

ENGINEERING THE INVERTER OTHERS COULDN'T DELIVER

How PD&E Electronics solved a demanding legacy naval power requirement with a high-frequency, ultra-low-distortion AC inverter.

When a legacy naval application required a true sine wave inverter with extremely tight specifications, the supply base struggled to deliver. PD&E Electronics recognized the need for a new approach—one that would meet every requirement, perform reliably across the full environmental range, and be producible at an affordable cost. The result: an inverter that exceeds expectations and opens the door to broader mission applications.



KEY ACHIEVEMENT

< 4%

Maximum Allowable
Distortion

1.9%

Achieved Distortion
at High Frequency

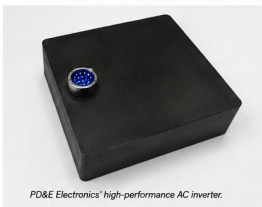


THE CHALLENGE

PD&E Electronics identified a Defense Logistics Agency (DLA) requirement to support a legacy naval system. History showed that multiple suppliers had received awards—only to have contracts cancelled because they could not deliver an affordable product that met all of the requirements. The specifications were exceptionally demanding:

- True sine wave output with ultra-low distortion (< 4% total harmonic distortion)
- Operation across the full specified temperature range
- Tight tolerances for frequency, voltage, and distortion
- Total electrical isolation
- Challenging temperature coefficient for output voltage
- Robust short-circuit response at 2.5 kHz switching frequency
- Small form factor with effective thermal management

The combination of these requirements had proven too difficult for existing solutions to achieve consistently.



PD&E Electronics' high-performance AC inverter.



OUR APPROACH

- PD&E built a technical scoping matrix to address every challenge systematically.
- Research included a NASA tech brief as a starting point, though the requirement's distortion limits were more restrictive.
 - Early focus was on achieving a fully isolated architecture and a pure sine wave.
 - A unique internal layout was developed to manage heat and fit the inverter into a small form factor.



ENGINEERING BREAKTHROUGHS

- Developed a circuit-level concept and iteratively solved each challenging requirement.
- Created unique isolation concepts to maintain performance at 2.5 kHz.
- Engineered a fast-acting short-circuit response capable of protecting the unit at high frequency.
- Handcrafted signal conditioning to produce an articulated sine wave with exceptional fidelity.



RESULTS THAT EXCEED EXPECTATIONS

- True sine wave output achieved.
- Distortion: 1.9% (less than half the allowable < 4%).
- All frequency, voltage, distortion, and temperature requirements met across the full operating range.
- Reliable performance validated through rigorous testing.
- According to end-user feedback, no alternative solution evaluated matched this combination of high-frequency performance and low distortion.



BUILT FOR TODAY. DESIGNED FOR TOMORROW.

- Using off-the-shelf components, PD&E engineered a modular architecture that provides significant scalability and future design potential:
- Easily adaptable from 60 Hz to 5 kHz while maintaining true sine wave output.
 - Power levels can be increased with the same core platform.
 - Units can be paralleled for three-phase power generation.
 - A streamlined path to a power signal generator.



Piranha Holdings LLC

We engineer power solutions when specifications are tight, the environment is severe, and mission success is non-negotiable.
When others can't deliver, we engineer the answer.