The Control System

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There are basically two types of control system: the open loop system and the closed loop system. They can both be represented by block diagrams. A block diagram uses blocks to represent processes, while arrows are used to connect different input, process and output parts

Open loop control system

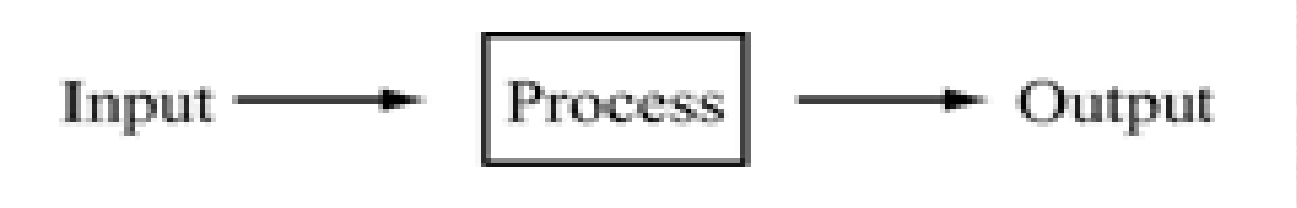


Fig. 1 Block diagram of an open loop control system

Fig. 1 shows a simple open loop control system. Its operation is very simple, when an input signal directs the control element to respond, an output will be produced. Examples of the open loop control systems include washing machines, light switches, gas ovens, etc.

example of an open loop control system

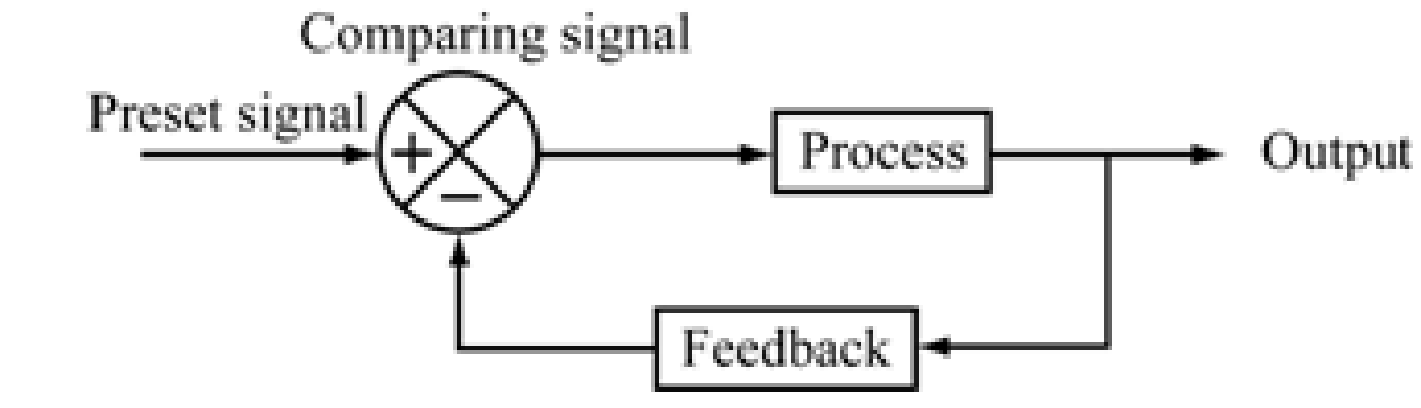
- A washing machine is an example of an open loop control system
- **burglar alarm system**

Drawback of an open loop control system

- The drawback of an open loop control system is that it is incapable of making automatic adjustments. Even when the magnitude of the output is too big or too small, the system will not make the appropriate adjustments. For this reason, an open loop control system is not suitable for use as a complex control system. Sometimes it may even require monitoring and response from the user. For example, when a washing machine finishes cleaning the clothes, the user will need to check whether the clothes are clean or not; if they are not, they have to be put back into the machine and washed again.

Closed loop control system

- Sometimes, we may use the output of the control system to adjust the input signal. This is called feedback. Feedback is a special feature of a closed loop control system. A closed loop control system compares the output with the expected result or command status, then it takes appropriate control actions to adjust the input signal. Therefore, a closed loop system is always equipped with a sensor, which is used to monitor the output and compare it with the expected result.



- Block diagram of a closed loop control system

Feedback

- Feedback can be divided into positive feedback and negative feedback. Positive feedback causes the new output to deviate from the present command status. For example, an amplifier is put next to a microphone, so the input volume will keep increasing, resulting in a very high output volume. Negative feedback directs the new output towards the present command status, so as to allow more sophisticated control. For example, a driver has to steer continuously to keep his car on the right track.
- Most modern appliances and machinery are equipped with closed loop control systems

Examples & advantage

- Examples include air conditioners, refrigerators, automatic rice cookers, automatic ticketing machines, etc. An air conditioner, for example, uses a thermostat to detect the temperature and control the operation of its electrical parts to keep the room temperature at a preset constant.
- One advantage of using the closed loop control system is that it is able to adjust its output automatically by feeding the output signal back to the input. When the load changes, the error signals generated by the system will adjust the output. However, closed loop control systems are generally more complicated and thus more expensive to make.

Application of control system

- Familiar control systems have the basic closed-loop configuration. For example, a refrigerator has a temperature setting for desired temperature, a thermostat to measure the actual temperature and the error, and a compressor motor for power amplification. Other examples in the home are the oven, furnace, and water heater. In industry, there are controls for speed, process temperature and pressure, position, thickness, composition, and quality, among many others. Feedback control concepts have also been applied to mass transportation, electric power systems, automatic warehousing and inventory control, automatic control of agricultural systems, biomedical experimentation and biological control systems, and social, economic, and political systems. *See also* Biomedical engineering; Electric power systems; Mathematical biology; Systems analysis; Systems engineering.

- A servomechanism, sometimes shortened to servo, is an automatic device that uses error-sensing negative feedback to correct the performance of a mechanism and is defined by its function. It usually includes a built-in encoder.A servomechanism is sometimes called a heterostat since it controls a system's behavior by means of heterostasis.

- The term correctly applies only to systems where The feedback or error-correction signals help control mechanical position, speed or other parameters. For example, an automotive Power window control is not a servomechanism, as there is no automatic feedback that controls position—the operator does this by observation. By contrast a car's cruise control uses closed loop feedback, which classifies it as a servomechanism