

Excitation Sequence of Stepping Motor and Driver Packages

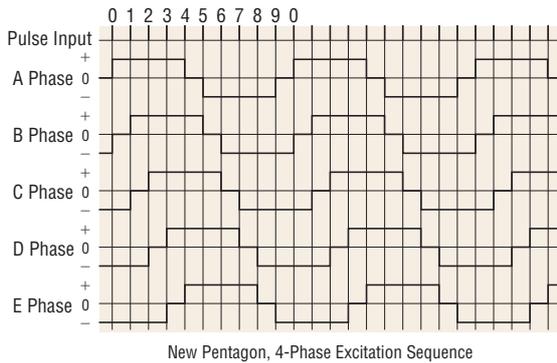
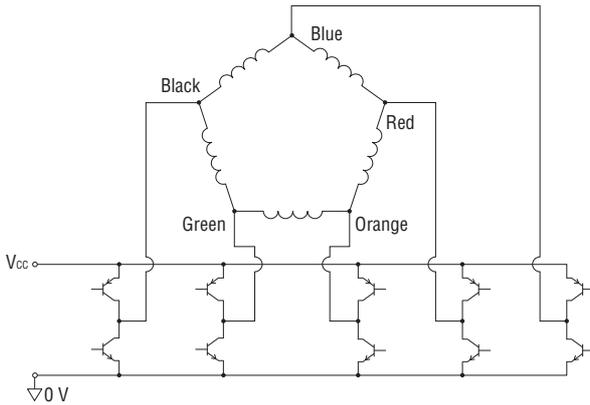
Every 5-phase motor and driver package listed in our catalogue consists of a New Pentagon, five-lead wire motor and a driver incorporating a special excitation sequence. This combination, which is proprietary to Oriental Motor, offers the following benefits:

- Simple connections for five leads
- Low vibration

The following sections describe the wiring and excitation sequence.

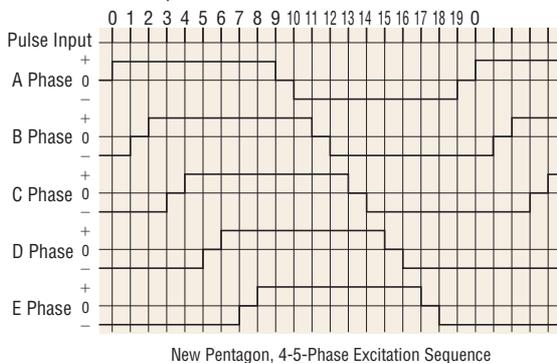
New Pentagon, 4-Phase Excitation: Full Step System 0.72°/step

This is a system unique to the 5-phase motor, in which four phases are excited. The step angle is 0.72° (0.36°). It offers a great damping effect, and therefore stable operation.



New Pentagon, 4-5-Phase Excitation: Half-Step System 0.36°/step

A step sequence of alternating the 4-phase and 5-phase excitation produces rotation at 0.36° per step. One rotation may be divided into 1000 steps.



Stepping Motor Drivers

There are two common systems of driving a stepping motor: constant current drive and constant voltage drive.

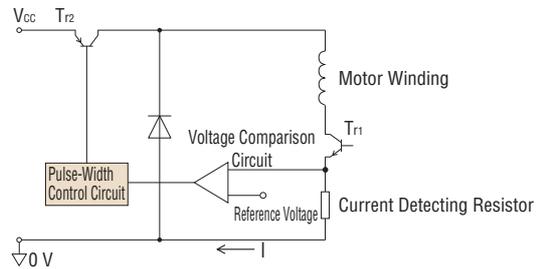
The circuitry for the constant voltage drive is simpler, but it's relatively more difficult to achieve torque performance at high speeds.

The constant current drive, on the other hand, is now the most commonly used drive method, since it offers excellent torque performance at high speeds. All Oriental Motor's drivers use the constant current drive system.

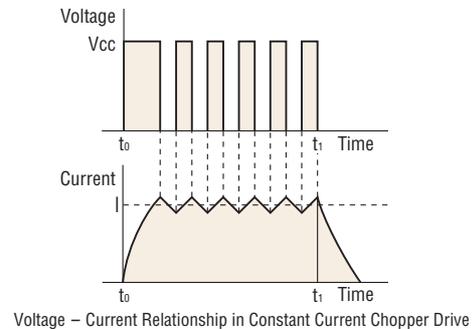
Overview of the Constant Current Drive System

The stepping motor rotates through the sequential switching of current flowing through the windings. When the speed increases, the switching rate also becomes faster and the current rise falls behind, resulting in lost torque.

The chopping of a DC voltage that is far higher than the motor's rated voltage will ensure the rated current reaches the motor, even at higher speeds.



The current flowing to the motor windings, detected as a voltage through a current detecting resistor, is compared to the reference voltage. Current control is accomplished by holding the switching transistor Tr2 ON when the voltage across the detecting resistor is lower than the reference voltage (when it hasn't reached the rated current), or turning Tr2 OFF when the value is higher than the reference voltage (when it exceeds the rated current), thereby providing a constant flow of rated current.



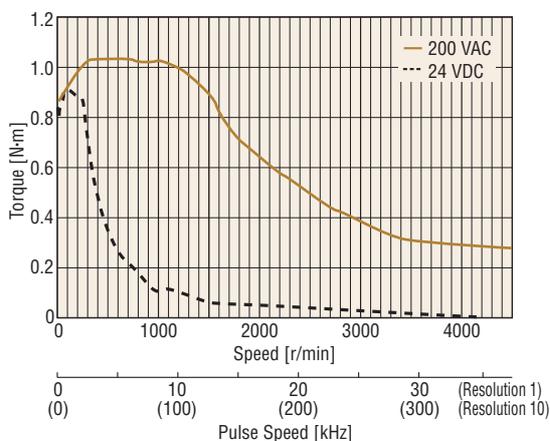
● Differences between AC Input and DC Input Characteristics

A stepping motor is driven by a DC voltage applied through a driver.

In Oriental Motor's 24 VDC input motor and driver packages, 24 VDC is applied to the motor. In the 200 VAC motor and driver packages the input is rectified to DC and then approximately 140 VDC is applied to the motor. (Certain products are exceptions to this.)

This difference in voltages applied to the motors appears as a difference in torque characteristics at high speeds. This is due to the fact that the higher the applied voltage is, the faster the current rise through the motor windings will be, facilitating the application of rated current at higher speeds. Thus, the AC input motor and driver package has superior torque characteristics over a wide speed range, from low to high speeds, offering a large speed ratio.

It is recommended that AC input motor and driver packages, which are compatible with a wider range of operating conditions, be considered for your applications.



● Microstep Drive Technology

Microstep drive technology is used to divide the basic step angle (0.72°) of the 5-phase stepping motor into smaller steps (up to a maximum of 250 divisions) without the use of a speed reduction mechanism.

◇ Microstep Drive Technology

The stepping motor moves and stops in increments of the step angle determined by the rotor and stator's salient pole structure, easily achieving a high degree of precision in positioning. The stepping motor, on the other hand, causes the rotor speed to vary because the motor rotates in step angle increments, resulting in resonance or greater vibration at a given speed.

Microstepping is a technology that achieves low resonance, low noise operation at extremely low speeds by controlling the flow of electric current fed to the motor coil and thereby dividing the motor's basic step angle into smaller steps.

- The motor's basic step angle (0.72°/full step) can be divided into smaller steps ranging from 1/1 to 1/250. Microstepping thus ensures smooth operation.
- With the technology for smoothly varying the motor drive current, motor vibration can be minimized for low noise operation.

◇ Up to 250 Microsteps

Thanks to the microstep driver, different step angles (16 steps up to 250 divisions) can be set to two step angle setting switches. By controlling the input signal for step angle switching via an external source, it is possible to switch the step angle between the levels set for the respective switches.

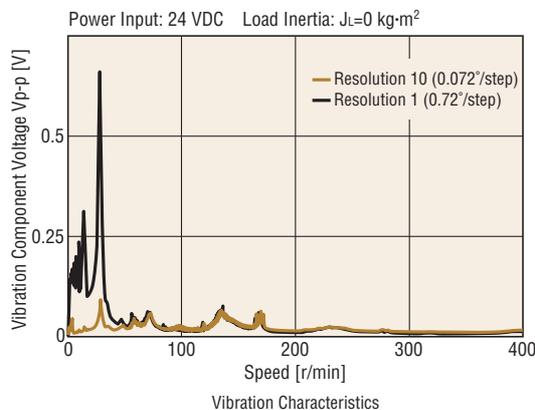
Features of Microstep Drive

● Low Vibration

Microstep drive technology electronically divides the step angle into smaller steps, ensuring smooth incremental motion at low speeds and significantly reducing vibration.

While a damper or similar device is generally used to reduce vibration, the low vibration design employed for the motor itself — along with the microstep drive technology — minimizes vibration more effectively.

Anti-vibration measures can be dramatically simplified, so it's ideal for most vibration sensitive applications and equipment.



● Low Noise

Microstep drive technology effectively reduces the vibration related noise level at low speeds, achieving low noise performance.

The motor demonstrates outstanding performance in even the most noise sensitive environment.

● Improved Controllability

The New Pentagon microstep driver, with its superior damping performance, minimizes overshoot and undershoot in response to step changes, accurately following the pulse pattern and ensuring improved linearity.

In addition, shock normally resulting from the motions of starting and stopping can be lessened.

