Tractive System Interface Throttle Plausibility and Brake Light - R005b

Test	Procedure	Results
1.1 Test Pedal Cluster provided by Mechanical Engineering Team	Multimeters will be connected across both potentiometers to ensure they are biased correctly. One should operate between 5-10V and the other from 0-5V.	
1.2 Test Pedal Cluster provided by Mechanical Engineering Team	When pedal is pressed, both potentiometers will react in the same linear scale. This will ensure that we will not have any mistaken faults due to relative measurements.	
1.3 Test Plausibility functioning correctly when operating at normal conditions	Press pedal as in normal use while driving. Output of plausibility circuit will react with expected values. This should be a linear scale coordinating to the percentage of the pedal you are pushing.	
1.4 Test Plausibility functioning correctly when mismatch is forced.	Include a resistor in series with one of the leads from the potentiometers. This will make the system see a mismatch in expected voltages. The system should not deliver any voltage from the output of the plausibility system.	
1.5 Test Plausibility functioning correctly with brake pressed	With the accelerator working correctly under normal conditions, press the brake until the brake light activates. Continue to press both pedals and measure the output that will be connected to the motor controller. This should read 0V. NOTE: this test must be completed after brake functionality is proven.	
1.6 Test Plausibility functioning correctly with brake pressed	After test 1.5 has passed, repeat test. This time, release accelerator pedal fully and then the brake. The accelerator pedals should operate as they did in test 1.3.	
1.8 Brake light turns on when brake is pressed	Press the brake to at least 5% of its travel. The brake light should turn on at this point.	

1.9 Brake light turns on when brake is pressed	Repeat test 1.5 and ensure the brake light turn on.	

TSAL - R005d

Test	Procedure	Result
2.1 Test turn on voltage of TSAL	Connect all high and low voltage connections to their correct ports on the PCB. With 0V on high voltage side, light should not be on.	
2.2 Test turn on voltage of TSAL	With setup of test 2.1, increase high voltage gradually until the light turns on. Record the voltage which should be ~30V.	
2.3 Test turn on voltage of TSAL	While light is turned on from test 2.2, continue to increase the voltage to 96V to test the light remains on for full range of battery power.	
2.4 Test discharging of voltage when IMD faults	With the light on at 96V, turn the output of the power supply off to simulate an IMD fault. The TSAL will shut down as the system will not be active.	

IMD - R005c

Test	Procedure	Result
3.1 Test IMD independently of other parts	Hook up IMD as stated in IMD Memo. Bridge 500 kOhm resistor between high voltage plus and minus. OKH S should read 24V and PWM should be 10 Hz with a Duty Cycle of roughly 23%.	
3.2 Test IMD independently of other parts	Connect IMD the same way as test 3.1 but with 25 kOhm resistor between high voltage plus and minus. The OKH S signal should read 0V and the PWM should be 0 Hz. NOTE: this will take around 10 seconds from when the resistor is connected to when the outputs will change.	
3.3 Test IMD in connection with safety loop relay	Hook up IMD where OK HS signal is controlling the safety loop relay. Under normal conditions, the relay	

	should be closed and the measured voltage out of the relay should be the low voltage applied.	
3.4 Test IMD in connection with safety loop relay	Hook up IMD as in test 3.3. Cause a ground fault as in test 3.2. The relay should open around 10 seconds after the resistor is connected. The measured voltage out of the relay should be 0V.	

TSMP - R005a

Test	Procedure	Result
4.1 Test accurate measurement of voltage	Connect the necessary components for powering the pcb off of controllable power supplies. The voltage on the power supply should be read off a multimeter rated high enough that is attached across the TSV+ and TSV- ports on the TSMP.	
4.2 Test IMD faulting	The test should be setup as in test 4.1. The TSV- will then be connected to the Chassis Ground port to trigger an IMD fault. This should take about 10 seconds. NOTE: Perform this task after successful IMD testing has been completed.	
4.3 Competition IMD faulting	Repeat test 4.2 but with a 50 kilo ohm resistor between the TSV- and Chassis Ground ports as this is the resistance the competition will use to test the faulting across the TSMP.	

RTDS - R005a

Test	Procedure	Result
5.1 Test RTDS decibels	When the drive button is pressed, the RTDS should be heard at 80dBA from 2 meters away.	
5.2 Test RTDS duration	The RTDS should be on for 2 seconds after the drive button is pressed. The rules state this must be on from 1-3 seconds.	

CAN Communication - R005a

Test	Procedure	Result
6.1 Test CAN communication with SCADA	Connect to the makeshift CAN network (made up of wires and a resistor) with SCADA and send over the necessary measurements and values. Ensure that SCADA sees those values and that they are correct.	
6.2 Test CAN communication with SCADA	Set up the TSI and SCADA so that they are both on the CAN network. This time let SCADA send the “drop out of drive mode” signal to the TSI. Ensure that the TSI sees that signal by letting an LED turn on when it has changed to a certain value or not.	
6.3 Test CAN Communication with SCADA Integrated	Setup the Pi so that it is now in the GLV and the TSI is fully assembled in it’s enclosure. Get the TSI and GLV connected and integrated and test that 6.1 and 6.2 still work in this integrated setup	

Precharge Relay - R005a

Test	Procedure	Result
7.1 Test Precharge Relay closing	When TSV is applied to the precharge circuit, the initial current will go through the fuse. The motor controller will then close the relay to deliver full power.	

Safety loop

Test	Procedure	Result
8.1 Brake Overtravel Trips Safety Loop	Using the dyno test panel, hook up the TSI to the test panel. Integrate all the subsystems together. Press the brake overtravel button and confirm that the safety loop opens by checking the status of the safety light in the dyno room.	
8.2 IMD Fault Trips Safety Loop	Set up the TSI in the dyno room integrated with the other subsystems. Cause an IMD fault by connecting the TSV- TSMP to the Chassis Ground	

	TSMP. Ensure that the safety loop opens due to this IMD fault. NOTE: The safety loop does not have to open instanteously. The rules require for a response within 30 seconds.	

Drive States

Test	Procedure	Result
9.1 Drive States comply with the suggested state diagram in the rules	Check that the drive states take care of the RTDS, any safety loop openings, a drive mode, and an idle mode (where the driver cannot throttle the car)	
9.2 RTDS sounds off for 1-3 seconds when going into drive mode	Hook up the TSI to the test panel and hook up a voltage to the drive button input (to simulate that it is being pushed.) When the brake and drive button are both pushed the TSI should go into drive mode and the RTDS should be heard for 1-3 seconds.	
9.3 RTDS sounds off for 1-3 seconds when going into drive mode	Repeat 9.2 but this time with the TSI integrated with other subsystems in the dyno room.	
9.4 TSI goes into drive mode	Hook up the TSI to the test panel and hook up a voltage to simulate the drive button. When brake and drive button are both pushed the TSI should go into drive mode. Ensure this with an LED turning on, sending drive state to the SCADA, or checking that the throttle voltages are now accepted and can be changed.	
9.5 TSI goes into drive mode	Repeat 9.4 but this time with the TSI integrated with other subsystems in the dyno room	
9.6 TSI drops out of drive mode due to safety loop	Put the TSI into drive mode. Trip the safety loop. Check that the throttle voltages do no change because the TSI is in IDLE. Or check the drive state through SCADA or check the LED.	

9.7 TSI drops out of drive mode due to driver input	Put TSI into drive mode. Press the drive button again and check that the throttle voltages do not change because the TSI is in IDLE. Or check the drive state through SCADA or check the LED.	
9.8 TSI drops out of drive mode due to SCADA	Put TSI into drive mode. Have SCADA send a 1 as the drop out of drive mode signal to tell the TSI to drop out of drive mode. C heck that the throttle voltages do not change because the TSI is in IDLE. Or check the drive state through SCADA or check the LED.	

TSI System Measurements

Test	Procedure	Result
10.1 Voltage Measurement	Put a voltage through the TSI and check by way of the measurement sent to SCADA that that measurements matches the voltage that is put through the TSI.	
10.2 Current Measurement	Put a current through the TSI and check by way of the measurement sent to SCADA that that measurements matches the current that is put through the TSI.	
10.3 Temperature Measurement	Power on the TSI pcb and hook it up to the SCADA on the CAN network. Check the temperature measurement and that it changes if it gets hotter or colder on the PCB (put your finger on the temp sensor to warm it up.)	
10.4 IMD Measurement	Hook the TSI to the SCADA via CAN network and check the values of the IMD measurement match what the IMD documentation outlines. Cause an IMD fault and check the resistance matches what it should be in a fault.	
10.5 Test Measurements with TSI Integrated in Dyno Room	Repeat the previous four steps but this time with the TSI integrated with other subsystems in the dyno room.	