

ICOSE/8080 OPERATING SYSTEM

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SYSTEM DESIGN PHILOSOPHY

The ICOSE/8080 Operating System is an Interactive Conversational Operations Support Executive designed and implemented to achieve the following objectives:

- (1) To be interactive and conversational so that the user is prompted to supply whatever information a particular function requires. This method provides visibility and simplicity to the user.
- (2) Adapted to use with a Video-Terminal for fast and convenient communication with the Operating System.
- (3) Versatile memory management functions including generalized off-line audio-tape storage capability.
- (4) Highly structured, modular design to provide many utilities easily accessed by the user with emphasis on minimizing the memory required.
- (5) General orientation toward assembly-level software development and debugging.

- (6) Consistent, simple, and explicit notation for specification of system function parameters.
- (7) Utilization of Digital Group 8080 System architecture, memory structure, and I/O design.
- (8) Ease of expansion for added performance.

GENERAL FEATURES

HARDWARE REQUIREMENTS

Keyboard and Video Display:

The ASCII, upper and lower case, 128-character keyboard must have the following special keys (or must be modified to provide these codes):

- (1) "ESCAPE" key (octal 233, MSB set)
- (2) "LINE-FEED" key (octal 212, MSB set)
- (3) "CTRL/Q" key (octal 221, MSB set)
- (4) "RETURN" key (octal 215, MSB set)

It is quite preferable to have a "REPEAT" capability.

The Video-Display must be 16 lines by 32 characters (or more) and be able to display upper and lower case alphabets.

Memory:

At least 6K (decimal) of RAM (above the Page* 000 ROM)

* "PAGE" refers to the upper eight address bits.

must be present for the ICOSE/8080 code itself. This means that the system stored on tape consists of Page 001₈ (01₁₆) through all of Page 026₈ (16₁₆). The system is written for 10K of memory and places the stack-pointer at Byte 000₈ Page 050₈ (28₁₆).

Printer:

Software for the Southwest Technical Products' PR-40 printer is included. The PR-40 software uses input port 002 and output port 007. These port assignments may be easily altered.

USER COMMUNICATION

Unit Records:

The System Executive and the Editor both require the user to input text information. Source or text information occurs in the form of a "unit record" which is merely a single ASCII character-string followed by an "end-of-record" mark. Each time the system displays a "CMND?" prompt, a "command", such as "ed", is to be provided by the user. Thus, when the user types "ed" followed by a "RETURN" or "CR" (octal 215); he is providing a unit record which is examined as a candidate for a function request.

In this example, "ed" indicates that the Editor program be executed. Furthermore, the Editor will prompt with "ENTER LINE" in order to obtain source records to be edited.

All of the System functions which manipulate or examine source or text information deal with character-string records. This is also true of the output and display of text information.

Due to the 32 character width of the original D.G. System Video-Display, most source information ("source" for short, abbreviated "SOR") contains from one through 32 characters and ends with one of several end-of-record bytes.

Address Specifications:

The performance of many functions requires one or more addresses to be provided by the user. In all of these cases, the System will display a request for an address which includes the abbreviation "BytPag". Since octal notation is easier to use than hexadecimal, and since many people realize immediately that "July 4" is the same day as "4July", the ICOSE/8080 System uses

"Intelese" octal notation for all addresses. Thus, the "BytPag" abbreviation indicates that the three-octit byte number would be followed by the three-octit page number in the user's response. For example, the list

000 017, 001 017, ... , 377 017

enumerates all 256 address within page 017.

Similarly, it is easy to mentally convert this notation to its equivalent decimal value by:

- (1) converting the page number to decimal, and,
- (2) multiplying the result by 256 (approx. $(1/4 \times 1000)$).

User Conveniences:

Since the unit record concept is applied to communication with the user, three important features are available during user response:

- (1) backspacing -- use "CTRL-Q"
- (2) "Clear Line/Screen" -- use "LINE-FEED"
- (3) "Escape" to System Executive -- use "ESC"

These three functions are enabled during all communications done via unit records by System routines.

Backspacing is indicated by the reappearance of the current line with an underscore character occurring at the point where the next input character will occur.

A "LINE-FEED" is used to allow the entire current line to be re-input. The screen is cleared at the same time to provide a method of "clearing-up" the display. A "Clear Line/Screen" is possible even before the first character of that record is input.

The "ESCAPE" key will cause a return to the next higher input mode. For example, in the DUMP function, a "SPACE" will cause the next segment of memory to be displayed. If "ESC" is pressed, however, the DUMP routine will request another address to dump at. Another pressing of "ESC" causes a return to the ICOSE/8080 Executive.

Several relaxations of address specification are permitted. The first and most commonly used is the omission of the Byte number and inclusion of only the Page octits. In this case, the Byte number is assumed to be 000_8 (the very beginning of the Page). For clarity, however, an additional relaxation is the optional inclusion of blanks between octits. For example, "012 042" may be input as "012 042" or even as "0 1 2 0 4 2".

Should the address be incorrectly specified, the user can use the backspace, Clear Line/Screen, or "ESCAPE" features up until "RETURN" is pressed. If, however, the specification contains one or two too-many or too-few octits, an error message "ERR-?" will be displayed and another attempt may be made.

Input lines (records) are terminated with the small Greek letter " ξ " which is the character corresponding to a "RETURN": an ASCII 215₈. Upon display, this character is suppressed.

ICOSE/8080 FUNCTIONS

The user can initiate a large group of commonly used utilities, assembler, and editor with a two-character (small letters) mnemonic. (Since the DUMP program is used extremely often, the one-character mnemonic "d" is the only exception.)

Following is a table describing the available functions:

<u>FUNCTION MNEMONIC</u>	<u>DESCRIPTION</u>	<u>SPECIFICATIONS REQUIRED</u>	<u>EXIT TO EXECUTIVE</u>
rd	Read block of information into memory from audio tape	First and last block addresses	automatic
wr	Write block of information to audio tape from memory	First and last block addresses	automatic
cd	Enter octal information (code) directly into memory (free field input)	(1) Memory address to start at (2) "SPACE" to go to next line of input	input non-blank character
mv	Move block of information to another location (can over-write if new location is lower)	(1) First and last block addresses (2) New location address	automatic

<u>FUNCTION MNEMONIC</u>	<u>DESCRIPTION</u>	<u>SPECIFICATIONS REQUIRED</u>	<u>EXIT TO EXECUTIVE</u>
ps	print source information (stop at zero byte)	starting address	automatic
cl	Clear block of memory	First and last block addresses	automatic
xq	Execute user code	Address of user program	user defined
d	Dump (display) memory	(1) Starting address (2) "SPACE" to continue	input non- blank char- acter, "ESC"
pt	Toggle display device (CRT or printer)	(none)	automatic
ck	Check for errors in blocks read from tape* (performs bit-count and dis- plays result as the two characters (base 128) in brackets in title line)	First and last block addresses	automatic
ed	Execute editor	(See section on Editor	Press "ESCAPE"
as	Execute Assembler	(See section on Assembler	automatic
ba co SI	Increments the version number		

* Perform immediately before and after reading or writing tape to enable later comparison of characters.

<u>FUNCTION MNEMONIC</u>	<u>DESCRIPTION</u>	<u>SPECIFICATION REQUIRED</u>	<u>EXIT TO EXECUTIVE</u>
ms	Memory search for available (zero) pages	(none)	automatic
ls	List (display) symbol table** (See Assembler section)	(none)	automatic
Unrecog- nized	User error	(not applicable)	automatic

Additional capabilities will be provided at later times.
These and other improvements will be reflected in the
version number on the title line displayed.

** Use of "ls" is limited to only once per assembly
since the symbol table is modified.

EDITOR

General Features

The ICOSE/8080 Editor is implemented as a fast "scroll" editor for reasons of minimizing the memory required. (Other editors commonly require more than half the memory that the entire ICOSE/8080 System occupies.) Since the display is 32 characters wide, the need for string replacement capability is greatly reduced and is, therefore, not satisfied. Also, it is common for source code to quickly consume large amounts of memory. The ICOSE/8080 Editor, consequently, sacrifices sophistication in order to make more memory available to the user.

After the user specifies the source location, the Editor responds with a "?".indicating that some editor function can now be performed. Text creation, line-insertion, and scrolling is done in this mode.

Text is stored internally as consecutive, adjacent records. The entire text block is delimited by two zero bytes which allows the Editor to detect the text beginning and end. This method of text storage allows the user to easily access and manipulate source information for his own purposes.

Editor Commands:

Following is a table of single-character commands and the directions performed once the address of the source information is provided.

<u>EDITOR COMMAND</u>	<u>FUNCTION PERFORMED</u>	<u>RETURN TO EDITOR MODE</u>
"a"	"add" text either to create text or append text to existing source	input empty record (press "RET" after "ENTER LINE")
"space"	scroll upward one line (toward end of text)	automatic
"b"	scroll backward one line (toward beginning)	automatic
"I" (NOTE: capital letter)	insert new line (a) after top line on display if last position command was a "space". (b) before top line if last command was a "b".	automatic
"D" (NOTE: capital Letter)	delete top line displayed	automatic
"ESC"	exit from Editor to Executive	(none)
Unrecognized	(none)	automatic