Variable Voltage Controller Test Plan

# Tools Required

* Benchtop power supply that can output up to 17V and 5A
* Digital multimeter that can perform continuity checks and measure up to 20V
* A variable power supply that can connect to a DC power jack
* The STM32CubeIDE that can run the program on the microcontroller in Debug Mode
* Digital oscilloscope
* Variable resistor and or rheostat

# Bring-Up

## Visual Inspection & Continuity Check

* Ensure all components are soldered onto the board and in the correct orientation
* Verify that there are no shorts between the power traces (Vin, Vo, 3.3V, 3.0V) and ground

## Power On

* Ensure that the output voltage terminal is in an open-circuit state
* Connect terminal block to bench-top power supply
* Turn bench top power supply on and slowly increase the voltage to 5V
* Check that the power indicator LED is on and that none of the components are heating up
* Use multimeter to check that all non-varying power rails (Vin, 3.3V and 3.0V) are at the correct value
* Increase input voltage from 5V to 17V (maximum input voltage for the device), recheck that none of the components overheating and that all the non-varying power rails are still set to the correct voltage level
* Connect a multimeter to the output terminal
* Rotate the potentiometer from it’s lowest setting to it’s highest setting, check that the output voltage increases from 1.32V to 20V

## Firmware Validation

* Connect device to a computer via the SWD interface, check that the computer can identify the microcontroller
* Upload a program that allows the microcontroller to transmit data to the LCD screen via the SPI interface, check that the message is correct
* Write and upload a program that the device will use during normal operation

# Functional Testing

## System Input Voltage Multiplexer Test

* **Purpose:** To confirm that the power multiplexer allows for two voltage sources to connect to the PCB at the same time, and the source with the larger voltage will deliver power to the device
* **Procedure:**
  + Ensure no load is connected to the output voltage terminals
  + Connect a variable power source to the DC power jack
  + Connect the bench-top supply source to the terminal block
  + A) Set the power jack source to 9V, vary the terminal block source from 3V to 17V
  + B) Set the terminal block source to 9V, vary the jack source from 3V to 17V
* **Expected Result:**
  + The power indicator LED and LCD screen should be turned on for the duration of the test
  + A – while the jack source is set to 9V, the LCD screen should display an input voltage of 9V until the benchtop supply > 9V, after which the measured input voltage should equal the benchtop supply source
  + B – while the terminal source is set to 9V, the LCD screen should display an input voltage of 9V until the jack source is > 9V, after which the measured input voltage should equal the jack supply source

## DC-DC Conversion Test

* **Purpose:** To confirm that the input voltage is accurately sensed by the input voltage sensor and that the value is displayed on the LCD screen error free
* **Procedure:**
  + Ensure no load is connected to the output voltage terminal
  + Connect the benchtop power supply to the input terminal block
  + Connect the oscilloscope probes to the input and output terminal blocks
  + Connect the programmer to the board, and operate the device in debug mode
    - Place a breakpoint after all the electrical value print statements
  + Change output voltage to Vo = {1.32V, 4V, 10V, 20V}
    - Change input voltage Vi = {3V, 6V, 12V, 17V
      * Set resistor value so that output current will be 4mA, 400mA, 1.5A and 4A/Max value
      * Record Vo, Vi, Io and Ii
      * Record oscilloscope waveform of Vo and Vi
      * \*\*\*If output value is ‘unstable’, make note of it
* **Expected Result**
  + Electrical values are stable under various loads
  + Power output limited by P = 1.667V + 10

## 3.3V Priority Multiplexer Test

* **Purpose:** To confirm that the programming header supplies the 3.3V circuitry with power if no supply is connected to the input terminals, otherwise the buck converter supplies the PCB with 3.3V
* **Procedure:**
  + Connect the benchtop power supply to the input terminal block and turn it on
  + Connect the programming header to the PCB and the laptop
  + Turn the power supply off, check the power indicator light of the PCB
  + Disconnect both the programming header and the power supply, then reconnect both and turn on the power supply
  + Unplug the programming header, check the power indicator light of the PCB
* **Expected Result:**
  + If both the header and benchtop supply are connected at the same time, the power indicator light should remain on if either of them are unplugged