

# Free Minor HV Electronics - Applied Sciences

Delft University of Technology | Formula Student Team Delft

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## Introduction

Since 2011 Formula Student Team Delft has been building an electric powered race car. At the heart of the car lies a set (2 or 4) of electric motors and motor controllers. The motor controllers convert a certain request in motor torque to a current sent to the motors. To properly do this and to be able to extract maximum performance from the motors a set of regulator and control pcbs is required to make sure that this is achieved. These pcbs need to perform in high noise environments and be able to handle high currents (up to 33A per motor) at 600V without jeopardizing the performance of the vehicle.

For the past years the team has always driven using a sponsored set of motors and motor controllers. This set is adapted from its usual purpose (electric drives in factories) to be better attuned to the demands of a Formula Student race car (high torques with high fluctuations in current and motor velocity). When pushed to the limit this system often becomes unstable which leads to undesirable effects such as a forced shutdown of the entire motor controller causing the car to grind to a halt.

These reasons made the team look at designing their own set of motor controller pcbs. Having these would allow us to better tune the choice of electric components on the pcb as well write our own control systems for these motor controllers. However, due to the difficult nature in which these pcbs have to operate, designing a working pcb will require a serious investment of time of the person doing this.

The minor student will get the responsibility to design and test a pcb located in the High Voltage system in the car. The difficulty of this work, and the time required to successfully fulfil this task will accredit to the 15 EC listed for this project. The assessment will be done by a final presentation, where focus should be put on the process applied and lessons learned. A paper needs to be written which will get a fail or pass result.

The idea behind the set-up of this minor is that several students working on different disciplines have 2 courses in common to ensure a basic level of understanding of project- and process management and decision making. This should enable the students to work more independently, while still performing as desired. The remaining ECTS will be gathered by following courses relevant for the discipline the student is working on, in this case High Voltage Electronics.

The work that the student will be doing at the team will involve him/her using techniques or knowledge learned in the following Applied Physics Bachelor: TN1322 (Inleiding Elektriciteit en Magnetisme), TN2054 (Elektromagnetisme), TN2545 (Systemen en Signalen) and TN2211 (Elektronische Instrumentatie). The table on the next page shows the proposed courses:

<b>Course</b>	<b>ECTS</b>	<b>Motivation</b>	<b>Period</b>
SPM6102 Process Management and Decision Making	5	A well-structured process and good decision making are of vital importance in such a high-paced project as Formula Student.	Q2
CT3101 Project Management Basics	5	Project management skills are a big plus in such a complex, multidisciplinary project.	Q1
ET3365TU-D1 Introduction to Electrical Power Engineering part 1	3	Introduction to Electrical Power Engineering part 1	Q1
ET3365TU-D2 Introduction to Electrical Power Engineering part 2	3	This course introduces the fundamentals of electrical power systems analysis in steady-state operating conditions. It is a follow up of ET3365TU-D2	Q2