



PowerMod Technology Breakthrough Brings High Availability to High Power Electronics

## **PowerMod™**

### Power Conversion

Commercial and military power systems require power conversion between many different formats. Traditionally, the conversion from one voltage and frequency to another involves several steps, each performed by separate electronics. DTI's solid-state PowerMod™ systems employ high frequency switching to perform the conversion within a single unit, thereby reducing power losses during the multiple steps required when using traditional electronics. As a result, a greater portion of the input power is preserved, yielding lower power costs and reduced cooling requirements. DTI's systems offer a modular design that can be scaled to different power requirements in virtually any combination of voltage and current. They feature high reliability, continued operation during instances of failure, and components that can be replaced easily during periodic maintenance.

#### **High Voltage Power Conversion**

DTI's proprietary high-voltage solid state switching technology enables high frequency power converters for applications requiring tens of kilovolts and megawatts of power. The advantage of high frequency switching lies in reduced size and weight of the power converter's reactive elements. Thus, efficient power conversion can be achieved in packages much more compact than comparable 60 Hz power converters. This technology opens entirely new applications such as DC-DC converters for distributed High-Voltage DC (HVDC) transmission and distribution networks, both terrestrial and undersea, as well as power conditioning systems for driving pulsed power systems.

#### **Weapons Power Converter**

Since the adoption of Commercial Off the Shelf (COTS) components, new ship electronics operate at 60 Hz to maintain compatibility with commercial, land-based equipment. Legacy electronics, such as MK-48 ADCAP torpedoes and Tomahawk missiles, still operate at 400 Hz. DTI's Weapons Power Converter is a MIL qualified, extremely low-distortion, quiet, and reliable device that enables these legacy systems to use 60 Hz ship power.

DTI's Weapons Power Converter operates at a switching frequency of 50 kHz. At these high frequencies, the switching harmonics can be highly filtered, without affecting either



**Weapons Power Converter.** DTI's 400 Hz weapons power converter was designed to satisfy the Navy's need for a "drop-in" replacement for the baseline power converters used on Virginia class submarines.



the input or output power. High frequency switching enables greater control bandwidth, allowing the output power to be highly regulated into nonlinear and transient loads.

This technology is also applicable to variable frequency power converters for synchronous AC motor drives, where high reliability and low acoustic noise emission are of the utmost importance.

### Modular DC-DC Power Converter

The PowerMod Modular DC-DC Power Converter is a revolutionary concept in powering DC servers and switches. It offers efficient power distribution with down-conversion at the Point-of-Load (POL); direct DC-DC conversion at high power levels; modular construction, configurable from 10 kW-150 kW per rack; and full system redundancy and ride-through from multiple power sources.

Each DC-DC power supply cabinet is built from fully independent, multi-kW drawers. The drawers are hot-swappable, and the six drawers per cabinet are configured to provide N+1 redundancy at the rated output power. Two fully independent input lines with diode combining provide input power to the cabinet. Should one power source be lost, the cabinet automatically and instantaneously operates from the second source without any external commands or delays.

The Modular DC-DC Power Converter is a simple buck regulator, or down converter, design. The DC input to the converter is connected and disconnected (at high frequency) from an LC filter. The duty cycle, which determines the output power, is controlled by a feedback network which maintains preset output voltage (or current). High frequency switching allows for a fast response to load transients, and reduces the physical size of the filter components.

DTI's universal power converter architecture can be used for a wide range of applications requiring AC-DC and DC-DC power conversion. Scaling this technology to higher voltage (tens of kV) and higher power (MWs) opens entirely new applications such as DC-DC converters for high voltage DC undersea networks and power conditioning systems for driving pulsed power systems.



**Modular DC-DC Power Converter.** In this configuration, each drawer is rated to 30 kW, with the cabinet rated up to 150 kW total, with N+1 redundancy.

