

### Non-invasive flow measurement of cryogenic liquids

FLUXUS Cryo extends the application range of the ultrasonic clamp-on flow measurement with Wavelnjector Cryo to cryogenic temperatures up to  $-200\text{ }^{\circ}\text{C}$ .

The patented mounting fixture thermally separates the ultrasonic transducers from cold pipes and at the same time ensures good acoustic contact. Therefore, FLEXIM's standard transducers are suitable for long-term operation even at extremely cold temperatures.

#### Features

- Non-invasive measurement without contact to the fluid
- Fluid temperature range:  $-200\dots+80\text{ }^{\circ}\text{C}$
- Transducers and mounting fixture can be fully integrated into the insulation
- Bidirectional measurement
- Paired and factory-calibrated transducers: no zeroizing necessary, excellent zero-point stability
- High repeatability of measurement results
- Highly reliable: maintenance-free, no moving or vibrating parts, dual-beam redundant measurement
- Operationally safe: no gaskets, no leakage points
- No pipework necessary for installation

#### Applications

Flow measurement of:

- LNG
- Liquid ethane
- Liquid nitrogen
- Liquid oxygen
- Other cryogenic fluids



F721



F801

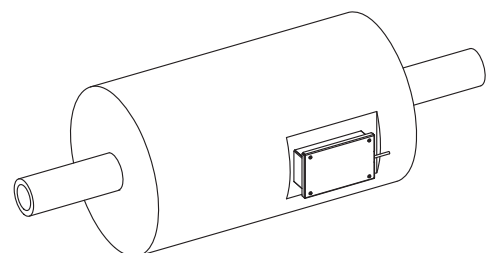


F809

Transmitters FLUXUS Cryo



Wavelnjector Cryo



Wavelnjector Cryo integrated in insulation

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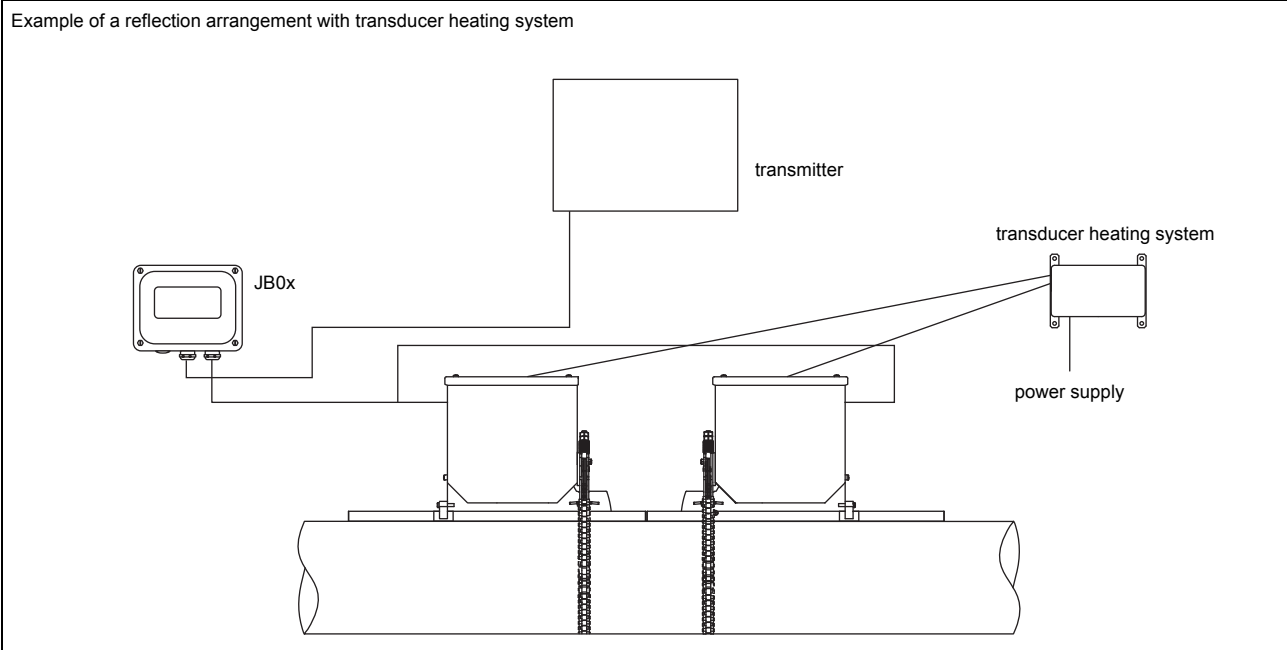
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### Typical measurement setup



# Transmitter F721

## Technical data

	FLUXUS F721**-NN0*A	FLUXUS F721**-NN0*S	FLUXUS F721**-A20*S
			
design	standard field device nonEx	field device with stainless steel housing nonEx	field device with stainless steel housing zone 2
measurement principle	transit time difference correlation principle, automatic NoiseTrek selection for measurements with high gaseous or solid content		
flow velocity	m/s 0.01...25		
repeatability	0.15 % of reading $\pm$ 0.005 m/s		
fluid	all acoustically conductive liquids with < 10 % gaseous or solid content in volume (transit time difference principle)		
temperature compensation	corresponding to the recommendations in ANSI/ASME MFC-5.1-2011		
<b>measurement uncertainty (volumetric flow rate)</b>			
measurement uncertainty of measuring system <sup>1</sup>	$\pm$ 0.3 % of reading $\pm$ 0.005 m/s		
measurement uncertainty at the measuring point <sup>2</sup>	$\pm$ 1 % of reading $\pm$ 0.005 m/s		
<b>transmitter</b>			
power supply	<ul style="list-style-type: none"> <li>• 100...230 V/50...60 Hz or</li> <li>• 20...32 V DC or</li> <li>• 11...16 V DC</li> </ul>		
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	stainless steel 316L (1.4404)
degree of protection		IP66	IP66   IP66
dimensions	mm	see dimensional drawing	
weight	kg	5.4	5.1
fixation		wall mounting, optional: 2" pipe mounting	
ambient temperature	°C	-40...+60 (< -20 °C without operation of the display)	
display		128 x 64 dots, backlight	
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish	
<b>explosion protection</b>			
• ATEX/IECEx			
marking	-	-	CE 0637  II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIC T120 °C Db T <sub>a</sub> -40...+60 °C
certification ATEX	-	-	IBExU11ATEX1015
certification IECEx	-	-	IECEx IBE 11.0008
<b>measuring functions</b>			
physical quantities		volumetric flow rate, mass flow rate, flow velocity, heat flow (if temperature inputs are installed)	
totalizer		volume, mass, optional: heat quantity	
calculation functions		average, difference, sum (2 measuring channels necessary)	
diagnostic functions		sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times	

<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> outside of explosive atmosphere (housing cover open)

<sup>4</sup> with inputs and including parametrization of the transmitter

	FLUXUS F721***-NN0*A	FLUXUS F721**-NN0*S	FLUXUS F721**-A20*S
<b>communication interfaces</b>			
service interfaces	measured value transmission, parametrization of the transmitter: <ul style="list-style-type: none"> <li>• USB<sup>3</sup></li> <li>• LAN<sup>3</sup></li> </ul>		
process interfaces	max. 1 option: <ul style="list-style-type: none"> <li>• RS485 (ASCII sender)</li> <li>• Modbus RTU<sup>4</sup></li> <li>• BACnet MS/TP</li> <li>• M-Bus</li> <li>• HART<sup>4</sup></li> <li>• Profibus PA<sup>4</sup></li> <li>• FF H1<sup>4</sup></li> <li>• Modbus TCP<sup>4</sup></li> <li>• BACnet IP</li> </ul>	max. 1 option: <ul style="list-style-type: none"> <li>• RS485 (ASCII sender)</li> <li>• Modbus RTU<sup>4</sup></li> <li>• BACnet MS/TP</li> <li>• M-Bus</li> <li>• HART<sup>4</sup></li> <li>• Profibus PA<sup>4</sup></li> <li>• FF H1<sup>4</sup></li> <li>• Modbus TCP<sup>4</sup></li> <li>• BACnet IP</li> </ul>	max. 1 option: <ul style="list-style-type: none"> <li>• RS485 (ASCII sender)</li> <li>• Modbus RTU<sup>4</sup></li> <li>• BACnet MS/TP</li> <li>• HART<sup>4</sup></li> <li>• Profibus PA<sup>4</sup></li> <li>• FF H1<sup>4</sup></li> <li>• Modbus TCP<sup>4</sup></li> <li>• BACnet IP</li> </ul>
<b>accessories</b>			
serial data kit	USB cable		
software	<ul style="list-style-type: none"> <li>• FluxDiagReader: download of measured values and parameters, graphical presentation</li> <li>• FluxDiag (optional): download of measurement data, graphical presentation, report generation, parametrization of the transmitter</li> </ul>		
<b>data logger</b>			
loggable values	all physical quantities, totalized values and diagnostic values		
capacity	max. 800 000 measured values		
<b>outputs</b>			
	The outputs are galvanically isolated from the transmitter.		
number	on request		
<b>• switchable current output</b>			
	The switchable current outputs are menu selectable all together as passive or active.		
range	mA	4...20 (3.2...22)	
accuracy		0.04 % of reading ±3 µA	
active output		$R_{ext} < 350 \Omega$	
passive output		$U_{ext} = 8...30 \text{ V}$ , depending on $R_{ext}$ ( $R_{ext} < 1 \text{ k}\Omega$ at 30 V)	
<b>• HART</b>			
range	mA	4...20	
accuracy		0.1 % of reading ±15 µA	
active output		$U_{int} = 24 \text{ V}$ , $R_{ext} < 500 \Omega$	
passive output		$U_{ext} = 10...24 \text{ V DC}$ , depending on $R_{ext}$ ( $R_{ext} < 1 \text{ k}\Omega$ at 24 V)	
<b>• voltage output</b>			
range	V	0...1 or 0...10	
accuracy		0...1 V: 0.1 % of reading ±1 mV 0...10 V: 0.1 % of reading ±10 mV	
internal resistance		$R_{int} = 500 \Omega$	
<b>• frequency output</b>			
range	kHz	0...5	
optorelay		24 V/4 mA, $R_{int} = 66.5 \Omega$	
<b>• binary output</b>			
optorelay		26 V/100 mA	
Reed relay		48 V/100 mA, $R_{int} = 22 \Omega$	
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	optorelay: 1...1000 Reed relay: 80...1000	

<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> outside of explosive atmosphere (housing cover open)

<sup>4</sup> with inputs and including parametrization of the transmitter

	FLUXUS F721**-NN0*A	FLUXUS F721**-NN0*S	FLUXUS F721**-A20*S
<b>inputs</b>			
	The inputs are galvanically isolated from the transmitter.		
number	max. 4, on request		
<b>• temperature input</b>			
type	Pt100/Pt1000		
connection	4-wire		
range	°C	-150...+560	
resolution	K	0.01	
accuracy	±0.01 % of reading ±0.03 K		
<b>• current input</b>			
accuracy	0.1 % of reading ±10 µA		
active input	U <sub>int</sub> = 24 V, R <sub>int</sub> = 50 Ω, P <sub>int</sub> < 0.5 W, not short-circuit proof		
• range	mA	0...20	
passive input	R <sub>int</sub> = 50 Ω, P <sub>int</sub> < 0.3 W		
• range	mA	-20...+20	
<b>• voltage input</b>			
range	V	0...1	
accuracy	0.1 % of reading ±1 mV		
internal resistance	R <sub>int</sub> = 1 MΩ		
<b>• binary input</b>			
switching signal	5...30 V, 1 mA		
functions	<ul style="list-style-type: none"> <li>• resetting the measured values</li> <li>• resetting the totalizers</li> <li>• stopping the totalizers</li> <li>• activation of the measuring mode for highly dynamic flows</li> </ul>		

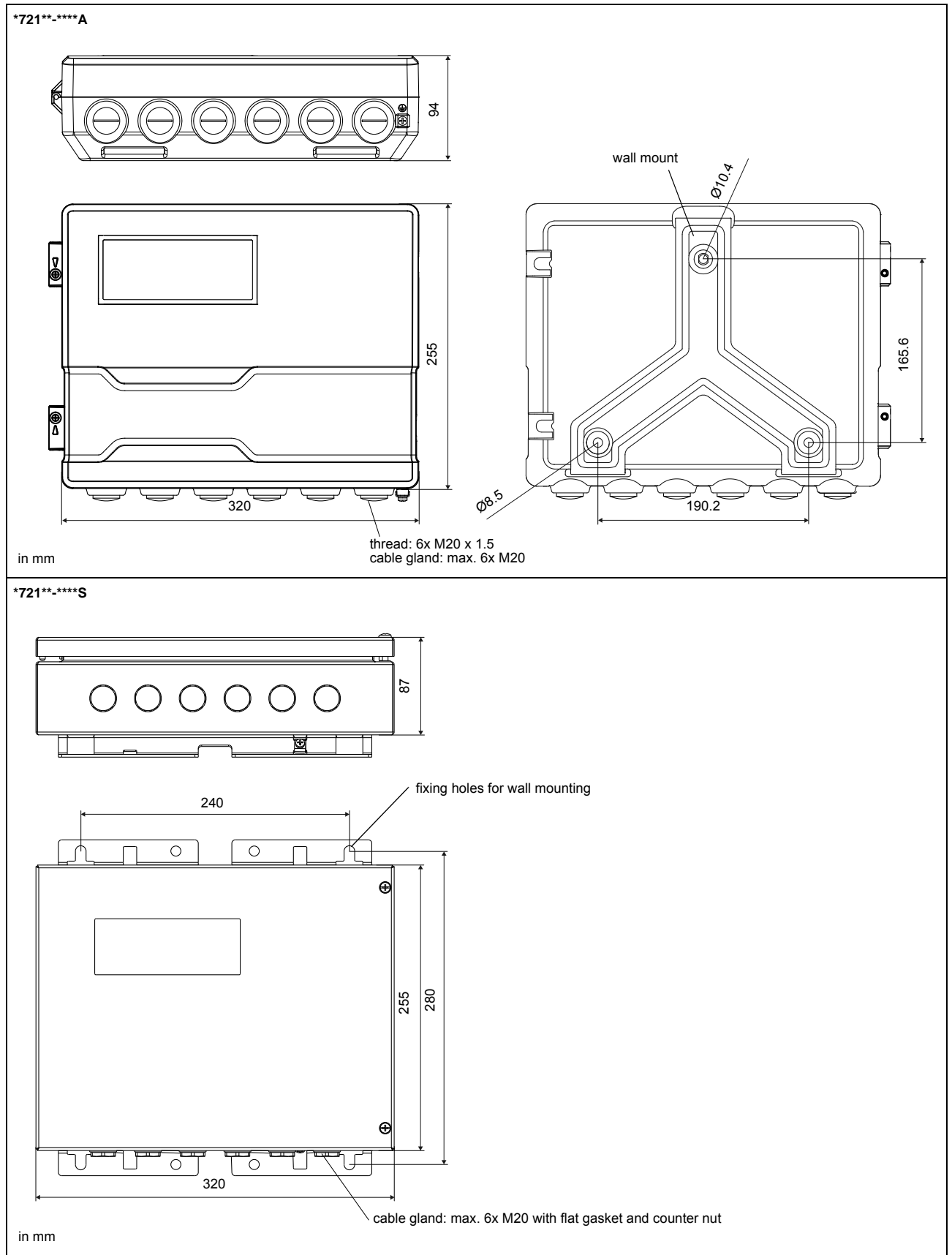
<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> outside of explosive atmosphere (housing cover open)

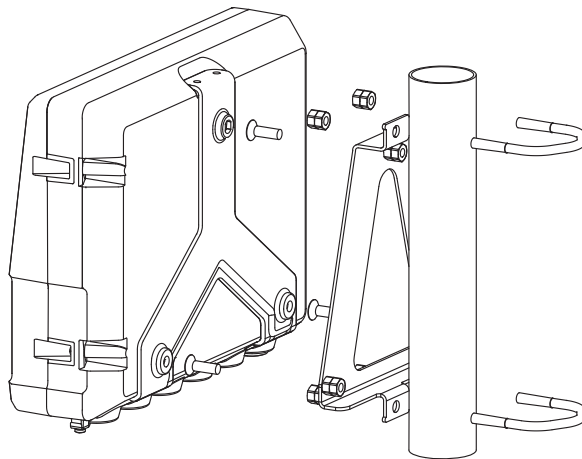
<sup>4</sup> with inputs and including parametrization of the transmitter

## Dimensions

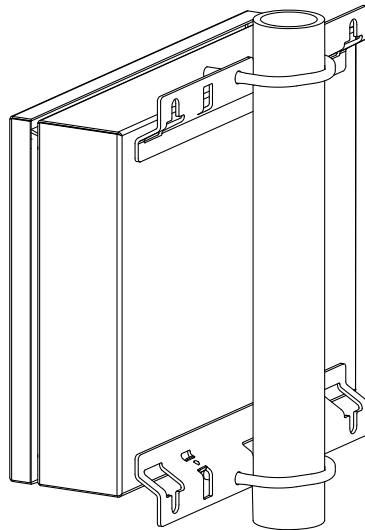


## 2" pipe mounting kit

\*721\*\*\_\*\*\*\*A

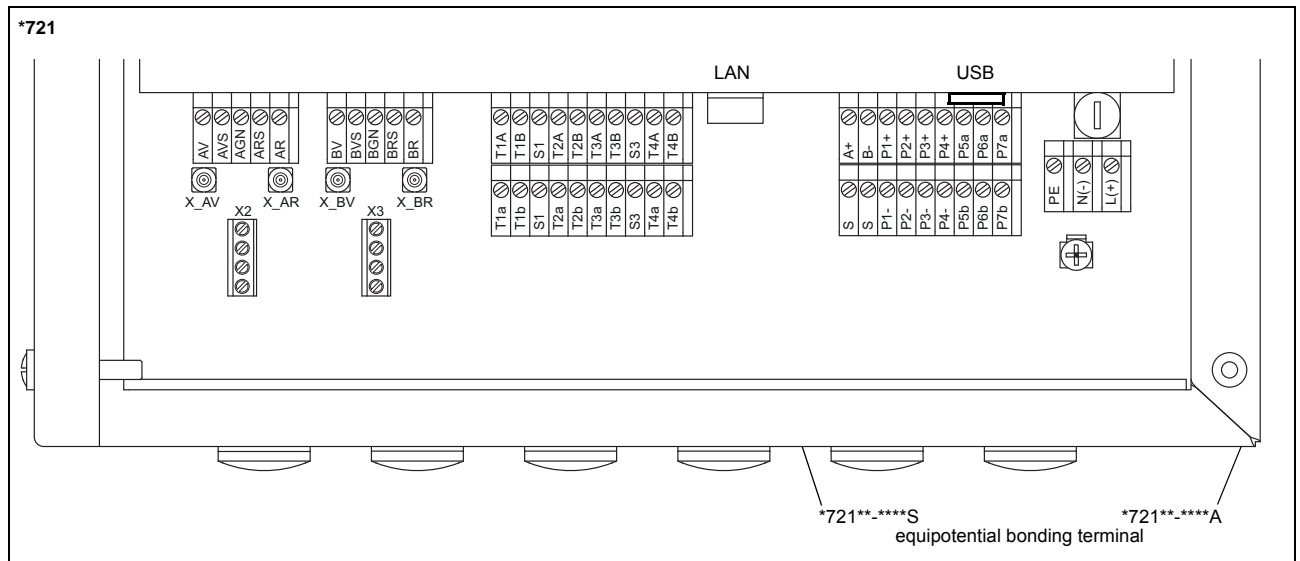


\*721\*\*\_\*\*\*\*S





## Terminal assignment



power supply <sup>1</sup>							
terminal		connection (AC)			connection (DC)		
PE		earth			earth		
N(-)		neutral			-		
L(+)		phase			+		
transducers							
transducer cable (transducers *****8*), 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	signal	BV	signal	↑	X_AV	X_BV	SMB connector
AVS	shield	BVS	shield				
ARS	shield	BRS	shield	⌋	X_AR	X_BR	SMB connector
AR	signal	BR	signal				
outputs <sup>1, 2</sup>							
terminal	connection	terminal	connection	communication interface			
P1+...P4+ P1-...P4-	current output, voltage output, frequency output, binary output (Reed relay), HART (P1)	A+	signal +	<ul style="list-style-type: none"> <li>• RS485<sup>1</sup></li> <li>• Modbus RTU<sup>1</sup></li> <li>• BACnet MS/TP<sup>1</sup></li> <li>• Profibus PA<sup>1</sup></li> <li>• FF H1<sup>1</sup></li> </ul>			
		B-	signal -				
P5a...P7a P5b...P7b	binary output (optorelay)	S	shield				
		USB	type B	<ul style="list-style-type: none"> <li>• service (FluxDiag/FluxDiagReader)</li> <li>• service (FluxDiag/FluxDiagReader)</li> <li>• BACnet IP</li> <li>• Modbus TCP</li> </ul>			
		LAN	RJ45				
analog inputs <sup>1, 2</sup>							
terminal	temperature probe		passive sensor		active sensor		
	direct connection	connection with extension cable	connection	connection	connection		
T1a...T4a	red	red	not connected		not connected		
T1A...T4A	red/blue	grey	-		+		
T1b...T4b	white/blue	blue	+		not connected		
T1B...T4B	white	white	not connected		-		
S1, S3	shield	shield	not connected		not connected		
binary inputs <sup>1, 2</sup>							
terminal							
P1+...P2+, P1-...P2-							


<sup>1</sup> cable (by customer):

- e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.25...2.5 mm<sup>2</sup>
- outer diameter of the cable (\*721\*\*-\*\*\*\*S with ferrite nut): max. 7.6 mm

<sup>2</sup> The number, type and terminal assignment will be customized.

# Transmitter F801

## Technical data

	FLUXUS F801**-A1		FLUXUS F801C24
order code	F801**-A10****-A F801**-A10****-P	F801**-A10****-FF	F801**-A1B
			
design	explosion proof offshore device		
supported transducer frequencies	K, M, P, Q on request: G		
<b>measurement</b>			
measurement principle	transit time difference correlation principle, automatic NoiseTrek selection for measurements with high gaseous or solid content		
flow velocity	m/s	0.01...25	
repeatability	0.15 % of reading $\pm$ 0.005 m/s		
fluid	all acoustically conductive liquids with < 10 % gaseous or solid content in volume (transit time difference principle)		
temperature compensation	corresponding to the recommendations in ANSI/ASME MFC-5.1-2011		
<b>measurement uncertainty (volumetric flow rate)</b>			
measurement uncertainty of measuring system <sup>1</sup>	$\pm$ 0.3 % of reading $\pm$ 0.005 m/s		
measurement uncertainty at the measuring point <sup>2</sup>	$\pm$ 1 % of reading $\pm$ 0.005 m/s		
<b>transmitter</b>			
power supply	<ul style="list-style-type: none"> <li>• 100...230 V/50...60 Hz or</li> <li>• 20...32 V DC or</li> <li>• on request: 11...16 V DC</li> </ul>	• 24 V DC $\pm$ 10 %	
power consumption	W	< 8	< 4
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: 0.07	
housing material	stainless steel 316/316L (1.4401, 1.4404, 1.4432)		
degree of protection	IP66		
dimensions	mm	see dimensional drawing	
weight	kg	6.6	
fixation	wall mounting, 2" pipe mounting		
ambient temperature	°C	-20...+60	-20...+50
display	2 x 16 characters, dot matrix, backlight		
menu language	English, German, French, Dutch, Spanish		
<b>explosion protection</b>			
• ATEX/IECEX			
marking	CE 0637 (Ex) II2G II2D Ex db eb IIC T6 Gb Ex tb IIC T100 °C Db T <sub>a</sub> -20...+60 °C	CE 0637 (Ex) II2G Ex db eb [ib] IIC T4 Gb T <sub>a</sub> -20...+50 °C	
certification ATEX	IBExU05ATEX1078		IBExU05ATEX1078
certification IECEX	IECEX IBE 12.0020		-
intrinsic safety parameters	-		U <sub>m</sub> = 250 V AC intrinsically safe outputs: U <sub>i</sub> = 28.2 V P <sub>i</sub> = 0.76 W L <sub>i</sub> , C <sub>i</sub> negligible
<b>measuring functions</b>			
physical quantities	volumetric flow rate, mass flow rate, flow velocity		
totalizer	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		

<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> connection of the interface RS232 outside of explosive atmosphere (housing cover open)

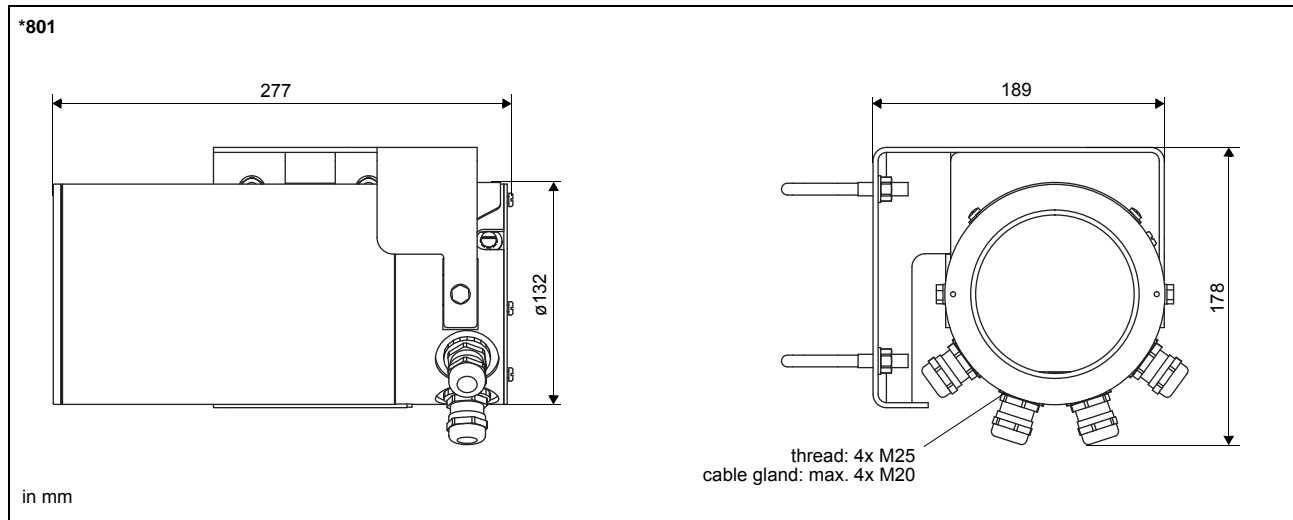
		FLUXUS F801**-A1	FLUXUS F801C24
<b>communication interfaces</b>			
service interfaces		<ul style="list-style-type: none"> <li>• RS232<sup>3</sup></li> <li>• USB (with adapter)<sup>3</sup></li> </ul>	
process interfaces		max. 1 option: <ul style="list-style-type: none"> <li>• RS485 (ASCII sender)</li> <li>• Modbus RTU</li> <li>• HART</li> </ul>	-
<b>accessories</b>			
serial data kit		RS232 RS232 - USB	
software		<ul style="list-style-type: none"> <li>• FluxDiagReader: download of measured values and parameters, graphical presentation</li> <li>• FluxDiag (optional): download of measurement data, graphical presentation, report generation</li> <li>• FluxSubstanceLoader: upload of fluid data sets</li> </ul>	
<b>data logger</b>			
loggable values		all physical quantities, totalized values and diagnostic values	
capacity		> 100 000 measured values	
<b>outputs</b>			
The outputs are galvanically isolated from the transmitter.			
number		<ul style="list-style-type: none"> <li>• current output: 1...2</li> <li>• binary output (open collector): 1...2</li> </ul> or <ul style="list-style-type: none"> <li>• current output: 1...2</li> <li>• binary output (open collector): 1</li> <li>• binary output (Reed relay): 1</li> </ul>	<ul style="list-style-type: none"> <li>• frequency output: 1</li> <li>• binary output (open collector): 1</li> </ul>
<b>• current output</b>			
range	mA	0/4...20	4...20
accuracy		0.1 % of reading ±15 µA	0.1 % of reading ±15 µA
active output		R <sub>ext</sub> < 500 Ω	-
passive output		U <sub>ext</sub> = 4...26.4 V, depending on R <sub>ext</sub> (R <sub>ext</sub> < 1 kΩ at 26.4 V)	U <sub>ext</sub> = 4...28.2 V, depending on R <sub>ext</sub> (R <sub>ext</sub> < 1 kΩ at 28.2 V) intrinsic safety
current output in HART mode		I1	-
• range	mA	4...20	-
• active output		U <sub>int</sub> = 24 V	-
• passive output		U <sub>ext</sub> = 10...24 V	-
<b>• frequency output</b>			
range	kHz	-	0...5
open collector		-	30 V/100 mA I <sub>off</sub> = 0.8 mA optional: 8.2 V DIN EN 60947-5-6 (NAMUR)
<b>• binary output</b>			
open collector		24 V/4 mA	30 V/100 mA I <sub>off</sub> = 0.8 mA 24 V/4 mA intrinsic safety
Reed relay		48 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	

<sup>1</sup> with aperture calibration of the transducers

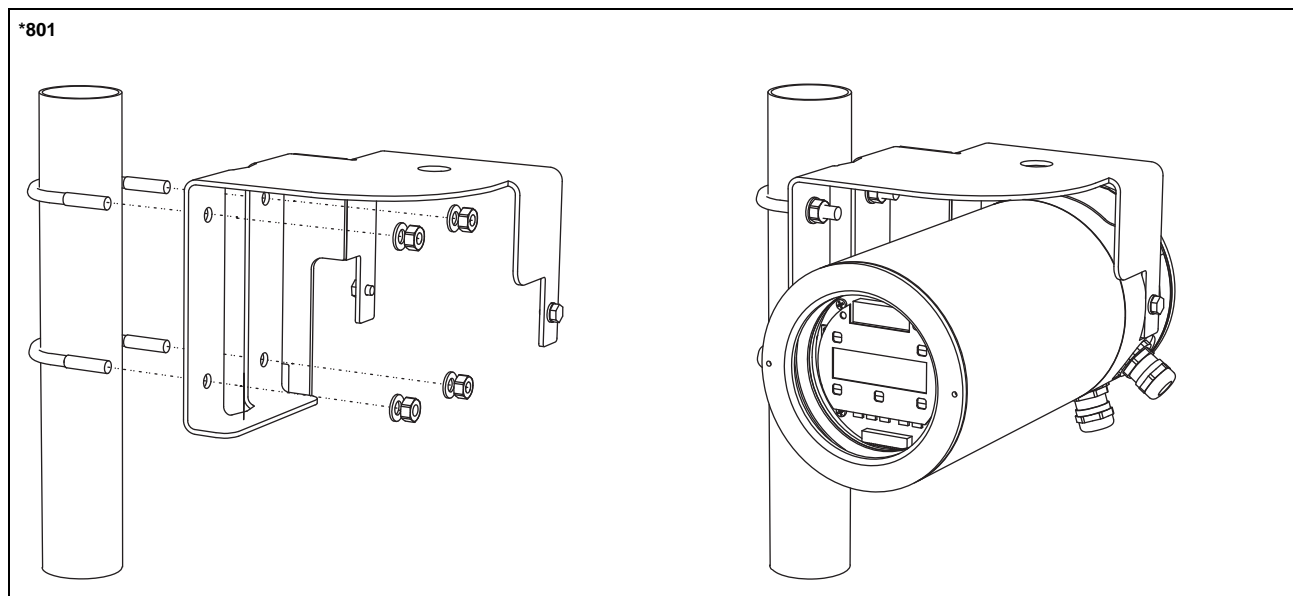
<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> connection of the interface RS232 outside of explosive atmosphere (housing cover open)

### Dimensions



### Wall and 2" pipe mounting kit



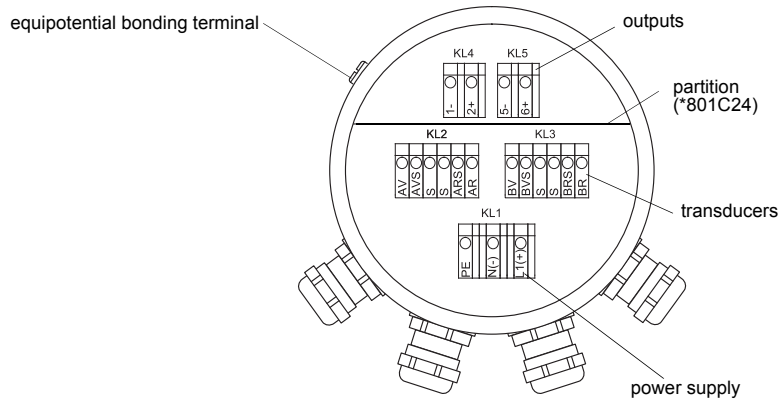
## Terminal assignment

**\*801\*\*-A10\*\*\*\*-A, 801\*\*-A10\*\*\*\*-P**

power supply <sup>1</sup>				
AC		DC		
terminal	connection	terminal	connection	
L1	phase	L+	+	
N	neutral	L-	-	
PE	earth	PE	earth	
transducers, extension cable				
measuring channel A		measuring channel B		transducer
terminal	connection	terminal	connection	
AV	signal	BV	signal	↑
AVS	internal shield	BVS	internal shield	
ARS	internal shield	BRS	internal shield	⚡
AR	signal	BR	signal	
cable gland	external shield	cable gland	external shield	↑ ⚡
outputs <sup>1</sup>				
*801**-A10****-A		*801**-A10****-P		
terminal	connection	terminal	connection	
1(-), 2(+)	active current output I1	1(+), 2(-)	passive current output I1	
3(-), 4(+)	active current output I2 (optional)	3(+), 4(-)	passive current output I2 (optional)	
5(-), 6(+)	binary output B1 (open collector)			
7(-), 8(+)	binary output B2 (open collector, optional)			
9(a), 10(b)	binary output B1 (open collector, Reed relay, optional)			
11(a), 12(b)	binary output B2 (open collector, Reed relay, optional)			
13(B-), 14(A+), 15 (shield)	communication interface			

<sup>1</sup> cable (by customer): e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.25...2.5 mm<sup>2</sup>

**\*801C24, \*801\*\*-A10\*\*\*\*-FF**



**power supply<sup>1</sup>**

AC		DC	
*801**-A10****-FF		*801C24, *801**-A10****-FF	
terminal	connection	terminal	connection
L1	phase	L+	+
N	neutral	L-	-
PE	earth	PE	earth

**transducers, extension cable**

measuring channel A		measuring channel B		transducer
terminal	connection	terminal	connection	
AV	signal	BV	signal	↑
AVS	internal shield	BVS	internal shield	↑
ARS	internal shield	BRS	internal shield	↑
AR	signal	BR	signal	
S	not connected	S	not connected	
cable gland	external shield	cable gland	external shield	↑ ↑


**outputs<sup>1</sup>**

	*801C24	*801**-A10****-FF
colour of terminals	blue (intrinsic safety)	green
terminal	connection	
1(-), 2(+)	current output I1	frequency output F1
5(-), 6(+)	binary output B1	binary output B1

<sup>1</sup> cable (by customer): e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.25...2.5 mm<sup>2</sup>

# Transmitter F809

## Technical data

	FLUXUS F809**-A1	FLUXUS F809**-A1A
		
design	explosion proof field device 1 or 2 measuring channels zone 1	explosion proof field device 1 or 2 measuring channels zone 1 (intrinsically safe current output)
supported transducer frequencies	K, M, P, Q on request: G	K, M, P, Q on request: G
<b>measurement</b>		
measurement principle	transit time difference correlation principle, automatic NoiseTrek selection for measurements with high gaseous or solid content	
flow velocity	m/s	0.01...25
repeatability	0.15 % of reading ±0.005 m/s	
fluid	all acoustically conductive liquids with < 10 % gaseous or solid content in volume (transit time difference principle)	
temperature compensation	corresponding to the recommendations in ANSI/ASME MFC-5.1-2011	
<b>measurement uncertainty (volumetric flow rate)</b>		
measurement uncertainty of measuring system <sup>1</sup>	±0.3 % of reading ±0.005 m/s	
measurement uncertainty at the measuring point <sup>2</sup>	±1 % of reading ±0.005 m/s	
<b>transmitter</b>		
power supply	<ul style="list-style-type: none"> <li>• 100...230 V/50...60 Hz or</li> <li>• 20...32 V DC</li> </ul>	• 20...32 V DC
power consumption	W	< 8
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: 0.07
housing material	cast aluminum, special heavy-duty coating	
degree of protection	IP66	
dimensions	mm	see dimensional drawing
weight	kg	7.1
fixation	wall mounting, 2" pipe mounting	
ambient temperature	°C	-30...+60 (< -20 °C without operation of the display)
display	2 x 16 characters, dot matrix, backlight	
menu language	English, German, French, Dutch, Spanish	
<b>explosion protection</b>		
<b>• ATEX/IECEX</b>		
marking	CE 0637 Ex II2G II2D Ex db eb IIC T6 Gb Ex tb IIIC T100 °C Db T <sub>a</sub> -40...+60 °C	CE 0637 Ex II2G II2D Ex db eb ia IIC T6 Gb Ex tb ia IIIC T100 °C Db T <sub>a</sub> -40...+60 °C
certification ATEX	IBExU11ATEX1022 X	
certification IECEX	IECEX IBE 11.0006X	
intrinsic safety parameters	U <sub>m</sub> = 250 V U <sub>i</sub> = 30 V DC I <sub>i</sub> = 100 mA P <sub>i</sub> = 0.75 W C <sub>i</sub> = 3 nF L <sub>i</sub> negligible	
<b>measuring functions</b>		
physical quantities	volumetric flow rate, mass flow rate, flow velocity	
totalizer	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	

<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> for transit time difference principle and reference conditions

<sup>3</sup> connection of the interface RS232 outside of explosive atmosphere (housing cover open)

		FLUXUS F809**-A1	FLUXUS F809**-A1A
<b>communication interfaces</b>			
service interfaces		<ul style="list-style-type: none"> <li>• RS232<sup>3</sup></li> <li>• USB (with adapter)<sup>3</sup></li> </ul>	
process interfaces		max. 1 option: <ul style="list-style-type: none"> <li>• RS485 (ASCII sender)</li> <li>• Modbus RTU</li> <li>• HART</li> </ul>	<ul style="list-style-type: none"> <li>• HART</li> </ul>
<b>accessories</b>			
serial data kit		RS232	
<ul style="list-style-type: none"> <li>• cable</li> <li>• adapter</li> </ul>		RS232 - USB	
software		<ul style="list-style-type: none"> <li>• FluxDiagReader: download of measured values and parameters, graphical presentation</li> <li>• FluxDiag (optional): download of measurement data, graphical presentation, report generation</li> <li>• FluxSubstanceLoader: upload of fluid data sets</li> </ul>	
<b>data logger</b>			
loggable values		all physical quantities, totaled values and diagnostic values	
capacity		> 100 000 measured values	
<b>outputs</b>			
		The outputs are galvanically isolated from the transmitter.	
number		max. 4	1
<b>• current output</b>			
number		max. 2 (I1, I2)	1 (I1, intrinsic safety)
range	mA	0/4...20	4...20
accuracy		0.1 % of reading ±15 µA	0.04 % of reading ±3 µA
active output		$R_{ext} < 500 \Omega$	-
passive output		$U_{ext} = 4...26.4 \text{ V}$ , depending on $R_{ext}$ ( $R_{ext} < 1 \text{ k}\Omega$ at 26.4 V)	$U_{ext} = 7...30 \text{ V}$ , depending on $R_{ext}$ ( $R_{ext} < 1 \text{ k}\Omega$ at 30 V)
current output in HART mode		I1	I1
<ul style="list-style-type: none"> <li>• range</li> <li>• active output</li> <li>• passive output</li> </ul>	mA	4...20 $U_{int} = 24 \text{ V}$ $U_{ext} = 7...30 \text{ V DC}$	4...20 - $U_{ext} = 7...30 \text{ V DC}$
<b>• frequency output</b>			
number		max. 1	-
range	kHz	0...5	-
open collector		30 V/100 mA or 8.2 V DIN EN 60947-5-6 (NAMUR) or 24 V/4 mA (on request)	-
<b>• binary output</b>			
number		max. 2	-
open collector		24 V/4 mA optional: <ul style="list-style-type: none"> <li>• 30 V/100 mA or</li> <li>• 8.2 V DIN EN 60947-5-6 (NAMUR)</li> </ul>	-
Reed relay		48 V/100 mA	-
binary output as alarm output			
<ul style="list-style-type: none"> <li>• functions</li> </ul>		limit, change of flow direction or error	-
binary output as pulse output			
<ul style="list-style-type: none"> <li>• functions</li> <li>• pulse value</li> <li>• pulse width</li> </ul>	units	mainly for totalizing 0.01...1000 1...1000	- - -

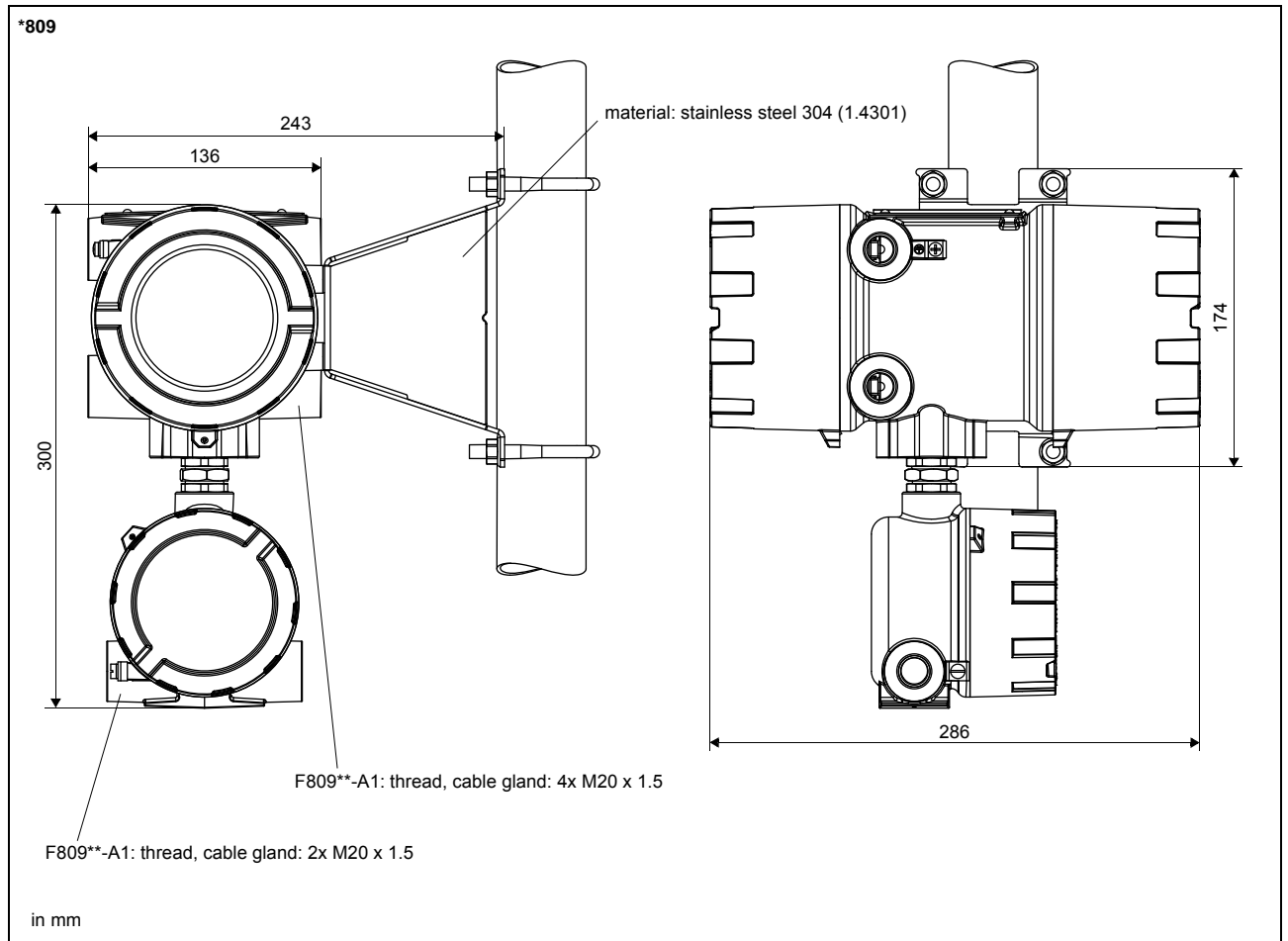
<sup>1</sup> with aperture calibration of the transducers

<sup>2</sup> for transit time difference principle and reference conditions

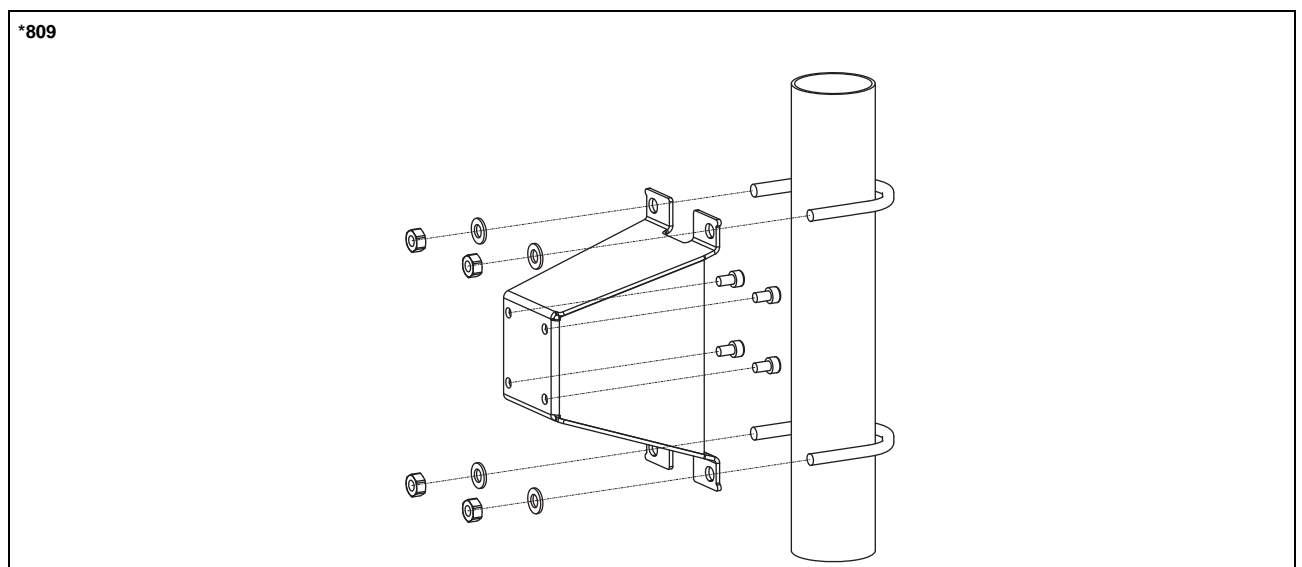
<sup>3</sup> connection of the interface RS232 outside of explosive atmosphere (housing cover open)



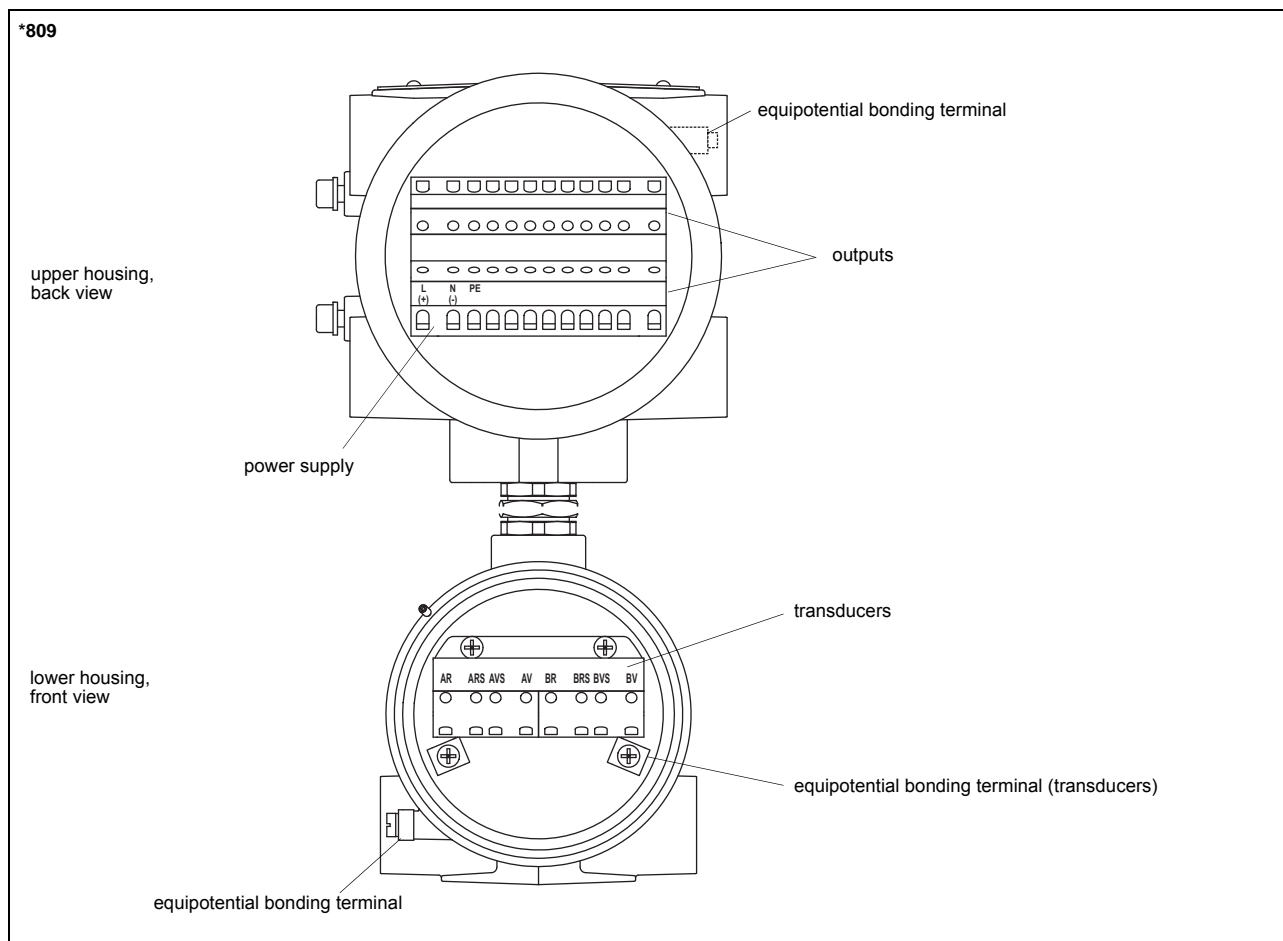
## Dimensions



## Wall and 2" pipe mounting kit



### Terminal assignment



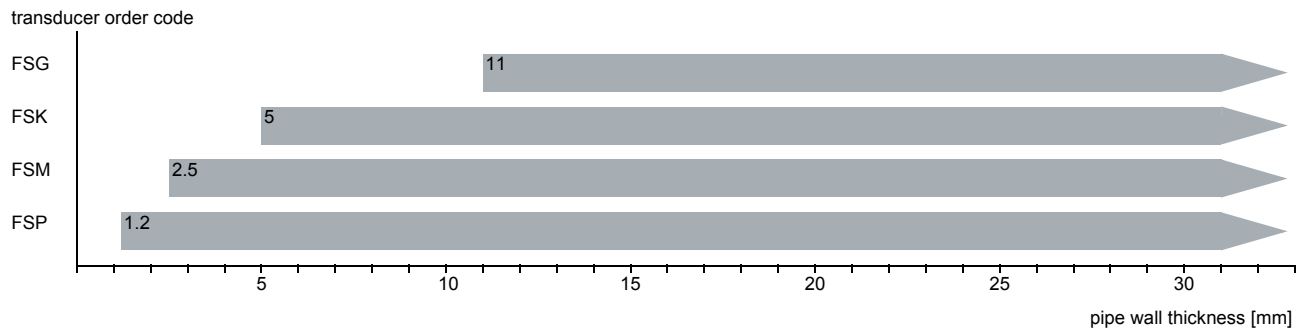
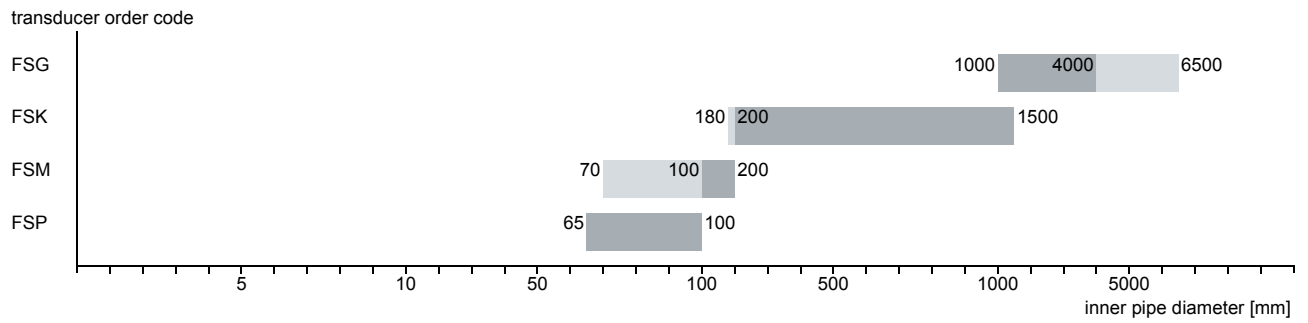
power supply <sup>1</sup>				
AC		DC		
terminal	connection	terminal	connection	
L	phase	L+	+	
N	neutral	N-	-	
PE	earth	PE	earth	
transducers, extension cable				
measuring channel A		measuring channel B		transducer
terminal	connection	terminal	connection	
AV	signal	BV	signal	↑
AVS	internal shield	BVS	internal shield	↑
ARS	internal shield	BRS	internal shield	↑
AR	signal	BR	signal	↑
cable gland or equipotential bonding terminal (transducers)	external shield	cable gland or equipotential bonding terminal (transducers)	external shield	↑ ↑
outputs (options) <sup>1</sup>				
terminal	connection			
1(-), 2(+)	current output I1	frequency output F1		
3(-), 4(+)	current output I2			
5(-), 6(+)	binary output B1 (open collector)			
7(-), 8(+)	binary output B2 (open collector)			
9(-), 10(+)	binary output B1 (Reed relay)	binary output B1 (open collector)		
A+, B-, S	communication interface			

<sup>1</sup> cable (by customer): e.g. flexible leads, with insulated wire end ferrules, lead cross sectional area: 0.25...2.5 mm<sup>2</sup>

## Transducers

### Transducer selection

- for LNG, others on request
- transducer mounting fixture available for outer pipe diameter 70...1000 mm  
on request: 40...70 mm, > 1000 mm



recommended
  possible

### Installation recommendation

inner pipe diameter	measurement arrangement	number of sound paths	min. number of measuring channels
mm			
65...100	diagonal arrangement	3	1
>100...180	reflection arrangement	2	1
>180	diagonal arrangement	1	2

## Technical data

### Shear wave transducers (zone 2 - nonEx, TS)

order code		FSG-N**TS/**	FSK-N**TS/**	FSM-N**TS/**	FSP-N**TS/**
technical type		C(DL)G1N52	C(DL)K1N52	C(DL)M2N52	C(DL)P2N52
transducer frequency	MHz	0.2	0.5	1	2
inner pipe diameter		see Transducer selection			
<b>pipe wall thickness</b>					
min.	mm	11	5	2.5	1.2
<b>material</b>					
housing		PEEK with stainless steel cap 304 (1.4301), ***-*****/OS: 316L (1.4404)			
contact surface		PEEK			
degree of protection		IP67			
<b>transducer cable</b>					
type		1699			
length	m	5		4	
length (**-*****/LC)	m	9			
<b>dimensions</b>					
length l	mm	129.5	126.5	64	
width b	mm	51	51	32	
height h	mm	67	67.5	40.5	
dimensional drawing					
weight (without cable)	kg	0.47	0.36	0.066	
<b>pipe surface temperature<sup>1</sup></b>					
min.	°C	-40			
max.	°C	+130			
<b>ambient temperature</b>					
min.	°C	-40			
max.	°C	+130			
temperature compensation		x			
<b>explosion protection</b>					
• ATEX/IECEX					
order code		FSG-NA2TS/**	FSK-NA2TS/**	FSM-NA2TS/**	FSP-NA2TS/**
pipe surface temperature (Ex)					
• min.	°C	-55			
• max.	°C	gas: +190, dust: +180			
marking		CE 0637 Ex II 3G II 2D Ex nA IIC T6...T2 Gc Ex tb IIIC TX Db			
certification ATEX		IBExU10ATEX1163 X			
certification IECEX		IECEX IBE 12.0005X			

<sup>1</sup> pipe surface temperature when using transducers with WI-CYO: min. -200 °C

The specified temperatures at the transducer contact surface are met if the transducers are installed with the correct insulation and heating.

**Shear wave transducers (zone 1, TS)**

order code		FSG-N*1TS/**	FSK-N*1TS/**	FSM-N*1TS/**	FSP-N*1TS/**
technical type		C(DL)G1N81	C(DL)K1N81	C(DL)M2N81	C(DL)P2N81
transducer frequency	MHz	0.2	0.5	1	2
inner pipe diameter		see Transducer selection			
<b>pipe wall thickness</b>					
min.	mm	11	5	2.5	1.2
<b>material</b>					
housing		PEEK with stainless steel cap 304 (1.4301), ***-****/OS: 316L (1.4404)			
contact surface		PEEK			
degree of protection		IP65	IP66		
<b>transducer cable</b>					
type		1699			
length	m	5		4	
length (**-****/LC)	m	9			
<b>dimensions</b>					
length l	mm	129.5	126.5	64	
width b	mm	51	51	32	
height h	mm	67	67.5	40.5	
dimensional drawing					
weight (without cable)	kg	0.47	0.36	0.066	
<b>pipe surface temperature<sup>1</sup></b>					
min.	°C	-40			
max.	°C	+130			
<b>ambient temperature</b>					
min.	°C	-40			
max.	°C	+130			
temperature compensation		x			
<b>explosion protection</b>					
<b>• ATEX/IECEX</b>					
order code		FSG-NA1TS/**	FSK-NA1TS/**	FSM-NA1TS/**	FSP-NA1TS/**
pipe surface temperature (Ex)					
• min.	°C	-55			
• max.	°C	+180			
marking		CE 0637 (E) II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC TX Db			
certification ATEX		IBExU07ATEX1168 X			
certification IECEX		IECEX IBE 08.0007X			
remark		F801, F809: on request			

<sup>1</sup> pipe surface temperature when using transducers with WI-CYO: min. -200 °C  
 The specified temperatures at the transducer contact surface are met if the transducers are installed with the correct insulation and heating.

# Transducer mounting fixture

## Order code

1...6	7	8	9	10	11...13	14	15	no. of character	
Waveinjector	transducer	measurement arrangement	size	fixation	outer pipe diameter <sup>1</sup>	coupling foil	tool	option	description
WI-CYO									type
	K								shear wave transducers with transducer frequency G, K
	M								shear wave transducers with transducer frequency M, P
		D							reflection arrangement or diagonal arrangement
			L						large
				C					chains
					017				70...170 mm
					038				80...380 mm
					056				350...560 mm
					085				560...850 mm
					100				600...1000 mm
						D			coupling foil -200...+80 °C
							A		automatic WI tool
							M		mechanical WI tool (pipe planer)
							O		WIT-R tool 110 V
							R		WIT-R tool 230 V
							N		without tool
								B	cryo insulation boxes for measuring channel (without transducer heating system)

<sup>1</sup> outer pipe diameter > 1000 mm on request

**Waveinjector WI-CYO**

dimensions:

- length:  $2 \cdot l + l_{cp}$   
 $l = 273 \text{ mm}$   
 $l_{cp} = \text{depending on application}$
- width:  
 outer pipe diameter + 32 mm  
 (min. 203 mm)
- height:  
 outer pipe diameter +  $2 \cdot h$   
 $h = 285 \text{ mm}$

material: stainless steel 304 (1.4301)

## Coupling materials for transducers

type	ambient temperature °C	position
coupling foil type SI	-40...+80	coupling plate - transducer
coupling foil type D	-200...+80	pipe - coupling plate

## Connection systems

connection system TS		
connection with extension cable	direct connection	transducers technical type
JB01 		****6*
JB02, JB03 		****52

### Cable

transducer cable		
type		1699
weight	kg/m	0.094
ambient temperature	°C	-55...+200
properties		
<b>cable jacket</b>		
material		PTFE
outer diameter	mm	2.9
thickness	mm	0.3
colour		brown
shield		x
<b>sheath</b>		
material		stainless steel 304 (1.4301) option OS: 316Ti (1.4571)
outer diameter	mm	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
<b>cable jacket</b>			
material		PUR	PUR
outer diameter	mm	12	12
thickness	mm	2	2
colour		black	black
shield		x	x
<b>sheath</b>			
material		-	steel wire braid with copolymer sheath
outer diameter	mm	-	15.6



**Cable length**

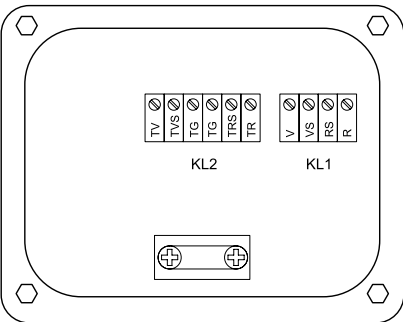
transducer frequency		G, K		M, P	
<b>connection system TS</b>					
<b>transducers technical type</b>		x	l	x	l
*D***8* *D***5*	m	5	≤ 300	4	≤ 300
option LC: *L***8* *L***5*	m	9	≤ 300	9	≤ 300

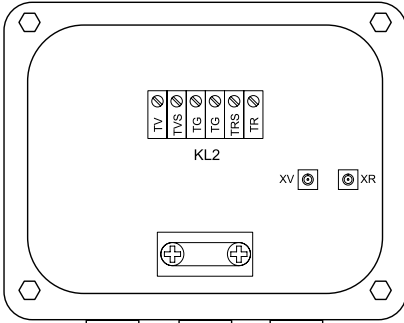
x - transducer cable length

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

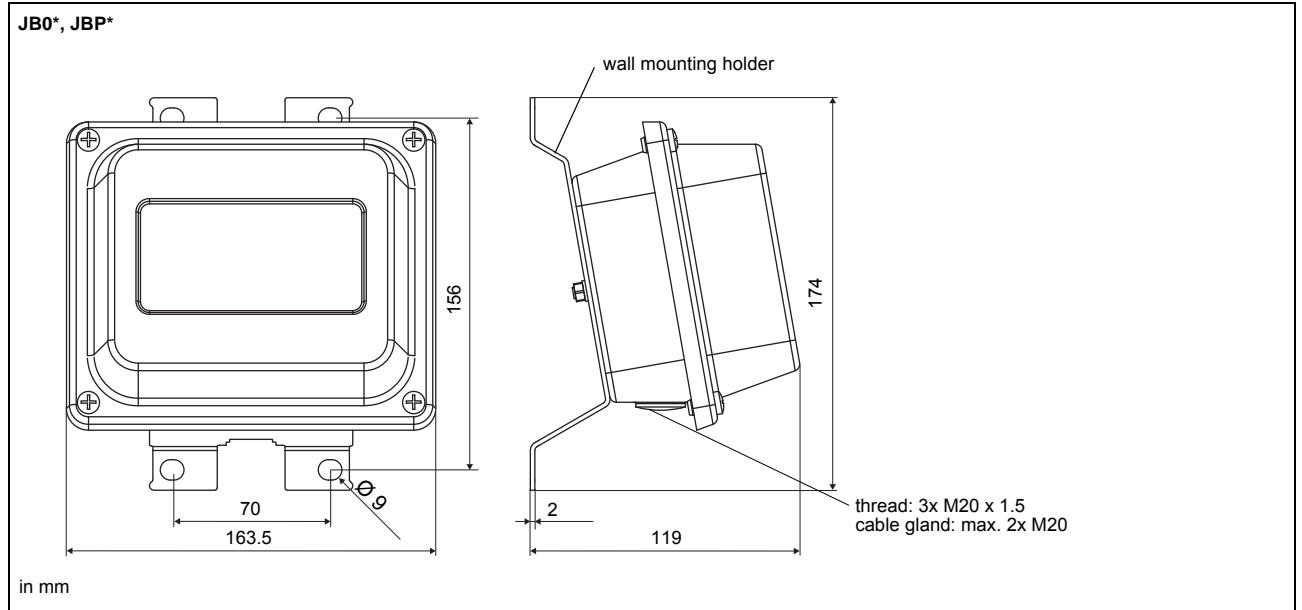
# Junction box

## Technical data

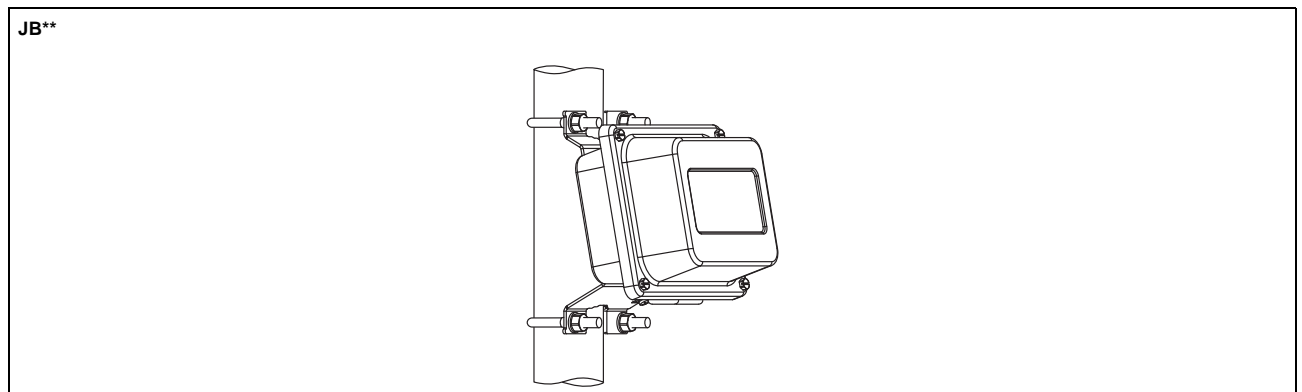
JB01S4E3M																															
weight	kg	1.2 kg																													
fixation		wall mounting optional: 2" pipe mounting																													
<b>material</b>																															
housing		stainless steel 316L (1.4404)																													
gasket		silicone																													
degree of protection		IP67																													
<b>ambient temperature</b>																															
min.	°C	-40																													
max.	°C	+80																													
<b>explosion protection</b>																															
• ATEX/IECEX																															
marking		CE 0637 Ex II2G II2D Ex eb mb IIC T6...T4 Gb Ex tb IIIC T100 °C Db Ta -40...+70/80 °C																													
certification ATEX		IBExU06ATEX1161																													
certification IECEX		IECEX IBE 08.0006																													
type of protection		gas: increased safety decoupled network: encapsulation dust: protection by enclosure																													
<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p><b>Connection</b></p>  </div> <div style="width: 60%;"> <p><b>Transducers</b></p> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> <th>transducer</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL1</td> <td>V</td> <td>signal</td> <td>↑</td> </tr> <tr> <td>VS</td> <td>internal shield</td> <td></td> </tr> <tr> <td>RS</td> <td>internal shield</td> <td>⤴</td> </tr> <tr> <td>R</td> <td>signal</td> <td></td> </tr> </tbody> </table> <p><b>Extension cable</b></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>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> </div> </div>			terminal strip	terminal	connection	transducer	KL1	V	signal	↑	VS	internal shield		RS	internal shield	⤴	R	signal		terminal strip	terminal	connection	KL2	TV	signal	TVS	internal shield	TRS	internal shield	TR	signal
terminal strip	terminal	connection	transducer																												
KL1	V	signal	↑																												
	VS	internal shield																													
	RS	internal shield	⤴																												
	R	signal																													
terminal strip	terminal	connection																													
KL2	TV	signal																													
	TVS	internal shield																													
	TRS	internal shield																													
	TR	signal																													

JB02, JB03																							
weight	kg	1.2 kg																					
fixation		wall mounting optional: 2" pipe mounting																					
<b>material</b>																							
housing		stainless steel 316L (1.4404)																					
gasket		silicone																					
degree of protection		IP67																					
<b>ambient temperature</b>																							
min.	°C	-40																					
max.	°C	+80																					
<b>explosion protection</b>																							
• ATEX																							
junction box		JB02																					
marking		CE Ex II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc IIIC T 100 °C Dc Ta -40...+(70)80 °C																					
<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p><b>Connection</b></p>  </div> <div style="width: 60%;"> <p><b>Transducers</b></p> <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> <p><b>Extension cable</b></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>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> </div> </div>			terminal	connection	transducer	XV	SMB connector	↑	XR	SMB connector	⤴	terminal strip	terminal	connection	KL2	TV	signal	TVS	internal shield	TRS	internal shield	TR	signal
terminal	connection	transducer																					
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XR	SMB connector	⤴																					
terminal strip	terminal	connection																					
KL2	TV	signal																					
	TVS	internal shield																					
	TRS	internal shield																					
	TR	signal																					

## Dimensions



## 2" pipe mounting kit



## Transducer heating system (optional)

### Continuous operation

fluid temperature < -40 °C: transducer heating system required

### Cycle operation

operating time in cycle operation > 12 h: transducer heating system required

operating time in cycle operation < 12 h and rest period ≥ 2x operating time: see table below

fluid temperature °C	ambient temperature °C					
	-30	-20	-10	0	+10	+20
-200	x	x	x	x	x	x
-190	x	x	x	x	x	x
-180	x	x	x	x	x	
-170	x	x	x	x	x	
-160	x	x	x	x		
-150	x	x	x	x		
-140	x	x	x	x		
-130	x	x	x			
-120	x	x	x			
-110	x	x				
-100	x	x				
-90	x	x				
-80	x					
-70	x					

x - transducer heating system required

### Technical data

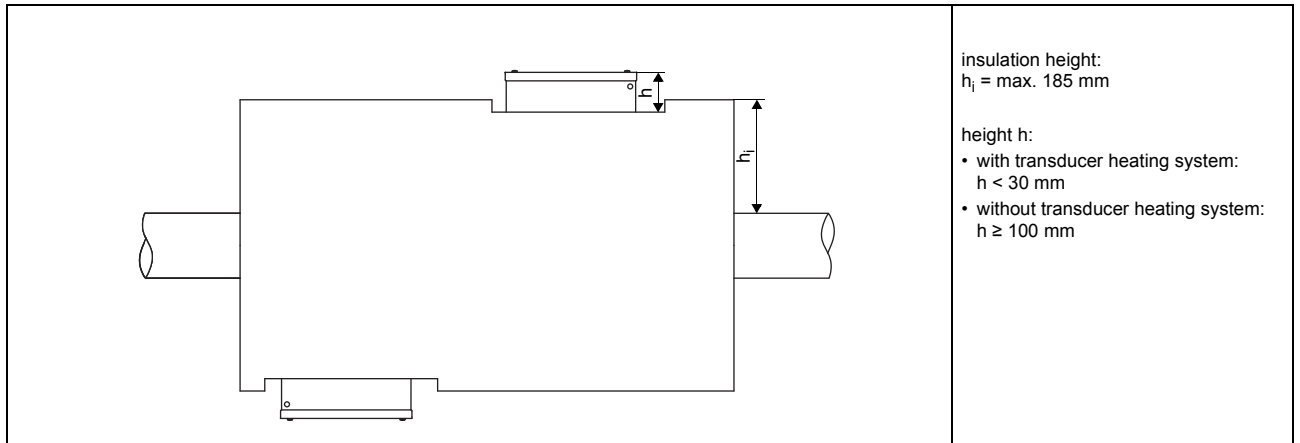
type	BARTEC PSB	
order code	ACC-PE-F***-CY1 (1 measuring channel)	ACC-PE-F***-CY2 (2 measuring channels)
power supply <sup>1</sup>	208...254 V AC	
<b>consisting of</b>		
heating element	2x PSB 33, 07-5801-2335 power consumption: 2x 44 W	4x PSB 33, 07-5801-2335 power consumption: 4x 44 W
connection system	2x PLEXO TCS 27-59P1-1010	4x PLEXO TCS 27-59P1-1010
junction box PSB	1x 07-5103-2201/2090	1x 07-5103-2201/2090
explosion protection	ATEX, IECEx, TR TS	

<sup>1</sup> on request: 120 V AC

### Cable junction box PSB - heating element

type	H05SS-F	
length	m	10
max. length	m	on request
weight	kg/ m	0.11
ambient temperature	°C	-60...+180
installation temperature	°C	-20...+50
bend radius	7.5 D	
<b>cable jacket</b>		
material	rubber	
outer diameter	mm	8...10.4
colour	black	
shield	-	

## Insulation



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e-mail: [info@flexim.com](mailto:info@flexim.com)

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