

# BioProTT™ FlowMeasurement System

Solutions for Industrial & Laboratory Applications



**em-tec**  
BIOPROCESSING

Where Innovation Flows

**PSG**  
a DOVER company

The **BioProTT™ FlowMeasurement System** consists of a flow sensor, the Clamp-On Transducer, and an electronic evaluation system, the flow meter. It is available in different variants with standard interfaces which allow an optimal integration into automated environments.

The function is based on the ultrasonic transit-time method and works non-invasively, meaning there is no direct contact with the medium — making it particularly suitable for processes with strict hygienic requirements.

Innovative design coupled with established and reliable technology for monitoring volumetric flow in real-time enables a truly compact, space saving solution. Our flow meters can be used with all sizes of our non-invasive BioProTT™ Clamp-On Transducers, and it is also possible to switch sensors and/or sensor sizes.



## BioProTT™ FlowMeasurement System

Our Flow Measurement System at a Glance



### BioProTT™ Clamp-On Transducer

- Easy to install on flexible tubing
- Customer-specific calibration in regard to tube, medium, temperature and flow range
- No additional shear stress on cells through the non-invasive flow measurement method
- Economical — reusable transducers last for years



### BioProTT™ FlowMCP

- Flow measurement platform in space-saving control cabinet design
- Seamless integration into existing systems
- Simultaneous flow measurement of up to eight flow channels with one housing size

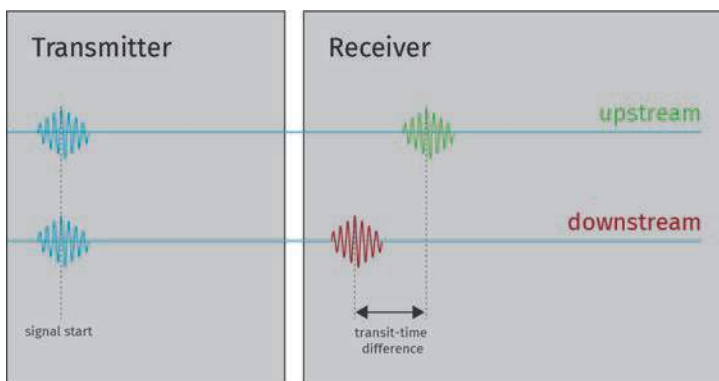
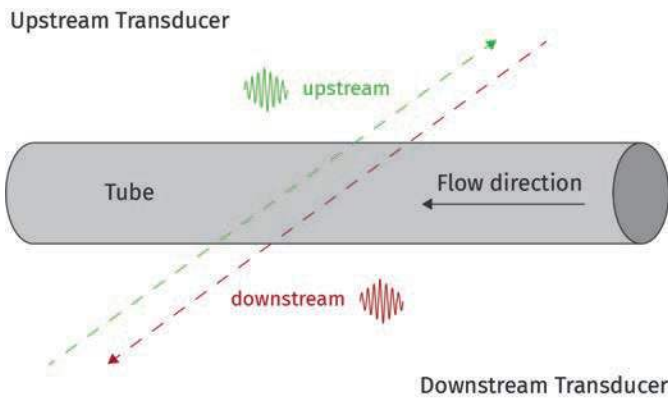
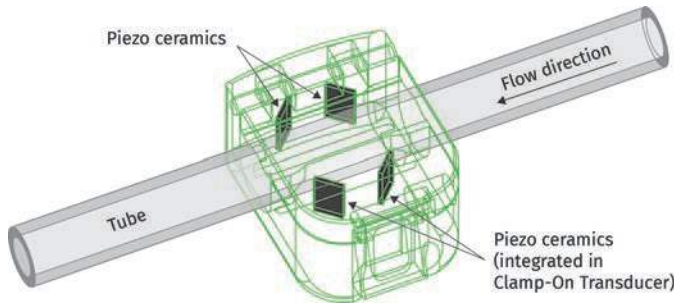


### BioProTT™ FlowTrack plus

- Flow meter in compact, space-saving bench-top design — ideal for applications within laboratories
- Monitoring of the volume flow rate in real time through an integrated display

# BioProTT™ | Operating Principle

The em-tec operating principle is based on the ultrasonic transit-time method. This method is non-invasive, meaning without direct contact to the medium, and determines the transit-time difference of ultrasound signals through a measuring section and is used to evaluate volumetric flow rates.



A typical transit time flow measurement system incorporates two piezo ceramics that act as both ultrasonic transmitter and receiver. The flow measurement is conducted by alternately transmitting and receiving an ultrasonic pulse between the two transducers and by measuring the transit time difference that it takes for the pulse to travel between them.

For a higher accuracy, our Clamp-On Transducers incorporate two pairs of sound transducers. They consist of four piezo ceramics and are arranged in a X-configuration around the tube containing the measured flow.

When sending ultrasonic sound signals through the measuring section, the transit time difference depends on the flow direction of the medium:

If the ultrasonic sound signals are sent along the flow direction, the downstream signal needs less time.

If the ultrasonic sound signals are sent against the flow direction, the upstream signal needs more time.

The evaluation of the received ultrasonic signals is based on the upstream and the downstream measuring section.

Consequently, the transit time difference is measured for every pulse. The difference between upstream and downstream measurements is proportional to the volumetric flow rate.

The picture on the left shows the transmitting impulses and the resulting received signals. The transit time difference is determined through the received signals.

Since the transit time difference is very slight (picoseconds), the calculation is done with a multi-step correlation method.

With a rising flow, the transit-time difference of the received signals increases as well. By adjusting the sensor, it is possible to convert the transit time difference into a volumetric flow.

## Industrial Flow Measurement

On the industrial scale of a GMP-oriented bioprocess, the focus is on automation as well as on high hygienic standards. The reliable measurement of flow rates is required at many different stages within the process flow.

Our system platform BioProTT™ FlowMCP is ideal for multiple and simultaneous flow measurements in the GMP-oriented and industrial bioprocess technology.

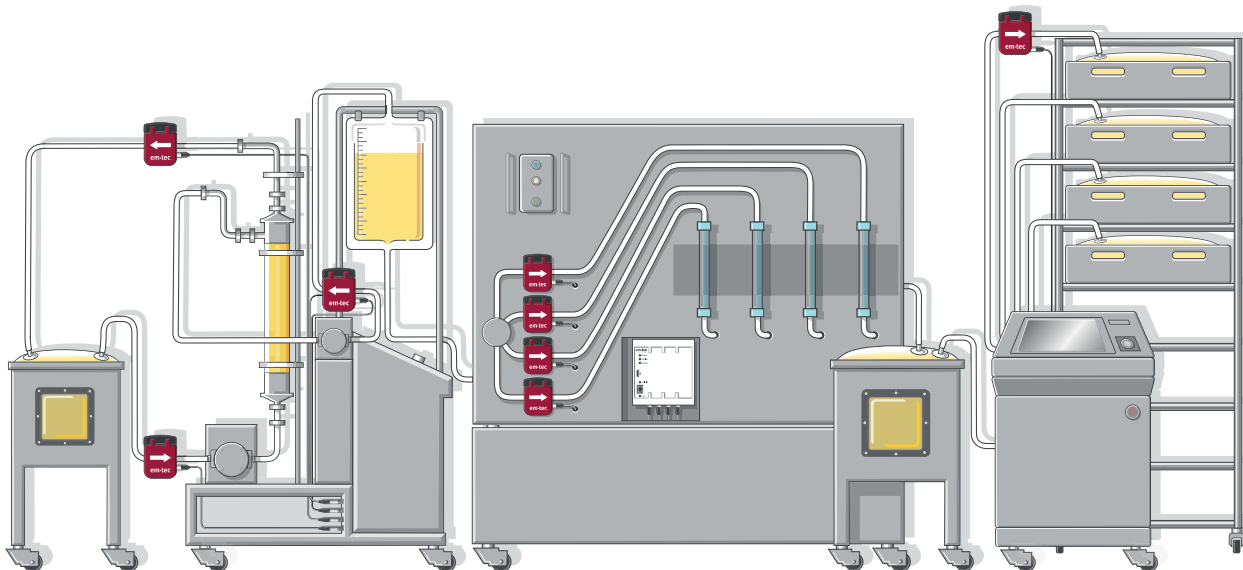
Depending on the version, you can measure and monitor up to eight flow channels at the same time. Every BioProTT™ FlowMCP works in combination with our BioProTT™ Clamp-On Transducers.

### KEY FACTS

- Space-saving control cabinet design
- Seamless integration into existing systems
- Full compatibility with all sizes of the BioProTT™ Clamp-On Transducers
- Modbus-TCP interface to feed data into the customer-specific process control system
- Different BioProTT™ FlowMCP versions ranging from one to eight flow channels
- Web interface to check the sensor calibration, to zero the flow value, and to implement the BioProTT™ FlowMCP into the control environment
- Linear adjustment of the pre-installed sensor calibration through a calibration factor

### INDUSTRIAL APPLICATIONS CAN BE

- Flow measurement on single-use equipment
- Adding media to bioreactors
- Control of process equipment (depending on the incorporation of data)
- Chromatographies, filtration, fillings, process evaluation, upscaling, research, etc.



## Flow Measurement on a Lab Scale

Liquid-bearing systems are used in numerous laboratory processes. Reliable monitoring and control of the media or buffer additions are essential in the early phase of cell cultivation or scale-up. Our ultrasonic-based flow measurement sensor technology ensures the monitoring and control of flowing media.

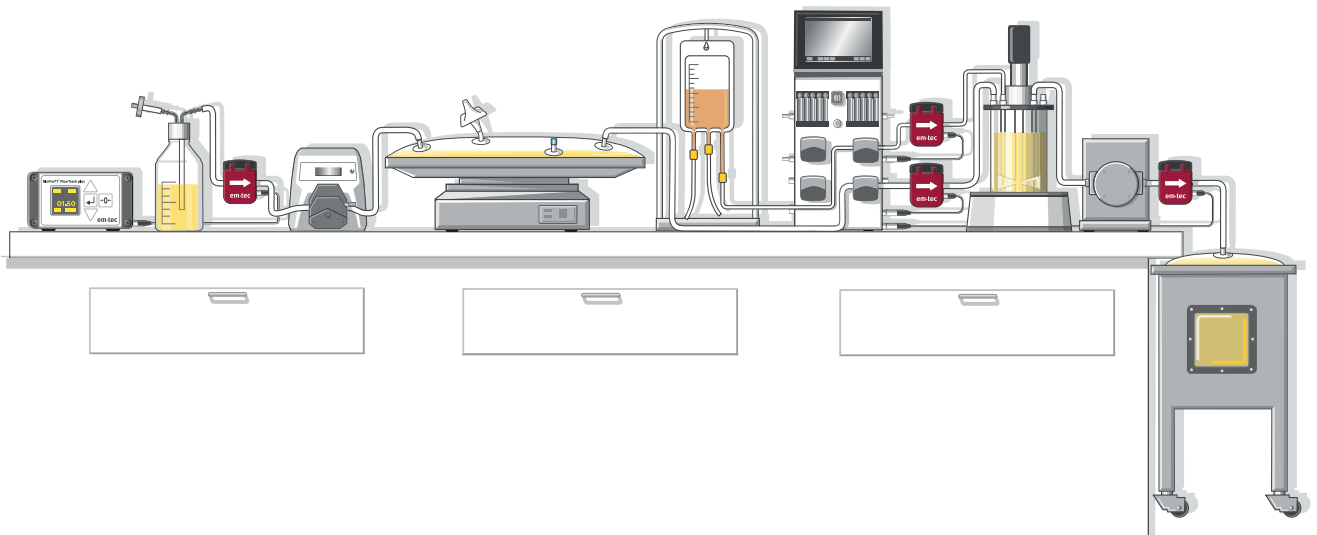
Our BioProTT™ FlowTrack plus bench-top version and the corresponding BioProTT™ Clamp-On Transducer are ideally geared for the independent monitoring of flows within the laboratory.

### KEY FACTS

- Monitoring of the volume flow rate in real time through the integrated display
- Compact, space-saving design — ideal for applications within laboratories
- Digital (RS-232) and analog (4-20 mA) interface for the data transfer to a computer
- Dust-tight and protected from water on all sides (IP 65)
- Linear adjustment of the pre-installed sensor calibration by using a factor
- Totalizing function

### INDUSTRIAL APPLICATIONS CAN BE

- Flow measurement on flexible tubes
- Flow monitoring during chromatographies or filtrations on a laboratory scale
- Control of the upstream feed
- Fillings
- Evaluation and upscaling of processes
- Control of process equipment such as pumps or valves



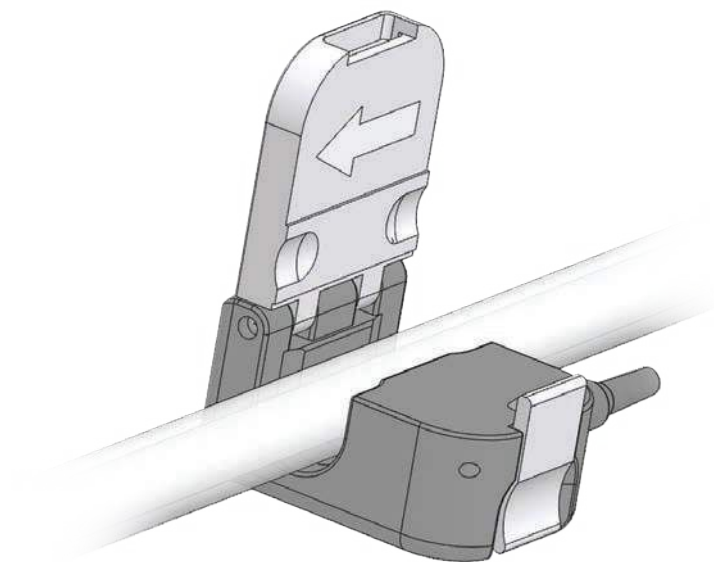
## Reliable Monitoring

Our BioProTT™ Products are used to monitor flow rates within bioprocess engineering. The function is based on the ultrasonic transit-time method and works non-invasively, meaning there is no direct contact with the medium, which makes it particularly suitable for processes with strict hygienic requirements.

In combination with the flow meter BioProTT™ FlowTrack plus or a BioProTT™ FlowMCP, the BioProTT™ Clamp-On Transducer ensures a reliable monitoring of the volume flow rate within laboratory or industrial applications.

### KEY FACTS

- Easy installation, non-invasive flow measurement
- Different sensor sizes for all commonly used tube sizes ranging from 1/4" to 1-5/8" outer diameter
- No additional shear stress on cells through the non-invasive measurement method
- Reusable and long-lasting
- Customer-specific calibration in regard to tube, medium, temperature and maximum flow rate
- Up to seven calibration tables storable on one sensor — for maximum flexibility
- Can be easily cleaned with commonly available disinfectants

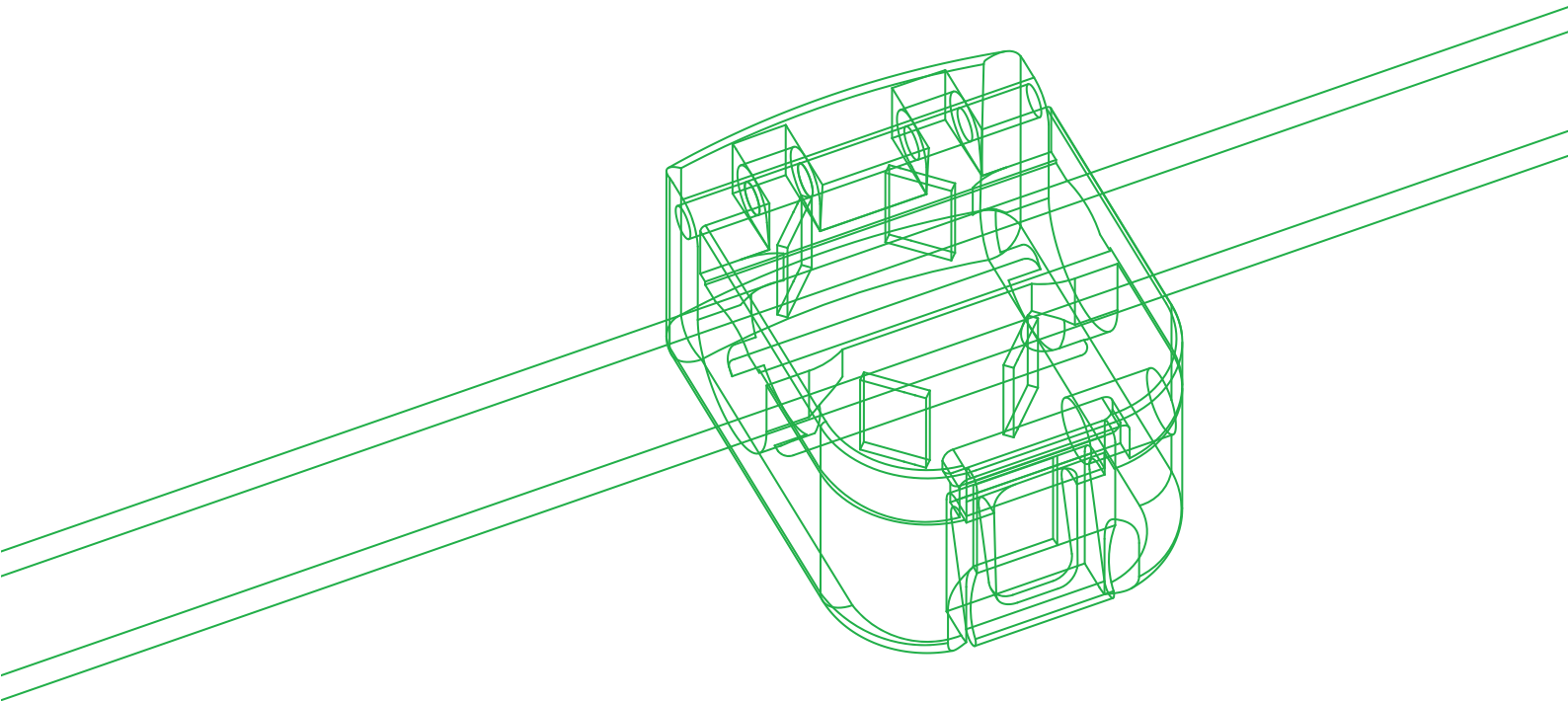


## Passion for Flow

For more than 30 years, we've been developing and producing components, products and customer-specific solutions for non-invasive flow measurement in medical and bioprocess engineering. Our technology uses the ultrasonic transit-time method. As experts in sensor technology and established partner for contract developing in medical engineering, we are also global market leaders in the area of non-invasive flow measurement for heart-lung machines.

Our rapidly growing company is part of PSG®, a Dover company, and based near Ammersee, Germany. We manufacture on site and have a modern and innovative development team. Based on proven know-how and years of expertise in medical engineering, em-tec BIOPROCESSING offers their own range of products specialized for the specific requirements of bioprocess engineering.

Whether for use in upstream or downstream, the laboratory or on an industrial scale, em-tec BIOPROCESSING provides optimal solutions for measuring flow in tube systems.



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