digital processor
LABEN 70

THE **LABEN 70** IS A VERSATILE, GENERAL PURPOSE COMPUTER DESIGNED FOR QUICK EXPANDIBILITY AND EASY INTERFACING TO MEET A BROAD RANGE OF APPLICATIONAL AND COMPUTATIONAL NEEDS IN SCIENCE AND INDUSTRY. THE DESIGN OF THE **LABEN 70**, WHICH UTILIZES ALSO MEDIUM-SCALE INTEGRATION TECHNIQUES, BUILDS UPON THE EXTENSIVE HARDWARE EXPERIENCE ACCUMULATED BY LABEN IN OVER TEN YEARS OF DEVELOPMENT AND PRODUCTION OF ADVANCED MULTICHANNEL ANALYZERS AND DIGITAL INSTRUMENTATION FOR NUCLEAR PHYSICS AND LIFE SCIENCE RESEARCH. BECAUSE OF ITS GENERAL PURPOSE CAPABILITY, THE **LABEN 70** CAN BE USED IN MANY TYPES OF ORGANIZATIONS FOR DIFFERENT KINDS OF WORK. AND, COMBINED WITH LABEN INSTRUMENTATION, IT BECOMES A POWERFUL PROBLEM-SOLVING TOOL IN VIRTUALLY ALL FIELDS OF TODAY'S RESEARCH.

SPECIAL HARDWARE FACILITIES, BACKED BY A WIDE RANGE OF INTERFACE CAPABILITIES DESIGNED FOR ON LINE OPERATION WITH LABEN MULTICHANNEL ANALYZERS, ANALOG-TO-DIGITAL CONVERTERS, TIME - OF - FLIGHT CODERS, AND BIOMEDICAL INSTRUMENTATION HELP TO OPTIMIZE COMPUTER PROGRAMMING AND TO MINIMIZE MEASURE DEAD TIME IN A GREAT VARIETY OF EXPERIMENTAL SITUATIONS IN PHYSICS AND LIFE SCIENCE RESEARCH.

SPECIAL EMPHASIS HAS BEEN PLACED ON PROCESSING OF 16-BIT INTEGER NUMBERS THROUGH THE USE OF THE EXTEND REGISTER.
THIS FEATURE IS ESPECIALLY VALUABLE IN NUCLEAR SPECTROMETRY SINCE IT PROVIDES FOR UP TO 65535 COUNTS PER CHANNEL. COMPLETE SOFTWARE, IN THE FORM OF COMPREHENSIVE LIBRARY ROUTINES ESPECIALLY DESIGNED TO MEET SPECIFIC DATA PROCESSING TASKS, IS PROVIDED TO MATCH DIFFERENT HARDWARE CONFIGURATIONS.

SIMPLE, SPECIAL-ORIENTED DISPLAY SYSTEMS ARE AVAILABLE TO FACILITATE USER-MACHINE COMMUNICATION, ALLOWING THE RESEARCHER TO MONITOR HIS EXPERIMENT AS IT PROGRESSES.

FEATURES

— 16-bit memory word-size - 17th bit for parity option
— Capacity of 4096 words expandable to 32.768 words (4 K word-module)
— **1.4 microseconds memory cycle time**
— **One hardware index register, and second accumulator (B register) used as second index register**
— **Eight addressing modes**
— **Up to 128 multilevel priority interrupt lines**
— Comprehensive instruction set: 76 basic instructions + 1024 microprogrammed skip instructions
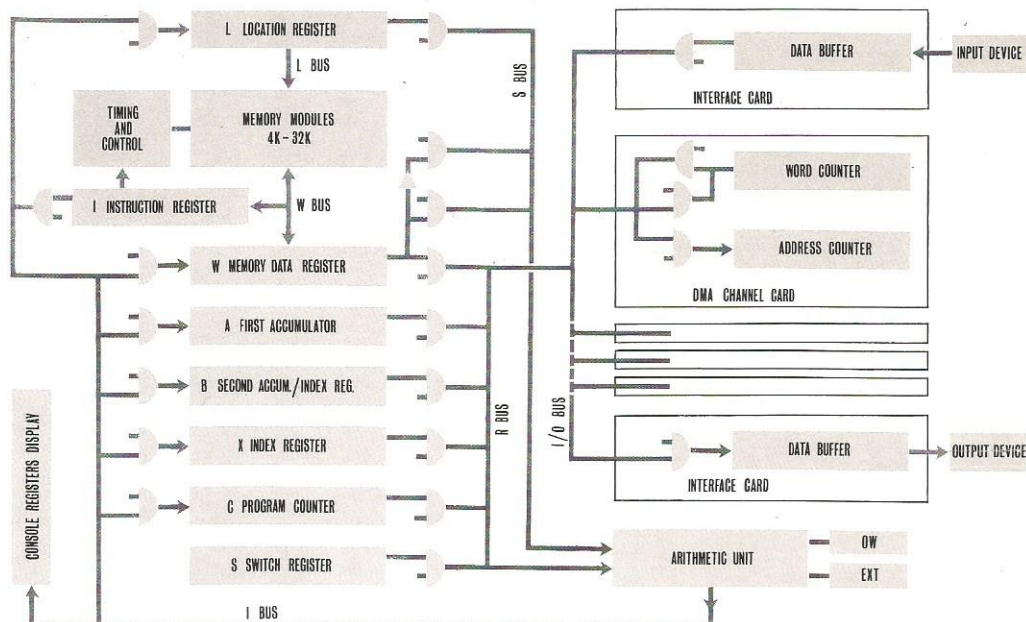— 2's complement arithmetic

Addressing

Eight addressing modes
Single and double indexing
Multilevel indirect addressing
Extended addressing (single or double skip provided)

Registers

10 registers displayed on console
All arithmetic registers addressable as memory locations
Two index registers (X and B)

— A   accumulator addressable as location zero
— B   second accumulator also used as index register; addressable as location one
— OW   overflow register; 1 bit
— E   extend register; 1 bit - used to link A and B registers or to indicate a carry from A or B
— X   index register; addressable as location two
— L   location register
— C   program counter
— W   memory data register
— I   instruction register: 16 bits
— S   switch register, manually transferable to A, B, X, C, L or memory; addressable as location three
— The arithmetic (A, B, X) and switch (S) registers addressable as normal memory locations (zero to three) can generally be used in all memory reference instructions.

LABEN 70 computer block diagram

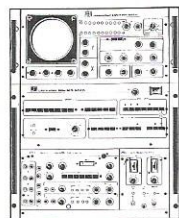L LOCATION REGISTER — L BUS
TIMING AND CONTROL
MEMORY MODULES 4K – 32K
I INSTRUCTION REGISTER — W BUS
W MEMORY DATA REGISTER
A FIRST ACCUMULATOR
B SECOND ACCUM./INDEX REG.
X INDEX REGISTER
C PROGRAM COUNTER
S SWITCH REGISTER
CONSOLE REGISTERS DISPLAY
S BUS
R BUS
I/O BUS
I BUS
DATA BUFFER — INPUT DEVICE
INTERFACE CARD
WORD COUNTER
ADDRESS COUNTER
DMA CHANNEL CARD
DATA BUFFER — OUTPUT DEVICE
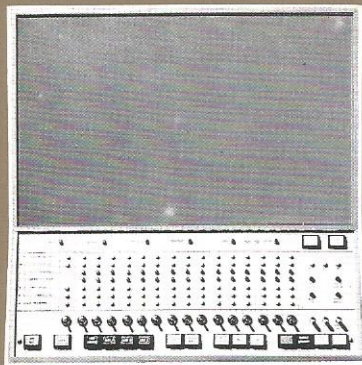INTERFACE CARD
ARITHMETIC UNIT — OW / EXT

Input/Output

— Up to 128 external distinct levels for 64 peripheral devices.
— Up to 32 high-speed simultaneous direct memory access channels, any of which may be assigned, by program, to any of peripheral devices.
— Data channel instructions for high-speed input/output to or from memory in interrupt mode:
  1. sequential input to memory per byte or word
  2. sequential output from memory per byte or word
  3. memory increment capability, especially useful for amplitude spectra measurements with automatic displacement
  4. add to memory feature particularly valuable in averaging measurements.
— Four different types (as per points 1., 2., 3., and 4.) of Data Transfer in DMA mode of each channel may be selected by program.

Options

— Hardware multiply and divide
— Direct memory access channels
— Memory protect

— Real time clock
— Power failure protection and restart system.

76 basic instructions

| Number	Type	Cycles
	30 Memory Instructions:	
4	Load (and double load)	$2 \div 3$
4	Store (and double store)	$2 \div 3$
8	Arithmetic	$2 \div 12$
6	Logical	$1 \div 3$
8	Other instructions (clear, complement, jump to subroutine, execute, compare and skip if equal, increment and skip if zero, decrement and skip if zero)	
24	Shift instructions (n = shift count variable from 1 to 31)	$1 \div 1 + 0.25\,n$
1024	Skip instructions	$1 \div 3$
	Input/Output Instructions:	
4	Data transfer	$1 \div 2$
4	Command or status transfer	$1 \div 2$
10	External control	$1 \div 2$
4	Data channel	$4 \div 7$

LABEN MULTICHANNEL ANALYZER
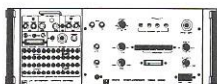

OLIVETTI TE 300 TELEPRINTER

TELETYPE ARS-33 or ASR-35 TELEPRINTER
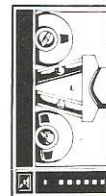
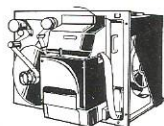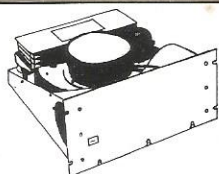POTTER SC-1030 MAGNETIC TAPE

DISPLAY EQUIPMENT

LABEN ANALOG-TO- DIGITAL CONVERTER

REMEX PUNCHED TAPE READER

FACIT PE 1500 TAPE PUNCH

DISC MEMORY

SOFTWARE

Advanced software operating and programming systems have been developed for the LABEN 70 Digital Processor. In addition to basic programs, especially designed programs for specific customer applications can be developed upon request.

MONITOR, the LABEN 70 Operating System, has been designed to enhance inherent system programming and operating efficiency by minimizing storage space and computing time. Extremely flexible, the system allows maximum usage of the various equipment configurations available.

Some of the Monitor's capabilities enable the user to provide the following operations:

— Batch processing
— Compile or assemble, load and execute on a mass storage
— Loading relocatable and absolute programs
— Input/output control and interrupt processing
— Library routines

Other software includes FORTRAN IV, ASSEMBLER and EXTENDED ASSEMBLER, a comprehensive Mathematical Subroutine Library, and debugging and diagnostics programs.

Laben reserves the right to change at any time the above specifications.

LABEN COMPUTER STAFF WILL BE PLEASED TO DISCUSS WITH YOU IN DETAIL THE LABEN 70 COMPUTING CAPABILITY, ITS APPLICATION TO YOUR SPECIFIC PROBLEMS, AND THE TECHNICAL AND ECONOMIC BENEFITS INVOLVED.

For additional technical information, ask for the « LABEN 70 DIGITAL PROCESSOR » brochure.