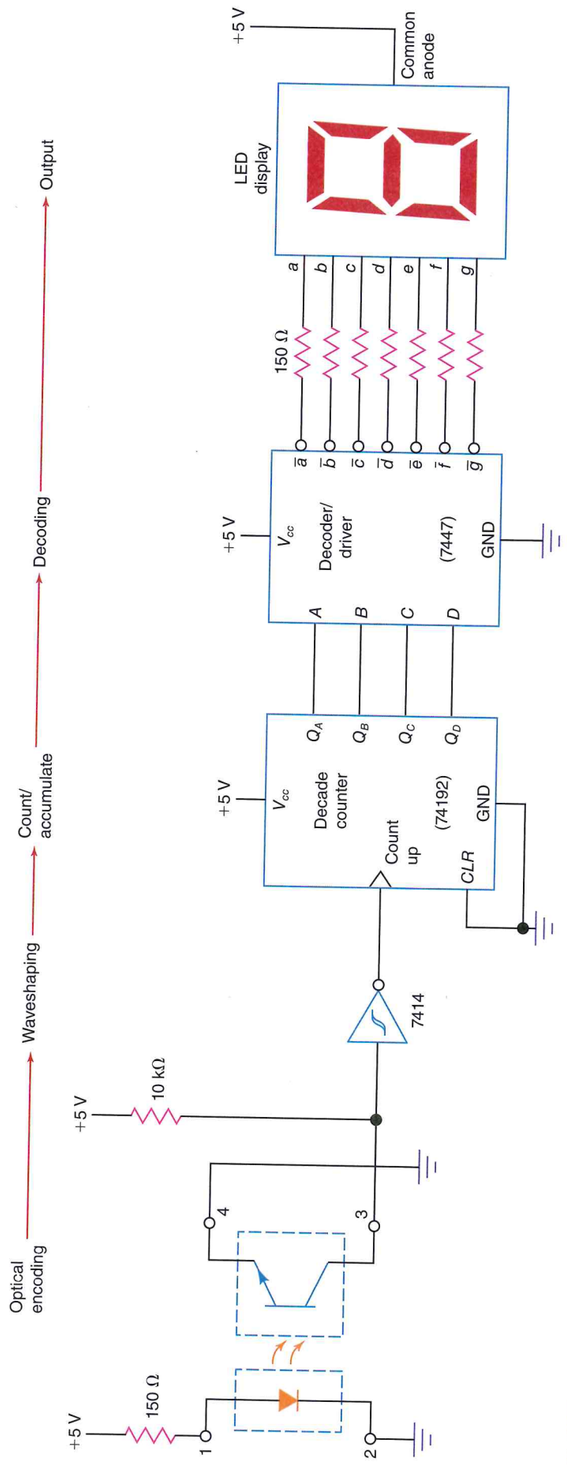


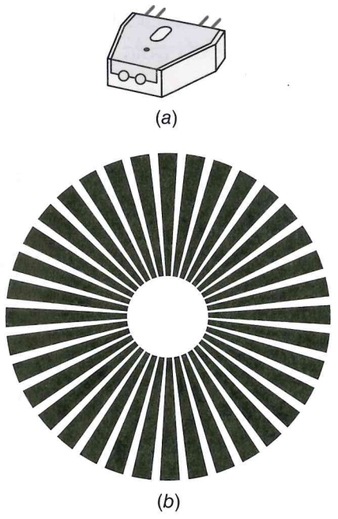
Fig. 8-26 Counter system using optical encoding.

Optical encoding

inverter goes from HIGH to LOW. When the opaque object is removed from the slot of the optocoupled interrupter module, the infrared light crosses the slot, striking the base of the phototransistor. The phototransistor is activated (turned on), and the voltage at pin 3 of the inverter goes from HIGH to LOW. Then the output of the waveshaper goes from LOW to HIGH, which will trigger the 74192 to count upward by 1. The 7447 IC decodes the BCD input to a seven-segment code and lights the appropriate segments on the LED display.

In summary, the optical encoder/counter system in Fig. 8-24(*b*) *increments* (one count upward) the count each time an opening in the encoder disk passes through the slot in the interrupter module. The optocoupled interrupted module uses infrared light so the ambient light does not cause false triggering. Remember that the infrared diode emits the correct wavelength of light for the phototransistor to detect.

Two common types of optical sensors are the slot-type module used in the last optical encoder/counter system and the *reflective-type sensor.* A sketch of a common reflective-type optical sensor is shown in Fig. 8-27(*a*). Notice that it has two holes in the front. One is an infrared-emitting diode, while the other is the receiver part of the optical sensor, which is



(*a*)

(*b*)

Fig. 8-27 (*a*) Reflective-type optical encoder. (*b*) Shaft encoder disk used with reflective-type optical encoder.

Types of optical sensors

a phototransistor. This reflective-type optical sensor is carefully aimed at a target such as the disk shown in Fig. 8-27(*b*). The white areas reflect light and turn on the output phototransistor, while the dark stripes absorb light and turn off the phototransistor.

Self-Test

Supply the missing word or words in each statement.

56. Refer to Fig. 8-24(*b*). The _____ (decoder, interrupter module) is the device that does the job of optical encoding in this circuit.
57. Refer to Fig. 8-25(*a*). The diode on the emitter side of the interrupter module gives off _____ (infrared, ultraviolet) light.
58. Refer to Fig. 8-25(*a*). The _____ (phototransistor, germanium transistor) on the detector side of the interrupter module is sensitive to infrared light and does not trigger because of white room light.
59. Refer to Fig. 8-24(*b*). The optical sensor being used in this system is classified as a _____ (reflective-type, slot-type) module.
60. Refer to Fig. 8-26. The count on the display increments when the output of the Schmitt-trigger inverter goes from _____ (H to L, L to H).
61. Refer to Fig. 8-24(*b*). The count on the display increments when the encoder disk opening just _____ (enters, leaves) the interrupter module.
62. Refer to Fig. 8-26. The 74192 operates as a _____ (decade, mod-16) counter in this circuit, and it also performs the task of _____ (decoding the count, temporarily storing the count).