

## THE BASICS OF MODULAR ENCLOSURES

### THE FUNDAMENTALS

A modular enclosure is simply an electrical enclosure that has a modular design. It is essentially a series of standard enclosure components that can be used interchangeably to create an electrical enclosure which is tailored to a specific application or customer.

### EQUIPMENT PROTECTION

So, of course the primary function of a modular enclosure is the same as any electrical enclosure:

- 1) To protect electrical equipment inside the enclosure from the operating environment.
- 2) Protect users of the electrical equipment from electrical and/or mechanical hazards of the equipment.
- 3) Potentially act as an interface between required human interaction with the electrical equipment.

### MODULARITY

Modular design is routinely used in many different technologies, some of which are computer architecture, automobile design and electrical power distribution. At its core, a modular design utilizes a system of smaller parts that can be used in different combinations to create a wide variety of systems. Ideally, a modular design creates flexibility and custom solutions while maintaining standardization—i.e. the smaller parts are familiar and static. It is just the combination of the smaller parts that creates unique, dynamic solutions.

So, a modular enclosure is composed of smaller parts that can be used to “configure” a unique enclosure solution.

### NUTS AND BOLTS OF MODULAR ENCLOSURE

#### THE FRAME

The core of a modular enclosure is the frame. The reason the frame is a critical element in a protective enclosure is because the frame is designed to bear the load of the electrical equipment mounted inside. Regardless of how the enclosure is populated, the vast majority of the weight of the equipment is supported by the frame. From the frame, one or more sub panels can be mounted. Rack equipment is mounted on rack angles which mount to the frame with brackets designed to transfer the load to the frame. Grid straps are used to create a custom mounting system inside the enclosure to mount any type of equipment. They are also designed to transfer the load back to the frame. The frame of the modular enclosure is as important to the enclosure integrity as the foundation and the weight bearing walls are to a building's stability.

#### MOUNTING SUBPANEL

In standard electrical enclosures most of the electrical equipment is mounted to a full mounting subpanel within the enclosure. Typically this full subpanel is screwed directly on the back cover of the enclosure. In a modular enclosure, the mounting subpanel can be in almost any location—front, middle, back—and multiple subpanels can easily be used. Full subpanels are still frequently used in the back of modular enclosures, however the enclosure could also utilize additional full, partial or swing-out subpanels.

#### RACK MOUNTING

Rack angles are vertical “scaffolding” that have the spacing and compatible holes to easily mount standard rack mount

equipment. A wide variety of industrial controls, measurement instrumentation and other technical equipment are designed with a standard housing size and mounting brackets to be compatible with standard rack mount sizes. 19 inch wide is the most common width, however 23 inch, 24 inch and some metric widths are also used. The height of a rack mount unit is measured in ‘rack units’. One “rack unit” is 1.752 inches (44.5 mm). Rack mount equipment can easily be mounted in a modular enclosure.

#### GRID SYSTEM

A grid system in a modular enclosure extends the internal framework so that essentially anything can be mounted securely inside the enclosure—sort of like an industrial internal erector set. Electrical equipment, shelves, keyboard compartments and cable management accessories all can be mounted easily on a grid strap network, which is created by combining vertical and horizontal grid straps.

#### TOPS/BASES/COVERS/DOORS

Electrical equipment is typically mounted inside a modular enclosure supported by the frame, but in order to protect the equipment—to make an enclosure—the frame needs to be covered. Tops, bases, covers and doors must form a “skin” around the frame and be attached in a way that maintains an environmental rating necessary for the surroundings. In this area, the modular nature of the system offers great variety. Users can choose from a diverse array of standard tops, bases, covers and doors which can be used on the front, rear, side, top and bottom—essentially covering the six planes of the the cube created by the frame.

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Sometimes components are mounted on the 'skins' of the modular enclosure. Common applications for this would be an HMI or other human interface device like a console or keyboard; cooling equipment; or even components that generate too much heat to house inside the enclosure like large drives or motors.

### WHY DO PEOPLE USE MODULAR ENCLOSURES?

People use modular enclosures because the modularity creates solution flexibility, and the removable nature of the components makes loading, modifying or ganging/joining the enclosure easier and more importantly faster. Faster population translates into cost savings. Modular enclosures fit very well in 'Lean' manufacturing environments. The process time savings of faster population is essentially 'elimination of waste' and the modularity of the system lends itself to faster, easier changes as work flows change.

#### BETTER INTERIOR ACCESS

Covers, doors, bases and tops can easily be removed. This makes it easier to wire equipment, route cabling, access instruments, load panels, troubleshoot problems, make field modifications, etc.

#### MORE EFFICIENT SPACE UTILIZATION

In standard enclosures, a full mounting subpanel is the primary method of populating the enclosure. In a modular enclosure, a variety of different mounting methods can easily be used. Full mounting subpanels can be mounted back to back in the center of the enclosure and a door can be used on the front AND the rear to ensure adequate user access. A subpanel could be used in the back of the enclosure, and a swing-out subpanel could be used in front of it. Partial subpanels could be used in

several different areas of the cabinet, and the remaining space could be used for rack mount equipment or a grid strap network for other options. For OEM customers, extra space could be reserved for other models that may require more electronics—enabling OEM customers to standardize on one or two sizes of enclosure to streamline manufacturing processes.

#### EASY EXPANSION

A modular enclosure solution allows you to easily join/gang cabinets without drilling or cutting, which is at best time consuming and creates a mess to clean up, and at worst can compromise the environmental rating of the enclosure. The ability to expand easily in the future means the enclosure can be designed for the current needs—with assurance that in the future you can expand as needed without hassle or extra costs.

#### FLEXIBILITY

With a modular enclosure, you can mount equipment any way you want it. You can have whatever top or side or door you need without the lead time and cost associated with 'custom' enclosures. If you need to make a change to your enclosure configuration it's easy to do. Just remove the component that is no longer wanted, and add the one you need. You can add holes and cutouts to an item by simply removing it and bringing it into your machine shop—instead of trying to bring the entire enclosure to the shop, or trying to perform a modification on the factory/manufacturing floor.

#### SAFETY OPTIONS AND OTHER USEFUL ACCESSORIES

Barrier panels make it easy to separate lower voltage DC electronics from higher voltage AC or DC power. The separation can not only potentially protect the

electrical equipment but most importantly, the people who may need to access the low voltage area of the enclosure. Disconnect enclosures are as simple to configure as standard enclosures. A variety of 'preferred' disconnect door cut-outs are available, designed for use with many commercially available disconnect switches and circuit breakers, including larger cutout options to accommodate circuits which use higher currents. Some of the manufacturers include Rockwell Allen-Bradley, ABB Controls, Eaton Cutler-Hammer, General Electric, Siemens and Schneider.

A variety of other accessories are available to add value to OEM solutions and speed up enclosure population through enhanced ease of use. LED light kits, window kits, keyboard trays, and cable management solutions are just a few of the standard accessories available.

If you are interested in learning more about modular enclosures contact one of Hoffman's industrial application experts. Hoffman has been a leading provider of industrial enclosure solutions for over 70 years and has a large global team of veteran experts in protective enclosure design and applications in industrial environments.



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