

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

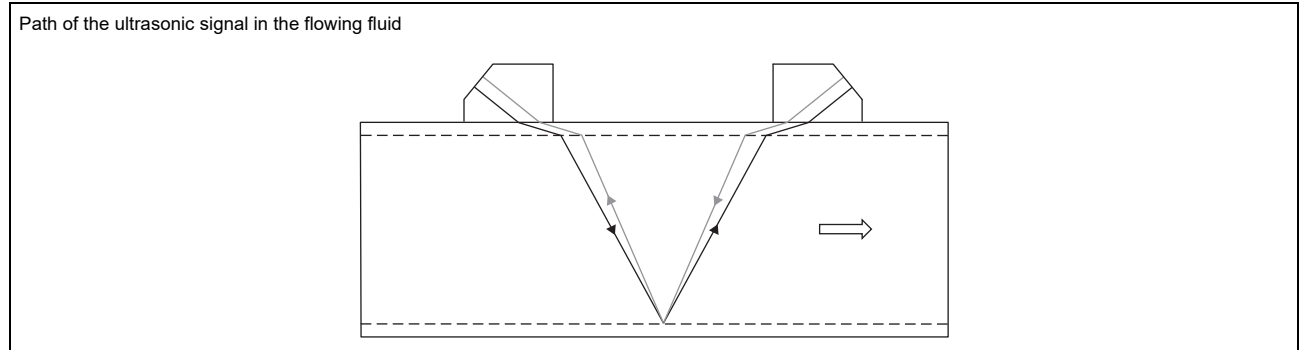
- Monitoring and balancing of industrial heating and cooling systems
- Data acquisition for energy management and ISO 50001
- Sub metering in buildings and building complexes
- Heat flow balancing and leakage control in district heating systems

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Function

Measurement principle

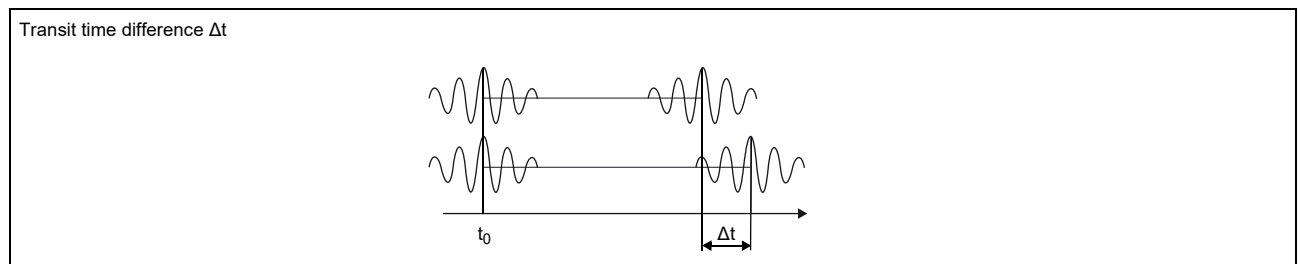
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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

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

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**

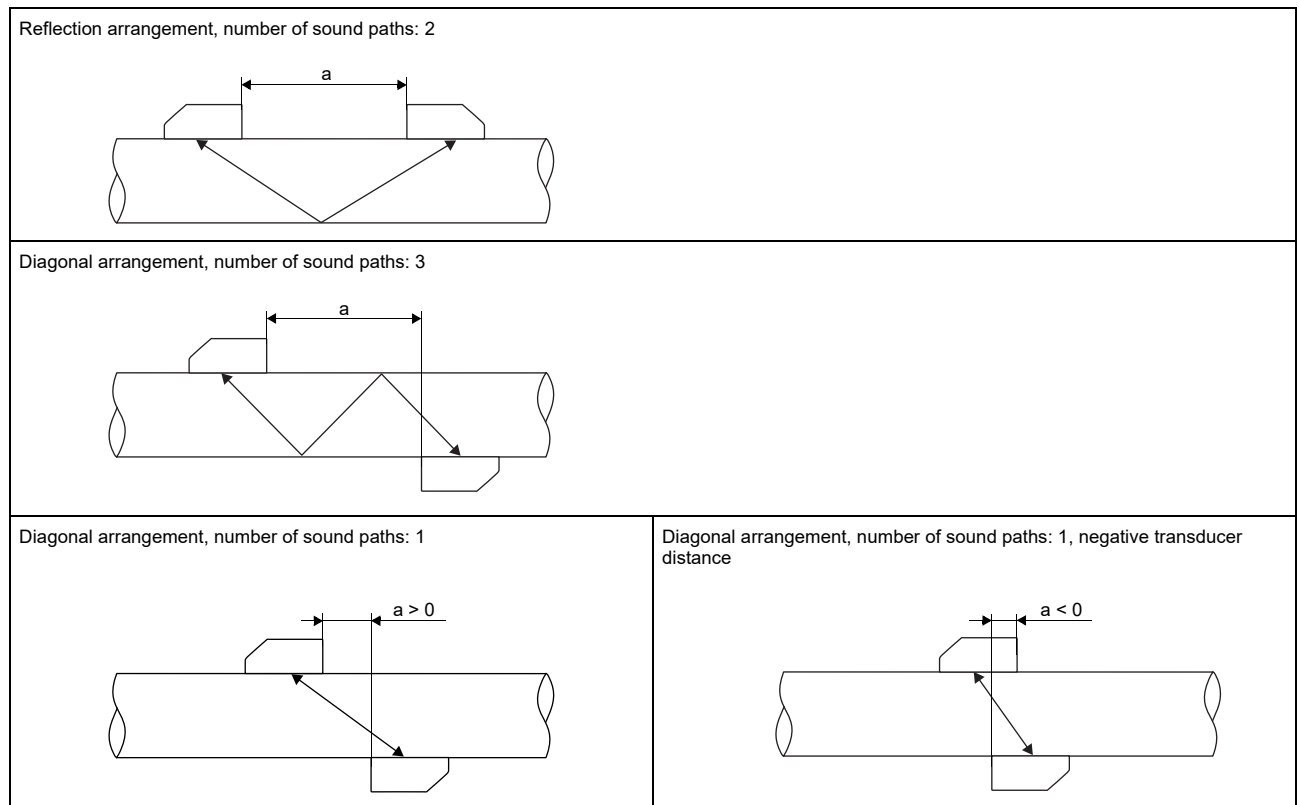
The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easy.

- **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.

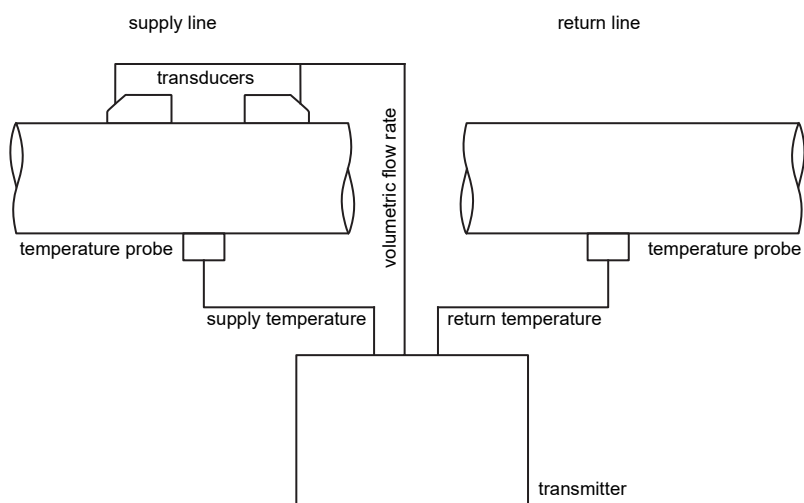
As the transducers can be mounted with the transducer mounting fixture in reflection arrangement or diagonal arrangement, the number of sound paths can be adjusted optimally for the application.



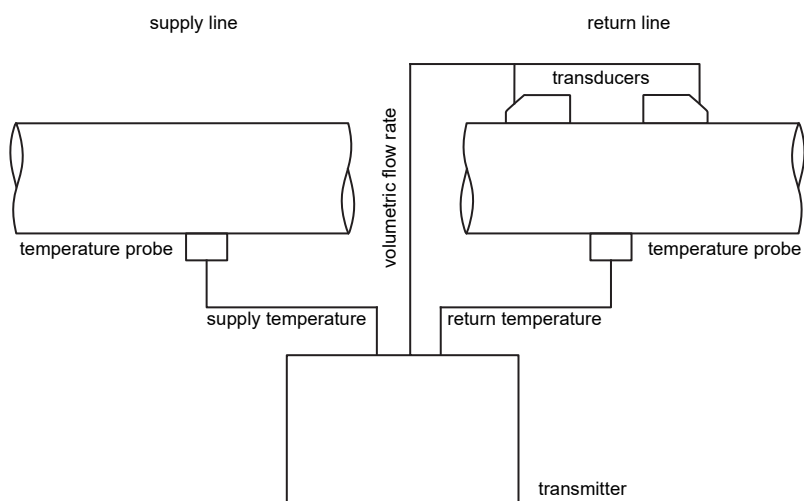
a - transducer distance

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 nonEx	FLUXUS F731TE ATEX/IECEX	FLUXUS F731TE FM Class I Div. 2
design		DE7-F731TE-NNN**-*AL... (aluminum housing) DE7-F731TE-NNN**-*ST... (stainless steel housing)	DE7-F731TE-A2N**-*AL... (aluminum housing) DE7-F731TE-A2N**-*ST... (stainless steel housing)	DE7-F731TE-F2N**-*AL... (aluminum housing) DE7-F731TE-F2N**-*ST... (stainless steel housing)
				
certification type			aluminum housing: 731-ADN (100...240 V) 731-ANN (11...32 V DC) stainless steel housing: 731-SNN	F731**-F2N...
application		energy meter		
measurement				
• energy				
max. permissible relative error		calculator: $E_c = \pm(0.4 + 1 K/\Delta\theta) \%$		
• temperature				
temperature difference		$\Delta\theta_{\min} = 3 \text{ K}$, $\Delta\theta_{\max} = 300 \text{ K}$		
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	m³/h	$Q_p = 17...20\,000$		
flow velocity	m/s	0.01...25		
repeatability		0.15 % MV $\pm 0.005 \text{ m/s}$		
fluid		• water • glycol/H ₂ O: 0...100 % • 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		$\pm 0.3 \%$ MV $\pm 0.005 \text{ m/s}$		
measurement uncertainty at the measuring point ²		$\pm 1 \%$ MV $\pm 0.005 \text{ m/s}$		
transmitter				
power supply		• 100...240 V $\pm 10 \%$ / 50...60 Hz or • 11...32 V DC	• 731-ADN, 731-SNN: 100...240 V $\pm 10 \%$ / 50...60 Hz or • 731-ANN, 731-SNN: 11...32 V DC	• 100...240 V $\pm 10 \%$ / 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)		
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 aluminum housing and 240 V: -40*...+65 * < -20 without operation of the display	731-ADN: -40*...+65 731-ANN, 731-SNN: -40*...+60 * < -20 without operation of the display	-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		

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

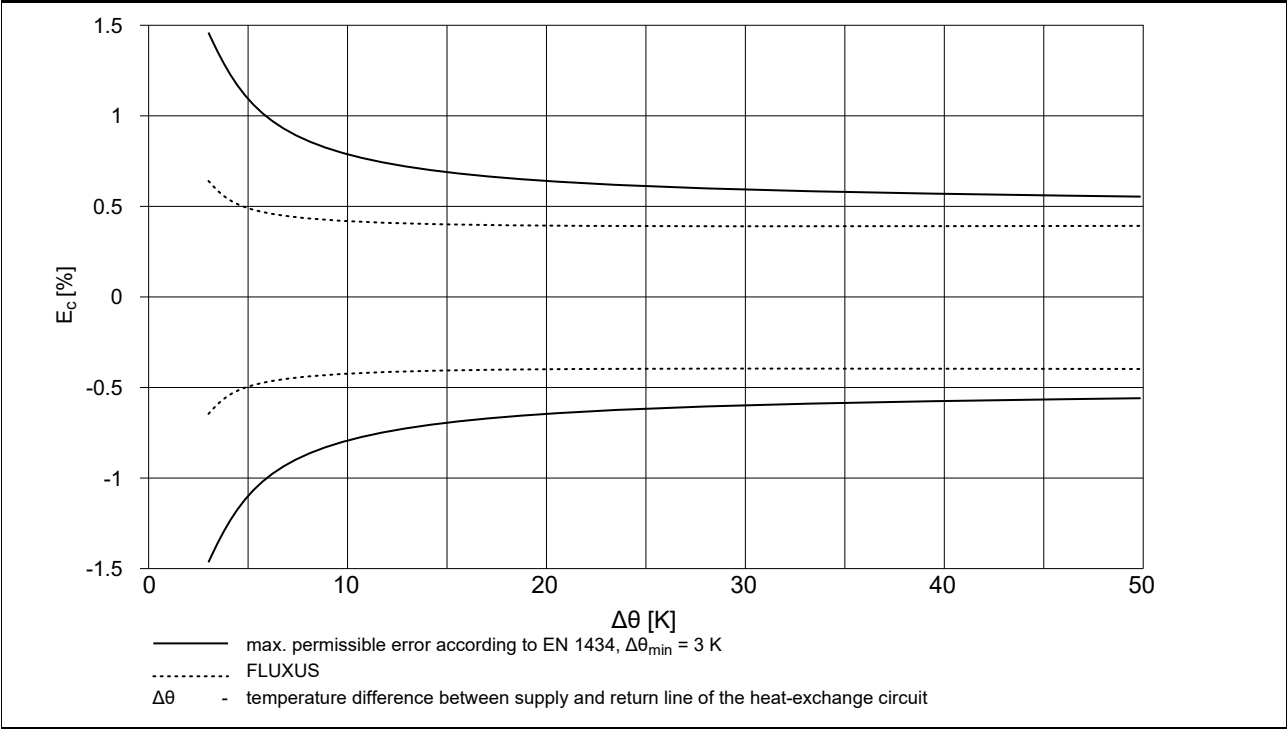
	FLUXUS F731TE nonEx	FLUXUS F731TE ATEX/IECEX	FLUXUS F731TE FM Class I Div. 2
explosion protection			
• ATEX/IECEX			
marking	-	CE 0637 UK Ex II3G Ex ec IIC T4 Gc II2D Ex tb IIIC T135 °C Db T _a -40...+65 °C (731-ADN) T _a -40...+60 °C (731-ANN) T _a -40...+59/60 °C (731-SNN)	-
certification	-	IBExU24ATEX1014 X, IECEX IBE 23.0024X	-
• FM			
marking	-	-	 Cl. I,II,III/Div. 2 / GP. A, B, C, D, F, G / T5 -40 °C ≤ Ta ≤ +60 °C
certification	-	-	FM23US0036, FM23CA0026
measuring functions			
physical quantities	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: • 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	max. 1 option: • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP
accessories			
data transmission kit	USB cable		
software	• FluxDiag Reader: reading of measured values and parameters, graphical representation • FluxDiag (optional): reading of measurement data, graphical representation, report generation, parametrisation of the transmitter		
data logger			
loggable values	all physical quantities, totalised physical quantities and diagnostic values		
capacity	max. 800 000 measured values		

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

		FLUXUS F731TE nonEx	FLUXUS F731TE ATEX/IECEx	FLUXUS F731TE FM Class I Div. 2
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 Ω, U _{opencircuit} = 28 V DC		
passive output		U _{ext} = 9...30 V DC, depending on R _{ext} (R _{ext} < 458 Ω 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 Ω, U _{opencircuit} = 28 V DC		
• passive output		U _{ext} = 9...30 V DC, depending on R _{ext} (R _{ext} = 250...458 Ω 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 mA, R _{int} = 20 Ω Low: U < 2 V at I _{loop} = 2 mA (R _{ext} = 12 kΩ at U _{ext} = 24 V) High: U > 15 V (R _{ext} = 12 kΩ at U _{ext} = 24 V) OC30V (IEC 60947-5-6) 5...30 V, I _{max} = 20 mA, R _{int} = 1020 Ω Low: U < 2 V at I _{loop} = 2 mA (R _{ext} = 11 kΩ at U _{ext} = 24 V) High: U > 15 V (R _{ext} = 11 kΩ at U _{ext} = 24 V)		
frequency output				
• range	kHz	0.002...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		

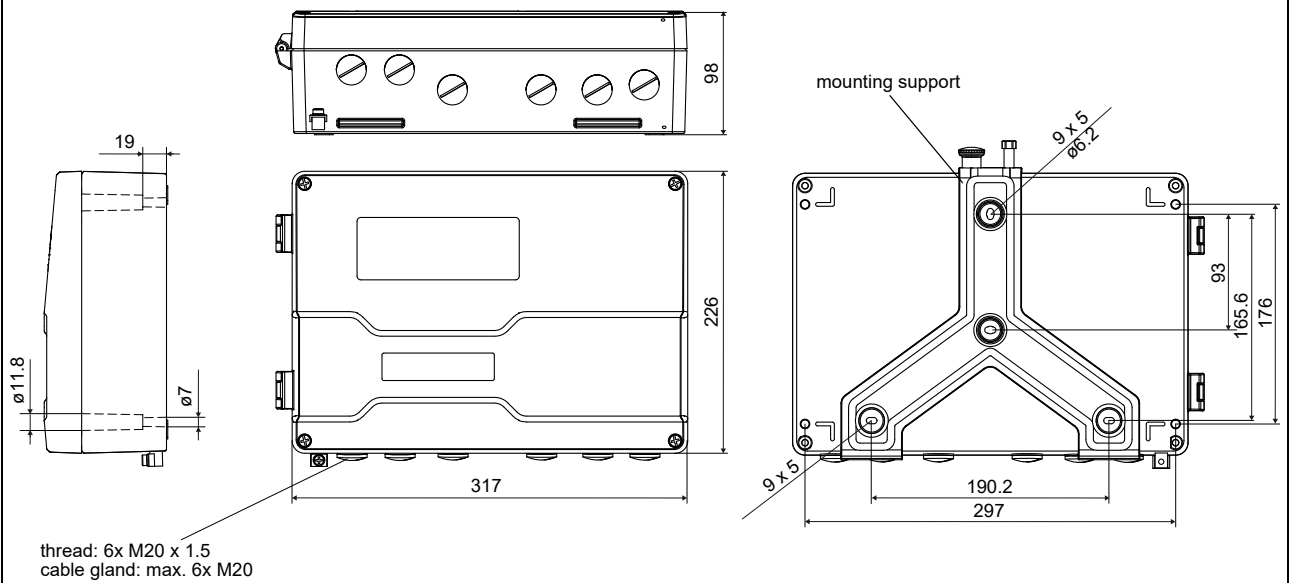
¹ with aperture calibration of the transducers² for transit time difference principle and reference conditions³ outside the explosive atmosphere (housing cover open)

Max. permissible error of the calculator



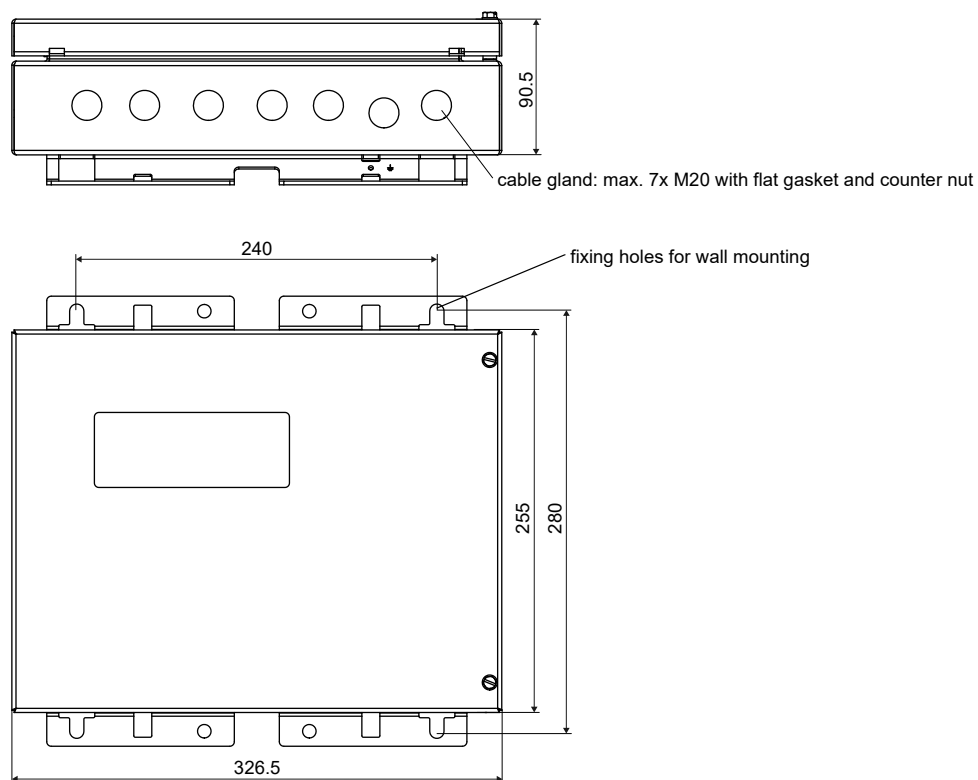
Dimensions

*731 (aluminum housing)



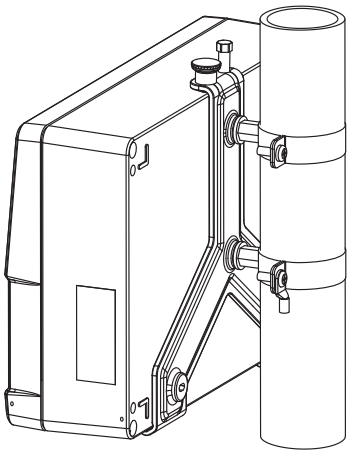
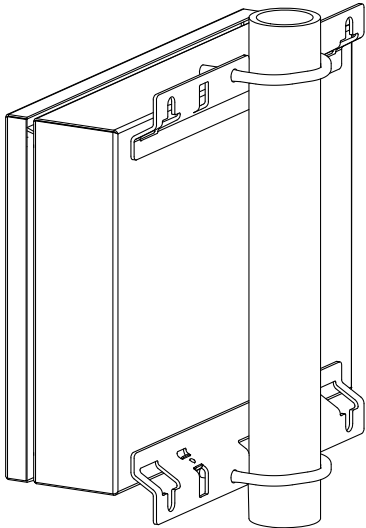
in mm

*731 (stainless steel housing)



in mm

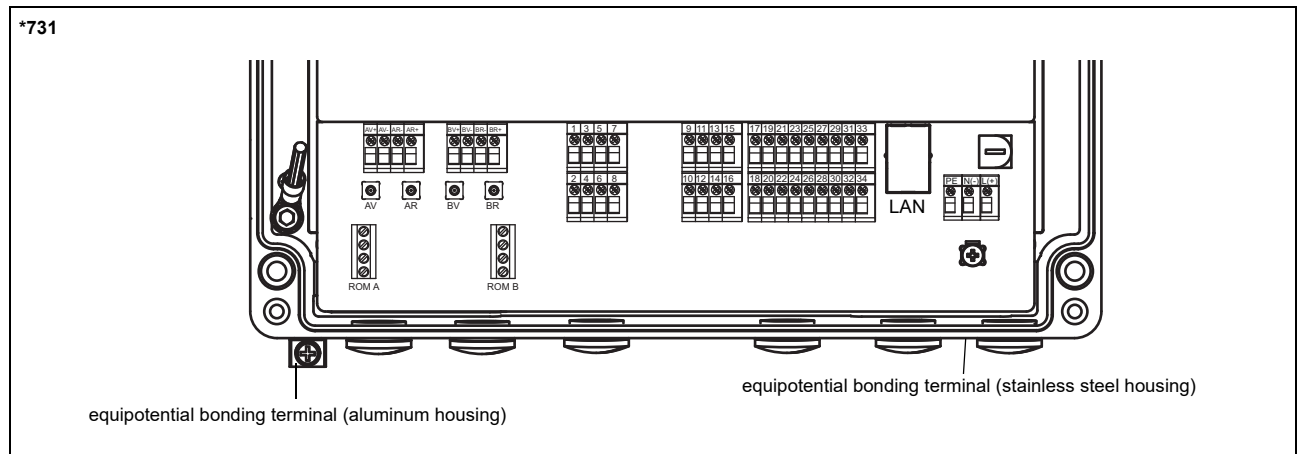
2" pipe mounting kit

*731 (aluminum housing) 	item number: 731037-1
*731 (stainless steel housing) 	item number: 721110-4

Storage

- do not store outdoors
- store within the original package
- store in a dry and dust-free place
- protect against sunlight
- keep all openings closed
- storing temperature: -40...+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			measuring channel A	measuring channel B	
terminal	connection	terminal	connection	transducer	terminal	terminal	connection
AV or AV+	signal	BV or BV+	signal	↑	X_AV	X_BV	SMB connector
AVS or AV-	shield	BVS or BV-	shield				
ARS or AR-	shield	BRS or BR-	shield	⌵	X_AR	X_BR	SMB connector
AR or AR+	signal	BR or 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			• service (FluxDiag/FluxDiagReader) • Modbus TCP • BACnet IP		

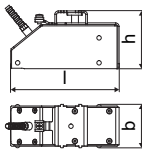
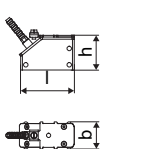
¹ cable (by customer): e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm²

² The number, type and terminal assignment are customised.

Transducers

Technical data

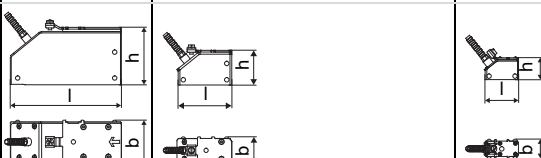
Shear wave transducers (zone 2 - FM Class I Div. 2 - nonEx, TS)

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/CI. I,II,III/Div. 2 / GP A,B,C,D,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 Ex II 3G 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/Cl. I,II,III/Div. 2 / GP A,B,C,D,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  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	-40...+235		
degree of protection		IP66			
marking			NI/CI. I,II,III/Div. 2 / GP A,B,C,D,F,G/ Temp. Codes dwg 3860		

¹ > +200 °C:

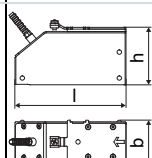
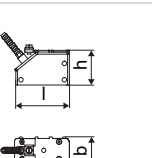
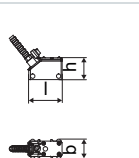
nonEx: Variofix C without cover or Variofix L

Ex: Variofix C or Variofix L, ambient temperature max. +40 °C

observe the insulation instruction

² nonEx: pipe surface temperature +200...+240 °C: Variofix C without cover³ nonEx: 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	-40...+235		
degree of protection		IP66			
marking			NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,F,G/ Temp. Codes dwg 3860		

¹ > +200 °C:

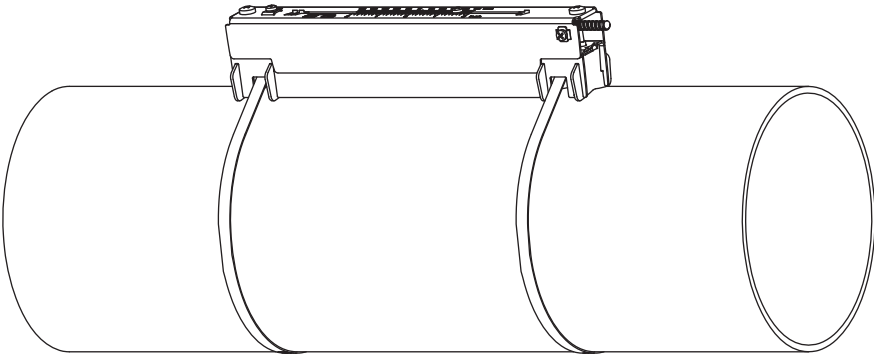
nonEx: Variotix C without cover or Variotix L

Ex: Variotix C or Variotix L, ambient temperature max. +40 °C

observe the insulation instruction

² nonEx: pipe surface temperature +200...+240 °C: Variotix C without cover³ pipe surface temperature max. +200 °C³nonEx: pipe surface temperature max. +200 °C

Transducer mounting fixture

Variofix L (VL) 	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
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Coupling materials for transducers

	normal temperature range (4th character of transducer order code = N)		extended temperature range higher temperatures (4th character of transducer order code = E)		
	< 100 °C	< 130 °C	< 180 °C	< 200 °C	200...240 °C
< 24 h	coupling compound type N or coupling foil type VT	coupling compound type N or type E or coupling foil type VT	coupling compound type E or coupling foil type VT	coupling compound type E or coupling foil type VT	coupling compound type H or coupling foil type TF
long time measure- ment	coupling foil type VT	coupling foil type VT	coupling foil type VT	coupling foil type VT	coupling foil type TF

Technical data

type	ambient temperature °C	remark
coupling compound type N	-30...+130	
coupling compound type E	-30...+200	
coupling compound type H	-30...+250	
coupling foil type VT	-10...+200	fluid temperature 200 °C: min. 2 years
coupling foil type TF	200...240	

Connection systems

connection system T1		
connection with extension cable	direct connection	transducers technical type
JBP2, JBP3, JB06		*****53
connection system TS		
connection with extension cable	direct connection	transducers technical type
JB02, JB03, JB04		*****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		K		M, P		Q	
transducers technical type		x	l	x	l	x	l
*D***5*	m	5	≤ 300	4	≤ 300	3	≤ 90
*L***5*	m	9	≤ 300	9	≤ 300	9	≤ 90

x - transducer cable length

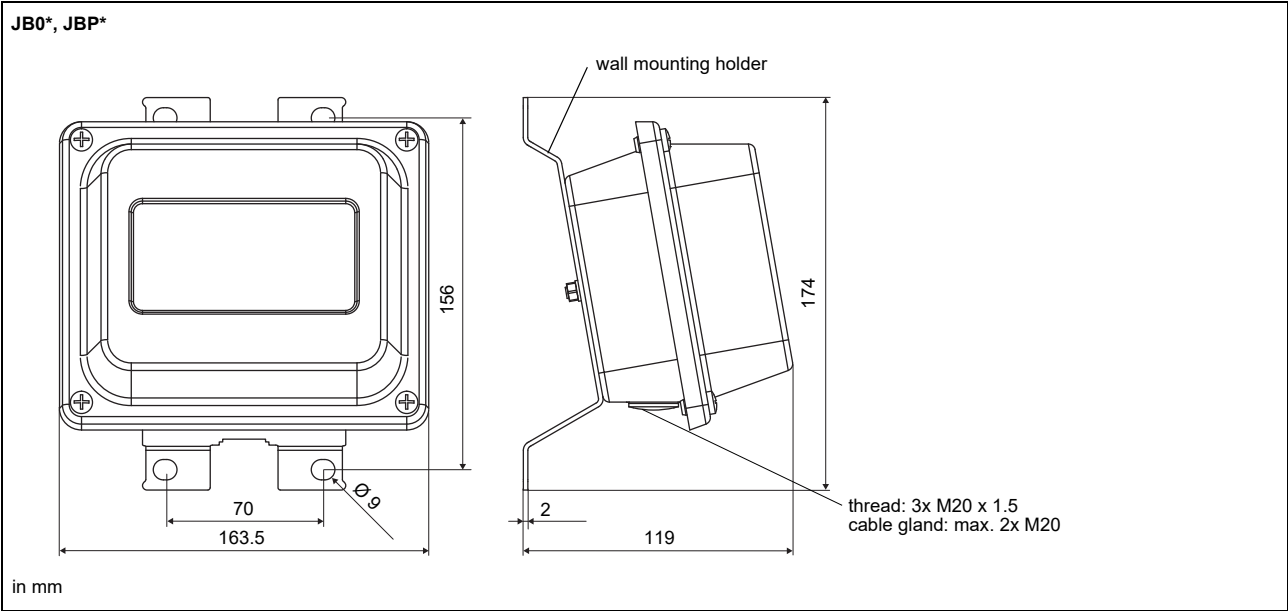
l - max. length of extension cable (depending on the application)

Junction box

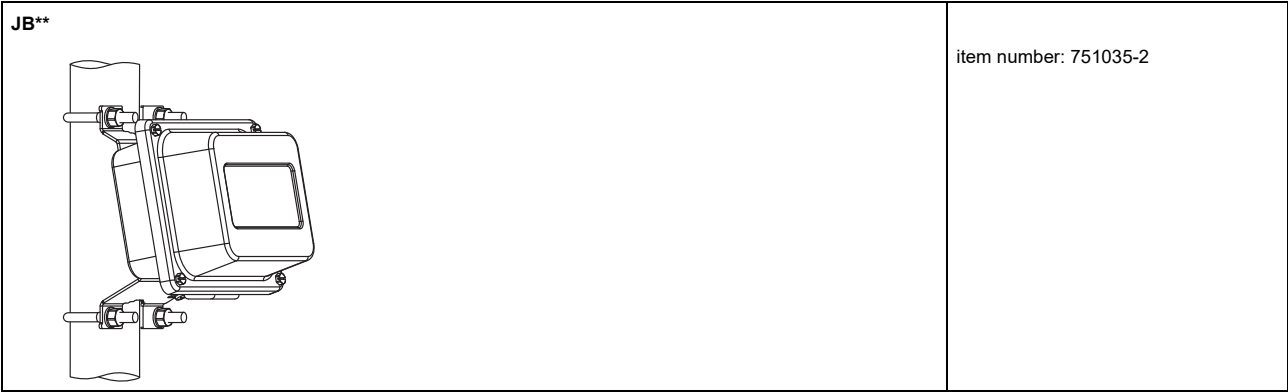
Technical data

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, UKEX		
junction box marking		JB02 CEUKCA II3G Ex nA IIC T6...T4 Gc II3D Ex tc IIIC T 100 °C Dc -40 ≤ Ta ≤ +70 °C/+80 °C
• FM		
junction box marking		JB04
certification type		JBC24
marking		FIMUSAPPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ T6 Ta = -40...+60 °C

Dimensions

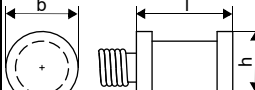


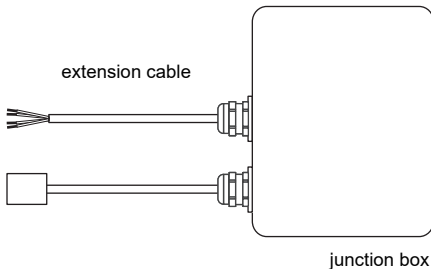
2" pipe mounting kit

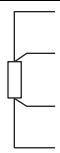


Clamp-on temperature probe (optional)

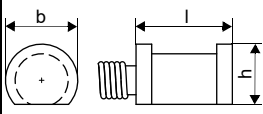
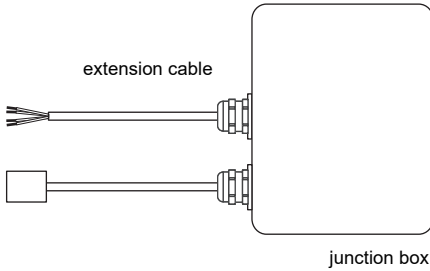
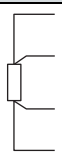
Technical data

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)		≤ 0.1 K (3 K < ΔT < 6 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

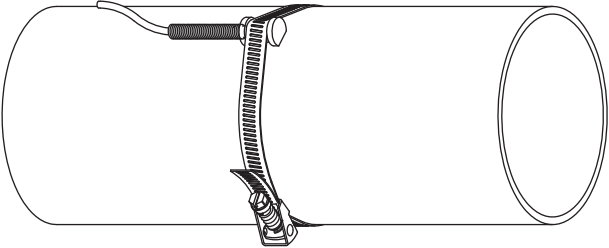
Connection system	
connection with extension cable	direct connection
	

Connection	
	temperature probe
	red
	red/blue
	white/blue
	white

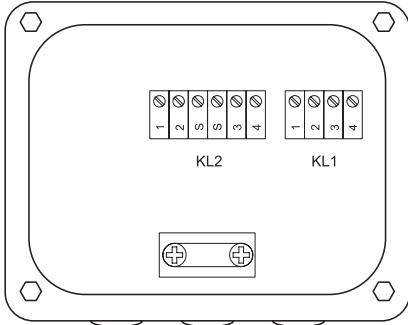
Cable		
	temperature probe	extension cable
type		4 x 0.22 mm ²
standard length	m	3
max. length	m	-
ambient temperature	°C	-30...+250
min. bend radius	mm	27
cable jacket		
material	PFA	PVC
outer diameter	mm	3.8 ±0.15
colour	black	grey

PT12N			
item number		• 770415-1A2 • 770414-1A2 (matched)	
design		clamp-on ATEX, UKEX	
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)		≤ 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, UKEX			
marking		 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	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 ±0.2
colour		black	grey

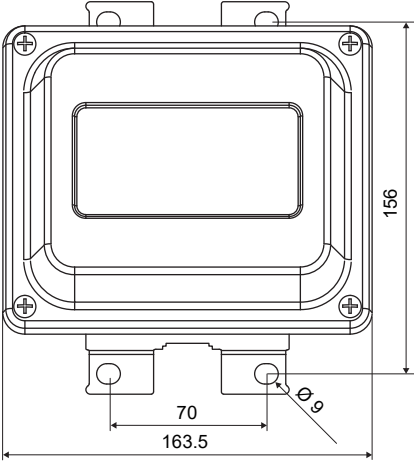
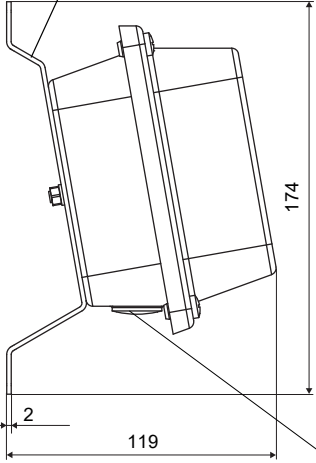
Fixation

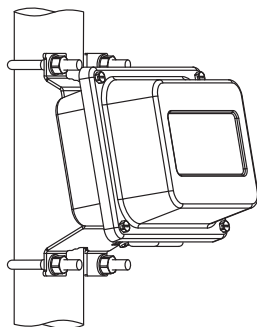
tension strap PT12N 	material: stainless steel 301 (1.4310), 410 (1.4006) thermal insulation necessary
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Junction box

JBT2, JBT3																													
item number		• JBT2:770428-5A2 • JBT3: 751040-36	Connection 																										
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		JBT2																											
marking		CE UK CA Ex II3G Ex nA IIC T6...T4 Gc II3D Ex tc IIIC T 100 °C Dc -40 ≤ Ta ≤ +70 °C/+80 °C																											
			Temperature probe <table> <tr> <th>terminal strip</th><th>terminal</th><th>connection</th></tr> <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> </table> Extension cable <table> <tr> <th>terminal strip</th><th>terminal</th><th>connection</th></tr> <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> </table>			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

JBT*	
 in mm	 thread: 3x M20 x 1.5 cable gland: max. 2x M12

2" pipe mounting kit**JB****

item number: 751035-2

Inline temperature probe (optional)

Technical data

PT12N-IT-P PT12N-IU-P		
item number		PT12N-IT-P: 770416-1 (matched, without cable) 770416-11 (matched, 10 m) 770416-12 (matched, 20 m) PT12N-IU-P: 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		$\pm(0.15\text{ °C} + 2 \cdot 10^{-3} \cdot T\text{ [°C]})$
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

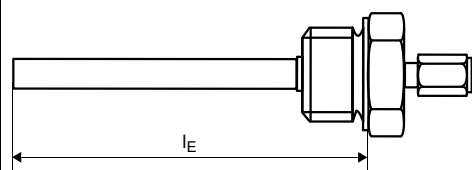
	temperature probe	cable
	red	red
	red	grey
	white	blue
	white	white

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



		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 velocity ¹			
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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