**Testing Protocol**

***SteerTurnIllum***



|  |  |  |
| --- | --- | --- |
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| Version: |  | 1.0 |

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# Glossary

This section contains a glossary of all the important terms and acronyms used inside the document.

|  |  |
| --- | --- |
| **Term / Acronym** | **Description** |
| uC | Microcontroller |
| PWM | Pulse-Width Modulation |
| ms | milliseconds |

Table - Glossary.

# Introduction

## Purpose of the Document

The purpose of the document is to define the testing protocol of the ***SteerTurnIllum*** embedded academy project.

## Overview

All the functionalities of this project are described in ‘AqRe\_SteerTurnIllum’ document which can be found at 1\_Acquisition\2\_Requirements.

# Testing procedure

Those tests shall be performed after every new implementation in order to check if the functionalities of the project are still available. It is mandatory to follow this procedure before any review meeting.

Components required:

* Eclipse IDE
* uC & other peripherals
* .elf file generated from project build
* Project pinout configuration

The uC pin configurations that shall be used are presented in **Table 2**.

|  |  |  |  |
| --- | --- | --- | --- |
| Pin Name | Pin Mode | Pin Direction | Peripheral |
| PA3 | Digital | In | BTN\_LEFT |
| PA2 | Digital | In | BTN\_RIGHT |
| PA5 | Digital | In | BTN\_HAZARD |
| PA4 | Digital | In | JOY\_STEER |
| PA7 | Digital | Out | BUZZ\_HORN |
| PA6 | Digital | Out | BUZZ\_HORN |
| PC2 | Digital | In | BUZZ\_BTN |
| PA10 | Digital | Out | LED\_TURN\_FRONT\_LEFT |
| PA8 | Digital | Out | LED\_TURN\_FRONT\_RIGHT |
| PC1 | Digital | Out | LED\_TURN\_BACK\_LEFT |
| PD11 | Digital | Out | LED\_TURN\_BACK\_RIGHT |
| PD0 | Digital | Out | DISP7SEG |
| PD2 | Digital | Out | DISP7SEG |
| PD1 | Digital | Out | DISP7SEG |
| PC12 | Digital | Out | DISP7SEG |
| PC13 | Digital | Out | DISP7SEG |
| PC15 | Digital | Out | DISP7SEG |
| PC14 | Digital | Out | DISP7SEG |
| PD4 | Digital | Out | DISP7SEG |
| PD3 | Digital | Out | DISP7SEG |
| PD6 | Digital | Out | DISP7SEG |
| PD5 | Digital | Out | DISP7SEG |
| PD7 | Digital | Out | DISP7SEG |
| PC7 | Digital | Out | DISP7SEG |
| PC6 | Digital | Out | DISP7SEG |
| PC9 | Digital | Out | DISP7SEG |
| PC8 | Digital | Out | DISP7SEG |
| PA1 | Analog | In | POT\_LUMINANCE |
| PB4 | PWM | Out | LED\_ILLUM\_NIGHT |
| PB5 | PWM | Out | LED\_ILLUM\_DAY |
| PB6 | PWM | Out | SERVO\_TURN\_LEFT |
| PB7 | PWM | Out | SERVO\_TURN\_RIGHT |

Table - Pin configurations.

## Illumination

For testing the illum functionality, POT\_LUMINANCE shall be rotated in both directions to check if the light beam is toggling between leds LED\_ILLUM\_NIGHT and LED\_ILLUM\_DAY.

## Blink

### Short left blink

Press the BTN\_LEFT button and LED\_TURN\_FRONT\_LEFT , LED\_TURN\_BACK\_LEFT shall perform 3 sequences of blink.

### Short right blink

Press the BTN\_RIGHT button and LED\_TURN\_FRONT\_RIGHT , LED\_TURN\_BACK\_RIGHT shall perform 3 sequences of blink.

### Hazard

Press the BTN\_HAZARD button and LED\_TURN\_FRONT\_LEFT, LED\_TURN\_BACK\_LEFT, LED\_TURN\_FRONT\_RIGHT, LED\_TURN\_BACK\_RIGHT shall perform continuous sequences of blink.

Press BTN\_LEFT. No process shall be initiated, all 4 leds still blinking in hazard mode.

Press BTN\_RIGHT. No process shall be initiated, all 4 leds still blinking in hazard mode.

Press BTN\_HAZARD to stop the hazard test.

### Long left blink

Press the BTN\_LEFT button for one second and LED\_TURN\_FRONT\_LEFT , LED\_TURN\_BACK\_LEFT shall perform continuous sequences of blink.

Press BTN\_LEFT to stop.

Press BTN\_LEFT for one second to reinitiate the process.

Simulate the steering wheel while left turn signal is on. For this, turn JOY\_STEER to right side. No effect expected.

Turn JOY\_STEER to left side. Blinking shall stop.

### Long right blink

Press the BTN\_RIGHT button for one second and LED\_TURN\_FRONT\_RIGHT , LED\_TURN\_BACK\_RIGHT shall perform continuous sequences of blink.

Press BTN\_RIGHT to stop.

Press BTN\_RIGHT for one second to reinitiate the process.

Simulate the steering wheel while right turn signal is on. For this, turn JOY\_STEER to left side. No effect expected.

Turn JOY\_STEER to right side. Blinking shall stop.

## Direction

By default, the system is set to parallel direction style. This means that both servomotors, SERVO\_TURN\_LEFT and SERVO\_TURN\_RIGHT shall perform the rotation at the same angle. Check this by rotating left and right the JOY\_STEER.

## Horn

By default, horn is set to continuous mode. For checking this, press BUZZ\_BTN and BUZZ\_HORN shall make a continuous sound while the button is pressed.

## Configuration Mode

For accessing this mode, press BTN\_LEFT and BTN\_RIGHT simultaneously. Once the system entered in this state, check if:

1.LED\_TURN\_FRONT\_LEFT is turned on

2.LED\_ILLUM\_NIGHT and LED\_ILLUM\_DAY are turned off

3.SERVO\_TURN\_LEFT and SERVO\_TURN\_RIGHT are rotated in opposite angles.

4. DISP7SEG is turned ON and is showing number ‘0’.

### Wheel Geometry

Currently the geometry is set to parallel so rotate the POT\_LUMINANCE in order to set the direction to Ackermann Style. The rotation shall be performed until number ‘1’ is showing on DISP7SEG. Attention, if the number ‘1’ is already showed, no action is required for POT\_LUMINANCE. Next step would be to save the change by pressing BUZZ\_BTN. While this button is pressed, both points from DISP7SEG are turned ON.

### Illum leds speed transition

Press BTN\_RIGHT for next configuration which represents the speed of transition from LED\_ILLUM\_NIGHT to LED\_ILLUM\_DAY and reverse when POT\_LUMINANCE is changing its current value.

Check if LED\_TURN\_FRONT\_RIGHT is turned ON. This means the system is in transition speed configuration.

Rotate POT\_LUMINANCE until the value showed on DISP7SEG is equal to ‘10’ and press BUZZ\_BTN to save. This value of 10 is just an example meaning that the transition between illuminations leds will be performed in 100 ms.

### Horn configuration

Press BTN\_RIGHT for next configuration and check if LED\_TURN\_BACK\_RIGHT and LED\_ILLUM\_NIGHT are turned ON.

In the current menu, horn can be set to work in 2 possible modes:

* 0 – continuous
* 1 – PWM

By default it is set to continuous , rotate POT\_LUMINANCE until number ‘1’ is showed on DISP7SEG and press BUZZ\_BTN to save.

This menu has another extra configuration which represents the duty cycle of the PWM signal for horn. It is responsible for controlling the length (periodicity) of the horn sounds. For this, press

BTN\_HAZARD and LED\_ILLUM\_DAY will be turned ON.

Rotate POT\_LUMINANCE until value ‘5’ is showed on DISP7SEG and press BUZZ\_BTN to save. By this, the periodicity of the PWM signal will be set to 50 milliseconds.

### Blinking period

Press BTN\_RIGHT for next configuration and check if LED\_TURN\_BACK\_LEFT and LED\_ILLUM\_NIGHT are turned ON.

In the current menu, it will be configured the number of blink sequences and the periodicity. Attention, the number of sequences is available only for short blink mode.

Rotate POT\_LUMINANCE until value ‘25’ is showed on DISP7SEG and click BUZZ\_BTN to save. Periodicity will be set to 250 ms.

For number of sequences, click HAZARD\_BTN and LED\_ILLUM\_DAY will be turned ON.

Rotate POT\_LUMINANCE until value ‘5’ is showed on DISP7SEG and click BUZZ\_BTN to save. Number of blinks will be set to 5.

Hold BTN\_LEFT and BTN\_RIGHT simultaneously to exit configuration menu.

## Final check

Now that all settings have been updated, it is required to test them.

1. Check Ackermann Geometry by rotating JOY\_STEER. SERVO\_TURN\_LEFT and SERVO\_TURN\_RIGHT should have different angle rotation, always the interior angle is greater than the exterior one.
2. Check if horn is set to PWM mode by pressing BUZZ\_BTN.
3. Press LEFT\_BTN and check if both left side leds are blinking 5 times with a periodicity of 250 ms.
4. Press RIGHT\_BTN and check if both right side leds are blinking 5 times with a periodicity of 250 ms.
5. Rotate POT\_LUMINANCE and check if the transition time from one luminance led to another is smaller than before the configuration changed.

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## Version Index

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Vers.** | **Date** | **Author** | **Chapter** | **Modification description** |
| 1.0 | 12.06.2021 | Alexandru-Sebastian  Anghel | All | Created. |
| 1.1 | 12.04.2023 | Alexandru-Sebastian  Anghel | 3.5.2 3.5.3  3.5.4 | Modified BTN\_LEFT to BTN\_RIGHT when switching from one submenu to another while system is configuration menu |

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