The Perfect Fit: Modular Design Electronic Enclosures

There are virtually limitless design possibilities for electronic enclosure design. For various types of enclosures, it can be difficult to find the appropriate size and configuration for an application. Often, the engineer will have to incorporate a fully customized design or settle on a size that is not quite ideal. This can be expensive, time-consuming, and result in an inferior design solution. A modular design approach for enclosures can help solve these problems.

Modular Design

Whether it's an instrument case, a backplane-based system platform, or a cabinet enclosure/rack, finding the right enclosure for your application can be very challenging. Often, the designer is forced to develop a highly customized design. Not only are the costs much higher, particularly during prototyping, but the time to market can be greatly outstretched. There is also inherently more risk, as you are relying on custom parts and potential problems with single sourcing, obsolescence, etc.

Incorporating a modular design helps resolve these problems. An extrusion-based design allows the frame of the chassis to be easily cut in different lengths for various size and configuration requirements.

Going one step further with a backplane-based system platform, the card cage can also be modular. A well-proven approach is replacing the punched card cage with aluminum extrusions and injection molded plastic card guides. They have holes cut at regular intervals to accept card guides in whatever location you choose. So, all sorts of configurations of backplanes, drives, power supplies, shock isolators, etc, can be incorporated into the same base chassis. Why is this important? There are several advantages for the design engineer:

- Less customization equal lower costs and shorter leadtimes
- Less risk with standardized platform – more vendor choices for components, less obsolescence risk
- Designer can get exact configuration, doesn't need to settle
- Designer's specific solution based on a proven and tested base platform

- Prototyping/low volumes are much more cost-effective

A modular design also has other technical advantages. With modular plastic card guides, the card slots can be set at various pitches (distance between each slot), so modifying the spacing to various architectures or configurations is simplified. The plastic card guides also provide the required electrical insulation and enlarged openings, resulting in a better cooling performance than many stamped chassis.

The same design principle can apply to cabinet enclosures. The tapped guide rails, stiffeners, and frame components have the holes at regular intervals. This allows elements such as the gold-colored cross bracing and stiffeners to be employed in various configurations. Just like the instrument case and system platform mentioned above, the modular design allows various frame heights, widths, depths, mounting rails, bases, and panels to easily be incorporated. Further, a modular design reduces the installation, upgrade, and service time.

The Perfect Fit

In various applications, saving space (and often weight) is critical. In medical applications, there is a premium on space for instruments. Military/Aerospace applications often have stringent space and weight requirements. All types of industrial applications require smaller electronics and enclosures. Therefore, "right-sizing" for the electronics in increasingly important. Taking modularity one step further, an enclosure can be built to an exact size in any volume without the high customization costs.

The system platforms mentioned above are based on the Eurocard format. The extrusions are cut in 1U increments. This is perfectly fine for backplane-based systems. For instrument cases, the sizes need to be more precise. A new modular design allows the exact sizing to be done without the typical high customization costs. It starts with the aluminum extrusion, which are cut to any specified length. In many Eurocard system platforms, the extrusion has a radius for sealing and gasketing purposes. For EMC, the extrusions are bent in 90-degree angles to cover any open seams. In this instrument case solution, the interlocking extrusions has a unique shape and design. The extrusion is designed to accept tapped strips, sealing cords for EMC, optional direct mounting of a panel or PCB, grounding terminals, or screws. This flexibility saves a few

manufacturing processes, keeping costs low. Further, the extrusion shape allows the extrusion and panels to be directly mated together. This prevents drilling and tapping the extrusion, again saving costs. With a simple design and only a few pieces, the assembly and quick and easy. These cost advantages far exceed the extra cost of a super-functional extrusion. The benefit to the designer is he can have an exact-sized case that is customized with a low cost – and in small volumes. Typically, this kind of customization would only be cost-effective in high volumes. Now, it can be done for prototypes and small volumes.

Customization – in any volume

Overall, these modular design techniques limit the effort, cost and risk of customization. In high volumes, many of these costs can be overcome. However, a modular design allows customization to be more cost-effective during prototyping and lower volumes.

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Justin Moll has over 10 years of high-tech marketing and sales experience and has been with Elma Electronic since 2000. As the Director of Marketing for Elma, he has led the company's charge in several next-generation backplane and chassis technologies. Justin is active in VITA and PICMG and has been an honorary speaker at several industry events. He also is the Publisher of PKG magazine, an RTC group publication; and has served as the VP of Marketing for the StarFabric Trade Association. Justin received his Bachelor of Science degree in Business Administration from the University of California, Riverside.