
Secondary inputs and outputs

In addition to the primary I/O devices—the keyboard and display—there are several secondary input and output devices in the Apple IIe. These devices are

- ☐ the speaker (output)
- ☐ cassette input and output
- ☐ annunciator outputs
- ☐ strobe output
- ☐ switch inputs
- ☐ analog (hand control) inputs

These devices are similar in operation to the soft switches described in the preceding section: you control them by reading or writing to dedicated memory locations. Action takes place any time your program reads or writes to one of these locations; information written is ignored.

Important

Some of these devices *toggle*—change state—each time they are accessed. If you write using an indexed store operation, the Apple IIe's microprocessor activates the address bus twice during successive clock cycles, causing a device that toggles each time it is addressed to end up back in its original state. For this reason, you should read, rather than write, to such devices.

Electrical specifications of the speaker circuit appear in Chapter 7.

The speaker

The Apple IIe has a small speaker mounted toward the front of the bottom plate. The speaker is connected to a soft switch that toggles; it has two states, off and on, and it changes from one to the other each time it is accessed. (At low frequencies, less than 400 Hz or so, the speaker clicks only on every other access.)

If you switch the speaker once, it emits a click; to make longer sounds, you access the speaker repeatedly. You should always use a read operation to toggle the speaker. If you write to this soft switch, it switches twice in rapid succession. The resulting pulse is so short that the speaker doesn't have time to respond; it doesn't make a sound.