1. Test Name: PWM Fan Control

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The purpose of controlling the fan speed is to have some control of the heat of the fire. By decreasing the flow rate into the combustion chamber of the stove we can reduce rate of combustion. A potentiometer is used to change the duty cycle supplied to an electric fan. This variable resistor should adjust the fan speed between 50%-60% duty cycle.

2. Required Equipment

	Equipment Description	Quantity	Settings
1	Power supply	1	12V input Voltage
2	Oscilloscope	1	Measure duty cycle of PWM
3	555 Timer	1	Generate PWM signal
4	12V DC fan	1	+ and – wire connected to 12V and 0V rails. PWM wire connected to 555 timer output.

Table 1: Required equipment and its settings.

3. Test Procedure

Step 1: Connect the power supply to fan and 555 timer. Build the 555 timer circuit according to PWM schematic (25 kHz and 50% duty cycle). [Fan uses a 4 wire design, the black and red wires should be connected to ground and the +12V rail. The brown wire is the PWM control and should be connected to the output of the 555 timer. The final yellow wires can be left disconnected.]

Step 2: Verify fan is running and measure duty cycle with oscilloscope.

Step 3: Adjust the Potentiometer (increasing resistance will increase duty cycle and increase fan speed)

Step 4: Verify fan is still running and measure duty cycle with oscilloscope.

4. Test Results

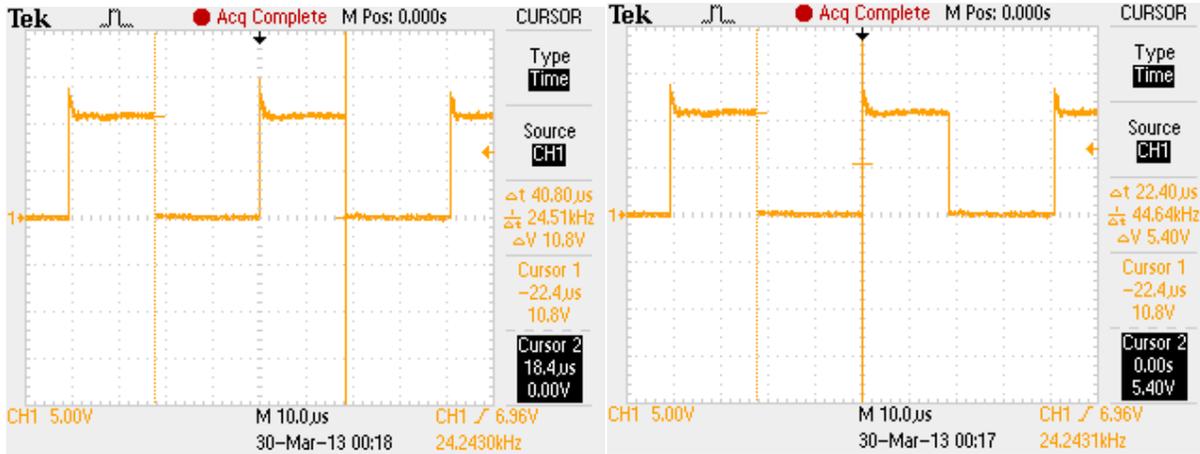| Step #	Description	Spec	Measurement
1	Measure Duty cycle with Potentiometer at minimum Resistance.	Duty cycle=50%	45.1%
2	Measure Duty Cycle with potentiometer at maximum resistance	Duty cycle=60%	65.5%

Table 2: The results of the test procedure.

Figure 1: Minimum Resistance

$$\%Duty\ Cycle = 100 * \left(\frac{T_{on}}{T_{on} + T_{off}}\right) = 100 * \left(\frac{18.4\ us}{40.8\ us}\right) = 45.1\% \approx 50\%$$
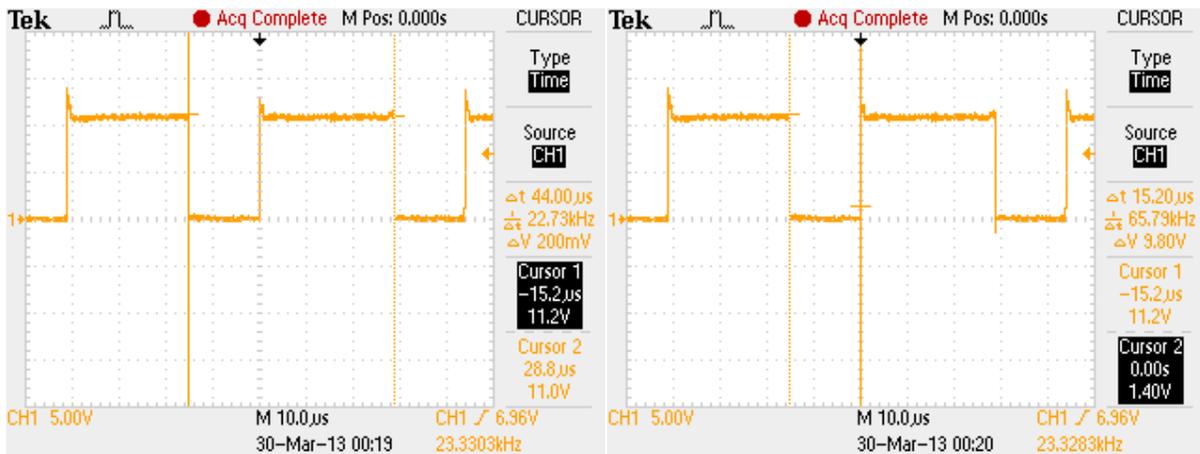

Figure 2: Maximum Resistance

$$\%Duty\ Cycle = 100 * \left(\frac{T_{on}}{T_{on} + T_{off}}\right) = 100 * \left(\frac{15.2\ us}{44.0\ us}\right) = 65.5\% \approx 60\%$$

5. Pass/Fail

Did the unit pass or fail the test? Defend your decision.

PASS	FAIL
Pass	

Table 3: PASS/FAIL