This example is focused on the well-known biphase encoder, which supplies tachometric signals from a displacement sensor and thus helps control high-speed digital plotters and similar mechanisms driven by commutating rather than stepping motors. It provides control signals to a counter, which records actual displacement. These count-up and count-down signals are obtained by means of an interpretation and manipulation of the transitions of two input signals, S_1 and S_0, produced, for instance, by two LED/phototransistor pairs which straddle a slotted disk on a motor shaft (Figure 11). The two sensors, circumferentially separated by $2N\pi \pm \pi/2$ cycles of the land/gap sequence around the disk's periphery, yield the S_1 and S_0 outputs shown in Figure 12. The positional states of the disk and their corresponding state diagram, shown in Figure 13, describe the device as a finite-state automaton.

Figure 14 shows a hardware implementation. The circuit requires 70 gate leads to five, 14-pin TTL chips plus 16 more to the resistors and capacitors.

INCREMENTAL ANGULAR DISPLACEMENT ENCODER

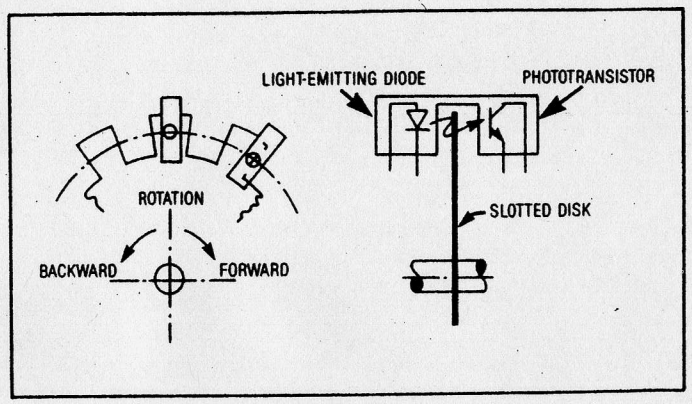

Figure 11. Biphase encoder hardware.

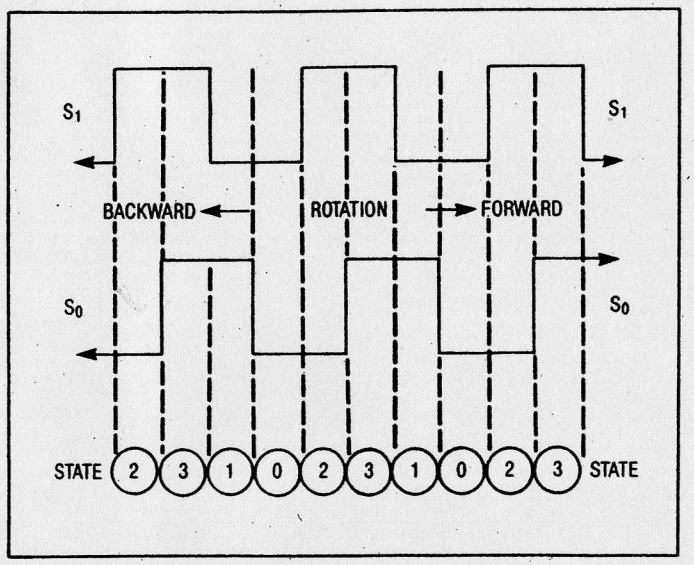

Figure 12. Biphase encoder outputs. The outputs can be analyzed in terms of four states.

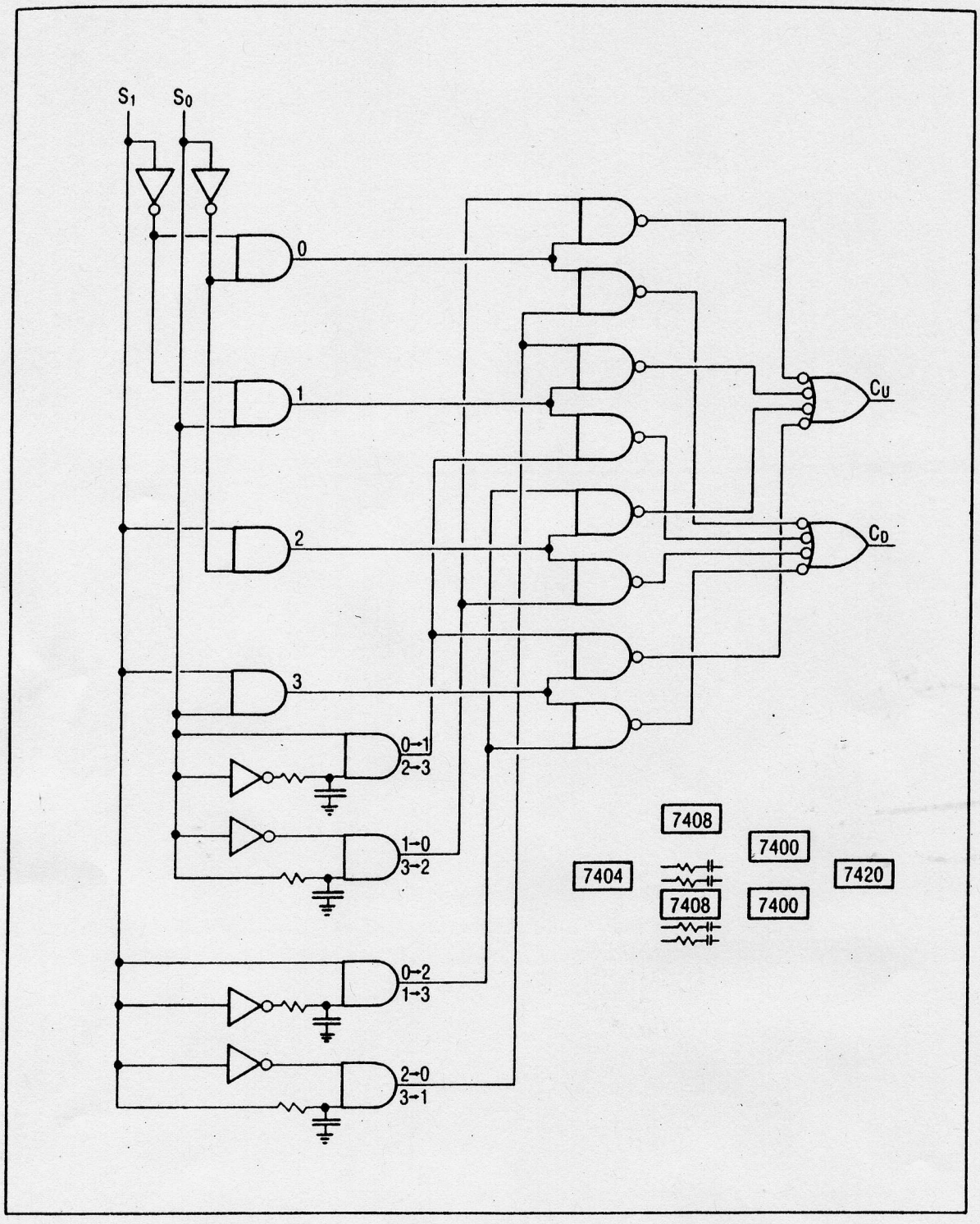

Figure 14. A hardware implementation of the biphase encoder.