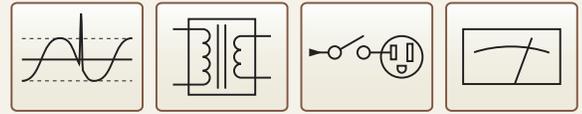


## Pillars of Power Management

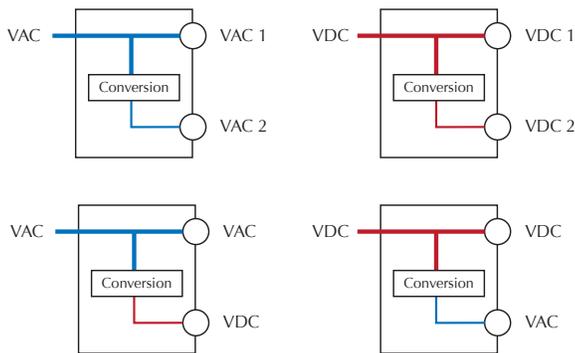
Conditioning • Conversion • Control • Monitoring



For over 30 years, Marway has specialized in purpose-built power distribution solutions for applications up to approximately 60 kVA. In addition to our core distribution features, we integrate power conditioning, conversion, control, and monitoring capabilities to optimize space and weight for today's electronics-intensive platforms. This has enabled Marway to deliver value-added solutions for our customer's unique military, defense, aerospace, and commercial applications.

## Power Distribution for Multiple Requirements

Power distribution units are usually thought of for branching single power sources to downstream equipment, all of which have a common power need. However, many installations of electronic equipment require more than one type of power source. In these cases, there can be advantages to integrating more than one power source, and even power conversion, into a single PDU. Starting with ac and/or dc power sources, there are four types of power conversion.



Simplified examples of input voltages being distributed and converted for more than one downstream voltage requirement. Conversions can be mixed to accommodate virtually any voltage and current capacity need.

### Ac to Ac Conversion

This is most often a straight conversion of one standard facility voltage to another voltage as needed for a specific application. There are three types of conversion.

The first uses a simple step-up or step-down transformer for a single-phase power source to either step up (increase) or step down (decrease) the input voltage.

The second type involves changing the phase configuration of a multi-phase power source. This is accomplished with a polyphase transformer. A common scenario is to start with a three-phase delta facility source such as 208 Vac 3 $\phi$  and convert it to a 120/208 Vac wye. This is done to provide a neutral line to power equipment which requires it. Wye to delta, and other configuration conversions are also possible.

A third conversion type converts ac frequency. Ac voltage normally operates at 50 or 60 Hz depending on the country where provided. There is also a 400 Hz power specification for many military and aerospace applications. From a conversion perspective, providing 400 Hz ac involves converting an ac source to dc, then back again to the higher frequency ac. However, it is also possible to use an electric motor coupled to a generator to create a 400 Hz power source. Both of these techniques involve components of significant size and cost which are not typically suitable for PDU integration.

Step up/down voltage conversion and power configuration changes are options commonly integrated into Marway PDUs where a transformer will be selected to meet the configuration, voltage, and other requirements.

### Ac to Dc Conversion

Many types of equipment require a stable dc power source. A power supply integrated into a PDU accepts common ac facility power and provides dc power as an alternative or additional power source for distribution.

A switched-mode power supply is the most common technology used today. Multiple COTS products offer excellent efficiency and voltage regulation while also being available in lightweight configurations suitable for PDU integration.

Linear power supplies may also be used. Multiple COTS products provide ample selection, but these tend to be larger,

# Pillars of Power Management: Conversion

heavier, and not as efficient as switch-mode supplies. However, linear-mode supplies can provide an advantage for downstream equipment which is very sensitive to the high-frequency noise created by switch-mode supplies.

Lastly, we can also integrate a rectifier circuit directly into the PDU. This would typically be done where the dc power is used for signaling or control and not as a power source.

## Dc to Dc Conversion

If there is an available dc power source, a converter can be used to deliver one or more different output voltages for distribution to downstream systems. These are usually solid-state modules easily mounted inside the PDU. Thermal considerations may be a factor for packaging, as these systems can generate quite a bit of heat when power capacity gets large.

For very small loads, we can also integrate a simple regulator or voltage divider circuit directly into the PDU. This would typically be done where the dc power is used for signaling or control and not as a power source.

## Dc to Ac Conversion

For those circumstances where only dc power is available, a properly selected inverter can be used to provide ac power. Though not a very common need, this is done usually to provide a “convenience” outlet for ancillary ac needs in an other-

wise dc-powered environment. For higher power capacities, the inverter tends to get large enough that integration within most PDUs may not be desirable.

## Advantages to Power Conversion Integration in Marway PDUs

Ultimately, a reduction in packaging complexity and component redundancy is the root of the following advantages found in the integration of power conversion into a pdu:

- reduced space
- reduced weight
- reduced cost
- improved cable management
- added convenience

When creating an integrated solution, Marway can address the unique needs of an application, and optimize the selection of components for power capacity and packaging efficiency.

Marway has specialized in the single-chassis integration of these capabilities to reduce space, weight, and costs, and to improve power performance compared to separately housed third-party components. We believe that ultimately it's the combination of power performance, packaging efficiency, and product quality which keeps our customers coming to Marway to meet their power distribution needs.

Conversion	Methods	Marway Capabilities
Ac to Ac	transformer	step-up transformer, step-down transformer, polyphase transformer
Ac to Dc	power supply	switch-mode power supply, linear-mode power supply, internal rectifier circuit
Dc to Dc	converter	dc-dc converter, regulator/voltage divider circuit
Dc to Ac	inverter	small capacity integrated inverter, large capacity external inverter