What is a Unipolar Stepper Motor?

A **unipolar stepper motor** is a type of stepper motor that has windings with a center tap. It is called "unipolar" because current flows in one direction through each winding at any given time. This type of motor is easier to control than a bipolar stepper motor, which requires reversing current direction.

How it Works

1. **Construction**:
    - A unipolar stepper motor typically has **5 or 6 wires**.
    - Each coil has a center tap that splits it into two halves, making it possible to energize only half of the winding at a time.
    - In a 5-wire configuration, the center taps of all coils are internally connected, whereas a 6-wire motor has separate center tap wires.
2. **Operation**:
    - Each step of the motor is achieved by sequentially energizing different coils in a specific order.
    - For the 28BYJ-48 stepper motor, this order is often **4-step** or **8-step sequences** (depending on the driver and configuration).
    - The center tap simplifies the driving circuit because you don't need to reverse the current's polarity for operation.
3. **Advantages**:
    - Simple driver circuitry.
    - Reduced power requirements compared to bipolar stepper motors.
4. **Disadvantages**:
    - Slightly less torque compared to bipolar stepper motors of the same size.
    - Slightly less efficient due to the use of only half the winding at a time.

What is the 28BYJ-48 Stepper Motor?

The **28BYJ-48** is a popular unipolar stepper motor commonly used in hobbyist and small-scale projects. It's compact, affordable, and ideal for low-power applications like robotics, automated blinds, and small mechanisms.

What Does "28BYJ-48" Stand For?

- **28**: The motor has a diameter of 28 mm.
- **BYJ**: A common code in stepper motors indicating its family or series. In this case, it refers to the **"BaiYangJi" (Chinese motor series)**.
- **48**: This number refers to the **step angle reduction ratio**, which is **1/48** of a full revolution. The motor itself has a step angle of 7.5° per step. However, due to the gear reduction mechanism, its effective step angle is 0.0879°.

How the 28BYJ-48 Works

1. **Gear Reduction**:
    - The motor has an internal **gearbox** with a gear ratio of approximately **1:64 (precisely 63.6839)**.
    - This means the motor must take 63.6839 full rotations to make one revolution of the output shaft.
    - The gearbox increases torque while sacrificing speed.
2. **Step Sequence**:
    - The motor operates using a 4-phase sequence, with each coil energized in turn.
    - A typical driver like the ULN2003 controls the sequence of current through the coils.
3. **Steps Per Revolution**:
    - The motor has 32 steps per full rotation of the internal rotor.
    - After applying the gearbox, the effective steps per output revolution become: Steps Per Revolution=32×63.6839=2048 steps\text{Steps Per Revolution} = 32 \times 63.6839 = 2048 \, \text{steps}Steps Per Revolution=32×63.6839=2048steps
4. **Driving the Motor**:
    - It requires a stepper motor driver (e.g., ULN2003 or L293D) to control the sequence of coil energization.

Summary of Key Features

- **Type**: Unipolar stepper motor.
- **Size**: 28 mm diameter.
- **Gear Ratio**: ~1:64.
- **Step Angle**: 0.0879° (after gear reduction).
- **Wires**: Typically 5 (center tap included).
- **Advantages**: Compact, low power, high torque due to gearbox.

[How does a Stepper Motor work?]

[Stepper Motors with Arduino - Controlling Bipolar & Unipolar stepper motors]

[28BYJ-48 Stepper Motor Disassembly]

[What is a stepper motor?]