

# BioProTT™ - Transit-Time Principle

**Non-invasive flow measurement systems by em-tec are based on the ultrasound transit-time principle.**

The **BioProTT™ Clamp-On Transducers** consist of four piezo ceramics housed in a fixed location within the transducer body. The piezo ceramics are arranged at a specific angle "alpha" in relation to the flowing medium. Tubing inserted into the cavity of the transducer is surrounded by the piezo ceramics in an "X" pattern.



A high frequency voltage impulse is used to excite the piezo-ceramics and transmit ultrasound waves from one ceramic to the opposing one, with each one acting alternately as transmitter and receiver.

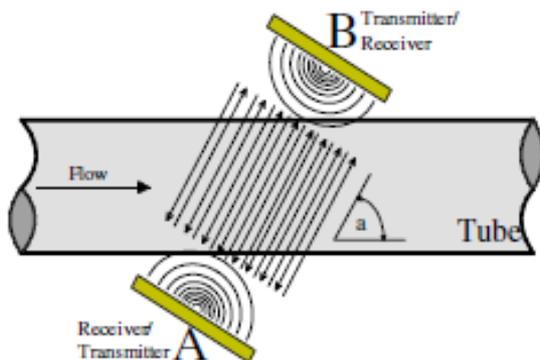
The length of time it takes the signal to travel from one crystal to another (transit time) is measured by the electronics of the flow meter.

As the ultrasound beam travels from one crystal to the other, it must pass through the tubing and medium within the cavity of the transducer.

The ultrasound beam will be affected by the fluid which is moving through the tubing.

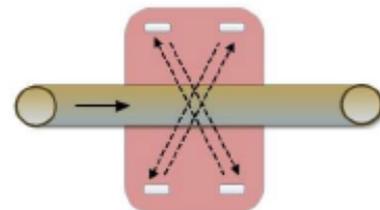
Signals traveling with the fluid flow will have faster transit time and those traveling against the flow will have slower transit times.

The difference between the upstream transit times (against the flow) and downstream transit times (with the flow) is proportional to the volumetric flow rate.



The X pattern arrangement of the transducers acoustically illuminates the whole cross section of the flow channel by four sound paths.

Thus all velocities contributing to the flow profile are accounted for and the overall flow rate can be determined accurately.



**About em-tec GmbH:** German-based em-tec GmbH has been consulting, developing and manufacturing products and components in the field of medical and bioprocess technology for thirty years. One of the company's core competences is in the field of non-invasive flow measurement systems using the ultrasound transit time method.