

MIDAC

Michigan Digital Automatic Computer

MANUFACTURER

University of Michigan
Engineering Research Institute



Picture by University of Michigan

APPLICATIONS

Scientific calculation; simulation; mathematical research by numerical solution of equations involving simultaneity, complex roots, high order differentials, eigenvalues, eigenvectors, partials, boundary values, calculus of variations.

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	44 plus sign
Binary digits per instruction	45
Instructions per word	1
Instructions decoded	19
Instructions used	17
Arithmetic system	Fixed point
Instruction type	Three address
Number range	$0, \pm (2^{-44} \leq n \leq 1-2^{-44})$

A standard machine word contains a sign and 11

decimal or sexadecimal characters.

ARITHMETIC UNIT

Add time (exclud. stor. access)	48	Microsec
Mult time (exclud. stor. access)	2,208	
Div time (exclud. stor. access)	2,208	
Construction	Diodes and vacuum tubes	
Basic pulse repetition rate	1 Mc/sec	
Arithmetic mode	Serial	
Timing	Synchronous	
Operation	Sequential	

STORAGE

Media	Words	Microsec
Mercury Delay Line (Technitrol)	512	192(Avg)
Magnetic Drum (ERA)	6,144	536

The drum is used as an auxiliary storage. Average access to the first word on a track is 3,400 micro-

sec, and access to the next 31 words is 536 microsec.

The drum storage capacity will be increased to 24,576 words of 48 bits each.

INPUT

Media	Speed
Paper Tape (Flexowriter)	10 char/sec
Keyboard (Flexowriter)	Manual
Paper Tape (Ferranti)	200 char/sec
Magnetic Tape	480 char/sec

One character requires 4 bits for decimal or sexa-decimal input and 6 bits for alpha-numeric input.

OUTPUT

Media	Speed
Paper Tape (Flexowriter)	10 dec dig/sec
Printed Page (Flexowriter)	10 dec dig/sec
Oscilloscope	1 dot/432 microsec
Magnetic Tape	480 char/sec

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	900
Tube types	10
Crystal diodes	20,000
Different plug-in units	30
Separate cabinets	8

Two types of tubes are used in the central computer; other types are used in the drum system, tape units, and input-output stations.

CHECKING FEATURES

Fixed

Odd-even parity on mercury storage and drum.

Optional

Odd-even parity on tapes.

Automatic transfer summing for drum and tapes.

POWER, SPACE AND WEIGHT

Power, computer	25 KW	
Space, computer	260 cu ft	65 sq ft
Power, air cond.	10 KW	
Space, air cond.	96 cu ft	12 sq ft
Capacity	10 Tons	

PRODUCTION RECORD

Number produced	1
Number in current operation	1

PERSONNEL REQUIREMENTS

Daily operation	No. of Eng.	No. of Tech.
Three 8-hour shifts	3	6

Engineers and technicians also do development work.

RELIABILITY AND OPERATING EXPERIENCE

Average error free running period	16 hours
Operating ratio	0.75

The operating ratio is defined as Good Time/Scheduled Time.

The average error free running period is estimated and is based on the longest problem performed.

ADDITIONAL FEATURES AND REMARKS

MAGIC system of automatic programming (utility programs, translation and conversions.)

Present-address relative instructions

Base counter (B-box)

Built for possible expansion of operation.

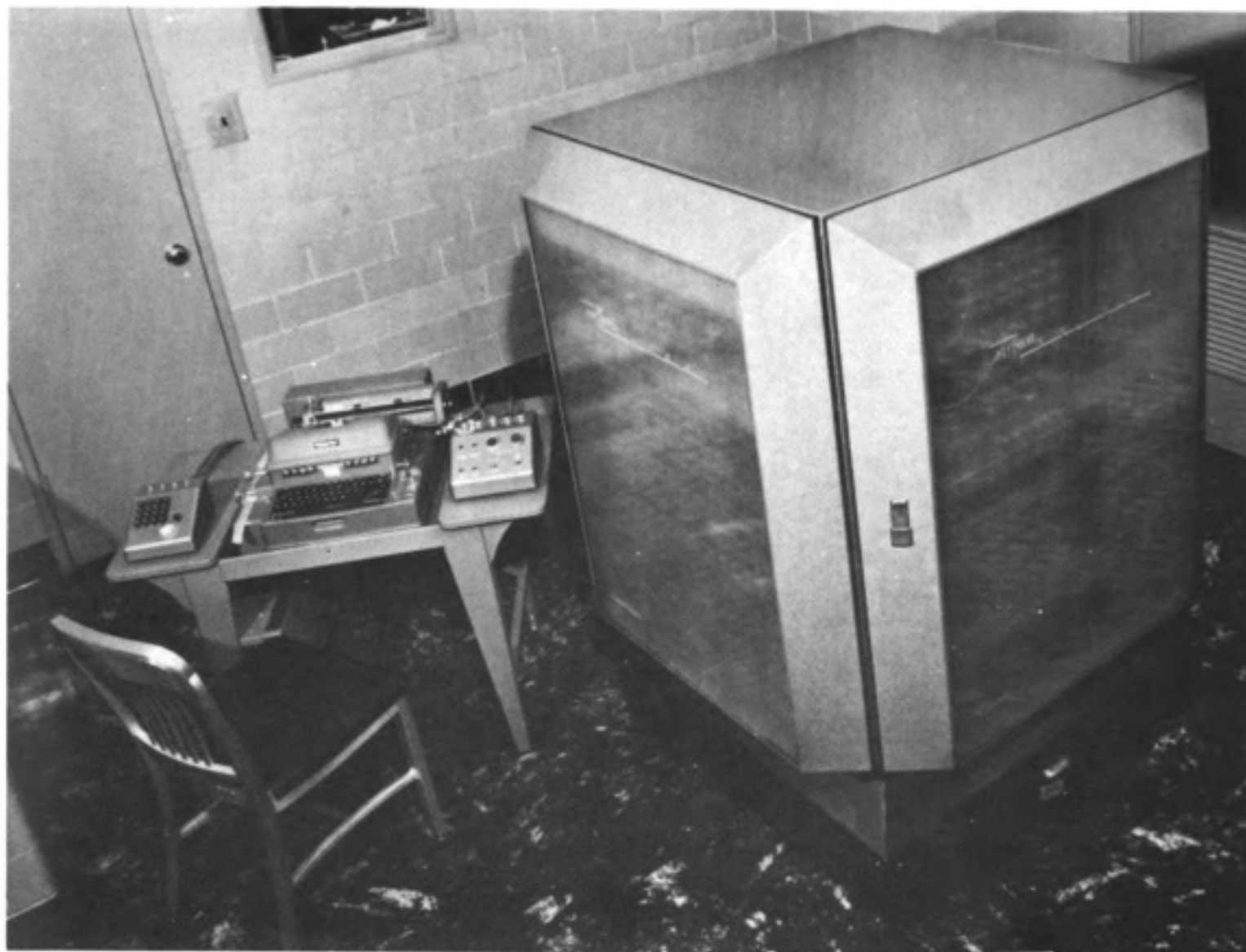
INSTALLATIONS

University of Michigan
Engineering Research Institute
Willow Run Research Center
Ypsilanti, Michigan

MINIAC C, II

MANUFACTURER

Marchant Calculators, Incorporated



Picture by The Atlantic Refining Company, Incorporated, Dallas, Texas

APPLICATIONS

The Atlantic Refining Company Scientific and engineering. The Model II and the Model C are identical in most respects.

NUMERICAL SYSTEM

	Model C	Model II
Internal number system	Bin coded dec	Bin coded and Hexa dec
Digits per word	10 decimal	10 decimal
Digits per instruction	20 binary	10 decimal
Instructions per word	1	1
Instructions decoded	67	71
Arithmetic system	Fixed point	Fixed point
Instruction type	One address	One address
Number range	$-1 < n < +1$	

The 67 instructions include 30 add, subtract and compare commands. The machine addresses are octal. There are binary and decimal addition commands.

ARITHMETIC UNIT

	Includ. Stor. Access Microsec	Exclud. Stor. Access Microsec	
	Average	Maximum	
Add time	11,200	21,200	450
Mult time	24,300	41,400	13,600
Div time	25,600	43,200	14,800
Construction		Vacuum tubes	
Basic pulse repetition rate		300 Kc/sec	
Arithmetic mode		Serial	
Timing		Synchronous (clocking channels on the drum)	
Operation		Sequential	

The add time, excluding storage access, given above, is equivalent to 3 word times. The operand and instruction times are included in all the above values.

STORAGE

	Media	Words	Digits	Microsec Access
Magnetic drum		4,096	10 plus sign	1,200-10,000

256 words, 2,500 microsec average access, is optional.

INPUT

Media	Speed
Paper Tape (Flexowriter)	600 char/min (6 channel tape)

Keyboard	Manual
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Loading 4,096 instructions would take approximately 70 minutes.

OUTPUT

Media	Speed
Paper Tape (Flexowriter)	600 dig/min

Spare Flexowriter can also be used for the separate preparation of data and programs.

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	850
Tube types	7 cover 95%
Crystal diodes	2,000
Separate cabinets	1

There are 75 types of plug-ins at \$10 each.

50% of the machine uses 7 types of plug-ins.

The major types of tubes are the 5963, 5687, 12BH7, 12AT7, 5965, 5915, 2D21.

A cold water supply and a desk for the Flexowriter is included.

CHECKING FEATURES

Timing circuits

Twenty jacks for applying marginal voltages

POWER, SPACE AND WEIGHT

Power, computer	5 KW, 220 volt
Space, computer	91 cu ft, 20 sq ft
Space, air cond.	Dimensions 4.5 x 4.5 x 4.5 ft plus desk
Weight, computer	2,000 lbs
Capacity, air cond.	2 Tons

Designed for cooling by water between 60° and 65°F.

PRODUCTION RECORD

Produced	1 Model C and 1 Model II
Operating	1 Model C and 1 Model II
Delivery time	6 Months

COST, PRICE AND RENTAL RATE

Approximate cost of basic system	\$85,000
Approximate cost of Flexowriter	\$ 2,950
Approximate cost of Spare Flexowriter	\$ 2,950

PERSONNEL REQUIREMENTS

Daily Operation	Engineers	Tech and Operators
One 8-Hour shift	1	1
Two 8-Hour shifts	1	2
Three 8-Hour shifts	1	3

RELIABILITY AND OPERATING EXPERIENCE

Atlantic Refining Company, Philadelphia - Model C
Average error-free running period 12 hours
(50% of 8 hour days are perfect)

Good time	403
Attempted to run time	442
Operating ratio (Good/Attempted to run)	0.91

Figures based on period 20 July 1956 to 11 October 1956

Acceptance test 17 October 1956

Preventive maintenance scheduled is 2 hours/week.

Atlantic Refining Company, Dallas - Model II	
Average error-free running period	5-10 hours
Good time	1,157 hours
Attempted to run time	1,482 hours
Operating ratio (Good/Attempted to run)	0.76



Picture by The Atlantic Refining Company, Incorporated, Philadelphia, Pennsylvania

Figures based on period January 1956 to November 1956
Acceptance test 1 March 1955

FUTURE PLANS

Atlantic Refining Company, Philadelphia
Optical tape reader
Magnetic tape
Atlantic Refining Company, Dallas
Optical tape input is partially completed, operation to begin in 1957.
Incorporation of a Moseley system, to have the following items:
Tape Translator
X-Y Recorder
Character Printer
Curve Follower

INSTALLATIONS

Model C:
Atlantic Refining Company
260 South Broad Street
Philadelphia 1, Pennsylvania
Model II
Atlantic Refining Company
Research and Development Laboratory
4500 W. Mockingbird Lane
Dallas, Texas

ADDITIONAL FEATURES AND REMARKS

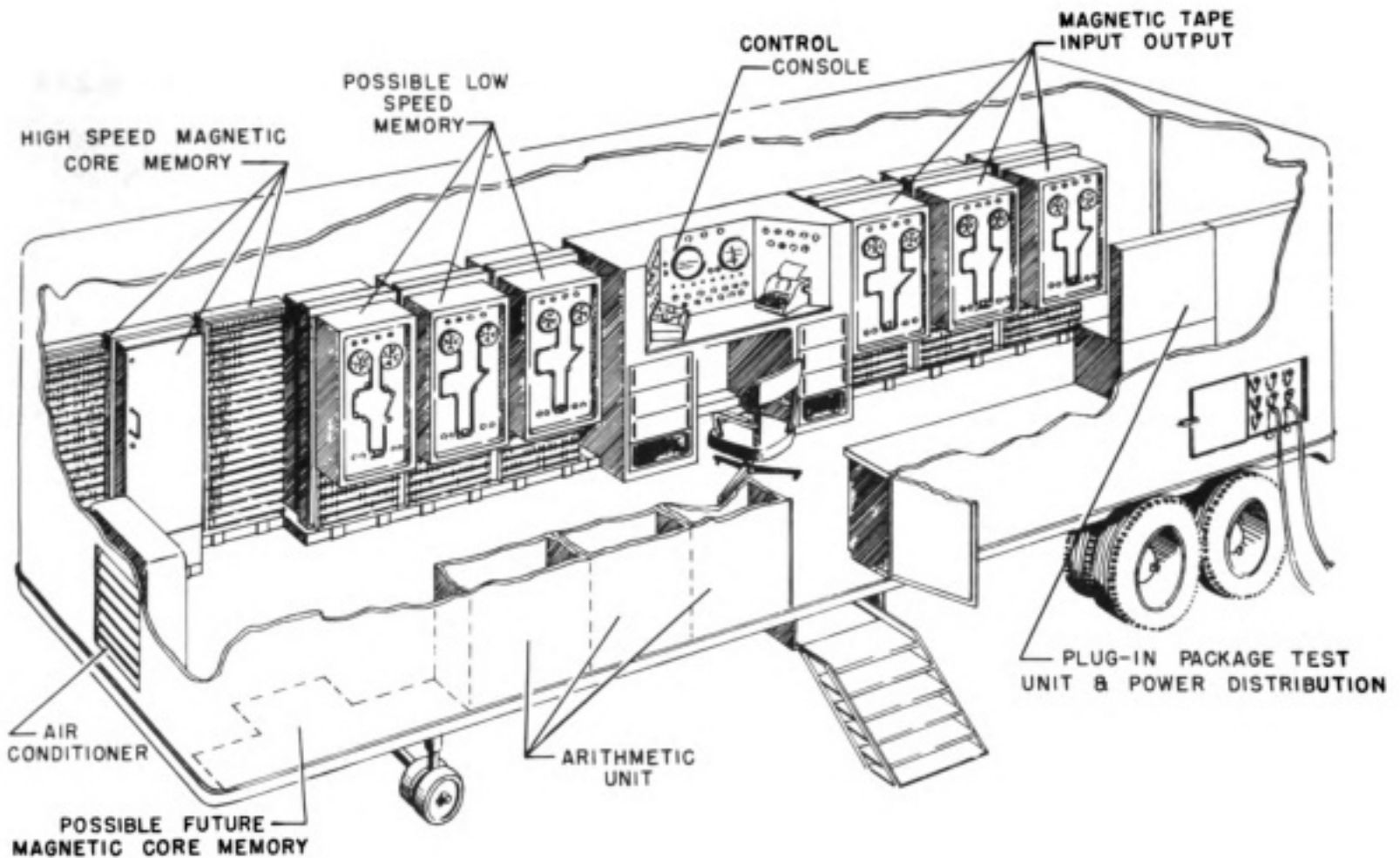
Atlantic Refining Company, Philadelphia
Fast access loop
B-box
Minimum size, general purpose computer

MOBIDIC

Mobile Digital Computer

MANUFACTURER

Electronic Systems Division, Sylvania Electric Products, Incorporated



Picture by Electronic Systems Division, Sylvania Electric Products, Incorporated

APPLICATIONS

Manufacturer
Military field use.

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	38
Binary digits per instruction	6
Instructions per word	1
Arithmetic system	Fixed point
Instruction type	One address
Number range	$-(1-2^{-36})$ to $+(1-2^{-36})$

Expandable word length and double precision.

ARITHMETIC UNIT

Time	Microsec
Add (includ. stor. access)	16
Mult (includ. stor. access)	50
Div (includ. stor. access)	150

Construction Transistors
Arithmetic mode Parallel
Timing Primarily synchronous
Operation Sequential

STORAGE

Media	Words	Digits	Microsec Access
Magnetic Core	4,096	38/word	8

The machine is capable of accepting a magnetic drum. Additional magnetic core storage units may be added if desirable.

INPUT

The system is to be equipped with paper and magnetic tape and electric typewriter input media.

OUTPUT

The system is to be equipped with paper and magnetic tape and electric typewriter output media.

CHECKING FEATURES

Parity check on storage unit. Marginal check on all circuits. Overflow check in arithmetic unit.

POWER, SPACE AND WEIGHT

The complete computer, including air conditioning and console will be mounted in a standard military trailer.

PRODUCTION RECORD

In production	1
On order	1
Delivery time	36 months

RELIABILITY AND OPERATING EXPERIENCE

Manufacturer

Designed for extremely high reliability under battlefield conditions.

INSTALLATIONS

Mobile. Presently located at Electronic Systems Division, Sylvania Electric Products, Incorporated, Waltham, Massachusetts

ADDITIONAL FEATURES AND REMARKS

Mobile and ruggedized for military use
Expandable word length
Expandable memory capacity
Expandable input-output capacity.

MODAC 404

Mountain Systems Digital Automatic Computer

MANUFACTURER

Airborne Instruments Laboratory, Incorporated (Parent)
Mountain Systems, Incorporated



Picture by Reader's Digest Association, Incorporated, Condensed Book Club

APPLICATIONS

Statistical and business data processing, accounting, coding and controls.

NUMERICAL SYSTEM

Internal number system	Binary coded decimal
Decimal digits per word	6
Decimal digits per instruction	2
Instructions decoded	8
Arithmetic system	Fixed point
Instruction type	One Address
Number range	0 to 999,999

Programming system is designed for special application. Operations include addition, subtraction, unit entry, bulk entry and transfer.

ARITHMETIC UNIT

	Includ. Stor. Access Microsec	Exclud. Stor. Access Microsec
Add time	25,000	240
Construction		Vacuum tubes
Basic pulse repetition rate		150 Kc/sec
Arithmetic mode		Serial
Timing		Asynchronous
Operation		Sequential

The addition time given above is for the addition of two 6-digit decimal numbers.

STORAGE

	Words	Digits	Microsec Access
Magnetic Drum	20,000	120,000	25,000

Access time given above is average. System stores 500,000 binary digits in 50 milliseconds access time.



Picture by Reader's Digest Association, Incorporated, Condensed Book Club

INPUT

Media	Speed
Paper Tape	200 char/sec
Punched Cards (Rem. Rand Tab)	4 cards/sec

OUTPUT

Media	Speed
Paper Tape	200 char/sec
Punched Cards (Rem. Rand Tab)	4 cards/sec

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	1,000 (approx.)
Tube types	3 (major)
Crystal diodes	2,000 (approx.)
Separate cabinets	1

CHECKING FEATURES

Address check.

POWER, SPACE AND WEIGHT

Power, computer	3 KW
Space, computer	120 cu ft, 20 sq ft
Weight, computer	1,500 lbs.

PRODUCTION RECORD

Reader's Digest Association	
Produced	1
Operating	1
Delivery time	9 Months

COST, PRICE AND RENTAL RATE

Reader's Digest Association
Approximate cost of basic system \$100,000.

PERSONNEL REQUIREMENTS

Reader's Digest Association		
Daily Operation	Engineers	Tech and Operators
One 8-hour shift	0	1

RELIABILITY AND OPERATING EXPERIENCE

Reader's Digest Association	
Good time	6,000 hours
Attempted to run time	6,188 hours
Operating ratio (Good/Attempted to run)	0.97
Figures based on period September 1955 to January 1957	
Acceptance test September 1954	
Additional features include external programming, dual entry to memory with single address and an address check.	

MODAC 410

Mountain Systems Digital Automatic Computer Model 410

MANUFACTURER

Airborne Instruments Laboratory, Incorporated (Parent)
Mountain Systems Incorporated

APPLICATIONS

Business Data Processing

NUMERICAL SYSTEM

Internal number system Decimal - Excess 3
Decimal digits per word 10
Arithmetic system Fixed point
Instruction type One address
Number range 0 to 10 decimal digits

Program is stored internally and on tape.

ARITHMETIC UNIT

	Microsec
Add time (exclud. stor. access)	600
Mult time (exclud. stor. access)	7,000
Div time (exclud. stor. access)	7,000
Construction	Vacuum tubes, mag- netic elements and diodes

Number of rapid access word registers	50
Basic pulse repetition rate	150 Kc/sec
Arithmetic mode	Serial
Timing	Asynchronous
Operation	Sequential

Computer is serial with buffer storage.

STORAGE

Media	Words	Microsec Access
Magnetic Drum	5,000	7,500

50,000 decimal digits stored.
Buffer storage in magnetic cores.

INPUT

Media	Speed
Punched Tape	400 char/sec
Punched Cards	600 cards/min

OUTPUT

Media	Speed
Punched Tape	60 char/sec
Punched Cards	600 cards/min

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	600
Tube types	3
Crystal diodes	3,000
Magnetic elements	1,000

Number of different plug in units	5
Number of separate cabinets	2

CHECKING FEATURES

Number checks
Address checks
Odd number check

POWER, SPACE AND WEIGHT

Power, computer	4 KW
Space, computer	40 cu ft, 20 sq ft
Weight, computer	1,000 lbs

PRODUCTION RECORD

Produced	1
In operation	1
Delivery time	10 Months

COST, PRICE AND RENTAL RATE

Approximate cost of basic system \$120,000.
Price includes input and output equipment described.
Other equipment dependent upon specific application.

PERSONNEL REQUIREMENTS

One operator required during operation.

INSTALLATIONS

Readers Digest Association, Incorporated
Condensed Book Club
Pleasantville, New York

ADDITIONAL FEATURES AND REMARKS

Special translator or converter feature reads an abbreviation on a punched card, looks up corresponding code from a list of 5,000 and punches a code number into the same card at a reading and punching rate of 500 per minute.

High speed tallying feature performs 1,440,000 unit additions per hour into selected registers.

Transactions, from a total of 4,000 categories, can be read at random and added to an appropriate one of 4,000 registers.

MODAC 414

Mountain Systems Digital Automatic Computer Model 414

MANUFACTURER

Airborne Instruments Laboratory, Incorporated (Parent)
Mountain Systems, Incorporated

APPLICATIONS

Reader's Digest Association, Incorporated
Large scale translation, statistical processing and general purpose computation.

NUMERICAL SYSTEM

Internal number system	Binary coded decimal and alphanumeric
Decimal digits per word	6
Decimal digits per instruction	2
Instructions decoded	12
Arithmetic system	Fixed point
Instruction type	One address (for general purpose applications)

ARITHMETIC UNIT

	Incl. Stor. Access Microsec	Exclud. Stor. Access Microsec
Add time	8,000	288
Mult time	8,000	8,000
Div time	8,000	8,000
Construction	Vacuum tubes and magnetic cores	
Arithmetic mode	Serial	
Timing	Asynchronous	
Operation	Sequential	
	Concurrent for punched cards in any of three modes.	

The multiply and divide times given above include re-record time.

STORAGE

Media	Words	Characters	Microsec Access
Magnetic Drum	6,000	36,000	8,000
Magnetic Drum	4	24	576
Magnetic Cores	2	12	288

INPUT

Media	Speed
Punched Cards	360 cards/min
Paper Tape	

Paper Tape is used for report programming and testing.

OUTPUT

Media	Speed
Punched Card	360 cards/min
Paper Tape	20 char/sec

Punched cards are used for translation and paper tape for reports.

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	2,000 (approx)
Tube types	3 (major)
Crystal diodes	3,000 (approx)
Magnetic cores	396

CHECKING FEATURES

Odd-even checks on numerical calculations are used.

POWER, SPACE AND WEIGHT

Power, computer	5 KW
Space, computer	240 cu ft, 40 sq ft
Weight, computer	3,000 lbs

PRODUCTION RECORD

Produced	1
Operating	1
Delivery time	12 Months

COST, PRICE AND RENTAL RATE

Approximate cost of basic system \$150,000.

PERSONNEL REQUIREMENTS

Daily Operation	Engineers	Tech and Operators
One 8-hour shift	0	2

RELIABILITY AND OPERATING EXPERIENCE

Acceptance test October 1956.

INSTALLATIONS

Reader's Digest Association, Incorporated
Condensed Book Club
Pleasantville, New York

