Computers on the Farm - What Are They?[1]

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Trade magazines have presented articles boasting about the great merits of using a small computer for managing the farm business. However, potential computer users have difficulty understanding the functions a computer performs. It is often thought of as a black box with inner workings which are not easily understood. The following discussion is intended to help give you a better understanding of what this black box does, what pieces of equipment are used to make a complete computer system, and what potential uses it might have for your business.

Accountant Functions

The computer functions similarly to your accountant at tax time. Its advantage over your accountant is the flexibility to tackle other tasks. The computer has a defined set of RULES needed to accomplish a task and gives you a defined set of results.

The basic functions of a tax accountant at tax time can be divided into five areas: RULES, INPUT, PROCESSING, STORAGE AND OUTPUT. Your accountant works by a predefined set of RULES and calculations when preparing tax forms. The information required by these calculations is called the INPUT. In the case of tax time, the

summaries of the cash record, check stubs, and other financial data are the INPUT. Your accountant accepts the INPUT and, using a calculator and an understanding of the tax laws, begins processing the information according to the calculation RULES. Intermediate results are stored for later use.

This STORAGE may be in the mind of the accountant as internal or temporary storage, or it may be on a scratch pad which serves as the external or peripheral storage device. The result of the calculations is the OUTPUT. In the example of tax time, this may be the dollars you owe the government. The hand and a pen or pencil are used by your accountant as the output device or output writer.

Computer Functions

Using these functions of your tax accountant as a parallel, let's define the five basic functions of a computer: RULES, INPUT, PROCESSING, STORAGE and OUTPUT. The size of the computer is not important for describing these functions. However, computer size may be important, depending on its application.

The RULES are the set of instructions defined by a programmer and carried out by the computer or hardware. These instructions are necessary for the

hardware to accomplish any tasks. A set of RULES is called a program. Programs are frequently referred to as "software".

INPUT is basically the communication from the user to the computer. The INPUT information is then transferred to STORAGE. The STORAGE is generally of two types: internal memory and external memory. Internal memory is used for the storage of information programs for rapid access during the PROCESSING functions. External memory is long-term storage. You can access internal memory in your mind very quickly, but external memory access, such as reading from a piece of paper, is slower. The same is true of a computer. Its internal memory is limited, but its access to peripheral memory is generally not. The time to retrieve data is generally greater for peripheral memory than for internal memory.

The PROCESSING function follows the instructions specified by the program, obtaining information from INPUT or STORAGE as necessary, and returning intermediate results to internal memory or external memory as appropriate. Since the processor can communicate with the memory, a series of instructions can be stored in the internal memory. The processor will complete those instructions when required.

The result of the computer's PROCESSING is the OUTPUT. OUTPUT can be communicated directly to the user, or it can be sent to external memory to be used as INPUT at a later time. An OUTPUT device can accept information which has been stored in either internal or external memory and display it in user readable form.

The computer is a working system of parts and components. What we have just described is a simplified computer.

The Parts That Make the Whole

The physical parts which make up a computer are the hardware. The following sections relate the functions of a computer, as previously defined, to the hardware often used.

The INPUT Function

Small computers generally use a typewriter style keyboard for communicating information from the user to the computer. Keyboards are not all laid out the same. In general, it is important to purchase, if possible, a full-size keyboard that approximates the IBM Selectric Typewriter pattern. If a lot of numerical data must be entered, a numeric keypad is useful.

The PROCESSING Function

The hardware pieces which embody the PROCESSING function are the heart of the computer. In large computers the logic and computation takes place in the processing unit, often using many integrated circuit (IC) chips. Technological improvements, reducing the size of these electrical parts, have allowed the grouping of many electrical components onto single silicon wafers, or IC chips. The processor unit was reduced in size and placed on one chip, hence the term microprocessor. The microprocessor is the

computational and logic center of the small computer.

The STORAGE Function

The STORAGE function is divided between two components: internal memory and peripheral memory. Internal memory generally provides rapid access by the microprocessor to the stored information and programs. External memory can store larger amounts of information, but with slower access by the microprocessor. Programs and information can be copied from external memory into internal memory and then either used and discarded or modified and returned to external storage.

The basic unit of memory is the byte. One byte is roughly equivalent to one character. A character would be the letter "A" or the digit "1". The memory space is typically organized so that 1024 bytes are grouped together and called "1 kilobyte" or "1 K". Memory designations are usually defined as so many "K" in size. A 32 K memory has 32 units of 1024 memory locations available, each location storing 1 character or byte of information.

Internal Memory

The computer can use either internal memory or peripheral memory for storing information. The internal memory is available for immediate use. Internal memory is of two types; (1) ROM - read only memory, and (2) RAM - random access memory. A computer will always have some RAM and may also have some ROM.

The read only memory (ROM) as the name indicates, can only supply the contents of its memory space to the microprocessor; the information stored in ROM cannot be changed by the PROCESSING function. ROM is usually a small portion of the internal memory used for storing permanent information necessary to the computer's functioning.

The random access memory (RAM) is most properly called the read-write memory. RAM generally comprises the majority of the computer's internal memory. RAM is used for storing instructions, INPUT information, intermediate results, and OUTPUT information prior to being sent to an output device.

The maximum internal memory of a computer is limited by the hardware design. If a computer is designed to have a maximum 64 K bytes (64 x 1024) of memory locations in the internal memory and the computer manufacturer filled 8 K bytes (8 x 1024) of the available space with ROM (read only memory), 56 K bytes (56 x 1024) of memory are left available for the user. Assume the computer is used to analyze financial information. The program may require 32 K bytes of memory. How much memory is left for storage of the input information? 64 K max. - 8 K ROM — 32 K RULES = 24 K bytes of usable space, or 24 x 1024 bytes or 24,576 characters.

External Memory

The finite size of the internal memory is a great disadvantage. Peripheral memory is less expensive per byte of information stored and can store more information than internal memory. Peripheral memory generally uses a magnetic media for storage.

Audio Cassette Storage

An audio cassette recorder can be used to store information in magnetic form. A tape storage system provides large volumes of storage with good reproducibility and secure storage. The low cost of the cassette recorder and tape makes this system attractive. The major disadvantages with audio cassettes are the slow rate of information transfer to the computer and the serial nature of the tape.

Imagine that you are Harold Zimmerman's accountant. Harold

telephones and wants to know next month's projected accounts payable status. To get Harold's information you must start at File A and search serially through every character of every line until you read Harold Zimmerman's file. Harold will likely look for a new accountant and find one before you find his information. The audio cassette searches its storage space in a serial fashion, character by character, until it finds a string of characters that look like "Harold Zimmerman".

Diskette Storage

Diskette storage uses a magnetic storage media similar to tape. The storage media is a round disk. The most common diskettes used on small computers are called floppy diskettes because they are made of a thin, flexible magnetic media. The diskette is sold with a square package covering the recording media. A hole is provided at the center of the package so that the recording media may be rotated within the protective package. The package protects the recording media from scratches, dust and fingerprints, all of which can reduce or destroy the quality of the information recorded.

The diskette removes the need to serially search through all the information by subdividing the disk into circular tracks concentric to one another. A moveable record-read head and small opening in the packaging material allow moving the record-read head mechanically to a given track and then reading the track character by character to locate the desired information.

Hard Disk Storage

Users with many programs or large volumes of data might want to consider a hard disk system. This system operates like the diskette except that the disk is rigid. Access to information on the disk is generally faster than with diskettes.

Winchester style hard disks are packaged in a vacuum enclosure which reduces dust problems and produces a storage medium of extremely high density. Cost is usually 4 to 10 times the cost of a single diskette drive; the storage volume is also many times greater.

The OUTPUT Function

Output devices offer the user a greater selection than do input devices. Output devices are generally video screens or devices that print on paper.

Video Output Devices

Video output devices are called monitors, CRT's (cathode ray tube) or VDM's (video display monitor). All are similar to a television set. A television set can be used with many small computers to display output. However, most users say that use of a television for other than short periods of time leads to eye fatigue and strain.

Video display devices for small computers utilize white, green or gray letters on a black background. Green or gray letters are preferred for ease of viewing. These devices come in a variety of sizes. In general, it is best to buy a display device that can display at least 24 lines of 80 characters each.

Paper Oriented Output Devices

It would be very time-consuming to copy the material from the video display. For this reason you will probably want to buy a device called a printer. Printers accept character information from the computer and transfer it to paper.

A dot matrix printer forms each letter, symbol or number using a pattern of dots. A variation of this technique produces better quality print by over printing a line a second time, adding dots between dots.

The formed character printer utilizes a rotating print device containing the letters, symbols or numbers, and gives print quality similar to that of a good typewriter. The quality of the print is generally better than for dot matrix printers, but it costs more. The interchangability of the print device allows the use of several different print styles on the same machine.

The Modem

A combination input-output device that will be useful for the farm computer is the modem. The modem is used to allow communication with other computers over telephone lines.

The advantage of the modem is the access it allows to large main frame computers. The user generally pays for the phone call and a usage charge. Connection to other computers, no matter what size, is possible and provides a broader range of accessible information.

Minimum System Recommendations

When planning to buy a small computer for your farm business, keep the following recommendations in mind:

(1) The user available internal memory capacity purchased should be at least 48 kilobytes. Most computer languages will occupy 10-12K of memory. Application programs will often use 30-32K of memory. Look carefully at your software memory requirement before purchasing less than 48K of memory. The cost of additional memory is cheap, especially relative to the convenience it provides.

(2) Buy a full size keyboard. The importance of a comfortable input terminal will be obvious after a short period of time. If a lot of

numerical data will need to be entered, a numeric keypad is an important input device.

(3) Buy a good quality video output device that handles 80 characters on a line, preferably displaying 24 lines at a time.

(4) Buy at least 300K of diskette storage, including at least one, preferably two, diskette drives.

One drive will usually contain program instructions while the other drive will store program input and results.

(5) Buy a printer. Your business must have records on paper; copying information from the video screen is laborious. Choose the type of printer based on the print quality needs of your business.

Other Extension Publications

Computers on the Farm
Extension Bulletin E-1638

Computers on the Farm -
Software Selection
Extension Bulletin E-1666

Computers on the Farm -
Purchasing a System
Extension Bulletin E-1667