

# Programming of a Microcontroller for Thermoelectric Cooler (TEC) Control

## Introduction:

Laser diodes convert electrical current to optical power. They are directly or indirectly used in several applications like for example optical communication, marking, 3D laser printing, optical sensing and LiDAR. Laser diodes can be operated in CW or pulsed/modulation modes by using appropriate electronic current driving circuits. In most of the cases, for increased power stability over wide ambient temperature ranges, thermal stabilization of such devices is also required.

This project aims to implement a TEC control electronic circuit using a microcontroller for laser diodes temperature stabilization. Currently, a dedicated IC MAX8521ETP is used in combination with an analog PID (proportional, integral, derivative) control loop. In alternative, the use of a microcontroller (ex.: STM32F411CCU6TR) will allow sharing of the microcontroller resources with other tasks, like laser current control and watchdog functions and to reduce cost. For that reason we have an interest in exploring what concepts like what is presented in application note “maxAN5425” [<https://www.maximintegrated.com/en/design/technical-documents/app-notes/5/5425.html>] might bring. The task is to program the microcontroller with feedback loop and PWM (Pulse Width Modulation) TEC drive outputs.

## Objective:

The objective of the project is to explore TEC control using a microcontroller. A prototype PCB has been developed with STM32F411CCU6TR microcontroller and push-pull driver.

For this project the PCB will be available and the focus will be on developing the microcontroller code. Depending on the interest and progress of the project, self-tuning methods taken from machine learning can be explored.

## Work:

Firmware/Software development for the microcontroller of a TEC circuit:

- Bibliographic research and activity plan definition
- Understanding and characterization of the problem
- Understanding the available hardware circuit
- Programming the microcontroller and test

## Candidate requirements:

Electrical engineering student.

Knowledge in electronics, with interest in microcontrollers. Ability to communicate in English.

## MWTECHNOLOGIES offers:

- Enthusiastic team working in emerging laser applications.
- Hardware and advanced equipment for test and measurement.