

UFM 610 P, UFM 600 T Clamp-on ultrasonic flowmeters for liquids



Variable area flowmeters

Vortex flowmeters

Flow controllers

Electromagnetic flowmeters

Ultrasonic flowmeters

Mass flowmeters

Level measuring instruments

Communications engineering

Engineering systems & solutions



UFM 610 P, UFM 600 T Clamp-on ultrasonic flowmeters

for liquids

Efficient flowmetering and volume counting of clean, homogeneous liquids with low gas and solids contents.

Applications

- Demineralized water for cooling purposes
- Boiler feedwater in power stations
- Pretreated wastewater in sewage plants
- Checking other flowmeters
- Oil
- Acids
- Alkaline solutions

Advantages of measuring from the outside

- Non-contact measurement
- No construction of the pipe cross-section
- No additional pressure drop
- No interruption of the process
- Electrical conductivity, pressure, density, etc. have no effect on measurements
- Easy to install
- No maintenance requirement
- Low power consumption
- Low operating costs

UFM 610 P portable device (in carrying case)

UFM 600 T wall mounted system

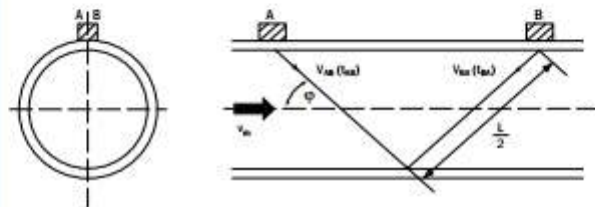
Configuration and function

- At the measuring point 2 ultrasonic sensors are attached to the outside wall with the aid of a mounting device.
- Each sensor emits and receives sonic pulses that are digitally converted in the signal converter.
- Data output in metric or US units via display, current, frequency and status outputs, UFM 610 P also via RS 232 interface and PC.

Reflex mode (only UFM 610 P)

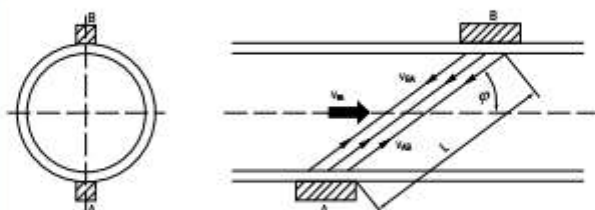
Two ultrasonic transducers (sensors) are mounted on the same side of the pipe at an angle φ to the pipe axis.

- A, B transmitter and receiver
- L distance between sensors
- v_m average flow velocity of liquid
- v_{AB} (v_{BA}) propagation speed (transit time) of sound waves from point A to point B, and B to point A



Diagonal mode (UFM 600 T and UFM 610 P)

Two ultrasonic transducers (sensors) are mounted on opposite sides of the pipe at angle φ to the pipe axis.





Systems

Versions

UFM 610 P

portable system

with CE approval to EN 50081-1 and EN 50082-1

local display

current and pulse outputs

RS 232 interface

battery charger

UFM 600 T

wall mounted system

with CE approval to EN 50081-1 and EN 50082-1

local display

current and pulse outputs

RS 232 interface

status output

Application

volumetric flowrate measurement and volume flow counting of liquids products

measurement in 1 or 2 flow directions

measurement of pipe wall temperature

volumetric flowrate measurement and volume flow counting of liquids products

measurement in 1 or 2 flow directions

ultrasonic wave propagation time to determine the liquid product

Pipeline characteristics

Diameter (meter size)

13 - 5000 mm or 1/2" - 200"

50 - 3000 mm or 2" - 120"

Wall thickness of steel

< 75 mm / < 2.95"

< 40 mm / < 1.60"

Materials

metal, plastic and internal / external coated pipes (coating and liners fully bonded to pipewall)

metal, plastic, ceramic, asbestos cement and internal / external coated pipes (coating and liners fully bonded to pipewall)

Primary heads

Sensors

2 ultrasonic sensors A, B, C and/or D with mounting device

2 ultrasonic sensors RS 600 with ALTOCLAMP mounting device

standard
standard
option
option

A: 13 - 89 mm (0.50" - 3.50")
B: 90 - 1000 mm (3.54" - 40.00")
C: 300 - 2000 mm (12.00" - 80.00")
D: 1000 - 5000 mm (40.00" - 200.00")

for the total range

Mounting device

a mounting set consists of 1 adjustable sensor and 1 fixed sensor with integrated pipe wall contact temperature measurement (not for D sensors)

ALTOCLAMP mounting set with 2 sensors and webbing straps

	<u>standard</u>	<u>option</u>
A:	chain	-
B:	chain	magnets
C:	chain	magnets
D:	webbing	magnets

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Error limits
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Signal converter
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Technical data

Full-scale ranges

Selectable units m³, Liter, gallons, k gallons, US gallons per second, minute, hour, day and m/s, ft/s

Full-scale ranges Q_{100%}

Sensors	Meter size	min.	max.
A	13 - 89 mm / 0.5" - 3.5"	0.03 m/s (0.10 ft/s)	13.47 m/s (44.19 ft/s)
B	90 - 1000 mm / 3.54" - 40"	0.006 m/s (0.020 ft/s)	14.89 m/s (49.15 ft/s)
C	300 - 2000 mm / 12" - 80"	0.06 m/s (0.20 ft/s)	12.29 m/s (40.32 ft/s)
D	1000 - 5000 mm / 40" - 200"	0.008 m/s (0.026 ft/s)	7.27 m/s (23.85 ft/s)

Error limits

Measuring error (typical)	v ≥ 1 m/s (≥ 3.3 ft/s): ± 2.0 % of measured value
	v < 1 m/s (< 3.3 ft/s): ± 0.02 m/s (+ 0.066 ft/s)
Repeatability (typical)	± 0.5 % of measured value

UFS 610 ultrasonic transducer sensors

Product	clean and homogeneous liquids
Temperature	sensors A + B -20 to +200°C / -4 to +392°F C -20 to +200°C / -4 to +392°F D -20 to + 80°C / -4 to +176°F
Reynolds number	Re > 10 000 (Re < 10 000 on request)
Solids and gas contents	< 1 % by volume
Protection category to IEC 529 / EN 60 529	IP 65 equivalent to NEMA 4/4X
Power supply	15 Volt from signal converter
Ambient temperature	-25 to +60°C / -13 to +140°F
Connections / sensor cables	coaxial cable RG 174 with LEMO connectors, length 3 m / 10 ft.
Materials	
Sensor housing	Polyetheretherketone (PEEK)
Mounting device	Aluminium, anodized



UFC 610 P signal converter

Current output	galvanically isolated, configurable ranges and values
Function	continuous flow measurement
Current	0 - 20 mA / 4 - 20 mA / 0 - 16 mA
Time constant	3 - 100 s
Load	$R_i = \frac{15 \text{ V}}{I_{100\%}[\text{mA}]}$ in kΩ (e.g. 0.75 kΩ at 20 mA)
Forward / reverse measurement (F/R)	configurable
Pulse output	configurable ranges and values
Function	continuous flow totalization
Pulse rate for Q - 100%	1 pulse/s or 100 pulses/s
Amplitude	5 V
Pulse width	100 ms or 5 ms
Load R _i	1 kΩ
Forward / reverse measurement (F/R)	settable
Low-flow cutoff	
Function	switches current and pulse outputs
Cutoff "on" and cutoff "off" values	configurable between 0 - 1 m/s / 0 - 3.3 ft/s
Interface	RS 232
Local display	back-lit display
Display functions	actual flowrate, totalizer, messages of outputs and errors, status data, temperature of pipe wall
Display units	m ³ /h, m ³ /min, m ³ /s, Liter/min, Liter/s, gallons/min, k gallons/h, US gallons/h and m/s, ft/s
	- flow
	- totalizer
	- temperature
Language of plain texts	°C factory setting: English and German can be changed to English and French (on floppy, diskette)
Power supply	
Voltage	90 - 257 V AC
Frequency	50 / 60 Hz
Power consumption	9 VA
Carrying case	
Material	hard plastic
Ambient temperature	- 25 to + 60°C / - 13 to + 140°F (electronics 0 to +60°C / + 32 to + 140°F)
Protection category (IEC 529 / EN 60 529)	IP 65 equivalent to NEMA 4/4X



Background

Flowtubes UFM 500

C clamp-on UFM 600/610

Weld-on UFM 800 W

Open channel UFM 800 C

Gas-tube flowmeter GFM 700

Custody transfer ALTOSONIC V

Calibration

Installation notes

Sizing guide

Ordering guide

Mounting the UFS 610 ultrasonic sensors

- The clamp-on ultrasonic flowmeter is suitable for volumetric flowrate measurement (and volume flow counting) in all metal, plastic, ceramic, asbestos cement and internally/externally coated pipelines. Refer to pipeline data on page 3. Coatings and liners must be fully bonded to the pipewall.
- Mount the flowmeter at a point where the pipe is always completely filled with the liquid product, even at "zero" flow velocity.
- Solid and gas contents not to exceed 1% of volume.

Note:

Even in liquids that are virtually gas-free, large quantities of gas may form if the liquid is allowed to expand before reaching the measuring point, e.g. downstream of partially closed valves or small pump outlets.

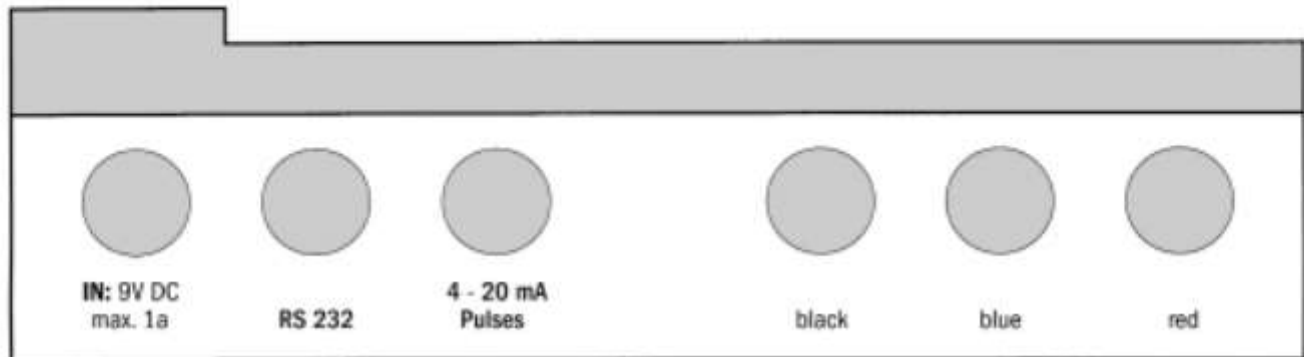
- For horizontal pipelines, position the sensors so that the measuring beam is horizontal.

- The point of contact between the sensor and the pipeline must be clean. If necessary, remove all traces of rust, flaked coatings, etc. before mounting.
- Inlet run
 - ... downstream of pump 15 x DN
 - ... downstream of one or two quarter bends 10 x DN
 - ... downstream of reducer (reducing angle $\alpha/2 \leq 4^\circ$) no additional inlet run necessary
- Outlet run 5 x DN (DN = nominal pipe dia.)
- The following physical parameters must be known: sound velocity in the fluids, inside diameter of the pipe.

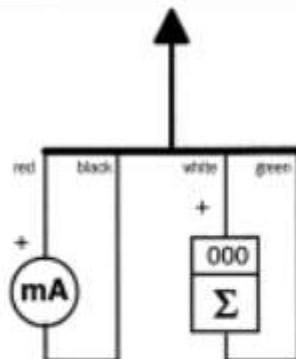
Electrical connection of UFC 610 P signal converter

- The two supplied sensor cables form the electrical connection between sensors and signal converter.
- Note that length of sensor cables is 3 m (10 ft).
- Ambient temperature must be from -25 to +60°C (-13 to +140°), therefore do not cover signal converter with heat-insulating materials, and do not expose to strong sunlight or other heat sources.
- Avoid intensive vibration.

Technical data for output see Page 5.



Connection of sensor

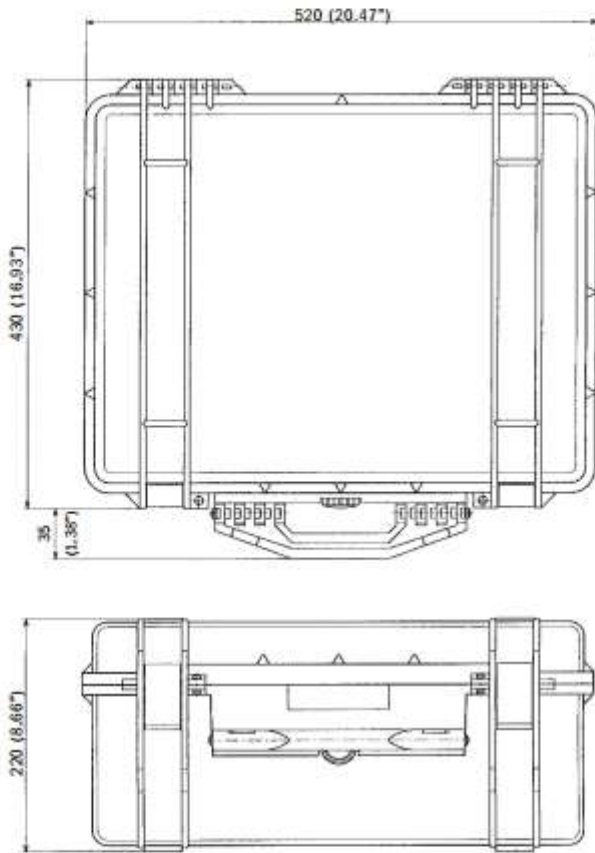


RS 232 interface	Colour of cable	Plugs	
		5-Pin	9-Pin
DSR	red	1 (marked)	6
DTR	black	2	4
GND (screen)	-	3	5
TXD	green	4	2
RXD	white	5	3

Dimensions and weights

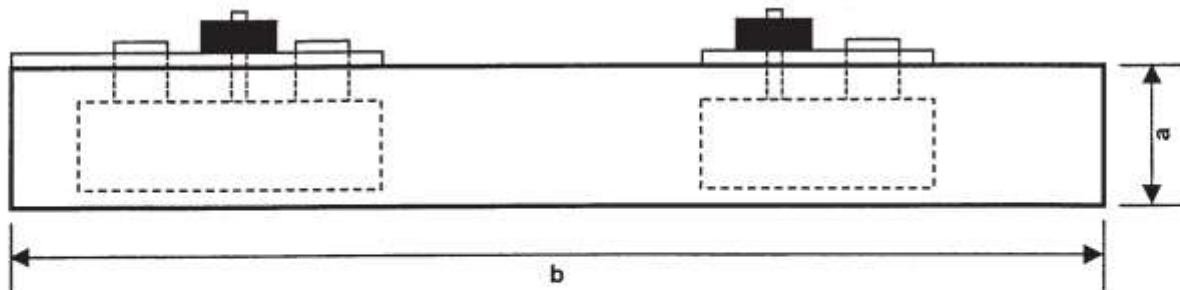
Dimensions in mm (inches)

Weight approx. 10.5 kg (23.5 lb)



UFS 610 transducer sensors and mounting device

Sensor	Dimensions mm (inches)		Weight kg (lb)
	a	b	
A	38 (1.50)	250 (9.84)	0.40 (1.0)
B + C	50 (1.97)	375 (14.76)	0.65 (1.5)



Sensors D on request

- Background
- Flowtubes UFM 500
- C clamp-on UFM 600/610
- Weld-on UFM 800 W
- Open channel UFM 800 C
- Gas-flowtube GFM 700
- Custom transfer ALTOSONIC V
- Calibration
- Installation notes
- Sizing guide
- Ordering guide

Technical data
Full-scale ranges
Selectable units m^3/h , liter/s, US gallons/min or user-defined unit

Full-scale range $Q_{100\%}$	Unit	lowest (min)	highest (max)
Meter size DN in mm	$Q_{100\%}$ in m^3/h	$-(DN / 100)^2 \times 14.2$	$- DN^2 \times 0.05$
Meter sizes (DN) in inches	$Q_{100\%}$ in m^3/h	$- DN^2 \times 0.9$	$- DN^2 \times 31.25$
	$Q_{100\%}$ in US Gal/min	$- DN^2 \times 3.9$	$- DN^2 \times 138$

Error limits
Measuring error $\pm 1 - 3\%$ of measured value, depending on application

Repeatability

$$\leq \frac{0.2}{D_i \times v_m} \text{ in \% of measured value with } \begin{matrix} v_m \text{ in } \mathbf{m/s} \text{ (flow velocity)} \\ D_i \text{ in } \mathbf{m} \text{ (inner tube diameter)} \end{matrix}$$

$$\leq \frac{24}{D_i \times v_m} \text{ in \% of measured value with } \begin{matrix} v_m \text{ in } \mathbf{ft/s} \text{ (flow velocity)} \\ D_i \text{ in } \mathbf{inch} \text{ (inner tube diameter)} \end{matrix}$$

RS 600 ultrasonic transducer sensors

Product clean and homogeneous liquids
Temperature $- 25$ to $+ 120^\circ\text{C}$ / $- 13$ to $+ 248^\circ\text{F}$
Reynolds number $Re > 10\,000$
Solids and gas contents $< 1\%$ by volumes (under operating conditions)

Protection category (IEC 529 / EN 60 529)

Standard IP 65 equivalent to NEMA 4 and 4X, sensors with BNC connectors
Special version IP 67 equivalent to NEMA 6, sensors with non-detachable connecting cable

Power supply 50 Volt from signal converter

Ambient temperature $- 25$ to $+ 60^\circ\text{C}$ / $- 13$ to $+ 140^\circ\text{C}$
Sensor cable coaxial cable with BNC connectors, 5 m / 15 ft long (Option: 5 - 300 m / 15 - 900 ft long)

Materials

Sensor housing Brass nickel-plated
ALTOCLAMP
 (mounting device) Aluminium anodized, for all pipe diameters



UFC 600 T signal converter

Current output (term. 5/6)	Galvanically isolated	
<u>Function</u>	Continuous flowrate measurement or measurement of ultrasonic wave propagation time to determine (composition of) the liquid product, can also be used at status output	
<u>Current</u>	0 to 16 mA } setting in increments of 1 mA 4 to 20 mA }	
$I_{10\%}$ for Q = 0%		
$I_{100\%}$ for Q = 100%		
<u>Low-flow cutoff (SMU)</u>	1 to 19% } of $Q_{100\%}$, setting in 1% increments, independent of pulse output 2 to 20% }	
cutoff "on" value	direction identified via pulse output, see under "status output"	
cutoff "off" value		
<u>Forward/reverse measurements (F/R)</u>	0.04 to 3600 seconds, setting in increments of 1, 0.1 or 0.01 seconds	
<u>Time constant</u>	14 V	
Max. load at $I_{100\%}$	$I_{100\%}$ [mA] in kohms (e.g. 0.7 kohms at 20 mA, 2.8 kohms at 5 mA)	
Pulse output	Galvanically isolated	
<u>Function</u>	continuous flow counting or measurement of ultrasonic wave propagation time to determine (composition of) the liquid product, can also be used as status output, see below	
<u>Pulse rate for Q = 100%</u>	10 to 36 000 000 pulses per hour 0.167 to 600 000 pulses per minute 0.0028 to 10 000 pulses per second (= Hz) optionally in pulses per liter, m ³ or US gallons short-circuit-proof for electromechanical (EMC) or electronic (EC) totalizers for electronic (EC) totalizers approx. 27 V DC see Table "pulse width"	
<u>Active output</u>	open collector for connection of active electronic totalizers (EC) or switchgear	
Terminals 4.1/4.2	5 to 30 V DC	
Terminals 4/4.1/4.2	max. 100 mA	
Amplitude		
Load rating		
<u>Passive output</u>		
Terminals 4/4.1		
Input voltage		
Load current		
<u>Pulse width</u>	<u>Frequency f at Q = 100%</u>	<u>Load rating of active output</u>
500 ms	0.0028 Hz < f ≤ 1 Hz	<u>Load current</u> <u>Load</u>
Pulse duty factor 1:1	1 Hz < f ≤ 1000 Hz	≤ 150 mA ≥ 180 ohms
160 μs	1000 Hz < f ≤ 2547 Hz	≤ 25 mA ≥ 1000 ohms
50 μs	2547 Hz < f ≤ 10000 Hz	≤ 25 mA ≥ 1000 ohms
<u>Low-flow cutoff (SMU)</u>	1 of 19% } of $Q_{100\%}$, setting in 1% increments, independent of current output 2 of 20% }	
cutoff "on" value	direction identified via current output, see under "status output"	
cutoff "off" value	0.04 seconds or same as current output	
<u>Forward/reverse measurements (F/R)</u>		
<u>Time constant</u>		
Status output	<u>Current output</u>	<u>Pulse output</u>
<u>Connection terminals</u>	5 + 6	4.1 + 4.2
<u>Voltage</u>	24 V DC	24 V DC
<u>Load current</u>	$I_{max} \leq 22$ mA	< 25 mA
	$I_{0\%} \leq 16$ mA	
<u>Load</u>	≤ 1.2 kohms	> 1 kohms
Local display, at UFC 600 T only	3-line back-lit LCD	
<u>Display functions</u>	actual flowrate, propagation time of ultrasonic waves, forward, reverse and sum totalizers (7-digit), each can be set for continuous or sequential display, and output of error messages	
<u>Display units</u>	liters, m ³ or US gallons per second, minute or hour, 1 user-defined unit (e.g. hectoliters per day or US million gallons per day)	
Actual flowrate		
Totalizers	liters, m ³ or US gallons and 1 user-defined unit (e.g. hectoliters or US million gallons), min. 1 year overflow time	
<u>Language of plain texts</u>	English, German, French, Dutch	
<u>Display</u>	8-digit, 7-segment numeral and sign display, symbols for key acknowledgement	
1st line (top)	10-character, 14-segment text display	
2nd line (middle)	5 markers ▼ to identify actual display	
3rd line (bottom)		
Power supply		
AC version	85 - 264 V AC / P ≤ 10 VA	
DC version	18 - 32 V DC / P ≤ 8 W	
Housing		
Material	die-cast aluminium with polyurethane finish	
Protection category (IEC 529 / EN 60 529)	IP 65 equivalent to NEMA 4 and 4X	
Hazardous duty version	Zone 2, Artidor	

Background
Flowtubes UFM 500
Clamp-on UFM 600/610
Weld-on UFM 800 W
Open channel UFM 800 C
Gas-tube flowtube GFM 700
Custody transfer ALTRONIC V
Calibration
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Ordering guide

UFM 610 T

Mounting the RS 600 ultrasonic sensors

- The clamp-on ultrasonic flowmeter is suitable for volumetric flowrate measurement (and volume flow counting) in all metal, plastic, ceramic, asbestos cement and internally/externally coated pipelines. Refer to pipeline data on page 3. Coatings and liners must be fully bonded to the pipewall.
- Mount the flowmeter at a point where the pipe is always completely filled with the liquid product, even at "zero" flow velocity.
- Not to exceed 1% by volume at flowing conditions.

Note:

Even in liquids that are virtually gas-free, large quantities of gas may form if the liquid is allowed to expand before reaching the measuring point, e.g. downstream of partially closed valves or small pump outlets.

- For horizontal pipelines, position the sensors so that the measuring beam is also approximately horizontal.

- The point of contact between the sensors and the pipeline must be clean. If necessary, remove all traces of rust, flaked coatings, etc. before mounting.

● Inlet run

- ... downstream of pump 15 x DN
- ... downstream of one or two quarter bends 10 x DN
- ... downstream of reducer (reducing angle $\alpha/2 = 4^\circ$) no additional inlet run necessary

- Outlet run 5 x DN (DN = nominal pipe dia.)

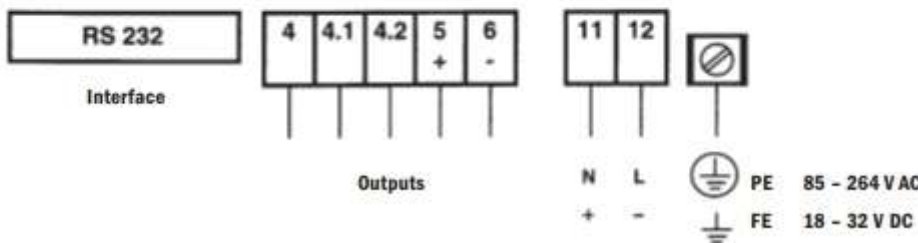
- The following physical parameters must be known: sound velocity in the fluid inside diameter of the pipe.

Mounting location and electrical connection of UFC 600 T signal converter

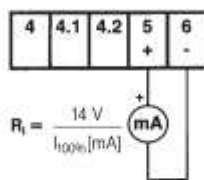
- Mount UFC 600 T signal converter close to the measuring point (RS 600 sensors).
- The two supplied sensor cables, fitted with BNC connectors, form the electrical connection between sensors and signal converter.
- Note that length of sensor cables is 5 m (15 ft) option: 5 - 100 m (15 - 300 ft).

- Ambient temperature must be from -25 to $+60^\circ\text{C}$ (-13 to $+140^\circ\text{F}$), therefore do not cover signal converter with heat-insulating materials, and do not expose to strong sunlight or other heat sources.
- Avoid intensive vibration.

Power supply

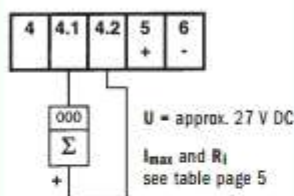


Current output I

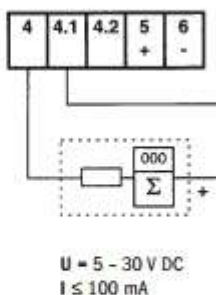


$I_{100\%}$	5 mA	20 mA
R_i	2.8 k Ω	700 Ω

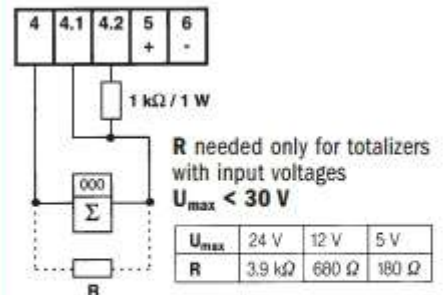
Pulse output P_{active} for EC and EMC



Pulse output P_{passive} for active EC



Pulse output P_{active} for EC



UFM 600 T

Dimensions and weights

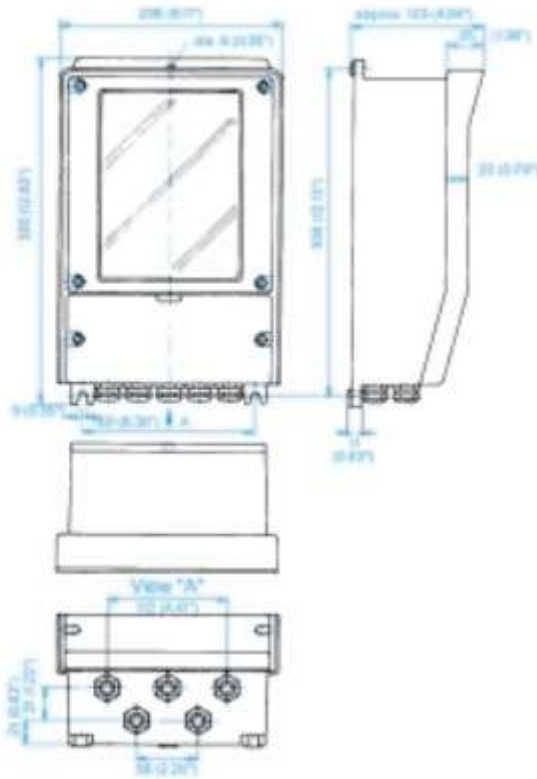
UFM 600 T signal converter

Weight

approx. 4.5 kg or 10 lbs

Dimensions

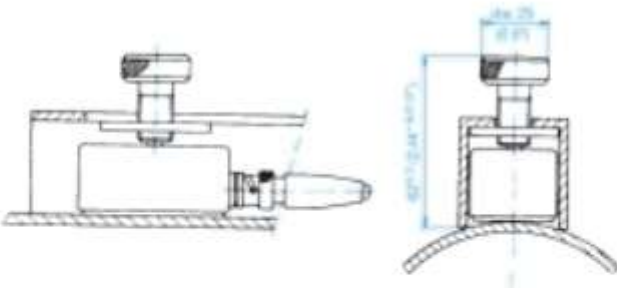
in mm (inches)



RS 600

Weight (2 sensors)

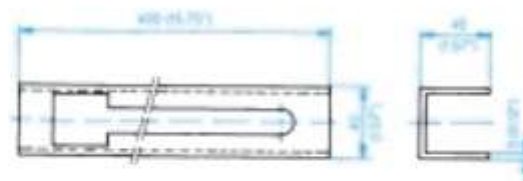
approx. 0.75 kg or 1.7 lbs



ALTOCLAMP

Weight (2 rails)

approx. 0.65 kg or 1.4 lbs



Background

Flowtubes
UFM 500

C clamp-on
UFM 600/610

Weld-on
UFM 800 W

Open channel
UFM 800 C

Gas-
flowtube
GFM 700

Custom
transfer
ALTOSONIC V

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