

CALDIC

California Digital Computer

MANUFACTURER

Electrical Engineering Division
University of California

APPLICATIONS

Application
Instruction and laboratory experimentation.

NUMERICAL SYSTEM

Internal number system	Binary coded decimal
Decimal digits per word	10
Decimal digits per instruction	2 plus two 4-digit addresses
Instructions per word	1
Instructions decoded	16
Instructions used	16
Arithmetic system	Fixed point
Instruction type	Two address
Number range	0 to $1 - 10^{-10}$

ARITHMETIC UNIT

	Incl. Stor. Access Microsec	Exclud. Stor. Access Microsec
Add time	4,000	640
Mult time	16,000	16,000
Construction	Vacuum tubes 1,300 Condenser diodes 1,000	
Basic pulse repetition rate	144 Kc/sec	
Arithmetic mode	Serial by decimal digit, parallel by bits which comprise digits.	
Timing	Synchronous	
Operation	Sequential	

Operational times are average. The times vary with operands.

STORAGE

Media	Words	Digits	Microsec Access
Magnetic Drum	5,000	50,000	15,000

INPUT

Media	Speed
Punched Cards (IBM)	100 cards/min
Punched Tape	600 dig/sec

OUTPUT

Media	Speed
Punched Cards	100 cards/min
Punched Tape	10 dig/sec

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	1,500
Tube types	2 (Main types)
Crystal diodes	1,000

The two main types of tubes utilized are the 5687 and the 12AU7.

Separate cabinets One power supply cabinet. There are 240 sq. ft. of exposed panel wiring.

POWER, SPACE AND WEIGHT

Power, computer	6 KW
Space, computer	300 cu. ft. 160 sq. ft.
Weight, computer	1,500 lbs.

The machine is in the form of a "V", 10 ft. by 10 ft. The power supply is additional.

PRODUCTION RECORD

Produced	1
Operating	1

COST, PRICE AND RENTAL RATE

Approximate cost of basic system \$125,000.
Above cost estimate includes all research and design.

PERSONNEL REQUIREMENTS

Daily Operation	Tech and Operators
1-8 Hour shift	1

RELIABILITY AND OPERATING EXPERIENCE

Average error-free running period Approximately
2 to 3 hours.

INSTALLATIONS

Electrical Engineering Division, University of California, Berkeley 4, California

ADDITIONAL FEATURES AND REMARKS

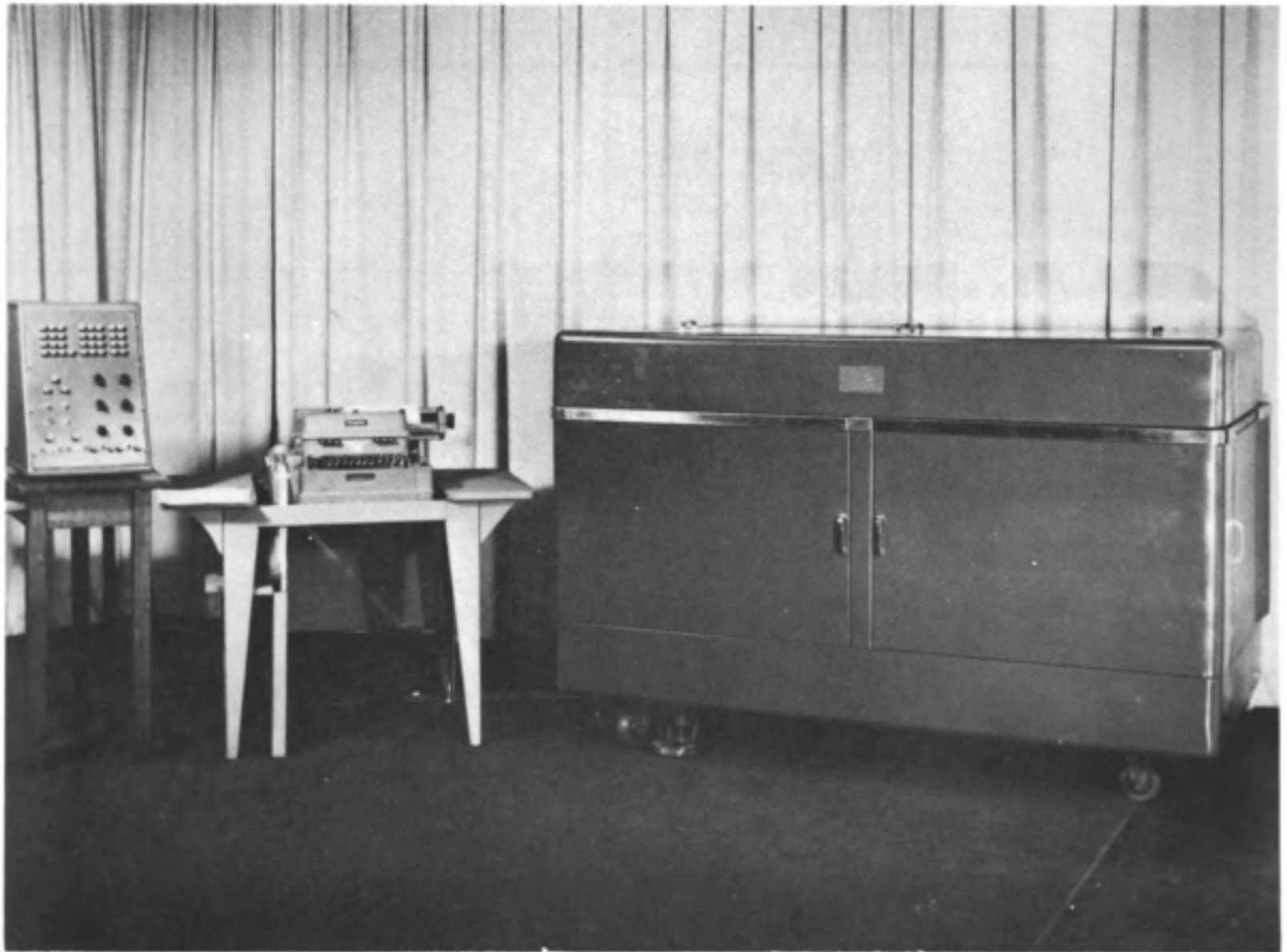
This machine is used only as a laboratory device, for the instruction of classes in computer components and similar subjects. Plans and drawings are available.

CIRCLE

Circle Digital Computer

MANUFACTURER

Hogan Laboratories, Incorporated



Picture by Hogan Laboratories, Incorporated

APPLICATIONS

Manufacturer
 General purpose, scientific computation
 Government Sample
 Engineer Research and Development Laboratories
 Scientific and engineering computation.

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	40-44 plus 2 sign digits
Binary digits per instruction	20
Binary digits per instruction not decoded	3
Instructions per word	2
Instructions decoded	64
Instructions used	33
Arithmetic system	Fixed point

Instruction type	One address code
Number range	-1 to +1 ($1-2^{-44}$)

Shift, Print, Convert Binary to Decimal, and Feed Instructions make use of Address Digits to determine number of shifts, digits, etc.

ARITHMETIC UNIT

	Microsec
Add time (exclud. stor. access)	500
Mult time (exclud. stor. access)	20,000
Div time (exclud. stor. access)	20,000
Construction	Vacuum tubes
Rapid access word registers	Operating Registers
Basic pulse repetition rate	82 Kc/sec
Arithmetic mode	Serial
Timing	Synchronous
Operation	Sequential

Conversion from decimal to binary requires 2,000 microseconds and one instruction.

STORAGE

Media	Words	Microsec Access
Drum	1,024-4,096	8,000 (avg)
	42-46 digits per word	

INPUT

Media	Speed
Paper Tape (Flexowriter)	10 dig/sec
Keyboard (Flexowriter)	Manual
Paper Tape (Reader)	30 dig/sec

The Paper tape reader is optional.

OUTPUT

Media	Speed
Hard Copy (Flexowriter)	10 dig/sec
Paper Tape (Flexowriter)	10 dig/sec

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	800-1,000
Tube types	3
Different plug in units	18
Separate cabinets	2

CHECKING FEATURES

Even-odd check on instructions
Programmed check is normally used.

POWER, SPACE AND WEIGHT

Power, computer	3- 3.5 KW
Space, computer	54-81 cu ft
Weight, computer	1,600 lbs

PRODUCTION RECORD

Number produced	2
Number in current operation	2

This system is no longer being manufactured.

COST, PRICE AND RENTAL RATE

Approximate cost of basic system
\$80,000 with 4,096 word storage
\$60,000 with 1,024 word storage
Optional features at extra cost were:
Twenty binary digit word operation
Special orders for unusual problems checking.
2,048 word storage

PERSONNEL REQUIREMENTS

Daily Operation	No. of Eng.	No. of Tech.
One 8-hour shift	0.5	1
Two 8-hour shifts	0.5	2
Three 8-hour shifts	0.5	3

RELIABILITY AND OPERATING EXPERIENCE

Manufacturer	
Good time	813 hours
Attempted to run time	996 hours
Operating ratio (Good/Attempted to run)	0.82
Acceptance test June 1954	

INSTALLATIONS

Government Sample
U. S. Army Corps of Engineers
Engineer Research and Development Laboratories
Fort Belvoir, Virginia
Industrial Sample
Westinghouse Electric Company
Atomic Products Division
Pittsburgh, Pennsylvania

APPLICATIONS

General and special purpose applications in weapons systems. Computer is in development stage.

NUMERICAL SYSTEM

Internal number system	Decimal
Decimal digits per word	16
Decimal digits per instruction	16
Instructions per word	1
Instructions decoded	16
Instructions used	16
Arithmetic system	Floating and fixed point
Instruction type	Three address
Number range	13 decimal digits

Two digits in command portion of instruction word.

ARITHMETIC UNIT

	Microsec
Add time (exclud. stor. access)	16
Mult time (exclud. stor. access)	32
Div time (exclud. stor. access)	229
Construction	Vacuum tubes, transistors, diodes and magnetic cores
Arithmetic mode	Serial
Timing	Synchronous
Operation	Concurrent

STORAGE

Media	Words	Microsec Access
Magnetic Cores	3,600	8
Magnetic Tape	Unlimited	Hi-speed

INPUT

Media	Speed
Magnetic Tape	70,000 char/sec

OUTPUT

Media	Speed
Magnetic Tape	1,050 char/sec

CHECKING FEATURES

Optional
Certain optional checking features are available.

PRODUCTION RECORD

Produced	1
In production	1
Operating	1
Delivery time	18 Months

RELIABILITY AND OPERATING EXPERIENCE

Operating ratio (Good/Attempted to run) over 0.50
Figures based on period 1955 to 1957.

Above figures are for the developmental model.

FUTURE PLANS

Future applications depend upon the state of the art of ordnance weapons systems and systems developments.

INSTALLATIONS

The Corbin Corporation
5419 - 56th Place
Riverdale, Maryland

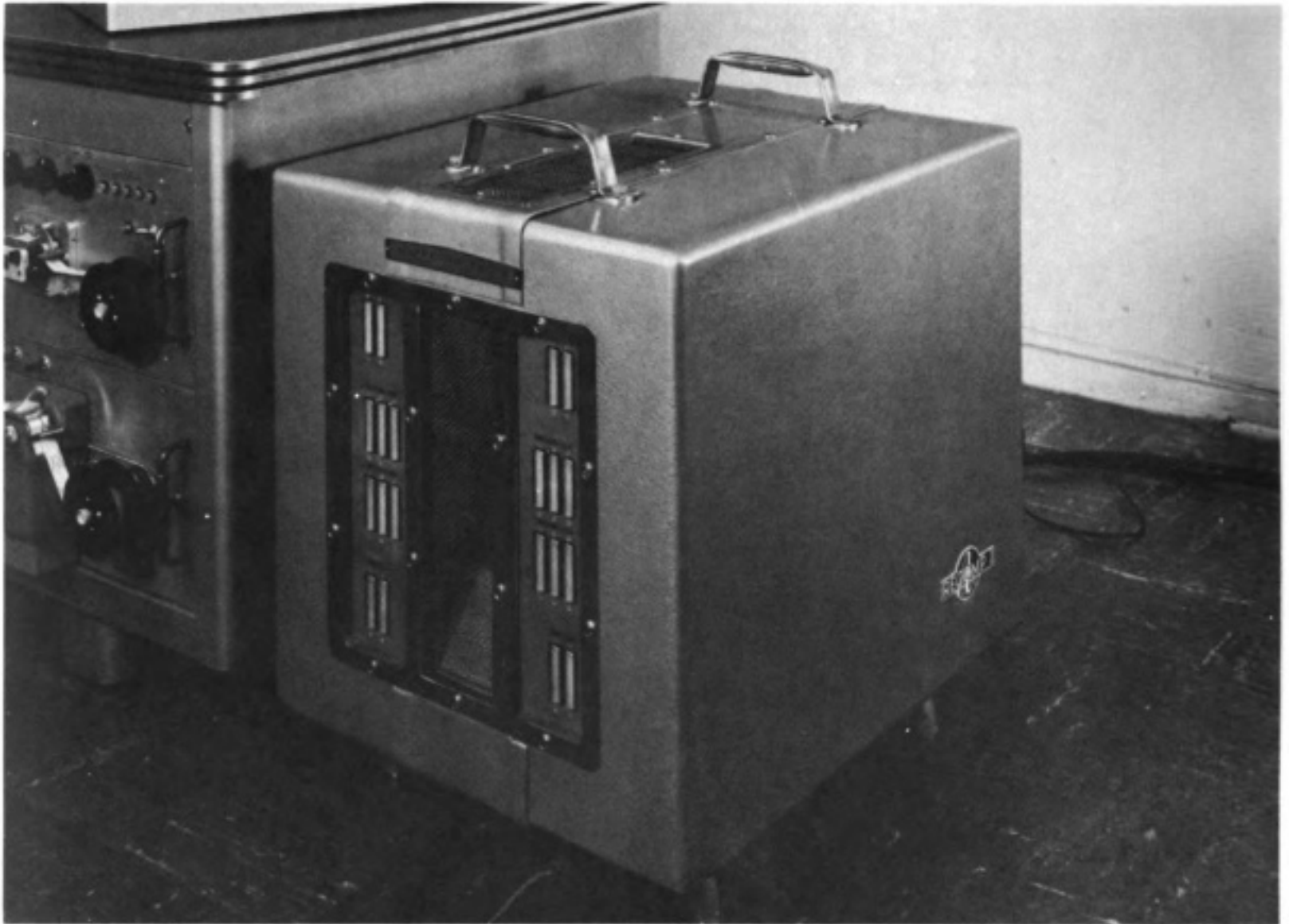
Fort Myers
Florida

CP 266

Electronic Digital Computer CP-266

MANUFACTURER

Autonetics Division
North American Aviation, Incorporated



Picture by Autonetics Division of North American Aviation

APPLICATIONS

Scientific computing and data processing for laboratory, field or mobile use.

NUMERICAL SYSTEM

Internal number system Binary
Binary digits per word 40
Binary digits per instruction 20
Instructions per word 2
Instructions decoded 34
Arithmetic system Fixed point
Instruction type One address

Number range $-(2^{39}-1)$ to $+(2^{39}-1)$

Three commands are provided in order to simplify "floating point" operation.

ARITHMETIC UNIT

Time	Microsec
Add (exclud. stor. access)	1,000
Add (includ. stor. access)	2,000
Mult (exclud. stor. access)	20,000
Mult (includ. stor. access)	21,000
Div (exclud. stor. access)	20,500
Div (includ. stor. access)	21,500
Construction	Transistors
Rapid access word registers	4
Arithmetic mode	Serial
Timing	Synchronous: Computer clock pulses are recorded on magnetic memory disc.
Operation	Sequential

Access time above is based on minimum access time. Transistors are used throughout. No vacuum tubes or magnetic amplifiers are employed.



Picture by Autonetics Division of North American Aviation

STORAGE

Medium	Words	Digits	Microsec Access
Rotary magnetic disk	2,048	40	1,000-32,500
Rotary magnetic disk	16	40	1,000- 2,500

The 2,500 microsecond maximum access time for the high speed loop occurs on a read operation. The computer memory is of the rotating magnetic disk. A special air bearing maintains an extremely close spacing between the rotating disc and the optically precise headplate. The air gap sensed by the magnetic circuit is about 100 microinches wide. This highly efficient recording system has permitted pulse densities of 300 pulses per inch with write currents of 15 milliamperes.

INPUT

Medium	Speed
Paper tape reader	37 char/sec
Decimal keyboard	Manual
Electric typewriter	Manual

Conversion of decimal mixed numbers to binary is wired in. Input process is automatically checked when the "verify" feature of computer is used.

OUTPUT

Medium	Speed
Paper tape punch	10 char/sec
Decimal readout panel	66 millisecc/dig
Electric typewriter	Manual

All output errors are automatically detected using "echo" checking feature of computer.

Up to 15 decimal digits plus sign may be displayed on the Decimal Read-Out Panel.

CIRCUIT ELEMENTS ENTIRE SYSTEM

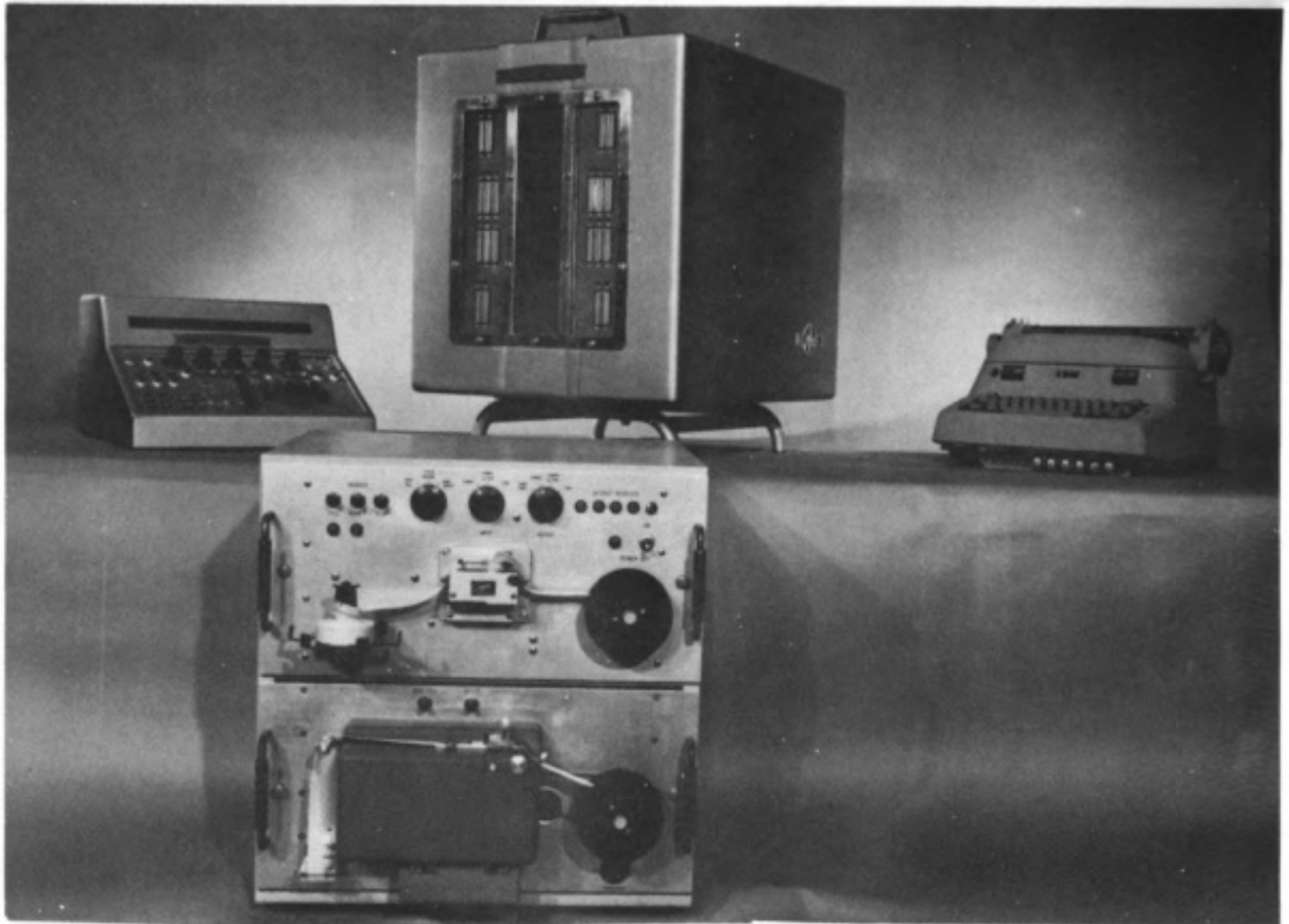
Crystal diodes	7,000
Transistors	1,600
Standardized etched circuit cards.	

CHECKING FEATURES

Fixed
System contains self-checking features designed to eliminate input-output errors. System has an "input-verify" feature and an "output-echo" checking feature.

POWER, SPACE AND WEIGHT

Power, computer	0.3KW, 0.3KVA
Power, air cond.	0.3KW, 0.4KVA



Picture by Autonetics Division of North American Aviation

Space, computer 5.7 cu. ft., including air conditioner; 19.5 in. by 23.5 in. by 21.5 in., excluding typewriter and paper tape units.

Weight, computer 200 lbs.

Power requirement figures exclude typewriter and paper tape units. Air conditioner is built into computer package. Voltage regulated power supply is included.

PRODUCTION RECORD

Produced 1

Operating 1

One developmental model which has been operating for several months.

COST, PRICE AND RENTAL RATE

Cost: Furnished upon request

Rental Rate: Furnished upon request defining application and quantity.

PERSONNEL REQUIREMENTS

Daily Operation	Engineers	Tech or Operators
1-8 Hour shift	0	1
2-8 Hour shifts	0	2

3-8 Hour shifts 0 3

Manufacturer

Computer is designed for simple operation. Inherent reliability and test equipment make computer very easy to checkout and maintain.

RELIABILITY AND OPERATING EXPERIENCE

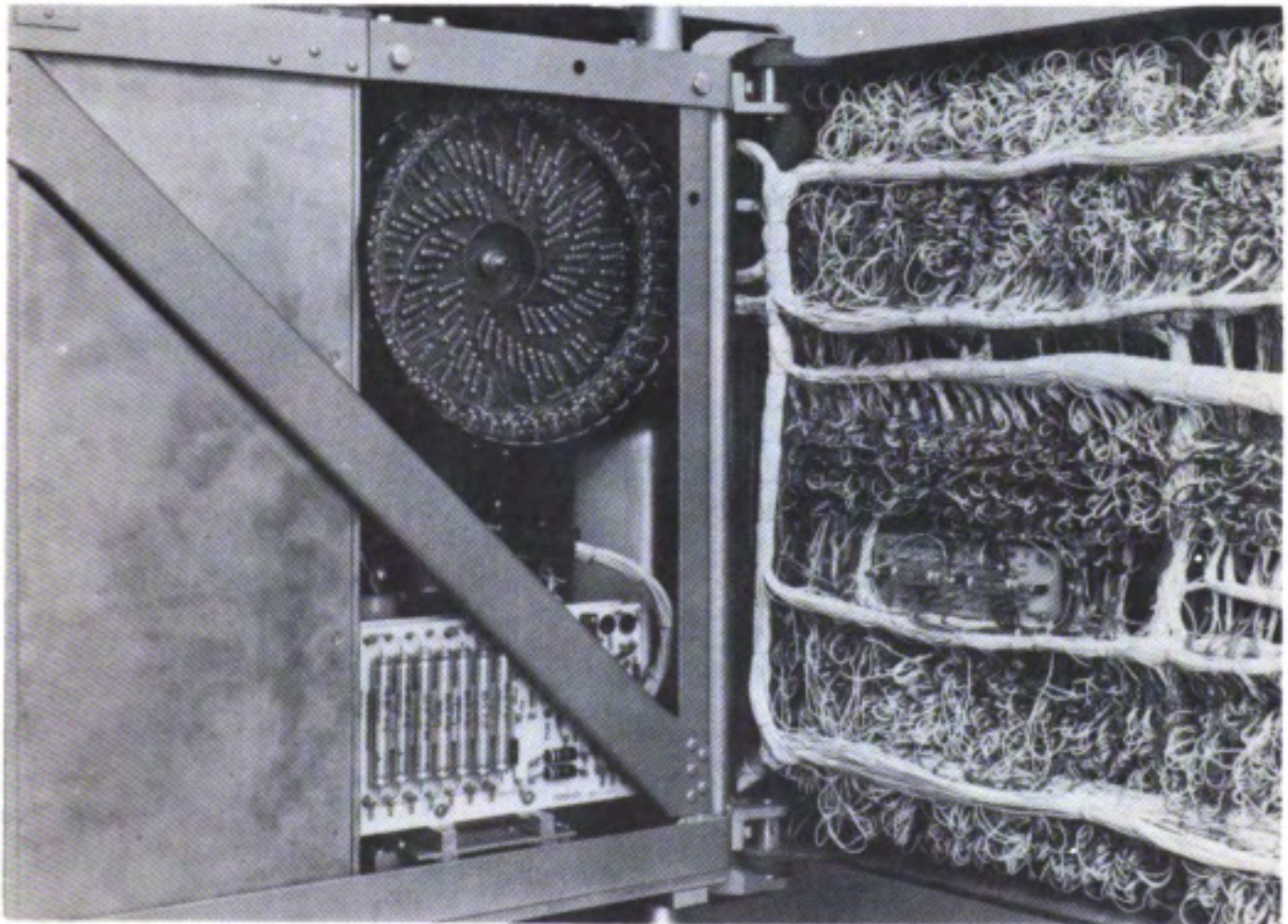
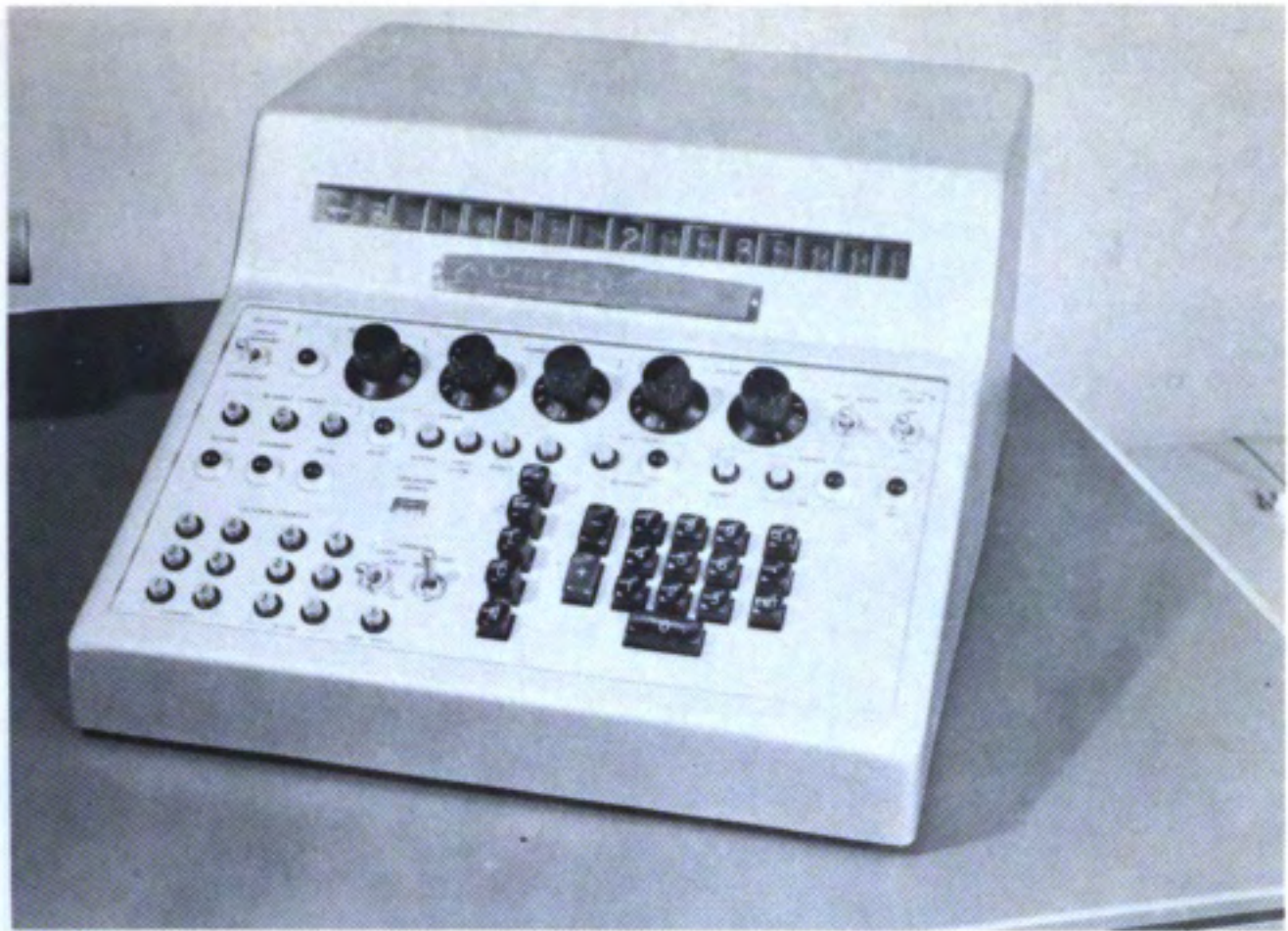
Manufacturer

Insufficient operating data available to provide estimate of operating ratio. All circuits and components used are designed to meet environmental conditions of the field, including continuous operation in 120° F ambient, vibration, humidity, etc.

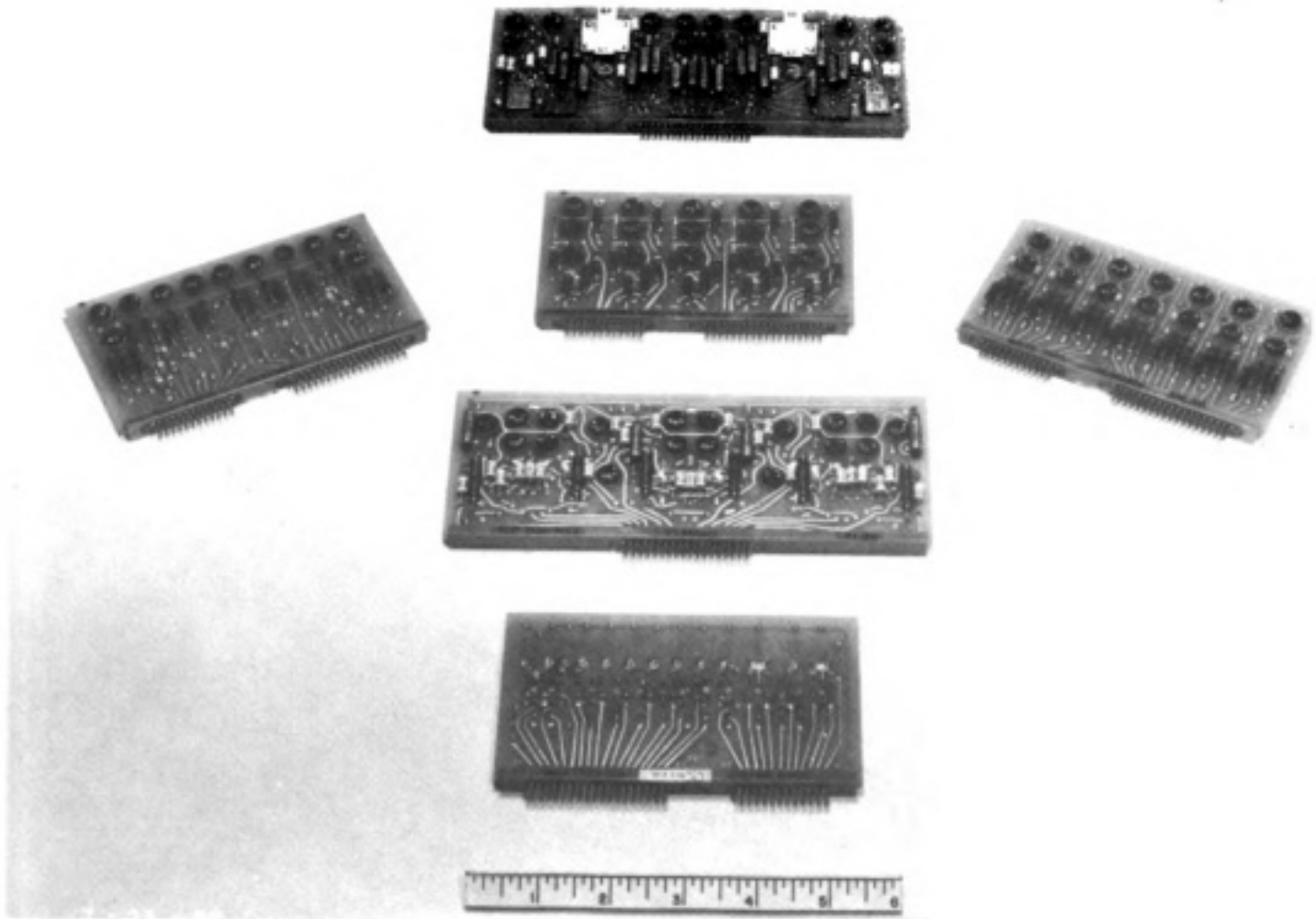
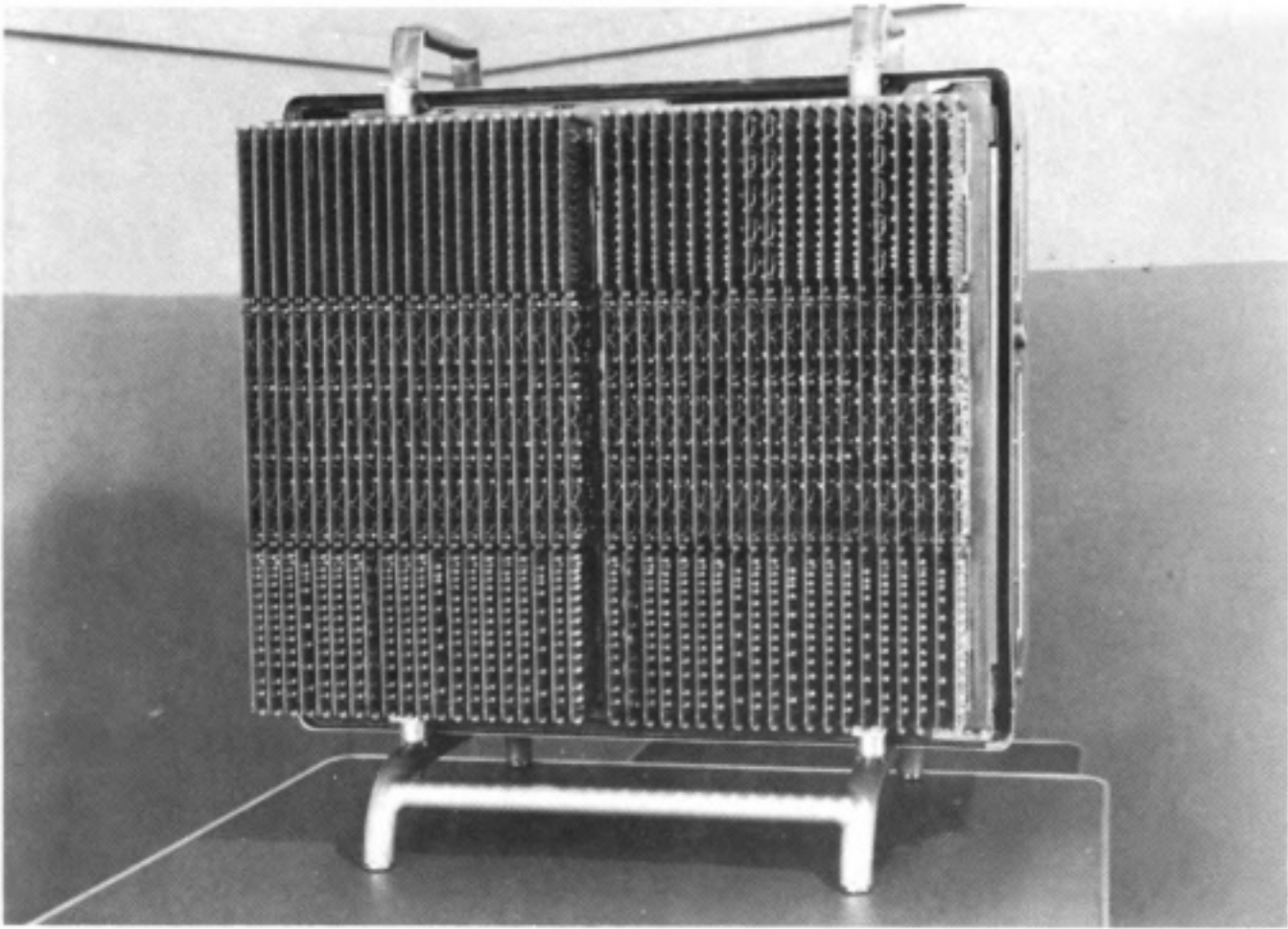
ADDITIONAL FEATURES AND REMARKS

Manufacturer

A checkout console is available, upon request, for plugging into the computer, which makes it possible to rapidly check the complete computer system and its plug-in components. Outstanding features include small size, weight and power requirements for efficient use in office, laboratory or field. It is compact and rugged. System was developed by Reconnaissance Charting Branch, Intelligence Laboratory, Rome Air Development Center, under contract with Autonetics Division of North American Aviation, Incorporated.



Pictures by Autonetics Division of North American Aviation



Pictures by Autonetics Division of North American Aviation

The first picture in this system description shows a general view of the computer.

The second picture shows the Computer Group with paper tape equipment desk mounted for laboratory or office use.

The third picture shows the Computer Group with tape units installed in special box for mobility.

The fourth picture shows the Computer Control Panel showing edge light type decimal display.

The fifth picture shows the Computer opened showing memory unit power supply and refrigerator.

The sixth picture shows the Computer with cover removed showing printed circuit plug-in board assembly.

The seventh picture shows the Printed Circuit Boards.