

## Test Plan and Results

Automated tests were created to check the functionality of individual modules: Accelerometer, TSI, SysTick and CBFIFO. However, the user needs to touch the TSI within 10 seconds for the TSI test case to pass. The message to prompt user to touch the TSI will be displayed when TSI test function is called.

For checking the overall working of the project, the following cases can be considered:

### Happy cases

- 1) User gives command **Cal\_roll** to set the zero-reference roll angle. Once user touches TSI, the position at which object is held, that angle would be reference zero and Red LED would glow momentarily. On the terminal, the calibration angle would be displayed.

**Result:** Tested for various angles like 15, 30, 45, 90, 130, 150, 165, etc.

Snapshot for 45 roll degree as reference angle can be seen below:

```
COM5 - Tera Term VT
File Edit Setup Control Window Help

Testing CBFIFO
Success: All the CBFIFO test cases have passed

Testing accelerometer
Success: Accelerometer initialization test passed

Testing if systick timer crosses 1 second
Success: Systick timer test case passed

Testing the TSI. Kindly touch the TSI one time within 10 seconds. If sense detected, Green LED should glow and message should be displayed
Success: Touch detected. TSI test case passed

All individual test cases are executed

Welcome to position tracking system!
? cal_roll
Move the object in roll angle and press TSI when angle to be reference zero degrees is needed
The reference angle is set to 45.296867 degrees
? █
```



- 2) For a user command **Roll\_sp**, any angle between 0 to (180-reference angle) can be set. Eg: Considering reference roll angle 0-degree, one can enter setpoint between 0 to 180. The user needs to move the object towards setpoint, if the current angle is greater than calibration angle, red LED would be on and once it reaches setpoint, it will transition smoothly from red to green in one second and then blink for 5 seconds in green. Note this transition only happens if calibration angle is set through TSI. If default calibration angle zero is considered and not set by TSI, it won't transition as per logic and would directly change to green. A message will be displayed on the command processor that setpoint has reached.

**Result:** Tested for multiple cases like for calibration angle 0 degrees, setpoint given was 180 roll degree (**Corner Case**). For calibration angle of 45 degrees, setpoint was 90.

Both these snapshots can be seen below:

```
COM5 - Tera Term VT
File Edit Setup Control Window Help

Testing CBFIFO
Success: All the CBFIFO test cases have passed
Testing accelerometer
Success: Accelerometer initialization test passed
Testing if systick timer crosses 1 second
Success: Systick timer test case passed
Testing the TSI. Kindly touch the TSI one time within 10 seconds. If sense detected, Green LED should glow and message should be displayed
Success: Touch detected. TSI test case passed
All individual test cases are executed
Welcome to position tracking system!
? roll_sp 180
Move the object in roll angle and once roll setpoint reaches, green LED will blink
The roll angle setpoint has reached
? □
```



For default calibration angle = 0 degrees and roll setpoint = 180 degrees

```
COM5 - Tera Term VT
File Edit Setup Control Window Help

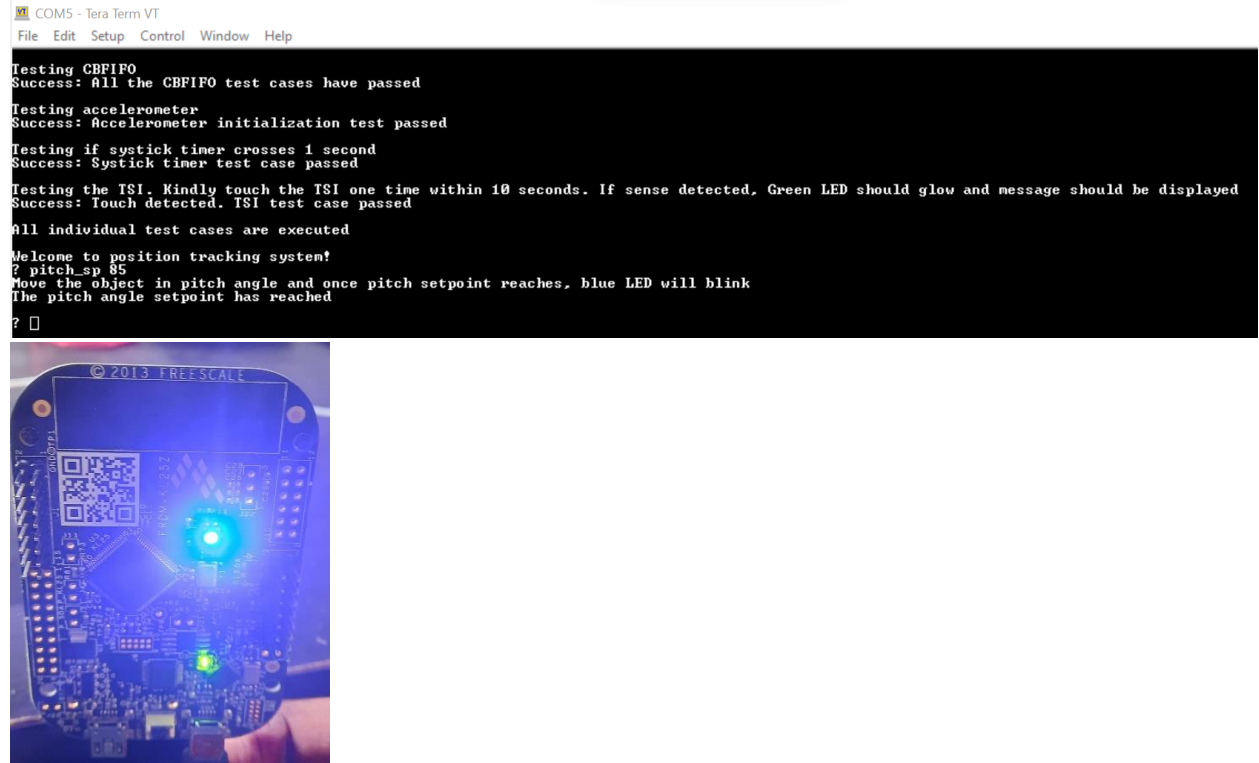
Testing CBFIFO
Success: All the CBFIFO test cases have passed
Testing accelerometer
Success: Accelerometer initialization test passed
Testing if systick timer crosses 1 second
Success: Systick timer test case passed
Testing the TSI. Kindly touch the TSI one time within 10 seconds. If sense detected, Green LED should glow and message should be displayed
Success: Touch detected. TSI test case passed
All individual test cases are executed
Welcome to position tracking system!
? cal_roll
Move the object in roll angle and press TSI when angle to be reference zero degrees is needed
The reference angle is set to 44.960892 degrees
? □
```



For calibration angle = 45 degrees and roll setpoint=90 degrees

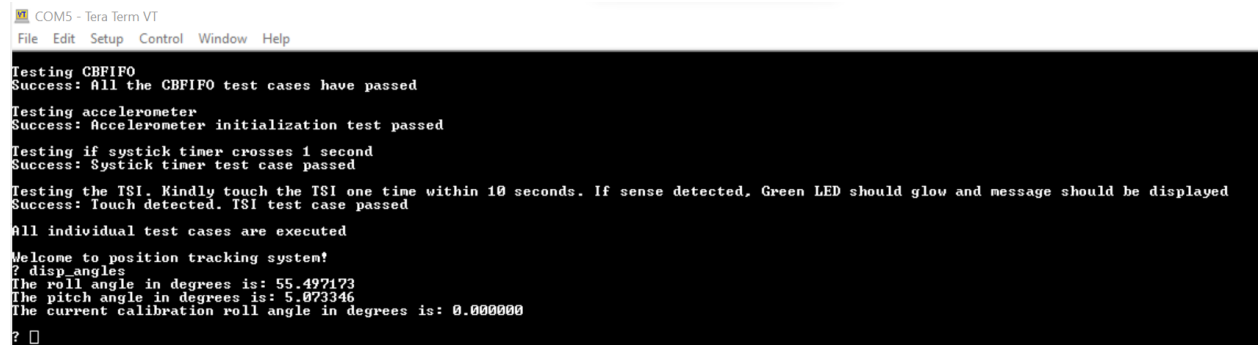
- 3) For user command **Pitch\_sp**, any angle between 0 to 85 degrees can be provided. The user can then move the object and once the setpoint reaches, blue LED will blink for 5 seconds. Message would also be displayed on the terminal.

**Result:** Tested for multiple angles like 10, 30, 45, 60, 85, etc. For 85-degree pitch angle (**Corner case**), the snapshot can be seen below:



- 4) When user gives the command **Disp\_angles**, the current roll, pitch and calibration angle is displayed. The user can hold the object at various angles to confirm if the roll and pitch angle is correct.

**Result:** Testing was done by holding board at various angles and confirming whether angles match. Eg: 15, 55, 85, 90(roll) and 10,25,50,80(pitch). Snapshot for roll = 55 can be found below:



- 5) When the user gives the command **Cal\_reset**, the calibration angle is reset to zero degrees. The user can confirm this by printing the angles. The test can also be done by trying to give roll setpoint to 180 degrees after this. Since calibration angle is zero, it should consider 180 as a valid input.

**Result:** Tested successfully by both methods above. Snapshot can be found below by displaying angles:

```
COM5 - Tera Term VT
File Edit Setup Control Window Help

Testing CBFIFO
Success: All the CBFIFO test cases have passed

Testing accelerometer
Success: Accelerometer initialization test passed

Testing if systick timer crosses 1 second
Success: Systick timer test case passed

Testing the TSI. Kindly touch the TSI one time within 10 seconds. If sense detected, Green LED should glow and message should be displayed
Success: Touch detected. TSI test case passed

All individual test cases are executed

Welcome to position tracking system!
? cal_roll
Move the object in roll angle and press TSI when angle to be reference zero degrees is needed
The reference angle is set to 77.051605 degrees

? disp_angles
The roll angle in degrees is: 0.954841
The pitch angle in degrees is: 0.491026
The current calibration roll angle in degrees is: 77.051605

? cal_reset
The roll reference angle is reset to zero degrees

? disp_angles
The roll angle in degrees is: 0.702502
The pitch angle in degrees is: 0.520344
The current calibration roll angle in degrees is: 0.000000
? □
```

### Error/Invalid cases

- 1) For user command **Roll\_sp**, enter setpoint which is not in range, like 185 degrees. On the terminal, invalid setpoint would be displayed. Same goes when the angle is not a multiple of 5. The snapshot can be found below:

```
COM5 - Tera Term VT
File Edit Setup Control Window Help

Testing CBFIFO
Success: All the CBFIFO test cases have passed

Testing accelerometer
Success: Accelerometer initialization test passed

Testing if systick timer crosses 1 second
Success: Systick timer test case passed

Testing the TSI. Kindly touch the TSI one time within 10 seconds. If sense detected, Green LED should glow and message should be displayed
Success: Touch detected. TSI test case passed

All individual test cases are executed

Welcome to position tracking system!
? roll_sp 185
Invalid roll angle setpoint

? roll_sp 132
Invalid roll angle setpoint
? □
```

- 2) When the calibration angle is set to say 90 degrees and if user provides roll setpoint of 95 degrees, invalid setpoint should be displayed as range should be (0 to 180-calibration angle). The snapshot for the following can be seen below:

```
COM5 - Tera Term VT
File Edit Setup Control Window Help

Testing CBFIFO
Success: All the CBFIFO test cases have passed

Testing accelerometer
Success: Accelerometer initialization test passed

Testing if systick timer crosses 1 second
Success: Systick timer test case passed

Testing the TSI. Kindly touch the TSI one time within 10 seconds. If sense detected, Green LED should glow and message should be displayed
Success: Touch detected. TSI test case passed

All individual test cases are executed

Welcome to position tracking system!
? cal_roll
Move the object in roll angle and press TSI when angle to be reference zero degrees is needed
The reference angle is set to 96.640770 degrees

? roll_sp 90
Invalid roll angle setpoint
? □
```

- 3) For a user command **Pitch\_sp**, enter setpoint which is not in range, like 95 degrees. On the terminal, invalid setpoint would be displayed. Same goes when the angle is not a multiple of 5. Both these snapshots can be found below:



```
COM5 - Tera Term VT
File Edit Setup Control Window Help

Testing CBFIFO
Success: All the CBFIFO test cases have passed

Testing accelerometer
Success: Accelerometer initialization test passed

Testing if systick timer crosses 1 second
Success: Systick timer test case passed

Testing the TSI. Kindly touch the TSI one time within 10 seconds. If sense detected, Green LED should glow and message should be displayed
Success: Touch detected. TSI test case passed

All individual test cases are executed

Welcome to position tracking system!
? pitch_sp 95
Invalid pitch angle setpoint

? pitch_sp 44
Invalid pitch angle setpoint

? □
```

- 4) If an unknown command is entered, a message will be displayed on the terminal. Snapshot can be found below:



```
COM5 - Tera Term VT
File Edit Setup Control Window Help

Testing CBFIFO
Success: All the CBFIFO test cases have passed

Testing accelerometer
Success: Accelerometer initialization test passed

Testing if systick timer crosses 1 second
Success: Systick timer test case passed

Testing the TSI. Kindly touch the TSI one time within 10 seconds. If sense detected, Green LED should glow and message should be displayed
Success: Touch detected. TSI test case passed

All individual test cases are executed

Welcome to position tracking system!
? printf
Unknown Command:printf

? □
```