1Ph_FW_AC-Controller_R_Load -- Overview

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1-PHASE FULL-WAVE AC CONTROLLER WITH RESISTIVE LOAD

Objective:

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

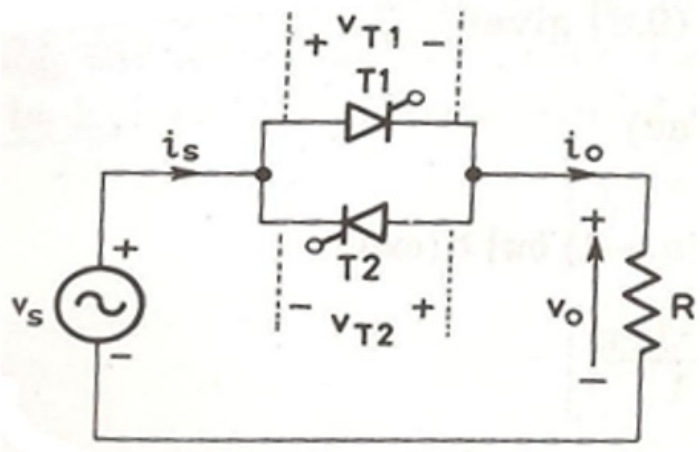
- Understand the working of AC-AC converter
- Learn the role of Power Electronics in utility related applications.
- Understand and design single-phase Full Wave AC voltage controller.
- Analyze and interpret results
- Work with digital oscilloscope to debug circuit and analyze signals

Equipment:

To carry out this experiment, you will need:

- Single phase AC Voltage Controller kit
- SCR firing circuit kit, 1-phase, 230V, 5A
- Patch chords
- Load
- Digital Oscilloscope

Circuit Diagram:

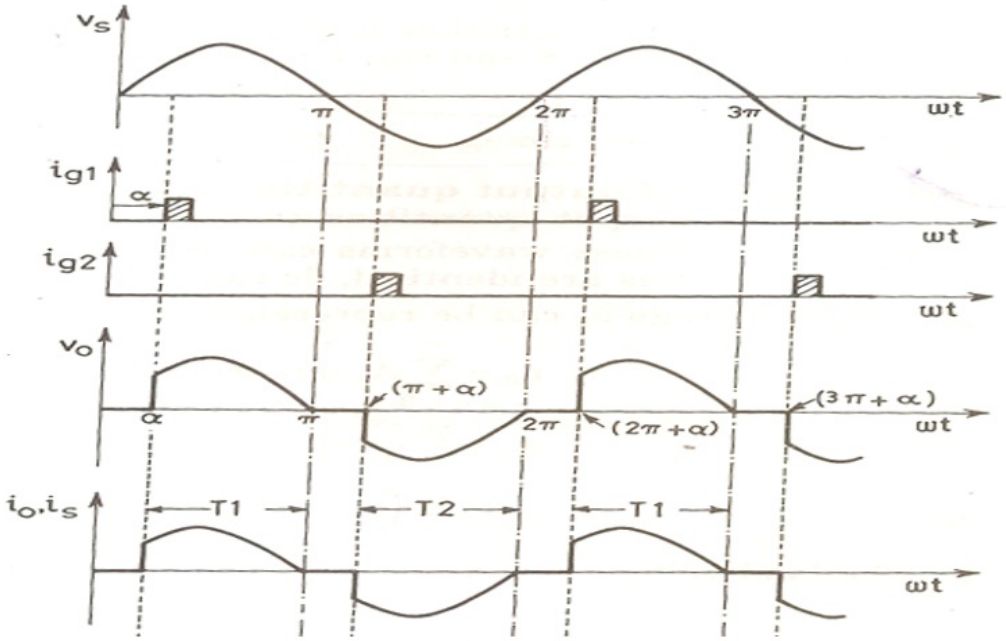


Theory:

- Single phase full wave voltage controller consists of two SCRs connected in antiparallel.
- Thyristors T1 and T2 are forward biased during positive and

negative half cycles respectively.

- During positive half cycle, T1 is triggered at firing angle α, it conducts from ωt = α to π and source voltage is applied to load.
- At π both source voltage and source current fall to zero. Just after π, T1 is reverse biased and therefore turned off.
- During negative half cycle T2 is triggered at ωt = π+ α, it conducts from π+ α to 2π.
- Soon after 2π, T2 is subjected to a reverse bias, it is therefore commutated. Load and source currents have same waveforms.
- The ideal waveform of the experimental setup is shown in Figure below:



1Ph_FW_AC-Controller_R_Load -- Procedures

Step 1

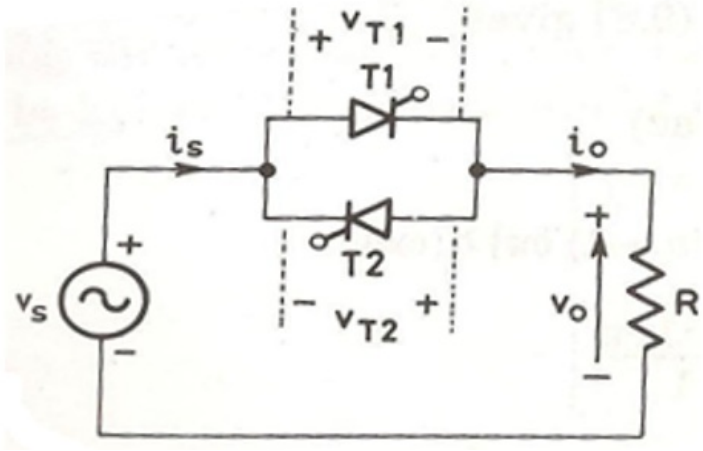
Precautions:

- 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 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
- Capture output waveform on oscilloscope

Step 7

- Measure the RMS value of the output
- Take screenshot of output waveform.

Step 8

- Set the firing angle to 30 degree
- Capture output waveform on oscilloscope

Step 9

- Measure the RMS value of the output
- Take screenshot of output waveform.

Step 10

Continue Step # 8 and 9 for different values of firing angle like 45,

60 and 90 degrees.

Step 11

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