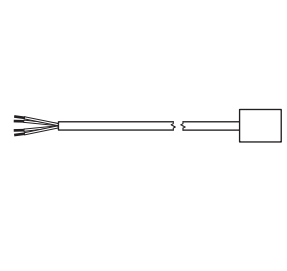
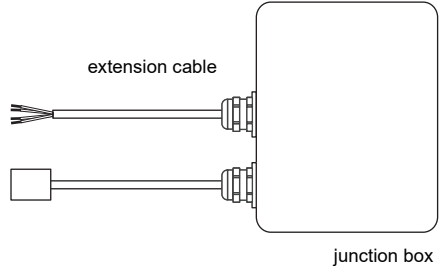
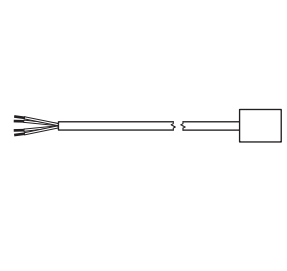
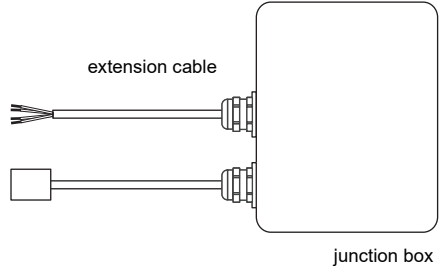
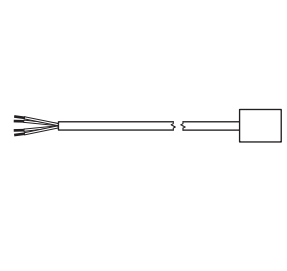












2" pipe mounting kit



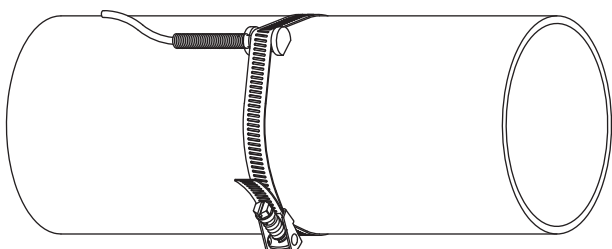
Clamp-on temperature probe (optional)

Technical data


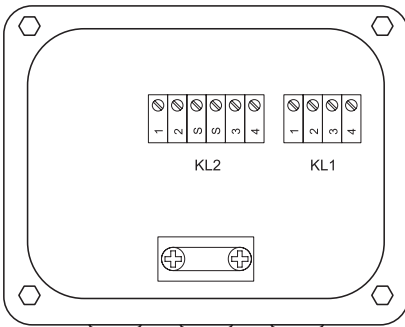
PT12N		
item number		<ul style="list-style-type: none"> • 770415-1 • 770414-1 (matched)
design		clamp-on
type		Pt100
connection		4-wire
measuring range	°C	-30...+250
accuracy T		$\pm(0.15 \text{ °C} + 2 \cdot 10^{-3} \cdot T \text{ [°C]})$ class A
accuracy ΔT (2x Pt matched according to EN 1434-1)		$\leq 0.1 \text{ K}$ ($3 \text{ K} < \Delta T < 6 \text{ K}$), more corresponding to EN 1434-1
response time	s	50 (t50, T1 = 25 °C, T2 = 60 °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	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 ±0.2
colour	black	grey

PT12N																															
item number	<ul style="list-style-type: none"> • 770415-1A2 • 770414-1A2 (matched) 																														
design	clamp-on ATEX/UKCA																														
type	Pt100																														
connection	4-wire																														
measuring range	-30...+250																														
accuracy T	$\pm(0.15\text{ }^\circ\text{C} + 2 \cdot 10^{-3} \cdot T\text{ [}^\circ\text{C]})$ 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																														
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/UKCA																															
marking	 II3G Ex nA IIC T6...T2 Gc Ta -30...+250 °C																														
Connection system																															
<table border="1"> <thead> <tr> <th>connection with extension cable</th> <th>direct connection</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> </tr> </tbody> </table>		connection with extension cable	direct connection																												
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	red																														
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Cable																															
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colour	black	grey																													

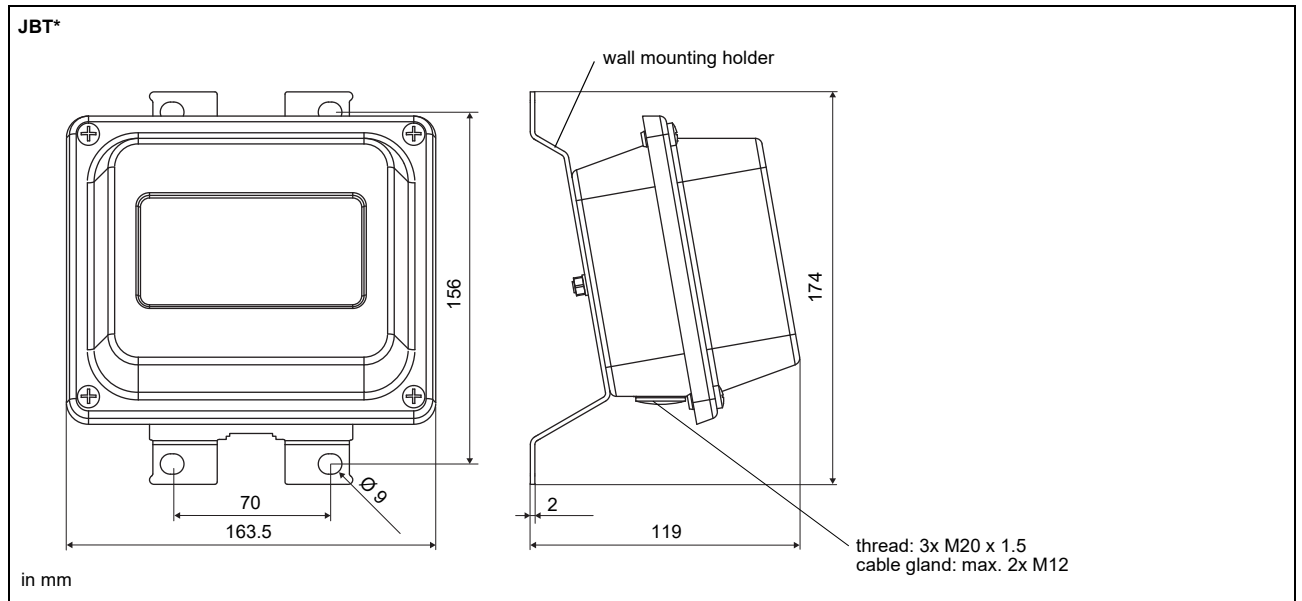
Fixation

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

Junction box

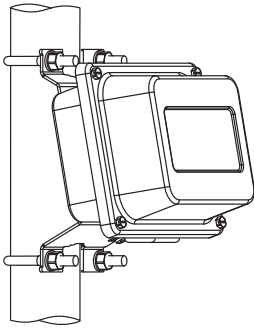
JBT2, JBT3																									
item number	<ul style="list-style-type: none"> JBT2: 770428-5A2 JBT3: 751040-36 																								
weight	kg 1.2 kg																								
fixation	wall mounting optional: 2" pipe mounting																								
material																									
housing	stainless steel 316L (1.4404)																								
gasket	silicone																								
degree of protection	IP66/IP67																								
ambient temperature																									
min.	°C -40																								
max.	°C +80																								
explosion protection																									
• ATEX																									
junction box marking	JBT2  II3G Ex nA IIC T6...T4 Gc II3D Ex tc III C T 100 °C Dc -40 ≤ Ta ≤ +70 °C/+80 °C																								
<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

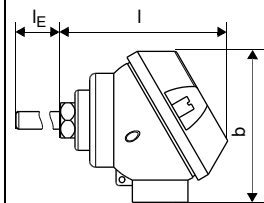
JB**

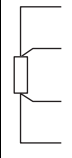


item number: 751035-2

Inline temperature probe (optional)

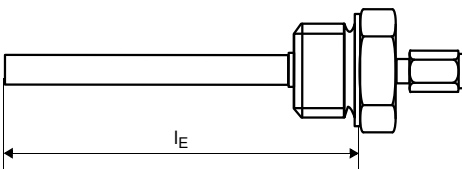
Technical data

PT12N-IT-P PT12N-IU-P	
item number	<p>PT12N-IT-P:</p> <ul style="list-style-type: none"> • 770416-1 (matched, without cable) • 770416-11 (matched, 10 m) • 770416-12 (matched, 20 m) <p>PT12N-IU-P:</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	$\pm(0.15 \text{ }^\circ\text{C} + 2 \cdot 10^{-3} \cdot T \text{ [}^\circ\text{C]})$ class A
max. permissible relative error	% $E_t = \pm 0.9 \cdot (0.5 + 3 \cdot \Delta\theta_{\text{min}}/\Delta\theta)$
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		
	temperature probe	cable
	red	red
	red	grey
	white	blue
	white	white

cable		
		temperature probe
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			
	mounting length l_E	mm	PT12N-IT-P: 120 PT12N-IU-P: 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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