THE NEW GENERATION OF CLINICAL MICROBUBBLE DETECTION
Since 1996 the team of GAMPT develops and produces high-class measuring technique for the detection and analysis of microbubbles during extracorporeal circulation (ECC).

The BubbleCounter is an established tool in many leading heart centers worldwide (heart center Munich, GOSH London, Rigshospital Copenhagen, MAYO Clinic Rochester, King Faisal Hospital Riyadh) and at manufacturers of heart-lung machines and ECC components (Medtronic, Terumo, LivaNova, Eurosets, XENIOS).

With the BCC300 we proudly present our newest innovative model with the latest electronics and patented sensor technology.

Microbubbles play a decisive role in ECC. It could be shown that transcranially detected microembolism in medial cerebral artery is closely connected to microbubble concentration in ECC and such may be jointly responsible for post-operative neurophysiologic deficiencies [Borger, M.A. 2001] ³.

Hence, in ECC precise monitoring of microbubbles formation and spreading is indispensable to prevent such from occurring in patients and reduce patient risks.

The BCC300 is a precise measuring system for the non-invasive monitoring and documentation of microbubble activity during extracorporeal circulation. Using latest Doppler ultrasound measuring technique the accurate analysis of the particle size distribution in the blood of the ECC is possible.

Its outstanding precision in measuring size, number and volume of microbubbles can help to improve the quality of the extracorporeal circulation and single components of the HLM.
USE OF THE BCC300 IN CLINICAL ROUTINE

For the monitoring of microbubble activity during ECC the probes can be placed at different positions of the tubing system depending on the problem to investigate. A steady training of the surgery team regarding microbubble management clearly reduces the risk of neurophysiological disorders caused by air embolism. This leads to manifold applications for the BubbleCounter BCC300:

- training and optimizing of the handling during the operation because of real-time display of the bubble activity [Herbst, D.P. 2016]¹
- targeted setup adjustment to the respective perfusion requirements
- efficiency analysis of individual HLM components (oxygenator, filter) by comparing the bubble distribution between input and output [Stehouwer, M.C. 2016]²
- monitoring and documentation of the microbubbles during the whole operation
- use with all kinds of ECC (CPB, ECMO) [Born, F. 2017]³ [Wagner, S. 2015]⁴

**USER INTERFACE**

Creating the user interface we reverted to the long term experiences and the feedback of the perfusionists. Thus, the BCC300 has a clearly structured user-interface that enables intuitive handling and inscriptions conforming to standards. The current bubble activity and the time course of the operation can be quickly obtained. The color coded measuring channels enable an easy localization of the probe position in the blood circulation. The bubble distribution and the bubble volume are displayed and evaluated simultaneously for up to three measuring points in the ECC.

**CONTINUOUS MONITORING**

- real-time display of the current bubble activity in number and size
- display of all measured bubbles in histograms
- numeric display of the cumulated bubble activity
- registration of patient and status information

**MEASUREMENT OVERVIEW**

- time course of bubble number and volume as well as control of coupling and Doppler shift
- time course of the bubble size distribution
- switchable display of the values
- documentation of inserted comments
CONTROL OF THE MEASUREMENT PROCESS

- intuitive handling of the touch elements to control the measurement
- switching between the displayed values
- set of predefined comments during the measurement
- generation of screenshots for documentation and evaluation
- acoustic signaling of the bubble activity
SOFTWARE TOOLS

Feedback of our customers and our own experience were incorporated in the software. The result is a program easy and clear in structure and intuitively to handle.

OFFLINE EVALUATION

- evaluation of stored measurements directly on the device
- zoom and ROI with calculation of the bubbles and their distribution for selected time frames
- screenshots and ASCII-export of time frames

REPORT AND DOCUMENTATION

- clearly summarized patient data and measurement information
- numeric display of the cumulated bubble number, volume and histogram of the bubble distribution
- graphic display of the time course of the complete measurement with bubble number and volume, coupling and Doppler shift as well as bubble distribution
- documentation with printout, pdf or screenshot
DATA MANAGEMENT

- handling of the measurements in a database
- user interface for patient information with onscreen keyboard
- storage and archive functions
  (also for later evaluations on a PC, e.g. for scientific publications)
PATENTED PROBE DESIGN
FOR IMPROVED MICROBUBBLE DETECTION

- robust clamp-on design for easy and safe handling
- no blood contact, therefore easy cleaning
- dynamic adaptation to the specific properties of the tubes
- probes for all standard tube sizes of the ECC available
- automatic probe recognition and parameter adaptation
- color coded probes for easy localization of the bubble activity
- handy monitoring system for the extracorporeal circulation
- patented clamp-on probes without blood contact
- continuous monitoring of the bubble activity on up to three positions
- precise measurement of the size distribution between 20 and 2000 µm bubble diameter
- continuous display of bubble activity, size distribution and bubble volume
- acoustic signaling of the bubble activity
- record and archive functions
- automatic probe recognition
- bracket for installation on the heart lung machine