



## What is a Stepper Motor?

A Stepper Motor is an electrical device which divides the full rotation of the motor into individual parts called steps. Generally, these motors are brushless in order to facilitate a synchronous rotation and operate without the input of an external source on the gear itself. They operate via the use of electromagnets arranged in different locations around the shaft, each engraved with teeth. These teeth match the teeth that are placed on the gear itself. As the gear rotates, one section matches with the teeth of the first electromagnet, offsetting the teeth from the other electromagnets and repeating this action as it rotates.

The general principle of stepper motors is to relegate each rotation into a specific phase. Each stepper motor phase is controlled by turning the electromagnet on and off in a repeated pattern. This means that, unlike direct current (DC) motors that use brushes and are controlled by voltage, stepper motors only need to be charged on the shaft itself.

Three types of stepper motor control mechanisms exist within the design of the device. One format uses a permanent magnet located within the rotor to control the electromagnets by creating attraction and repulsion on the gear. Others use a magnetic control on the shaft itself and essentially pull the gear towards the shaft in the opposite manner of the previous format. Still another design is a combination technique, which uses magnetic reactions from both the gear and the shaft.

Some of the negative characteristics of stepper motors make them highly unique to the field of motion control. First, a stepper motor driver requires a constant power source to operate. Additionally, the physics of the device means that as the speed of the gear increases, the actual torque decreases. This creates a situation in which the motor begins to vibrate, which can only be controlled by adding a dampener to the shaft itself. One way to mitigate this overall effect is to add more electromagnets to the system, which increases the number of steps and decreases the vibrations.

The majority of modern stepper motors are controlled via a computer system, which maintains the proper positioning through digital commands. They can be designed much smaller than DC motors, due to the lack of voltage needs on the gear itself. Examples of small stepper motors used in modern equipment include those in compact disc drives, computer printers and other precision-controlled devices that require small detailed actions to function properly.