

## DESCRIPTION

## DISK DRIVE

## TECHNICAL FIELD

The present invention relates to a disk drive which controls the rotation speed of a rotary motor for rotating a disk.

## BACKGROUND ART

A disk drive is a device which searches for a target position on receipt of an instruction from an external device such as a host computer, reads target data from data recorded on a disk, and transfers the target data to the external device. It is premised that a CD (Compact Disk) and a CD-ROM (CD-Read Only Memory) are played back at a speed as fast as CLV (Constant Linear Velocity).

Computer peripheral equipment such as a CD-ROM player is required to perform high-speed search and high-and-constant-speed playback (high-and-constant-speed reading) without increasing the cost, and high-and-constant-speed reading at quadruple or octuple CLV is carried out when a CD-ROM is played back. However, in order to increase the search speed during the high-and-constant-speed reading at quadruple or octuple CLV, an expensive and large-sized spindle motor is required because the load applied to the spindle motor will be considerably large. Accordingly, in

recent years, there have been implemented a player which plays a CLV-recorded disk at CAV (Constant Angular Velocity), and a wide-range CLV system which has a very wide playback range although it is CLV playback and thereby enables both of high-speed search and high-and-constant-speed playback. Both of them can significantly reduce the load on the spindle motor, thereby realizing high-speed search using an inexpensive and small-sized motor.

Figure 3 is a diagram illustrating the structure of a conventional CD drive.

In figure 3, 100 denotes a disk supported by a clamper 101, and the disk 100 is rotated by a spindle motor 102 which is feedback-controlled by a signal processing circuit 110 via a spindle motor control circuit 103. Further, 105 denotes an optical pickup for reading a signal from the disk 100, and focusing and tracking are adjusted by focusing coil/tracking coil 106 which is controlled by a focusing/tracking control circuit 104. The optical pickup 105 is driven along the diameter of the disk by a traverse motor 108 which is controlled by a traverse motor control circuit 109. Further, 107 denotes an RF amplifier which extracts a focus error signal, a tracking error signal, and an RF signal from the output of the optical pickup 105, and 110 denotes a signal processing circuit which controls the traverse motor control circuit 109, the focusing/tracking control circuit 104, and the spindle motor control circuit 103. Further, 111 denotes a system controller which performs CLV/CAV switching, and

the system controller 111 is connected to the signal processing circuit 110 and to a signal processing circuit interface circuit 112.

Hereinafter, the operation will be described.

The RF amplifier 107 extracts a focus error signal, a tracking error signal, and an RF signal from signals read from the disk 100 by the optical pickup 105, and outputs them to the signal processing circuit 110. The signal processing circuit 110 generates control signals for focus servo and tracking servo from the signals supplied from the RF amplifier 107, and outputs these control signals to the focusing/tracking control circuit 104. Further, the signal processing circuit 110 generates an EFM signal by binary-coding the RF signal, and generates a phase-locked loop (PLL) clock which is in synchronization with the EFM signal to read the EFM signal.

The frequency of the PLL clock signal is 4.3218MHz at CLV, and it is variable in a range of  $\pm$  several tens %. The rotation speed of the spindle motor 102 varies according to the track position where the optical pickup 105 reads data so that the frequency of the PLL clock is kept constant, i.e., so that the disk 100 rotates at CLV. The signal processing circuit 110 processes a rotation speed detection signal 200 from the spindle motor control circuit 103, and outputs a spindle motor control signal 201 to the spindle motor control circuit 103 so that the rotation speed is accelerated as the optical pickup 105 moves

from the peripheral portion of the disk 100 toward the center.

On the other hand, at CAV, the signal processing circuit 110 processes the rotation speed detection signal 200 from the spindle motor control circuit 103, and outputs the spindle motor control signal 201 to the spindle motor control circuit 103 so that the disk 100 rotates at CAV.

Further, since the rotation speed detection signal 200 is continuously output so long as the spindle motor 102 rotates even when the RF signal is absent, this signal 200 can be used for confirming the rotation state of the spindle motor 102. That is, in the conventional CD drive, the rotation state of the spindle motor 102 can be confirmed by monitoring the rotation speed detection signal 200 with the signal processing circuit 110 even when focusing or tracking deviates or when focus servo or tracking servo does not work normally, whereby the spindle motor 102 is prevented from abnormally rotating or stopping.

However, in the case where a brushless motor is used as the spindle motor, which brushless motor has one hall sensor along the inner periphery of a stator and generates a pulse output of Lo/Hi twice by one rotation, the width of one pulse of the rotation speed detection signal which is the output from the spindle motor control circuit for detecting the rotation speed of the spindle motor becomes 4.3msec in high-speed rotation, for example, 7000rpm, and it becomes 150msec in low-speed rotation, for example, 200rpm. Accordingly, when the rotation speed of the

spindle motor is detected using the rotation speed detection signal, the width of one pulse of the rotation speed detection signal becomes larger in the low-speed rotation than in the high-speed rotation and, therefore, detection of the rotation speed takes longer time in the low-speed rotation than in the high-speed rotation.

The present invention is made to solve the above-described problem and has for its object to provide a disk drive which can detect the rotation speed of the spindle motor in a short time even when the spindle motor rotates at a low speed.

#### DISCLOSURE OF INVENTION

A disk drive according to the present invention is provided with a rotation speed detection means for detecting the rotation speed of a rotary motor, and a rotation speed detection interval changing means for changing the rotation speed detection intervals of the rotation speed detection means. When the rotation speed of the rotary motor is lower than a predetermined speed, the rotation speed detection intervals of the rotation speed detection means are made shorter. Thereby, even when the rotary motor rotates at a speed lower than the predetermined speed, the rotation speed of the rotary motor can be detected in a short time, resulting in stable disk control.

#### BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a block diagram of a preferable CD drive according to the present invention, Figure 2 is a diagram illustrating signal waveforms for explaining the operation of changing the rotation speed detection intervals of a spindle motor control circuit included in this CD drive, and Figure 3 is a block diagram of a conventional CD drive.

#### BEST MODE TO EXECUTE THE INVENTION

In order to explain the present invention in more detail, the present invention will be described with reference to the drawings attached hereto.

Figure 1 is a block diagram of a preferable CD drive according to the present invention. In figure 1, the same reference numerals as those shown in figure 3 denote the same or corresponding parts. This CD drive is obtained by providing the spindle motor control circuit 103 of the conventional CD drive shown in figure 3 with a rotation speed detection interval changing circuit 113 for changing the rotation speed detection intervals of the spindle motor control circuit 103.

Hereinafter, the operation of changing the rotation speed detection intervals of the spindle motor control circuit 103 will be described.

Figure 2 is a diagram illustrating signal waveforms for explaining the operation of changing the rotation speed detection intervals of the spindle motor control circuit. As shown in

figure 2, when the rotation speed of the spindle motor 102 is lower than a predetermined speed, the signal processing circuit 110 outputs a rotation speed detection interval changing signal 202 to the rotation speed detection interval changing circuit 113 in the spindle motor control circuit 103 so as to make the rotation speed detection intervals shorter.

For example, in the case of using, as the spindle motor, a brushless motor having three hall sensors in positions shifted by  $120^\circ$  (electrical angle) along the inner periphery of a stator, the signal processing circuit 110 changes the rotation speed detection intervals of the spindle motor control circuit 103 by outputting a rotation speed detection interval changing signal 202 to the rotation speed detection interval changing circuit 113 in the spindle motor control circuit 103, which signal 202 instructs the spindle motor control circuit 103 to use, for detecting the rotation speed of the spindle motor 102, only the output from one hall sensor when the rotation speed of the spindle motor 102 is higher than the predetermined speed, or the outputs from all of the three hall sensors when the rotation speed of the spindle motor 102 is lower than the predetermined speed. Thereby, the width of one pulse output from the spindle motor 102 rotating at the speed lower than the predetermined speed becomes shorter and, therefore, even when the spindle motor 102 rotates at the low speed, the rotation speed of the spindle motor 102 can be detected in a short time.

As described above, in the disk drive according to the present invention, when the rotation speed of the spindle motor is lower than the predetermined speed, the rotation speed detection interval changing means makes the rotation speed detection intervals of the spindle motor control circuit shorter. Therefore, even when the spindle motor rotates at a low speed, the rotation speed of the spindle motor can be detected in a short time.

#### APPLICABILITY IN INDUSTRY

As described above, the disk drive according to the present invention is available as a device for controlling the number of rotations of a rotary motor for rotating a disk, to be used in a device for writing or reading data by using disk-shaped recording media such as a CD, a CD-ROM, a CD-R (CD-Recordable), a CD-RW (CD-Re-Writable), a DVD-ROM (Digital Video Disc-Read Only Memory), and a DVD-RAM (Digital Video Disc-Random Access Memory).

## CLAIMS

1. A disk drive for rotating a disk with a rotary motor, and controlling the rotation speed of the rotary motor, comprising:

rotation speed detection means for detecting the rotation speed of the rotary motor; and

rotation speed detection interval changing means for changing the rotation speed detection intervals of the rotation speed detection means.

2. A disk drive as described in Claim 1, wherein said rotation speed detection interval changing means changes the rotation speed detection intervals of the rotation speed detection means, according to the rotation speed of the rotary motor.



---

This Sheet Has Been Replaced

