



I.C.T 1900 SERIES

EXECUTIVE PROGRAM FOR CENTRAL PROCESSORS 1902 and 1903

DESCRIPTION

Executive is the name given to a program which, when the Central Processor is in normal operational use, is always present in the core store. This program varies in size according to the requirements of the installation. The main functions performed by Executive are:—

- 1 Interpretation and execution of the operator's commands to the system, and provision of information for the operator concerning normal running incidents in the object program and peripheral devices needing attention.
- 2 The control of data transfers to and from peripheral devices including checking that the transfer was successful, and where appropriate, attempting to correct any failures.
- 3 To provide facilities in the instruction code without involving extra electronic circuits (some of these functions, e.g. division, are in fact performed by hardware in processors higher in the series).

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Operator communication

The operator communicates with the Executive program by means of the console typewriter. This is an input/output typewriter, allocated permanently to the Executive, and provided with buttons to allow the operator to indicate that he wishes to insert a message on the keyboard. When the operator presses the 'INPUT' button, Executive will be entered as soon as the object program has completed its current instruction, and the operator can then type one of the standard messages to load and enter another program, or to dump the current program, or to suspend the program to await a further operator instruction. Executive reports on the failure of peripheral equipment, such as parity failures and the necessity for attention to such things as 'paper out' on the line printer or the tape punch.

Loading and storing program

The main types of message entered by the operator on the typewriter concern the loading and starting of programs. Executive reads the program into the store starting at the next available address following Executive's own area.

Control of Peripherals

All transfers of data to or from peripheral devices are requested by means of voluntary entries to Executive. While the Central Processor is in Executive mode certain instructions are available which enable Executive to send signals to the actual logical elements which control the peripheral devices (e.g. Start, Read, Write, Disengage), and to obtain responses from those elements which indicate the status of the devices (e.g. Busy, Transfer Ended).

When a peripheral transfer is requested by the program, Executive decodes the function by examination of the instruction causing the entry and

identifies the actual peripheral devices referred to. If the device is busy the program will be suspended until it becomes free. When free, Executive tests whether the transfer will exceed the limits of the store and then transfers the control word to the peripheral control area to start the operation. Having initiated the transfer which will continue autonomously by hardware, Executive returns control to the object program unless there is another peripheral requiring attention.

The object program can ask Executive whether a peripheral transfer is complete, so that alternate buffer areas may be used, and when one area is undergoing a transfer the other area of data can be processed.

Failure of a transfer is detected by Executive, which arranges to repeat, if possible, the transfer up to a predetermined number of times before notifying the operator. If the transfer cannot be carried out because of conditions requiring operator attention, such as 'paper out' on the line printer, the program is held up and the operator notified. After the operator has taken the necessary action, he presses the appropriate button on the peripheral and Executive causes the requested transfer to take place and the object program to proceed.

Instructions performed by Executive

Executive maintains program compatibility with processors higher in the series by carrying out certain instructions by subroutine, which in the larger processors are performed by hardware.

From the point of view of the user the functions will appear to be carried out by electronic hardware within the Central Processor. The use of Executive program enables many complex functions to be incorporated in the system without a corresponding increase in the amount of electronic

circuits required, and enables the system to be readily adaptable to changing circumstances, such as the availability of new types of peripheral devices.

Operating principles

The object program is prevented by means of the store reservation circuits from interfering with the Executive. However Executive can refer to any core store location.

The size of Executive will vary. The basic program will control a configuration with paper tape or punched card input and output and perform the 'extra-code' functions, operator-computer communication controls and control routines common to all peripheral devices. To this basic program will be added, depending on the installation, routines to control particular peripherals. The 1902 and 1903 Executive programs do not include facilities for multi-programming.

An entry to Executive can be one of two types, known as Voluntary and Involuntary. The first type occurs when the object program obeys an instruction which calls for Executive action, for example a peripheral transfer request. Involuntary entries, on the other hand, arise mainly because of events outside the Central Processor—peripheral events such as the completion of a transfer, the occurrence of a parity failure or an operator action—but including also an attempt by the program to obey an illegal instruction.

Conclusion

It is clear from the above that the Executive concept is an essential requirement in up-to-date computer systems such as the 1900 series. This has removed from the programmer and the operator the problems involved in peripheral control in particular and operating in general.

This specification is subject to modification

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