Husky Robotics - Electronics - Firmware

Science Servo Board: Firmware Specifications

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Board: PSoC

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# Firmware Project Overview

The Science Servo board will be used to control a collection of servo motors on the instrumentation module. Currently, the Science Servo board is needed to drive four servos, but the board will be designed to drive six to eight. On the firmware side, the code should be generalized to support any reasonable number of servo motors. To interface with the servo hardware, the board will use a PCA9685 servo controller chip, which takes I2C inputs and outputs PWM signals. Additionally, the servo motors should be able to be run in parallel, meaning two can be controlled virtually simultaneously and independently.

# Background Information

* [Science\_Board\_2021-2022 Firmware](https://github.com/huskyroboticsteam/Science_Board_2021-2022/tree/main/science%20wow.cydsn): the 2021-2022 Science board firmware has drivers for the servo chip, but it also has some extra code for things that aren’t on this new Science Servo Board
* [PCA9685 Controller](https://www.nxp.com/products/power-management/lighting-driver-and-controller-ics/led-drivers/16-channel-12-bit-pwm-fm-plus-ic-bus-led-controller:PCA9685?cid=Brand_nxpdatafeed-web_third_party-09_01_13): the PWM controller we will be using to drive the stepper motors
* [HindsightCAN Wiki](https://github.com/huskyroboticsteam/HindsightCAN/wiki): details the CAN packet used and format
* [I2C](https://en.wikipedia.org/wiki/I%C2%B2C): the communication protocol that will be used to drive the PCA9685 controller
* [Science Servo Board Spec](https://docs.google.com/document/d/1s_KfgA7S1CwDepY7S_8yBB-n3DausK9riIjJQS-1YF4/edit?usp=sharing)

# Expected Behavior

## Primary Goals

* Upon receiving a “Science Servo Set” CAN packet, the servo specified in the packet should be set to the angle specified in the CAN packet
* If a servo ID does not exist, then print an error to the debug UART and send a “Failure Report” CAN packet
* If the target angle is out of bounds, then print an error to the debug UART and send a “Failure Report” CAN packet

*Secondary Goals*

* Standard CAN LED behavior
* Standard DBG LED behavior

# Minimum Firmware Test Cases

* Set each individual motor to
  + the maximum angle
  + the minimum angle
  + various intermediate angles
  + out-of-bounds angles
* Set multiple combinations of motors to
  + all the maximum angle
  + all the minimum angle
  + all to the same intermediate angles
  + various combinations of angles
* Set the position of a non-existent servo

# Recommended Initial Steps

* Look at [Science\_Board\_2021-2022](https://github.com/huskyroboticsteam/Science_Board_2021-2022/tree/main/science%20wow.cydsn), it has drivers for the servo chip, but has some extra code for things that aren’t on this new Science Servo Board