

## Advancement in Telehealthcare Places Focus Firmly on Hi-Tech Design

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*Continuous advancements in IT and communications solutions, which make medical devices easier to use and more difficult to misuse, support the spread of telehealthcare in the UK. This has generated increasing demand for telemetry and ambulatory products, which can be used safely in the home by patients or carers and supervised remotely by clinicians and used more effectively in hospitals. Here, Gareth Beckett explains how the medical equipment industry is responding to the new design and manufacturing challenges this creates.*

The demands for in-hospital products which are smaller and easier to use has spawned the growing popularity of telehealthcare among medical professionals and has been driven by the greater availability of technology – for example broadband connections in people’s homes and the growing acceptability of wireless in healthcare organisations – plus the constant need to achieve new efficiencies and cost savings in the National Health Service.

The evolution of ward products that can be monitored remotely from either the ward office or some other location has led to the development of products which can now be used in the home which allow for better and more frequent communication between patient and clinician. As this further develops, there will be greater emphasis on superior cost effective product design leading to greater collaboration between designers and manufacturers to create the next generation of easy-to-use, safe and reliable in home or mobile patient devices.

Where practicality and functionality once dominated the product development stage; the former traditional, heavy industrial appearance of medical products is being rapidly replaced by more patient-friendly aesthetically pleasing designs.

Such changes are increasingly dictating the process through which designers and electronic manufacturing service (EMS) providers engage, consult and develop electronic medical devices. In particular this has led to a need for greater collaboration earlier in the design stage.



### **The polar extremes of medical design for manufacture**

Modern-day design and manufacture for the medical sector does not focus solely on the development of high-level technology and industrial-looking systems. In fact, product development that we encounter can be found at both ends of the electronic design spectrum.

At the more traditional end, the focus clearly remains on technological product development. For example, the design and manufacture of high-voltage, highly-functional products such as RF plasma generators, which use high-powered pulsed bipolar energy that enables surgeons to perform highly complex procedures, such as keyhole surgery and, increasingly, cosmetic surgery, results in an entirely functional form factor for the product.

In these cases, size, appearance and intuitive operation are less of an issue for product designers. In terms of manufacture it follows the SMT/through hole hybrid approach where you still find proliferation of traditional electronic through-hole components such as wire wound resistors, torroidal coils and ferrites, inserted in to heavily copper clad PCBs using both reflow and wave soldering processes.

However, with the need for increasingly “intelligent” ward based products and telehealthcare driving new product design and development, products are becoming smaller where attention to accessibility, safety, fail safes and ease of use, demand more innovative approaches to design, assembly and test.

As an example, let us draw upon the intravenous pump driver. This highly complex product is required to be user-friendly, compact, lightweight, reliable and robust whilst also carrying a battery-powered function to allow for it to function with complete mobility in and around hospital wards and in patients’ homes. Whilst legacy solutions have tended to rely on serial communications, there is increasingly a move to accept other technologies such as wireless, which offers mobility and connectivity for fast data updates and patient peace of mind.

As form factors reduce and require a more aesthetically pleasing high-tech look and functionality, which are easier to use and less able to be misused, the whole design structure and process changes and requires a more complex design for the circuit board, and will usually mean the need for several supporting boards. In the case of a complex intravenous pump driver, the PCB will require use of high density SMT components, which are required due to the limited ‘real estate’ (or space) on the board.

Along with the demands in functionality comes the need for more memory and an increasing use of ball grid arrays (BGAs) and tiny 0402 passives, help to facilitate this. BGAs allow for smaller footprints enabling higher density interconnecting designs to be employed.

Despite the potential benefits of miniaturisation on the design process, circuit board design poses challenges during assembly and particularly test. This has led to test solutions which leverage for example the new JTAG technology.

**Greater synergy between design and manufacture**

As developments progress, we have witnessed and will continue to see older industrial style medical products replaced with modern more aesthetically pleasing designed equipment.

Such changes are lifting the bar on electronic design and assembly technology, requiring that both functions accommodate the limited space available within the product's external casing in which to mount PCBs, motors and encoders etc and/or the necessary electro mechanical parts.

Introducing design for test, design for procurement and design for manufacture early on in the design phase is vital and will confirm that the processes and components are valid and reduce risk of early market failure – issues which may not naturally occur to designers.

**Benefits of engaging with the EMS provider early**

Involving the EMS provider at an early stage in the design process or by outsourcing design to these providers, gives the OEM the opportunity of early warning on whether or not a particular design approach will or won't work during the production stage. Added to that is the EMS provider's ability to provide early costing and build an effective supply chain.

If left unaddressed, such problems could lead to late time to market due to difficulty of manufacture or long product lead times. Worse still, this could lead to unreliable products for this highly life-critical sector.

While medical design and manufacture cannot be aligned with the aesthetic appeal of high-volume consumer goods such as Apple Macs or i-pods, product end users are calling for easy-to-use, accessible, attractive and reliable products.

Designers and manufacturers will increasingly face challenges to produce these multi-faceted products and a greater emphasis on collaboration throughout can boost efficiency, reduce time and realise cost savings across the board.

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