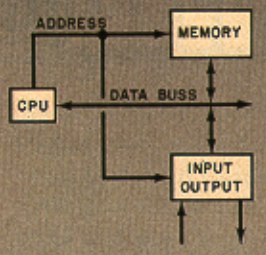

Fig. 1. Basic block diagram of computer parts and operation.

In an upcoming issue, we will describe how to build a low-cost CRT-type terminal that can be used with the computer and can also be mated with any time-sharing computer by telephone.

About the Computer. A computer is basically a piece of variable hardware. By changing the bit pattern stored in the memory, the hardware (electronic circuitry) can be altered from one type of device to another. When the bit pattern, and thus the hardware, is changed, we have what is referred to as "software." Any type of variable instruction (programming)—such as Basic, Fortran, Cobol, Algol—is generally classified as software.

To cause it to vary the hardware, you must communicate with the computer. In the case of the 8800, this is done by setting the bit pattern on the front-panel switches in accordance with a set of instructions (provided with the Intel 8080 LSI chip). For example, the 8800 computer will automatically add when a specific bit pattern (10000010) is received. By setting address and data switches, a complete program of up to 78 steps in the basic computer can be inserted into the processor. If extensive programming is to be performed, an assembler or higher language is used. With an assembler, the person doing the program simply types the word "add" on the device. (In Basic and Fortran, a + is used instead.)

Fundamental programming concepts are simple enough to master in a relatively short time. However, to become an efficient programmer requires a lot of experience and a large amount of creativity.

The block diagram of the basic 8800 computer (or any computer, for that matter) is shown in Fig. 1. It consists of the following subsystems:

CPU. The heart of the computer is the CPU, or central processor unit. See fig. 2. The CPU performs all the calculations, generates system timing, and makes all decisions. Of particular importance are the decisions the CPU makes concerning what device should have access to the data buss. It makes these decisions by sending status information at the beginning of each computer cycle, telling the memory and the input/output what to expect for the rest of the cycle.

The CPU contains the program timer, sometimes called the P counter. This device keeps track of the current location in the memory that the processor is using. Also located in the CPU is the arithmetic unit.

The CPU used in the 8800 computer, the Intel 8080 LSI chip, is relatively expensive in quantities of one. It was selected, however, because it serves to create a minicomputer whose performance competes with current commercial minicomputers. In practice, a lower-performance processor would have been adequate for the majority of the tasks the user might wish to initially define. But the problem with the lesser-power approach is that relatively little money would be saved, and it would be doomed to near-future obsolescence for practical purposes. Our intent here was to produce a processor with more than enough power to handle any job.

Still another consideration was programming. The larger the instruction set, the easier the computer is to program. The 8080 chip has 78 instructions, which is almost twice that of the next power level CPU available (Intel's 8008), which is really designed for use as a buffer.

The CPU contains eight general-purpose registers, P counter, arithmetic unit, accumulator, stack pointer, instruction decoder, and miscellaneous timing and control circuits. The arithmetic unit is of special interest because it contains the circuitry required to perform arithmetic in both decimal and binary formats.

The stack pointer is the register that keeps track of the subroutine addresses. The 8800 computer is capable of performing an almost unlimited number of subroutines, a feature not available with other microprocessors and absent in many minicomputers.

The instruction decoder is the core of the variable-hardware concept. It

PARTS LIST

C1, C5 to C13—0.1-μF disc capacitor
C2—0.01-μF disc capacitor
C3, C4—100-pF disc capacitor
C14 to C20—0.001-μF disc capacitor
IC1—8080 central processing unit IC (Intel)
IC2 to IC5—74L74 IC
IC6 to IC14—8T97 IC
IC15, IC17—7402 IC
IC16, IC32, IC33—7404 IC
IC18 to IC20, IC51—74123 IC
IC21—7473 IC
IC22 to IC24, IC50—7400 IC
IC25—7430 IC
IC26—7410 IC
IC27 to IC31, IC39 to IC41—7405 IC
IC34, IC35—8111 IC
IC36—74L30 IC
IC42 to IC49—74L00 IC
IC52—7406 IC
IC53 to IC58—8111 IC (optional)
LED1 to LED36—Panel-type, red light-emitting diode
(Note: Following are resistors ½-watt, 10% tolerance)
R1, R3, R9 to R31, R56—1000 ohm
R2, R4, R7, R8—330 ohm
R5, R33 to R37—2200 ohm
R6—7500 ohm
R32—100 ohm
R38, R48 to R55—10,000 ohm
R39—200,000 ohm
R40 to R47—470 ohm
R57 to R92—220 ohm
S1 to S16, S25—Spst miniature toggle switch
S17 to S24—Spdt spring-loaded, momentary-action miniature toggle switch
XTAL—2-MHz crystal
Misc.—Metal case; power supply (see text); line cord; multiconductor ribbon cable; mounting hardware; solder; etc.

Note: The following items are available from MITS, Inc., 6328 Linn N.E., Albuquerque, NM 87108 (Tel.: 505-265-7553): partial kit No. 8800PK (includes pc boards and all electronic components (but not case, switches, or power supply), $298; complete kit No. 8800K (contains all parts, including ready-to-use case, switches, and power supply), $397; Completely assembled and tested Model 8800A computer (includes 90-day warranty), $498. Prices do not include postage or delivery charge. Both kits include detailed assembly and operating manual. A FREE set of etching and drilling guides, component-placement diagrams and miscellaneous information is available from the kit supplier (send self-addressed 8½" × 11" envelope with 40c postage). Check supplier or manufacturer for latest ICI price, available separately.