BUILD THE ALTAIR 8800 MINICOMPUTER

PART TWO

Practical use of the computer, including programming

BY H. EDWARD ROBERTS AND WILLIAM YATES

LAST MONTH, we discussed the various subassemblies used in the basic Altair 8800 computer, went into details on how it is assembled, and listed a few applications. Here, we will describe a test program to be used in checking operation and then focus on practical uses and go through a software example to familiarize you with some operating procedures.

Test Program. The following simple program is used for initial testing of the computer's operation. It also illustrates how a program is loaded and run. The selected program will add two numbers stored at address locations 128 and 129 and store the result at address location 130. The procedure is as follows:

1 Set the power switch to ON and momentarily toggle the RESET switch. (Note: Excluding the power switch, all bottom-row switches on the front panel are spring-loaded, momentary-action types. The switches automatically return to their center-off positions when released from either of their operate positions. When instructed to operate any of the bottom row switches, momentarily throw it to the position indicated and release it.)

2 Set address switches *A0* through *A15* all to the 0 positions (down). Operate the EXAMINE switch, which should cause address LED's *A0* through *A15* to extinguish to indicate that location 0 is ready. (Some of the data LED's, *D0* through *D7*, might be illuminated, indicating the current contents at location 0.)

3 Next, store the load accumulator instruction at location 0 by using the binary number for 58 (00111010). Set this binary input up by using switches *D0* through *D7*, with a 1 represented by the switch in the up position and a 0 with the switch in the down position. Hence the switch sequence for 00111010 would be: *D7* down, *D6* down, *D5* up, *D4* up, *D3* up, *D2* down, *D1* up, *D0* down. Store this number at location 0 by operating the DEPOSIT switch. The *D0* through *D7* LED's should now match these settings, with a lighted LED indicating a 1 and a darkened LED indicating a 0. None of the *A0-A15* LED's should be on indicating location 0. The load accumulator instruction now tells the computer that the next two entries will be an address number (16 bits). Upon program execution, the data stored at that address number will be transferred to the accumulator.

4 Address numbers, such as address 128, are expressed in 16-bit binary format. The least-significant bits (last eight) are stored in the first memory location following the load accumulator instruction, while the most-significant bits are stored in the second memory location. Set *D0* through *D7* for 10000000 (128) and operate the DEPOSIT NEXT switch. This number is now stored, in binary form, at memory location 1. (*A0* LED should be lit indicating location 1.) Set *D0* through *D7* all to 0 and operate the DEPOSIT NEXT switch. The all-zero binary number is now stored at memory location 2 (*A1* LED is lit) and the computer has been instructed to put the contents of address 128 into the accumulator.

5 To add a second number to the current number stored in the accumulator, the computer must be instructed to transfer the current number to one of the general-purpose registers. In this example, we will use register B. The instruction used is "move A to B," where A is the accumulator. The code for this instruction is 01000111, set up with switches *D0* through *D7*. Operate the DEPOSIT NEXT switch. The instruction "move A to B" is now stored at memory location 3. (*A1* and *A0* lit.)

6 Now, instruct the computer to load the data from address 129 into the accumulator. This procedure is identical to that outlined in steps 3 and 4 above. Set switches *D0* through *D7* for 00111010 and operate the DEPOSIT NEXT switch. The load accumulator instruction is now stored at memory location 4. (*A2* lit.) Set *D0* through *D7* for