Brushless DC Motor Controller
Project Statement
Statement of Need

Triumph Group Systems and Support is looking to obtain a standalone Brushless Motor Controller (BLDC). Many customers of Triumph are looking for Products and Systems that are adaptable, reconfigurable, and allow for rapid upgrade. Triumph is currently developing a family of BLDC motor controllers that will meet the needs of current and future customers.

Tasks and Deliverables

The overall goal of this project is to create a BLDC motor controller that can operate for any length of time in a wide range of temperatures. To create such a controller, Triumph has tasked our team with several deliverables to create a functioning system that they can utilize in existing projects. Deliverables/Major Items include:

- Controller Board/Unit (QTY = 1/min)
- BLDC Motor(s) used during development and validation (QTY = 1/min)
- Software developed to operate the BLDC Motor(s)
- Interfacing harnesses between Controller & BLDC Motor
- Motor Control Design Manual shall include all Major Project Activities, as well as:
  - Controller & Motor Requirements
  - Electrical Parts Selection, Analyses/Simulation artifacts
  - Mechanical/Packaging Design artifacts
  - PCB design files
  - Test Plan/Procedure/Report

To complete the project on time, Triumph has also provided a list of major project activities to ensure the tasks and deliverables in the design process are completed. Major Project Activities include:

- Kick-Off Meeting
- Design Concept Review (DCAR)
- Preliminary Design Review (PDR)
- Critical Design Review (CDR)
- Test Readiness Review
- Review of Test Results
Preliminary Requirements

Triumph has a list of requirements that the project must meet to be considered successful. These requirements are split up by Motor Controller and DC Motor requirements that must be supplied to Triumph at the end of this project.

**Motor Controller**
- Shall be fully autonomous and include the following:
  - Input Power conditioning for local circuits, and Motor/Load
  - BLDC Motor Controller-chip
  - MOSFET or IGBT Output Driver stage
  - Internal or External Feedback/Sense circuits
- Must be capable of driving up to a 1.5 kW (2 HP), Fixed or Variable Speed BLDC Motor
- Shall be powered from 115-120 Vrms/60Hz single phase
- Shall utilize an AC to 24-48V Variable DC converter
- Shall be capable of driving 30-75 Amps DC
- Shall be capable of operating Sensorless or with Sensor feedback
- Shall operate on a Continuous Duty Cycle
- Shall operate at an ambient temperature of -40 to 85°C
- Shall be air-cooled, compact, and mounted in an enclosure
- The design shall not utilize any obsolete parts or parts with less than 3 Years-to-End-of-Life (YTEOL)
- Should be able to detect motor stall, short-circuit, over-current, and over-heating conditions.

**DC Motor**
- Shall operate between 3,000 to 20,000 RPM
- Shall operate at an ambient temperature of -40 to 85°C
Basic Limitations

There are some limitations for this project, such as the software being utilized to design the motor controller circuit and layout. Some of the students are not familiar with the software we will be using, and learning how to utilize the program will take time. Additionally, the software that will be utilized to program the motor controller may also be unfamiliar to some of the students; this also includes the software that will be used to interface with the motor controller.

Questions

- How large will the motor controller circuit be?
- What vendor will we use to supply the board?
- What will the prototype cost?