A Flow Measurement Guide
for Industry Bioengineers

WORKING WITH TRANSONIC

transonic
THE MEASURE OF BETTER RESULTS.
www.transonic.com

Mission: 'To Advance Meaningful Measurements'

Who Is Transonic?

Transonic leverages the value of its transit-time ultrasound volume flow measurements and indicator dilution measurements to optimize the quality, accuracy and safety of biomedical devices.

Transonic's Core Values

Innovation

From pioneering transit-time technology to developing flowprobes and pressure-volume catheters small enough to make measurements in mice, we have never ceased the pursuit of innovation in the life science research arena and to bring that innovation from bench to bedside.

Collaboration

Transonic® technology is found in many heart-lung and other circulatory assist devices as the result of an OEM collaboration. Helping customers approach evolving challenges with effective customized solutions is central to our success. By placing state-of-the art technology in our customers' hands and providing prompt person-to-person technical advice, Transonic is recognized as the world leader in biomedical flow measurement technology and its applications.

Accountability

At Transonic our name is our reputation. From initial design, to production, and aftermarket support, we stand by our products knowing that we never settle for good enough when we can strive for the best.

Responsiveness

In this global economy it is vital to develop a global perspective. This is why we continue to strengthen and expand our international customer service, repair and maintenance teams.

Excellence

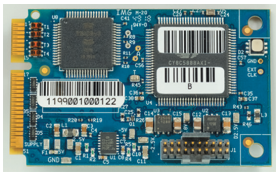
In the surgical arena, measurements need to be simple and quick to perform in addition to accurate and precise. Our elegant Flowprobe design and sophisticated meters provide real-time flow measurements in the operating room and at the patient's bedside.

Innovative Liquid Flow Measurement Solutions

Transonic flow measurement technology is used by a wide variety of the biomedical industry's leading manufacturers to deliver the highest accuracy and performance. Typical applications include:

- CP bypass pumps
- Ventricular Assist Devices
- ECMO systems
- Steam delivery modules
- Infusion/Transfusion/Perfusion
- Dialysis machines
- Organ perfusions systems
- Much more!

Tubing Flowsensor


Flowboard

"From Bench to Bedside"

Transonic is passionate about helping our biomedical manufacturing partners advance liquid flow measurement innovations from the early research stages to standard-of-care commercial products.

Gold Standard Life Science Research

- Perivascular and Tubing Flow Measurements for animal research in a wide variety of applications;
- PV Measurements with Admittance Technology to define cardiac function in pre-clinical testing;
- Implantable Telemetry for flow, pressure & ECG.

Medical Product Design & Development

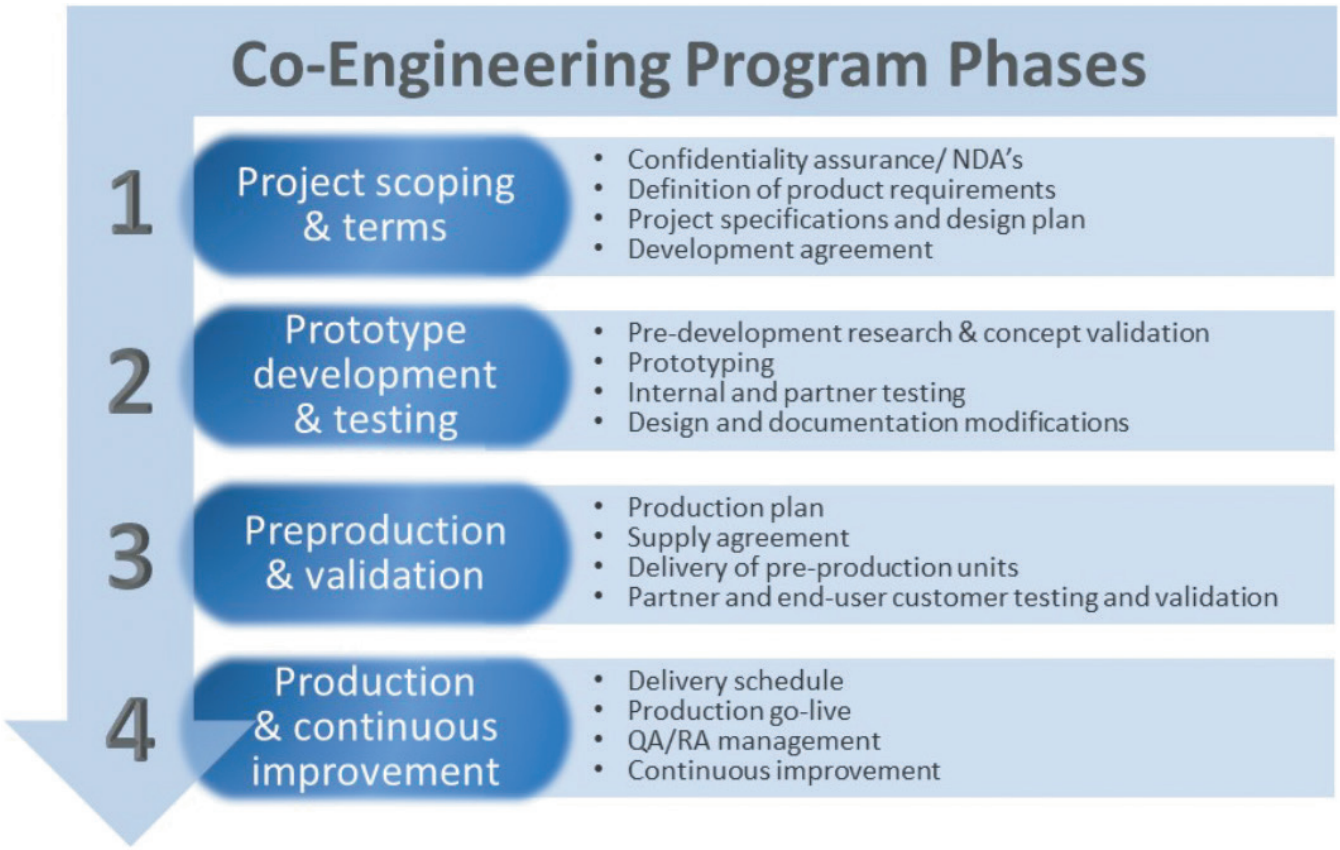
- Advanced product design and development capabilities;
- Highly experienced engineering team specializing in liquid flow measurement;
- Extensive knowledge of healthcare regulations & FDA approval.

World Class Manufacturing Capabilities

- ISO-certified manufacturing facility in Ithaca, NY;
- High skilled workforce and state-of-the-art automation;
- Rigorous compliance and quality control standards.

Co-engineering Program

Transonic has a long history of working with both start-ups and established medical device companies to develop custom-engineered volume flow measurement solutions that suit a wealth of applications. The Co-Engineering Program is designed to meet the unique needs of each business and streamline the partnership, from prototype to production. It consists of:



Transonic's Lineage of Intellectual Property

PATENT #	ISSUE DATE	INVENTOR(S)	TITLE
8,968,204	03/03/2015	CJ Drost	System and Method of perivascular and flow measurement
8,603,000	12/10/2013	K Wood, PC Hodgson, P Plouf	Method and apparatus for measuring blood volume
8,460,198	1/8/2013	P Plouf, B Poetschke, M Placko, K Wood, M Maymandi-Nejad	Implant Transmitter
8,348,879	1/8/2013	SX Gao, N Nazarifar,CJ Drost, Y Shkarlet	Surgical System having a Cassette with an acoustic air reflector
8,273,048	09/25/2012	N Thuramalla, NM Krivitski, M Alsberge	System and Method for Diverting flow to facilitate measurement of system parameters
8,214,168	07/03/2012	Y Shkarlet	Noninvasive testing of a material intermediate spaced walls
8,162,843	04/24/2012	NM Krivitski	Method for measuring cardiac output via an extracorporeal cardiopulmonary support circuit
8,133,185	03/13/2012	NM Krivitski, VV Kislukhin	Catheter with common guide wire and indicator lumen
8,006,570		N Nazarifar, LJ Drost, Y Shkarlet 08/30/2011	Non-invasive flow measurement
7,803,121	09/28/2010	P Plouf, B Poetschke, M Placko, K Wood, M Maymandi-Nejad	Implant Transmitter
7,734,322	06/08/2010	NM Krivitski, DM Starostin	Blood volume determination and sensor calibration
7,549,965	06/23/2009	NM Krivitski, VV Kislukhin	Compensation method for thermodilution catheter having an injectate induced thermal effect in a blood flow measurement
7,481,114	12/30/2008	LC Lynnworth	Noninvasive measurement of liquid characteristics using reversibly deformed conduit (bought patent)
7,469,598	12/30/2008	Y Shkarlet, CJ Drost	A method of employing a transit time ultrasound sensor
7,275,447	10/02/2007	NM Krivitski, CJ Drost	Method and apparatus to determine an initial flow rate in a conduit
7,261,696	08/28/2007	NM Krivitski, CJ Drost	Method and apparatus for measuring cardiac output via an extracorporeal cardiopulmonary support circuit
7,210,359	05/01/2007	NM Krivitski	Method and apparatus to determine an initial flow rate in a conduit
7,194,919	03/27/2007	NM Krivitski, CJ Drost	Acoustically coupled ultrasonic transit time flow sensor
7,121,150	10/17/2006	Y Shkarlet, CJ Drost	Method and apparatus to determine an initial flow rate in a conduit
7,112,176	09/26/2006	NM Krivitski, VV Kislukhin	Compensation method for thermodilution catheter having an injectate induced thermal effect in a blood flow measurement
6,986,744	01/17/2006	NM Krivitski,	Method and apparatus for determining a blood flow during a vascular corrective procedure
6,868,739	03/22/2005	NM Krivitski, CJ Drost	Method and apparatus for determining a blood flow during a vascular corrective procedure

Transonic's Lineage of Intellectual Property cont.

PATENT #	ISSUE DATE	INVENTOR(S)	TITLE
6,746,408	06/08/2004	NM Krivitski, CJ Drost	Indicator dilution catheter for blood flow measurement in arterio-venous hemodialysis shunts
6,718,190	04/06/2004	NM Krivitski, DM Starostin	Sensor calibration and blood volume determination
6,623,436	09/23/2003	NM Krivitski, VV Kislukhin	Retrograde catheter with reduced injectate induced temperature offset
6,548,017	04/15/2003	NM Krivitski, VV Kislukhin	Method for real time monitoring of blood volume in a filter
6,494,832	12/17/2002	MD Feldman, JW Valvano, JA Pearce	Multifrequency conductance catheter-based system and method to determine LV function in a patient (Licensed patent)
6,308,737	10/30/2001	NM Krivitski	Deformable flow diverter
6,155,984	12/05/2000	NM Krivitski	Method and apparatus for measuring cardiac output through an arterial cannula
6,098,466	08/08/2000	Yuri Shkarlet	Ultrasonic flow sensor incorporating full flow illumination
6,061,591	05/09/2000	NM Krivitski	Method and apparatus for predicting intradialytic morbid events through the monitoring of a central blood volume
6,041,246	03/21/2000	NM Krivitski, DM Starostin	Single light sensor optical probe for monitoring blood parameters and cardiovascular measurements
6,036,645	03/14/2000	CJ Drost, Y Shkarlet, A Kopychev, L Ostergren, I Sergeeva	Ultrasonic Probe
5,928,180	07/27/1999	NM Krivitski, VV Kislukhin	Method and apparatus for real time monitoring of blood volume in a filter
5,595,182	01/21/1997	NM Krivitski	Cardiovascular measurements by sound velocity dilution