2.9 Applications of converter

LIGHT DIMMERS

Semiconductor dimmers switch on at an adjustable time (phase angle) after the start of each alternating current half-cycle, thereby altering the voltage waveform applied to lamps and so changing its RMS effective value. Because they switch instead of absorbing part of the voltage supplied, there is very little wasted power. Dimming can be almost instantaneous and is easily controlled by remote electronics. This development also made it possible to make dimmers small enough to be used in place of normal domestic light switches.

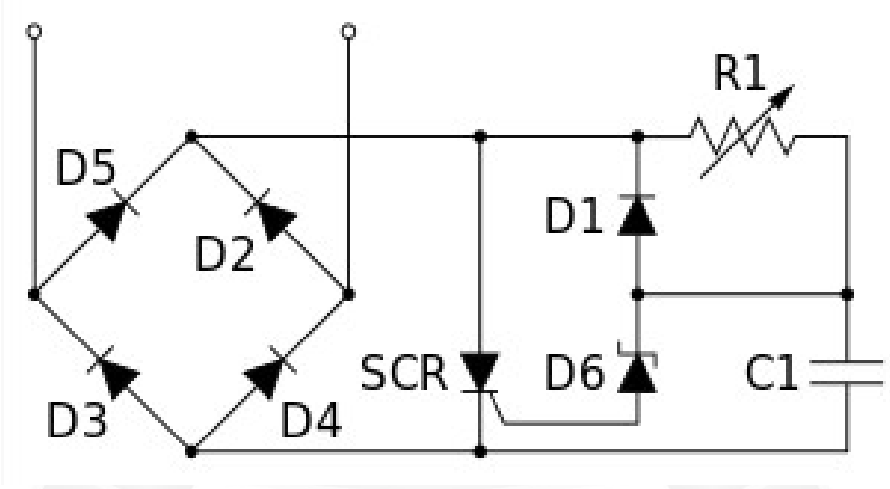

Figure 2.9.1 An electrical schematic for a SCR-based light dimmer

[Source: "Power Electronics" *by* P.S.Bimbra*,* Khanna Publishers *Page: 219]*

In the electrical schematic shown, a typical silicon-controlled rectifier (SCR) based light dimmer dims the light through phase-angle control. This unit is wired in series with the load. Diodes (D2, D3, D4 and D5) form a bridge, which generates pulsed DC. R1 and C1 form a circuit with a time

constant. As the voltage increases from zero (at the start of every halfwave) C1 will charge up. When C1 is able to make Zener diode D6 conduct and inject current into the SCR, the SCR will fire. When the SCR conducts, D1 will discharge C1 via the SCR. The SCR will shut off when the current falls to zero and the supply voltage drops at the end of the half cycle, ready for the circuit to start work on the next half cycle. This circuit is called a Leading-Edge Dimmer or Forward Phase Dimming.

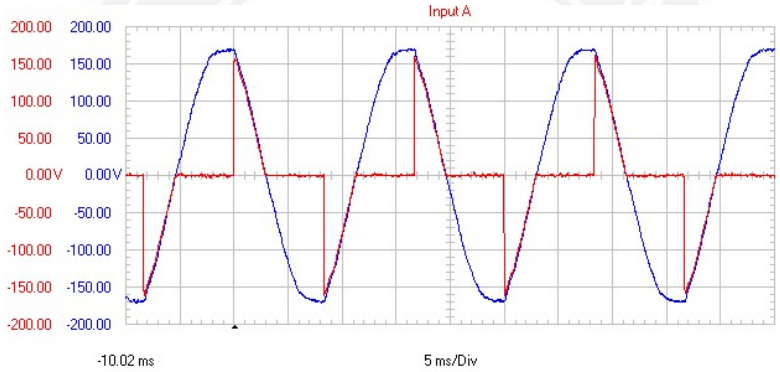

Figure 2.9.2 Phase control waveform of SCR-based light dimmer

[Source: "Power Electronics" *by* P.S.Bimbra, Khanna Publishers *Page: 220]*

Waveform of the output voltage of a thyristor dimmer set for 60 volts RMS output, with 120 V input. The red trace shows the output device switching on about 5.5 ms after the input (blue) voltage crosses zero. Switching the thyristor on earlier in each half cycle gives a higher output voltage and brighter lights.