FLEXIM

Technical specification

FLUXUS Cryo

Non-invasive flow measurement of cryogenic liquids

FLUXUS Cryo extends the application range of the ultrasonic clamp-on flow measurement with WaveInjector Cryo to cryogenic temperatures up to -200 °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...+80 °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

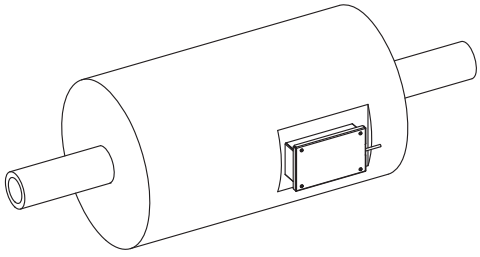
F72*

F801

F809

Transmitters FLUXUS Cryo

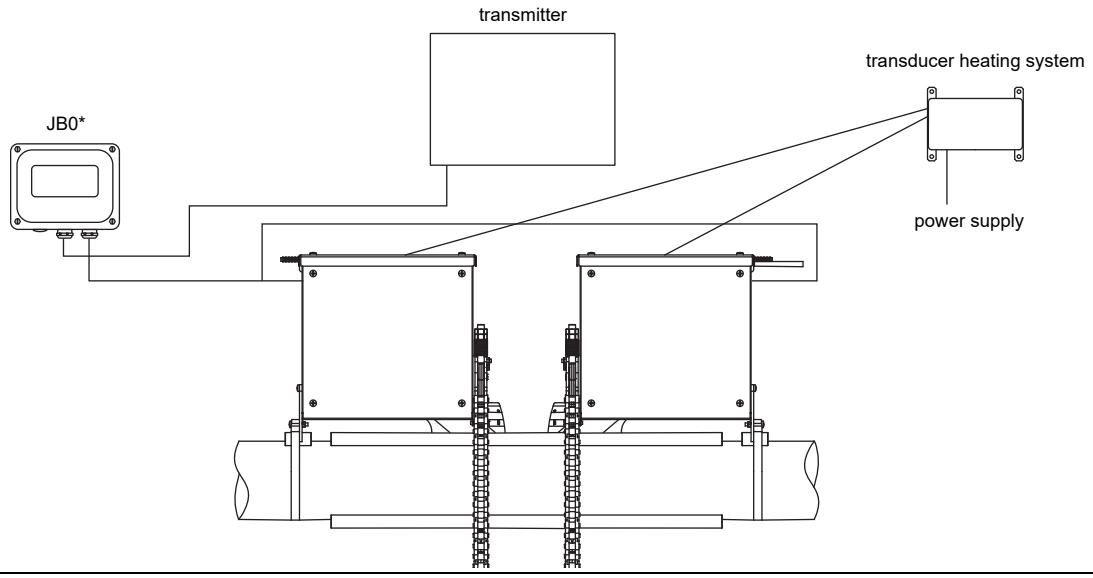
WaveInjector Cryo



WaveInjector Cryo integrated in insulation

Typical measurement setup

Example of a reflection arrangement with transducer heating system



Transmitter F72*

Technical data

		FLUXUS F721**-NN0*A F721**-NN0*S	FLUXUS F721**-A20*A F721**-A20*S	FLUXUS F721**-F20*A F721**-F20*S	FLUXUS F722**-NN0*A F722**-NN0*S	FLUXUS F722**-A20*A F722**-A20*S	FLUXUS F722**-F20*A F722**-F20*S
							
design		standard field device	standard field device zone 2	standard field device FM Class I Div. 2	standard field device	standard field device zone 2	standard field device FM Class I Div. 2
measurement							
measurement principle		transit time difference correlation principle, automatic NoiseTrek selection for measurements with high gaseous or solid content					
synchronised channel averaging		-			x (2 measuring channels necessary)		
flow velocity	m/s	0.01...25					
repeatability		0.15 % MV ±0.005 m/s					
fluid		liquefied natural gas (LNG), liquid ethane,liquid nitrogen, liquid oxygen					
temperature compensation		corresponding to the recommendations in ANSI/ASME MFC-5.1-2011					
measurement uncertainty (volumetric flow rate)							
measurement uncertainty of the measuring system[1]		±0.3 % MV ±0.005 m/s					
measurement uncertainty at the measuring point[2]		±1 % MV ±0.005 m/s					
transmitter							
power supply		• 100...230 V/50...60 Hz or • 20...32 V DC or • 11...16 V DC					
power consumption	W	< 15					
number of measuring channels		1, optional: 2			1, optional: 2 (1 measuring point)		
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		aluminum housing: IP66/NEMA 4X stainless steel housing: IP65	IP66		aluminum housing: IP66/NEMA 4X stainless steel housing: IP65
dimensions	mm	see dimensional drawing					
weight	kg	aluminum housing: 5.4 stainless steel housing: 5.1					
fixation		wall mounting, optional: 2" pipe mounting					
ambient temperature	°C	-40...+60 (< -20 without operation of the display)		aluminum housing: -40...+55/60 (< -20 without operation of the display) stainless steel housing: -20...+55/60	-40...+60 (< -20 without operation of the display)		aluminum housing: -40...+55/60 (< -20 without operation of the display) stainless steel housing: -20...+55/60
display		128 x 64 pixels, backlight					
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian					
explosion protection							
• ATEX/IECEx							
marking		-	CE 0637 Ex II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 °C Db T_a -40...+60 °C	-	-	CE 0637 Ex II3G II2D Ex nA nC ic IIC T4 Gc Ex tb IIIC T120 °C Db T_a -40...+60 °C	-
certification ATEX		-	IBExU11ATEX1015	-	-	IBExU11ATEX1015	-
certification IECEx		-	IECEx IBE 11.0008	-	-	IECEx IBE 11.0008	-

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] outside the explosive atmosphere (housing cover open)

		FLUXUS F721-NN0*A F721**-NN0*S**	**FLUXUS F721**-A20*A F721**-A20*S**	**FLUXUS F721**-F20*A F721**-F20*S**	**FLUXUS F722**-NN0*A F722**-NN0*S**	**FLUXUS F722**-A20*A F722**-A20*S**	**FLUXUS F722**-F20*A F722**-F20*S**
• FM							
marking		-	-	F721**-F20**2, F721**-F20**3: FM APPROVED NI/Cl. I,II,III/ Div. 2/GP. A,B,C,D,E, F,G/ T5 F721**-F20**1: FM APPROVED NI/Cl. I,II,III/ Div. 2/GP. A,B,C,D,E, F,G/ T4A	-	-	F722**-F20**2, F722**-F20**3: FM APPROVED NI/Cl. I,II,III/ Div. 2/GP. A,B,C,D,E, F,G/ T5 F722**-F20**1: FM APPROVED NI/Cl. I,II,III/ Div. 2/GP. A,B,C,D,E, F,G/ T4A
measuring functions							
physical quantities		volumetric flow rate, mass flow rate, flow velocity, thermal energy rate (if temperature inputs are installed)					
totaliser		volume, mass, optional: thermal energy					
calculation functions		average, difference, sum (2 measuring channels necessary)					
diagnostic functions		sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times					
communication interfaces							
service interfaces		measured value transmission, parametrisation of the transmitter: • USB[3] • LAN[3]					
process interfaces		max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • M-Bus • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • M-Bus • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP
accessories							
data transmission kit		USB cable					
software		• FluxDiagReader: reading of measured values and parameters, graphical representation • FluxDiag (optional): reading of measurement data, graphical representation, report generation, parametrisation of the transmitter					
data logger							
loggable values		all physical quantities, totalised physical quantities and diagnostic values					
capacity		max. 800 000 measured values					
outputs							
		The outputs are galvanically isolated from the transmitter.					
number		on request					
• switchable current output							
		All switchable current outputs are jointly switched to active or passive.					
range	mA	4...20 (3.2...22)					
accuracy		0.04 % MV ±3 µA					
active output		R_{ext} < 250 Ω					
passive output		U_{ext} = 8...30 V, depending on R_{ext} (R_{ext} < 1 kΩ at 30 V)					
• HART							
range	mA	4...20					
accuracy		0.1 % MV ±15 µA					
active output		U_{int} = 24 V, R_{ext} < 500 Ω					
passive output		U_{ext} = 10...24 V DC, depending on R_{ext} (R_{ext} < 1 kΩ at 24 V)					
• voltage output							
range	V	0...1 or 0...10					
accuracy		0...1 V: 0.1 % MV ±1 mV 0...10 V: 0.1 % MV ±10 mV					
internal resistance		R_{int} = 500 Ω					
• frequency output							
range	kHz	-	0...5	-	-		
optorelay		-	24 V/4 mA, R_{int} = 66.5 Ω	-	-		

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] outside the explosive atmosphere (housing cover open)

		FLUXUS F721**-NN0*A F721**-NN0*S	FLUXUS F721**-A20*A F721**-A20*S	FLUXUS F721**-F20*A F721**-F20*S	FLUXUS F722**-NN0*A F722**-NN0*S	FLUXUS F722**-A20*A F722**-A20*S	FLUXUS F722**-F20*A F722**-F20*S
• binary output							
optorelay		-	26 V/100 mA	-	-		
Reed relay		-	48 V/100 mA, R_{int} = 22 Ω	-	-		
binary output as alarm output							
• functions		-	limit, change of flow direction or error	-	-		
binary output as pulse output							
• functions		-	mainly for totalising	-	-		
• pulse value	units	-	0.01...1000	-	-		
• pulse width	ms	-	optorelay: 1...1000 Reed relay: 80...1000	-	-		
• digital output							
functions		• frequency output • binary output • pulse output	-	• frequency output • binary output • pulse output			
number		3	-	3			
operating parameters		5...30 V/< 100 mA	-	5...30 V/< 100 mA			
frequency output							
• range	kHz	0...5	-	0...5			
binary output							
• binary output as alarm output		limit, change of flow direction or error	-	limit, change of flow direction or error			
pulse output							
• functions		mainly for totalising	-	mainly for totalising			
• pulse value	units	0.01...1000	-	0.01...1000			
• pulse width	ms	0.05...1000	-	0.05...1000			
inputs							
		The inputs are galvanically isolated from the transmitter.					
number		max. 4, on request					
• temperature input							
type		Pt100/Pt1000					
connection		4-wire					
range	°C	-150...+560					
resolution	K	0.01					
accuracy		±0.01 % MV ±0.03 K					
• current input							
accuracy		0.1 % MV ±10 µA					
active input		U_{int} = 24 V, R_{int} = 50 Ω, P_{int} < 0.5 W, not short-circuit proof					
• range	mA	0...20					
passive input		R_{int} = 50 Ω, P_{int} < 0.3 W					
• range	mA	-20...+20					
• voltage input							
range	V	0...1					
accuracy		0.1 % MV ±1 mV					
internal resistance		R_{int} = 1 MΩ					
• binary input							
switching signal		5...30 V, 1 mA		5...26 V, 1 mA	5...30 V, 1 mA		5...26 V, 1 mA
functions		• reset of the measured values • reset of the totalisers • stop of the totalisers • activation of the measuring mode for highly dynamic flows					

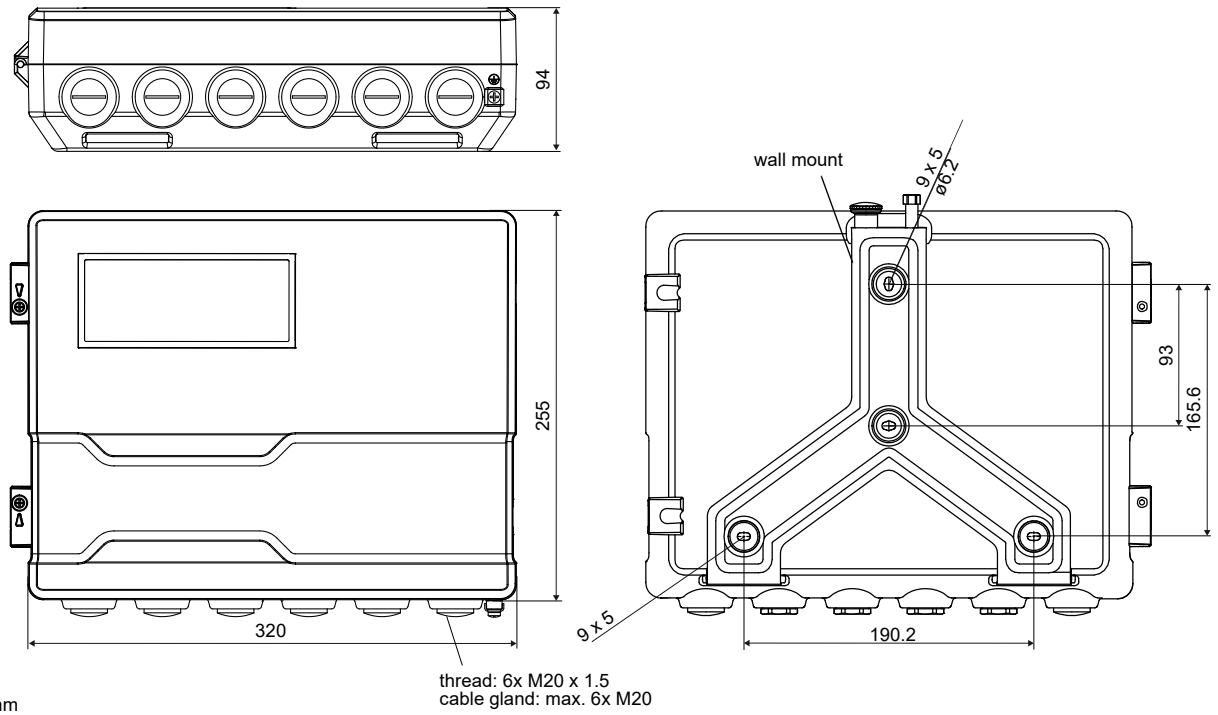
[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] outside the explosive atmosphere (housing cover open)

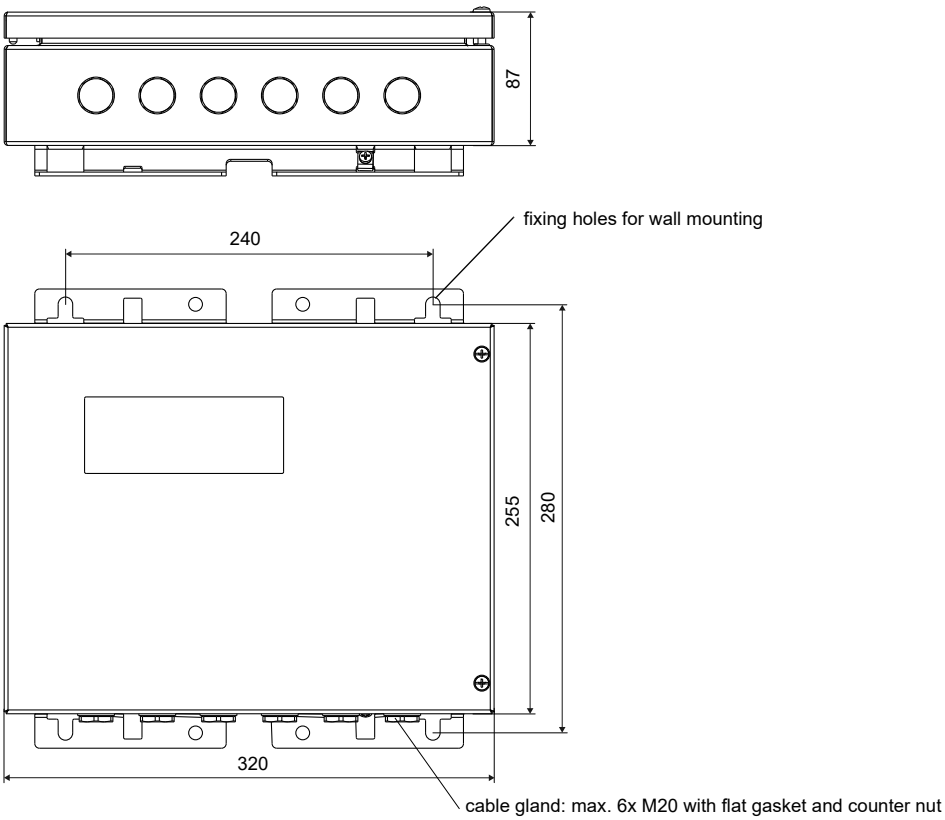
Dimensions

72-****A**



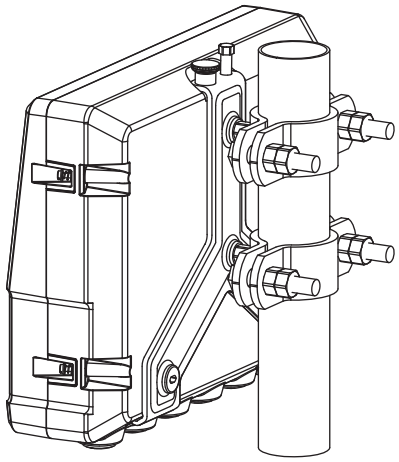
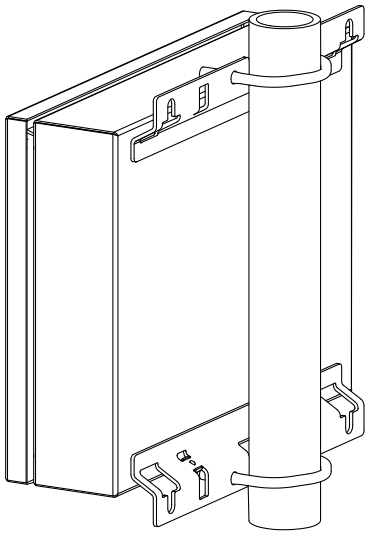
in mm

72-****S**



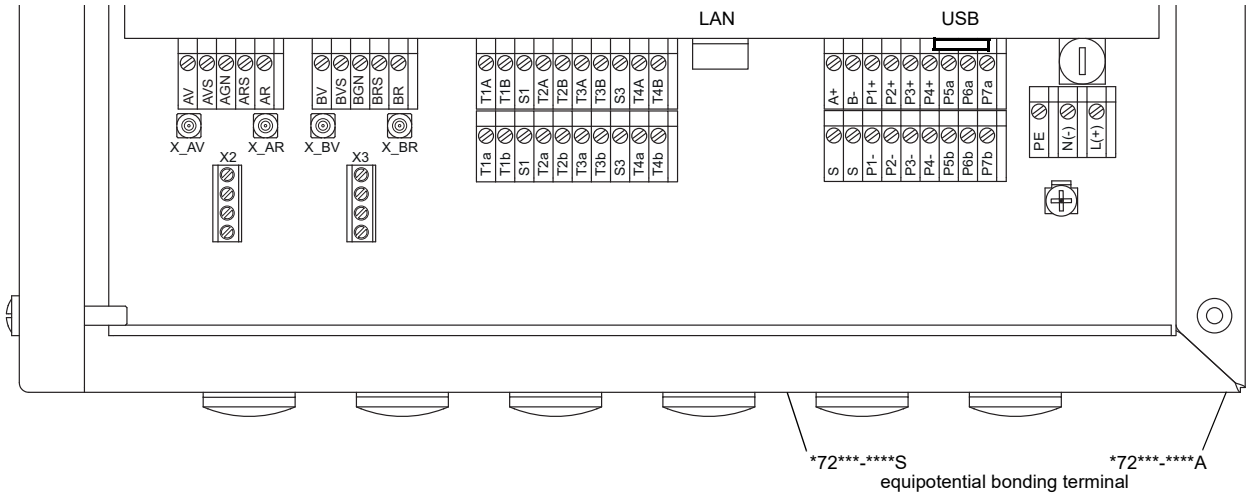
in mm

2" pipe mounting kit

72-****A** 	order code: ACC-PE-*721-/PMK4
72-****S** 	order code: ACC-PE-*721-/PMK6

Terminal assignment

72



power supply[1]		
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**		**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[1, 2]

terminal	**connection**
P1+...P4+ P1-...P4-	current output, voltage output, frequency output, binary output (Reed relay), HART (P1)
P5a...P7a P5b...P7b	binary output (optorelay), digital output

terminal	**connection**	**communication interface**
A+	signal +	• RS485[1] • Modbus RTU[1] • BACnet MS/TP[1] • Profibus PA[1] • FF H1[1]
B-	signal -	
S	shield	
USB	type B Hi-Speed USB 2.0 Device	• service (FluxDiag/ FluxDiagReader)
LAN	RJ45 10/100 Mbps Ethernet	• service (FluxDiag/ FluxDiagReader) • BACnet IP • Modbus TCP

analog inputs[1, 2]

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

binary inputs[1, 2]

terminal
P1+...P2+, P1-...P2-

[1] cable (by customer):
- e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm^2
- outer diameter of the cable (*72***-****S with ferrite nut): max. 7.6 mm

[2] The number, type and terminal assignment are customised.

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		
measurement				
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 % MV ±0.005 m/s		
fluid		liquefied natural gas (LNG), liquid ethane,liquid nitrogen, liquid oxygen		
temperature compensation		corresponding to the recommendations in ANSI/ASME MFC-5.1-2011		
measurement uncertainty (volumetric flow rate)				
measurement uncertainty of the measuring system[1]		±0.3 % MV ±0.005 m/s		
measurement uncertainty at the measuring point[2]		±1 % MV ±0.005 m/s		
transmitter				
power supply		• 100...230 V/50...60 Hz or • 20...32 V DC or • on request: 11...16 V DC		• 24 V DC ±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		
explosion protection				
• ATEX/IECEx				
marking		CE 0637 Ex II2G II2D Ex db eb IIC T6 Gb Ex tb IIIC T100 °C Db T_a -20...+60 °C		CE 0637 Ex II2G Ex db eb [ib] IIC T4 Gb T_a -20...+50 °C
certification ATEX		IBExU05ATEX1078		IBExU05ATEX1078
certification IECEx		IECEx IBE 12.0020		-
intrinsic safety parameters		-		U_m = 250 V intrinsically safe outputs: U_i = 28.2 V P_i = 0.76 W L_i, C_i negligible
measuring functions				
physical quantities		volumetric flow rate, mass flow rate, flow velocity		
totaliser		volume, mass		
calculation functions		average, difference, sum (2 measuring channels necessary)		
diagnostic functions		sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times		

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] connection of the RS232 interface outside the explosive atmosphere (housing cover is open)

		FLUXUS F801**-A1		FLUXUS F801C24
communication interfaces				
service interfaces		• RS232[3] • USB (with adapter)[3]		
process interfaces		max. 1 option: • RS485 (ASCII sender) • Modbus RTU • HART	-	-
accessories				
data transmission kit • cable • adapter		 RS232 RS232 - USB		
software		• FluxDiagReader: reading of measured values and parameters, graphical representation • FluxDiag (optional): reading of measurement data, graphical representation, report generation		
data logger				
loggable values		all physical quantities, totalised physical quantities and diagnostic values		
capacity		> 100 000 measured values		
outputs				
		The outputs are galvanically isolated from the transmitter.		
number		• current output: 1...2 • binary output (open collector): 1...2 or • current output: 1...2 • binary output (open collector): 1 • binary output (Reed relay): 1	• frequency output: 1 • binary output (open collector): 1	• current output: 1 • binary output (open collector): 1
• current output				
range	mA	0/4...20	-	4...20
accuracy		0.1 % MV ±15 µA	-	0.1 % MV ±15 µA
active output		R_{ext} < 500 Ω	-	-
passive output		U_{ext} = 4...26.4 V, depending on R_{ext} (R_{ext} < 1 kΩ at 26.4 V)	-	U_{ext} = 4...28.2 V, depending on R_{ext} (R_{ext} < 1 kΩ at 28.2 V) intrinsic safety
current output in HART mode		I1	-	-
• range	mA	4...20	-	-
• active output		U_{int} = 24 V	-	-
• passive output		U_{ext} = 10...24 V	-	-
• frequency output				
range	kHz	-	0...5	-
open collector		-	30 V/100 mA I_{off} = 0.8 mA optional: 8.2 V DIN EN 60947-5-6 (NAMUR)	-
• binary output				
open collector		24 V/4 mA	30 V/100 mA I_{off} = 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 totalising		
• pulse value	units	0.01...1000		
• pulse width	ms	1...1000		

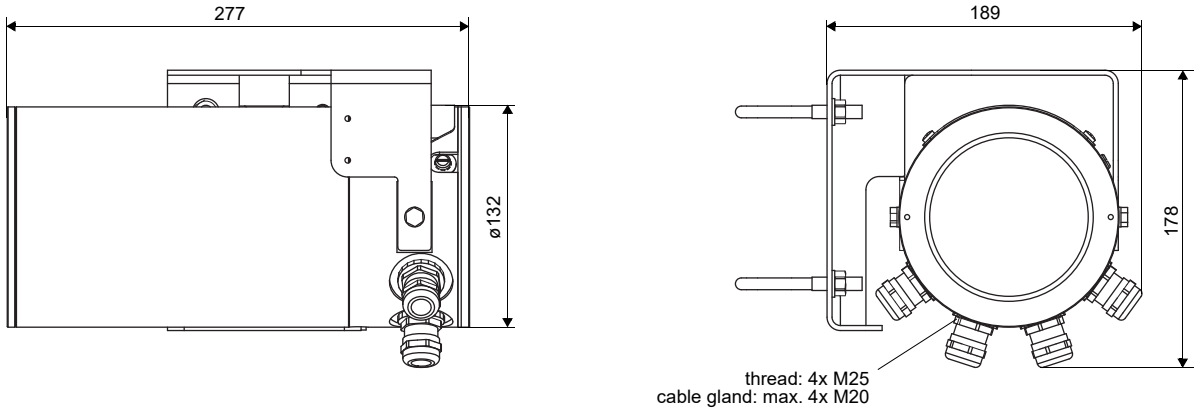
[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] connection of the RS232 interface outside the explosive atmosphere (housing cover is open)

Dimensions

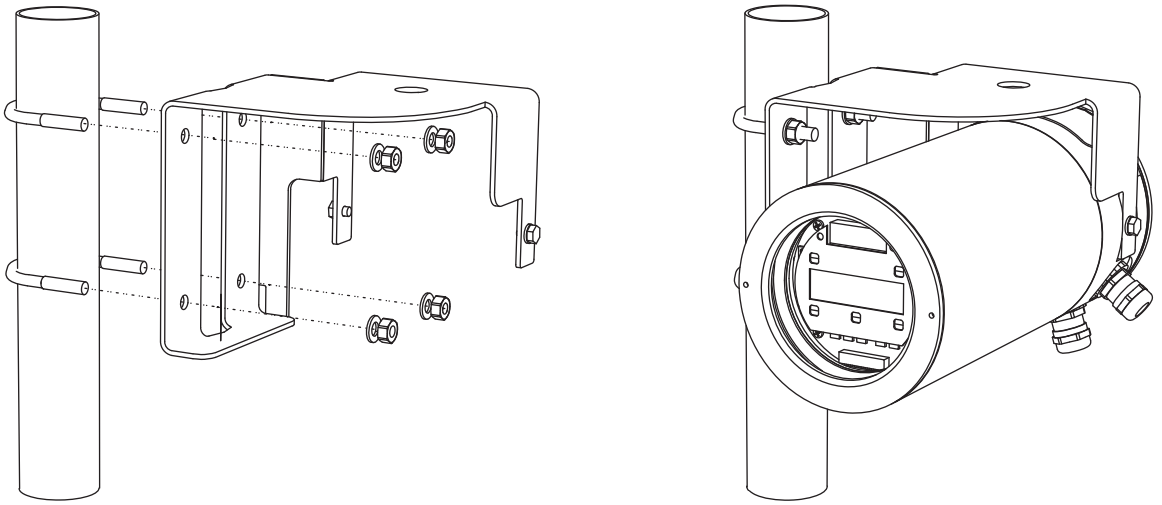
***801**



in mm

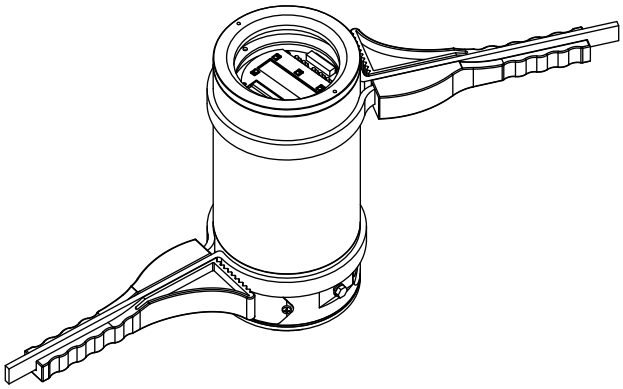
Wall and 2" pipe mounting kit

***801**



Strap wrench

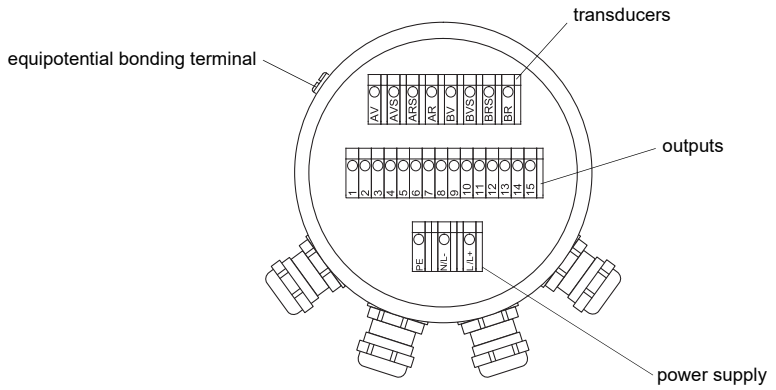
***801 strap wrench**



order code: ACC-PE-#801-/DT

Terminal assignment

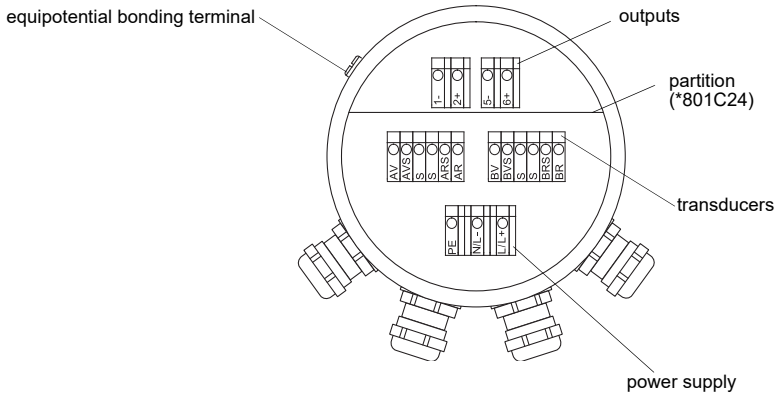
801**-A10*-*A, 801**-A10****-*P**



power supply[1]				
AC		**DC**		
terminal	**connection**	**terminal**	**connection**	
L	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[1]				
terminal		**connection**		
1(-), 2(+)		current output I1		
3(-), 4(+)		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		

[1] cable (by customer): e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm^2

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



power supply[1]				
AC		**DC**		
*801**-A10****-FF		*801C24, *801**-A10****-FF		
terminal	**connection**	**terminal**	**connection**	
L	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[1]		
	*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

[1] cable (by customer): e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm^2

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)
transducers		C***N81	C***N81
supported transducer frequencies		K, M, P on request: G	
measurement			
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 % MV ±0.005 m/s	
fluid		liquefied natural gas (LNG), liquid ethane,liquid nitrogen, liquid oxygen	
temperature compensation		corresponding to the recommendations in ANSI/ASME MFC-5.1-2011	
measurement uncertainty (volumetric flow rate)			
measurement uncertainty of the measuring system[1]		±0.3 % MV ±0.005 m/s	
measurement uncertainty at the measuring point[2]		±1 % MV ±0.005 m/s	
transmitter			
power supply		• 100...230 V/50...60 Hz or • 20...32 V DC	• 20...32 V DC
power consumption	W	< 8	< 5
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 EN AC 44200 mod, special heavy-duty coating (C5 according to EN ISO 12944)	
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 without operation of the display)	
display		2 x 16 characters, dot matrix, backlight	
menu language		English, German, French, Dutch, Spanish	
explosion protection			
• **ATEX/IECEx**			
marking		CE 0637 Ex II2G II2D Ex db eb IIC T6 Gb Ex tb IIIC T100 °C Db T_a -40...+60 °C	CE 0637 Ex II2G II2D Ex db eb ia IIC T6 Gb Ex tb ia IIIC T100 °C Db T_a -40...+60 °C
certification ATEX		IBExU11ATEX1022 X	IBExU11ATEX1022 X
certification IECEx		IECEx IBE 11.0006X	IECEx IBE 11.0006X
intrinsic safety parameters		-	U_m = 250 V U_i = 30 V DC I_i = 100 mA P_i = 0.75 W C_i = 3 nF L_i negligible
measuring functions			
physical quantities		volumetric flow rate, mass flow rate, flow velocity	
totaliser		volume, mass	
calculation functions		average, difference, sum (2 measuring channels necessary)	
diagnostic functions		sound speed, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times	

[1] with aperture calibration of the transducers

[2] for transit time difference principle and reference conditions

[3] connection of the RS232 interface outside the explosive atmosphere (housing cover is open)

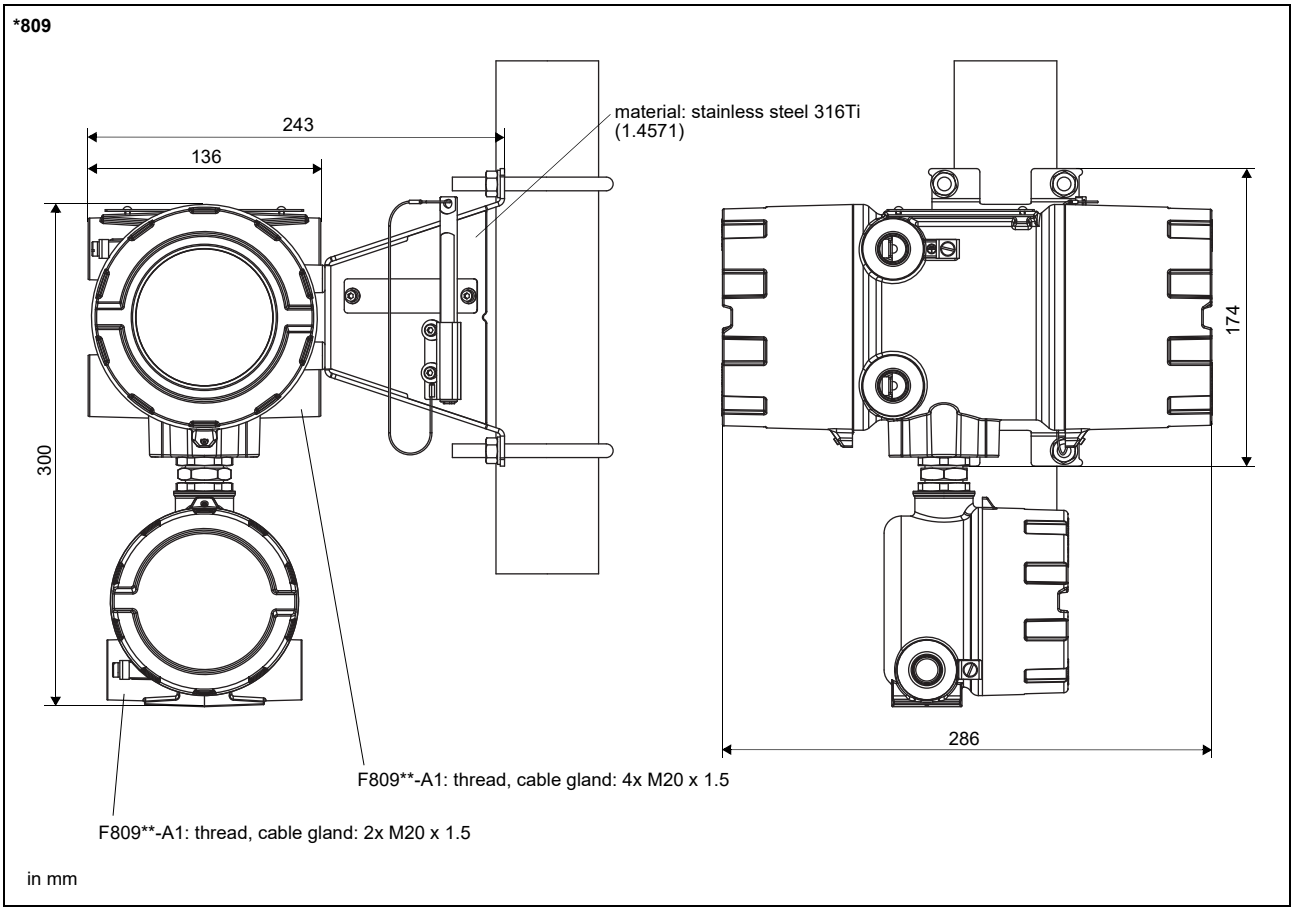
		FLUXUS F809**-A1	FLUXUS F809**-A1A
communication interfaces			
service interfaces		• RS232[3] • USB (with adapter)[3]	
process interfaces		max. 1 option: • RS485 (ASCII sender) • Modbus RTU • HART	• HART
accessories			
data transmission kit • cable • adapter		 RS232 RS232 - USB	
software		• FluxDiagReader: reading of measured values and parameters, graphical representation • FluxDiag (optional): reading of measurement data, graphical representation, report generation	
data logger			
loggable values		all physical quantities, totalised physical quantities and diagnostic values	
capacity		> 100 000 measured values	
outputs			
		The outputs are galvanically isolated from the transmitter.	
number		max. 4	1
• current output			
number		max. 2 (I1, I2)	1 (I1, intrinsic safety)
range	mA	0/4...20	4...20
accuracy		0.1 % MV ±15 µA	0.04 % MV ±3 µA
active output		R_{ext} < 500 Ω	-
passive output		U_{ext} = 4...26.4 V, depending on R_{ext} (R_{ext} < 1 kΩ at 26.4 V)	U_{ext} = 7...30 V, depending on R_{ext} (R_{ext} < 1 kΩ at 30 V)
current output in HART mode • range • active output • passive output	 mA	I1 4...20 U_{int} = 24 V U_{ext} = 7...30 V DC	I1 4...20 - U_{ext} = 7...30 V DC
• frequency output			
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)	-
• binary output			
number		max. 2	-
open collector		24 V/4 mA optional: • 30 V/100 mA or • 8.2 V DIN EN 60947-5-6 (NAMUR)	-
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 totalising	-
• pulse value	units	0.01...1000	-
• pulse width	ms	1...1000	-

[1] with aperture calibration of the transducers

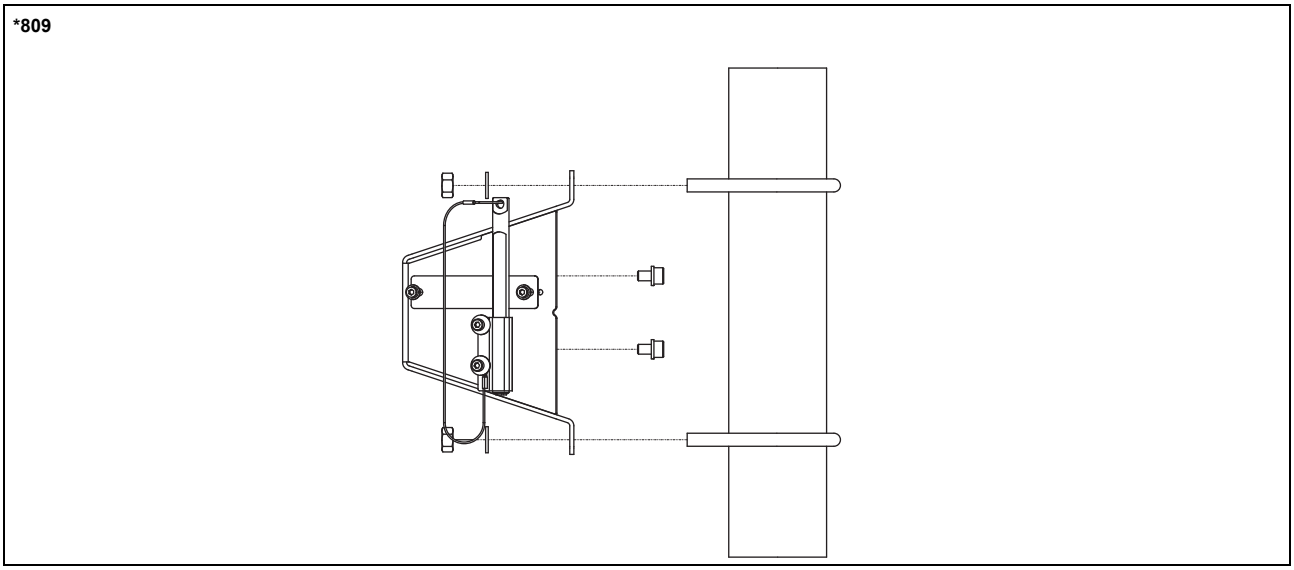
[2] for transit time difference principle and reference conditions

[3] connection of the RS232 interface outside the explosive atmosphere (housing cover is open)

Dimensions

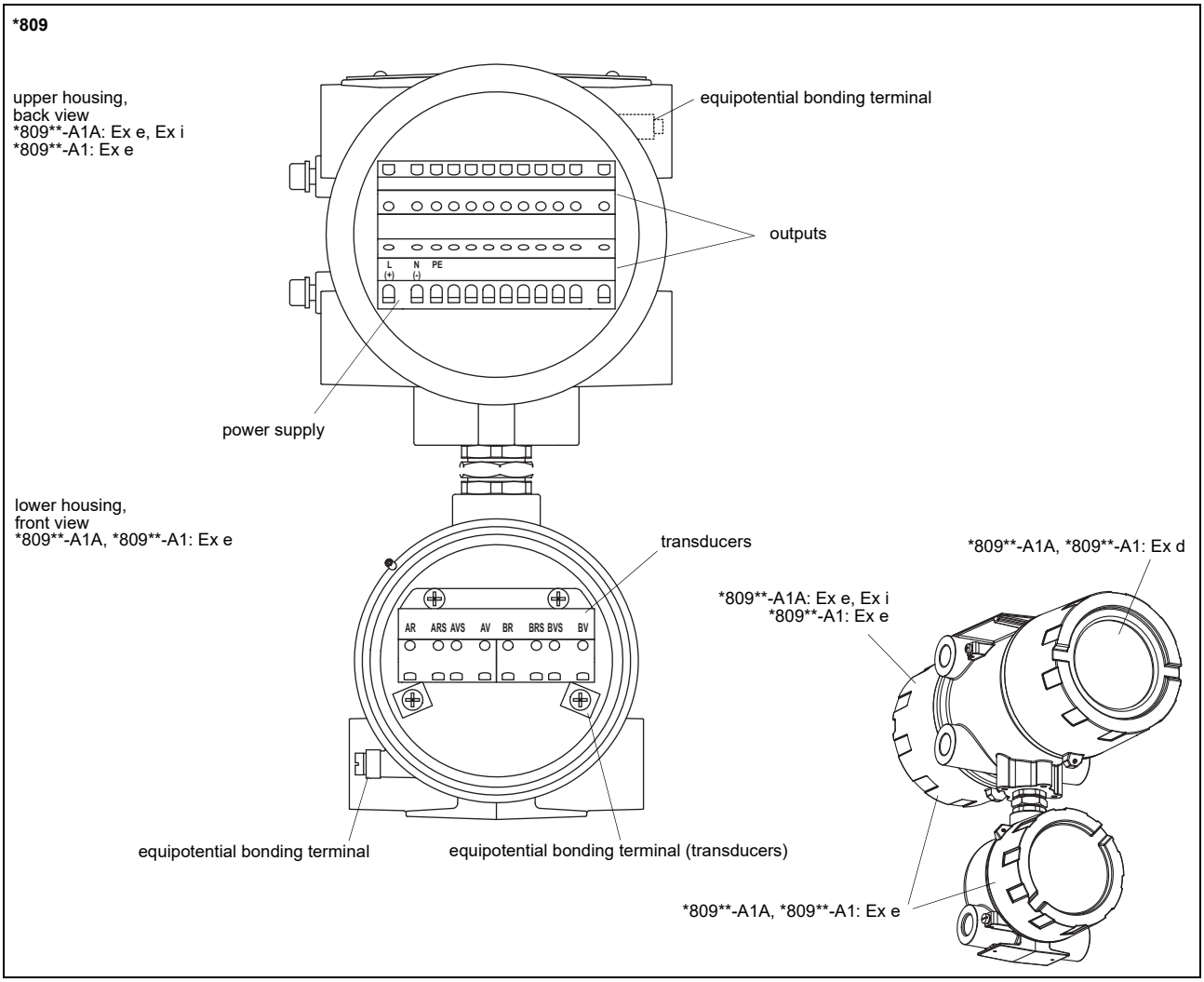


Wall and 2" pipe mounting kit



Terminal assignment

***809**



power supply[1]			
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	↑ ⇈

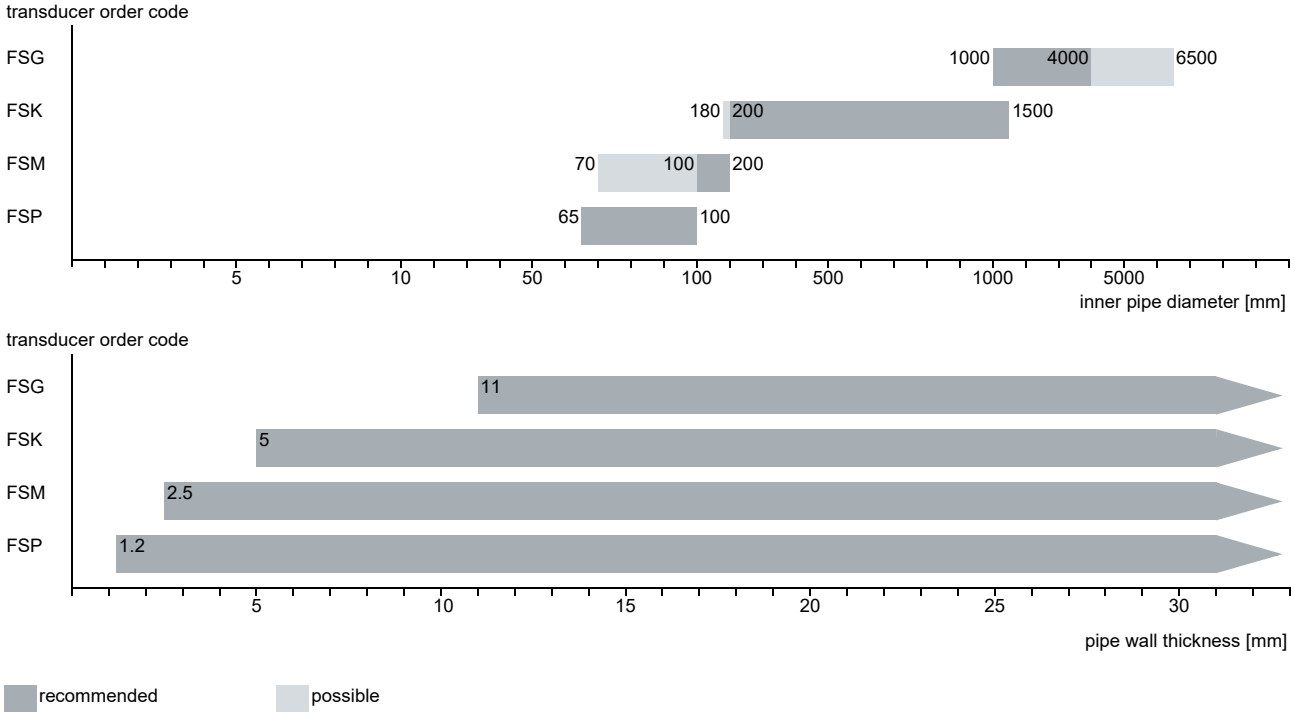
outputs (options)[1]		
terminal	**connection**	
1(-), 2(+)	current output I1	frequency output F1
3(-), 4(+)	current output I2	
5(-), 6(+)	binary output B1 (open collector)	
7(-), 8(+)	binary output B2 (open collector)	
9(-), 10(+)	binary output B1 (Reed relay)	binary output B1 (open collector)
A+, B-, S	communication interface	

[1] cable (by customer): e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm^2

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

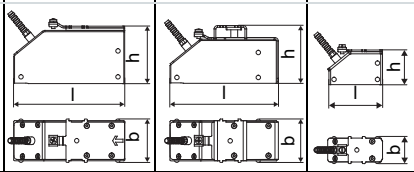


Installation recommendation

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

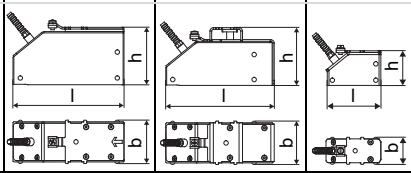
Technical data

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			
pipe wall thickness					
min.	mm	11	5	2.5	1.2
material					
housing		PEEK with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)			
contact surface		PEEK			
degree of protection		IP67			
transducer cable					
type		1699			
length	m	5		4	
length (***-*****/LC)	m	9			
dimensions					
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	
pipe surface temperature[1]					
min.	°C	-40			
max.	°C	+130			
ambient temperature					
min.	°C	-40			
max.	°C	+130			
temperature compensation		x			
explosion protection					
• **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 II3G II2D Ex nA IIC T6...T3 Gc Ex tb IIIC T80 °C...T185 °C Db			
certification ATEX		IBExU10ATEX1163 X			
certification IECEx		IECEx IBE 12.0005X			

[1] pipe surface temperature when using transducers with WIT-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, T1)

order code		FSG-N*1T1/**	FSK-N*1T1/**	FSM-N*1T1/**	FSP-N*1T1/**
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			
pipe wall thickness					
min.	mm	11	5	2.5	1.2
material					
housing		PEEK with stainless steel cover 304 (1.4301), ***-*****/OS: 316L (1.4404)			
contact surface		PEEK			
degree of protection		IP65	IP66		
transducer cable					
type		1699			
length	m	5		4	
length (***-*****/LC)	m	9			
dimensions					
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	
pipe surface temperature[1]					
min.	°C	-40			
max.	°C	+130			
ambient temperature					
min.	°C	-40			
max.	°C	+130			
temperature compensation		x			
explosion protection					
• **ATEX/IECEx**					
order code		FSG-NA1T1/**	FSK-NA1T1/**	FSM-NA1T1/**	FSP-NA1T1/**
pipe surface temperature (Ex)					
• min.	°C	-55			
• max.	°C	+180			
marking		CE 0637 Ex II2G II2D Ex q IIC T6...T3 Gb Ex tb IIIC T80 °C...T185 °C Db			
certification ATEX		IBExU07ATEX1168 X			
certification IECEx		IECEx IBE 08.0007X			
remark		F801, F809: on request			

[1] pipe surface temperature when using transducers with WIT-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.

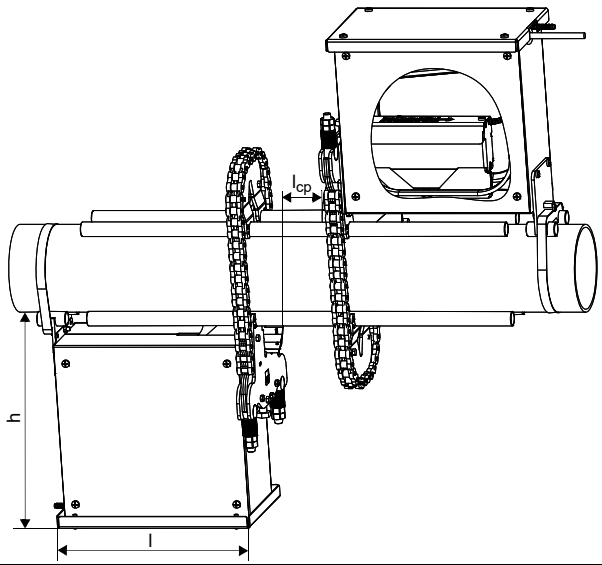
Transducer mounting fixture

Order code

1...6	7		8	9		10	11...13		14	15			no. of character
WaveInjector	**transducer**	**-**	**measurement arrangement**	**size**	**-**	**fixation**	**outer pipe diameter[1]**	**-**	**coupling foil**	**tool**	**/**	**option**	**description**
WIT-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						70...370 mm
							056						350...560 mm
							085						560...850 mm
							100						600...1000 mm
									D				coupling foil min. -200 °C
										A			WIT-A tool
										M			WIT-M tool
										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)

[1] outer pipe diameter > 1000 mm on request

WaveInjector WIT-CYO (ATEX/IECEx)



dimensions:

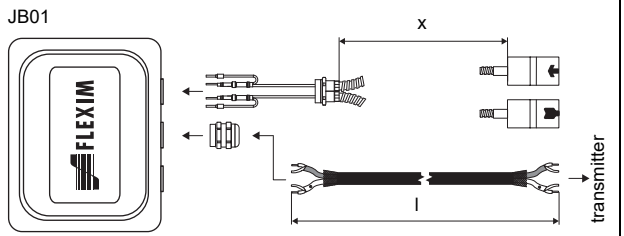
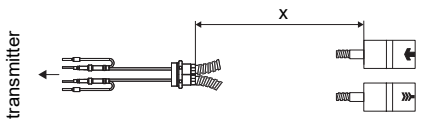
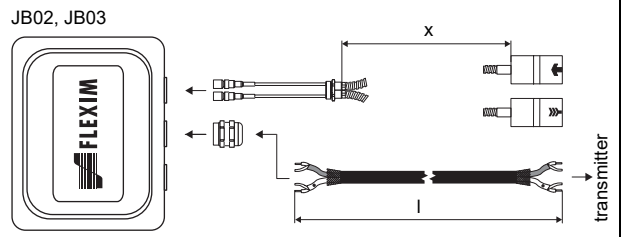
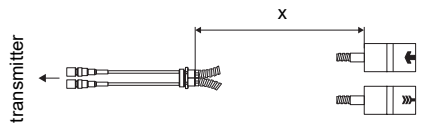
- length: $2 \cdot l + l_{cp}$
  l = 273 mm
  l_{cp} = depending on the application
- width:
  outer pipe diameter + 32 mm
  (min. 203 mm)
- height:
  outer pipe diameter + $2 \cdot h$
  h = 285 mm

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 T1		
connection with extension cable	direct connection	transducers technical type
		*****8*
connection system TS		
		*****52

Cable

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

extension cable			
type		**2615**	**5245**
order code		ACC-PE- GNNN-/EXEXXXX	ACC-PE- GNNN-/EXA1XXX
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

XXX - cable length in m

Cable length

transducer frequency		**G, K**		**M, P**	
connection system T1					
transducers technical type		x	l	x	l
*D***8*	m	5	≤ 300	4	≤ 300
option LC: *L***8*	m	9	≤ 300	9	≤ 300
connection system TS					
*D***5*	m	5	≤ 300	4	≤ 300
option LC: *L***5*	m	9	≤ 300	9	≤ 300

x - transducer cable length

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

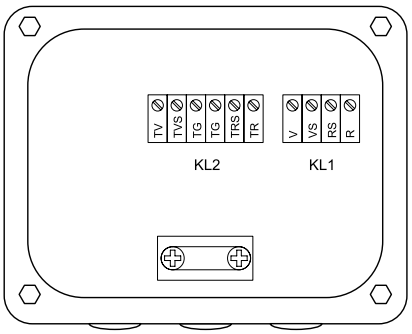
Junction box

Technical data

JB01S4E3M

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/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 decoupling network: encapsulation dust: protection by enclosure

Connection



Transducers

terminal strip	terminal	connection	transducer
KL1	V	signal	↑
	VS	internal shield	
	RS	internal shield	⇈
	R	signal	

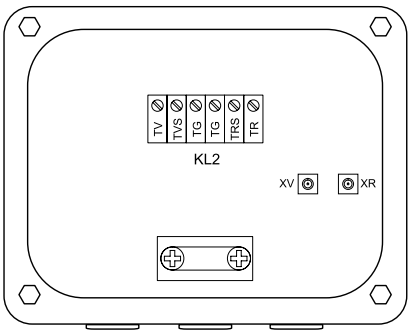
Extension cable

terminal strip	terminal	connection
KL2	TV	signal
	TVS	internal shield
	TRS	internal shield
	TR	signal

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		JB02
marking		CE Ex II3G Ex nA IIC (T6)...T4 Gc II3D Ex tc IIIC T 100 °C Dc Ta -40...+(70)80 °C

Connection



Transducers

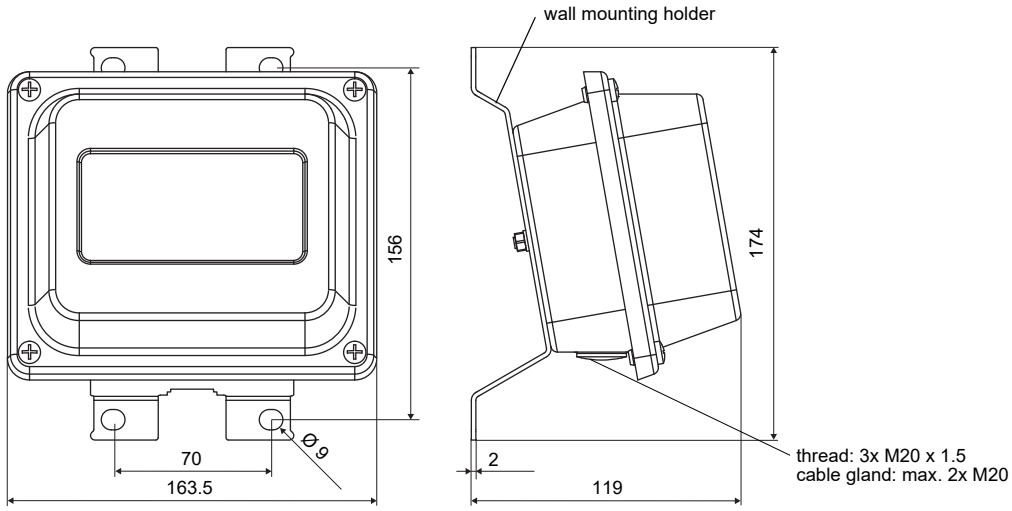
terminal	connection	transducer
XV	SMB connector	↑
XR	SMB connector	⇈

Extension cable

terminal strip	terminal	connection
KL2	TV	signal
	TVS	internal shield
	TRS	internal shield
	TR	signal

Dimensions

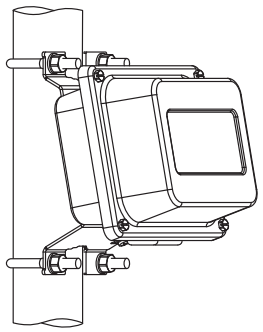
JB0*, JBP*



in mm

2" pipe mounting kit

JB**



order code:
ACC-PE-GNNN-/JBPMK4

Transducer heating system (optional)

Continous operation

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

Cyclic operation

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

operating time in cyclic operation < 12 h and resting time ≥ 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

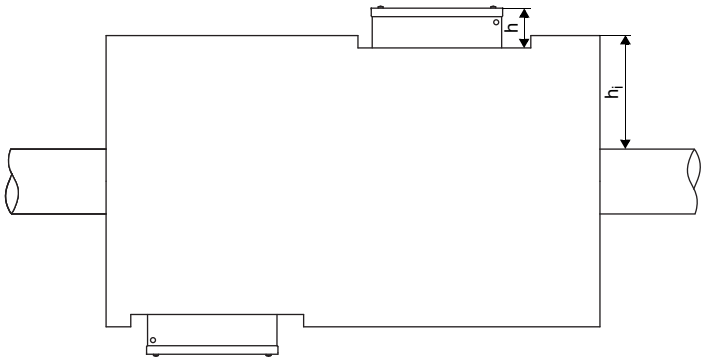
type		BARTEC PSB	
order code		ACC-PE-F***-CY1 (1 measuring channel)	ACC-PE-F***-CY2 (2 measuring channels)
power supply[1]		208...254 V AC	
consisting of			
heating element		2x PSB 33, 07-5801-2335 power consumption: 2x 44 W	4x PSB 33, 07-5801-2335 power consumption: 4x 44 W
connection system		2x PLEXO 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	

[1] 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
cable jacket		
material		rubber
outer diameter	mm	8...10.4
colour		black
shield		-

Insulation



insulation height:
$h_i \leq 185$ mm

height h:

- with transducer heating system:
  h < 30 mm
- without transducer heating system:
  h ≥ 100 mm

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2021-12-01, TSFLUXUS_CYOV2-4EN_Leu