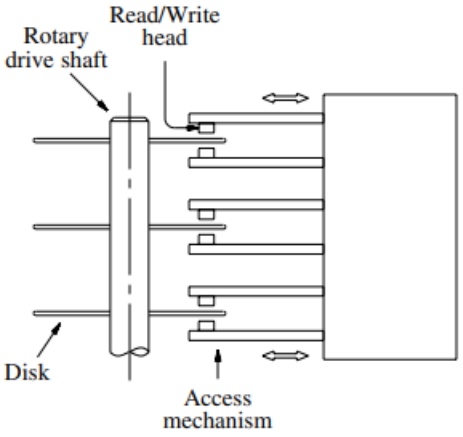
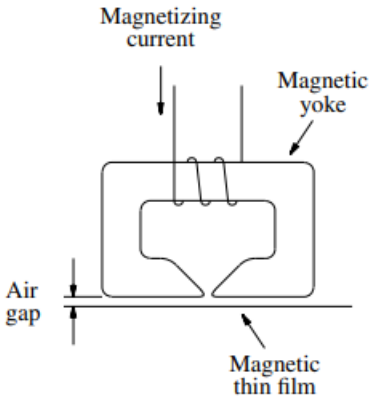
Magnetic Hard Disks

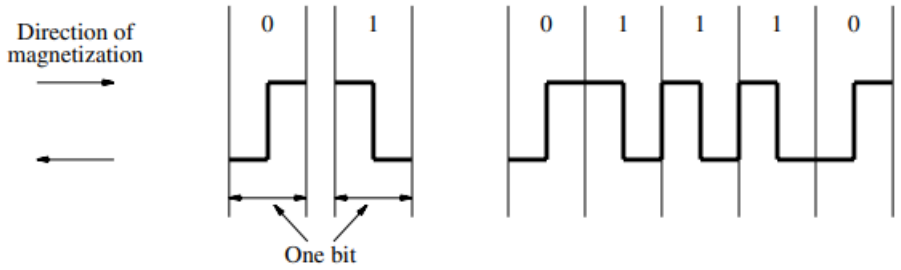
- The storage medium in a magnetic-disk system consists of one or more disk platters mounted on a common spindle.
- A thin magnetic film is deposited on each platter, usually on both sides. The assembly is placed in a drive that causes it to rotate at a constant speed.
- The magnetized surfaces move in close proximity to read/write heads, as shown in Figure 8.27a.
- Data are stored on concentric tracks, and the read/write heads move radially to access different tracks.
- Each read/write head consists of a magnetic yoke and a magnetizing coil, as indicated in Figure 8.27b.
- Digital information can be stored on the magnetic film by applying current pulses of suitable polarity to the magnetizing coil.
- This causes the magnetization of the film in the area immediately underneath the head to switch to a direction parallel to the applied field.



(a) Mechanical structure



(b) Read/Write head detail



(c) Bit representation by phase encoding

- The same head can be used for reading the stored information.

- In this case, changes in the magnetic field in the vicinity of the head caused by the movement of the film relative to the yoke induce a voltage in the coil, which now serves as a sense coil.
- The polarity of this voltage is monitored by the control circuitry to determine the state of magnetization of the film. Only changes in the magnetic field under the head can be sensed during the Read operation.
- Therefore, if the binary states 0 and 1 are represented by two opposite states of magnetization, a voltage is induced in the head only at 0-to-1 and at 1-to-0 transitions in the bit stream.
- A long string of 0s or 1s causes an induced voltage only at the beginning and end of the string. Therefore, to determine the number of consecutive 0s or 1s stored, a clock must provide information for synchronization.
- In some early designs, a clock was stored on a separate track, on which a change in magnetization is forced for each bit period. Using the clock signal as a reference, the data stored on other tracks can be read correctly.
- The modern approach is to combine the clocking information with the data. Several different techniques have been developed for such encoding.
- One simple scheme, depicted in Figure 8.27c, is known as phase encoding or Manchester encoding. In this scheme, changes in magnetization occur for each data bit, as shown in the figure. Clocking information is provided by the change in magnetization at the midpoint of each bit period.
- The drawback of Manchester encoding is its poor bit-storage density.
- The space required to represent each bit must be large enough to accommodate two changes in magnetization.
- We use the Manchester encoding example to illustrate how a self-clocking scheme may be implemented, because it is easy to understand. Other, more compact codes have been developed.
- They are much more efficient and provide better storage density. They also require more complex control circuitry.
- The read/write heads of a disk system are movable. There is one head per surface. All heads are mounted on a comb-like arm that can move radially across the stack of disks to provide access to individual tracks, as shown in Figure 8.27a.
- To read or write data on a given track, the read/write heads must first be positioned over that track