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Elbit Computer

THE COMPUTER HISTORY MUSEUM



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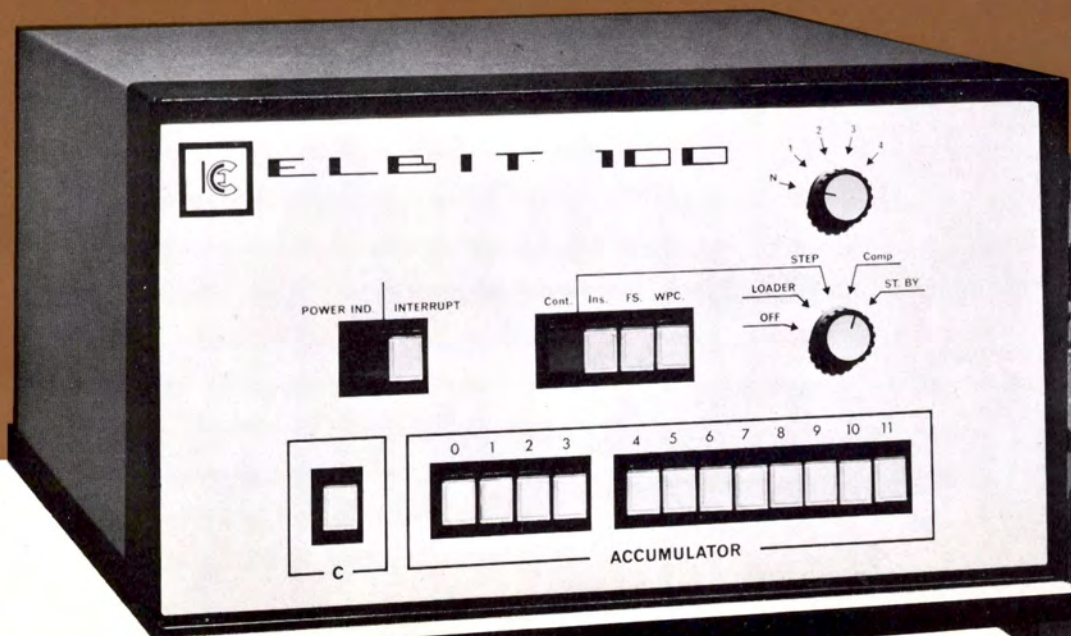


ELBIT 100

FOR PEOPLE WHO THOUGHT THEY COULDN'T AFFORD A DIGITAL COMPUTER

A \$4900 DIGITAL COMPUTER

- ★ 2 MICROSECOND CORE STORE.
- ★ 400 NANOSECOND READ ONLY STORE.
- ★ 6 μ SEC FULL WORD ADD TIME.
- ★ MICROPROGRAMMABLE.
- ★ UP TO 256 I/O..DEVICES.
- ★ ALL DTL INTEGRATED CIRCUIT CONSTRUCTION.



ELBIT COMPUTERS LTD. 88, HAGIBORIM STREET, P.O.B. 5390

HAIFA, ISRAEL

ELBIT 100 SERIES

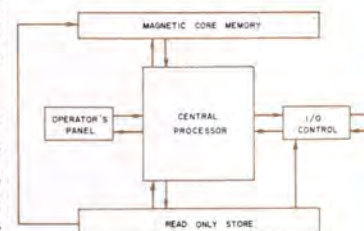
The Elbit 100 is a small, low cost, special purpose computer with a speed and flexibility unequalled in machines of this size. By use of a "two level memory" the Elbit 100 offers the capability of **microprogramming** instructions in a fixed memory section (Read Only Store), eliminating much conventional hardware and software used to perform special functions. This feature is found in such large general purpose computers as the IBM 360, the Spectra 70 and the Honeywell 8200.

The low base price and the flexibility of the Elbit 100 is made possible by use of the "two level memory" construction. The manufacturer is able to use the production techniques of a general purpose computer, while the special functions required by the application are implemented by modifications in the Read Only Store matrix. Use of a completely integrated circuit and modular design makes the Elbit 100 ideally suited for incorporation into systems or O.E.M. equipment.

The Elbit 100 can be economically applied in:

- ★ High speed instrumentation control systems.
- ★ Remote control of peripheral equipment.
- ★ Process control.
- ★ Real time display control.
- ★ Calculations and control in scientific experiments.
- ★ Data logging and controlled data transfer.

★ Your system ?!



FEATURES

TWO LEVEL MEMORY

1. CORE STORE

- 2 microsecond cycle time, random access core store; optional 1024, 2048 or 4096 words of 12 bits each, organized in pages of 256 words. The stored information is protected against power failure.

2. READ ONLY STORE

- 400 nanosecond full cycle time fixed matrix store; executes the instructions from the core store.

EXTERNAL INSTRUCTIONS

- instructions of 12 bits stored in the core store define the sequence of microinstructions in the Read Only Store.

DATA WORD LENGTH

- the word length is 12 bits; it may be doubled or trebled by microprogramming in the Read Only Store.

OPERATOR'S CONTROL PANEL

- designed for convenient and simple operation and debugging. It allows manual insertion of all available external instructions (single cycle operation). Displays computer registers.

INPUT-OUTPUT TRANSFER

- in addition to the general instructions special instructions are also available to control selected peripheral equipment. One of these instructions can initiate block transfers, directly on each of 256 input/output channels. The maximum transfer rate on each channel is over one megabit/second.

CONSTRUCTION

- DTL dual-in-line integrated circuits mounted on fiberglass printed circuit cards. Self contained instrument for desk or rack mounting.

MECHANICAL DIMENSIONS

- 22.1 cm high; 42 cm wide; 56 cm deep.

WEIGHT

- 25 kgs (52 lbs).

POWER REQUIREMENTS

- 50 VA; 115/230 volt; 50/60 cps.

OPERATING TEMPERATURE RANGE

- 5°—55°C.

WHAT IS MICROPROGRAMMING

In conventional logic design, the control section of a digital computer is a fixed, hard wired group of elements. As an example, an adder is a group of gates wired up so as to provide a binary sum. In a microprogrammable machine, these gates can be individually controlled so that the same set of gates can operate as both an adder, a subtractor or theoretically anything else the user desires. Microprogramming enables the implementation of complex functions with a minimum use of hardware.

DESIGN PHILOSOPHY OF A TWO-LEVEL MEMORY COMPUTER

The Elbit 100, as mentioned, has both a fixed memory from which it can only read and a core storage which operates in the Normal Read/Write fashion.

The Read Only Store (ROS) is a prewired set of micro-instructions generally set up specifically for an application. This means that **the specifications of the Elbit 100 may be tailored to suit the specific application of the user.** Thus in an application where square root or some other special function must be performed repeatedly & rapidly, such a sequence of operations may be hard wired into the R.O.S.

Micro-steps, the basic instructions of a stored logic computer, permit the programmer to control the operation at a more basic level than is possible in a conventional computer. Sequences of micro-steps are stored in the R.O.S. memory as "micro-routines" which are executed much as a conventional sub routine. However, unlike the unalterable commands of the conventional computer, stored micro-routines may be used by the programmer to form the most efficient combination of basic computer logical operations for a given application. The extremely high speed of the R.O.S. (400 nsec cycle time) gives the Elbit 100 greater computational speed than other machines in its price class and the "two level memory" a far greater flexibility.

THE FIXED PROGRAM — READ ONLY STORE

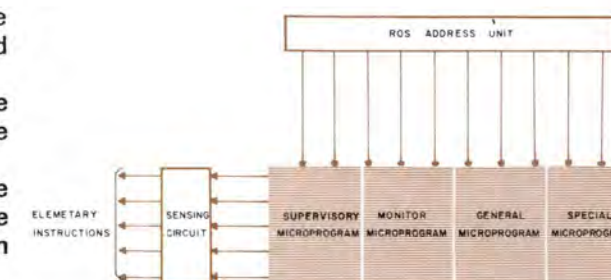
The Read Only Store microprograms have four distinct functions:—

The MONITOR function controls a sophisticated interface between the computer, the operator's control panel and program input equipment.

The SUPERVISORY function controls the selection of the appropriate executive section in the Read Only Store matrix according to external instructions.

The GENERAL executive function in the Read Only Store is used in every application, while SPECIAL executive functions may be wired for use in a given application where time or storage must be optimized.

The entire Read Only Store consisting of a resistor matrix with its driver and sensing circuits is mounted on 2 printed circuit cards.



THE STORED PROGRAM — CORE STORE

Data, as well as the stored portion of the program is fed into the core memory from the input/output equipment or, manually, from the operator's control panel. Operating in this fashion enables the user to develop several modes of operation within the given system. He may also use any of the standard software packaged supplied by Elbit Computers Ltd.

ELBIT 100 GENERAL INSTRUCTION LIST

- | | |
|--|--|
| LDA - Load the accumulator from current page. | RSH - Rotate accumulator right 4 bits. |
| LDZ - Load the accumulator from the base page. | JIP - Unconditional jump. |
| LDS - Load the accumulator with 1111 & 8 bits. | JMA - Jump and replace accumulator. |
| ADA - Add to the accumulator. | SNA - Skip if accumulator is negative. |
| SBA - Subtract from accumulator. | SPA - Skip if accumulator is positive. |
| ADS - Add to memory. | SIC - Skip if carry is indicated. |
| STA - Store Accumulator. | IPS - Increment memory & skip if positive. |
| STS - Store 8 L.S. bits of accumulator. | IO - Input/output to accumulator. |
| HLT - Halt program. | NOP - No operation. |

Note: Many others are implementable for special applications.

INPUT/OUTPUT OPERATIONS

Since the Elbit 100 has been specifically designed for use in a system or as a part of an overall control loop, its ability to interface with the outside world is of particular importance.

256 input/output channels, each having 12 parallel lines are available for transfer of data and control signals as needed. The transfer rate may be up to a full one megabit per second on each channel.

Input/output transfer is normally effected word by word. Special instructions are however available to control particular pieces of equipment and block transfers. The fast Read Only Store microprograms are available for use where transfer control times are critical.

A large variety of peripheral equipment may be used with the ELBIT 100:—

- | | | |
|-------------------------|---------------------------|-------------------|
| A—D converter | Paper tape reader & Punch | Magnetic tape |
| Counters | Teletypewriter | Magnetic disc |
| Process control console | Card punch & reader | X—Y plotter |
| Data communication | Line printer | CRT Display |
| | | Numerical display |

APPLICATIONS

DATA LOGGING

The ELBIT 100 with its many input/output channels is particularly suited for data collection and logging from a large number of information sources such as process monitors, typewriters and telemetering stations. At the same time the ELBIT 100 can control real time displays.

DATA TRANSFER AND CONVERSION

The high speed * and flexible input/output control allows use of the ELBIT 100 for data transfer and real time display control from mass memories or large capacity tapes. IOT for tape transfer with or without data processing is available.

* 1 megabit/sec on each channel.

DISPLAY CONTROL

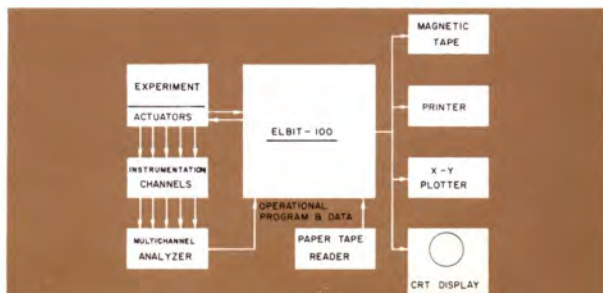
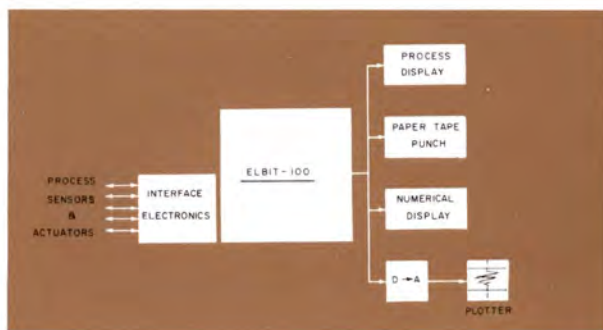
As a display computer the ELBIT 100 can collect data, as well as process and reduce it according to any desired criterion. It is fast enough to display the information in real time on a CRT or large scale display.

PROCESS CONTROL

ELBIT 100 can be programmed to control different automatic processes. It can also control the displays, and the print-out of sensor indications; reduce data in graphical form, or operate individually engineered process displays and alarms. To supplement the fixed program, the core store may be externally programmed for batch changes.

SCIENTIFIC EXPERIMENTS

The ELBIT 100 can be used to control series of experiments fully automatically: it will monitor their progress, collect and process data and display it in the desired format. On the other hand it is inexpensive enough to be used only for data reduction; for instance to obtain the "best curves" through a maze of experimental points according to any desired statistical criterion. A typical experimental set up is illustrated.



LOCKHEED ELECTRONICS COMPANY
INTERDEPARTMENTAL COMMUNICATION

TO Stan Friedman ORGAN. NO. LOCATION DATE 9-16-69
cc: K. Hinrichs
R. Miller

FROM F. G. Snyder ORGAN. NO. LOCATION EXT. 276

SUBJECT: ELBIT 100 COMPUTER

I have briefly reviewed the literature on the Elbit computer and I recall looking at it closely in December, 1968, when it was quite new. This memorandum contains my general comments about this computer and my recommendation that LEC not consider adding it to our product line.

The Elbit 100 computer is competitive in price and performance with many 8 bit mini-computers. Its biggest draw-back is in its appearance and hardware design. It looks like an "old" computer and uses "old" components. The maximum 4K memory is a system limitation.

The 12 bit word size is not a major advantage over the eight bit word size in many applications. The read-only-store of 256 words is not large enough to be highly useful. The four bit adder yields slow instruction execution rates.

In general, I get the feeling that not enough capability in hardware and software is provided. If we sold the Elbit I would expect that the customers would feel that LEC would back it up and provide more extensive software and system support than is now available.

If we did market the Elbit we would desire to repackage and manufacture it ourselves in order to add Lockheed quality, use our memory and make it like our other products. This would be a mistake. We could design our own mini-computer logic which would be superior to the present competition and we should build that, instead.

Some of the reasons that we should not adopt the Elbit are:

1. It is not hardware compatible with our other products. We would have spares problems. Our new or old controllers would not have the same components.
2. It is not Input-Output compatible with MAC. Although, several of Elbit's purchased I/O Devices are the same as ours, their Controllers are not the same.
3. It is not software compatible with MAC. We would have a new set of software to maintain and extend.

4. It does not use LEC memories.
5. It is not a real winner performance wise. Newer computers like the MICRO-800 and the older General Automation SPC-12 offer more performance features. Next month's 8 bitter will also be more attractive, whatever it may be.

The following comparison table summarizes the Elbit 100 with some of its competitors.

Comparison Table

	Word Size	Mem. Size	Cycle Time	Number Instr.	Price*
BIT 480	8	1-65K	3.0	58	\$9.8
CAI 208	8	4-16K	2.67	76	8.0
CAI 808	8	4-16K	8.0	73	7.0
DT-1600	8	4-16K	8.0	73	6.6
G.A. SPC-12	8	4-16K	2.2	50	5.0
Interdata 2	16	1-2K	3.0	45	6.9(1K)
MICRO 800	8	0-32K	1.1	22	6.9
MDP-100	8	4-16K	2.2	46	9.3
PDP-8L	12	4-8K	1.6	28	8.5
PDP-8i	12	4-32K	1.6	43	12.8
Varian 520i	8	4-32K	1.5	32	8.9
Elbit 100	12	1-4K	2.0	37	5.7

* Pricing data from: Modern Data, August 1969.

F. G. Snyder
F. G. Snyder

jc

December 9, 1969

Mr. Yehuda Shinahr
Division Manager
Elbit Computers Limited
36-88, Hagiborim Street
P.O.B. 5390 HAIFA
ISRAEL

Dear Mr. Shinahr:

I trust that by the time you receive this letter, all of your business desires were achieved during your visit to the U.S. As for your brief visit with us, we appreciate the opportunity to discuss your requirements with you in the hopes that an area of mutual interest may arise.

As I am sure you gathered during our discussions, one of the principle concerns we have regarding any potential ventures involving our two companies is the complicated area of communications.

Neglecting the communications problem for the moment, it appears that one possible area to explore is that associated with a small computer which would sell in the U.S. for well under \$5,000. You suggested that Elbit has the capability and experience to design such a computer complete with software that would be reasonably compatible with our existing MAC-16. Further, we discussed your interest in MAC-16 as an upward extension of your product line.

(Continued)

December 9, 1969

I also understand your desires to obtain a reasonable market area for your version of MAC-16 in the event that this computer was involved in some sort of an exchange between us. Although we are presently planning to increase our market penetration throughout Western Europe, it is possible that we could reach some agreements in assigning certain market areas to you, provided the benefits to Lockheed were sufficient. Rather than getting too specific in this area at the moment, I would rather learn of your thoughts following our discussions in order to determine if future negotiations will prove a benefit to both of us.

Again, many thanks for sharing your ideas with us. I hope to have an opportunity to discuss them further and to meet with you again in the future.

Sincerely,

LOCKHEED ELECTRONICS COMPANY
Data Products Division

R. D. Miller, Director
Business and Market Development

RDM:deb
cc: S. Friedman



COMPUTERS LTD.

K. Heinrich / S. Snyder
Heinrich-File

DATE 28 December, 1969

OUR REF -12 JS'23-724

YOUR REF

Mr. R. D. Miller, Director
Business and Market Development
Lockheed Electronics
Data Products Division
6201 E. Randolph Street
Los Angeles, California 90022

Dear Mr. Miller,

First of all, I would like to apologize for the delay in answering your letter of the 9th of December. The main reason for this delay is that it took us some time to conclude that, for the present time, we would like to put aside the possibility of cooperation with Lockheed Electronics Company, in the terms which we have discussed in my visit to your plant and those which you expressed in your letter. For now, we have decided to look into other possibilities.

On this occasion, I would like to thank you once again for your hospitality during my visit to your plant.

Sincerely yours,

Jehuda Shinar
Division Manager

cc: U. Galil

JS:lw

