Applying Tech: Portable Medical—Part 1

How are you influencing Portable Medical Devices?

Dave Bird
Business Development Manager, Medical, Balluff Inc.

Many fluidic monitoring applications can be difficult to manage in portable or modular medical devices and instruments. This is the case with foam, froth, or residue accumulation on vessel walls or inside tubing carrying a wide variety of reagents, chemicals, body fluids, and solutions in the application. Nuisance false alarms or miss-read fluidic parameters need to be avoided, especially in portable medical products.

A new generation of technology found in Smart Level sensors ignores residue, foam, and froth found in many bio fluid applications, providing dependable blood sensing and leak detection in certain portable/modular, “on-board” apheresis and blood processing instrumentation. Blood levels can also be dependably monitored on perfusionist blood oxygenation canisters or on dialysis instruments. Dependable reagent monitoring inside hemostasis type instruments or in automated genomic instruments are dependably detected through bulkheads and instrument partitions up to 12 millimeters thick to reliably detect only the desired fluid target that could possess a conductivity level down to one microsiemens (found typically in sterilizer fluids).

Balluff provides a large selection of off-the-shelf sizes and profiles of this technology for a wide range of applications with various degrees of available space inside the instrument, but we also build custom housings.

Steve Garelli
Engineering Manager, Specialty Silicone Fabricators

The ever changing regulatory and insurance landscape has created the need for caregivers to improve patient care while reducing the time that patients spend in healthcare facilities. A key component to this is the necessity for more portable medical devices. SSF helped develop silicone jacketed cables used in vascular assist devices (VAD). With VADs, external controls and power packs connect to an implanted device, enabling streamlined patient ambulation while adhering to stringent design criteria.

SSF makes combination products (i.e., a silicone base combined with additives ranging from steroids, hormones, or antimicrobial agents to make components such as catheters or wound drains). Impregnating silicone with an antimicrobial agent prevents hospital post-discharge infection, giving caregivers confidence to release patients earlier.

Kevin Klingbeil
R&D Manager, LasX Industries Inc

At LasX Industries, we are utilizing our unique ability to precisely control high speed laser processing to economically manufacture next generation microfluidic components. Laser digital converting offers the flexibility to create miniaturized features in laminated polymer materials that are not obtainable through other methods. By integrating this technology with continuous web processing, multilayer medical device components can be mass produced in a manner that is far more cost effective than competitive methodologies. LasX creates subcomponents that can be incorporated with embossed and/or molded components to complete the assembly. The ability to manufacture complex disposable components at a low price point makes point-of-care testing a feasible solution for rapid microfluidic analysis within a clinical setting.

LasX is also influencing the portable medical device market through prototyping

and product development. An in depth comprehension of varying types of lasers allows us to pinpoint specific wavelengths suitable for diverse microfluidic component applications. By understanding how lasers interact with various materials, we help medical device manufacturers select the materials that will most efficiently achieve desired structures. LasX then integrates the manufacturing process in order to meet the demands of each component, enabling the development of accurate, high-performance microassays from conception to full scale production.

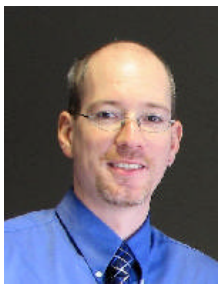
Edward Lasch
Sales Manager, Medical, Bosch Rexroth Corp.

Portable medical devices have severe space constraints versus their stationary counterparts. This forces careful consideration of component selection. In many cases, multiple components are needed to be integrated to meet space requirements. Many times, these parts are integral to the device design. With any medical device, quality and reliability are a given. This is a challenge with fully customized solutions as months or years will be required to complete testing.

At Bosch Rexroth, we integrate our proven valve technology into a custom solution designed in collaboration with the medical device designers. This satisfies space requirements while utilizing core components with proven reliability. Our custom design and production capabilities ensure an optimized, cost effective solution with the quality and reliability required.

Depending on the desires of the device manufacturer, we have been able to reduce the number of components required to achieve the necessary functions. This could involve integrated fittings, manifolds, air channels, etc. Due to large production quantities of these devices, a customized solution can be extremely beneficial. Through these methods, we help make the final portable medical device more affordable and more dependable.

Dan Viggiano III
Director, Custom Products Division, New Scale Technologies



Piezoelectric motors allow portable medical device makers to add precision motion in impossibly small spaces, automating features and improving accuracy while reducing system size and power use. Now, micro mechatronic systems based on these motors are even easier to integrate into compact portable devices.

Since 2004, we have reduced the size of our piezoelectric SQUIGGLE motor by 500x and the drive system 10,000x, while adding intelligence to optimize performance and power use. We've reduced the voltage requirement to 2.8 V for direct operation from a battery. Finally, we have integrated the motor and driver with a position sensor and microprocessor to create fully-contained, closed-loop motion systems. These M3 modules offer 0.5 micrometer position resolution in packages 12 x 30 mm or smaller.

These modules enable disruptive medical products with extreme performance. Two primary applications are fluidics and optics.

Precision motion corresponds to more precise fluid control in pumps and valves. Combined with small size and low power use, M3 modules provide this precision and enable smaller, higher-performance portable devices, such as insulin pumps, pain medication pumps, and glucose monitors. The benefits extend to MRI-safe implantable devices as well.

In optics, M3 modules enable zoom and autofocus for higher image quality and faster image acquisition in very small portable diagnostic devices. They also enable lightweight augmented vision systems (e.g., goggles with an integrated camera and display system can automatically correct for vision loss in the central field caused by macular degeneration). They provide pinpoint laser positioning accuracy in point-of-care systems.

Erik Moses
Strategist, Product Development Technologies

Product Development Technologies has extensive experience in mobile communications and medical devices. With this in-depth knowledge, we have noticed that trends in the portable medical device arena are very similar to those in mobile communications. By utilizing advanced strategy and research tactics, we have gained intelligence to incorporate into next-generation portable medical devices. Balancing these findings with physician specifications, patients' lifestyles, and expectations, we are able to develop advanced technologies with personalized attributes.

We are constantly searching to find a perfect balance of features that are easy-to-use, robust, and aesthetically pleasing to the user. Cost and construction (critical components for mobile communication devices) are heavily weighted in the development of portable medical devices. Many of these portable devices will be battery-powered; therefore, low power designs must be integrated and solutions can be pulled from existing consumer devices. Technologies are readily available for the development of portable (sometimes wearable) medical devices, but lower cost solutions need to be developed. Companies that provide end-user focused devices that create positive experiences for the user at reasonable costs of production will lead the industry. PDT continues to test new technologies in order to achieve this feat.