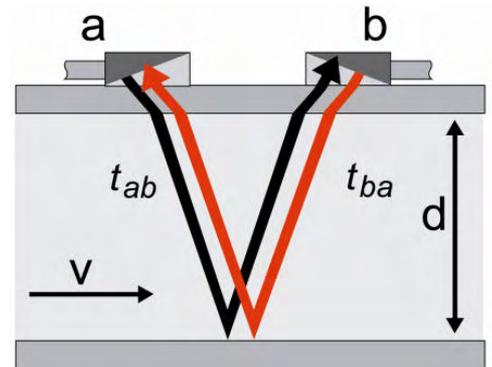


Here are answers to the most frequently asked questions about ultrasonic flow measurement in general and our products in particular. Should you have any further questions, please feel free to contact us.

## 1. How do Katronic's ultrasonic clamp-on flowmeters work?

The KATflow flowmeters work on the Transit-Time ultrasonic principle. This put simple, involves sending and receiving ultrasonic pulses from a pair of sensors and examining the time difference in the signal. This is a more direct method of determining flow than some other systems and therefore provides a much more reliable measurement. Ultrasonic transducers are mounted on the external surface of the pipe and are used to generate ultrasonic pulses which are passed through the pipe wall. The flowing liquid within causes time differences, frequency variations and phase shifts in the ultrasonic signals, which are then evaluated by the flowmeter to produce an accurate flow measurement.

The key principle is that sound waves travelling with the flow will move faster than those travelling against it. The difference in the transit time of these signals is directly proportional to the flow velocity of the liquid and consequently of the volumetric flow rate. Whilst elements such as flow profile, type of liquid and pipe material could have an effect on the measurement, the flowmeter's electronics compensate for and adapt to changes in the medium in order to provide reliable measurements.



*Transit time measurement technology as applied by Katronic's flowmeters: The ultrasonic pulse ab is travelling faster with the current than pulse ba, which has to travel against it. The resulting transit time difference is directly proportional to the flow velocity (v).*

## 2. For which fluids can I use Katronic's ultrasonic flowmeters?

Katronic's ultrasonic clamp-on flowmeters can be used to measure the flow of a wide range of electrically conductive and non-conductive liquids including liquefied gases.

Depending on the industry, measurable liquids can range from water and wastewater to beverages, liquid food, shampoo, vegetable and mineral oils, hydrocarbons, refrigerants and many more. There is almost no acoustically conductive liquid which the KATflow flowmeters cannot measure.

Alcohol, Benzol, Carbon tetrachloride, Diesel, Ethanol, Ethyl Alcohol, Ether, Formaldehyde, Glycol, Isopropanol, Methanol, Milk, Naphta, Mineral & Vegetable Oil, Refrigerants, Tetrachlorides, Water, Wastewater, ...

*Only a small sample of liquids which can be measured with the KATflow flowmeters.*

## 3. Does the pipe have to be made of particular material?

The clamp-on flowmeters can be used on all commonly applied pipe materials including ferrous, alloys and plastic piping.

The flowmeters will also operate on lined pipes provided that the lining is acoustically conductive and properly bonded to the pipe's internal surface.

Carbon / Hardened / Mild / Stainless Steel, Aluminium, Copper, Brass, Cast / Ductile Iron, Nickel, Tin, Titanium, Glass, Polyethylene, PVC, CPVC, Acrylic, ...

*Small sample of pipe materials on which the KATflow flowmeters can be applied.*

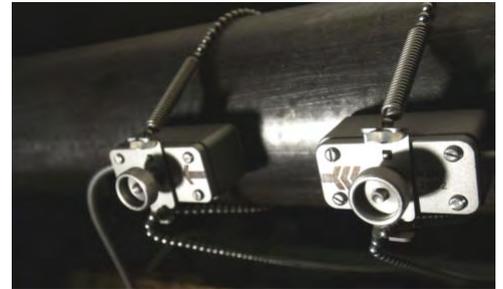
## 4. How accurate are Katronic's ultrasonic flowmeters?

For volume flow measurements, Katronic's KATflow flowmeters can achieve an uncertainty of 1 to 3 % of the measured value depending on the specific application. An decreased uncertainty of approximately 0.5 % can be achieved with on-site process calibration. In case of flow velocity measurements, the flowmeters achieve an uncertainty within 0.5 % of the measured value.

## 5. How do I install the flowmeter?

As the ultrasonic sensors are simply clamped on the pipe surface, Katronic's ultrasonic flowmeters can be installed without the need to open pipelines. The sensors are fixed to the pipe using special metal chains, straps or mounting rails. Additionally, a special coupling paste is applied to the bottom of the sensors to ensure an acoustically conductive connection to the pipe.

In order to achieve a good signal strength and high accuracy, the mounting points on rough pipes may need to be ground before the installation of the sensors. Every instrument of the KATflow series is equipped with a set-up wizard and sensor positioning assistant, which guide the user step-by-step through the installation process. As a result, it only takes minutes to install and set up the flowmeter and to obtain correct measurement data.



*Ultrasonic flow sensors strapped on the pipe surface using chains and clips. The clamp-on mounting technique allows flow to be measured on pipes of various diameters without the need to cut into the pipes.*

## 6. Is there any regular maintenance work required?

Katronic's ultrasonic clamp-on flowmeters do not contain moving parts which could wear out. Moreover, the sensor casings are manufactured of stainless steel and are in no contact with the flowing medium, which helps avoid corrosion. Thus maintenance should not be necessary.

## 7. On which pipe diameters can I measure with the flowmeters?

The KATflow series of ultrasonic clamp-on flowmeters can cover a pipe diameter range from 10 mm (0.4 inches) to 3 m (118 inches) with special solutions available for non-standard applications.



*Ultrasonic flow sensors with stainless steel head casing and cable conduit for extreme robustness. There are two sensor types available to cover a diameter range from 10 mm to 3 m.*

## 8. What is the standard cable length for the ultrasonic sensors?

The ultrasonic clamp-on sensors of the KATflow series come with a standard cable length of 2.5 or 4.0 meters depending on the specific sensor type. Additional extension cables of up to 200 meters can be ordered separately.

## 9. Do the flowmeters come with a calibration certificate?

Due to the ultrasonic measurement technology, there is no need to calibrate the flowmeters to achieve the above stated accuracy (see question no. 4).

If a customer requires a calibration certificate, it can be ordered for an additional charge. It confirms that the supplied sensor and flowmeter combination is delivering measurements which are in the accuracy range as stated.

## 10. Can the flowmeter cope with air bubbles and solid content?

The flowmeters of the KATflow range can measure the flow of liquids with solid particle or air bubble content of up to 10% of the measured volume.



*Katronic's flowmeters can cope with an air bubble content of up to 10% of the measured volume.*

## 11. Can the sensors get wet or be buried?

All of Katronic's ultrasonic clamp-on sensors have a minimum ingress protection rating of IP66. This means that they are suitable for installation on buried pipes, in open areas where they are subject to rain, and in plants where there is spray cleaning. There is also the option to upgrade the sensors to IP68 for permanent immersion in water.



Ultrasonic flow sensors mounted on a main water line of Thames Water. After the installation the sensors were buried.

## 12. Do I have to replace the acoustic coupling paste regularly?

Once applied to the sensors during the initial installation, the acoustic coupling paste should not have to be replaced. If the mounting point is exposed to extreme atmospheric conditions such as permanent salt water mist, we would recommend the coverage of the sensors to be checked once a year.

## 13. Can the flowmeters measure non-liquefied gases and air?

Not at the present time.

## 14. Does the flowmeter have to be calibrated for each specific pipe?

Calibrations for specific pipes are not necessary. Entering the specific application parameters (e.g. pipe diameter, pipe material, type of fluid) into the transmitter ensures the above stated accuracy.

If additional accuracy is required, a process calibration can be carried out on site.

## 15. Which measurement units can be displayed?

Katronic's ultrasonic clamp-on flowmeters of the KATflow range can display following units:

Volumetric flow rate:	m <sup>3</sup> /h, m <sup>3</sup> /min, m <sup>3</sup> /s, l/h, l/min, l/s, USgal/h (US gallons per hour), USgal/min, USgal/s, bbl/d (barrels per day), bbl/h, bbl/min, bbl/s
Flow velocity:	m/s, ft/s, inch/s
Mass flow rate:	g/s, t/h, kg/h, kg/min
Volume:	m <sup>3</sup> , l, gal (US gallons), bbl
Mass:	g, kg, t
Heat flow:	W, kW, MW (only with heat quantity measurement option on KATflow 230 and 150)
Heat quantity:	J, kJ, MJ (only with heat quantity measurement option on KATflow 230 and 150)



KATflow 200 hand-held flowmeter.



KATflow 230 portable flowmeter.



KATflow 150 fixed installation flowmeter.

