1Ph_HW_Converter_R-Load -- Overview

Dr. Ashish Shrivastava
Professor & Head
Electrical Engineering Department
JRE Group of Instiution, Noida (UP)

1-PHASE HALF WAVE CONTROLLED CONVERTER WITH R-LOAD

Objective:

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

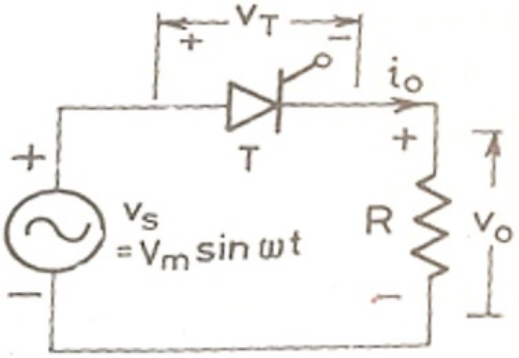
- Understand the working of 1-phase half wave control converter.
- Learn the role of Power Electronics in utility related applications, e.g. drives etc.
- Analyze and interpret results.
- Work with a digital oscilloscope to debug circuit and analyze signals.

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:

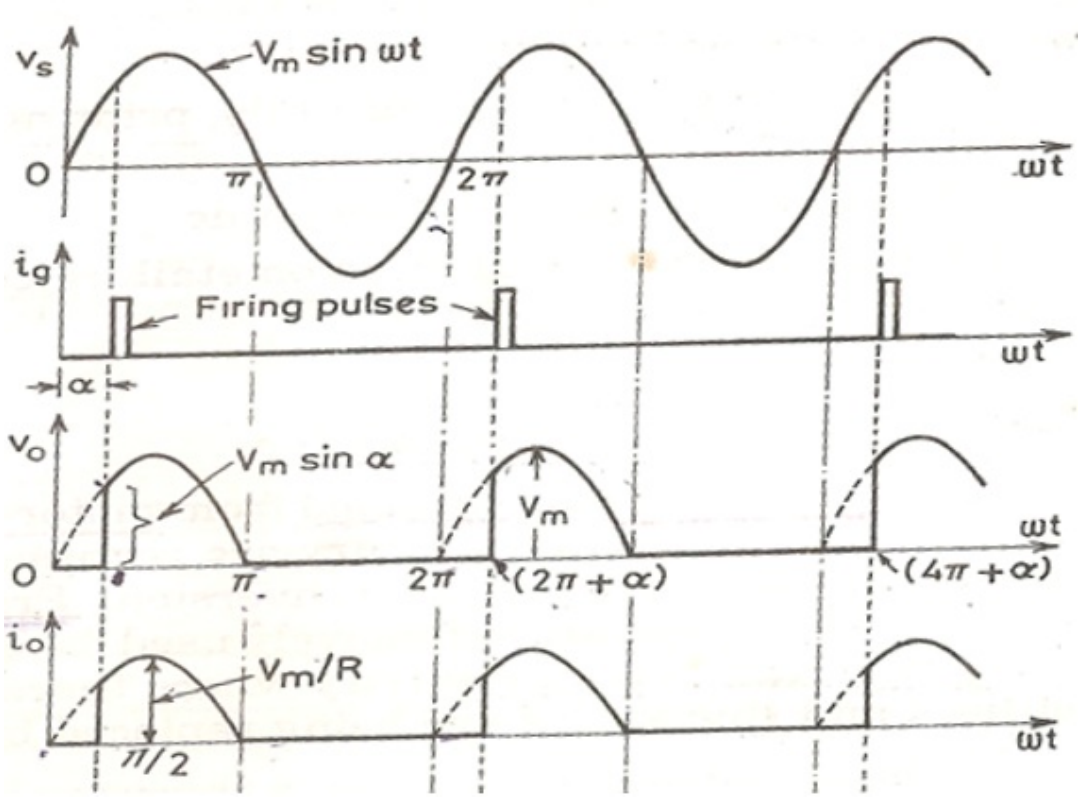


Theory:

- In the period $0 < \omega t < \pi$; the SCR is forward biased. Then current through the load and voltage drop across the load are zero, and all the supply voltage appears between the anode and cathode of the SCR.
- Let the SCR be triggered at an angle of α ($0 < \alpha < \pi$).Then the supply terminals are connected to the load through the SCR

and the current starts flowing through the load via SCR. Therefore the supply appears across the load with a drop of R and the voltage drop across the SCR is zero (SCR is assumed ideal).

- In the period π < ωt < 2π; the SCR is Reversed biased and the SCR cannot conduct. The voltage drop across the load is zero and the total supply voltage appears the SCR.
- Again during the third positive half cycle supply is positive again SCR is forward biased and if we give triggering pulse, then SCR starts conducting and this cycle repeats.
- Average Voltage V_0 across load R in terms of firing angle is given by : V_0=V_m/2π(1+cosα)
- The ideal waveform of the experimental setup is shown in Figure below:



Acknowledgement:

Special thanks to Vikas Singh Bhadoria (Asst. Professor, Electrical Engineeering Department, JRE Group of Instiutions) for supporting the development of this lab courseware.

1Ph_HW_Converter_R-Load -- Procedures

Step 1

Precautions:

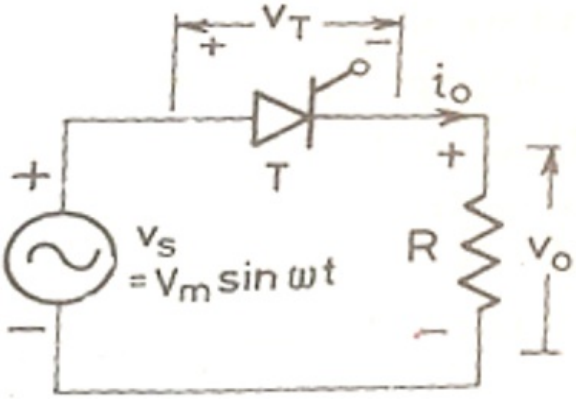
- A main switch should be included in whole circuit, so that in case of any emergency main supply can be disconnected from the circuit.
- Check all the connection before switching ON the power supply.

- 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.