A Flow Measurement Guide
for Industry Bioengineers

# INFUSION PUMPS

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THE MEASURE OF BETTER RESULTS.
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# Transonic Applications

Transonic began partnering with outside companies shortly after its inception in 1983 to develop innovative devices. Soon, a robust Transonic/Customer synergy developed between Transonic and device manufacturers and this vital Customer/Manufacturer relationship has become part of Transonic's DNA. It lies at the heart of the development of all Transonic products.

Our applications range from utilizing standard products straight off the shelf to creating such novel designs that they would not be recognized as a Transonic product. Together with our collaborators, Transonic has striven to push the limit on flow measurements including ultra-low flow applications in novel measurement mediums. Transonic customized Flowsensors and Flowboards are being used in a wide range of products and applications including:

Mechanical Circulatory Support Devices including:

1. Heart Lung Machines
2. Extracorporeal Membrane Oxygenation (ECMO) circuits
3. Artificial Hearts (AH)
4. Ventricular Assist Devices (VADs)

Renal Replacement Devices: Hemodialysis Machines

Organ Preservation Devices

Treatment Delivery /Therapy Devices

1. Anesthesia Delivery / Pain Management Systems including:
2. Organ Infusion Pumps
3. Urodynamic System / Urometer
4. Pediatric Hydrocephalus
5. Endometrial Ablation
6. Ocular Surgery

Many More Possibilities

A sampling of the broad spectrum of Transonic application will be presented along with the solutions that Transonic offers for each application.

# Monitor Perfusion Pump Performance

An infusion pump infuses liquids, medication or nutrients into a patient's circulatory system. It is generally used intravenously, although subcutaneous, arterial and epidural infusions are occasionally used.

Infusion pumps can administer liquids in ways that would be impractically expensive or unreliable if performed manually by nursing staff. For example, they can administer as little as 0.1 mL per hour injections (too small for a drip), injections every minute, injections with repeated boluses requested by the patient, up to maximum number per hour (e.g. in patient-controlled analgesia), or liquids whose volumes vary by the time of day.

Because they can also produce quite high but controlled pressures, they can inject controlled amounts of liquids subcutaneously (beneath the skin), or epidurally (just within the surface of the central nervous system – a very popular local spinal anesthesia for childbirth).

Infusion pumps have been a source of numerous patient safety concerns. Errors with liquid/medication delivery to high risk patients can have significant impacts on cost and clinical outcomes. Even with the adoption of smart infusion pumps, IV medication errors continue to occur at alarming rates (up to 60 % in some studies). The U.S. Food and Drug Administration (FDA) reported that over 56,000 medical device errors related to infusion pumps were reported between Jan 2005 – December 2009. Some of the common hazards identified are: air in line; occlusion; free flow; reverse flow; mismatch between set and delivered flow rate; leading to overdose; under dose; and delay in therapy delivery, etc. The World Health Organization (WHO) has called for 50% fewer errors by 2022.

Currently, there is no simple system to automatically monitor the external infusion pump operation, that could reduce the associated problems leading to major patient risks and FDA recalls.

However, by integrating "True Flow" technology into infusion pumps, actual (not estimated) medication delivery can be monitored to dramatically improve dosing accuracy. The Flow Monitor provides double protection safety and accountability by operating independently from the infusion pump, and can detect discrepancies between dosing and delivery.

"True Flow" TTFM technology offers an easy-to-use monitoring system to identify common infusion pump failure modes such as: air in line; occlusion; free flow; reverse flow; leakage; etc). This would lead to a significant reduction in the corresponding health risks; reduce hospital stays and costs; reducing clinical man hours; and improve outcomes. It would also allow pump manufacturers and FDA to easily evaluate new infusion pumps and perform post market surveillance.

## Transonic Solution

### Volume Flow Measurement

Provides independent verification of delivered dose to avoid over or under infusion to minimize adverse events and improve outcomes.

### Bubble Detection

Identifies bubbles in the infusion system to help reduce the risk of micro-emboli.