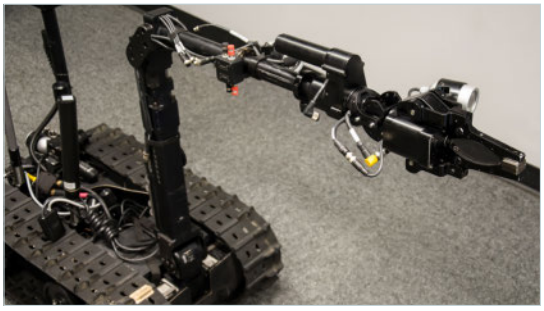
PCDM | Small Size, Low Profile | Low Weight | Low Noise

## Tethered Robot

# Multiple Power Source, Rugged Vehicle

## The Customer's Challenge



For the past 40 years robots have taken the place of humans in bomb detection, removal, transportation and detonation, with increasing levels of investment in the last decade or so. Originally controlled by a series of ropes, technology has advanced to meet the enhanced needs of modern-day security forces and law enforcement, and the threats they now face.

One manufacturer we worked with was developing a small, robust system. To enable one device to be used across all environments it needed to be able to be operated from multiple power sources: 115/230$V_{AC}$; or 12/24$V_{DC}$ from either the internal or external battery. The complexities involved were compounded by a lack of specialized power expertise on the design team.

In addition to carrying a larger payload than previous designs (a variety of enhanced and complex electronics such as sensors, cameras, diffusion tools and communications and control), they needed the robot to be smaller and lighter to be make it easier to be carried to remote deployment locations, and robust enough to deal with varied terrains.

Given the remote operation, intricacy of tasks and the risks involved from failure, data transmission speed, sensor accuracy and image quality were paramount. Management of the EMI from the power supply was a fundamental requirement.

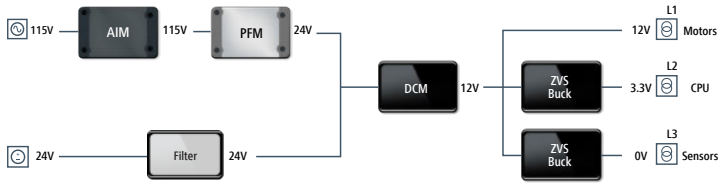
## The Solution

Our applications engineers worked closely with the design team to develop a one-vendor solution for the various power requirements.

The wide input voltage range of the DCM DC-DC converter enabled it to be used to provide a regulated 12V rail from either a 12V or 24V battery. When the robot was powered via a tether from the AC source, a PFM Isolated AC-DC Converter provided the 24V intermediate rail, which was also regulated by the DCM.

The DCM provides power to the drive motors and to two ZVS Buck regulators that provide 3.3V and 5.0V to power micro-controller circuitry.

Link to Whiteboard »




## The Results

Vicor's Power Component Design Methodology is a scalable and modular building block approach to power system designs, with each off-the-shelf power component optimized to work together to deliver outstanding performance. This meant that the design effort required was minimized.

With the complete multi-input solution having a footprint of just 66.8cm$^2$, the team achieved the dramatic reduction of the power supply weight and size necessary to enable the increased payload required.

The isolation provided by the DCM reduces input transients from reaching the micro-controller. In addition it prevents power supply noise impacting the video quality.

| Product Family Key Specifications | |
|---|---|
| **PFM Isolated AC-DC Converters with PFC** | |
| **Input Voltages** | Universal rectified: 85 – 264$V_{RMS}$ |
| **Output Voltage** | 24 and 48V isolated, regulated outputs |
| **Output Power** | 400W |
| **Efficiency** | Up to 92% |
| **Power Density** | ≥127W/in$^3$ |
| **Dimensions** | PFM 4414: 111 x 36 x 9.4mm<br>PFM 4914: 125 x 36 x 9.4mm |
| **DCM DC-DC Converter Module** | |
| **Input Voltages** | 9 – 50$V_{DC}$; 16 – 50$V_{DC}$<br>18 – 36$V_{DC}$; 36 – 75$V_{DC}$<br>120 – 420$V_{DC}$; 160 – 420$V_{DC}$<br>200 – 420$V_{DC}$ |
| **Output Voltage (SELV)** | 3.3, 5, 12, 13.8, 15, 24, 28, 36, 48V |
| **Output Power** | 4623 ChiP: Up to 600W<br>3623 ChiP: Up to 320W |
| **Efficiency** | Up to 93% |
| **Dimensions** | 4623 ChiP: 47.91 x 22.8 x 7.21mm<br>3623 ChiP: 38.72 x 22.8 x 7.21mm |
| **Cool-Power ZVS Buck Switching Regulators** | |
| **Input Voltages** | 12$V_{IN}$ nominal (8 – 18$V_{IN}$ )<br>24$V_{IN}$ nominal (8 – 36$V_{IN}$ )<br>48$V_{IN}$ nominal (36 – 60$V_{IN}$ ) |
| **Output Voltage** | Wide output range (1 – 16V) |
| **Output Current** | 8 , 9, 10, and 15A versions |
| **Efficiency** | Up to 96.5% Light load and full load high efficiency performance |
| **Dimensions** | 10 x 14 x 2.56mm |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