FLEXIM

Technical specification

FLUXUS G721CA

Stationary ultrasonic clamp-on system for flow measurement of compressed air and other industrial gases

Transmitter for permanent outdoor wall or pipe mounting

Features

- Accurate and reliable flow measurement
- Bidirectional measurement for flow direction detection in compressed-air networks
- Installation and start-up do not require any pipe work nor any process interruptions
- Measurement unaffected by gas density, viscosity, dust content and humidity
- Measurement at extremely low pressure:
  - min. 44 psia in metal pipes
  - 15 psia in plastic pipes
- Extremely high turndown ratio > 1000:1
- High measuring accuracy, even at low flow velocities down to 0.03 ft/s
  - Monitoring of small flows (e.g., during the night)
  - Leakage detection
- For pipe diameters of 0.6 to 9.8"
- Maintenance-free acoustic coupling using permanent coupling material
- Support of numerous fieldbus systems
- FM Class I Div. 2 approved transducers for hazardous areas available

Applications

- Industrial manufacturing facilities:
  - Air compressors and compressed-air distribution networks
  - Pressure generators and distribution networks for inert or purge gases
  - Pressure generators and distribution networks for oxygen, e.g. for steel production
- Measurement of atmospheric gases consumption: compressed air, nitrogen, oxygen, argon, helium

FLUXUS G721CA-****A

FLUXUS G721CA-****S

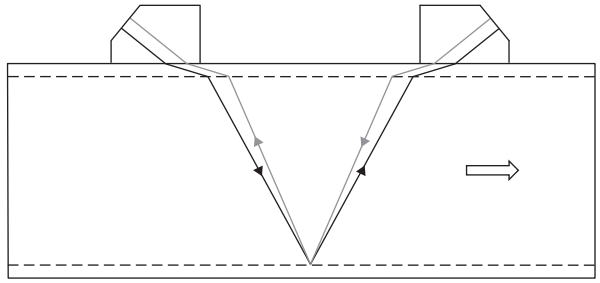
PermaRail

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.

Path of the ultrasonic signal in the flowing fluid

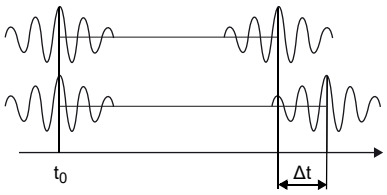


As the fluid where the ultrasound propagates is flowing, the transit time of the ultrasonic signal in flow direction is shorter than the one against the flow direction.

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

The integrated microprocessors control the entire measuring cycle. The received ultrasonic signals are checked for measurement usability and evaluated for their reliability. Noise signals are eliminated.

Transit time difference Δt



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 standard volumetric flow rate

The standard volumetric flow rate can be selected as physical quantity. It is calculated with the following formula:

$$\dot{V}_N = \dot{V} \cdot \frac{p}{p_N} \cdot \frac{T_N}{T} \cdot \frac{1}{K}$$

where

$\dot{V}_N$ - standard volumetric flow rate

$\dot{V}$ - operating volumetric flow rate

p_N - standard pressure (absolute value)

p - operating pressure (absolute value)

T_N - standard temperature in K

T - operating temperature in K

K compressibility coefficient of gas: ratio of the compressibility factors of the gas at operating conditions and at standard conditions Z/Z_N

The operational pressure p and the operational temperature T of the fluid will be entered directly as fixed values into the transmitter.

or:

If inputs are installed (optional), pressure and temperature can be measured by the customer and fed in the transmitter.

Number of sound paths

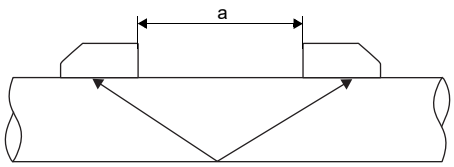
The number of sound paths is the number of transits of the ultrasonic signal through the fluid in the pipe. Depending on the number of sound paths, the following methods of installation exist:

- **reflect arrangement**
  The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easy.
- **diagonal arrangement**
  The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe.
- **direct mode**
  Diagonal arrangement with 1 sound path. This should be used in the case of a high signal attenuation by the fluid, pipe or coatings.

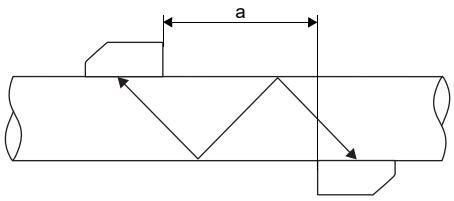
The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the transmitter.

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

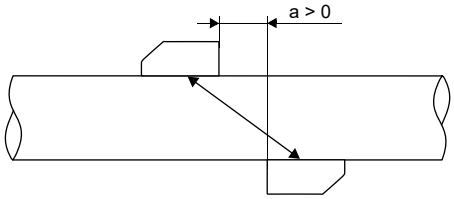
Reflect arrangement, number of sound paths: 2



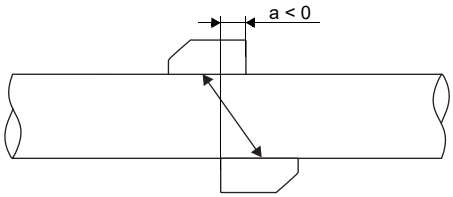
Diagonal arrangement, number of sound paths: 3



Direct mode, number of sound paths: 1



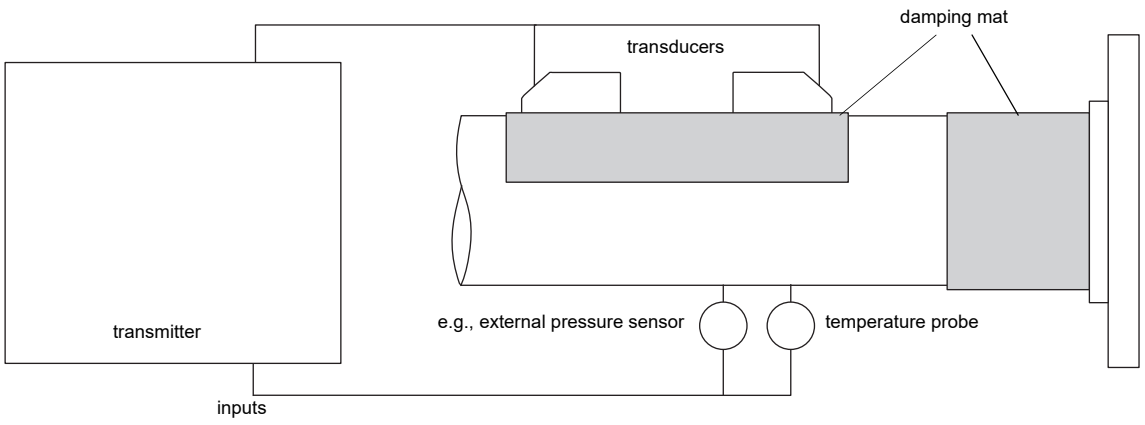
Direct mode, number of sound paths: 1, negative transducer distance



a - transducer distance

Typical measurement setup

Example of a reflect arrangement with connection of the inputs to an external process pressure and temperature measurement for standard volumetric flow rate calculation



Transmitter

Technical data

		FLUXUS G721CA-NN0*A G721CA-NN0*S	FLUXUS G721CA-A20*A G721CA-A20*S	FLUXUS G721CA-F20*A G721CA-F20*S
		 		
design		standard field device	standard field device zone 2	standard field device FM Class I Div. 2
application		flow measurement of compressed air and industrial gases		
measurement				
measurement principle		transit time difference correlation principle		
flow velocity	ft/s	0.03 to 115, depending on pipe diameter		
repeatability		0.15 % MV ±0.02 ft/s		
fluid		compressed air, oxygen, nitrogen, argon, helium		
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 ±0.02 ft/s includes calibration certificate traceable to NIST		
measurement uncertainty at the measuring point		±1 to 2 % MV ±0.02 ft/s, contact FLEXIM for an application specific uncertainty evaluation		
transmitter				
power supply		• 100 to 230 V/50 to 60 Hz or • 20 to 32 V DC or • 11 to 16 V DC		
power consumption	W	< 15		
number of measuring channels		1, optional: 2		
damping	s	0 to 100 (adjustable)		
measuring cycle	Hz	100 to 1000 (1 channel)		
response time	s	1 (1 channel), option: 0.02		
housing material		aluminum, powder coated or stainless steel 316L		
degree of protection		IP66		aluminum housing: IP66/NEMA 4X stainless steel housing: IP65
dimensions	inch	see dimensional drawing		
weight	lb	aluminum housing: 11.9 stainless steel housing: 11.2		
fixation		wall mounting, optional: 2" pipe mounting		
ambient temperature	°F	-40...+140 (< -4 °F without operation of the display)		aluminum housing: -40...+131/140 (< -4 °F without operation of the display) stainless steel housing: -4...+131/140
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	-
certification ATEX		-	IBExU11ATEX1015	-
certification IECEx		-	IECEx IBE 11.0008	-
• FM				
marking		-	-	G721**-F20*S2, G721**-F20*S3: FM APPROVED NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T5 G721**-F20*S1: FM APPROVED NI/Cl. I,II,III/Div. 2/ GP. A,B,C,D,E,F,G/ T4A
measuring functions				
physical quantities		operating volumetric flow rate, standard 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		

[1] with aperture calibration of the transducers

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

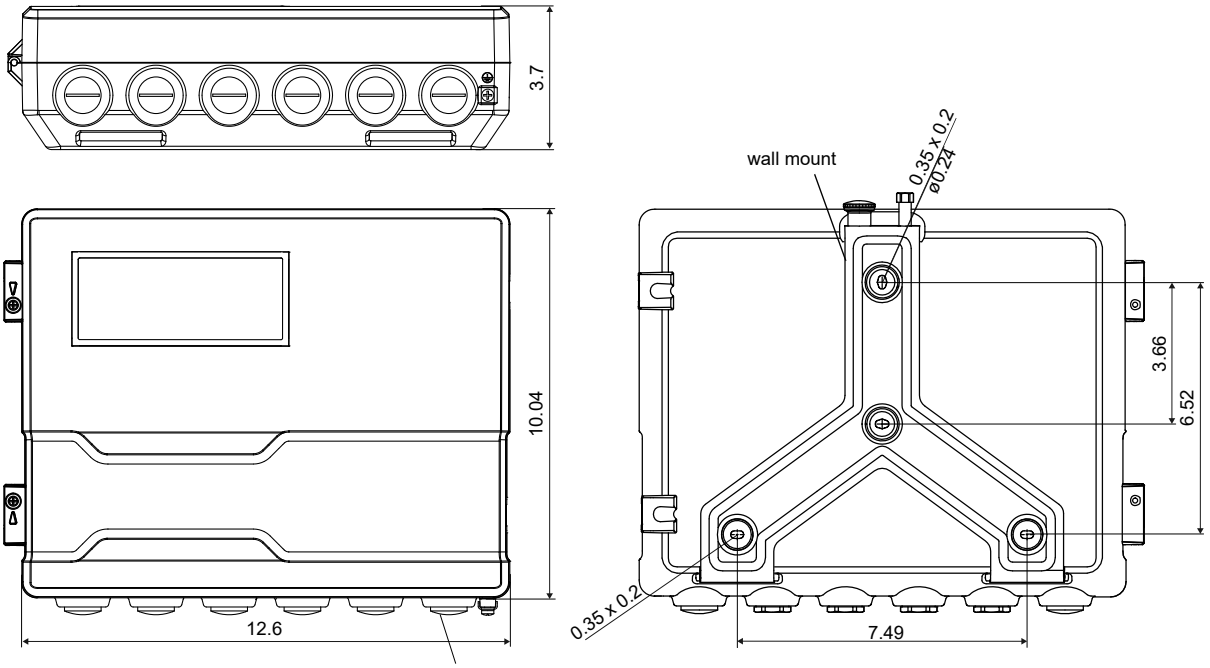
		FLUXUS G721CA-NN0*A G721CA-NN0*S	FLUXUS G721CA-A20*A G721CA-A20*S	FLUXUS G721CA-F20*A G721CA-F20*S
communication interfaces				
service interfaces		measured value transmission, parametrization of the transmitter: • USB[2] • LAN[2]		
process interfaces		max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • Profibus PA • FF H1 • Modbus TCP • BACnet IP	max. 1 option: • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • Profibus PA • FF H1 • Modbus TCP • BACnet IP
accessories				
data transmission kit		USB cable		
software		• FluxDiagReader: reading of measured values and parameters, graphical presentation • FluxDiag (optional): reading of measurement data, graphical presentation, report generation, parametrization of the transmitter		
data logger				
loggable values		all physical quantities, totalized physical quantities and diagnostic values		
capacity		max. 800 000 measured values		
outputs				
		The outputs are galvanically isolated from the transmitter.		
• switchable current output				
		All switchable current outputs are jointly switched to active or passive.		
number		2 or 4		
range	mA	4 to 20 (3.2 to 22)		
accuracy		0.04 % MV ±3 µA		
active output		R_{ext} < 350 Ω		
passive output		U_{ext} = 8 to 30 V, depending on R_{ext} (R_{ext} < 1 kΩ at 30 V)		
• 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 to 1000		
• pulse width	ms	optorelay: 1 to 1000		
inputs				
		The inputs are galvanically isolated from the transmitter.		
• temperature input				
number		1 (1 measuring channel), 2 (2 measuring channels)		
type		Pt100/Pt1000		
connection		4-wire		
range	°F	-238 to +1040		
resolution	K	0.01		
accuracy		±0.01 % MV ±0.03 K		
• current input				
number		1 (1 measuring channel), 2 (2 measuring channels)		
accuracy		0.1 % MV ±10 µA		
active input • range	 mA	U_{int} = 24 V, R_{int} = 50 Ω, P_{int} < 0.5 W, not short-circuit proof 0 to 20		
passive input • range	 mA	R_{int} = 50 Ω, P_{int} < 0.3 W -20 to +20		

[1] with aperture calibration of the transducers

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

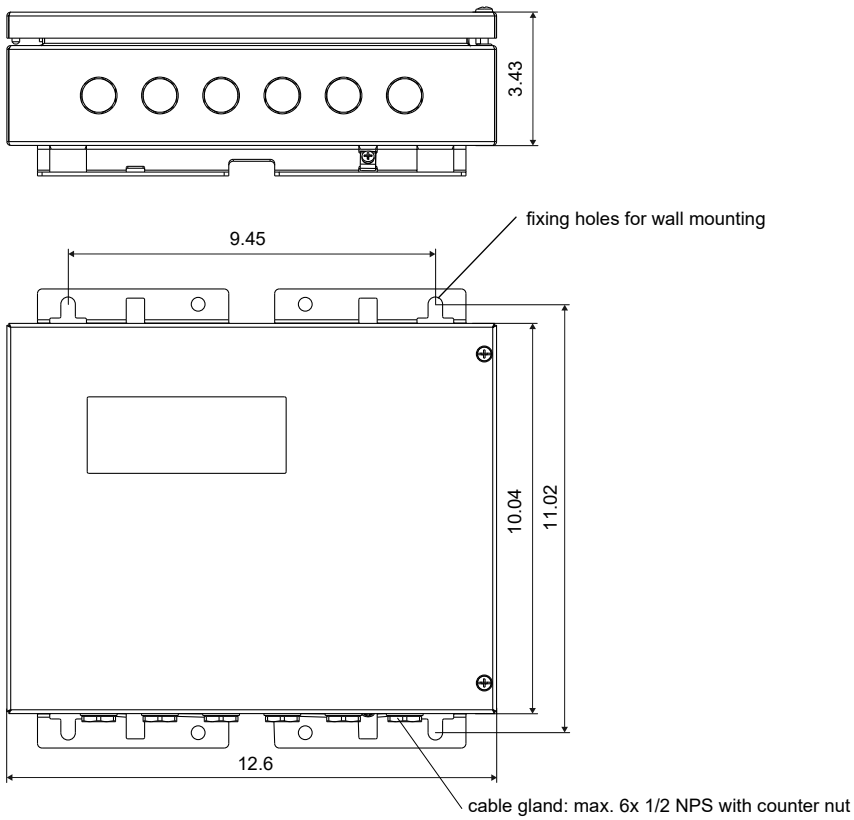
Dimensions

72-****A**



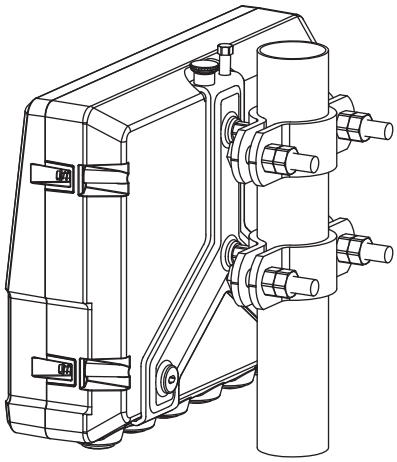
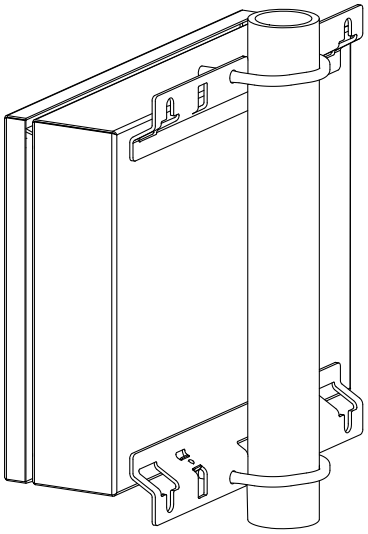
in inch

72-****S**

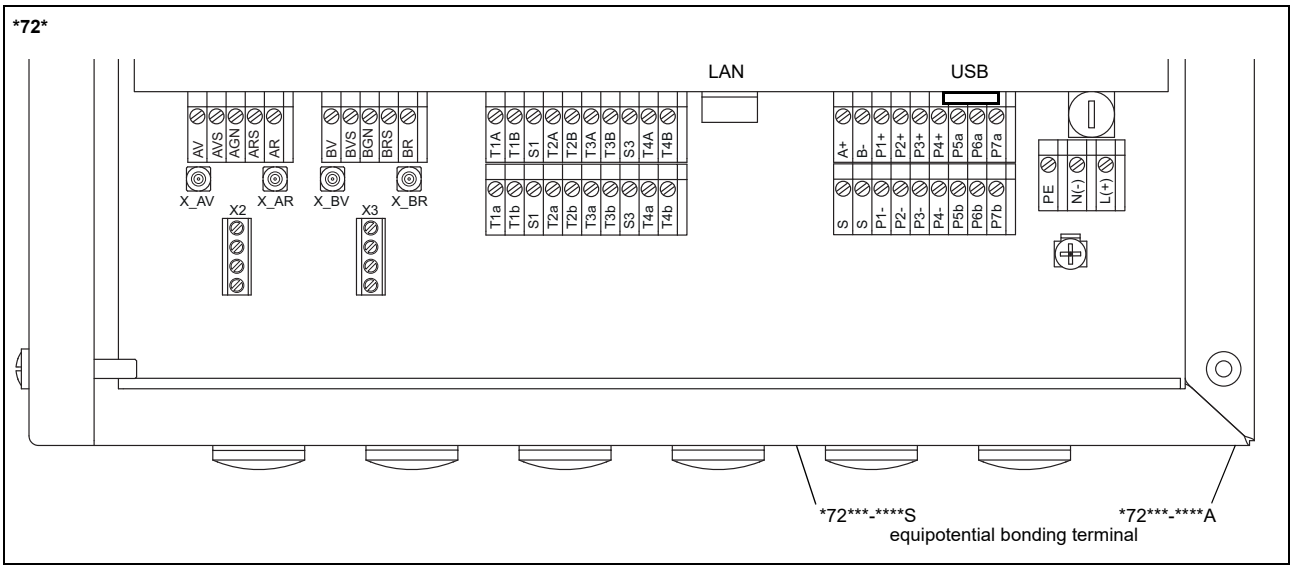


in inch

2" pipe mounting kit

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

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**			**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]

terminal	**connection**
P1+ to P4+ P1- to P4-	current output
P5a to P7a P5b to P7b	binary 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) • Modbus TCP • BACnet IP

analog inputs[1, 2]

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

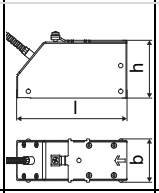
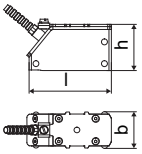
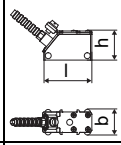
[1] cable (by customer):
- e.g., flexible wires, with insulated wire ferrules, wire cross-section: AWG14 to 24
- outer diameter of the cable (*72***-****S with ferrite nut): max. 0.3 inch

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

Transducers

Technical data

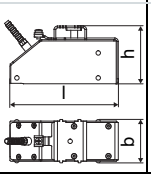
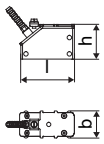
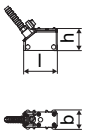
Lamb wave transducers

order code		GLK-N**TS/**	GLM-N**TS/**	GLP-N**TS/**	GLQ-N**TS/**
technical type		G(RT)K1N52	G(RT)M1N52	G(RT)P1N52	G(RT)Q1N52
transducer frequency	MHz	0.5	1	2	4
fluid pressure[1]					
min. extended	psi	metal pipe: 145 (d > 4.7 inch) 44 (d < 4.7 inch)	metal pipe: 44 (d < 2.4 inch)	metal pipe: 44 (d < 1.4 inch)	metal pipe: 44 (d < 0.59 inch)
min.	psi	metal pipe: 218 (d > 4.7 inch) 145 (d < 4.7 inch) plastic pipe: 15	metal pipe: 145 (d > 2.4 inch) 73 (d < 2.4 inch) plastic pipe: 15	metal pipe: 145 (d > 1.4 inch) 73 (d < 1.4 inch) plastic pipe: 15	metal pipe: 145 (d > 0.59 inch) 73 (d < 0.59 inch) plastic pipe: 15
inner pipe diameter d					
min. extended	inch	2.4	1.2	0.59	0.28
min. recommended	inch	3.1	1.6	0.79	0.39
max. recommended	inch	9.8	5.9	2	0.87
max. extended	inch	9.8	7.1	2.4	1.2
pipe wall thickness[2]					
min.	inch	0.2	0.1	0.05	0.02
max.	inch	0.39	0.2	0.12	0.05
material					
housing		PPSU with stainless steel cover 304			
contact surface		PPSU			
degree of protection		IP67	IP65		
transducer cable					
type		1699			
length	ft	16	13		9
length (***-*****/LC)	ft	29			
dimensions					
length l	inch	5.06	2.91		1.65
width b	inch	2.01	1.26		0.87
height h	inch	2.66	1.59		1
dimensional drawing					
weight (without cable)	lb	1	0.17		0.04
pipe surface temperature					
min.	°F	-40			
max.	°F	+266			
ambient temperature					
min.	°F	-40			
max.	°F	+266			
temperature compensation		x			
explosion protection					
• **ATEX/IECEx**					
order code		GLK-NA2TS/**	GLM-NA2TS/**	GLP-NA2TS/**	GLQ-NA2TS/**
pipe surface temperature (Ex)					
• min.	°C	-50			
• max.	°C	gas: +165, dust: +155			
marking		CE 0637 Ex II3G II2D Ex nA IIC T6...T3 Gc Ex tb IIIC T80 °C...T160 °C Db			
certification ATEX		IBExU10ATEX1163 X			
certification IECEx		IECEx IBE 12.0005X			
• **FM**					
order code		GLK-NF2TS/**	GLM-NF2TS/**	GLP-NF2TS/**	GLQ-NF2TS/**
pipe surface temperature (Ex)					
• min.	°F	-40			
• max.	°F	+329			
degree of protection		IP66			
marking		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860			

[1] depending on the application, typical absolute value for compressed air, nitrogen, argon

[2] typical values for steel, aluminum and titanium pipes, for other pipe materials please contact FLEXIM

Shear wave transducers (optional)

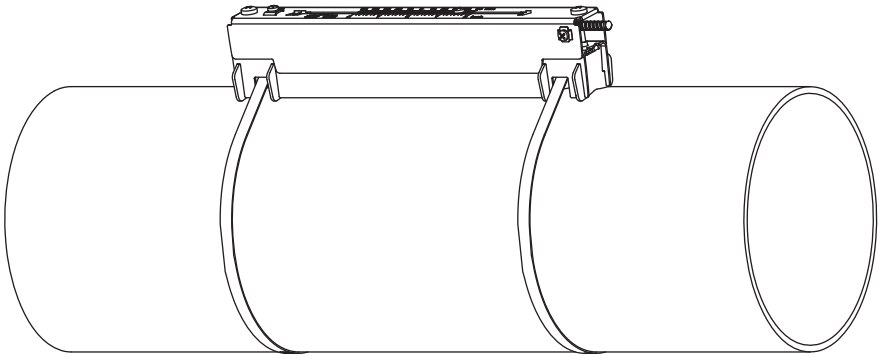
order code		GSK-N**TS/**	GSM-N**TS/**	GSP-N**TS/**	GSQ-N**TS/**
technical type		G(DL)K1N52	G(DL)M2N52	G(DL)P2N52	G(DL)Q2N52
transducer frequency	MHz	0.5	1	2	4
fluid pressure[1]					
min. extended	psi	metal pipe: 290			
min.	psi	metal pipe: 435, plastic pipe: 15			
inner pipe diameter d					
min. extended	inch	2.4	1.2	0.59	0.28
min. recommended	inch	3.1	1.6	0.79	0.39
max. recommended	inch	9.8	5.9	2	0.87
max. extended	inch	9.8	7.1	2.4	1.2
pipe wall thickness[2]					
min.	inch	0.2	0.1	0.05	0.02
material					
housing		PEEK with stainless steel cover 304			
contact surface		PEEK			
degree of protection		NEMA 6			
transducer cable					
type		1699			
length	ft	16	13		9
length (***-*****/LC)	ft	29			
dimensions					
length l	inch	4.98	2.52		1.57
width b	inch	2.01	1.26		0.87
height h	inch	2.66	1.59		1
dimensional drawing					
weight (without cable)	lb	0.79	0.15		0.04
pipe surface temperature					
min.	°F	-40			
max.	°F	+266			
ambient temperature					
min.	°F	-40			
max.	°F	+266			
temperature compensation		x			
explosion protection					
• ATEX/IECEx					
order code		GSK-NA2TS/**	GSM-NA2TS/**	GSP-NA2TS/**	GSQ-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			
• FM					
order code		GSK-NF2TS/**	GSM-NF2TS/**	GSP-NF2TS/**	GSQ-NF2TS/**
pipe surface temperature (Ex)					
• min.	°F	-40			
• max.	°F	+257	+374		
degree of protection		IP66			
marking		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ Temp. Codes dwg 3860			

[1] depending on the application, typical absolute value for compressed air, nitrogen, argon

[2] typical values for steel, aluminum and titanium pipes, for other pipe materials please contact FLEXIM

Transducer mounting fixture

PermaRail (VLK, VLM, VLQ)



material: stainless steel 304, 301, 410
inner length:
VLK: 13.7 inch
VLM: 9.2 inch
VLQ: 6.9 inch

dimensions:
VLK: 16.65 x 3.54 x 3.66 inch
VLM: 12.17 x 2.24 x 2.48 inch
VLQ: 9.72 x 1.69 x 1.85 inch

Coupling materials for transducers

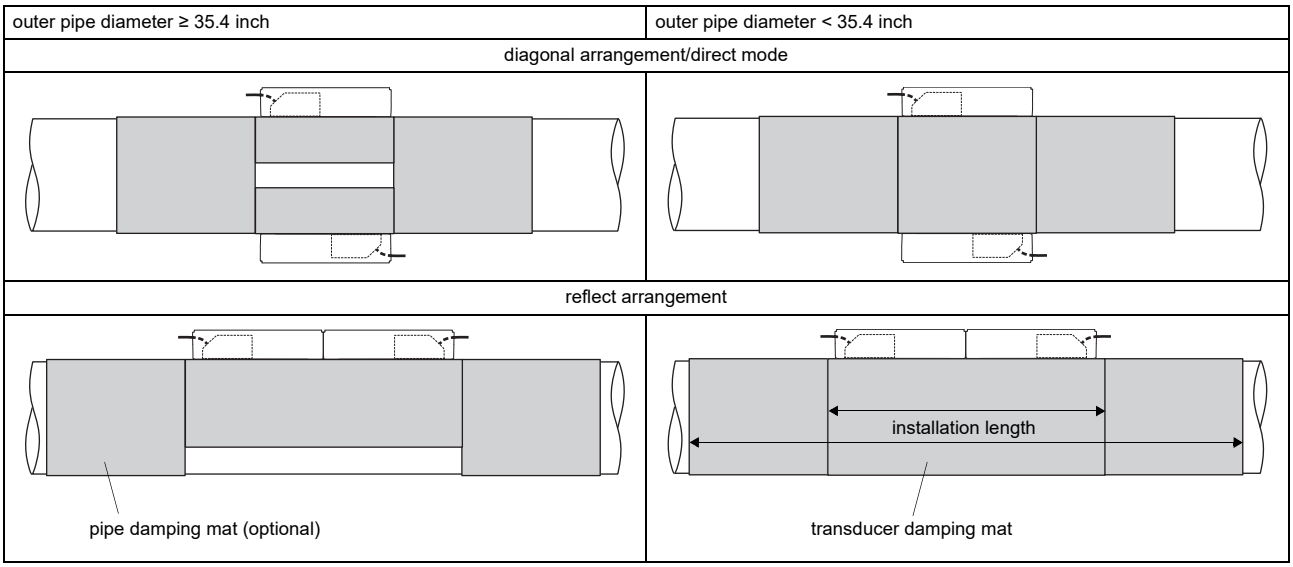
type	**ambient temperature** °F
coupling compound type N	-22 to +266
coupling pad type VT	14 to +392

Damping mats (optional)

Damping mats will be used for the gas measurement to reduce acoustic noise influences on the measurement.

transducer damping mat
Transducer damping mats will be installed below the transducers.

pipe damping mat
Pipe damping mats will be installed if the sound propagation is disturbed at reflection points (e.g., flange, weld). Depending on the noise, the pipe damping mats will be installed at one or both sides of the transducer damping mat. If the local conditions are unknown, pipe damping mats should be installed.



Technical data

type		E30R4	E30R3
order code		ACC-PE-GNNN-/DPD2	ACC-PE-GNNN-/DPD1
width	inch	8.9	2
thickness	inch	0.03	
length (per roll)	ft	32	
weight	lb/ft²	2.2	
ambient temperature	°F	-22 to +176	
properties		self-adhesive	

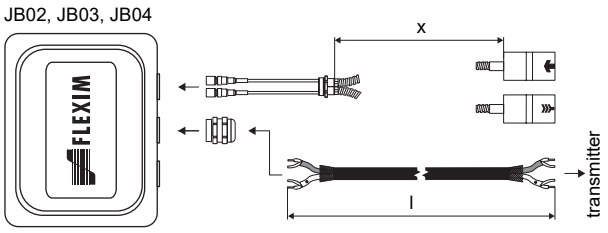
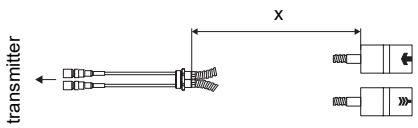
Dimensioning

transducer		damping mat							
transducer mounting fixture	order code	type	number of layers	transducer damping mat			transducer damping mat + 2x pipe damping mat		
				max. installation length	number of rolls[1]		max. installation length	number of rolls[1]	
				[inch]	standard[2]	extended[2]	[inch]	standard	extended
PermaRail									
VLK	GLK	E30R4	1	35	1	1	72	2	2
	GSK		1		1	1		2	2
VLM	GLM	E30R3	1	26	1	1	53.5	2	2
	GSM		1		1	1		2	2
	GLP		1		1	1		1	1
	GSP		1		1	1		1	1

[1] calculation on the base of:
max. installation length (installation of one transducer mounting fixture per transducer in reflect arrangement) and
max. recommended pipe diameter (standard) or max. extended pipe diameter (extended)

[2] calculation of the number of rolls when both transducers are mounted in one transducer mounting fixture (reflect arrangement) or in diagonal arrangement/direct mode: number of rolls/2 and round up to the nearest integer

Connection systems

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

Cable

transducer cable		
type		**1699**
weight	lb/ft	0.06
ambient temperature	°F	-67 to +392
properties		
cable jacket		
material		PTFE
outer diameter	inch	0.11
thickness	inch	0.01
color		brown
shield		x
sheath		
material		stainless steel 304
outer diameter	inch	0.31

extension cable			
type		**2615**	**5245**
weight	lb/ft	0.12	0.26
ambient temperature	°F	-22 to +158	-22 to +158
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	inch	max. 0.47	max. 0.47
thickness	inch	0.08	0.08
color		black	black
shield		x	x
sheath			
material		-	steel wire braid with copolymer sheath
outer diameter	inch	-	max. 0.61

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
*(DR)***5*	ft	16	≤ 984	13	≤ 984	9	≤ 295	6	≤ 131
option LC: *(LT)***5*	ft	29	≤ 984	29	≤ 984	29	≤ 295	-	≤ 131

x = transducer cable length

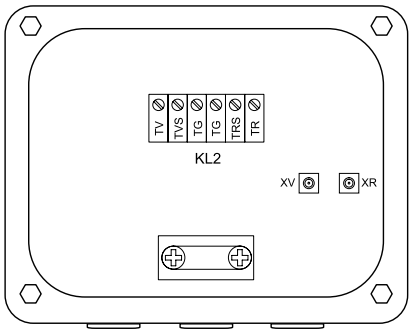
l = max. length of extension cable (depending on the application)

Junction box

Technical data

JB02, JB03, JB04		
weight	lb	2.6 lb
fixation		wall mounting optional: 2" pipe mounting
material		
housing		stainless steel 316L
gasket		silicone
degree of protection		IP67
ambient temperature		
min.	°F	-40
max.	°F	+176
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
• FM		
junction box		JB04
marking		FM APPROVED NI/Cl. I,II,III/Div. 2 / GP A,B,C,D,E,F,G/ T6 Ta = -40...+60 °C

Connection



Transducers

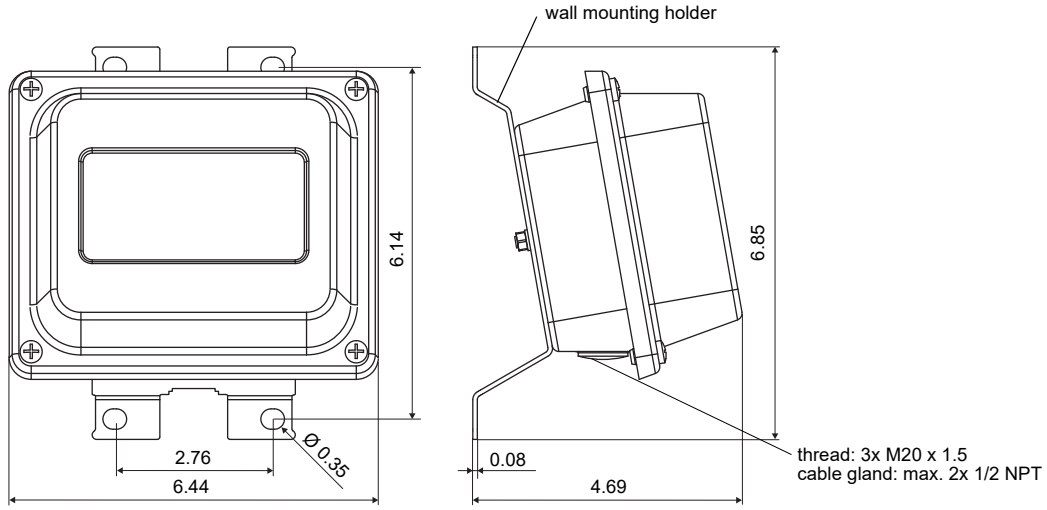
	terminal	connection	transducer
	XV	SMB connector	
	XR	SMB connector	

Extension cable

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

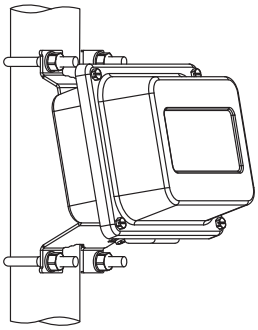
Dimensions

JB0*, JBP*



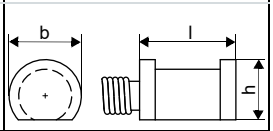
in inch

2" pipe mounting kit

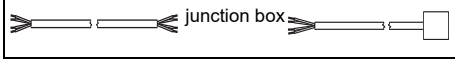
JB** 	order code: ACC-PE-GNNN-/JBPMK4

Clamp-on temperature probe (optional)

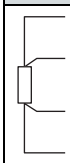
Technical data

PT13N		
design		clamp-on
type		Pt1000
connection		4-wire
measuring range	°F	-40 to +392
accuracy T		±(0.27 °F + 2 · 10^{-3} · (|T [°F]| - 32 °F)) class A
accuracy ΔT (2x Pt matched according to EN 1434-1)		≤ 0.03 °F (at 50 °F)
housing		360 brass alloy
degree of protection		NEMA 4
dimensions		
length l	inch	0.79
width b	inch	0.59
height h	inch	0.49
dimensional drawing		
weight	lb	0.437
accessories		
thermal conductivity foil 482 °F		x

Connection system

connection with extension cable	direct connection
extension cable 	

Connection

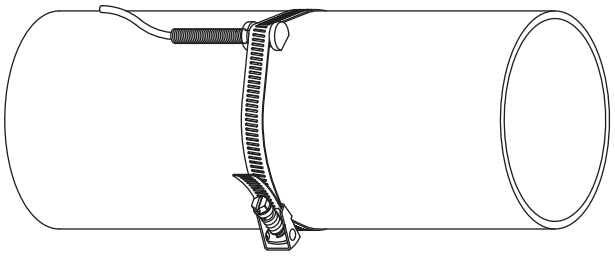
	temperature probe
	red
	red
	white
	white

Cable

		temperature probe	extension cable
type		4 x 24 AWG	4 x 18 AWG
standard length	ft	20	-
max. length	ft	-	656
cable jacket		PTFE	LS PVC

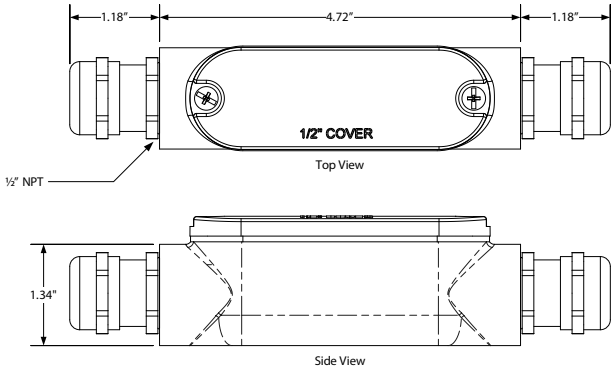
Fixation

tension strap PT13N



material: stainless steel 301, 410
thermal insulation necessary

Junction box



Connection

temperature probe	extension cable
red	white
red	black
white	green
white	red

FLEXIM AMERICAS Corporation
Edgewood, NY 11717
USA

Tel.:(631) 492-2300
Fax:(631) 492-2117

internet: www.flexim.com
e-mail: usinfo@flexim.com

1-888-852-7473

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