



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION
COUNCIL (TVET CDACC)**

Qualification Code : 071606T4MCT
Qualification : Mechatronics Level 6
Unit Code : ENG/OS/MC/CR/04/6/A
Unit of Competency : Perform Mechatronics Systems Instrumentation and Control

PRACTICAL ASSESSMENT

INSTRUCTIONS TO THE CANDIDATE:

Time allocated: THREE (3) hours

In this practical assessment, you are required to Design, construct, and test a ON/OFF temperature control system according to the following specifications.

- When the temperature exceeds 85 ° F, a 2N3904-transistor switch energizes a relay. When energized, the relay turns an ac fan ON. (Fan will be represented by an ac bulb)
- Use a LM34 temperature sensor with a non-inverting Op-Amp amplifier circuit having the required gain.
- Use a Schmitt trigger comparator circuit with a reference voltage of 6 V. Use the LM7806 to supply the reference voltage. Design the Schmitt trigger for a threshold temperature of less than 2°F.
- Use the MJE3055T as a heat source.

NOTE:

The threshold of the Schmitt trigger circuit is about 0.12 V. This corresponds to a temperature change of 1.7 ° F. When the temperature is 85 ° F, the output from the first Op-Amp circuit is 6 V. As the temperature increases, the corresponding voltage increases until a low voltage from the Schmidt trigger is observed. The U1B Op-Amp circuit inverts the output from the Schmitt trigger. At this point, the transistor will be ON and the relay is energized. The fan cools off the transistor until the temperature is below 83.3 ° F.

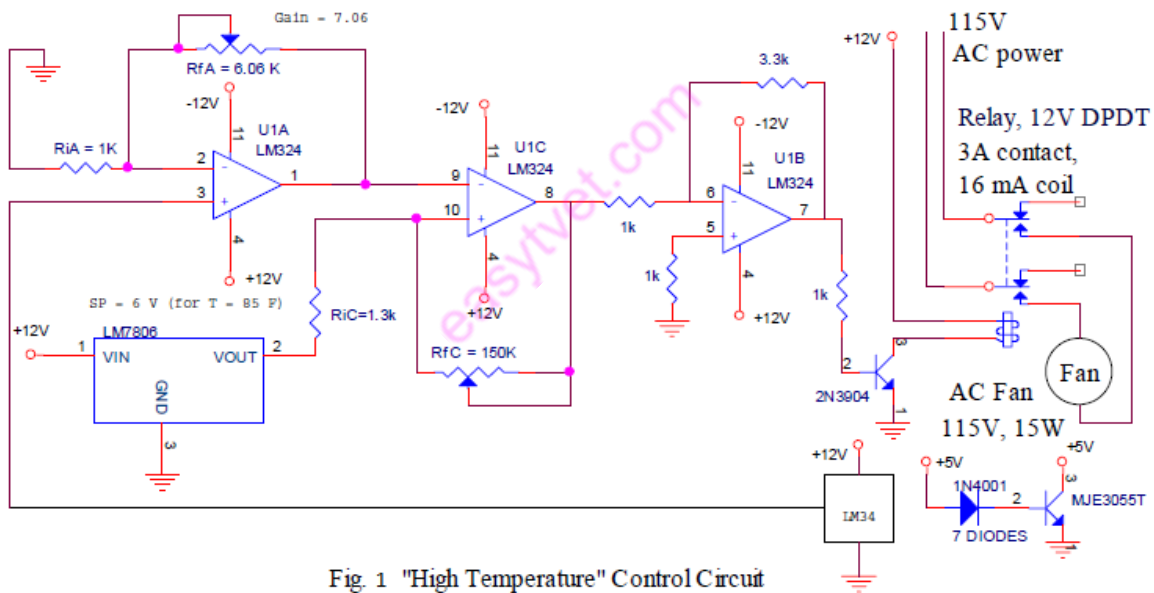


Fig. 1 "High Temperature" Control Circuit

Testing the Circuit

The circuit is constructed and tested in stages as follows.

- I. Construct the non-inverting Op-Amp circuit and adjust the feedback resistor to achieve a gain of 7.06.

- II. Add the Schmitt trigger circuit, including the LM7806, and verify that the voltage at pin 8 is low whenever the temperature exceeds $86.7^{\circ}F$.
- III. Add the inverting Op-Amp circuit and test it. The output at pin 7 should be at saturation.
- IV. Add the transistor and relay circuit and test it.

PROCEDURE

1. Review the working drawing in 10minutes
2. Prepare the work operation plan in 10minutes
3. Collect the tools as per the work operation plan in 10minutes
4. Design the Schmitt trigger comparator control circuit in 1hour.
5. Perform the test as per the instruction above.
6. The assessor will record your performance at critical points using audio-visual means