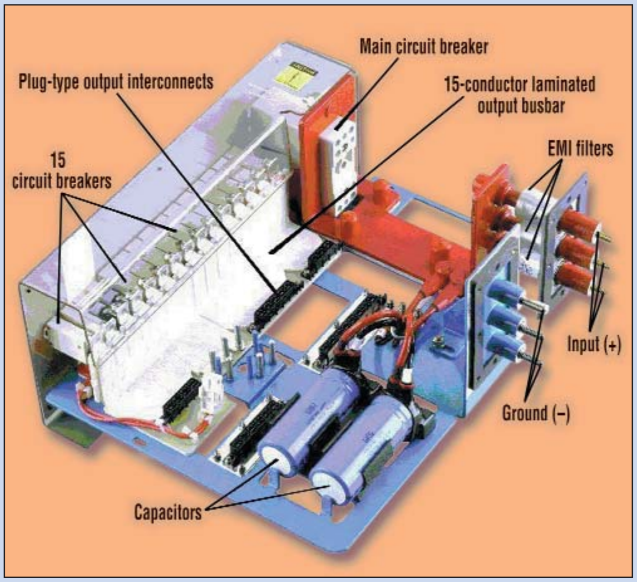
# Bus-Bar Benefits

By David G. Morrison • Power, Packaging & Components Editor

Not every system requires laminated bus bars. In some rack-mounted systems, current levels don't rise above the capacity of a backplane. In other cases, there are relatively few taps off the power bus, so a wiring harness is the best approach. Also, in applications where only a few cabinets need to be wired, a wiring harness may be sufficient, even when the number of taps off the power bus and wiring complexity are high. But with a complex power distribution in production volumes, the advantages of a bus-bar design are compelling.

Laminated bus bars are typically more costly than wiring harnesses because of how they're made. Their manufacturing process involves cutting strips of copper and insulation to shape and then combining them into a multilayer structure with mounting holes, tabs, or connectors added for interface.

As Rick Whistler, national sales manager at bus-bar manufacturer Eldre, Rochester, N.Y., describes the process, fabricated copper conductors and integral interconnections and insulation are assembled in a fixture and then subjected to pressure and high temperature over time. The insulation–one of several materials such as Mylar, Nomex, Tedlar, or Kapton–has been customized with a b-stage resin. When heated, this material bonds the insulation to the copper. The copper conductors are sized to achieve the required current ratings based on the acceptable temperature rise for the conductors. The Copper Development Association publishes current ratings for various sizes of bus bars at a temperature rise of 30°C, a limit applied in UL safety tests *(see http://busbar.copper.org/ampcapacity/busbar.html and go to Table 1, "Ampacities of Copper No. 110 Bus Bars")*. Whistler notes, though, that Eldre sizes conductors around a more conservative temperature rise of 20°C, in part to account for the presence of insulators on the copper.




***Advanced bus-bar designs, like this one developed by Eldre, distribute power neatly and efficiently and integrate many of the discrete components associated with power distribution.***

Although its material cost will likely be higher than that of an equivalent wiring harness, a bus bar's overall cost may be less after taking assembly, reliability, and field service requirements into account. In the factory, the interconnect components can be assembled much faster with a bus-bar design than with a wiring harness. Moreover, the likelihood of miswiring with bus bars is less. One reason for this is that with bus bars, the location of the interconnects is fixed. They also are readily labeled using a variety of methods, including rubber stamp, silk screen, and adhesive labels. Plus, the benefits of easier assembly translate into faster and easier component repair in the field.

Bus bars offer other advantages as well. A bus-bar design is generally more compact than a wiring harness and may eliminate the restriction of air flow posed by wires. Reliability is better too, particularly when a system is exposed to harsh environmental conditions. Hervé Dauvergne, a market development engineer at Eldre, has noted that while a wiring harness might fail in five years, a bus bar might last 30 years or more.

Beyond these benefits, bus bars provide a platform for greater mechanical integration at the system level. Advanced designs are exploiting this capability *(see the figure)*. As Whistler says, "The greatest innovations are custom solutions that integrate as many components as possible." In addition to integrating power connectors, bus-bar designs are taking on other power-related components, including fuses, circuit breakers, filters, and capacitors. Because the bus bar is essentially a custom design, there's an incentive to exploit its ability to clean up and simplify assembly. Another opportunity for customization lies in the combination of power and signal interconnect within a bus bar that incorporates small wires or flex circuits to route signals.