Servomotor with PID control and overcurrent protection

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Glossary

- **PWM (Pulse Width Modulation)**
- **PID (Proportional, derivative and integrated)**

1 Introduction

The following sections present the main specifications of the servomotor module.

- General design and operation
- PWM generate
- PID controler
- Overcurrent protection
- Analog-digital converter

2 PWM Servomotor Control

This servomotor is controlled via a Pulse Width Modulation (PWM) signal with a pulse duration ranging from 1.0 ms to 2.0 ms. This range defines the angular displacement from 0° to 180°, as follows:

- **1.0 ms** corresponds to 0°.
- **1.5 ms** represents the neutral or center position (90°).
- **2.0 ms** corresponds to the maximum limit of 180°.

The system consists of several interconnected internal modules designed to ensure precise positioning and operational safety.

2.1 Analog-to-Digital Converter (ADC)

To interact with the physical environment, the system utilizes analog-to-digital converters. These modules transform analog input signals—from the position sensor, the current sensor, and the target setpoint—into 12-bit digital values. This conversion enables precise data processing within the system's digital logic.

2.2 PID Controller

The PID (Proportional-Integral-Derivative) controller manages the movement dynamics. Its primary objective is to minimize the error between the desired setpoint and the actual position, eliminating unwanted oscillations while ensuring a smooth and rapid response. By continuously calculating the error, this module maintains high positioning reliability at all times.

2.3 PWM Generator

The PWM generation module is the core of the system. Its main function is to produce pulses with the exact duration calculated by the controller. This provides the necessary command signal for the servomotor to reach and maintain the target position steadily.

2.4 Overcurrent Protection

Since motors can experience high current spikes under excessive loads or mechanical stalls, a dedicated protection module is implemented. By utilizing the current sensor, this module provides constant monitoring of power consumption. If a significant overcurrent condition is detected for a sustained period, the system is deactivated to prevent permanent hardware failure or thermal damage.

2.5 Servomotor Top Diagram

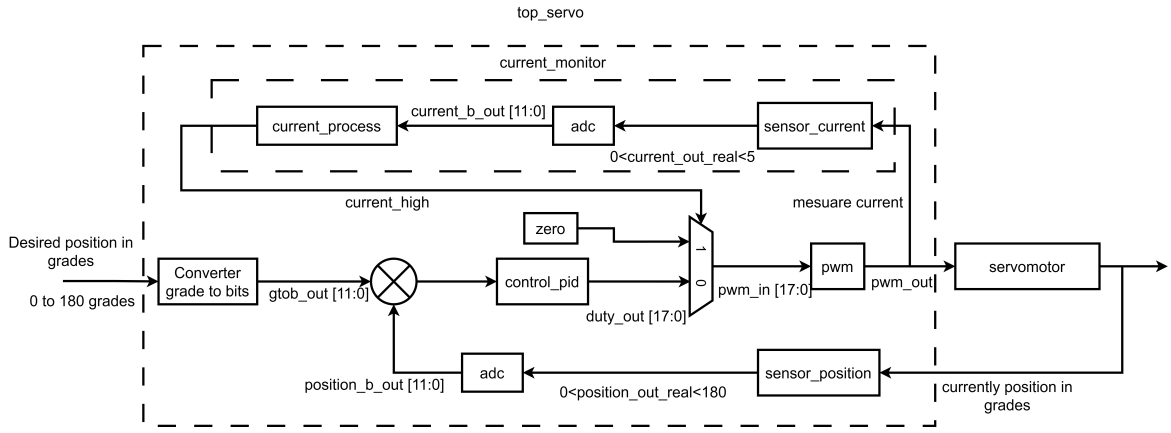

Figure 1: Microarquitectura Servomotor