Arduino Module   ID: TP-1

Circuit Testing Protocol – 20 Pts

Test Protocol: – TP-1

Date Written – 4/1/2020

Date Revised – 4/3/2020

Author: Sean Hansen, Shreemathi Harikrishnan, Kenny Ngo, Jihan Shah

Protocol Description – (Testing Protocol for PP-1)

The testing protocol for the PCD is relatively simple. Once PP-1 has been completed, the PCB should have all of the circuit components soldered onto it (TE2) and the motor should be assembled with the micropump 3D printed parts (TE3). To test to ensure the PCB functions correctly, a multimeter (TE1) will be used to check for continuity (MS1) for all of the traces (VR 1-10). This will ensure that all of the traces correctly route the signals where they should. After all the continuity tests have been performed to ensure the traces are correct, the PCB will be inserted into the Arduino Uno R3 as a shield, and then the Arduino will be plugged into the computer (TE4) via its serial port. Additionally, the 12 V power supply will need to be connected to the 2-Pin Molex power connector. Once the Arduino is hooked up to the computer, the Arduino IDE application (TE5) will be opened and the code will be uploaded and run. The final test is a systems-level test (VR11) to ensure that the PCB runs the micro pump correctly when attached to the Arduino. To do this, the user inputs (UI) will be input into the serial monitor of the Arduino IDE application when prompted, and then the circuit should operate as follows; the push button turns on the blinking light and motor actuates (at the correct flow rate), and then the light and motor turn off when the button is pressed again. This test will be considered complete if all of the continuity tests (VR1-10) and the systems level test (VR11) both pass. This indicates the PCB is functional and meets DI-1 and DO-1 in DCW-1.

Tools and Equipment

ID	Tool	Name / # if applicable	Location	Purpose
TE1	Multimeter	N/A	Design Lab	Check continuity of traces.
TE2	Finished PCB from PP-1 with components soldered on	MicroPump PCB	Shipped from Advanced Circuits	Circuit board that operates the circuit - needs to be tested.
TE3	Assembled micropump from PP-1	MicroPump	Design Lab	Motor and micropump to ensure the circuit works.

Intro. to Biodesign
 BIOE 3090

Micropump - Testing Protocol

Department of Bioengineering
UNIVERSITY OF COLORADO
DENVER | ANSCHUTZ MEDICAL CAMPUS

| TE4 | Computer | N/A | Design Lab | To upload code onto the Arduino and run the serial monitor for UI inputs. |
| TE5 | Arduino Computer Application | Arduino IDE | Design Lab | Program used to upload code onto the Arduino and run the serial monitor for UI inputs. |

Materials

ID	Material	Purpose
MAT1	Multimeter Probes	Leads to attach to PCB to test for continuity of circuit components.

Machine Settings

ID	Device	Setting	Purpose
MS1	Multimeter	Continuity Testing	Checks continuity of traces in PCB to make sure everything is connected correctly.

Values to be Recorded

ID	Component	Test	Reason	Pass / Fail
VR1	Ground Traces	Continuity w/ multimeter	To ensure the grounds are connected correctly.	
VR2	5V Power Traces	Continuity w/ multimeter	To ensure the 5 V power from the board is connected correctly.	
VR3	12V Power Traces	Continuity w/ multimeter	To ensure the 12 V power from the wall power adapter is connected correctly.	
VR4	4-Pin Motor Connector	Continuity w/ multimeter	To ensure the 4 pins from the 4-pin connector are correctly connected to the 4 pins on the A4988 motor driver.	

Micropump - Testing Protocol

VR5	2-Pin Molex Motor Power Supply Connector	Continuity w/ multimeter	To ensure the 2-Pin Molex connector for the 12 V wall power supply is connected correctly to the A4988 motor driver.	
VR6	LED	Continuity w/ multimeter	To ensure that the LED is connected correctly in series with the 1 kΩ Resistor and pin 6 on the Arduino.	
VR7	Push Button	Continuity w/ multimeter	To ensure that the push button is connected correctly to pin 5 of the Arduino and also that the 50 kΩ Resistor is correctly connected in parallel.	
VR8	1 kΩ Resistor (for LED)	Continuity w/ multimeter	To ensure that the resistor is connected correctly in series to the LED.	
VR9	50 kΩ Resistor (for push button)	Continuity w/ multimeter	To ensure that the pullup resistor for the push button is connected correctly between the input pin and ground.	
VR10	100 µF Capacitor (for 12V power supply)	Continuity w/ multimeter	To ensure that the capacitor is connected correctly in parallel with the 12 V power supply to reduce the noise coming from it.	
VR11	Whole Circuit	Systems-level test w/ all components plugged in	To ensure that the whole circuit works on a system level when the components are plugged in. It should run the code to accept the UI from the Arduino serial monitor, and then the motor and LED should actuate when the button is pressed and turn off when it is pressed again.	