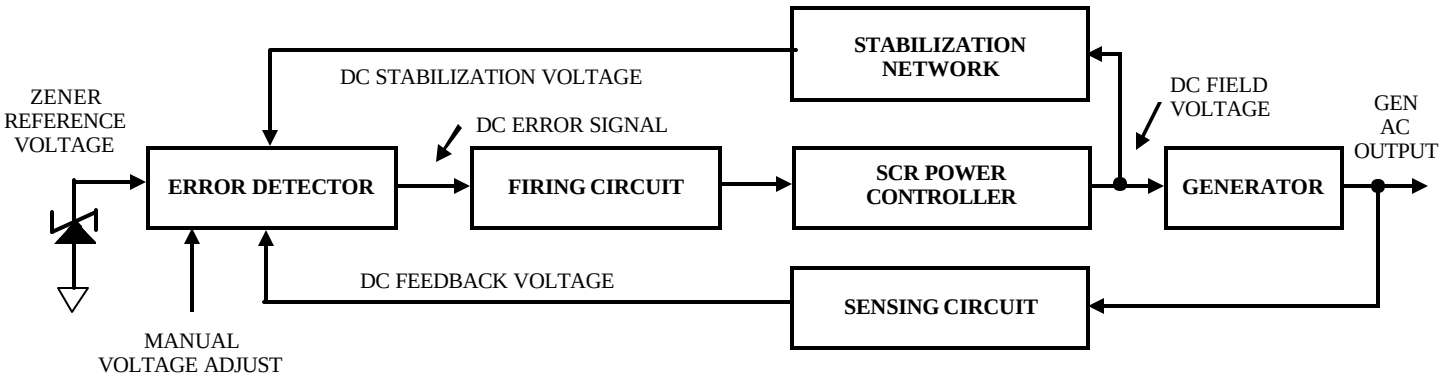
Generator Voltage Regulation
Functional Block Diagram

Typical Regulator Block Diagram



Kilowatt Classroom Drawing

Functional Blocks

A typical analog voltage regulator is illustrated in the block diagram above and incorporates the following:

- A **Sensing Circuit** using a single- or three-phase, step-down potential (voltage) transformers and DC rectifier/filter assembly supplies the **Error Detector** with a DC feedback voltage that is proportional to the AC output of the generator.
- A zener diode is used to provide a constant DC **Voltage Reference** against which the feedback voltage is compared. An external voltage adjustment potentiometer is also provided to permit fine voltage adjustments to be made manually.
- The **Error Detector** circuit produces a DC output error voltage proportional to the difference between the feedback and the reference (zener diode) voltage. The **Stabilization Network** also inputs the error detector and is adjusted to match the response of the regulator to the inductive time constant of the generator to provide quick, smooth response when generator load is increased or decreased.
- The **Firing Circuit** converts the DC error voltage to a phase-controlled pulse that provides firing for the SCR Power Controller package.
- The **SCR Power Controller** provides a phase-controlled signal to the generator DC field which holds the generator output voltage constant under varying load conditions. Depending on the type of generator excitation, the DC field may be applied directly to the slip rings of a rotating DC field, to the stationary field of a DC pilot exciter, or to the stationary field of a brushless excitation system. Both single-phase and three-phase generators typically use a single-phase SCR rectifier assembly. Larger machines often use a pilot exciter, the field of which is excited by the voltage regulator, so that the amount of current required from the regulator is relatively small. Note: See the *Electrician's Notebook* article "The Silicon Controlled Rectifier" for details on a typical SCR phase-controlled system.
- Because solid-state generator controls require a voltage output from the generator before they can begin working, a **Build-Up Circuit** is employed which bypasses the SCR's until the generator output becomes sufficient for the electronic control to take-over control of the system. In its simplest form, this build-up circuit may be a relay or contactor, the coil of which is connected to the sensing circuit, with the contacts wired in parallel to bypass the SCR's until the generator output voltage rises to about 85% of normal. Residual magnetism in the generator field provides sufficient magnetism for the initial generator build-up to occur. On systems where sufficient residual magnetism is not retained, a **Field-Flashing Circuit** may be employed to insure consistent generator build-up. These functions will be covered in Part 2 of this article.