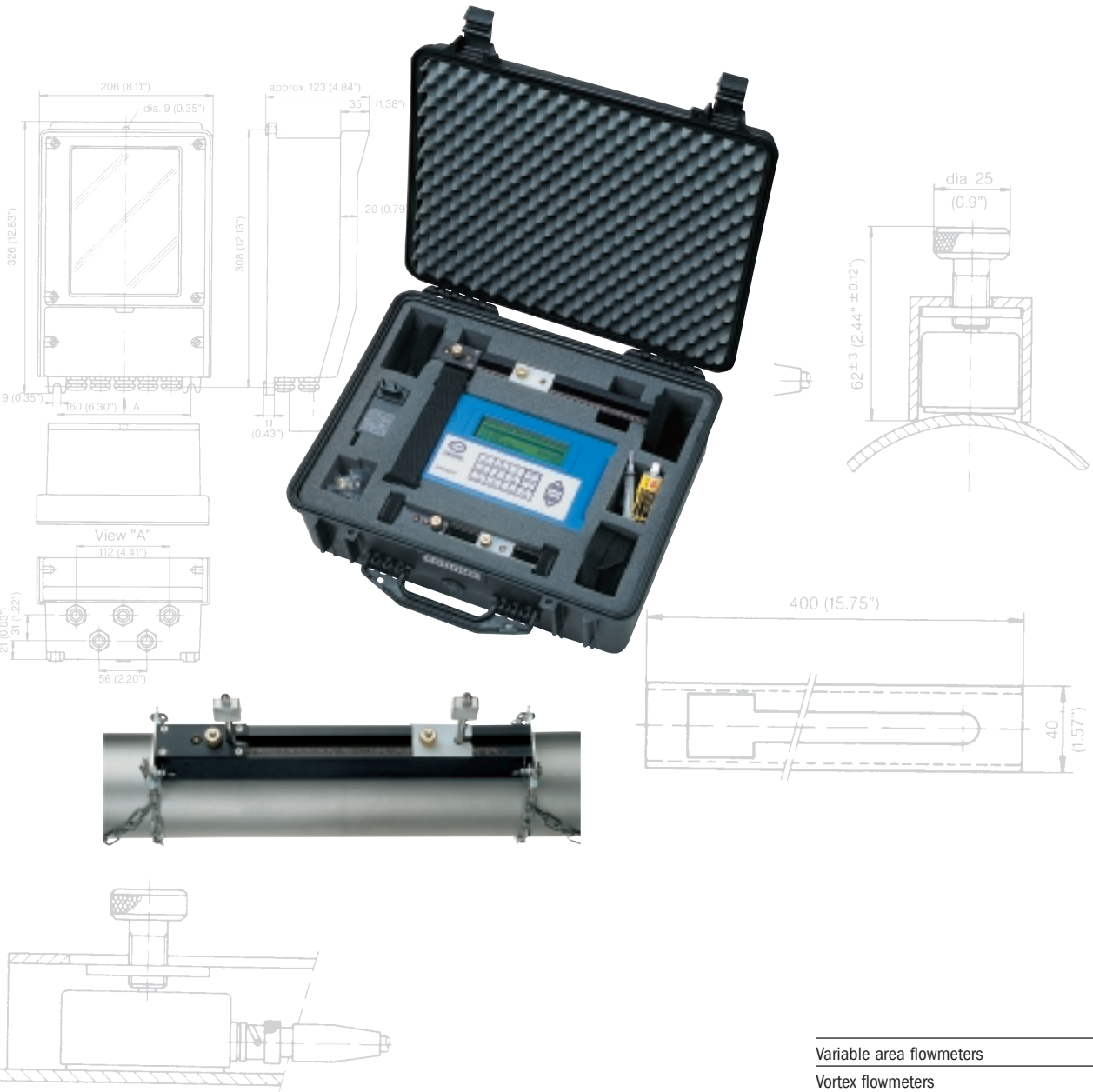
 7.02378.21.00

GR/PRINTO

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

for liquids



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

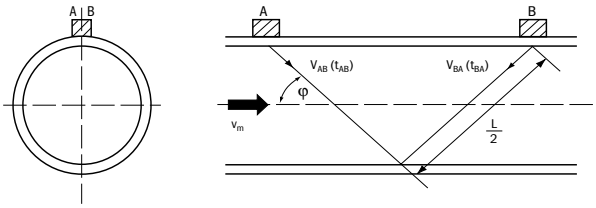
Configuration and function

- 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)

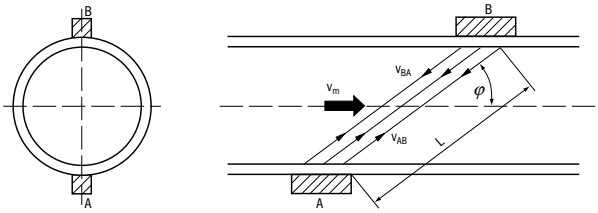
Two ultrasonic transducers (sensors) are mounted on the same side of the pipe at an angle φ to the pipe axis.

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.



UFM 610 P / UFM 600 T

Systems	UFM 610 P	UFM 600 T
Versions	portable system	wall mounted system
	with CE approval to EN 50081-1 and EN 50082-1	with CE approval to EN 50081-1 and EN 50082-1
	local display	local display
	current and pulse outputs	current and pulse outputs
	RS 232 interface	RS 232 interface
	battery charger	status output
Application	volumetric flowrate measurement and volume flow counting of liquids products	volumetric flowrate measurement and volume flow counting of liquids products
	measurement in 1 or 2 flow directions	measurement in 1 or 2 flow directions
	measurement of pipe wall temperature	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	A: 13 – 89 mm (0.50" – 3.50") inside	for the total range
standard	B: 90 – 1000 mm (3.54" – 40.00") pipe	
option	C: 300 – 2000 mm (12.00" – 80.00") dia-	
option	D: 1000 – 5000 mm (40.00" – 200.00") meter	
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
	standard / option	
	A: chain / –	
	B: chain / magnets	
	C: chain / magnets	
	D: webbing / magnets	
Technical data	Page **4 – 7**	Page **8 – 11**
Full-scale range	4	8
Error limits	4	8
Primary head	4	8
Signal converter	5	9
Application information	6	10
Dimensions	7	11

Technical data

Full-scale ranges

Selectable units	m^3, 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	$R_i = \frac{15\ V}{I_{100\%}[mA]}$ 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 - flow	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
- totalizer	m^3, Liter, gallons, US gallons
- temperature	°C
Language of plain texts	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

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

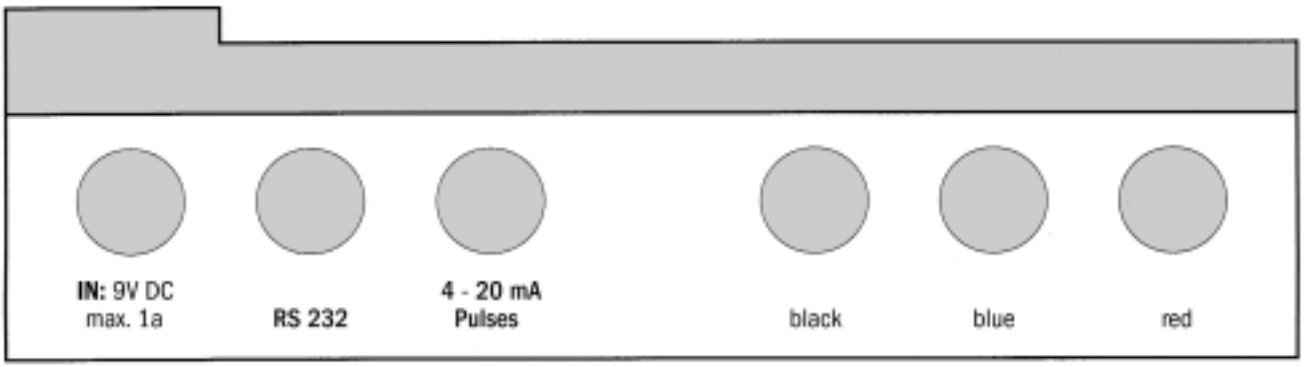
...	downstream of pump	15 x DN
...	downstream of one or two quarter bends	10 x DN
...	downstream of reducer (reducing angle $\alpha/2 \leq 4°$)	no additional inlet run necessary

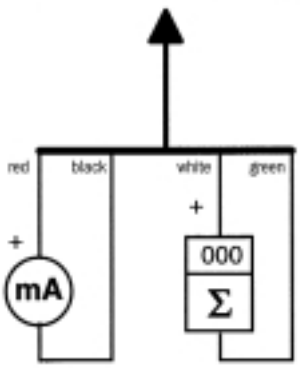
- Outlet run 5 x DN
  (DN = nominal pipe dia.)
- The following physical parameters must be known: sound velocity in the fluids, inside diameter of the pipe.

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.





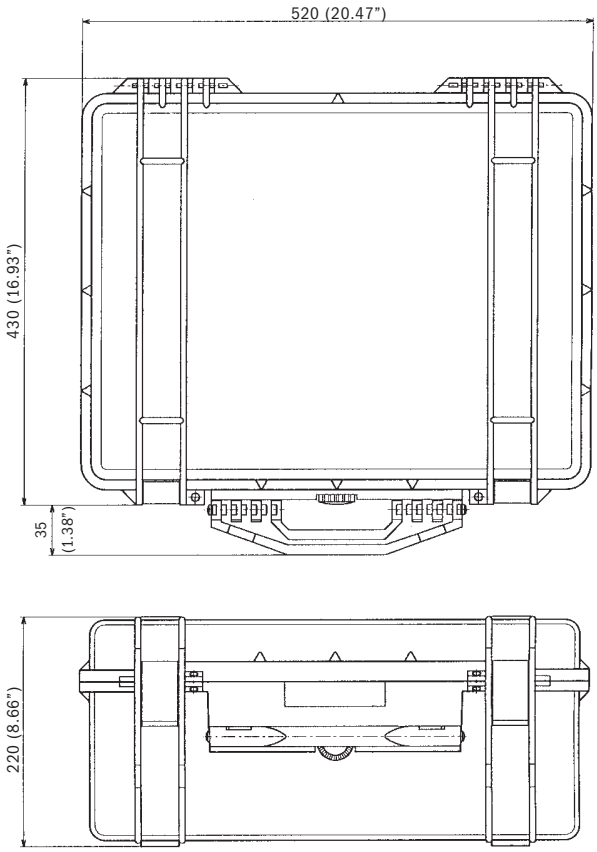
Connection of sensor

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

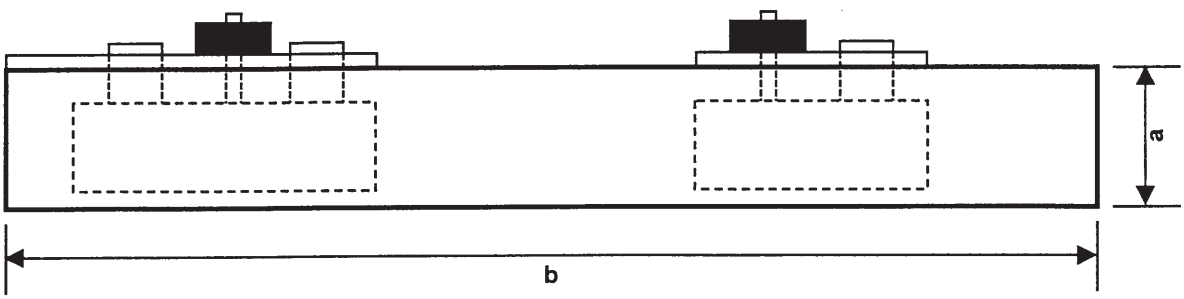
Dimensions in mm (inches)

Weight approx. 10.5 kg (23.5 lb)



UFS 610 transducer sensors and mounting device

Sensor	Dimensions mm (inches)		Weight
	a	b	kg (lb)
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

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**	= $(DN / 100)^2$ x 14.2	= DN^2 x 0.05
Meter sizes (DN) in inches	$Q_{100\%}$ in **m^3/h**	= DN^2 x 0.9	= DN^2 x 31.25
	$Q_{100\%}$ in **US Gal/min**	= DN^2 x 3.9	= DN^2 x 138

Error limits

Measuring error	± 1 – 3% of measured value, depending on application	
Repeatability		
	$\leq \frac{0.2}{Di \times vm}$ in % of measured value with	vm in **m/s** (flow velocity) Di in **m** (inner tube diameter)
	$\leq \frac{24}{Di \times vm}$ in % of measured value with	vm in **ft/s** (flow velocity) Di in **inch** (inner tube diameter)

RS 600 ultrasonic transducer sensors

Product	clean and homogeneous liquids
Temperature	– 25 to + 120°C / – 13 to + 248°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°C / – 13 to + 140°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
Function	Continuous flowrate measurement **or** measurement of ultrasonic wave propagation time to determine (composition of) the liquid product, can also be used at status output
Current	
$I_{0\%}$ for Q = 0%	0 to 16 mA } setting in increments of 1 mA
$I_{100\%}$ for Q = 100%	4 to 20 mA }
Low-flow cutoff (SMU)	
cutoff "on" value	1 to 19% } of $Q_{100\%}$, setting in 1% increments, independent of pulse output
cutoff "off" value	2 to 20% }
Forward/reverse measurements (F/R)	direction identified via pulse output, see under "status output"
Time constant	0.04 to 3600 seconds, setting in increments of 1, 0.1 or 0.01 seconds
Max. load at $I_{100\%}$	$\frac{14\ V}{I_{100\%}\ [mA]}$ in kohms (e.g. 0.7 kohms at 20 mA, 2.8 kohms at 5 mA)
Pulse output	Galvanically isolated
Function	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
Pulse rate for Q = 100%	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
Active output	short-circuit-proof
Terminals 4.1/4.2	for electromechanical (EMC) or electronic (EC) totalizers
Terminals 4/4.1/4.2	for electronic (EC) totalizers
Amplitude	approx. 27 V DC
Load rating	see Table "pulse width"
Passive output	
Terminals 4/4.1	open collector for connection of active electronic totalizers (EC) or switchgear
Input voltage	5 to 30 V DC
Load current	max. 100 mA

		Load rating of active output	
Pulse width	Frequency f at Q = 100%	Load current	Load
500 ms	0.0028 Hz < f ≤ 1 Hz	≤ 150 mA	≥ 180 ohms
Pulse duty factor 1:1	1 Hz < f ≤ 1000 Hz	≤ 25 mA	≥ 1000 ohms
160 µs	1000 Hz < f ≤ 2547 Hz	≤ 25 mA	≥ 1000 ohms
50 µs	2547 Hz < f ≤ 10000 Hz	≤ 25 mA	≥ 1000 ohms

Low-flow cutoff (SMU)	
cutoff "on" value	1 of 19% } of $Q_{100\%}$, setting in 1% increments, independent of current output
cutoff "off" value	2 of 20% }
Forward/reverse measurements (F/R)	direction identified via current output, see under "status output"
Time constant	0.04 seconds or same as current output

Status output	Current output	Pulse output
Connection terminals	5 + 6	4.1 + 4.2
Voltage	24 V DC	24 V DC
Load current	I_{max} ≤ 22 mA $I_{0\%}$ ≤ 16 mA	< 25 mA
Load	≤ 1.2 kohms	> 1 kohms

Local display, at UFC 600 T only	3-line back-lit LCD
Display functions	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
Display units	
Actual flowrate	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)
Totalizers	liters, m^3 or US gallons and 1 user-defined unit (e.g. hectoliters or US million gallons), min. 1 year overflow time
Language of plain texts	English, German, French, Dutch
Display	
1st line (top)	8-digit, 7-segment numeral and sign display, symbols for key acknowledgement
2nd line (middle)	10-character, 14-segment text display
3rd line (buttom)	5 markers ▼ to identify actual display
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

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

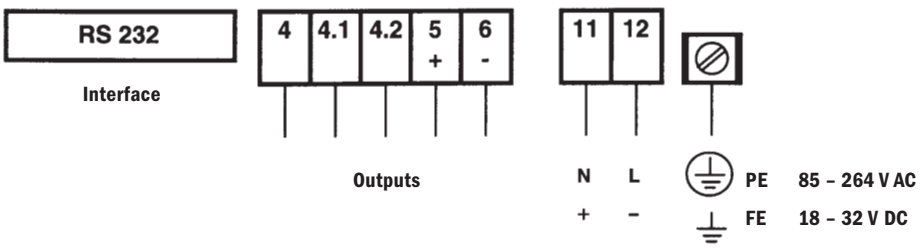
... downstream of pump	15 x DN
... downstream of one or two quarter bends	10 x DN
... downstream of reducer (reducing angle $\alpha/2 = 4°$)	no additional inlet run necessary

- 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.

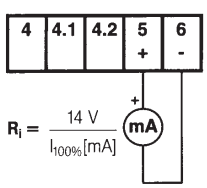
Mounting location and electrical connection of UFC 600 T signal converter

- 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°C (–13 to +140°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

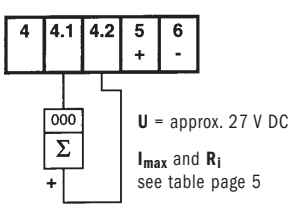


Current output I



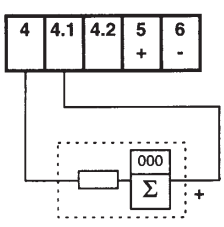
$I_{100\%}$	5 mA	20 mA
R_i	2.8 kΩ	700 Ω

Pulse output P_{active}
for EC and EMC



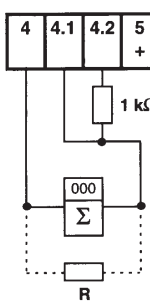
U = approx. 27 V DC
I_{max} and R_i
see table page 5

Pulse output $P_{passive}$
for active EC



U = 5 – 30 V DC
I ≤ 100 mA

Pulse output P_{active}
for EC



R needed only for totalizers with input voltages
U_{max} **< 30 V**

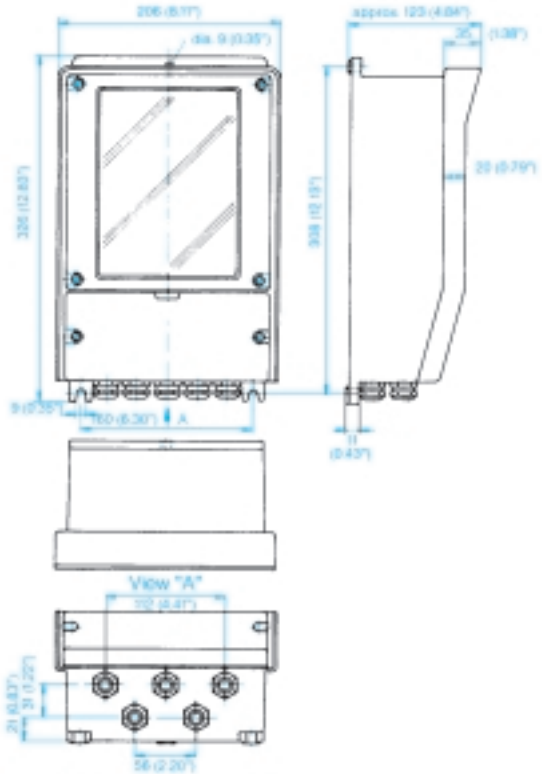
U_{max}	24 V	12 V	5 V
R	3.9 kΩ	680 Ω	180 Ω

Dimensions and weights

UFC 600 T signal converter

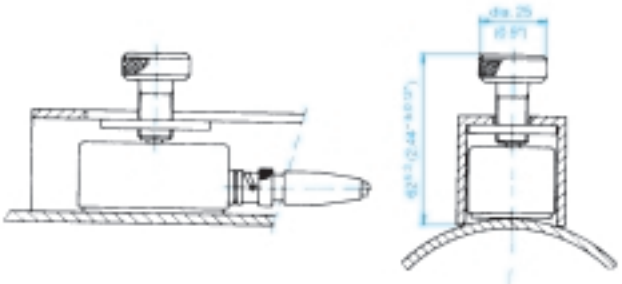
Weight
approx. 4.5 kg or 10 lbs

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