Integrated Drive Motors

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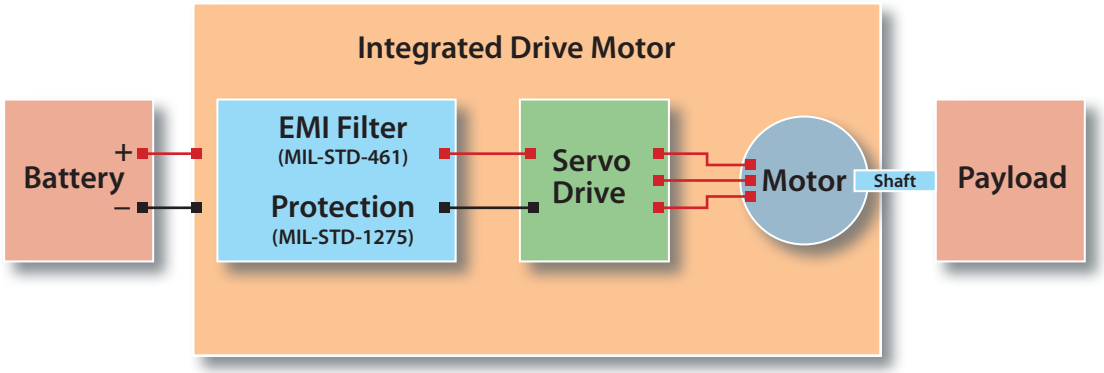
In the development of extreme-conditions servo applications, system engineers face numerous challenges.

Typically, they procure a Servo Drive and an Electric Motor which must be seamlessly integrated to function in unison.

They are often also tasked with designing EMI filters and protective electronics to comply with MIL-STD-461 and MIL-STD-1275 standards.

Engineers must create housing for these components and the Servo Drive. Furthermore, the motor must be calibrated in conjunction with the Servo Drive, in addition to the calibration needed for the payload itself.



Components encapsulated by an integral motor

A significant benefit of utilizing an Integral Motor for system engineers is the elimination of these complexities.

Figure 1 depicts a military-grade Integral Motor incorporating all the components above.

Simply connect the Integral Motor to the Battery/Power Supply to start calibrating and controlling the payload.

Motors can routinely reach temperatures exceeding 100°C during standard operation and the electronics are housed alongside the motor. This situation significantly amplifies the intricacies of mechanical, thermal, and electrical design.
Ensuring the integrity of these systems under such conditions demands meticulous design considerations. These considerations are crucial to maintaining optimal performance and reliability.

Integral motors offer several advantages that can be particularly beneficial in various applications, including military-grade servo systems. Some of these advantages are:

- **High Power Density and High Efficiency:** Reduces the overall size of the system and makes it compact.
- **Cost-Effectiveness:** Integrating components within the motor can reduce the number of separate parts needed, resulting in cost savings.
- **Reduced Wiring Complexity:** With fewer separate components, the wiring complexity is significantly reduced, leading to easier installation and maintenance.
- **Faster System Setup and Construction:** Integrating components can speed up the system's setup and construction.

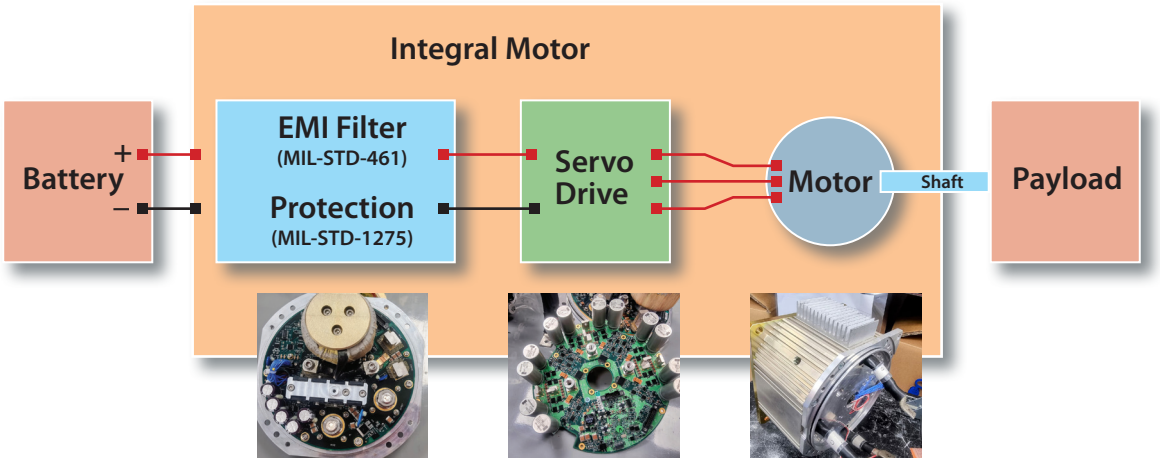
An additional advantage that integral motors may provide in the context of EMI is active impedance matching that reduces the ringing between the motor phase coils and their parasitic capacitance.

These benefits make integral motors a compelling choice for system designers looking to streamline the development process and enhance the performance of their applications.

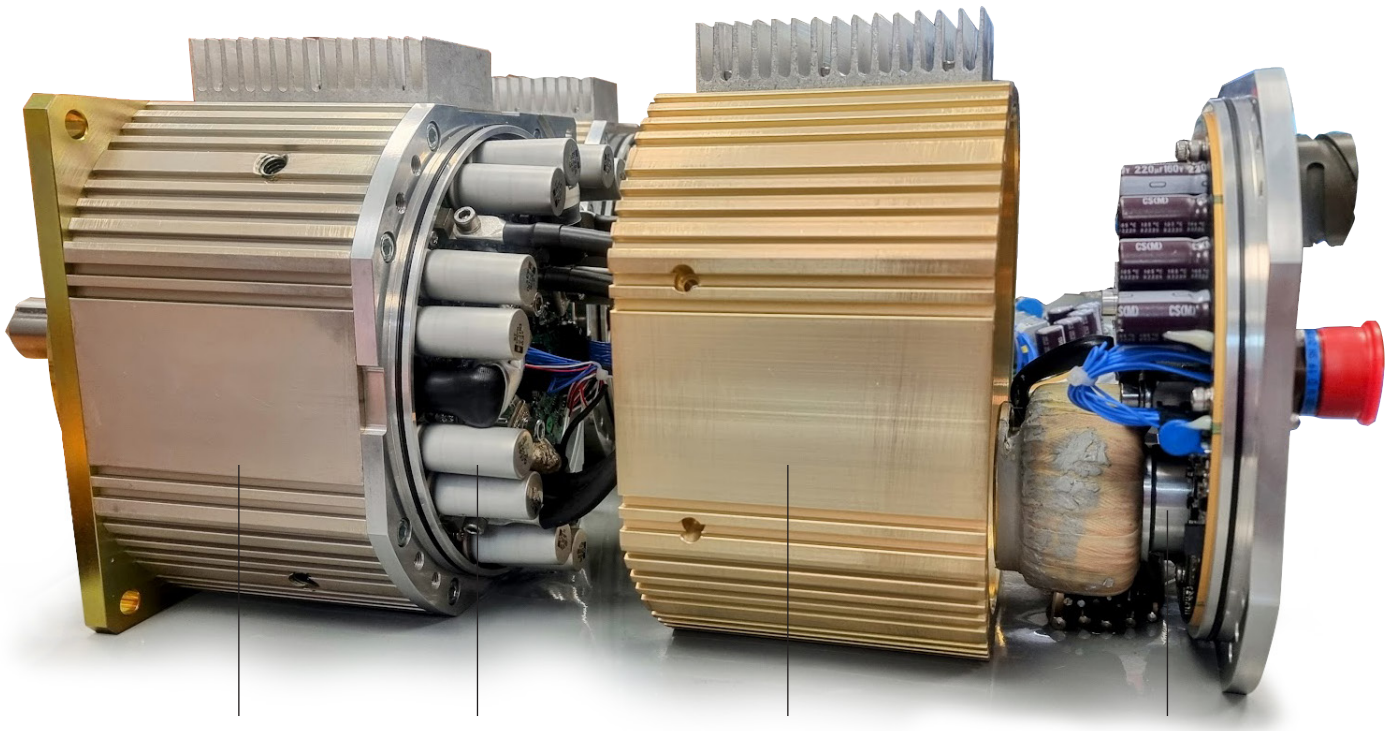
GFT and **Bental** developed an integral motor with the following specs:

- Outputs 20Nm @ 2400RPM continues (5kW).
- Complies with MIL-STD-461 & MIL-STD-1275.
- Fed by 28Vdc and communicates via CAN.
- Drives a Compressor in an Air-Cooling System.
- **Dimensions:** 200x200x256 mm³; **Weight:** 24kg

The following figure depicts the 3 components of the Integral motor:



Which assembles like this:



Motor

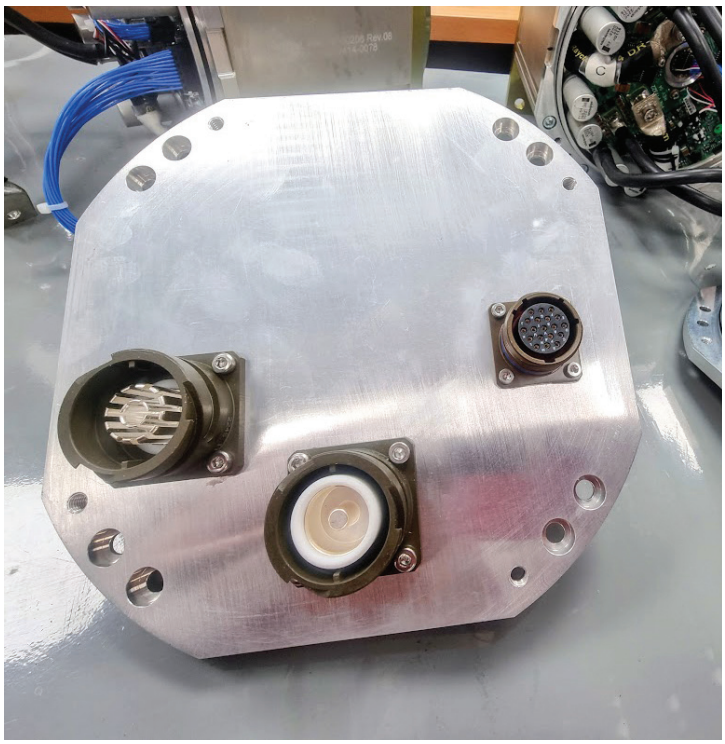
Drive installed on the rear flange of the motor

Electronics housing

Input Stage. EMI filter & Protections

The simple electrical interface consists of:

- Power connections to a battery.
- Logic Power Supply (which is also protected).
- CAN & RS-232 communication.
- One DI & One DO.



In this air-cooling application, where the motor may operate continuously at its maximum power output, the electronics were designed to withstand an **ambient temperature of approximately 90°C**. Currently, we are designing a smaller integral motor for a servo application in a harsh environment.