

Microwave User Manual

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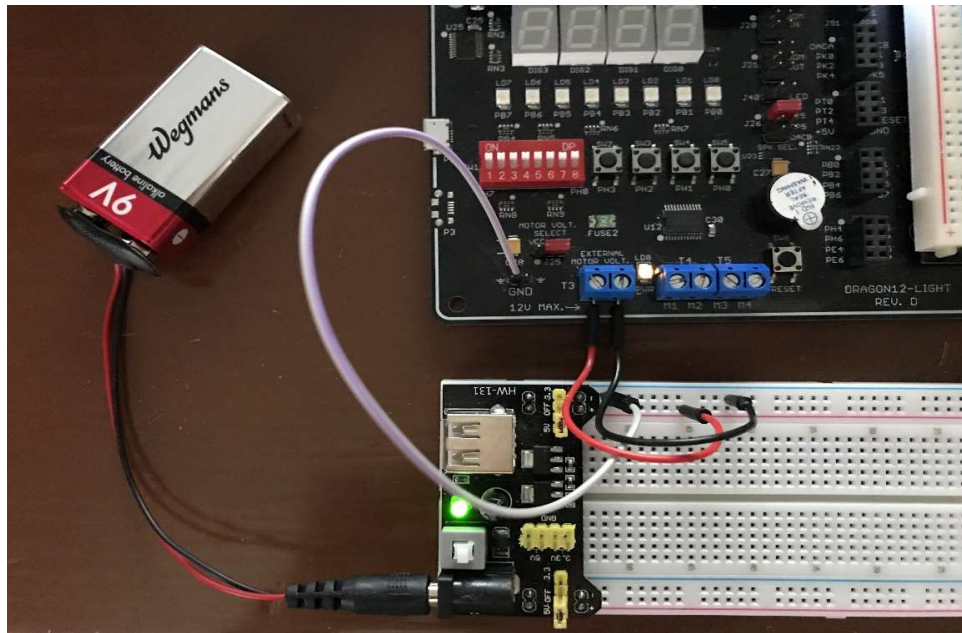
19 - Component Inputs

External components used on the DRAGON12-Plus-USB Microcontroller

- External Breadboard (External Power)
- Servo Motor
- DC Motor
- External LED
- External Potentiometer

Wiring

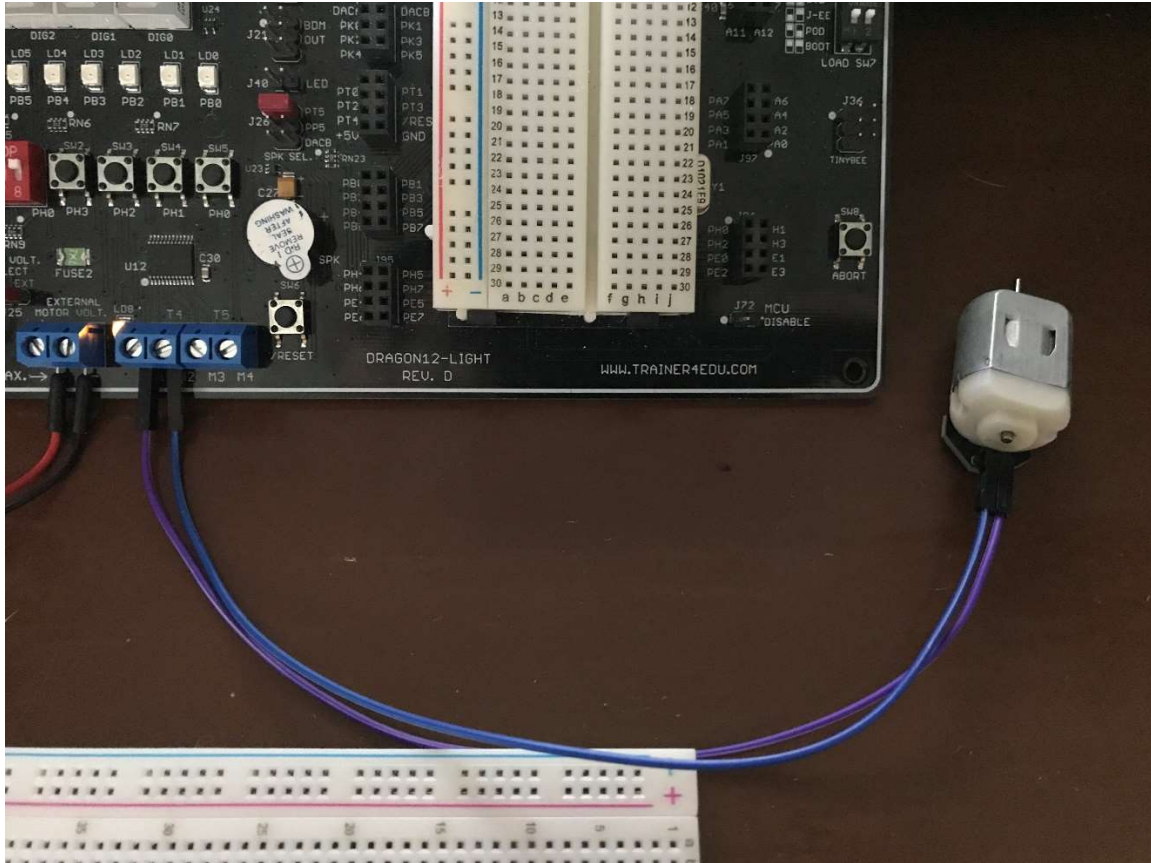
External Breadboard



Connect the following:

- 9V battery to the external breadboard and turn it on.
- Ground (blue row) on the external breadboard to ground on the dragonboard.
- 5V (red row) and ground on the external breadboard to T3 on the dragonboard.

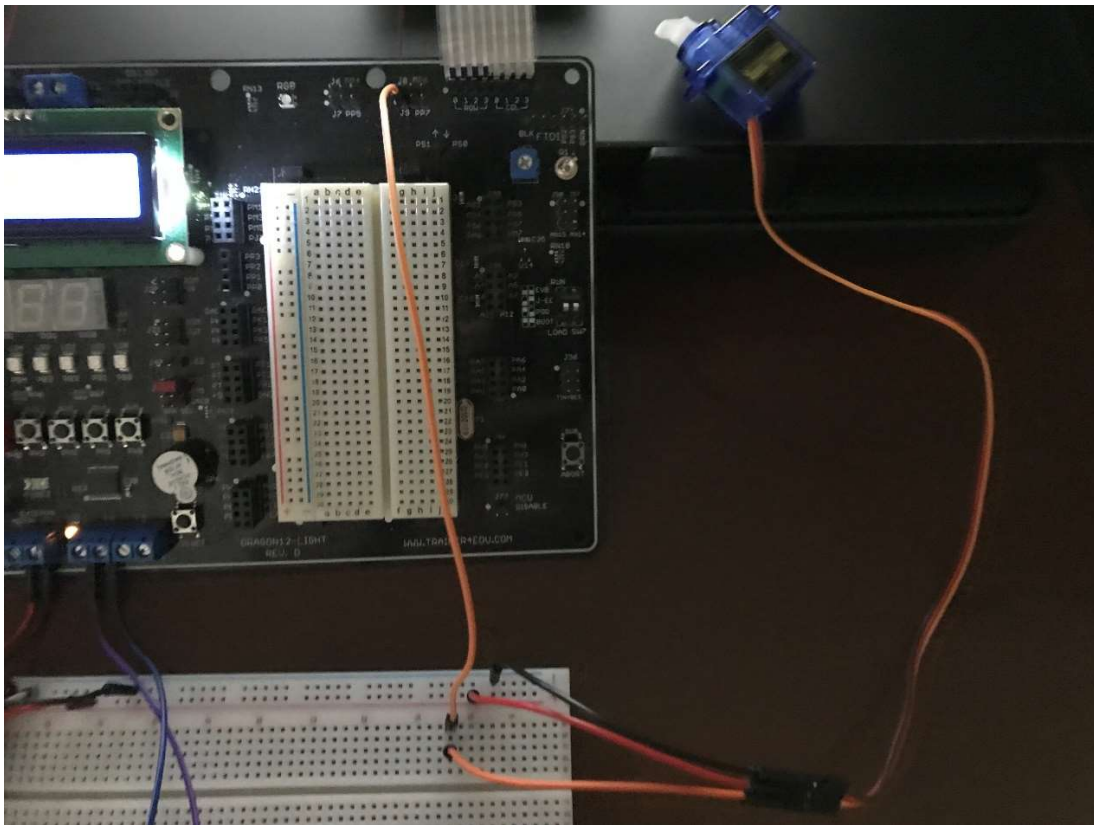
DC Motor



Connect the following:

- DC Motor to M1 and M2 on the dragonboard

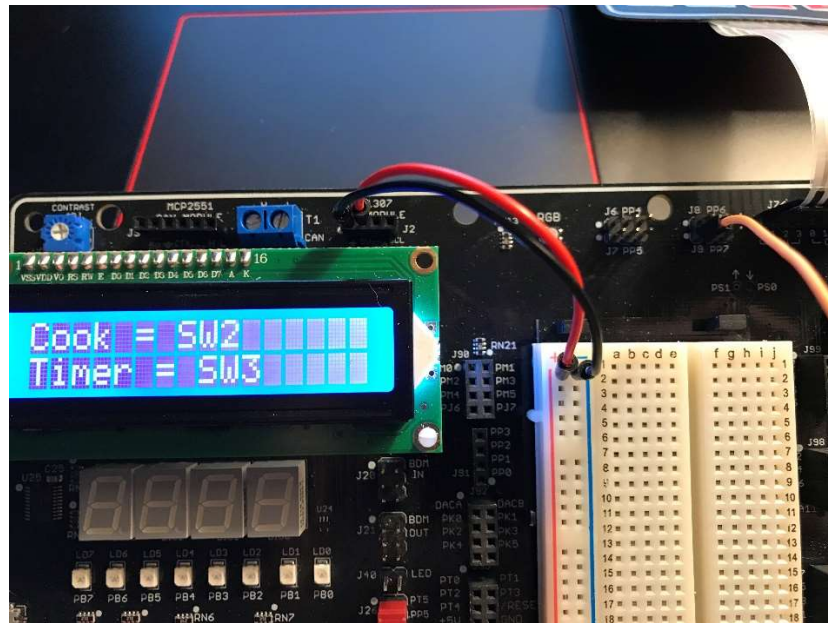
Servo Motor



Connect the following:

- Ground on the servo motor (black wire) to ground on the external breadboard (blue row).
- 5V on the servo motor (red wire) to 5V on the external breadboard (red row).
- Control on the servo motor (orange or white wire) to PP7 on the dragonboard.

Connecting the on-board breadboard to 5V and Ground

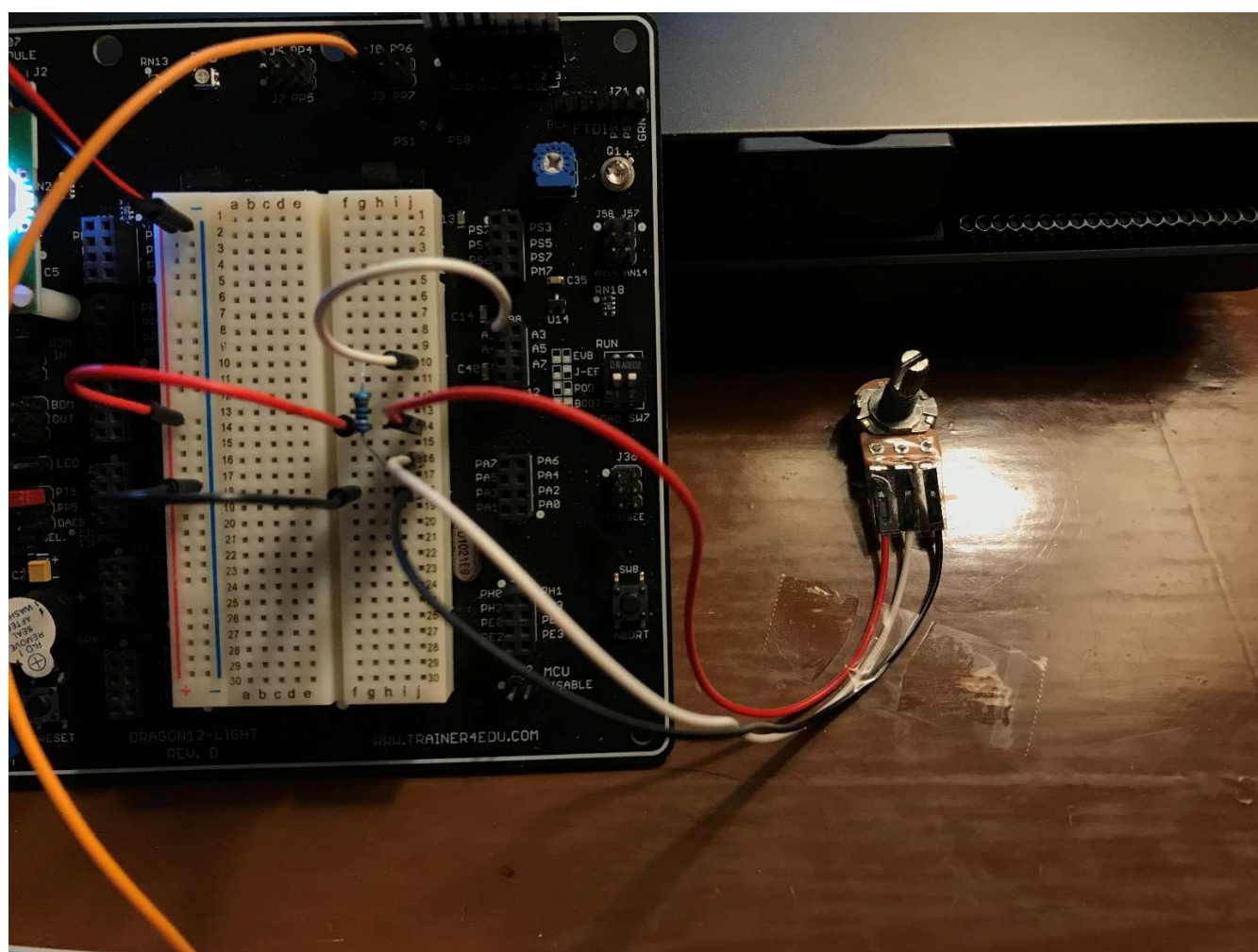
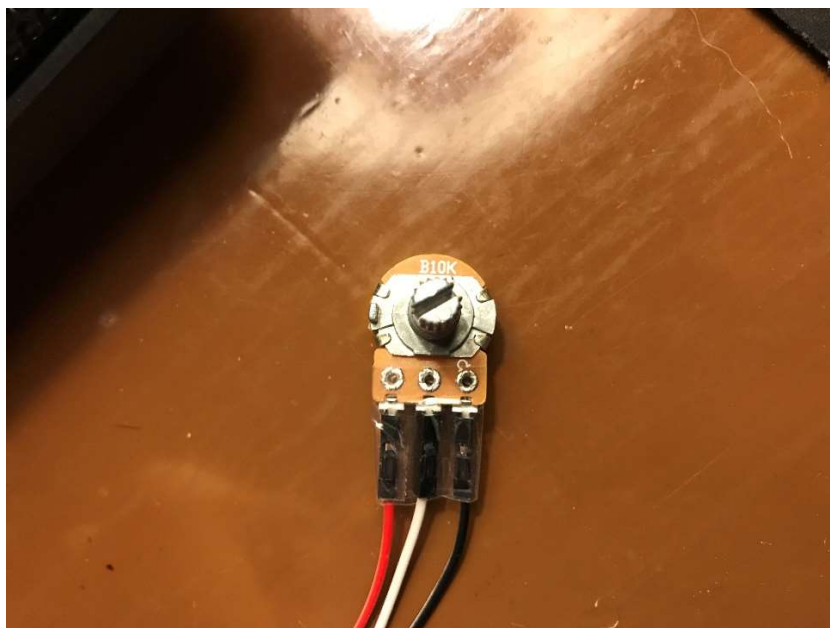


This is a necessary step to operate the external potentiometer and external led.

Connect the following:

- 5V on the on-board breadboard (red row) to 5V on the dragonboard.
- Ground on the on-board breadboard (blue row) to ground on the dragonboard.

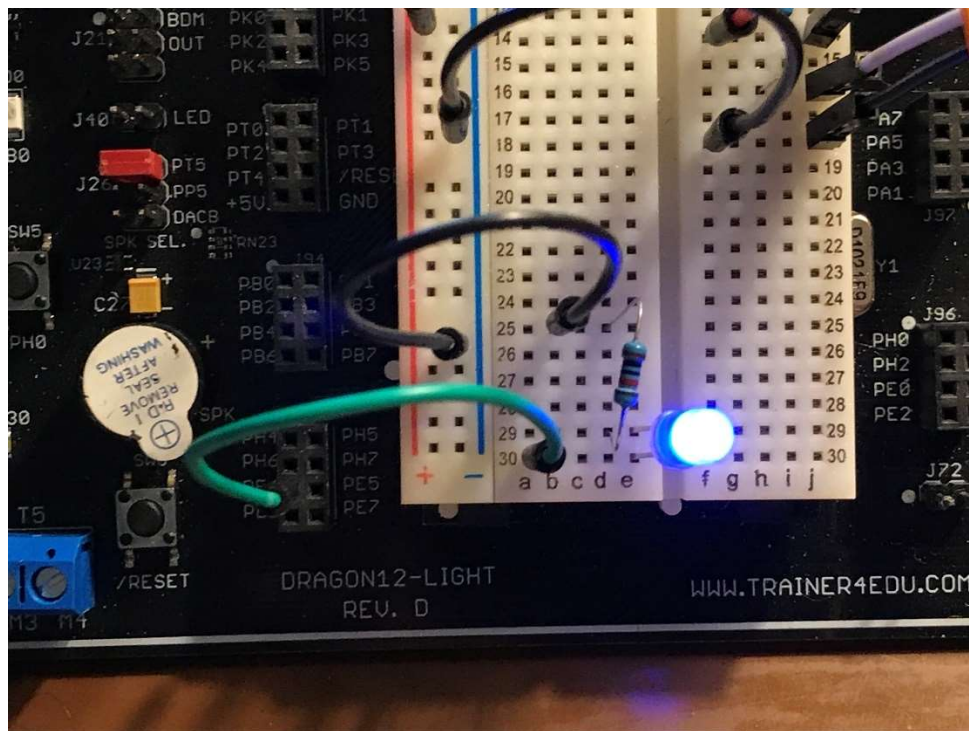
External potentiometer



Connect the following:

- Connect the left pin (red wire as pictured) on the external potentiometer to 5V on the on-board breadboard (red row).
- Connect the right pin (black wire as pictured) on the external potentiometer to ground on the on-board breadboard (blue row).
- The middle pin (white wire as pictured) on the external potentiometer to the on-board breadboard.
- A wire on connecting the on-board breadboard to A2 on J98
- A resistor connecting the middle pin on the external potentiometer to A2 on J98

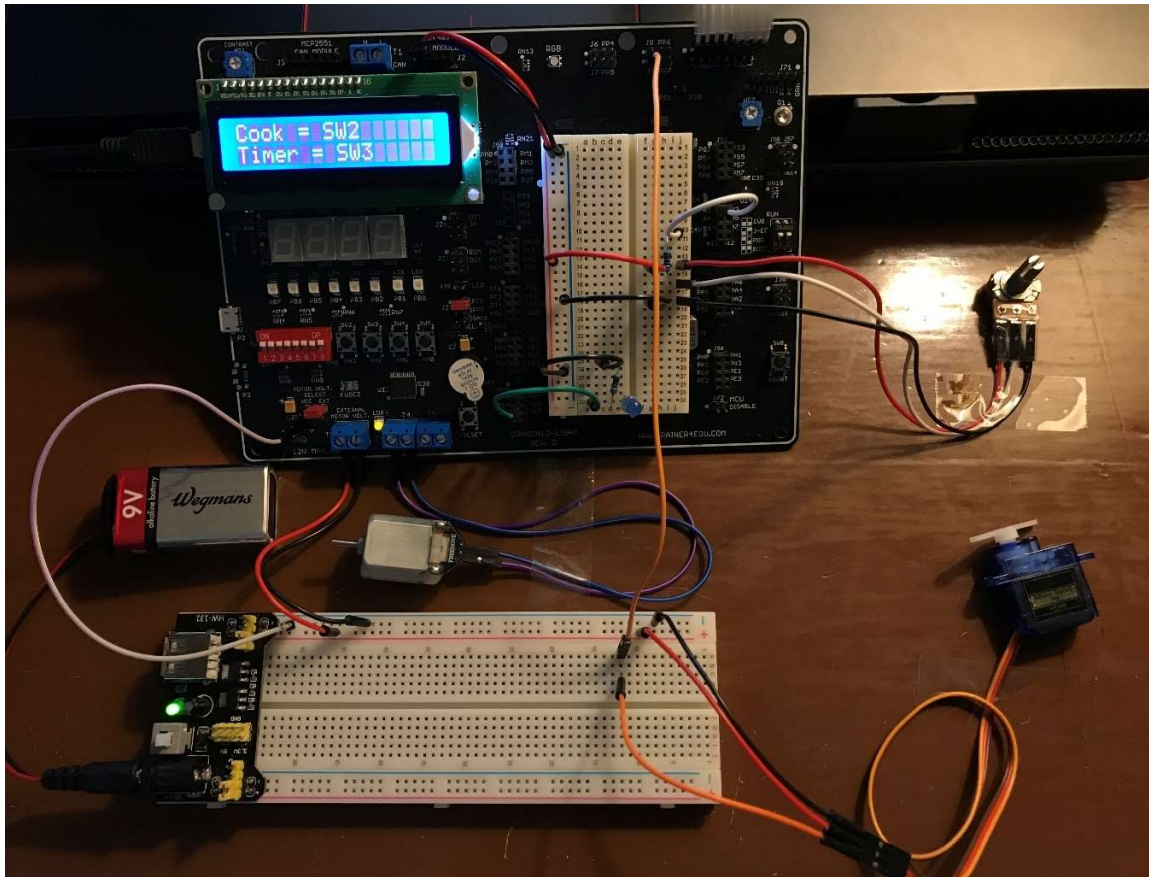
External LED



Connect the following:

- External LED on the on-board breadboard.
- PE4 on J95 to the long pin side of the external LED.

- Ground to the short pin side of the external LED
- A resistor connecting the external LED and ground



All the external components set up and operational

Software Set Up

- Select “Load Example Project” on CodeWarriorIDE software
- Select “LBE_DRAGON12_PLUS under HCS12X and create the project
- Load the microwave simulation code into the main.c file under Sources folder
- Turn the “Load” switch on the dragonboard down (reset if needed)
- Select HCS12 Serial Monitor and click debug (Green arrow)
- Select the appropriate Serial Communication Port
- Set the derivative to MC9S12DG256B

- Exit the debugger
- Connect to the appropriate port on MGTEK MiniIDE software (Terminal -> Options -> Port)
- Turn the “Load switch on the dragonboard up and reset

Program Instructions

Entering Time

- Upon selecting a mode, enter digits on the hex keypad. (A, B, C, D, * have no effect)
- Digits will shift left (become more significant) at each digit press.
- Press “#” when done.

Kitchen Timer Mode

- Press SW3 upon starting.
- Enter the desired time on the hex keypad and “#” when done.
- Press SW3 to start.

Cooking Mode

- Press SW2 upon starting.
- Enter the desired time on the hex keypad and “#” when done.
- Press SW3 to start (Note: door must be closed with SW4 as mentioned previously).

Adjusting Plate Spin Speed in Cooking Mode

- Adjust the speed of the plate (DC Motor) by turning the external potentiometer

Adjusting Power Level in Cooking Mode

- Adjust the power level by turning the on-board potentiometer.

Temperature Update in Cooking Mode

- Temperature of the food is taken initially when the cooking operation commences. Every five seconds the current power level value is added onto the temperature. Temperature increase will stop when the food temperature is at least 200 degrees Fahrenheit.

Stopping the Kitchen Timer and Cooking Operation

- While under operation, the timer and cooking mode may be stopped early by pressing the SW5 button.

Opening the Door

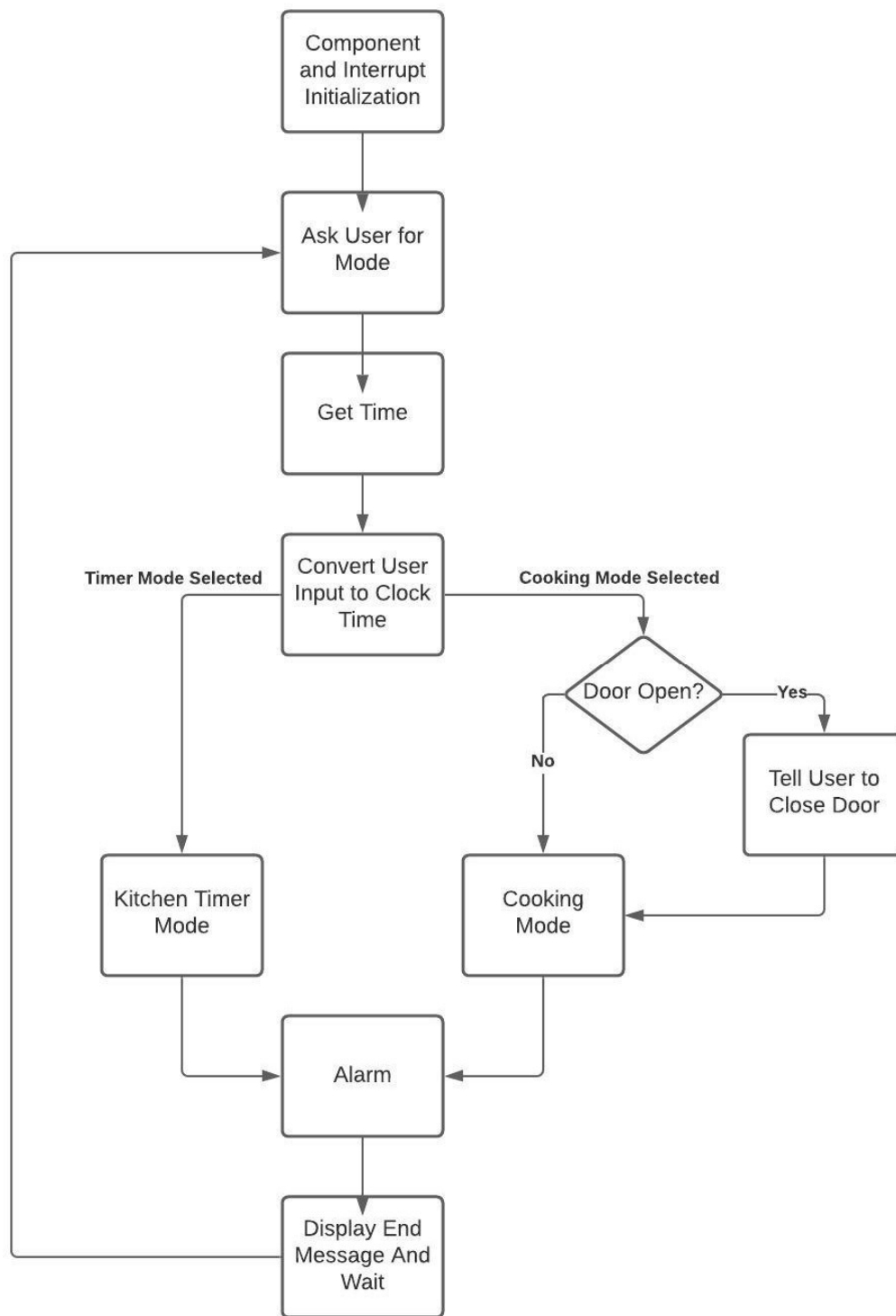
- The door (Servo motor) may be opened and closed by pressing SW4. The door must be closed to start the cooking operation. The door may not be opened during the cooking operation, users must either wait until it has completed or end the operation early with SW5.

Stopping the Ending Message

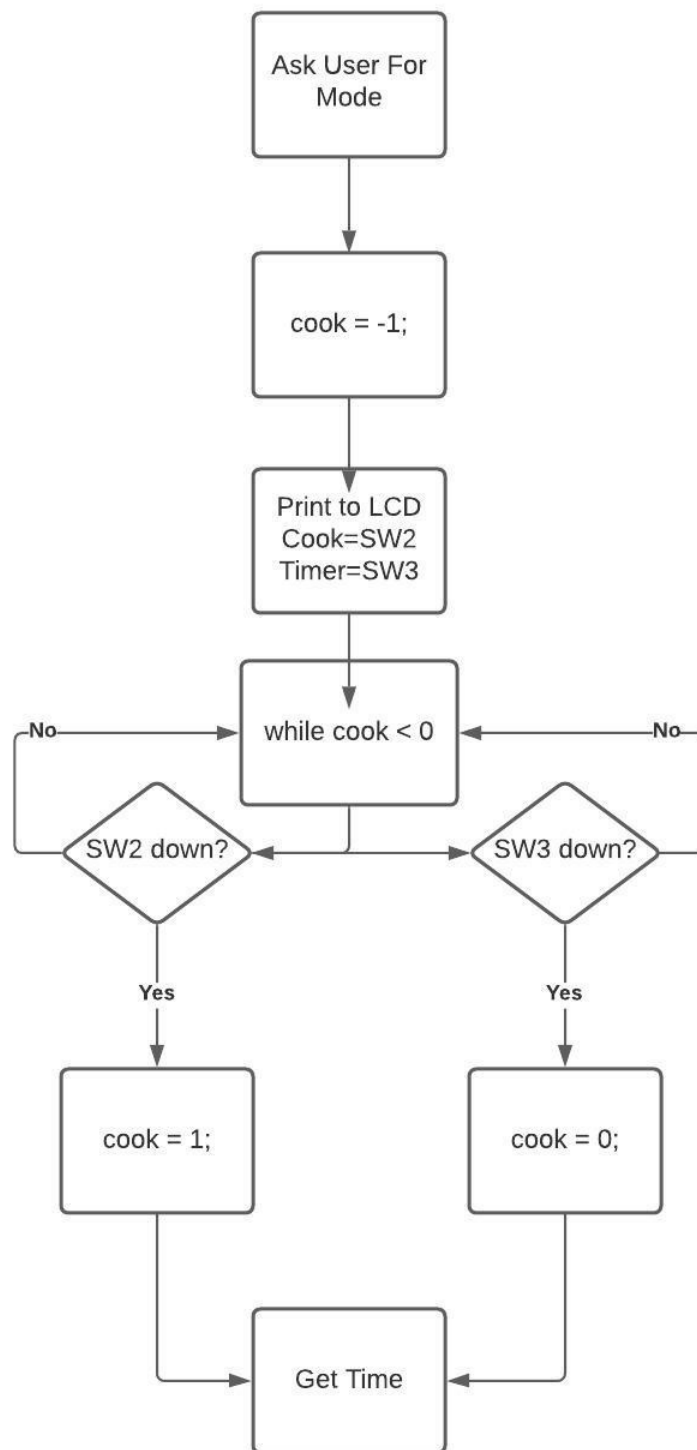
- After the alarm has sounded off after an operation has finished, the three second ending message may be ended early by pressing SW5.

Flowchart

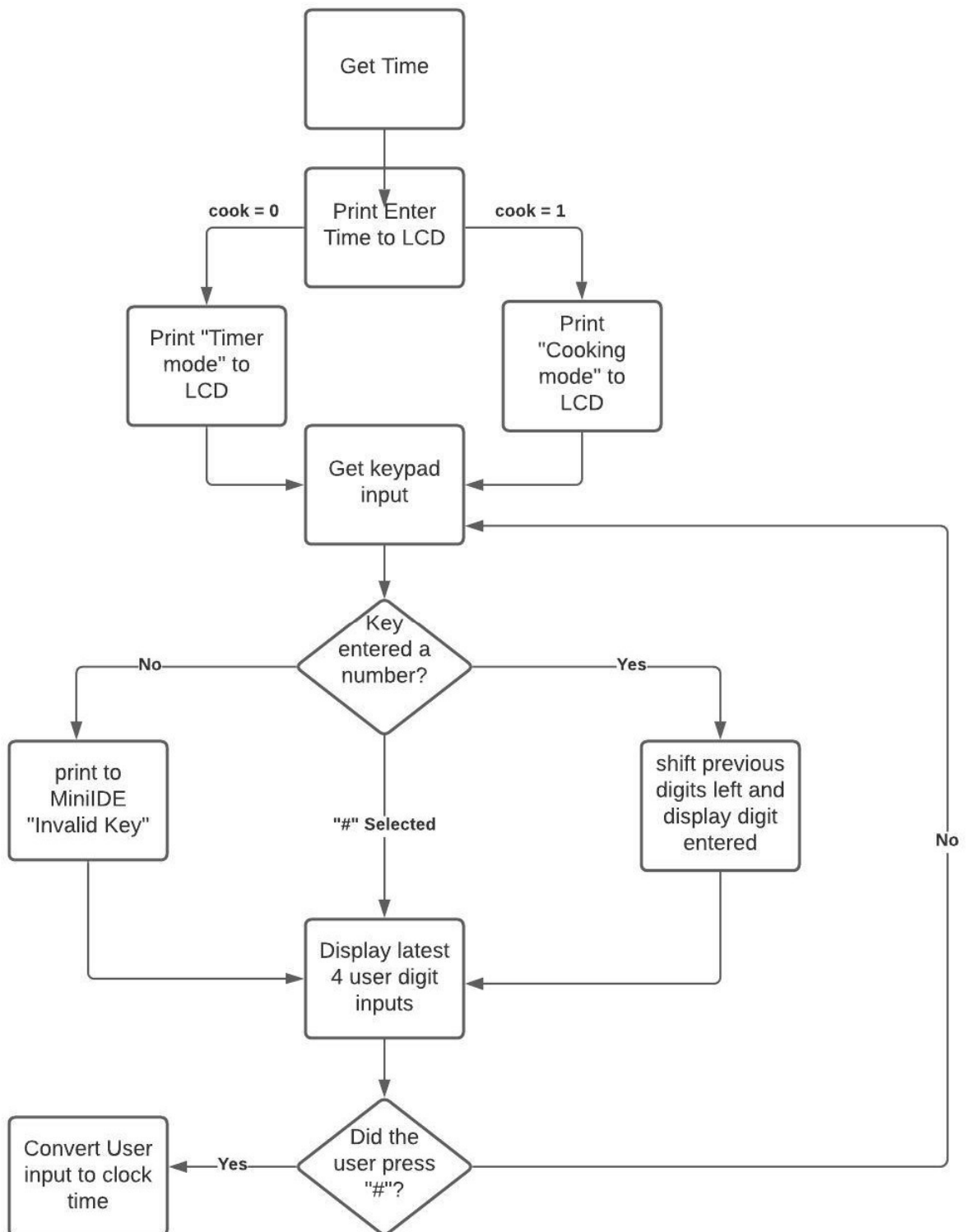
Overview



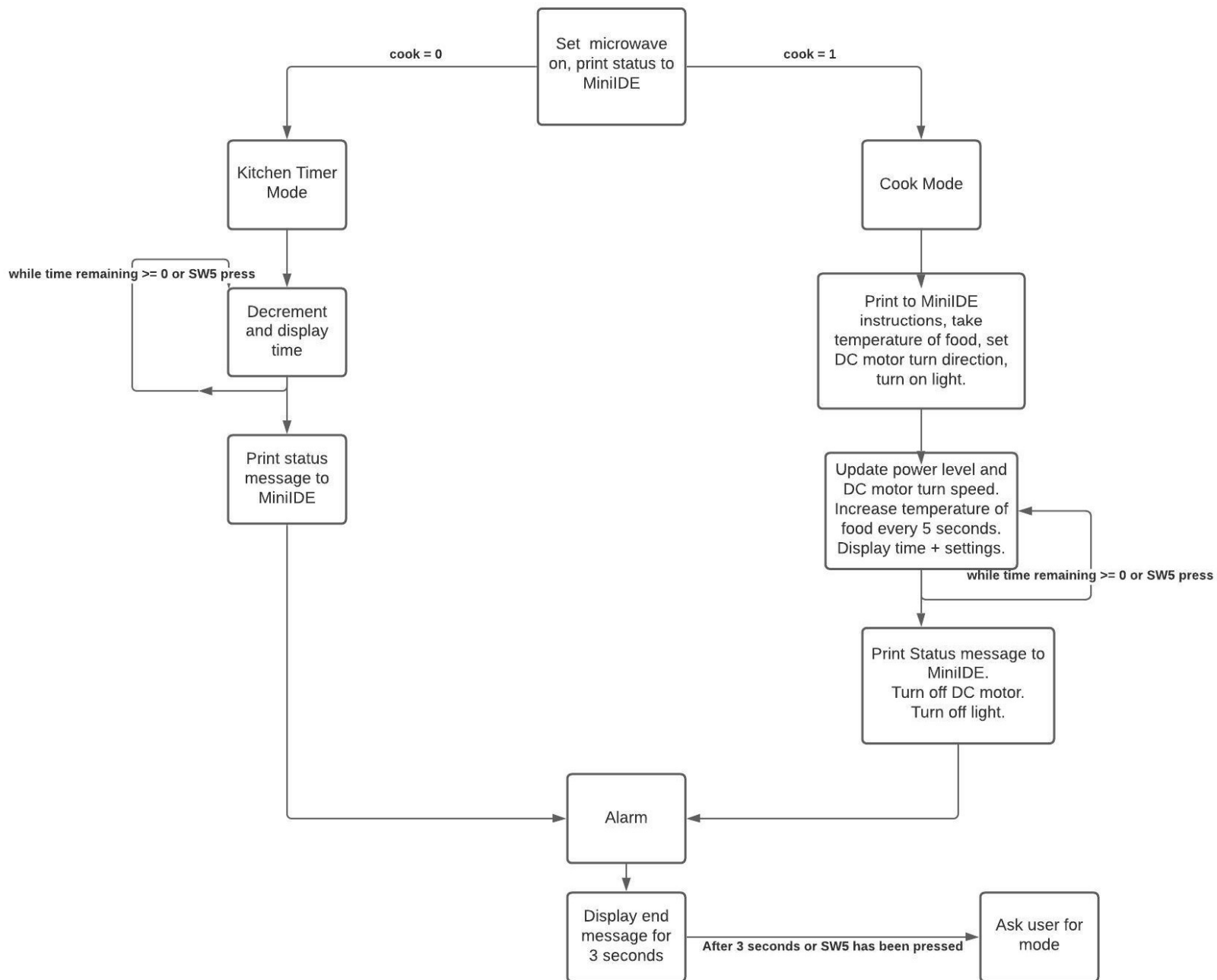
Ask user for mode (expanded)



Get time (expanded)



Kitchen Timer Mode / Cooking Mode (expanded)



LCD Outputs

- *Cook = SW2*

Timer = SW3

Displays upon the program start and means users are able to input what mode they would like to select.

- *Enter Time (KEY)*

Cooking Mode

Displays upon pressing SW2 upon program start (Cooking mode selected). Prompts users to enter the operation time on the hex keypad.

- *Enter Time (KEY)*

Timer Mode

Displays upon pressing SW3 upon program start (Timer mode selected). Prompts users to enter the operation time on the hex keypad.

- *xx M yy S*

#=DONE

Displays once users have chosen their mode and have started to enter the desired time (xx= two digit user input for minutes entered, yy= two digit user input for seconds entered).

- *START=SW3*

Displays when “#” has been pressed on the time select screen. Prompts the user to press SW3 to start the operation.

- *Close door (SW4)*

Displays after “START=SW3” if the user selected cooking mode and the door is open. Prompts the user to close the door prior to the operation.

- *h ss mm*

pPWR tttTMP

Displays when the cooking mode operation has commenced and until it has ended (h = hour remaining, mm = minutes remaining, ss = seconds remaining, p = Power level, ttt = temperature of food.).

- *Cooking complete*

Enjoy!

Displays after the alarm has ended if cooking mode was selected for three seconds or SW5 has been pressed.

- *Timer complete*

Displays after the alarm has ended if kitchen timer mode was selected for three seconds or SW5 has been pressed.

MiniIDE Messages

- *Microwave door closed*

Displays when the user has closed the microwave door with SW4.

- *Microwave door opened*

Displays when the user has opened the microwave door with SW4.

- *Cannot open while microwave is cooking*

Displays when the user tries to open the microwave with SW4 while cooking mode is in operation.

- *Microwave door must be closed before starting*

Displays when the user tries to start cooking mode while the microwave door is open.

- *Operation Aborted*

Displays when the user presses SW5 while kitchen timer or cooking mode is in operation.

- *The microwave is now cooking*

Displays when the cooking mode operation has started.

- *Timer has started*

Displays when the timer mode operation has started.

- *Press SW5 to end*

Displays when either cooking or kitchen timer mode has started. Informs the user they may end the operation early

- *Adjust the external potentiometer to adjust rotation speed*

Adjust The onboard potentiometer to adjust the power level

Displays when the cooking mode operation has started. Informs the users how they can use components to their liking.

- *Microwave has finished cooking.*

Displays at the end of the cooking mode operation.

- *Timer has ended*

Displays at the end of the timer mode operation.

- *Wait or press SW5 to return to the mode select menu.*

Displays after the alarm has finished. Informs the users they may wait for the end message to finish or end it early by pressing SW5 to return to mode select.

Component Outputs

Internal LED

All internal LEDs will flash on and off for half a second for a total of four times when the kitchen timer mode or cooking mode has finished to provide a visual alarm.

External LED

The external LED will light up when either the door is open, or the cooking mode is under operation.

Seven Segment Display

When the DC motor is turning, display 0 of the seven segment displays will display a value of 0x01 (from PORTB). This is due to PWME0's signal on PTP bit 0.

Speaker

After the kitchen timer mode or cooking mode has finished, the speaker will output a tone synonymously with the internal LEDs flash to provide an audible alarm.

DC Motor

The DC motor will turn only during the cooking mode operation in accordance with the spin speed set by the external potentiometer. This simulates the speed of the plate spin.

Servo Motor

The servo motor will turn to simulate the door opening and closing when the user pressed SW4. This may happen at any time except when the cooking mode is in operation.

Component Inputs

SW2

SW2 is used as an option select button. It is ready for input at the mode select screen.

SW3

SW3 is used as an option select and a start button. It is ready for input at the mode select screen and after the user has completed entering their time.

SW4

SW4 is the door opening and closing mechanism. It is activated at any time during the program. Users will be asked to press it if they try to start cooking mode while the door is open. SW4 will not open the door during the cooking operation and instead print a status message to MiniIDE.

SW5

SW5 is the cancel button. It can be activated while the microwave is an operation during either kitchen timer mode or cooking mode. It can also be activated while the three second ending display is active to end it.

Hex Keypad

The hex keypad simulates the digital input pad on the microwave. It becomes active when the user has selected the microwave mode. Keys 0-9 and # are active until # is pressed. Inputting A, B, C, D, and * on the keypad will have no effect at any time during the program.

Internal Thermometer

The internal thermometer will take its temperature at the commencing of the cooking mode operation. This is to simulate the temperature of the food when initially put in the microwave chamber (which will increase when cooking).

Internal Potentiometer

The internal potentiometer's value is taken and able to be changed during the cooking operation. This is to simulate a knob on the microwave which controls the power level.

External Potentiometer

The external potentiometer's value is taken and able to be changed during the cooking operation to adjust the speed at which the DC motor turns. This simulates a knob on the microwave which adjust the speed of the plate turn.