

Permanently installed and non-invasive ultrasonic flowmeter for the measurement of thermal energy and volumetric flow rate

Precise and intelligent energy measuring system with extremely high measuring dynamic

Features

- Integrated measuring system for the determination of thermal energy in real time, enables smart metering
- For inner pipe diameters of DN 25...DN 1000
- High-precision temperature measurement using paired temperature probes (0.1 °C temperature difference)
- Extremely high measuring dynamic > 1000 : 1
- Measures even the lowest flow velocities down to 0.01 m/s – important for the measurement of low flow rates, e.g. during the night
- Permanent acoustic coupling of the ultrasonic transducers by long-lasting coupling pads; does not require further greasing and maintenance
- Bidirectional communication and support of standard bus systems
- Flowmeter can be configured for two independent heat flow measurements
- Integrated calculation functions for two measuring channels, e.g. sum or difference
- Standard configuration includes numerous heat transfer fluids; possible expansion of fluid data sets

Applications

- Industrial manufacturing facilities
 - Thermal processes
 - Heating and climate control
- Facilities for the generation of renewable energies
 - Solar and geothermal energy, waste heat
- District heating
 - Heating and cooling systems
 - Heat interface units
 - Distribution nets
- Building technology
 - Heating and cooling systems
 - Internal balancing
- Energy management
 - Energy efficiency
 - Energy monitoring



FLUXUS F704TE



Variofix L

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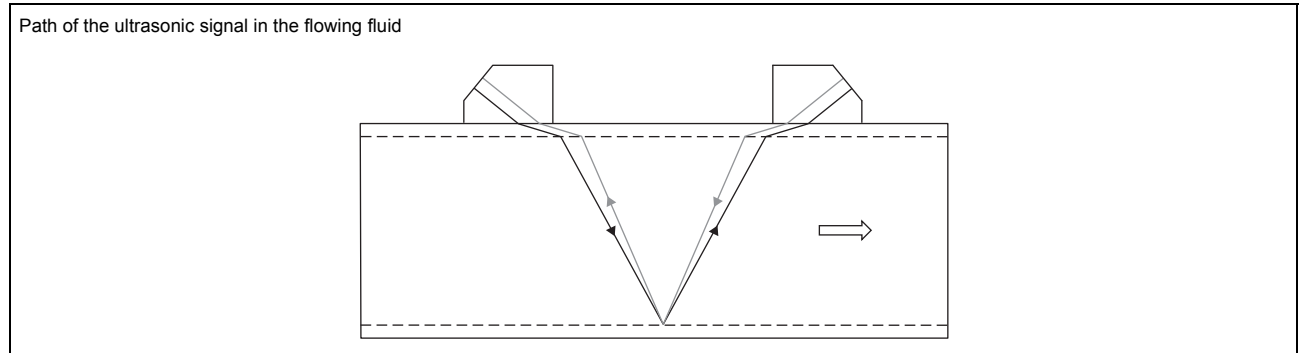
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Function

Measurement principle

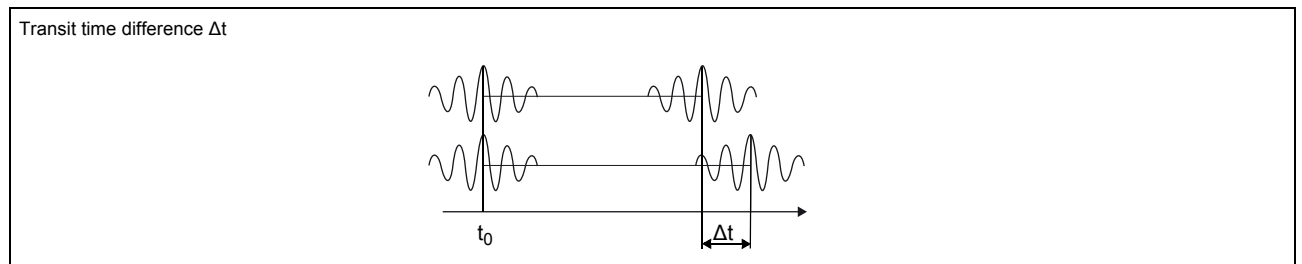
The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.



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

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

Two integrated microprocessors control the entire measuring process. This allows the flowmeter to remove disturbance signals, and to check each received ultrasonic wave for its validity which reduces noise.



Calculation of volumetric flow rate

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

where

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

Calculation of heat flow

The heat flow is internally 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 – heat flow
- k_i – heat coefficient
- \dot{V} – volumetric flow rate
- T_V – supply temperature
- T_R – return temperature

The heat coefficient k_i results from several heat flow coefficients for the specific enthalpy and density of the fluid. The heat flow coefficients of some fluids are stored in the internal database of the transmitter. Further user-defined 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. It depends on $\Delta\theta$ and is therefore calculated according to the operational conditions at the measuring point.

$$\text{MPE} = \sqrt{E_c^2 + E_t^2 + E_f^2}$$

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
- $\Delta\theta$ – temperature difference between supply and return line of the heat-exchange circuit

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**

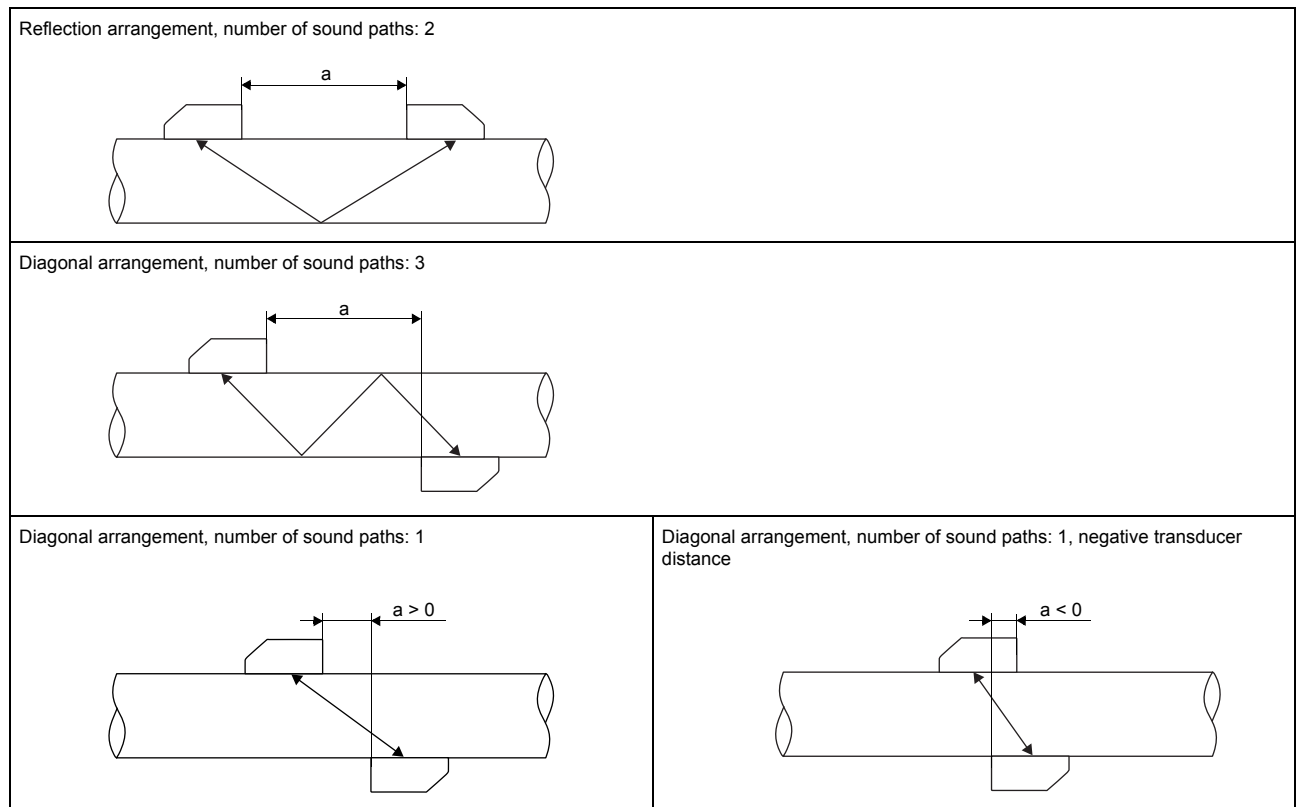
The number of sound paths is even. Both of the transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easier.

- **diagonal arrangement**

The number of sound paths is odd. Both of 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.

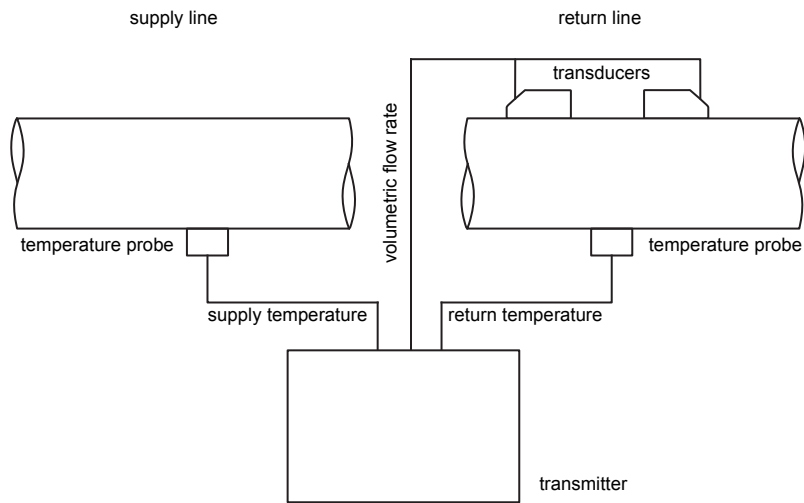
As the transducers can be mounted with the transducer mounting fixture in reflection arrangement or diagonal arrangement, the number of sound paths can be adjusted optimally for the application.



a - transducer distance


Typical measurement setup

Example of a heat flow measurement measuring the volume flow rate in the return line



Transmitter

Technical data



	FLUXUS F704TE-NN FLUXUS F704TE-A2 (Standard)	FLUXUS F704TE-NN FLUXUS F704TE-A2 (Dual)	FLUXUS F704TE-F2 (Standard)	FLUXUS F704TE-F2 (Dual)
				
design	standard field device, nonEx or ATEX/IECEX		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	$\Delta\theta_{\min} = 3 \text{ K}, \Delta\theta_{\max} = 300 \text{ K}$			
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	m ³ /h	$Q_p = 17...20\ 000$		
flow velocity	m/s	0.01...25		
fluid pressure	without influence			
pressure loss	-			
repeatability	0.15 % of reading $\pm 0.01 \text{ m/s}$			
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			
accuracy ¹	<ul style="list-style-type: none"> • with standard calibration $\pm 1.6 \%$ of reading $\pm 0.01 \text{ m/s}$ • with advanced calibration (optional) $\pm 1.2 \%$ of reading $\pm 0.01 \text{ m/s}$ • with field calibration² $\pm 0.5 \%$ of reading $\pm 0.01 \text{ m/s}$ 			
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	2	1
damping	s	0...100 (adjustable)		
measuring cycle	Hz	100...1000 (1 channel)		
response time	s	1 (1 channel), option: 0.07		
housing material	aluminum, powder coated			
degree of protection	IP65			
dimensions	mm	see dimensional drawing		
weight	kg	3.1		
fixation	wall mounting, optional: 2" pipe mounting			
ambient temperature	°C	-40...+60 °C (< -20 °C without operation of the display)		-20...+60 °C
display	2 x 16 characters, dot matrix, backlight			
menu language	English, German, French, Dutch, Spanish			
explosion protection				
• ATEX/IECEX				
transmitter	F704TE-A2		-	
marking	CE 0637 Ex II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T 120 °C Db T _a -40...+60 °C		-	
certification ATEX	IBExU11ATEX1015		-	
certification IECEX	IECEX IBE 11.0008		-	

¹ for transit time difference principle, reference conditions and $v > 0.15 \text{ m/s}$

² reference uncertainty < 0.2 %

³ outside of explosive atmosphere (housing cover open)

⁴ Further outputs and inputs are possible with FLUXUS F721 (see Technical specification TSFLUXUS_F721Vx-xxx).

	FLUXUS F704TE-NN FLUXUS F704TE-A2 (Standard)	FLUXUS F704TE-NN FLUXUS F704TE-A2 (Dual)	FLUXUS F704TE-F2 (Standard)	FLUXUS F704TE-F2 (Dual)
• FM				
marking	-		F70[1 or 2]Z2**[1 or 2]:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T5 Ta = 60 °C F70[1 or 2]Z2**9:  NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T4A Ta = 55 °C	
measuring functions				
physical quantities	heat flow, volumetric flow rate, mass flow rate, flow velocity			
totalizer	heat quantity, volume, mass			
calculation functions	-		average, difference, sum	average, difference, sum
diagnostic functions	sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times			
communication interfaces				
service interfaces	<ul style="list-style-type: none"> • RS232³ • USB (with adapter)³ 		<ul style="list-style-type: none"> • RS232 • USB (with adapter) 	
process interfaces	max. 1 option: <ul style="list-style-type: none"> • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • M-Bus (nonEx) 		max. 1 option: <ul style="list-style-type: none"> • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP 	
accessories				
serial data kit	<ul style="list-style-type: none"> • cable • adapter 		RS232	RS232 - USB
software	<ul style="list-style-type: none"> • FluxDiagReader: download of measured values and parameters, graphical presentation • FluxDiag (optional): download of measurement data, graphical presentation, report generation • FluxSubstanceLoader: upload of fluid data sets 			
data logger				
loggable values	all physical quantities, totalized values and diagnostic values			
capacity	> 100 000 measured values			
outputs				
	The outputs are galvanically isolated from the transmitter.			
• switchable current output				
	All switchable current outputs are switched to active or passive mode at the same time.			
number	1, optional: 2 ⁴	2, optional: 4 ⁴	1, optional: 2 ⁴	2, optional: 4 ⁴
range	mA 4...20 (3.2...22)			
accuracy	0.04 % of reading ±3 µA			
active output	R _{ext} < 350 Ω			
passive output	U _{ext} = 8...30 V, depending on R _{ext} , R _{ext} < 1 kΩ			
• binary output				
number	3			
optorelay	26 V/100 mA			
binary output as alarm output				
• functions	limit, change of flow direction or error			
binary output as pulse output				
• functions	mainly for totalizing			
• pulse value	units 0.01...1000			
• pulse width	ms 1...1000			
inputs				
	The inputs are galvanically isolated from the transmitter.			
• temperature input				
number	2 ⁴	4	2 ⁴	4
type	Pt100/Pt1000			
connection	4-wire			
range	°C -150...+560			
resolution	K 0.01			
accuracy	±0.01 % of reading ±0.03 K			

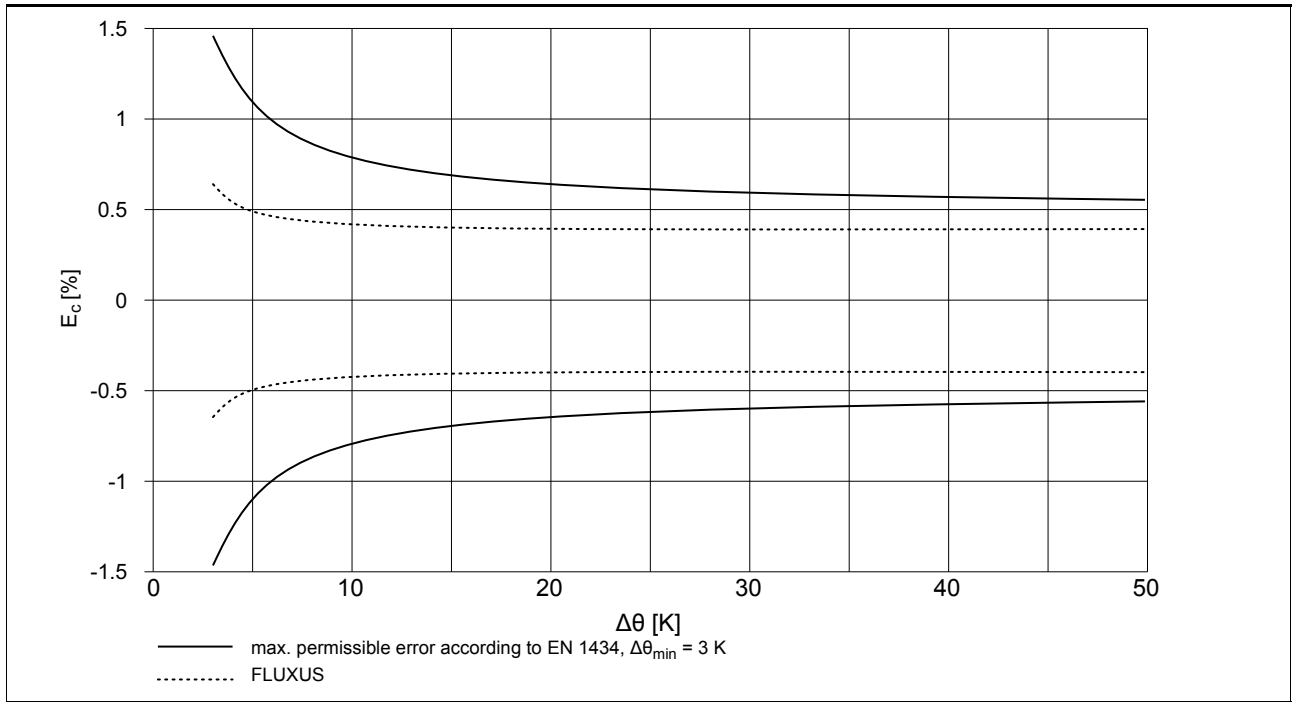
¹ for transit time difference principle, reference conditions and v > 0.15 m/s

² reference uncertainty < 0.2 %

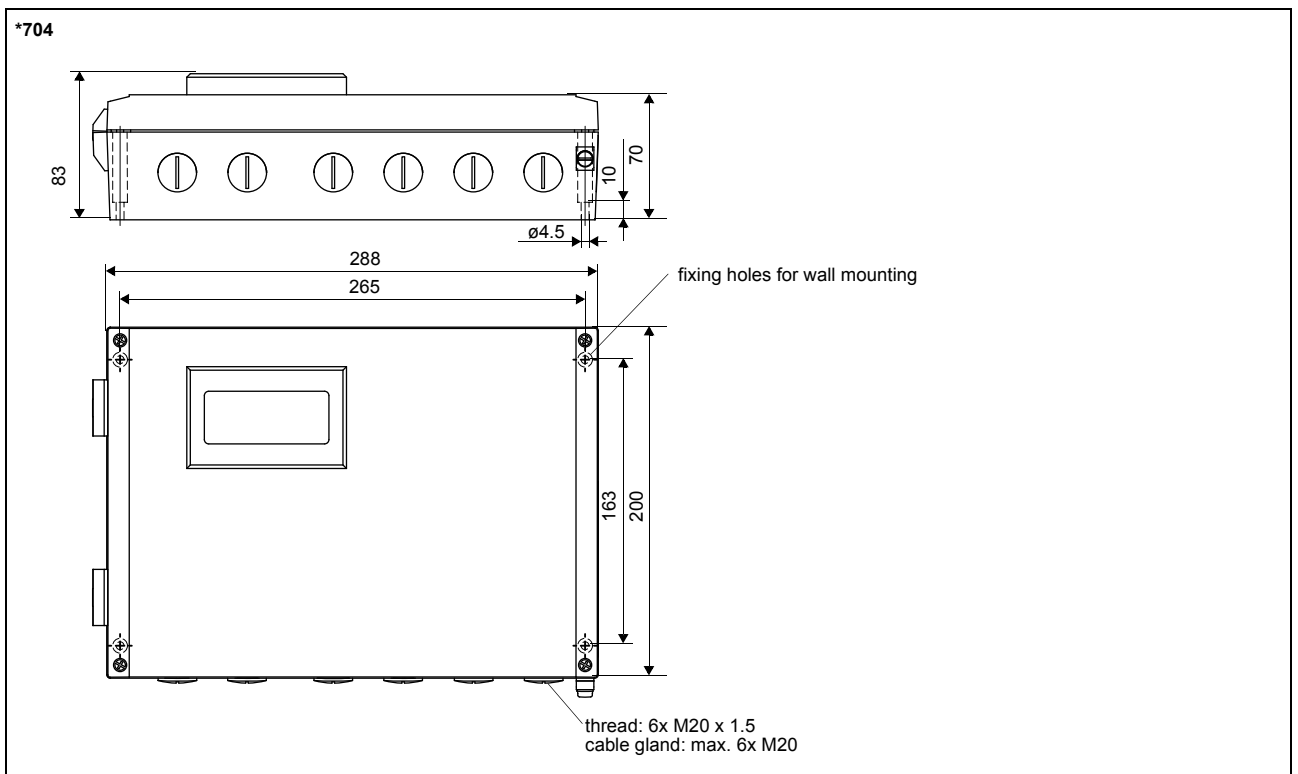
³ outside of explosive atmosphere (housing cover open)

⁴ Further outputs and inputs are possible with FLUXUS F721 (see Technical specification TSFLUXUS_F721Vx-xXX).

Max. permissible error of the calculator



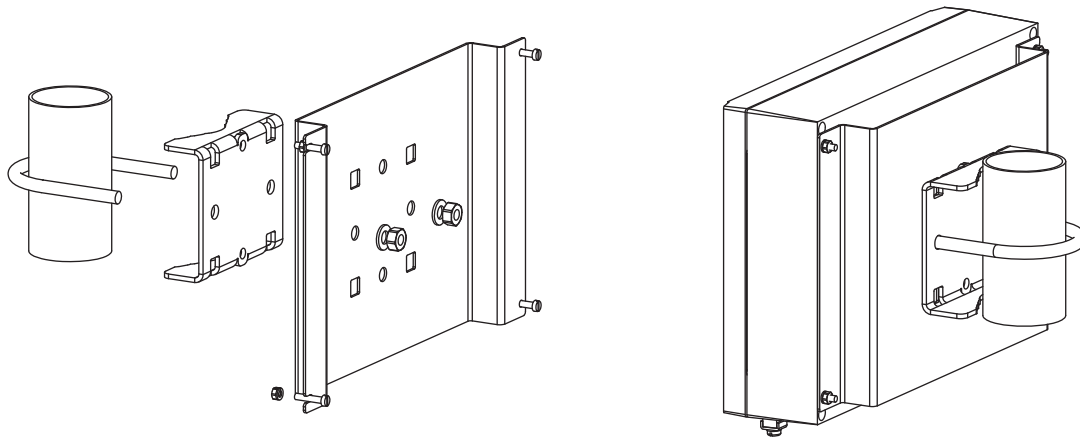
Dimensions



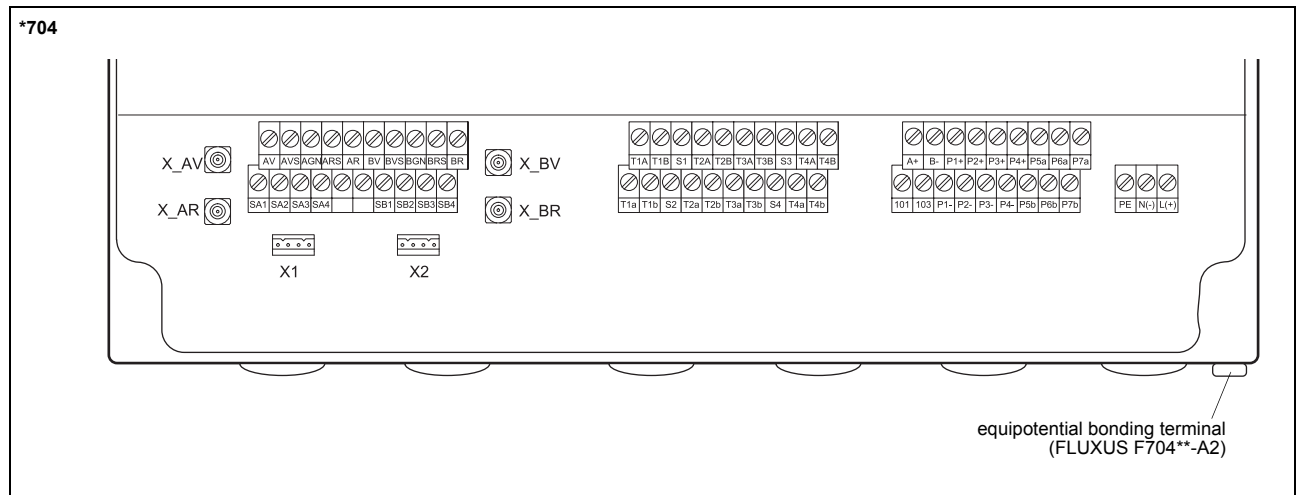
in mm

2" pipe mounting kit

*704



Terminal assignment



power supply ¹							
terminal		connection (AC)			connection (DC)		
PE		earth			earth		
N(-)		neutral			-		
L(+)		phase			+		
transducers							
extension cable				transducer cable			
measuring channel A				measuring channel B			
terminal	connection	terminal	connection	transducer	terminal	terminal	connection
AV	signal	BV	signal	↑	X_AV	X_BV	SMB connector
AVS	shield	BVS	shield		X_AR	X_BR	
ARS	shield	BRS	shield	⌆			
AR	signal	BR	signal				
outputs ^{1, 2}				communication interfaces ^{1, 2}			
terminal	connection			terminal	connection		communication interface
P1+...P4+ P1-...P4-	current output			A+	signal +		<ul style="list-style-type: none"> • RS485 • Modbus RTU • BACnet MS/TP • M-Bus
				B-	signal -		
P5a...P7a P5b...P7b	binary output			101	shield		
analog inputs ^{1, 2}							
terminal		direct connection (clamp-on)		connection with extension cable (clamp-on)		direct connection (inline)	
T1a...T4a		red		red		red	
T1A...T4A		red/blue		grey		grey	
T1b...T4b		white/blue		blue		blue	
T1B...T4B		white		white		white	
S1, S3		shield		shield		-	

¹ cable (by customer): lead cross sectional area: 0.5...1.5 mm²

² The number, type and terminal assignment will be customized.

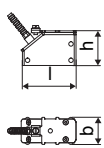
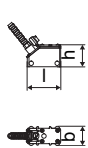

Transducers

Technical data

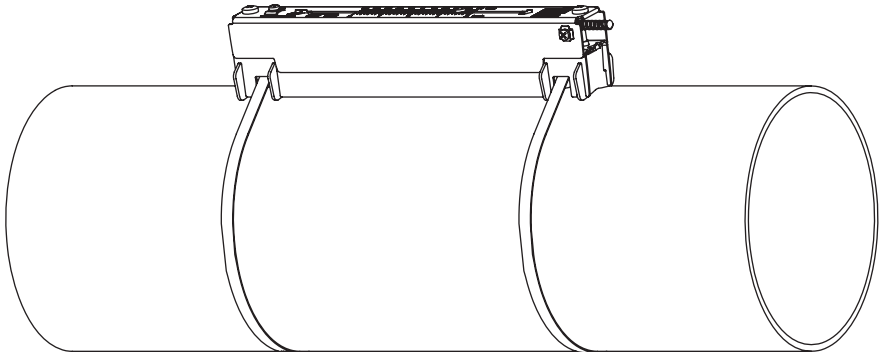
Shear wave transducers (nonEx, ATEX/IECEx (zone 2) or FM Class I Div. 2)

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 cap 304 (1.4301)			
contact surface		PEEK			
degree of protection (nonEx)		IP67			
transducer cable					
type		1699			
length	m	5, ***_****/LC: 9	4, ***_****/LC: 9		3, ***_****/LC: 9
dimensions					
length l	mm	126.5	64		40
width b	mm	51	32		22
height h	mm	67.5	40.5		25.5
dimensional drawing					
weight (without cable)	kg	0.36	0.066		0.016
ambient temperature					
min.	°C	-40			
max.	°C	+130			
temperature compensation		x			
explosion protection					
• ATEX/IECEx					
explosion protection temperature (pipe surface)					
• min.	°C	-55			
• max.	°C	gas: +190, dust: +180			
marking		CE 0637 II3G II2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db			
certification ATEX		IBExU10ATEX1163 X			
certification IECEx		IECEx IBE 12.0005X			
degree of protection		IP65			
• FM					
explosion protection temperature					
• min.	°C	-40			
• max.	°C	+125			
marking		NI/CI, I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860			
degree of protection		IP66			

Shear wave transducers (extended temperature range - nonEx, ATEX/IECEX (zone 2) or FM Class I Div. 2)

technical type		C(DL)M2E52	C(DL)P2E52	C(DL)Q2E52
transducer frequency	MHz	1	2	4
nominal size				
min.		DN 200	DN 100	DN 25
max.		DN 600	DN 400	DN 150
material				
housing		PI with stainless steel cap 304 (1.4301)		
contact surface		PI		
degree of protection (nonEx)		IP56		
transducer cable				
type		6111		
length	m	4, ***_****/LC: 9		3, ***_****/LC: 9
dimensions				
length l	mm	64	40	
width b	mm	32	22	
height h	mm	40.5	25.5	
dimensional drawing				
weight (without cable)	kg	0.066	0.017	
ambient temperature				
min.	°C	-30		
max.	°C	+200		
temperature compensation		x		
explosion protection				
• ATEX/IECEX				
explosion protection temperature (pipe surface)				
• min.	°C	-45		
• max.	°C	gas: +235, dust: +225		
marking		CE 0637 Ex II 3G II 2D Ex nA IIC T6...T2 Gc Ex tb IIIA TX Db		
certification ATEX		IBExU10ATEX1163 X		
certification IECEX		IECEX IBE 12.0005X		
degree of protection		IP56		
• FM				
explosion protection temperature				
• min.	°C	-40		
• max.	°C	+235		
marking		 NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860		
degree of protection		IP66		

Transducer mounting fixture

<p>Variofix L (VLK, VLM, VLQ)</p> 	<p>material: stainless steel 304 (1.4301), 301 (1.4310), 410 (1.4006) option OS: 316 (1.4571), 316L (1.4404), 17-7PH (1.4568) inner length: VLK: 348 mm, option IP68: 368 mm VLM: 234 mm VLQ: 176 mm dimensions: VLK: 423 x 90 x 93 mm option IP68: 443 x 94 x 105 mm VLM: 309 x 57 x 63 mm VLQ: 247 x 43 x 47 mm</p>
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Coupling materials for transducers

	< 100 °C	< 170 °C
< 24 h	coupling compound type N or coupling foil type VT	coupling compound type E or coupling foil type VT
long time measurement	coupling foil type VT ¹	coupling foil type VT ²

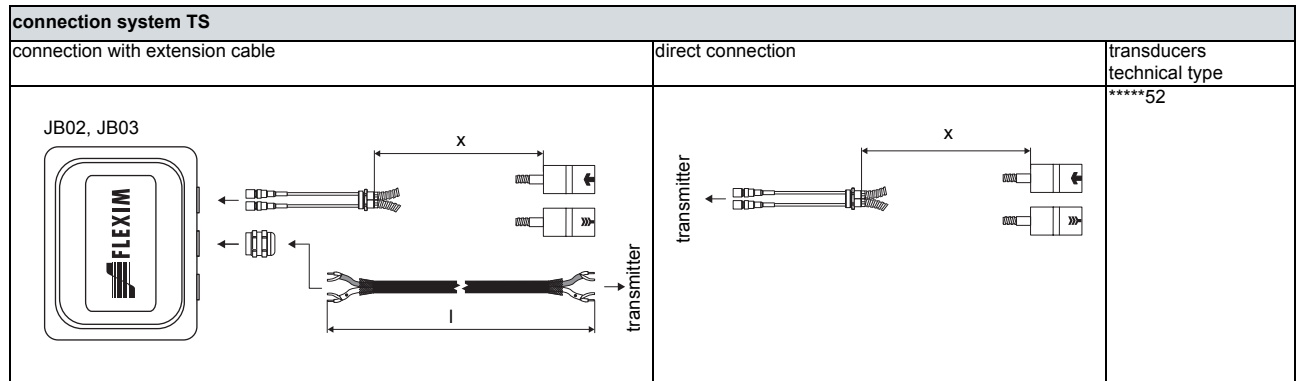
¹ < 5 years

² < 6 months

Technical data

type	ambient temperature °C	material
coupling compound type N	-30...+130	mineral grease paste
coupling compound type E	-30...+200	silicone paste
coupling foil type VT	-10...+200	fluoroelastomer

Connection systems



Cable

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

extension cable			
type		2615	5245
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	12	12
thickness	mm	2	2
colour		black	black
shield		x	x
sheath			
material		-	steel wire braid with copolymer sheath
outer diameter	mm	-	15.6

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	
*****5*	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40
option LC *****5*	m	9	≤ 300	9	≤ 300	9	≤ 90	-	≤ 40

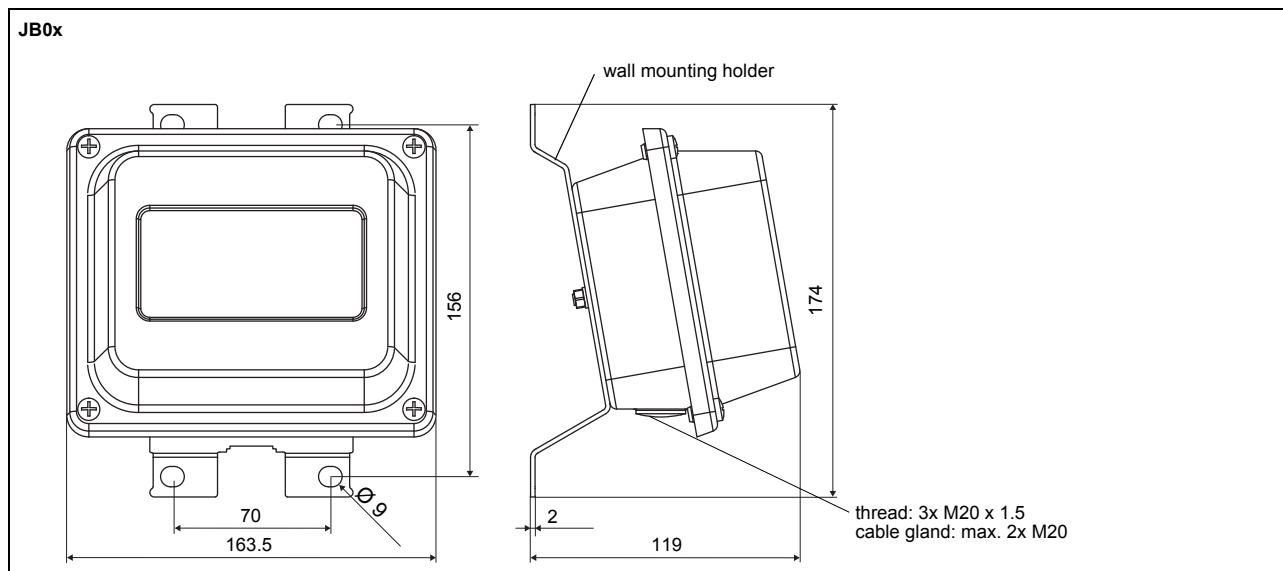
x - transducer cable length
l - max. length of extension cable

Junction box

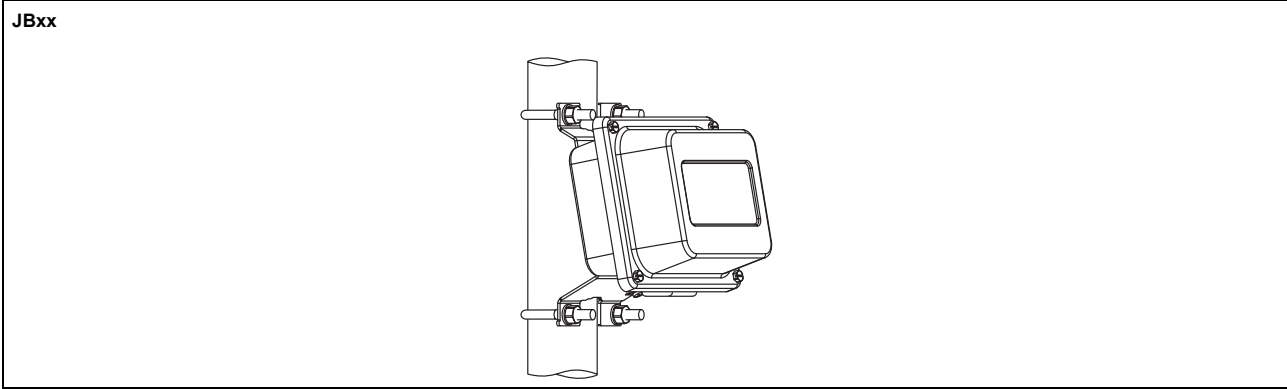
Technical data

JB02, JB03													
weight	kg 1.2 kg												
fixation	wall mounting optional: 2" pipe mounting												
material													
housing	stainless steel 316L (1.4404)												
gasket	silicone												
degree of protection	IP67												
ambient temperature													
min.	°C -40												
max.	°C +80												
explosion protection													
• ATEX													
junction box marking	JB02 CE Ex II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc III C T 100 °C Dc Ta -40...+(70)80 °C												
connection													
transducers													
	<table border="1"> <thead> <tr> <th>terminal</th> <th>connection</th> <th>transducer</th> </tr> </thead> <tbody> <tr> <td>XV</td> <td>SMB connector</td> <td>↑</td> </tr> <tr> <td>XR</td> <td>SMB connector</td> <td>⬇</td> </tr> </tbody> </table>	terminal	connection	transducer	XV	SMB connector	↑	XR	SMB connector	⬇			
terminal	connection	transducer											
XV	SMB connector	↑											
XR	SMB connector	⬇											
extension cable													
	<table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL2</td> <td>TV</td> <td>signal</td> </tr> <tr> <td>TVS</td> <td>internal shield</td> </tr> <tr> <td>TRS</td> <td>internal shield</td> </tr> <tr> <td>TR</td> <td>signal</td> </tr> </tbody> </table>	terminal strip	terminal	connection	KL2	TV	signal	TVS	internal shield	TRS	internal shield	TR	signal
terminal strip	terminal	connection											
KL2	TV	signal											
	TVS	internal shield											
	TRS	internal shield											
	TR	signal											

Dimensions

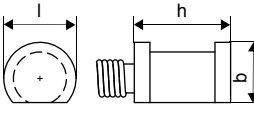
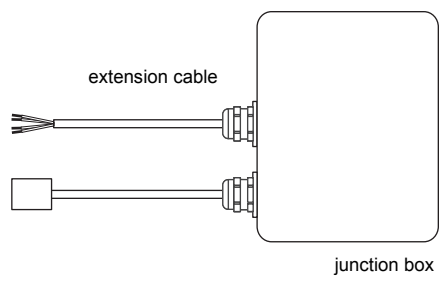
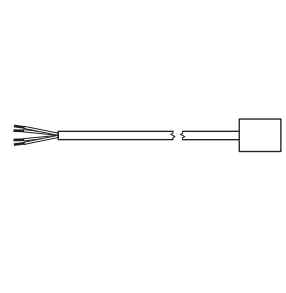
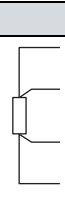


2" pipe mounting kit

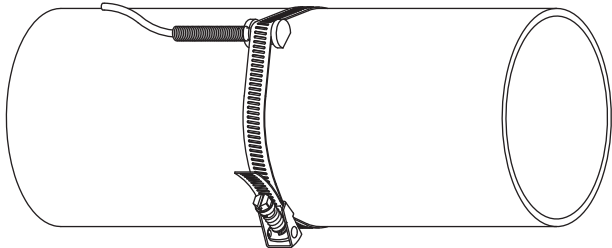


Clamp-on temperature probe (optional)

Technical data

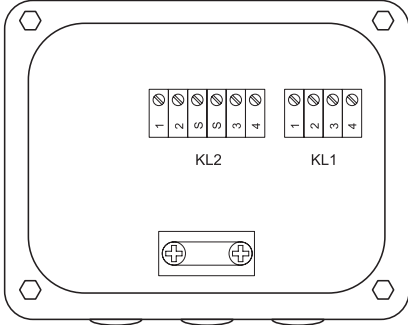
PT12N - nonEx, ATEX		
type	Pt100	
connection	4-wire	
measuring range	°C -30...+250	
accuracy θ	$\pm(0.15 \text{ }^\circ\text{C} + 2 \cdot 10^{-3} \cdot \theta \text{ [}^\circ\text{C]})$ class A	
max. permissible relative error	$E_t = 0.1 \text{ K (3 K < } \Delta\theta \leq 6 \text{ K)}$ $E_t = 0.2 \text{ K (6 K < } \Delta\theta \leq 30 \text{ K)}$ $E_t = 0.3 \text{ K (30 K < } \Delta\theta \leq 50 \text{ K)}$	
response time	s 50	
housing	aluminum	
degree of protection	IP66	
dimensions		
length l	mm 15	
width b	mm 13	
height h	mm 20	
dimensional drawing		
weight	kg 0.25	
accessories		
thermal conductivity foil 250 °C	x	
explosion protection (optional)		
• ATEX		
explosion protection temperature		
min.	°C -30	
max.	°C +250	
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/blue	
	red	
	white/blue	
	white	
cable		
	temperature probe	extension cable
type	4 x 0.25 mm² black	LIYCY 8 x 0.14 mm² grey
standard length	m 3	5/10/25
max. length	m -	200
cable jacket	PTFE	PVC

Fixation

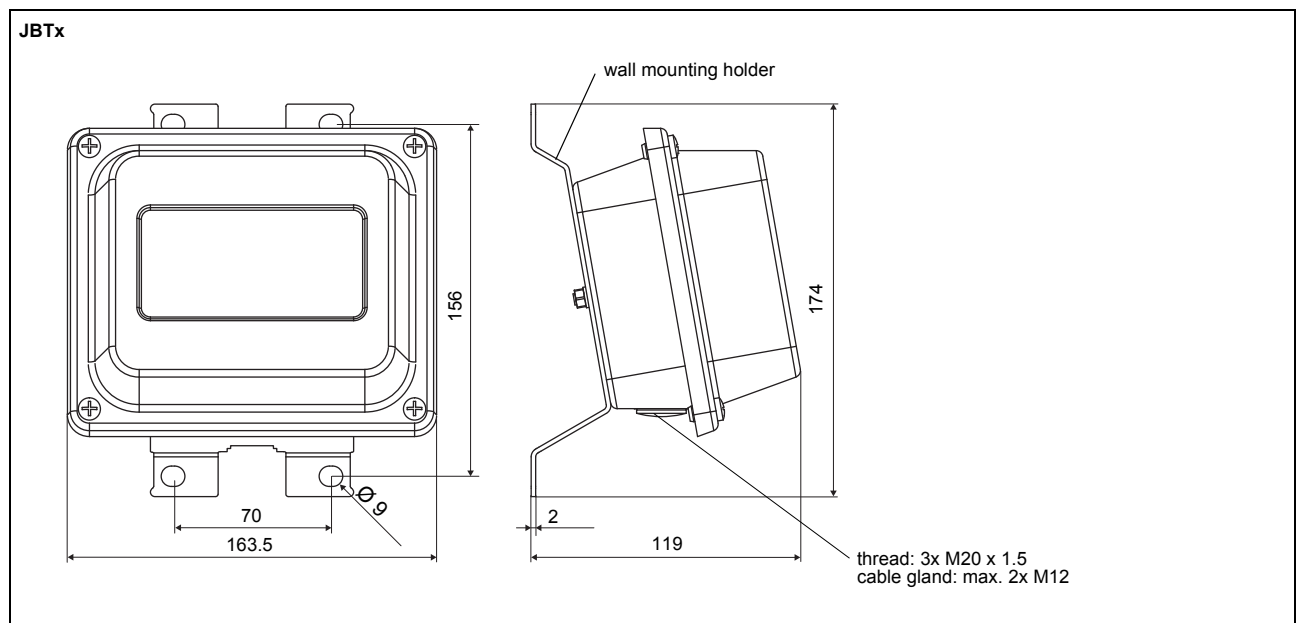
tension strap PT12N	material: stainless steel 301 (1.4310), 410 (1.4006)
	

Junction box

Technical data

JBT2, JBT3		
weight	kg	1.2 kg
fixation		wall mounting optional: 2" pipe mounting
material		
housing		stainless steel 316L (1.4404)
gasket		silicone
degree of protection		IP67
ambient temperature		
min.	°C	-40
max.	°C	+80
explosion protection		
• ATEX		
junction box marking		JBT2 CE Ex 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

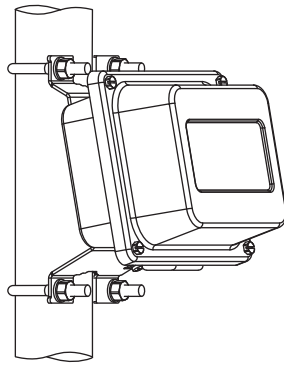
Dimensions



in mm

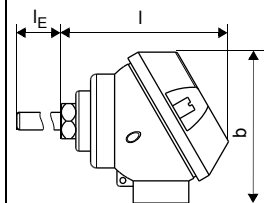
2" pipe mounting kit

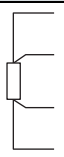
JBxx



Inline temperature probe (optional)

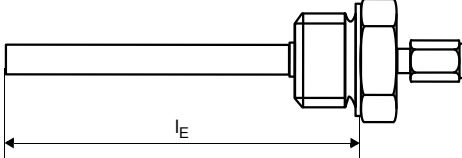
Technical data

PT12N-IT-P PT12N-IU-P	
type	2x Pt100 matched according to EN 1434
connection	4-wire
measuring range	-30...+200
accuracy θ	$\pm(0.15 \text{ }^\circ\text{C} + 2 \cdot 10^{-3} \cdot T \text{ [}^\circ\text{C]})$ class A
max. permissible relative error	$E_t = \pm 0.9 \cdot (0.5 + 3 \cdot \Delta\theta_{\min}/\Delta\theta)$
response time	s T50: 5, T90: 19
housing	316Ti (1.4571) connecting head J: aluminum
degree of protection	IP65
dimensions	
length l	mm 72 PT12N-IT-P: $l_E = 140$ PT12N-IU-P: $l_E = 230$
width b	mm 51
dimensional drawing	
weight	kg PT12N-IT-P: 0.136 PT12N-IU-P: 0.142

connection		
	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	zinc coated 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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