# Portability Is the Name of the Game

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Medical electronic devices are no longer a trend; they are the reality of today's healthcare environment. Seemingly, the number of powered medical devices far exceeds their non-powered counterparts. Even devices that had traditionally not been powered, such as the stethoscope, are now either being replaced by more effective electronic devices or being updated with electronics to function more efficiently and, more simply, better.

Not only are medical electronics an integral part of healthcare across all sectors, but portability has become essential for these devices. Systems that traditionally needed to be used in a specialized hospital room have now been made into devices that are able to be carried by a doctor from room to room or even brought into the field via EMTs to use in emergency situations. Further, the devices are moving into patients' homes and being used daily by them. The primary user of these devices is not necessarily a healthcare professional, but rather, the patients themselves. This offers its own batch of design challenges for the designers and manufacturers of these products.

**Consumer Design**

One area medical device manufacturers can look to for inspiration on the design of portable medical devices, especially those that are intended to be used by patients directly, is the consumer marketplace. From smartphone apps to devices that are to be worn on a patient, designing for the consumer may not be an area intimately familiar to a medical device engineer.

"Designers are now looking at the Apple design philosophy of not only making devices that are functional, but that are ergonomically and aesthetically pleasing," explains Guy Francfort, vice president of sales and marketing for MEGA Electronics [1]. "Options of using voice and video built into devices that communicate over the internet will be able to revolutionize the medical field. There are already insurance companies employing doctors that are arranging office visits from remote locations."

Mel Berman, product marketing manager with TDK-Lambda Americas [2] agrees, pointing to the incorporation of smart phone and tablet technologies into medical devices, such as touch panels, icons, and pull-down menus, as having a significant impact on today's medical devices.

However, as good as a device may look or as "consumer-oriented" it may appear, the key is still ensuring the patient is going to use the device as it is intended. "If there is one thing the medical industry is learning from the consumer industry, it's the concept of adapting the device to consumer and patient lifestyles," states Tony Zarola, strategic marketing manager for the Healthcare Group at Analog Devices [3]. "In order to be effective, health monitoring devices need to be used—as

opposed to collecting dust in a drawer—and any barriers that could jeopardize use must be removed."

**Power**

While medical electronics span all the different device sectors, they do share one commonality that is unavoidable—power. There seemed to be two areas of interest in addressing power in the responses for this roundtable discussion. The first was improving/enhancing battery power and the second was the incorporation of energy harvesting technology. The reality will most likely depend on each particular application and which works best for a given device, or even an adoption of both technologies in a single product.

Stephen Swift, senior vice president and general manager of medical products with Microsemi Corp. [4], speaks to both of these technologies and their use in medical devices. "Batteries need to be reliable, energy dense, small, and quickly rechargeable, with low series impedance. Cell phones and electric automobiles are driving advances in battery chemistries, which are headed in the right direction. But electronics can be ultra low-power to the extent that they can harvest or scavenge energy from their environment, either to replace the battery entirely or at least reduce its size by supplementing the power the battery provides."

Berman supports the "harvest" technology's use in medical devices. "For implantable sensors/transmitters, I think the development of power sources that take advantage of the body's movement, temperature, and chemistry (i.e., energy harvesting) will support the next big breakthroughs in medical devices."

**Component-Level Advancements**

The electronic component technology that is available to today's design engineers is astounding. Advancements are coming at an incredibly rapid pace. As such, medical device designers can take advantage of components and technologies that have broad ranging impacts on the products they are developing.

"From the simple standpoint of Intel co-founder Gordon Moore, who contends that advances in computing power will essentially double every eighteen month, one can see that this would have broad reaching effects across a number of industries," says Kirk Barker, maxon motors' [5] electronic product manager. "Size, cost, and availability of electronics components have contributed significantly to the development of portable devices."

Sharing this point of view is Deepak Hariharan, business manager for the Electronics Division at Adhesives Research [6]. "The growing trends of increased miniaturization and design elegance seen for electronic components in consumer electronics are naturally transitioning to the medical electronics market for improving the ease-of-use, compliance, and speed in which information is processed through patient monitoring systems and other portable medical electronic devices. These improvements are often made possible through advances in material options used in applications for flexible and robust electrical interconnects grounding, shielding, and touch screens."

Francfort shared a comment with regard to how advancing component technology was aiding in the development of more medical devices that are portable. “Component designs are getting more and more compact. For instance, a brick DC/DC power supply at one time referred to a certain size and wattage. The wattage has been increasing to the point where we can now [achieve] three or four times the amount of power out of the same size converter, thus making it possible to take a device that took up a rack 20 years ago and put it into a hand-held device.”

**Challenges**

The downside of this advancement at the component level is the environment surrounding the medical device industry. Challenges at the regulatory level, concerns with software, the medical device tax, and the rapidly changing components themselves were all cited as concerns and potential limitations for medical device designers.

The regulatory environment is probably the most significant to the development of an electronic medical device since the approval process can make a device that is to be used by the public directly seem outdated by the time it is released. Baker speaks to this challenge, “I would first look at the regulatory bodies and the difficulty and costs associated with bringing new products to market. Given Moore’s Law’s and a supposed window of eighteen month, it’s easy to see how quickly one concept or design can be displaced by technological advances. Technology is just moving too quickly today to let new products languish in the certification process. I would question what measure can be taken, at the regulatory level, to streamline and fast track the introduction of some of these products.”

**What’s Ahead?**

When asked to look ahead five to ten years into the future, the responses from the Roundtable participants ranged greatly, but all were positive and each provided an encouraging spin on the industry.

“I can only imagine what the creative minds of the engineers and physicist working within the medical community with come up with,” said Baker. “I envision a great deal of new products emerging as a function of wireless communication and bus development. It’s a blank sheet of paper but the ability to transmit bundles of secure, real-time, high-speed data opens up a whole new dimension with respect to portable devices.”

“The advances made in the area of personal computing will translate to medical devices and may even lead to merging of the two areas in some form,” predicted Hariharan. “In the future, it is likely that devices will be capable of administering a drug dose based on vital signs measured by a patient monitoring system. These systems may also be capable of communicating patient data to a remote physician’s office and accept a remote command to deliver a drug dose.”

Zarola offers a slightly more futuristic view of where the industry is headed. However, given how quickly the industry has changed in such a short period of time, he may not be far off speaking to five to ten years from now. “Medical

electronics is heading to wherever we wish to take it. The future of medical electronics has the potential to become all-encompassing and an integrated part of daily life. The environments where we will be monitored will expand beyond the clinic. Whether we are in the car, in the office, at the gym, or at home, there will be technology available to monitor our vital signs. For example, monitoring a driver's heart rate may help to avoid dozing at the wheel; monitoring our activity level while seated at our desk may help ensure we are not in a sedentary state for long periods; or tracking our energy exertion during exercise can help keep us healthy and safe in the comfort of our home."

Regardless of the challenges that will be faced, the future of medical electronic devices is extremely bright. Design engineers will continue to push the edges of what is considered modern technology in their concepts and tackle seemingly impossible obstacles with solutions that reshape the very definition of quality healthcare.

**Full Responses**
To see the full responses of the participants, view these links:

- Reliability and Longevity Are Critical for Medical Electronics [7]- Deepak Hariharan, Business Manager, Electronics Division Adhesives Research Inc.
- Make Medical Devices Integrated with Patients [8]- Tony Zarola, Strategic Marketing Manager, Healthcare Group, Analog Devices Inc.
- Consumer Electronics Moving into Medical Devices [9]- Vladimir Dreytser, Senior Staff Engineer, Intertek
- Rapid Changes with Portable Medical Devices [10]- Kirk Barker, Electronic Product Manager, maxon motors
- Borrowing from Cell Phone Technology [11]- Stephen Swift, Senior VP & GM, Medical Products, Microsemi Corporation
- A Look at Today's Medical Electronics Landscape [12] - Mel Berman, former Product Marketing Manager, TDK-Lambda Americas
- Designing Medical Electronics [13]- Guy Francfort, Vice President, Sales and Marketing, MEGA Electronics Inc.

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