1Ph_FW_Converter_R-Load -- Overview

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1-PHASE FULL WAVE CONTROLLED CONVERTER WITH R-LOAD

Objective:

After performing this lab exercise, learner will be able to:

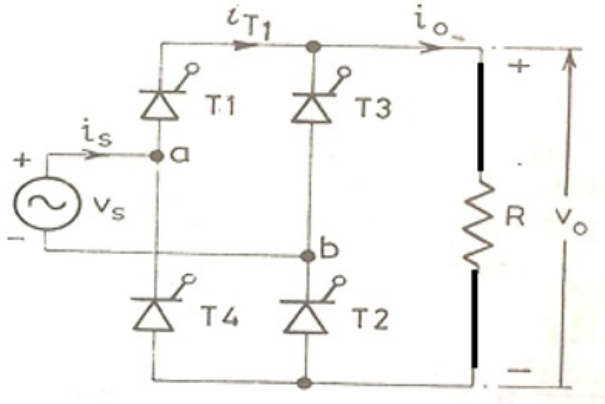
- Understand the working of 1-phase full wave control converter with R load.
- Learn the role of Power Electronics in speed control of motors.
- Understand and design single-phase full wave converter with SCR.
- Analyze and interpret results.
- Work with a digital oscilloscope to debug circuit and analyze signals.

Equipment:

To carry out this experiment, you will need:

- Half wave controlled Converter Power circuit kit
- SCR firing circuit kit, 1-phase, 230V, 5A
- Patch chords
- Load (100 ohm / 2A)
- Digital Oscilloscope

Circuit Diagram:



Theory:

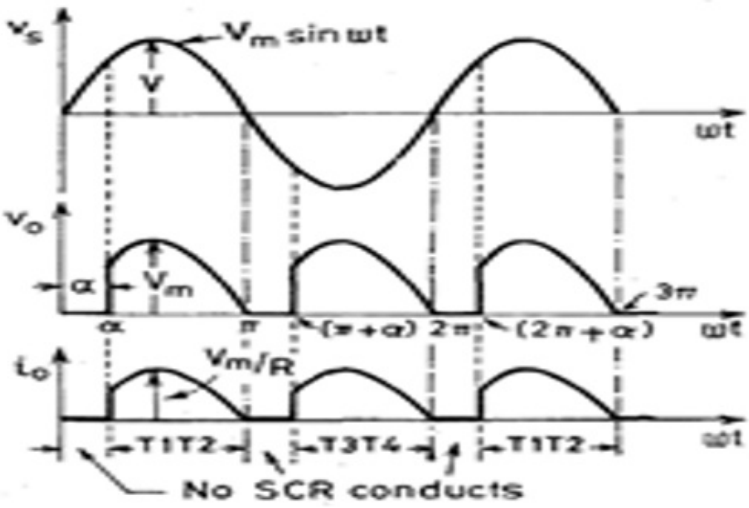
- The circuit has four SCRs. For this circuit, Vs is a sinusoidal voltage source. When the supply voltage is positive, SCRs T1 and T2 triggered then current flows from Vs through SCR T1,

load resistor R (from up to down), SCR T2 and back into the source.

- In the next half cycle, the other pair of SCRs T3 and T4 conducts when get pulse on their gates. Then current flows from Vs through SCR T3, load resistor R (from up to down), SCR T4 and back into the source.
- Even though the direction of current through the source alternates from one half-cycle to the other half-cycle, the current through the load remains unidirectional (from up to down).
- The main purpose of this circuit is to provide a controllable DC output voltage, which is brought about by varying the firing angle, α. Let Vs= Vm sin ωt, with 0 < ωt < 360 degree .
- If ωt= 30 degree when T1 and T2 are triggered, then the firing angle α is said to be 30 degree. In this instance, the other pair is triggered when ωt= 30+180=210 degrees
- When Vs changes from positive to negative value, the current through the load becomes zero at the instant ωt= π radians, since the load is purely resistive. After that there is no current flow till the other is triggered. The conduction through the load is discontinuous.
- Average Voltage V_0 across load R in terms of firing angle is given by :

$$V_0 = \frac{V_m}{\pi}(1 + cos\alpha)$$

- The ideal waveform of the experimental setup is shown in Figure below:



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1Ph_FW_Converter_R-Load -- Procedures

Step 1

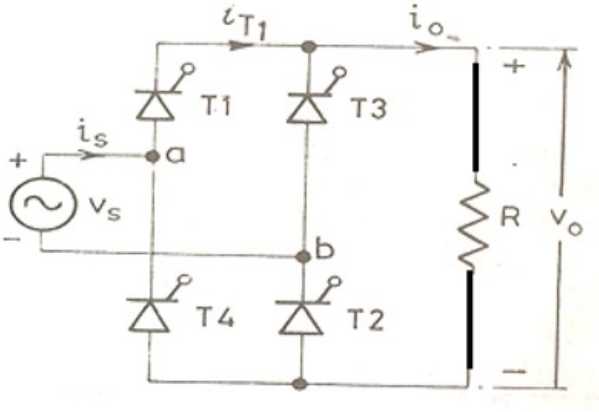
Precautions:

- A main switch should be included in whole circuit, so that in case of any emergency main supply can be disconnected from the circuit.
- Check all the connection before switching ON the power supply.
- Apply low voltages or low power to check the proper functionality of circuits.
- Load should be remained connected to the experimental setup for discharging the energy stored in the inductor or capacitor present in the circuit, if any.
- Don’t touch live wires.

Step 2

Circuit Setup:

Build the circuit as shown below:



Step 3

Probe at Sine wave input (signal generator) source and across load resistance (V_0)

Step 4

Keep the multiplication factor of the CRO’s probe at the maximum position (10X or 100X - whichever is available)

Step 5

Switch on the experimental kit and firing circuit kit.

Step 6

Set the firing angle to 0 degree and capture input and output waveforms on oscilloscope

Step 7

Measure the RMS value of the output and take screenshot of input and output waveform.

Step 8

Now change the firing angle to 30 degree.

Step 9

Measure the RMS value of the output and take screenshot of input and output waveform.

Step 10

Continue Step # 8 for different values of firing angle like 45, 60 and 90 degrees.

Step 11

Open Question:

- What will be RMS value when firing angle is - (a) 60 degree, (b) 90 degree?

Step 12

Switch off the power supply and disconnect from the power source.