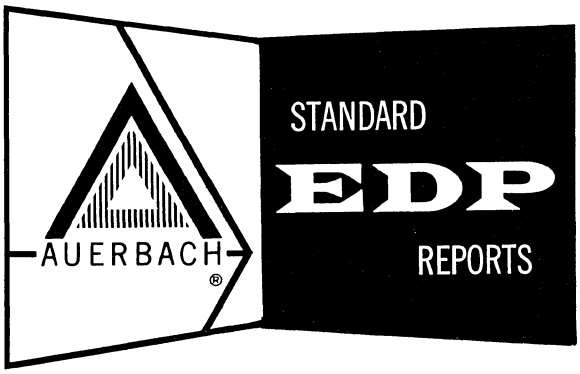
RCA 301

Radio Corporation of America



AUERBACH INFO, INC.

PRINTED IN U. S. A.

CONTENTS

CONTENTS (Contd.)

INTRODUCTION

§ 011.

The RCA 301 is a small to medium scale, solid-state data processing system oriented toward business and scientific applications. The wide range of optional features which are available provide for expansion and simultaneous operations. System configuration rentals range from $3,500 to $25,000 per month, with typical systems renting for $9,000. The purely business-oriented processor is available with three sizes of core storage: 10,000, 20,000, or 40,000 alphameric characters (Model 303, 304, or 305, respectively). The Model 354 and 355 processors (for business and scientific applications) can perform automatic floating point operations and automatic eight-digit fixed point operations in addition to having all the facilities of the Model 303, 304, and 305 processors. The Model 354 and 355 processors are available with 20,000 and 40,000 alphameric characters of core storage, respectively. The 301 system is available with a wide range of peripheral equipments, including auxiliary disc storage. Its fixed length, 10-character instructions use a 2-address add-to-storage logic. In the standard processor, the data fields, which are variable-length (up to 44 characters), are processed serially by character.

Model 303, 304, and 305 Processors

The speed of the standard arithmetic unit (i.e., Models 303, 304, and 305) makes it suitable for general data processing but it performs mathematical operations slowly. Multiplication, division, and floating-point operations can be performed only by means of subroutines. Indexing is not available, but indirect addressing is provided. While there is no integrated editing facility, edit routines are rapid and straightforward, and a sufficient number of variable-length operations for handling alphameric items are available. These include convenient code translation operation and Boolean operations. Arithmetic operations are executed through the use of sum and difference tables which occupy 200 characters of core storage.

Model 354 and 355 Processors

The Model 354 and 355 processors contain additional high speed arithmetic circuits which allow automatic fixed and floating point operations to be performed on eight-digit operands in a two-address format. A double-length accumulator is provided. The operations which are possible are: add, subtract, multiply, divide, and indexing operations for fixed and floating point data. Additional instructions are provided for shifting and storing the contents of the accumulator and for incrementing the index registers. The index registers permit address modification, and loop control is provided by the Tally instruction or by other coding.

Processor Speeds

The time required for the Model 303, 304, and 305 processors to add 2 eight-digit numbers (including instruction access) is 273 microseconds, a rate of 3,660 additions per second. The same operation on the Model 354 and 355 processors requires 98 microseconds (no indexing; results left in accumulator), a rate of 10,200 additions per second.

Simultaneous operations can be carried out only through the use of optional equipment. The Simultaneous Mode Control permits two operations to proceed at a time. The device (any peripheral device) controlled via the Simultaneous Mode Control delays the Processor for 7 microseconds per character transferred. The second operation can be another peripheral device data transfer, or internal processing.

The 7-microsecond core store can be supplemented by Data Record Files (juke-box type discs) with up to 27.6 million characters or by Data Disc Files with up to 176 million characters of storage. While access to data in the Record Files can take several seconds, access to Disc File data requires approximately 0.1 second. Remote inquiry operations to the Data Record or Data Disc Files can be handled through the Interrogating Typewriter.

INTRODUCTION (Contd.)

§ 011.

Programming for the 301 is relatively straightforward except where dynamically variable length fields require continual adjustment of the N character used to specify operand length. Also, the programmer is restricted by the limited simultaneous operation facilities, which normally permit only one data transfer to be overlapped with internal processing.

Standard paper tape and punched card equipment is available, as well as a fast paper tape reader which reads at 1,000 characters per second. Paper tape is normally read and punched at 100 characters per second. Punched card equipment can include two card readers, which operate at rates of up to 600 cards per minute, and a card punch which operates at 100 cards per minute. More recently, a card read punch unit (an IBM 1402) has become available as part of the equipment line. This unit can read 800 cards per minute and punch 250 cards per minute. Hollerith code to RCA 301 code translation is performed automatically. Two models of line printers are available, one with 120, the other with 160 character positions per line; these printers are capable of maximum speeds of 1,000 and 1,075 lines per minute, respectively.

A variety of magnetic tape units can be used with the 301 system. One or 2 cabinets of low-cost magnetic tapes are available, which operate at 10,000 characters per second; each cabinet contains 3, 4, or 6 tape stations. Higher performance tape stations (33,333 and 66,667 characters per second) are available for use by the 301, and up to 14 such stations, which are also used on the RCA 501 system, can be connected.

RCA has recently announced an Optical Character Reader (Videoscan) which can read up to 1,500 documents per minute. The Burroughs Magnetic Ink Character Reader can be connected to the 301 system to provide for input of magnetic ink documents at speeds of up to 1,560 per minute. Adapters are available for connecting two IBM 729II Magnetic Tape Units.

The software for the 301 can accommodate three different situations; the program library can be held on cards, magnetic tape, or Data Records. In addition to standard assembly routines, subroutines, mathematical functions, and diagnostic routines, there is an elementary operating system appropriate for this size of computer, and an integrated testing procedure. COBOL-61 for the 301 magnetic tape system is available, as is the RCA 301 version of UMAC, the University of Miami Algebraic Compiler. A scientific interpreter is also available.

DATA STRUCTURE

§ 021.

.1 STORAGE LOCATIONS

Name of Location	Size	Purpose or Use
Character:	6 bits + parity bit	alphamerics.
Diad:	2 char	access to High Speed Memory.
Cell:	900 char	location for record in Data Record File.
Band:	10 cells	Data Record File.
Data Record:	4 bands	Data Record File.
Sector:	160 char	location for record in Data Disc File.
Band:	10 sectors	Data Disc File.
Zone:	group of 128 bands readable by one head	Data Disc File.
Stratum:	group of 108-432 bands readable by all heads without yoke movement	Data Disc File (1 File of 1-4 modules).
Data Disc:	2,304 bands	Data Disc File.

.2 INFORMATION FORMATS

Type of Information	Representation
Numeric:	1 char.
Alphabetic:	1 char.
Instruction:	10 char.
Numbers:	1 to 44 char.
Items:	1 to 44 char.
Block:	any number of char.
Number referenced by automatic arithmetic operations in 354/355 Processor	
Fixed point:	8 char (digits).
Floating point:	8 char (digits) mantissa and 2 char (digits) exponent.

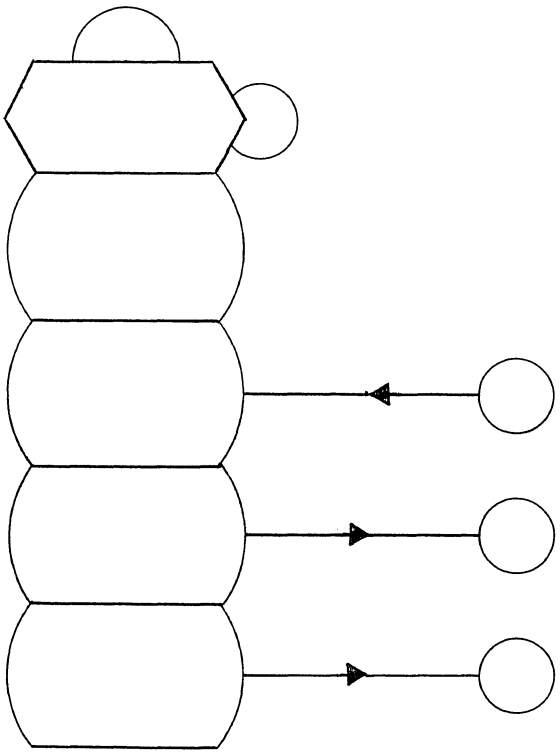
SYSTEM CONFIGURATION

§ 031.

.1 TYPICAL CARD SYSTEM (CONFIGURATION I)

Deviations from Standard Configuration: . . . . . Multiply-Divide not available.

Rental: . . . . . $4,271 per month.



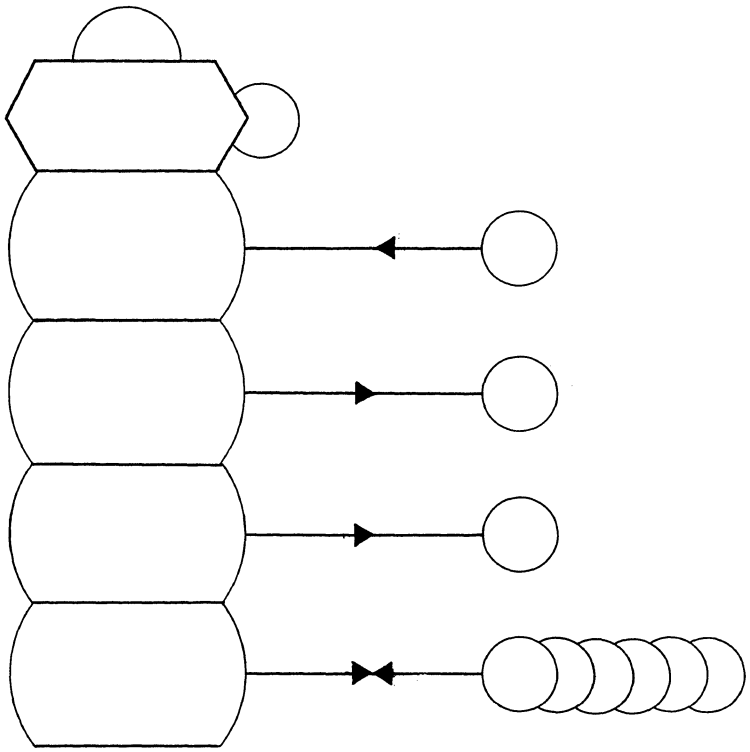
Equipment	Rental
Core Storage: 10,000 characters 303 Processor and Console	1,803
392 Simultaneous Mode Control	608
314-1R Controller	134
323 Card Reader 600 cards/min.	361
315 Controller	283
334 Card Punch 100 cards/min.	206
316-1 Controller	155
333 Printer 1,000 lines/min.	721
Total	$4,271

§ 031.

.2 4-TAPE BUSINESS SYSTEM (CONFIGURATION II)

Deviations from Standard Configuration:. . . . . none.

Rental: . . . . . $5,084 per month.



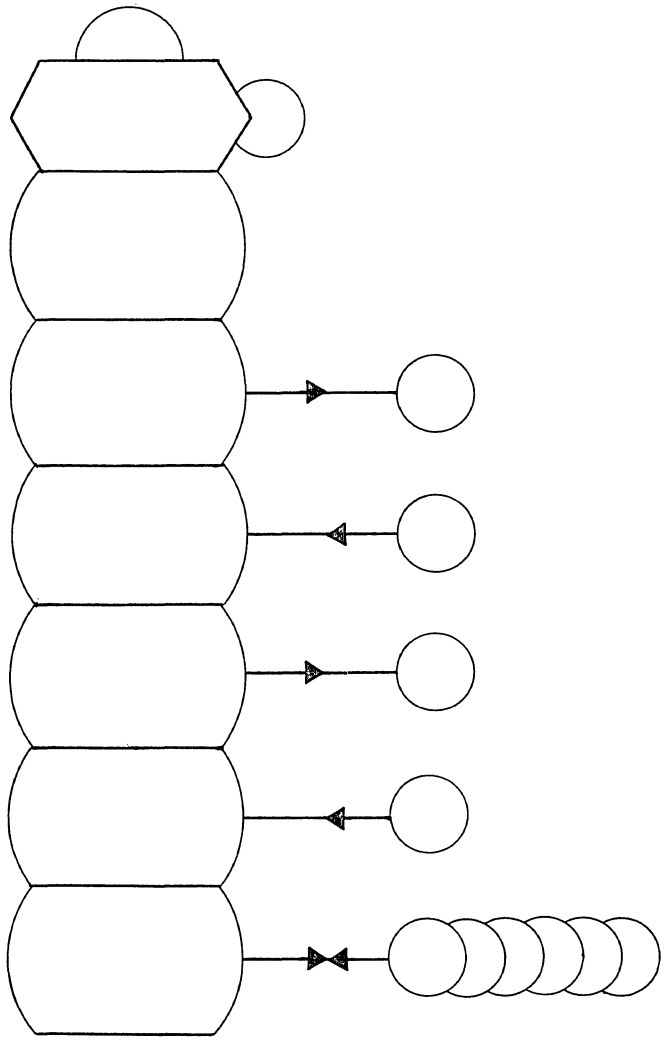
Equipment	Rental
Core Storage: 10,000 characters 303 Processor and Console	1,803
314-1R Controller	134
323 Card reader 600 cards/min.	361
315 Controller	283
334 Card Punch 100 cards/min.	206
316-1 Controller	155
333 Printer 1,000 lines/min.	721
318 Controller	386
381-4 Hi-Data Tape Group (4 magnetic tape units)	1,040
Total	$5,084

§ 031.

.3 6-TAPE BUSINESS SYSTEM (CONFIGURATION III)

Deviations from Standard Configuration: . . . . . Multiply-Divide not available.

Rental: . . . . . $9,687 per month.



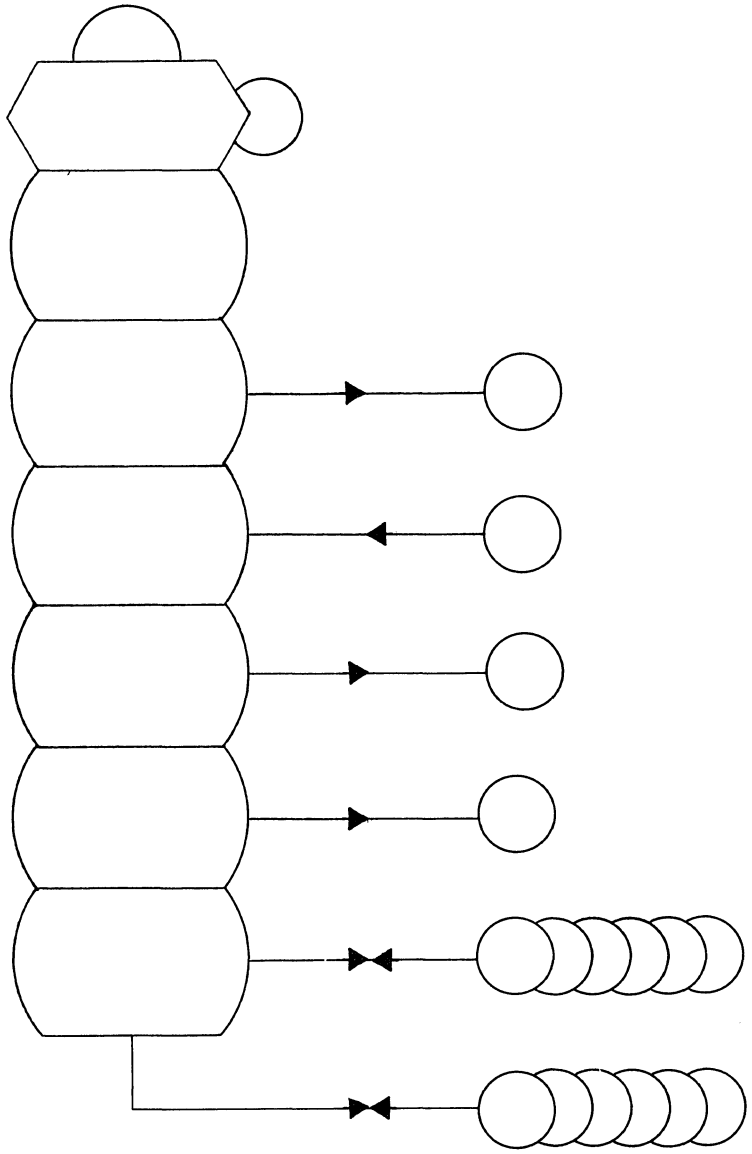
Equipment	Rental
Core Storage: 20,000 characters. 304 Processor and Console	2,421
392 Simultaneous Mode Control	608
308 Controller	170
338 Monitor Printer 10 char/sec.	196
314-1R Controller	134
323 Card Reader 600 cards/min.	361
315 Controller	283
334 Card Punch 100 cards/min.	206
316-1 Controller	155
333 Printer 1,000 lines/min.	721
341 Controller	1,030
581 Magnetic Tape Units (6) 33,333 char/sec.	3,402
Total	$9,687

§ 031.

.4 12-TAPE BUSINESS SYSTEM (CONFIGURATION IV)

Deviations from Standard Configuration: . . . . . Multiply-Divide not available. Simultaneous Read, Write, and Compute is not available.

Rental: . . . . . $20,290 per month.



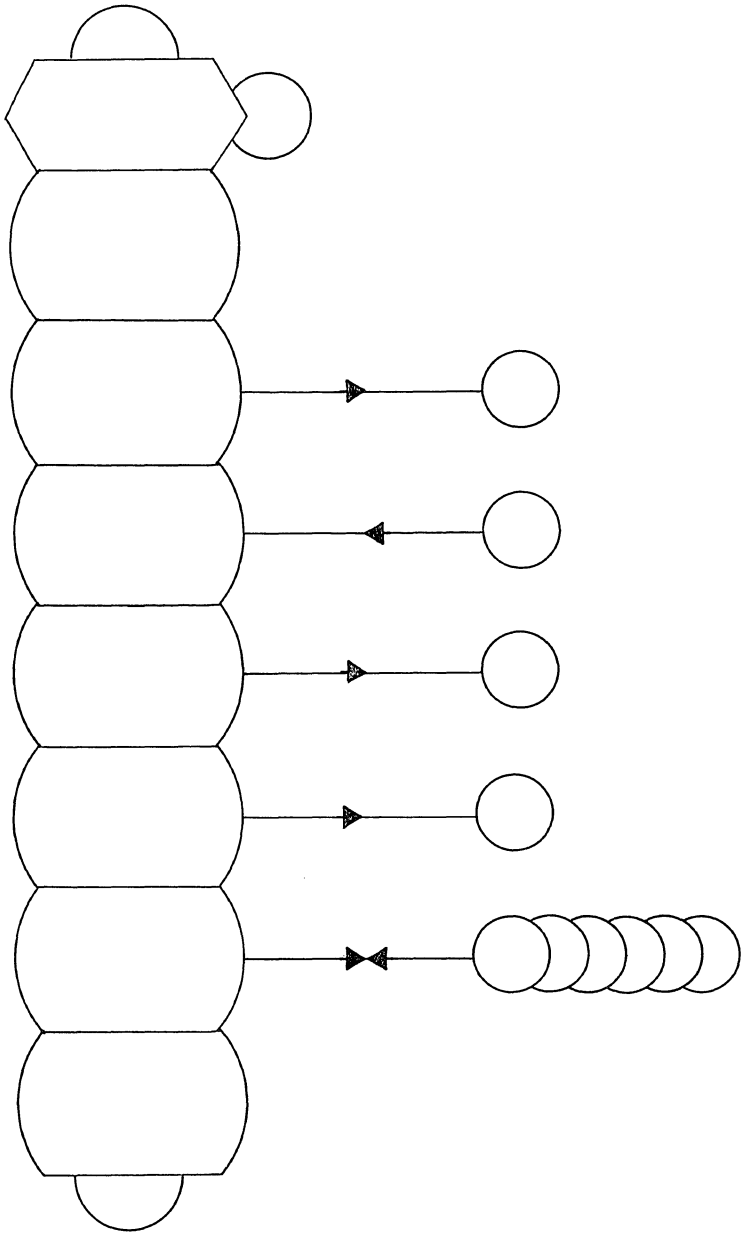
Equipment	Rental
Core Storage: 40,000 characters 305 Processor and Console	4,069
392 Simultaneous Mode Control	608
308 Controller 338 Monitor Printer 10 char/sec.	170 196
314-1R Controller 323 Card Reader 600 cards/min.	134 361
315 Controller 334 Card Punch 100 cards/min.	283 206
316-1 Controller 333 Printer 1,000 lines/min.	155 721
352 Controller 582 Magnetic Tape Units (12) 66,667 char/sec.	2,575 10,812
Total	$20,290

§031.

.5 AUXILIARY STORAGE SYSTEM (CONFIGURATION V)

Deviations from Standard Configuration: . . . . . Multiply-Divide not available.

Rental: . . . . . $12,777 per month.



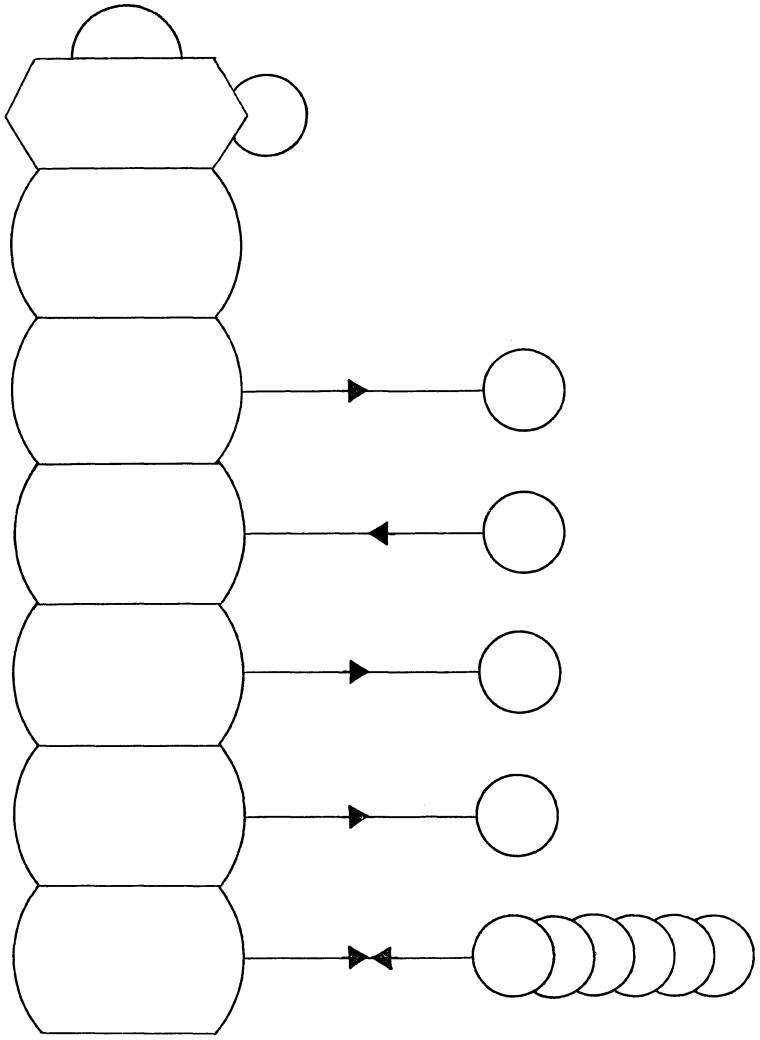
Equipment	Rental
Core Storage: 20,000 characters. 304 Processor and Console	2,421
392 Simultaneous Mode Control	608
308 Controller 338 Monitor Printer 10 char/sec.	170 196
314-1R Controller 323 Card Reader 600 cards/min.	134 361
315 Controller 334 Card Punch 100 card/min.	283 206
316-1 Controller 333 Printer 1,000 lines/min.	155 721
341 Controller 581 Magnetic Tape Units (6) 33,333 char/sec.	1,030 3,402
3661-1 Disc Storage and Controller: 22,000,000 characters.	3,090
Total	$12,777

§ 031.

.6 6-TAPE BUSINESS/SCIENTIFIC SYSTEM (CONFIGURATION VI)

Deviations from Standard Configuration: . . . . . 1. Core storage is 40,000 char rather than 85,000.
2. 2 index registers rather than 3.
3. 1 simultaneous transfer with processing rather than 2.
4. Printer 100% faster

Rental: . . . . . $12,880 per month.



Equipment	Rental
Core Storage: 40,000 characters. 355 Processor and Console.	5,614
392 Simultaneous Mode Control.	608
308 Controller 338 Monitor Printer 10 char/sec.	170 196
314-1R Controller 323 Card Reader 600 cards/min.	134 361
315 Controller 334 Card Punch 100 cards/min.	283 206
316-1 Controller 333 Printer 1,000 lines/min.	155 721
341 Controller 581 Magnetic Tape Units (6) 33,333 char/sec.	1,030 3,402
Total	$12,880

INTERNAL STORAGE: HIGH SPEED MEMORY

§ 041.

.1 GENERAL

.11 Identity: . . . . . High Speed Memory. Part of Model 303, 304, or 305 Processor. HSM.

.12 Basic Use: . . . . . working storage.

.13 Description:

Magnetic core storage, addressed by single characters, is a part of the Processor. Models 303, 304, and 305 Processors contain 10,000, 20,000, and 40,000 alphameric characters of storage, respectively. Cycle time is 7.0 microseconds for each memory access. One access to storage obtains a two-character diad, but only the single addressed character is used in data processing operations. Each character consists of seven bits: six data bits and one odd parity bit. Core storage is used for all input-output areas, working storage, and restricted-access special Processor tables.

.14 Availability: . . . . . February, 1961

.15 First Delivery: . . . . . February, 1961

.16 Reserved Storage

Purpose	Number of locations	Locks
Arith registers:	200.	
Logic registers:	12.	
I-O control:	4.	
Arithmetic control:	4.	
Print table:	64.	
Service Engineering:	22.	
Total:	306	switch on console.

.2 PHYSICAL FORM

.21 Storage Medium: . . . . magnetic core.

.22 Physical Dimensions

.221 Magnetic core storage
Core size: . . . . . 0.050 inches O.D.
0.030 inches I.D.
Array size (10,000 characters): . . . . . 100 bits by 50 bits by 14 bits. 8 inches by 4 inches.
Array size (20,000 characters): . . . . . 100 bits by 100 bits by 14 bits. 8 inches by 8 inches.
Array size (40,000 characters): . . . . . 200 bits by 100 bits by 14 bits. 17 inches by 8 inches.

.23 Storage phenomenon: . . direction of magnetization.

.24 Recording Permanence

.241 Data erasable by program:. . . . . yes.
.242 Data regenerated constantly: . . . . . no.
.243 Data volatile: . . . . . yes.
.244 Data permanent: . . . . no.
.245 Storage changeable: . . . no.

.28 Access Techniques

.281 Recording method: . . . coincident current.
.283 Type of access: . . . . . uniform.

.29 Potential Transfer Rates

.292 Peak data rates
Unit of data:. . . . . 2 characters (1 diad).
Cycling rate: . . . . . 142,857 cycles per second.
Conversion factor: . . 14 bits per diad.
Data rate: . . . . . 285,714 char/sec.
Compound data rate: . 285,714 char/sec.

.3 DATA CAPACITY

.31 Module and System Sizes

Identity:	Minimum Storage 303 Processor	304 Processor	Maximum Storage 305 Processor
Characters:	10,000	20,000	40,000
Instructions:	1,000	2,000	4,000
Modules:	1	1	1

.32 Rules for Combining Modules: . . . . . choice of 303, 304, or 305 Processor.

.4 CONTROLLER . . . . . none.

.5 ACCESS TIMING

.51 Arrangement of Heads: . 1 access device per system.

.52 Simultaneous Operations: . . . . . none.

.53 Access Time Parameters and Variations

.531 For uniform access
Access time: . . . . . 3.5 μ sec.
Cycle time: . . . . . 7.0 μ sec.
For data unit of: . . . 1 char (6 bits plus parity bit).

.6 CHANGEABLE STORAGE: . . . . . none

§ 041.

.7 AUXILIARY STORAGE PERFORMANCE

.71 Data Transfer

Pair of storage units possibilities
With self: . . . . . yes.

.72 Transfer Load Size

With self: . . . . . 1 to 44 char.

.73 Effective Transfer Rate

With self: . . . . . 67,600 char per sec max. (44 char).

.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Invalid address:	check	stop computer, alarm.
Receipt of data:	parity check on memory register	stop computer, alarm.
Dispatch of data:	transmits parity bit.	
Conflicting commands:	none.	
Physical record missing:	none.	
Attempt to write in arithmetic table area of memory:	check	stop computer, alarm.
Recording of data:	none.	
Recovery of data:	parity check on memory register	stop computer, alarm.

INTERNAL STORAGE: DATA RECORD FILE

§ 042.

.1 GENERAL

.11 Identity: Data Record File.
Model 361.
DRF.

.12 Basic Use: auxiliary storage.

.13 Description

This store consists of thin magnetic discs. They are automatically placed upon a turntable to be recorded or read. Up to 128 discs are held in a carrousel-type cage which rotates to bring any required disc into position to be placed on the turntable. Individual discs can be inserted and removed from the cage by an operator. Data is recorded on both sides of each disc. On each side there are two spiral bands, and the heads are able to follow the spirals -- as a disc turns -- by using a locating groove on the disc. Each Data Record File has a capacity of 4.6 million characters in 5,120 variable-length blocks. Access time varies from 0.01 to over six seconds. While the peak transfer rate is 2,500 characters per second bulk transfer is at 1,500 characters per second. There are checks to insure that positions accessed in the cage are occupied, but standard program procedures similar to tape labeling procedures are used to insure that the correct discs have been accessed. Tabs on the record cage can be used to prevent recording on discs. One type of instruction physically locates a disc, and another type provides data transfers.

.14 Availability: . . . . . January, 1962

.15 First Delivery: . . . . . January, 1962

.16 Reserved Storage: none.

.2 PHYSICAL FORM

.21 Storage Medium: magnetic discs.

.22 Physical Dimensions

.222 Drum or Disc
Diameter: . . . . . 6.815 inches.
Thickness or length: . . thin.
Number on shaft: . . . 128 in carrousel.

.23 Storage Phenomenon: . . magnetization.

.24 Recording Permanence

.241 Data erasable by program: . . . . . yes.
.242 Data regenerated constantly: . . . . . no.
.243 Data volatile: . . . . . no.
.244 Data permanent: . . . . no.
.245 Storage changeable: . . . yes.

.25 Data Volume per Band of 1 Track

Characters: . . . . . 9,000 max.
Digits: . . . . . 9,000 max.
Instructions: . . . . . 900 max.
Revolutions: . . . . . 20; spiral track.
Calls: . . . . . 10.

.26 Bands per Physical Unit: 4 per disc (2 on each side).

.27 Interleaving levels: . . . 1.

.28 Access Techniques

.281 Recording method: . . . magnetic heads which follow tracks.

.283 Type of access

Description of stage	Possible starting stage
Remove unwanted disc from turntable:	if previous disc remains when band select (search) given.
Turn to selected disc:	no.
Place on turntable and position head: . .	no.
Wait for start of band:	always new instruction.
Wait for chosen cell:	no.
Read or record records in cells: . . .	no
Optional return of disc from turntable:	no (option at end of data transfer).

.29 Potential Transfer Rates

.291 Peak bit rates
Cycling rates: . . . . . band traversed in 4 seconds.
Track/head speed: . . . approx. 50 inches/sec.
Bits/inch/track: . . . . approx. 280.
Bit rate per track: . . . 17,500 bits/sec/track.

.292 Peak data rates
Unit of data: . . . . . character.
Conversion factor: . . . 7 bits per char.
Data rate: . . . . . 2,500 char/sec/device (Normal Mode).
Compound data rate: . . 5,000 char/sec/system (Normal and Simultaneous Mode).
7,500 char/sec/system (Normal, Simultaneous and Data Record File Mode).

§ 042.

.3 DATA CAPACITY

.31 Module and System Sizes

	Minimum Storage		Maximum Storage
Identity:	-	Model 361	Model 361.
Discs:	0	128	768.
Characters:	0	4,608,000	27,648,000.
Instructions:	0	460,800	2,746,800.
Bands:	0	512	3,072.
Cells:	0	5,120	30,720.
Cartridges:	0	128	768.
Modules:	0	1	6.

.32 Rules for Combining Modules: . . . . . up to six modules in system.

.4 CONTROLLER

.41 Identity: . . . . . Data Record File Control; Model 317-1, 317-2; DRFC.
Data Record File Mode Control; Model 391; DRFMC.

.42 Connection to System

.421 On-Line: . . . . . maximum of one, each model control.
.422 Off-Line: . . . . . none.

.43 Connection to Device

.431 Devices per controller: . . . . . one to DRFC, Model 317-1; one to DRFC, Model 317-2; four to DRFMC, Model 391; total of six at one time in system.
.432 Restrictions: . . . . . when using DRFC, first DRF requires DRFC 317-1.

.44 Data Transfer Control

.441 Size of load: . . . . . 1 to 10 blocks, each of 1 to 900 char.
.442 Input-Output area: . . . core storage.
.443 Input-Output area access: . . . . . each character.
.444 Input-Output area lockout: . . . . . none.
.445 Synchronization: . . . . automatic.
.447 Table control: . . . . . none.
.448 Testable conditions: . . Record File operable.
Record File operating.
disc on turntable.

.5 ACCESS TIMING

.51 Arrangement of Heads

.511 Number of stacks
Stacks per system: . . 12.
Stacks per module: . . 2.
Stacks per yoke: . . . . 2.
Yokes per module: . . . 1.
.512 Stack movement: . . . . to beginning of band on selected disc.
.513 Stacks that can access any particular location: 1.
.514 Accessible locations
By single stack
With no movement: . . 1 band (10 cells).
With all movement: 1 band (10 cells).
By all stacks
With no movement: . 1 band per module.
6 bands per system.
.515 Relationship between stacks and locations: odd-even address of band.

.52 Simultaneous Operations

A: . . . . . waiting for access to specified location (searching).
B: . . . . . searching for access by pattern matching.
C: . . . . . reading.
D: . . . . . recording.
a ≤ 1 per DRFC + 4 per DRFMC.
b = 0.
c + d ≤ 2 per 2 DRFCs.
c + d ≤ 1 per DRFMC.

.53 Access Time Parameters and Variations

.532 Variation in access time

Stage	Variation, sec.	Example, sec.
Return of disc from table:	0.0 or 1.5	1.5.
Physical selection of unit; turn cage:	0.0 to 2.5	1.3.
Place disc on table:	1.5	1.5
Wait for start of band:	0.0 to 0.2 (0 to 1 rev).	0.1
Wait for chosen cell:	0.0 to 4.0	2.0
Read N cells:	0.4 N	0.0
Read M char in last chosen cell:	M/2500	0.2
Total		6.6 sec.

.6 CHANGEABLE STORAGE

.61 Cartridges

.611 Cartridge capacity: . . . 40 cells, each 1 to 900 char (36,000 char total).
.612 Cartridges per module: . 128
.613 Interchangeable: . . . . yes.

.62 Loading Convenience

.621 Possible loading
While computing system in use: . . . . yes.
While storage system in use: . . . . no.
.622 Method of loading: . . . . operator.
.623 Approximate change time: . . . . . 0.75 min.
.624 Bulk loading: . . . . . no.

§ 042.

.7 AUXILIARY STORAGE PERFORMANCE

.71 Data Transfer

Pair of storage units possibilities
With Self: . . . . . no.
With HSM: . . . . . yes.

.72 Transfer Load Size: . . with HSM in units of 1 to 10 cells, each 1 to 900 char.

.73 Effective Transfer Rate

With HSM: . . . . . 1,540 char/sec. for 36,000 character transfer.

.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Invalid address:	parity check	stop computer, alarm.
Receipt of data:	parity	stop computer, alarm.
Dispatch of data:	transmits parity bit.	
Conflicting commands:	interlock	wait.
Physical record missing:	sensing	stop computer, alarm.
Inoperable device:	check	stop computer, alarm.
Recording of data:	check	stop computer, alarm.
Recovery of data:	parity check by Processor	stop computer, alarm.

RCA 301
Internal Storage
DDF 366

INTERNAL STORAGE: DATA DISC FILE

§ 043.

.1 GENERAL

.11 Identity: . . . . . Data Disc File.
Model 366.
DDF.

.12 Basic Use: . . . . . auxiliary storage.

.13 Description

The Data Disc File offers up to 88 million characters of random-access bulk storage, with access times on the order of 130 milliseconds to locate and read a group of characters. Two such files may be used with a system. The Data Disc File is available in modules of 22 million characters resulting in the following models:

Model 366-1	22 million characters
Model 366-2	44 million characters
Model 366-3	66 million characters
Model 366-4	88 million characters

The 301 System Data Record Files also offer bulk storage but with slower access times and smaller storage capacities. The Data Disc File single module capacity is much greater than that of the Data Record File module and is employed for fast on-line data record-keeping applications.

Each module consists of six discs spinning on a common shaft. Access within a module is by multiple heads mounted on a common movable yoke, which has 128 possible positions. Each disc face has six two-inch zones for recorded data. Each zone contains 128 bands or tracks of data, read and recorded by one of the heads. Three of the six zones have double packing of data; hence, there are effectively nine zones per disc face. Each of the 128 physical locations of the yoke permits access to 1 band in each of the 108 zones in a 6-disc module, and there are 72 read-record heads total. Selection of the particular one of the 108 possible bands is by electrical switching of the heads, and each group of 108 bands is called a stratum. A stratum stores a maximum of 172,800 characters. There are additional bands in the file held in reserve.

Data is stored in a circular band in 10 sectors, all of which may be read or recorded in a single operation. One sector stores up to 160 characters. Each module stores 13,824 bands and 138,240 sectors. Information is stored in 301 internal code form, requiring no translation

Access time varies from 0 to 100 milliseconds to position the heads; rotation time of a disc is 50 milliseconds. The peak data transfer rate is 32,000 characters per second. The effective bulk transfer rate is claimed by the manufacturer to be 25,400 characters per second. At this data rate, data must be stored in the same band location of the zones used or in bands physically near each other.

.13 Description (Contd.)

The heads are positioned within a zone by one type of instruction, and the head and sector are selected by a second type of instruction. After head positioning is initiated, the computer is free to perform other instructions. Arrival of the heads at the specified position may be sensed by the program. The band address is automatically checked for validity of the address of the band being read.

The Disc File demand on the central processor, that is, the time the central processor is tied up by the transfer of data, is 100% since there can be no overlapped operations without the Simultaneous Mode Control. When the Simultaneous Mode Control is present, overlapped operation is possible and the central processor is delayed for only 11.2% of the total data transfer time.

.14 Availability: . . . . . approximately 6 months.

.15 First Delivery: . . . February, 1963.

.16 Reserved Storage: . . none.

.2 PHYSICAL FORM

.21 Storage Medium: . . . multiple discs.

.22 Physical Dimensions

.222 Disc
Diameter: . . . . . 39 inches.
Thickness or length: . thin.
Number on shaft: . . . 6 in 1 module, recorded on both sides.

.23 Storage Phenomenon: direction of magnetization.

.24 Recording Permanence

.241 Data erasable by program: . . . . . yes.
.242 Data regenerated constantly: . . . . . no.
.243 Data volatile: . . . . . no.
.244 Data permanent: . . . . no.
.245 Storage changeable: . . no.

.25 Data volume per band of 1 track

Characters: . . . . . 1,600.
Digits: . . . . . 1,600.
Instructions: . . . . . 160.
Sectors: . . . . . 10.

.26 Bands per Physical Unit: 1,152 per disc side, of which 768 are packed 2 to a track.

.27 Bands per Physical Unit: 1 on 384 tracks per disc side; 2 on 384 tracks per disc side.

§ 043.

.28 Access Techniques

.281 Recording method: . . moving head.

.283 Type of access

Description of stage	Possible starting stage
Move yoke to selected band:	if new yoke position is selected.
Select head:	if same yoke position is selected.
Wait for start of selected sector of band:	no.
Wait for transfer of 1-10 sectors of data:	no.

.29 Potential Transfer Rates

.291 Peak bit rates
- Cycling rates: . . . . 1,200 rpm.
- Bit rate per track: . . 224,000 bits/sec/track.
- Bits/track: . . . . . 11,200.

.292 Peak data rates
- Unit of data: . . . . . character.
- Conversion factor: . . 7 bits per char.
- Data rate: . . . . . 32,000 char/sec.
- Compound data rate: . 64,000 char/sec. max; 2 files operating and SMC 392 in system.

.3 DATA CAPACITY

.31 Module and System Sizes (See table below)

.32 Rules for Combining Modules: . . . . . 2 files may be used in a system. This brings maximum storage of Data Disc Files to 176,947,200 characters.

.4 CONTROLLER

.41 Identity: . . . . . controller is built into Disc File.

.42 Connection to System

.421 On-line: . . . . . 1 or 2 files.
.422 Off-line: . . . . . none.

.43 Connection to Device

.431 Devices per controller: file consists of Model 366-1, -2, -3, or -4.

.44 Data Transfer Control

.441 Size of load: . . . . . 1 to 10 sectors of 1 band, of max. of 160 characters per sector. Number of sectors specified by program.

.442 Input-Output area: . . . core storage.
.443 Input-Output area access: . . . . . each character.
.444 Input-Output area lockout: . . . . . none.
.445 Synchronization: . . . . automatic.
.447 Table control: . . . . . none.
.448 Testable conditions: . . Disc File operable.
Disc File operating.
Yoke moving.

.5 ACCESS TIMING

.51 Arrangement of Heads

.511 Number of stacks
- Stacks per system: . . 576 (2 Model 366-4).
- Stacks per module: . . 72.
- Stacks per yoke: . . . 72 to 288 (1-4 modules).
- Yokes per module: . . 1.
- Yokes per file: . . . . 1.

.512 Stack movement: . . . . across group (zone) of 128 tracks to addressed band.

.513 Stacks that can access any particular location: 1.

.514 Accessible locations
- By single stack
  - With no movement: . 1 band.
  - With all movement: 128 bands.
- By all stacks
  - With no movement: . 108 bands per module (stratum). 864 bands per system (2 Model 366-4).

.52 Simultaneous Operations

- A: . . . . . waiting for access to specified location.
- B: . . . . . searching for access by pattern matching.
- C: . . . . . reading.
- D: . . . . . recording.

a + c + d ≤ 1 for each file in use.
b = 0 in all operations.

.53 Access Time Parameters and Variations

.532 Variation in access time

Stage	Variation	Example
Move yoke to selected band:	0, or 10-100 msec.	80 msec.*
Select head:		negligible.
Wait for start of selected sector of band:	0-50 msec.	25 msec.
Wait for transfer of 1-10 sectors of data:	5-50 msec.	25 msec.
Total:		130 msec.

*yoke movement proceeds independently of computer after initiation (0.042 msec.).

	Minimum Storage				Maximum Storage (1 file)
Identity:		DDF 366-1	DDF 366-2	DDF 366-3	DDF 366-4.
Discs:	0	6	12	18	24.
Characters:	0	22,118,400	44,236,800	66,355,200	88,473,600.
Instructions:	0	2,211,840	4,423,680	6,635,520	8,847,360.
Sectors:	0	221,184	442,368	663,552	884,736.
Modules:	0	1	2	3	4.

§ 043.

.6 CHANGEABLE STORAGE: . . . . . none.

.7 AUXILIARY STORAGE PERFORMANCE

.71 Data Transfer

Pair of storage units possibilities
With self: . . . . . no.
With HSM: . . . . . yes.

.72 Transfer Load Size

With HSM: . . . . . 1-10 sectors on one band, of max of 160 characters per sector.

.73 Effective Transfer Rate

With HSM: . . . . . 25,400 char/sec (claimed).

.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Invalid address:	?	
Receipt of data:	parity check	stop computer, alarm.
Dispatch of data:	transmits parity bit.	
Conflicting commands:	interlock	wait.
Disc file inoperable:	check	stop computer, alarm.
Data File positioning:	check	stop computer, alarm.
Recording of data:	?	
Recovery of data:	?	
Bit counter check:	check	stop computer, alarm.

CENTRAL PROCESSOR

§ 051.

.1 GENERAL

.11 Identity: . . . . . Processor. Models 303, 304, and 305.

Processor. Models 354 and 355.

.12 Description

All models of the 301 processor are identical except for their core storage capacity and provisions for built-in fixed and floating point operations. The central processor is a sequential, two-address, add-to-storage unit. The instruction uses four-character operand addresses, with alphamerics in the most significant position to indicate the segment of core storage to be referenced. A program written for one processor will run on any other model processor containing the same or greater amount of core storage, assuming the program does not call for use of floating point arithmetic hardware facilities (which applies to programs written for Models 354 and 355 only).

The Model 303 processor contains 10,000 positions of core storage. Each character position contains six information bits plus a parity bit and is individually addressable. Models 304 and 354 contain 20,000 positions of core storage, and Models 305 and 355 contain 40,000 positions.

Models 354 and 355 contain additional high speed arithmetic circuits, not present in any form in Models 303, 304, and 305 (they use sum and difference tables which are always present in core storage) for fixed and floating point arithmetic. The high speed arithmetic unit is located in some of the space previously assigned to input-output controllers (cabinets next to the processor cabinets). The manufacturer's recommended procedure for changing from a 303/304/305 processor to a 354/355 processor is to replace the existing cabinets with new cabinets. Use of a 354/355 processor may limit the system to less than the maximum number of input-output devices previously available.

Standard Processor

The standard unit processes data serially by character with operands of up to 44 characters; the operand length is specified by the 6-bit alphameric N-character of the instruction.

The standard processor does not include index registers or automatic multiply or divide instructions. However, with the Models 354 and 355 high speed processors, a set of 10 instructions exists that can be indexed through 3 index registers.

.12 Description (Contd.)

Indirect addressing is provided in all five processor models; also, instructions for comparison, Boolean operations, data movement, and repeating instruction groups. A translate instruction exists which converts the code of each six-bit character of an operand to any other desired (preset) code.

A conditional transfer instruction can test the position of a console spring-return switch (Interrupt Button) which permits a console-initiated program interrupt. Another conditional branch instruction provides a jump based on the input-output operation proceeding in the Simultaneous Mode; i.e., a write, a read, or no operation. Program sequencing utilizes direct or indirect operand addresses. Addition and subtraction are performed in the Models 303, 304, and 305 with the use of restricted-access sum and difference tables rather than conventional adder circuits. The tables always occupy 200 positions of core storage.

Input-output operations performed independently of the central processor are: advance paper on printer; seek a record on the Data Record File; rewind magnetic tape; and seek a band on the Data Disc File. Although the processor is basically a decimally addressed machine which can be programmed simply, a number of instructions require the use of special characters: for special cases, control of bits within a character, referencing core storage beyond 10,000 locations, or specifying operand length.

Although the central processor has provision for processing variable length data fields (through use of item separator symbols), the arithmetic and logical instructions must use field lengths specified by the N-character of the instruction. Therefore, to use the processor for dynamically variable length fields or variable length records would increase the programming complexity.

Simultaneous operations are provided by optional hardware. Two data transfers or one data transfer and internal processing can occur simultaneously. Use of one additional option, the Data Record File Mode Control, permits one additional data transfer, to the Data Record File only.

Fast Processor Additions

Models 354 and 355 each provide facilities for operating on fixed or floating point eight-digit numeric operands. These facilities are provided by the introduction of special accumulators, 10 new instruction operations, and an extension to the TALLY instruction to step indexes. Only the 10 new instructions are indexable.

The 10 new operations provide addition, subtraction, multiplication, division, and shifting of fixed and

§ 051.

.12 Description (Contd.)

floating point numbers. These new operations require fixed sized operands in contrast to the variable length operations available in the basic operation repertoire. Floating point decimal operations are carried out on eight-character fixed point parts (mantissas) and two-character exponents and are normalized and rounded.

Models 354 and 355 have an 8-digit parallel adder circuit and a 16-digit accumulator. The accumulator contents can be stored and can be shifted. For convenience, either operand can be obtained from the accumulator, and the result can be left in the accumulator after the operation, or can be placed in storage. Increase in time to obtain or store each operand is shown in the table below. Operations which can use an operand in the accumulator or can leave the results in the accumulator (summing, for example) require less time than the full two-address add-to-storage operation.

The times for individual instructions can be computed from the following components:

	Fixed point, μsec	Floating point, μsec
Addition or subtraction	42	42
Multiplication	350	357
Division	357	364
Fetch each operand from HSM	28	35
Place result in HSM	28	35
Shift for alignment or normalizing	28	7
Index an address	21	21
Step an index	21	21
Addition range	70 to 126	77 to 210

These facilities increase the arithmetic speeds by a factor of 2.5 to 3.0 for addition and a factor of 10 to 20 for multiplication and floating point.

Three index locations, A, B, and C, are held in the high speed memory. It is possible to specify:

no indexing.
index address A by index A.
index address B by index B.
index addresses A and B, by indexes A and B, respectively.
index addresses A and B, each by index C.

.13 Availability

303/304/305: . . . . . 6 months following receipt of order.
354/355: . . . . . 6 months following receipt of order.

.14 First Delivery

303/304/305: . . . . . February, 1961.
354/355: . . . . . scheduled Sept. 1963.

.2 PROCESSING FACILITIES

.21 Operations and Operands

Operation and variation	Provision	Radix	Size
.211 Fixed point			
Add-subtract			
303/304/305:	automatic	decimal	1 to 44 digits.
354/355:	automatic	decimal	8 digits, or 1 to 44 digits.
Multiply			
Short:	none.		
Long			
303/304/305:	subroutine	decimal	8, 13, or 18 digits.
354/355:	automatic	decimal	8 digits.
Divide			
No remainder:	none.		
Remainder			
303/304/305:	subroutine	decimal	8, 13, or 18 digits.
354/355:	automatic	decimal	8 digits.
.212 Floating point			
Add-subtract			
303/304/305:	subroutine	decimal	8, 13, or 18 and 2.
354/355:	automatic	decimal	8 and 2.
Multiply			
303/304/305:	subroutine	decimal	8, 13, or 18 and 2.
354/355:	automatic	decimal	8 and 2.
Divide			
303/304/305:	subroutine	decimal	8, 13, or 18 and 2.
354/355:	automatic	decimal	8 and 2.
.213 Boolean			
AND: / Inclusive OR: / Exclusive OR:	automatic	binary	1 to 44 6-bit groups.
.214 Comparison			
Numbers:	automatic	high, low, equal	1 to 44 char.
Absolute:	none.		
Letters:	automatic		
Mixed:	automatic		
Collating sequence:	numerals, letters, specials interspersed.		

.215 Code translation
Provision: . . . . . automatic, using table.
Between: . . . . . any 6-bit codes.
Size: . . . . . 1 to 44 char.
.216 Radix conversion: . . . none; decimal machine.
.217 Edit format: . . . . . subroutine only.
.218 Table lookup
Equality: . . . . . no provision.
Greater than: . . . . . no provision.
Greatest: . . . . . no provision.
Least: . . . . . no provision.
Non-equality: . . . . . automatic; searches 1 to 44 char for absence of 1 specified char.
.219 Other
Repeat
Provision: . . . . . automatic.
Comment: . . . . . repeats any group of instructions up to 14 times. Applies to arithmetic, data transfer, translate, Boolean, tape and card read instructions.
Tally
Provision: . . . . . automatic.
Comment: . . . . . provides loop control by automatic counting; 100 times maximum.

§ 051.

.22 Special Cases of Operands

.221 Negative numbers: . . . absolute value with sign bit in one of the digits.
.222 Zero: . . . . . minus zero is exceptional case; it cannot arise in arithmetic; it is different from plus zero in comparison.
.223 Operand size determination
303/304/305: . . . . . count in instruction.
354/355: . . . . . automatic; 8 digits.

.23 Instruction Formats

.231 Instruction structure: . 10 char.
.232 Instruction layout

Part	O	N	A	B
Size (char.)	1	1	4	4

.233 Instruction parts

Name	Purpose
O:	operation code.
N:	operand size delimiter code, device addressing, count specification, register/indicator selection, device control, I/O data transfer control, index register selection (354/355), or index register incrementing control (354/355).
A:	HSM location or instruction control.
B:	HSM location, instruction control, or device control.

.234 Basic address structure: . . . . . 2 + 0.
.235 Literals
Arithmetic: . . . . . none.
Comparisons and tests: . . . . . single character.
Incrementing modifiers: . . . . . none.
.236 Directly addressed operands

	Minimum size	Maximum size	Volume accessible
Core Storage:	1 char	44 char	total capacity.
Data Record File:	1 block	10 blocks	total capacity.
Data Disc File:	1 sector	10 sectors	total capacity.

.237 Address indexing
.2371 Number of methods: . 1; in 354/355 Processor only.
.2373 Indexing rule: . . . . . algebraic addition of field to operand address. If negative address or overflow address occurs, halt and alarm results. Entire store is available.
.2374 Index specification: . . within the modified instruction which must be 1 of the 10 new instructions associated with the 354/355 Processor.
.2375 Number of potential indexers: . . . . . A address, B address, both A and B address by the same value, or both A and B addresses by different values; specified by N-character of instruction. 3 index registers.
.2376 Addresses which can be indexed: . . . . . all.
.2377 Cumulative indexing: . not possible.
.2378 Combined index and step: . . . . . yes; indirect addressing followed by indexing.
.238 Indirect addressing
.2381 Recursive: . . . . . yes.
.2382 Designation: . . . . . bit in least significant address character.
.2383 Control: . . . . . executed address has no indirect bit.
.239 Stepping: . . . . . using Tally instruction; 100 steps max.
.2391 Specification of increment
303/304/305: . . . . . always -1 (implicit).
354/355: . . . . . arbitrary value, held in index increment register.
.2392 Increment sign
303/304/305: . . . . . always -1 (implicit).
354/355: . . . . . + or - .
.2393 Size of increment
303/304/305: . . . . . 1, as above.
354/355: . . . . . arbitrary within maximum size of storage.
.2394 End value
303/304/305: . . . . . implied as zero.
354/355: . . . . . none as such; either indexing is controlled by N char in Tally instruction, or is done one time.
.2395 Combined step and test: . . . . . automatic, using Tally instruction.

.24 Special Processor Storage

.241 Category of storage

	Number of locations	Program usage
Core storage in all processors:	200	tables.
	4	card punch.
	4	arithmetic unit.
	12	program control.
	22	other reserved areas.
Additional core storage in 354/355:	12	3 index registers.
	12	3 index increment registers.

.242 Category: . . . . . core storage.
Access time: . . . . . 3.5 μsec.
Cycle time: . . . . . 7.0 μsec.

.3 SEQUENCE CONTROL FEATURES

.31 Instruction Sequencing

.311 Number of sequence control facilities: . . 1.

§ 051.

.314 Special sub-sequence counters

Number	Purpose
1:	repeat instruction counter.
1:	operand size counter.

.315 Sequence control step size: . . . . . instruction.

.316 Accessibility to program: . . . . . yes; stored if jump takes place.

.317 Permanent or optional modifier: . . . . . none.

.32 Look-Ahead: . . . . . none.

.33 Interruption: . . . . . none; operator can depress sense switch (Interrupt Button) on console, and program can contain test instructions for this condition.

.34 Multi-running: . . . . . none.

.35 Multi-sequencing: . . . none.

.4 PROCESSOR SPEEDS

.41 Instruction Times in μsec

	303/304/305 Processor	354/355 Processor
.411 Fixed point		
Add-subtract:	49 + 28D	130 (8 digits; includes obtaining and storing operands).
Multiply:	5,000 (8-digit operands)	406 (8 digits; includes obtaining operands).
Divide:	18,000 (8-digit operands)	413 (8 digits; includes obtaining operands).
.412 Floating point		
Add-subtract:	3,500 (8-digit subroutine)	150 (8 digits; includes obtaining and storing operands).
Multiply:	5,800 (8-digit subroutine)	430 (8 digits; includes obtaining operands).
Divide:	18,800 (8-digit subroutine)	440 (8 digits; includes obtaining operands).
.413 Additional allowance for		
Indirect addressing: .	14.	
Recomplementing		
303/304/305:	14 + 11D.	
354/355:	7.	
.414 Control		
Compare:	35 + 21D.	
Branch:	49.	
.415 Counter control		
Step:	none.	
Step and test:	70 (Tally Instruction).	
.416 Edit:	subroutine only.	
.417 Convert:	0 (decimal machine).	
.418 Shift		
303/304/305:	no shifting.	
354/355:	7D.	
.419 Other		
Translate:	35 + 21C.	
Boolean instructions: .	35 + 21C, where C includes all 6 bits.	

.42 Processor Performance in μsec

	303/304/305 Processor	354/355 Processor
.421 For random addresses		
Fixed point		
c = a + b:	84 + 42D	166 (8 digits).
b = a + b:	49 + 28D	126 (8 digits).
Sum N items:	49 + 28D	70 (8 digits).
c = ab:	8,400 (8-digit subroutine)	434 (8 digits).
c = a/b:	18,000 (8-digit subroutine)	441 (8 digits).
Floating point		
c = a + b:	3,500 (8-digit subroutine)	196 (8 digits).
b = a + b:	3,500 (8-digit subroutine)	161 (8 digits).
Sum N items:	3,500 (8-digit subroutine)	91 (8 digits).
c = ab:	9,200 (8-digit subroutine)	476 (8 digits).
c = a/b:	18,800 (8-digit subroutine)	483 (8 digits).
.422 For arrays of data		
Fixed point		
$c_i = a_i + b_j$:	442 + 42D	500 (8 digits).
$b_j = a_i + b_j$:	311 + 28D	448 (8 digits).
Sum N items:	215 + 28D	329 (8 digits).
$c = c + a_i b_j$:	9,400 (8-digit subroutine)	826 (8 digits).
Floating point		
$c_i = a_i + b_j$:	3,800 (8-digit subroutine)	539 (8 digits).
$b_j = a_i + b_j$:	3,750 (8-digit subroutine)	483 (8 digits).
Sum N items:	3,650 (8-digit subroutine)	336 (8 digits).
$c = c + a_i b_j$:	19,000 (8-digit subroutine)	882 (8 digits).

.423 Branch based on comparison	
Numeric data:	240 + 25C.
Alphabetic data: . . .	240 + 25C.
Alphameric data: . . .	276 + 46C.
.424 Switching	
Unchecked:	305.
Checked:	375 + 21C.
List search:	14 + (70 + 21C)N.
.425 Format control per character	
Unpack:	18.
Compose:	34.
.426 Table look up per comparison	
For a match:	266 + 21C.
For least or greatest:	357 + 21C.
For interpolation point:	266 + 21C.
.427 Bit indicators	
Set bit in separate location:	49.
Test bit in separate location:	105.
.428 Moving:	35 + 14C.

§ 051.

.5 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Fixed point overflow (303/304/305):	check	indicator, and bit in result.
Fixed point overflow (354/355):	check	indicator; alarm and halt on next arithmetic operation.
Address indexing (354/355):	check	stop computer; alarm.
Floating point exponent overflow check (354/355):	check	indicator; alarm and halt on next arithmetic operation.
Floating point mantissa overflow check (354/355):	none.	
Invalid data:	parity check	stop computer; alarm.
Invalid operation:	check	stop computer; alarm.
Arithmetic error:	none.	
Invalid address:	check	stop computer; alarm.
Receipt of data:	parity check	stop computer; alarm.
Control registers:	parity	stop computer; alarm.

CONSOLE

§ 061.

.1 GENERAL

.11 Identity: . . . . . Console Panel; a sub-unit of Processor. Console is built into center area of Processor cabinet and consists of sloping panel and horizontal work space.

.12 Associated Units: . . . none.

.13 Description

The Console Panel contains the controls and visible indicators used in the operation and maintenance of the computer. These are contained in three banks of pushbuttons and indicators. The pushbuttons light when depressed.

The right-hand bank displays and allows insertion of bits into the four (or two)-character-size computer registers. Core storage locations themselves are not directly addressable. The system must be stopped for register display.

The center bank allows selection of the computer register to be displayed or filled. Also, it includes some alternate action selection switches and switches to select one of the five instruction-staticizing levels.

The left-hand bank contains the balance of the alternate action selection switches, error indicators, and miscellaneous indicators.

The panel also contains a Start button, a General Reset button, and a Power Off button. Power can be turned on only at the System Power Supply.

.2 CONTROLS

.21 Power

Name	Form	Comment
Power Off:	button	turns off power to power supply and Processor.

.22 Connections: . . . . . none.

.23 Stops and Restarts

Name	Form	Comment
Start:	button	initiates execution of selected status level of instruction.
Stop:	none.	
One Cycle Stop (OCSP):	button	stops computer at end of execution of each status level.
Instruction Complete Stop (ICSP):	button	stops computer prior to staticizing of next instruction.
First Processing Level Stop (FPLS):	button	stops computer after staticizing an instruction.

.24 Stepping: . . . . . The OCSP, ICSP, and FPLS buttons in section 23 provide stepping.

.25 Resets

Name	Form	Comment
General Reset:	button	resets all registers, counters and most flip-flops (error indicators). It sets up initial status level of instruction staticizing.
Status Level Reset:	button	clears push buttons which specify status level.
Clear Register	buttons	clears register selection.
Clear Error		clears error indicators.
C_o	button	clears binary coded data entry push buttons.

.26 Loading: . . . . . Must use bit filling of registers or core storage locations.

.27 Special

Name	Form	Comment
High Speed Memory Inhibit (HSMI):	button	inhibits information from going to or coming from HSM.
Bus Adder Inhibit (BAI):	button	output of Bus Adder same as input.
Status Level Repeat (STLR):	button	inhibits changing the current status level.
Inhibit Simultaneity (ISIM):	button	all instructions executed serially but in mode control specified by instruction.
Simultaneous Mode Inhibit (SMDI):	button	all instructions performed in Normal Mode (Processor only).
Bypass Card Translation (BCT):	button	characters from cards read as binary data.
Interrupt (INT):	button	single sense switch becomes set.
Alarm Inhibit (ALI):	button	computer does not stop on an error. Error indicator lights and remains lit.
Write to Table (WTAB):	button	allows access to HSM arithmetic tables.
Specify a status level:	binary coded buttons	set up binary value to specify one of the five status levels.

§ 061.

.3 DISPLAY

.31 Alarms

Name	Form	Conditions Indicated
Parity Errors		
Simultaneous Operation or M Register (SORM):	static lamp	parity error in register(s).
Normal Operation or N Register (NORN):	static lamp	parity error in register(s).
V or L Register (FORL):	static lamp	parity error in register(s).
Repeat Register (NRPE):	static lamp	parity error in register(s).
Memory Address Register (MAPE):	static lamp	parity error in register(s).
Memory Register (MRPE):	static lamp	parity error in register(s).
D Register (DPE):	static lamp	parity error in register(s).
Status Level (STLE):	static lamp	parity error in register(s).
Other Errors		
COME:	static lamp	comparator error.
ARIE:	static lamp	arithmetic error.
WTT:	static lamp	illegal attempt to write to sum or difference table.
DDF:	static lamp	device inoperable.
RE:	static lamp	error during a read instruction.
WE:	static lamp	error during a write instruction.
TAE:	static lamp	parity error in tape address.
CCE:	static lamp	hole count error on card reader or card punch.
MCP:	static lamp	missing clock pulse on 581/582 tape stations.
SAL:	static lamp	peripheral error while instruction using SMC.
MPE:	static lamp	invalid card character.
CIG:	static lamp	character in paper tape or magnetic tape gap.
RAE:	static lamp	parity error in Data Record File or Data Disc File. Address Register.
FAL:	static lamp	error during Record File Mode instruction operation.

.32 Conditions

Name	Form	Condition Indicated
SB:	lamp while condition present	Simultaneous Mode occupied.
FB:	lamp while condition present	Record File Mode occupied.

.33 Control Registers

Name	Form	Comment
P, A, B, S, T, U, V:	binary coded indicating push buttons	desired register selected for display by appropriate push button. Contents shown as four 7-bit characters.
NOR/N, SOR/M, FOR/L, MR:	same binary coded indicating push buttons as above	as registers above, except are two 7-bit characters.

.34 Storage: . . . . . One HSM location displayed by using RDM (Read Memory) push button, and register selection and data entry push buttons.

.4 ENTRY OF DATA

.41 Into Control Registers

(1) desired register selected by depressing appropriate push button.
(2) depress binary coded indicating push buttons.

.42 Into Storage: . . . . . One HSM location may be written into by using WRM (Write Memory) push button, and register selection and data entry push buttons.

.5 CONVENIENCES

.51 Communication: . . . . none.

.52 Clock: . . . . . none.

.53 Desk Space: . . . . . approximately 12 by 48 inches.

.54 View: . . . . . operator sits at console directly in front of Processor cabinet. All equipment is to side or rear of operator.

INPUT-OUTPUT: PAPER TAPE READER/PUNCH

§ 071.

.1 GENERAL

.11 Identity: . . . . . Paper Tape Reader/Punch. Model 321. PTRP.

.12 Description:

This is a pair of separate units housed in a single cabinet. Both the reader and the punch operate at one hundred rows per second on standard one-inch seven-level paper tape. Optional features permit five- or seven-level punch and/or five- or seven-level reader operation. The external code is the same as the internal code, but a convenient code translation instruction can be used to translate any code. The system normally requires that blocks be separated by gaps of three rows, but the reader can be set to read gapless tape by ignoring gap detection.

.13 Availability: . . . . . July, 1961.

.14 First Delivery: . . . . . July, 1961.

.2 PHYSICAL FORM

.21 Drive Mechanism

.211 Drive past the head: . . . sprocket drive for punch. clutch controlled rollers for reader.

.212 Reservoirs
- Number: . . . . . 4; 2 per unit.
- Form: . . . . . swinging arm.
- Capacity: . . . . . 8 inches maximum.

.213 Feed drive: . . . . . electric motor.

.214 Take-up drive: . . . . . electric motor

.22 Sensing and Recording System

.221 Recording system: . . . die punch.

.222 Sensing system: . . . . . photoelectric.

.223 Common system: . . . . no.

.23 Multiple Copies: . . . . . none.

.24 Arrangement of Heads

Use of station: . . . . . reading
Stacks: . . . . . 1.
Heads/stack: . . . . . 8.
Method of use: . . . . . reads one row at a time.

Use of station: . . . . . punching.
Stacks: . . . . . 1.
Heads/stack: . . . . . 8.
Method of use: . . . . . punches one row at a time.

.3 EXTERNAL STORAGE

.31 Form of Storage

.311 Medium: . . . . . paper tape.

.312 Phenomenon: . . . . . standard punched holes.

.32 Positional Arrangement

.321 Serial by: . . . . . N rows at 10 per inch.

.322 Parallel by: 7 tracks at standard spacing (5- or 7-tracks in modified units).

.324 Track use

	7-level	5-level
Data:	6	5.
Redundancy check:	1	0.
Timing:	1 (sprocket track)	1 (sprocket track).
Control signals:	0	0.
Unused:	0	0.
Total:	7 plus sprocket track	5 plus sprocket track.

.325 Row use
- Data: . . . . . all.
- Redundancy check: . . . 0.
- Timing: . . . . . 0.
- Control signals: . . . . 0.
- Gap: . . . . . 3, in block format.

.33 Coding: . . . . . as in Data Code Table No. 1, with holes representing zero bits and no holes representing one bits.

.34 Format Compatibility: . any paper tape device accepting standard 11/16-inch 5-level or 1-inch 7-level tape.

.35 Physical Dimensions

.351 Overall width: . . . . . 11/16-inch or 1-inch.

.352 Length: . . . . . 1,000 ft max, punch and reader; also short lengths (reader).

.4 CONTROLLER

.41 Identity: . . . . . Paper Tape Reader/Punch Control. Model 311. PTRPC.

.42 Connection to System

.421 On-line: . . . . . one PTRPC max.

.422 Off-line: . . . . . none.

§ 071.

.43 Connection to Device

.431 Devices per controller: . 1.
.432 Restrictions:. . . . . the PTRP Control 311 can control either one PTRP 321, or one PTR 322 and one PTP 331.

.44 Data Transfer Control

.441 Size of load: . . . . . 1 to N char, limited by available core storage.
.442 Input-output areas: . . . core storage.
.443 Input-output area access: . . . . . each character.
.444 Input-output area lockout: . . . . . none.
.445 Table control: . . . . . none.
.446 Synchronization:. . . . . automatic.

.5 PROGRAM FACILITIES AVAILABLE

.51 Blocks

.511 Size of block: 1 to N char; depends on available core storage.

.512 Block demarcation
Input: . . . . . block gap for input.
Output: . . . . . limit counter for output.

.52 Input-Output Operations

.521 Input: . . . . . 1 block forward with limit cut off; block gap or HSM location.
.522 Output: . . . . . 1 block forward.
.523 Stepping:. . . . . none.
.524 Skipping:. . . . . none.
.525 Marking:. . . . . none.
.526 Searching: . . . . . none.

.53 Code Translation: . . . . matched codes; parity bit generated when reading 5-level codes.

.54 Format Control:. . . . . none.

.55 Control Operations

Disable: . . . . . no.
Request interrupt: . . . no.
Select format: . . . . . no.
Select code: . . . . . no.
Rewind: . . . . . no.
Unload: . . . . . no.

.56 Testable Conditions

Disabled: . . . . . yes.
Busy device: . . . . . yes.
Nearly exhausted: . . . . no.
Busy controller: . . . . yes.
End of medium marks: . no.
Exhausted: . . . . . no.

.6 PERFORMANCE

.61 Conditions

I: . . . . . without SMC.
II: . . . . . with SMC.

.62 Speeds

.621 Nominal or peak speed: . . . . . 100 rows/sec for reading and punching.

.622 Important parameters
Speed: . . . . . 10 in/sec.
Stopping distance: . . . ready to read or punch next character at nominal spacing.

.623 Overhead: . . . . . 3 rows per block gap; no gap required when reading.

.624 Effective speeds: 100 N/(N + 3G) char/sec where N = char in block
G = no. of gaps in data.

.63 Demands on System

Component	Condition	m. sec per char	or	Percentage
Processor	I	10,000	or	100.00.
Processor	II	0.007	or	0.07

.7 EXTERNAL FACILITIES

.71 Adjustments

Adjustment	Method	Comment
Tape width guide for modified 5- or 7-level reader and/or punch:	knob	by operator.

.72 Other Controls

Function	Form	Comment
Stop mode:	button	gap detection made inoperative for reading gapless tape.
Tape feed:	button	feeds tape, punching sprocket holes.
Punch delete codes:	button	feeds tape punching holes in each track.

.73 Loading and Unloading

.731 Volumes handled: spools of 1,000 feet.
.732 Replenishment time: 1 to 2 mins.
device needs to be stopped.
.733 Adjustment time: 5- or 7-level option; 0.5 min to adjust tape width guide.
.734 Optimum reloading period: 20 mins.

§ 071.

. 8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Recording	parity check on punch	stop computer, alarm.
Reading:	parity check	stop computer, alarm.
Input area overflow:	limit counter interlock	cut-off and indicator.
Invalid code:	all codes valid.	
Exhausted medium:	none.	
Imperfect medium:	none.	
Timing conflicts:	interlock	wait.
Punch, reader inoperable:	check	stop computer, alarm.
Character found in gap:	check	stop computer, alarm.
Output block size:	limit counter interlock	cut-off and indicator.

INPUT-OUTPUT: PAPER TAPE READER

§ 072.

.1 GENERAL

.11 Identity: . . . . . Paper Tape Reader. Model 322. PTR.

.12 Description:

This is a high-speed paper tape reader which will read 5, 6, or 7 level chad (fully perforated) punched paper tape at rates up to 1,000 rows per second. The normal external code is the same as the internal code, but a convenient translation instruction can be used to translate any code. The reader can be set to read gapless tape, at 500 rows/second. The system requires that blocks be separated by gaps of three rows when reading at the rate of 1,000 rows per second.

.13 Availability: . . . . . December, 1961.

.14 First Delivery: . . . . . December, 1961.

.2 PHYSICAL FORM

.21 Drive Mechanism

.211 Drive past the head: . . . clutch controlled rollers.
.212 Reservoirs
Number: . . . . . 2.
Form: . . . . . swinging arm.
Capacity: . . . . . 60 inches maximum.
.213 Feed drive: . . . . . electric motor.
.214 Take-up drive: . . . . . electric motor.

.22 Sensing and Recording Systems

.221 Recording system: . . . none.
.222 Sensing system: . . . . . photoelectric.

.23 Multiple Copies: . . . . . none.

.24 Arrangement of Heads

Use of station: . . . . . reading.
Stacks: . . . . . 1.
Heads/stack: . . . . . 8.
Method of use: . . . . . reads one row at a time.

.3 EXTERNAL STORAGE

.31 Form of Storage

.311 Medium: . . . . . paper tape.
.312 Phenomenon: . . . . . standard punched holes.

.32 Positional Arrangement

.321 Serial by: . . . . . N rows at 10 per inch.
.322 Parallel by: . . . . . 5, 6, or 7 tracks at standard spacing.

.324 Track use
Data: . . . . . 5 or 6.
Redundancy check: . . . 1 (if 7 level).
Timing: . . . . . 1 (sprocket track).
Control signals: . . . . 0.
Unused: . . . . . 0.
Total: . . . . . 5, 6 or 7 plus sprocket track.
.325 Row use
Data: . . . . . all.
Redundancy check: . . . 0.
Timing: . . . . . 0.
Control signals: . . . . 0.
Gap: . . . . . 3, in block format.

.33 Coding: . . . . . as in Data Code Table No. 1, with holes representing zero bits and no holes representing one bits.

.34 Format Compatibility: . . any paper tape device accepting standard 11/16 inch 5-level to 1-inch 7-level tape.

.35 Physical Dimensions

.351 Overall width: . . . . . 11/16 to 1 inch by 1/16 inch increments.

.352 Length: . . . . . 1,000 ft. max.; also short lengths.

.4 CONTROLLER

.41 Identity: . . . . . Paper Tape Reader Punch Control. Model 311. PTRPC.

.42 Connection to System

.421 On-line: . . . . . one PTRPC max.
.422 Off-line: . . . . . none.

.43 Connection to Device

.431 Devices per controller: . 1.
.432 Restrictions: . . . . . the 311 PTRP Control can control either one 321 PTRP, or one 322 PTR and one 331 PTP.

.44 Data Transfer Control

.441 Size of load: . . . . . 1 to N char, limited by available core storage.
.442 Input-output areas: . . . core storage.
.443 Input-output area access: . . . . . each character.
.444 Input-output area lockout: . . . . . none.

§ 072.

.445 Table control: . . . . . none.
.446 Synchronization: . . . . . automatic.

.5 PROGRAM FACILITIES AVAILABLE

.51 Blocks

.511 Size of block: . . . . . 1 to N char, depends on available core storage.
.512 Block demarcation
Input: . . . . . block gap.

.52 Input-Output Operations

.521 Input: . . . . . 1 block forward with limit cut off; block gap or HSM location.
.522 Output: . . . . . none.
.523 Stepping: . . . . . none.
.524 Skipping: . . . . . none.
.525 Marking: . . . . . none.
.526 Searching: . . . . . none.

.53 Code Translation: . . . . matched codes; parity bit generated when reading 5- or 6-level codes.

.54 Format Control: . . . . . none.

.55 Control Operations

Disable: . . . . . no.
Request interrupt: . . . no.
Select format: . . . . . no.
Select code: . . . . . no.
Rewind: . . . . . no.
Unload: . . . . . no.

.56 Testable Conditions

Disabled: . . . . . yes.
Busy device: . . . . . yes.
Nearly exhausted: . . . . no.
Busy controller: . . . . yes.
End of medium marks: . no.
Code level (5, 6 or 7) . . no.
Exhausted: . . . . . no.

.6 PERFORMANCE

.61 Conditions

I: . . . . . without SMC.
II: . . . . . with SMC.

.62 Speeds

.621 Nominal or peak speed: . 1000 rows/sec normal; 500 row/sec with gapless tape (telegraph codes).

.622 Important parameters
Speed: . . . . . 50 or 100 in/sec.
Stopping distance: . . . approximately 0.3 inches at 100 in/sec; stops on a single character at 50 in/sec (no gap).
.623 Overhead: . . . . . 3 rows per block gap in block format.

.624 Effective speeds: 500 N/(N + 3G) char/sec or 1,000 N/(N+3G) char/sec.
N = number of characters read.
G = number of gaps in data.

.63 Demands on System

Component	Condition	m.sec. per char	or	Percentage
Processor:	I	2 or 1	or	100.
Processor:	II	0.007	or	0.35 or 0.7.

.7 EXTERNAL FACILITIES

.71 Adjustments

Adjustment	Method	Comment
Tape width guide	knob	by operator.

.72 Other Controls

Function	Form	Comment
Rewind:	button	
Stop:	button	stops tape motion.
Start:	button	starts tape motion.
Stop mode:	button	gap detection made inoperative for reading gapless tape; speed set to 500 char/sec.
Parity select:	button	selects odd or even parity.
Servo control:	buttons	control servo power.
Tape type select:	button	permits reading of short strips of tape.
Code select:	switch	selects 5-, 6-, 7-, 8-level tape.
Remoting:	button	puts reader under computer control.

.73 Loading and Unloading

.731 Volumes handled: . . . reel of 1,000 feet.
.732 Replenishment time: . . . 0.75 min. to 1 min; reader needs to be stopped.
.733 Adjustment time: . . . . 1/2 min. to adjust tape width guide.
.734 Optimum reloading period: . . . . . 2 minutes at 1,000 char/sec.
4 minutes at 500 char/sec.

.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Reading:	parity	stop computer, alarm.
Input area overflow:	limit counter interlock	cut off and indicator.
Invalid code:	all good.	
Exhausted medium:	none.	
Imperfect medium:	none.	
Timing conflicts	interlock	wait.
Reader inoperable:	check	stop computer, alarm.
Character found in gap:	check	stop computer, alarm.

INPUT-OUTPUT: PAPER TAPE PUNCH

§ 073.

.1 GENERAL

.11 Identity: . . . . . Paper Tape Punch.
Model 331.
PTP.

.12 Description

This is the same punch unit used in the Paper Tape Reader/Punch, Model 321. The Model 331 PTP is used when a paper tape punch is required with the high-speed Paper Tape Reader, Model 322. Its peak speed is 100 rows per second. The standard unit punches 7-level tape. An optional feature provides for punching either 5- or 7-level tapes.

.13 Availability: . . . . . April, 1961.

.14 First Delivery: . . . . February, 1962.

.2 PHYSICAL FORM

.21 Drive Mechanism

.211 Drive past the head: . . sprocket drive.
.212 Reservoirs
Number: . . . . . 2.
Form: . . . . . swinging arm.
Capacity: . . . . . 8 inches maximum.
.213 Feed drive: . . . . . electric motor.
.214 Take-up drive: . . . . . electric motor.

.22 Sensing and Recording Systems

.221 Recording system: . . . die punch.
.222 Sensing system: . . . . none.

.23 Multiple Copies: . . . . none.

.24 Arrangement of Heads

Use of station: . . . . . punching.
Stacks: . . . . . 1.
Heads/stack: . . . . . 8.
Method of use: . . . . . one row at a time.

.3 EXTERNAL STORAGE

.31 Form of Storage

.311 Medium: . . . . . paper tape.
.213 Phenomenon: . . . . . standard punched holes.

.32 Positional Arrangement

.321 Serial by: . . . . . N rows at 10 per inch.
.322 Parallel by: . . . . . 8 tracks at standard spacing (6 or 8 tracks in modified units).

.324 Track use:

	7-level	5-level
Data:	6	5.
Redundancy check: . . .	1	0.
Timing:	1 (sprocket track)	1 (sprocket track).
Control signals:	0	0.
Unused:	0	0.
Total:	7 plus sprocket track	5 plus sprocket track.

.325 Row use
Data: . . . . . all.
Redundancy check: . . 0.
Timing: . . . . . 0.
Control signals: . . . 0.
Gap: . . . . . 3.

.33 Coding: . . . . . as in Data Code Table No. 1, with holes representing zero bits and no holes representing one bits.
.34 Format Compatibility: any paper tape device accepting standard 11/16 inch 5-level or 1-inch 7-level tape.

.35 Physical Dimensions

.351 Overall width: . . . . . 11/16 inch or 1 inch.
.352 Length: . . . . . 1,000 ft. max.

.4 CONTROLLER

.41 Identity: . . . . . Paper Tape Reader/Punch Control.
Model 311.
PTRPC.

.42 Connection to System

.421 On-line: . . . . . one PTRPC max.
.422 Off-line: . . . . . none.

.43 Connection to Device

.431 Devices per controller: 1.
.432 Restrictions: . . . . . the PTRP Control 311 can control either one PTRP 321 or one PTR 322 and one PTP 331.

.44 Data Transfer Control

.441 Size of load: . . . . . 1 to N char, limited by available core storage.
.442 Input-output areas: . . core storage.
.443 Input-output area access: . . . . . each character.
.444 Input-output area lockout: . . . . . none.
.445 Table control: . . . . . none.
.446 Synchronization: . . . . automatic.

§ 073.

.5 PROGRAM FACILITIES AVAILABLE

.51 Blocks

.511 Size of block: . . . . . 1 to N char, depends on available core storage.

.512 Block demarcation
Output: . . . . . limit counter for output.

.52 Input-Output Operations

.521 Input: . . . . . none.
.522 Output: . . . . . punch 1 block forward.
.523 Stepping: . . . . . none.
.524 Skipping: . . . . . none.
.525 Marking: . . . . . none.
.526 Searching: . . . . . none.

.53 Code Translation: . . . matched codes.

.54 Format Control: . . . . none.

.55 Control Operations

Disable: . . . . . no.
Request interrupt: . . . no.
Select format: . . . . . no.
Select code: . . . . . no.
Rewind: . . . . . no.
Unload: . . . . . no.

.56 Testable Conditions

Disabled: . . . . . yes.
Busy device: . . . . . yes.
Nearly exhausted: . . . no.
Busy controller: . . . . yes.
Exhausted: . . . . . no.

.6 PERFORMANCE

.61 Conditions

I: . . . . . without SMC.
II: . . . . . with SMC.

.62 Speeds

.621 Nominal or peak speed: 100 rows/sec.

.622 Important parameters
Speed: . . . . . 10 in/sec.
Stopping distance: . . ready to punch next character at nominal spacing.

.623 Overhead: . . . . . 3 rows per block gap.

.624 Effective speeds: . . . 100 N/(N + 3) char./sec., where N = char. in block.

.63 Demands on System

Component	Condition	m.sec per char.	or	Percentage
Processor:	I	10.000	or	100.00.
Processor:	II	0.007	or	0.07.

.7 EXTERNAL FACILITIES

.71 Adjustments

Adjustment	Method	Comment
Tape width guide for modified 5- or 7-level punch:	knob	by operator.

.72 Other Controls

Function	Form	Comment
Punch feed:	button	feeds tape, punching sprocket holes.
Punch delete codes:	button	feeds tape, punching holes in each track.

.73 Loading and Unloading

.731 Volumes handled: . . . spools of 1,000 feet.
.732 Replenishment time: . . 1 to 2 mins. punch needs to be stopped.
.733 Adjustment time: . . . 5- 7-level option: 1/2 min. to adjust tape width guide.
.734 Optimum reloading period: . . . . . 20 mins.

.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Recording:	parity check at punch	stop computer, alarm.
Output block size:	limit counter interlock	cut off & indicator.
Invalid code:	all codes valid.	
Exhausted medium:	none.	
Imperfect medium:	none.	
Timing conflicts:	interlock	wait.
Punch inoperable:	check	stop computer, alarm.

INPUT-OUTPUT: CARD READER

§ 074.

.1 GENERAL

.11 Identity: . . . . . Card Reader.
Model 323.
CR.

.12 Description

The Card Reader has a maximum speed of six hundred cards per minute and reads 80-column punched cards. Each instruction causes one card to be read. Card timing can be reduced to three hundred cards per minute under program control, or cards may be fed on demand at a maximum rate of approximately two hundred cards per minute. The Card Reader Control automatically translates from standard card code to 301 internal code. Automatic translation may be by-passed, in which case the card image will be read into core storage and translation will be performed by a subroutine. The reader employs two sensing stations and a hole count check for reliability. The input hopper and output stacker have capacities of 2,000 cards each and can be loaded and unloaded while the reader is operating. The reject stacker has a capacity of 100 cards.

.13 Availability: . . . . . September, 1961.

.14 First Delivery: . . . . September, 1961.

.2 PHYSICAL FORM

.21 Drive Mechanism

.211 Drive past the head: . . clutch driven rollers.
.212 Reservoirs: . . . . . none.

.22 Sensing and Recording Systems

.221 Recording system: . . . none.
.222 Sensing system: . . . . brush.

.23 Multiple Copies: . . . . none.

.24 Arrangement of Heads

Use of station: . . . . . reading.
Stacks: . . . . . 1.
Heads/stack: . . . . . 80.
Method of use: . . . . . one row at a time.

Use of station: . . . . . checking.
Distance: . . . . . one row.
Stacks: . . . . . 1.
Heads/stack: . . . . . 80.
Method of use: . . . . . one row at a time.

.3 EXTERNAL STORAGE

.31 Form of Storage

.311 Medium: . . . . . standard 80-column cards.
.312 Phenomenon: . . . . . rectangular holes.

.32 Positional Arrangement

.321 Serial by: . . . . . 12 rows.
.322 Parallel by: . . . . . 80 columns.
.324 Track use: . . . . . all for data.
.325 Row use: . . . . . all for data.

.33 Coding: . . . . . as in Data Code Table No. 2.

.34 Format Compatibility: . all devices using standard 80-column cards.

.35 Physical Dimensions: . standard 80-column cards.

.4 CONTROLLER

.41 Identity: . . . . . Card Reader Control.
Models 314-1R, 314-2R.

.42 Connection to System

.421 On-line: . . . . . one 314-1R controls first card reader.
one 314-2R controls second card reader.
.422 Off-line: . . . . . none.

.43 Connection to Device

.431 Devices per controller: 1.
.432 Restrictions: . . . . . none.

.44 Data Transfer Control

.441 Size of load: . . . . . one card, punched in any format.
.442 Input-output areas: . . core storage.
.443 Input-output area access: . . . . . each character.
.444 Input-output area lockout: . . . . . none.
.445 Table control: . . . . . none.
.446 Synchronization: . . . . automatic.

.5 PROGRAM FACILITIES AVAILABLE

.51 Blocks

.511 Size of block: . . . . . 1 card.
.512 Block demarcation Input: . . . . . at end of each card.

.52 Input-Output Operations

.521 Input: . . . . . 1 card.
.522 Output: . . . . . none.
.523 Stepping: . . . . . none.
.524 Skipping: . . . . . none.
.525 Marking: . . . . . none.
.526 Searching: . . . . . none.

§ 074.

.53 Code Translation: . . . automatic translation unless manually by-passed.

.54 Format Control: . . . . none.

.55 Control Operations

Disable:	no.
Request interrupt: . . .	no.
Offset card:	no.
Select stacker:	no.
Select format:	no.
Select code:	no.
Unload:	no.

.56 Testable Conditions

Disabled:	yes.
Busy device:	yes.
Nearly exhausted: . . .	no.
Hopper empty:	no.
Stacker full:	no.

.6 PERFORMANCE

.61 Conditions

I:	without SMC.
II:	with SMC.

.62 Speeds

.621 Nominal or peak speed: 600 ± 10 cards/min.
.623 Overhead: . . . . . single-point clutch.
.624 Effective speeds: . . .
1. at 600 cards per minute; available processing time is 20 m. sec.
2. at 300 cards per minute; available processing time is 120 m. sec.
3. single card reading: maximum speed is approximately 200 cards per minute.

.63 Demands on System

Component	Condition	m. sec per card	or	Percentage*
Processor:	I	80.00	or	80.00
Processor:	II	13.44	or	13.44

* at 600 cards/minute.

.7 EXTERNAL FACILITIES

.71 Adjustments: . . . . . none.

.72 Other Controls: . . . . none.

.73 Loading and Unloading

.731 Volumes handled

Storage	Capacity
Hopper:	2,000 cards.
Stacker:	2,000 cards.

.732 Replenishment time: 1 min max.; reader does not need to be stopped.

.734 Optimum reloading period: . . . . . 3.3 mins.

.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Receipt of data from translator:	parity check	stop computer, alarm.
Reading:	double reading and hole count	stop computer, alarm.
Input area overflow:	fixed size.	
Invalid code:	check for non-301 character	stop computer, alarm.
Read instruction too late for continuous feeding:	check	stop computer, alarm, at next read instruction.
Exhausted medium:	disabled check	stop computer, alarm.
Imperfect medium:	none.	
Timing conflicts:	interlock	wait.
Full stacker:	disabled check	stop computer, alarm.
Reader inoperable:	disabled check	stop computer, alarm.

INPUT-OUTPUT: CARD PUNCH

§ 075.

.1 GENERAL

.11 Identity: . . . . . Card Punch.
Model 334.
CP 334.

.12 Description

This card punch has a maximum speed of 100 cards per minute, and punches standard 80-column cards. Internal codes are punched in standard RCA card code after automatic translation by the card punch controller. The punch unit has a reading station after the punching station for hole-count accuracy control purposes. Stacker and hopper capacity is 800 cards. A card punch instruction causes one card to be punched.

.13 Availability: . . . . . September, 1961.

.14 First Delivery: . . . . September, 1961.

.2 PHYSICAL FORM

.21 Drive Mechanism

.211 Drive past the head: . . clutch-controlled rollers.
.212 Reservoirs: . . . . . none.

.22 Sensing and Recording Systems

.221 Recording system: . . . die punch.
.222 Sensing system: . . . . brush.
.223 Common system: . . . no.

.23 Multiple Copies: . . . . none.

.24 Arrangement of Heads

Use of station: . . . . . punching.
Stacks: . . . . . 1.
Heads/stack: . . . . . 80.
Method of use: . . . . . one row at a time.

Use of station: . . . . . reading.
Distance: . . . . . one card.
Stacks: . . . . . 1.
Heads/stack: . . . . . 80.
Method of use: . . . . . one row at a time.

.3 EXTERNAL STORAGE

.31 Form of Storage

.311 Medium: . . . . . standard 80-column cards.
.312 Phenomenon: . . . . . rectangular holes.

.32 Positional Arrangement

.321 Serial by: . . . . . 12 rows.
.322 Parallel by: . . . . . 80 columns.
.323 Bands: . . . . . 1.
.324 Track use: . . . . . all for data.
.325 Row use: . . . . . all for data.

.33 Coding: . . . . . as in Data Code Table No. 2.

.34 Format Compatibility: . all devices using standard 80-column punched cards.

.35 Physical Dimensions: . standard 80-column cards.

.4 CONTROLLER

.41 Identity: . . . . . Card Punch Control.
Model 315.
CPC 315.

.42 Connection to System

.421 On-line: . . . . . one CPC 315.
.422 Off-line: . . . . . none.

.43 Connection to Device

.431 Devices per controller: one per control.
.432 Restrictions: . . . . . none.

.44 Data Transfer Control

.441 Size of load: . . . . . 1 to 80 char of one card.
.442 Input-output areas: . . core storage.
.443 Input-output area access: . . . . . each character.
.444 Input-output area lockout: . . . . . none.
.445 Table control: . . . . . none.
.446 Synchronization: . . . . automatic.

.5 PROGRAM FACILITIES AVAILABLE

.51 Blocks

.511 Size of block: . . . . . 1 card of 1 - 80 columns.
.512 Block demarcation: . . limit counter.

.52 Input-Output Operations

.521 Input: . . . . . none.
.522 Output: . . . . . 1 card forward controlled by column count.
.523 Stepping: . . . . . none.
.524 Skipping: . . . . . none.
.525 Marking: . . . . . none.
.526 Searching: . . . . . none.

.53 Code Translation: . . . internal code to card code by CPC 315.

.54 Format Control: . . . . none.

§ 075.

.55 Control Operations

Disable: . . . . . no.
Request interrupt: . . . no.
Offset card: . . . . . no.
Select stacker: . . . . . no.
Select format: . . . . . no:
Select code: . . . . . no.

.56 Testable Conditions

Disabled: . . . . . yes.
Busy device: . . . . . yes.
Nearly exhausted: . . . no.
Busy controller: . . . . not applicable.

.6 PERFORMANCE

.61 Conditions

I: . . . . . normal mode.
II: . . . . . simultaneous mode.

.62 Speeds

.621 Nominal or peak speed: 100 ± 5 cards/min.
.622 Important parameters: none.
.623 Overhead: . . . . . single point clutch.
.624 Effective speeds: . . . maximum speed depends on cycles missed.

.63 Demands on System

Component	Condition	m.sec per card	or	Percentage
Processor:	I	600	or	100.0.
Processor:	II	6.72	or	1.1.

.7 EXTERNAL FACILITIES

.71 Adjustments: . . . . . none.

.72 Other Controls: . . . . load, unload.

.73 Loading and Unloading

.731 Volumes handled

Storage	Capacity
Hopper:	800.
Stacker:	800.

.732 Replenishment time: 1 min max. no need to be stopped.

.734 Optimum reloading period: . . . . . 8 mins.

.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Recording:	read-after-punch; hole count	stop computer, alarm.
Output block size:	limit counter interlock	cut off and indicator.
Invalid code:	301 code check	stop computer, alarm.
Exhausted medium:	disabled check	stop computer, alarm.
Imperfect medium:	none.	
Timing conflicts:	interlock	wait.
Full stacker:	disabled check	stop computer, alarm.
Punch inoperable:	disabled check	stop computer, alarm.

INPUT-OUTPUT: PRINTER (MODEL 333)

§ 081.

.1 GENERAL

.11 Identity: . . . . . On-Line Printer. Model 333. O-LP 333.

.12 Description:

Model 333 printer provides high-speed line printing capability for the 301 system up to one thousand single-spaced lines per minute. Output format is 120 characters per line, and six lines per inch vertically. As an option, vertical pitch may be specified as eight or ten lines per inch. When a restricted set of 47 characters is specified, printing can be done at one thousand lines per minute, and when the full set of 64 is used, Model 333 can print eight hundred lines per minute. At one-inch line spacing, printing speed drops to about 565 lines per minute. Two Model 333 printers may be used in the system.

The printer uses the standard rotating drum printing technique and prints one line from one computer instruction. Paper skipping speed is 25 inches (150 single-spaced lines) per second. The printer controller requires sixty computer memory cycles for each character in the printed character set (47-64 characters) for each line printed. All paper movement is performed independent of the computer.

Under manual selection, the rotational speed of the engraved printing drum may be lowered, giving maximum printing speeds of 667 and 570 lines per minute.

There is another printer, Model 335, which can print 160 characters per line at approximately the same speeds as Model 333.

.13 Availability: . . . . . September, 1961.

.14 First Delivery: . . . . . September, 1961.

.2 PHYSICAL FORM

.21 Drive Mechanism

.211 Drive past the head: . . . sprocket drive push and pull.
.212 Reservoirs: . . . . . none.

.22 Sensing and Recording Systems

.221 Recording system: . . . on-the-fly hammer stroke against engraved drum.
.222 Sensing system: . . . . . none.

.23 Multiple Copies

.231 Maximum number
Interleaved carbon: . . 1 + 5.
Carbon creep: . . . . . no.

.232 Types of master
Multilith: . . . . . yes.
Zerox: . . . . . yes.
Spirit: . . . . . yes.

.24 Arrangement of Heads

Use of station: . . . . . printing.
Stacks: . . . . . 1.
Heads/stack: . . . . . 120.
Method of use: . . . . . prints one line at a time.

.25 Range of Symbols

Numerals:	10	0 to 9.
Letters:	26	A to Z.
Special:	28, including space	see below*
Alternatives:		by special request.
FORTRAN set:		yes.
Basic COBOL set:		yes, with all electives.
Total:	64	

* In restricted set		Balance of full set	
-	minus	(	open parenthesis	÷	divide
+	plus	)	closed parenthesis	↑	up arrow
,	comma	"	quote	=	equal
.	period	$_{10}$	subscript 10	@	at the rate of
	space	[	open bracket	%	percent
'	apostrophe	]	close bracket	:	colon
*	asterisk	;	semicolon	#	number
&	ampersand	<	less than	$	dollar
/	slant	>	greater than		
□	lozenge				
CR	credit				

.3 EXTERNAL STORAGE

.31 Form of Storage

.311 Medium: . . . . . paper fanfold, multi-set.
.312 Phenomenon: . . . . . printing of engraved characters.

.32 Positional Arrangement

.321 Serial by: . . . . . one line at 6 lines per inch; 6 or 8 and 6 or 10 lines per inch options available.
.322 Parallel by: . . . . . 120 columns at 10 per inch.
.323 Bands: . . . . . 1.
.324 Track use: . . . . . all for data.
.325 Row use: . . . . . all for data.

.33 Coding: . . . . . as in Data Code Table No. 1.

.35 Physical Dimensions

.351 Overall width: . . . . . 4 to 19 inches.
.352 Length: . . . . . 0.5 to 17 inches.

§ 081.

.353 Maximum margins
Left: . . . . . 3.5 inches
Right: . . . . . 3.5 inches.

.4 CONTROLLER

.41 Identity: . . . . . On-Line Printer Control; Model 316-1 and Model 316-2.

.42 Connection to System

.421 On-line: . . . . . 2 controllers maximum; one Model 316-1 and one Model 316-2. If Model 316-1, 2 used, Model 396, for Model 335 Printer, may not be used.

.422 Off-line: . . . . . none.

.43 Connection to Device

.431 Devices per controller: . 1.
.432 Restrictions: . . . . . first printer connected to Model 316-1; second printer connected to Model 316-2. Both printers must be same model (333).

.44 Data Transfer Control

.441 Size of load: . . . . . 120 characters.
.442 Input-output areas: . . . core storage.
.443 Input-output area access: . . . . . each character.
.444 Input-output area lockout: . . . . . none.
.445 Table control: . . . . . none.
.446 Synchronization: . . . . . automatic.

.5 PROGRAM FACILITIES AVAILABLE

.51 Blocks

.511 Size of block: . . . . . one line of 120 characters
.512 Block demarcation Output: . . . . . counter.

.52 Input-Output Operations

.521 Input: . . . . . none.
.522 Output: . . . . . one block.
.523 Stepping: . . . . . combined as "output then step forward" 0 to 14 lines.
.524 Skipping: . . . . . combined as "output then skip forward" choice of two paper tape loop tracks as alternative to step. Up to 44 lines.
.525 Marking: . . . . . none.
.526 Searching: . . . . . none.

.53 Code Translation: . . . automatic variable output using a table set up in HSM.

.54 Format Control: . . . . none.

.55 Control Operations

Disable: . . . . . no.
Request interrupt: . . . no.
Select format: . . . . . no.
Select code: . . . . . yes, any code.
Unload: . . . . . no.

.56 Testable Conditions

Disabled: . . . . . yes.
Busy device: . . . . . yes.
Nearly exhausted: . . . . no.
Busy controller: . . . . yes.
Paper advancing: . . . . yes.
Exhausted: . . . . . no.

.6 PERFORMANCE

.61 Conditions

I: . . . . . synchronous.
II: . . . . . asynchronous.
III: . . . . . high speed.
IV: . . . . . low speed.
V: . . . . . with SMC.
VI: . . . . . without SMC.

.62 Speeds

.621 Nominal or peak speed
I & III: . . . . . 1,000 lines/min.
II & III: . . . . . 800 lines/min.
I & IV: . . . . . 667 lines/min.
II & IV: . . . . . 570 lines/min.

.622 Important parameters
Printing timing tolerances: . . . . . + 3%, - 5.5%.
Skipping speed: . . . 150 lines per second.

.623 Overhead: paper advance time.
.624 Effective speeds
II & III: . . . . . 36,000/ (41 + 4N) lines/min.
II & IV: . . . . . 36,000/ (59 + 4N) lines/min.
N = No. of lines advanced.

.63 Demands on System

Component	Condition	m. sec per line	or	Percentage
Processor:	I & III & VI	44		73.
Processor:	I & III & V	20		33.
Processor:	II & III & VI	59		79.
Processor:	II & III & V	27		36.
Processor:	I & IV & VI	74		82.
Processor:	I & IV & V	20		22.
Processor:	II & IV & VI	89		85.
Processor:	II & IV & V	27		26.

Notes:

1. Single space printing.
2. Includes print table access time.

§ 081.

.7 EXTERNAL FACILITIES

.71 Adjustments

Adjustment	Method	Comment
Vertical alignment:	knob.	
Horizontal alignment:	knob.	
Width:	knob	tractor adjustment.
New paper loop:	operator.	

.72 Other Controls

Function	Form	Comment
Select print drum speed:	switch	selects high or low speed.
Paper tension adj.:		fine adj. of paper stock.
Fine adj. of tractors:	vernier.	
Phasing:		synchronization pulse timing adj.
Penetration:		print hammer/print roll fine adj.
Top of form positioning:		align paper at form stop.

.73 Loading and Unloading

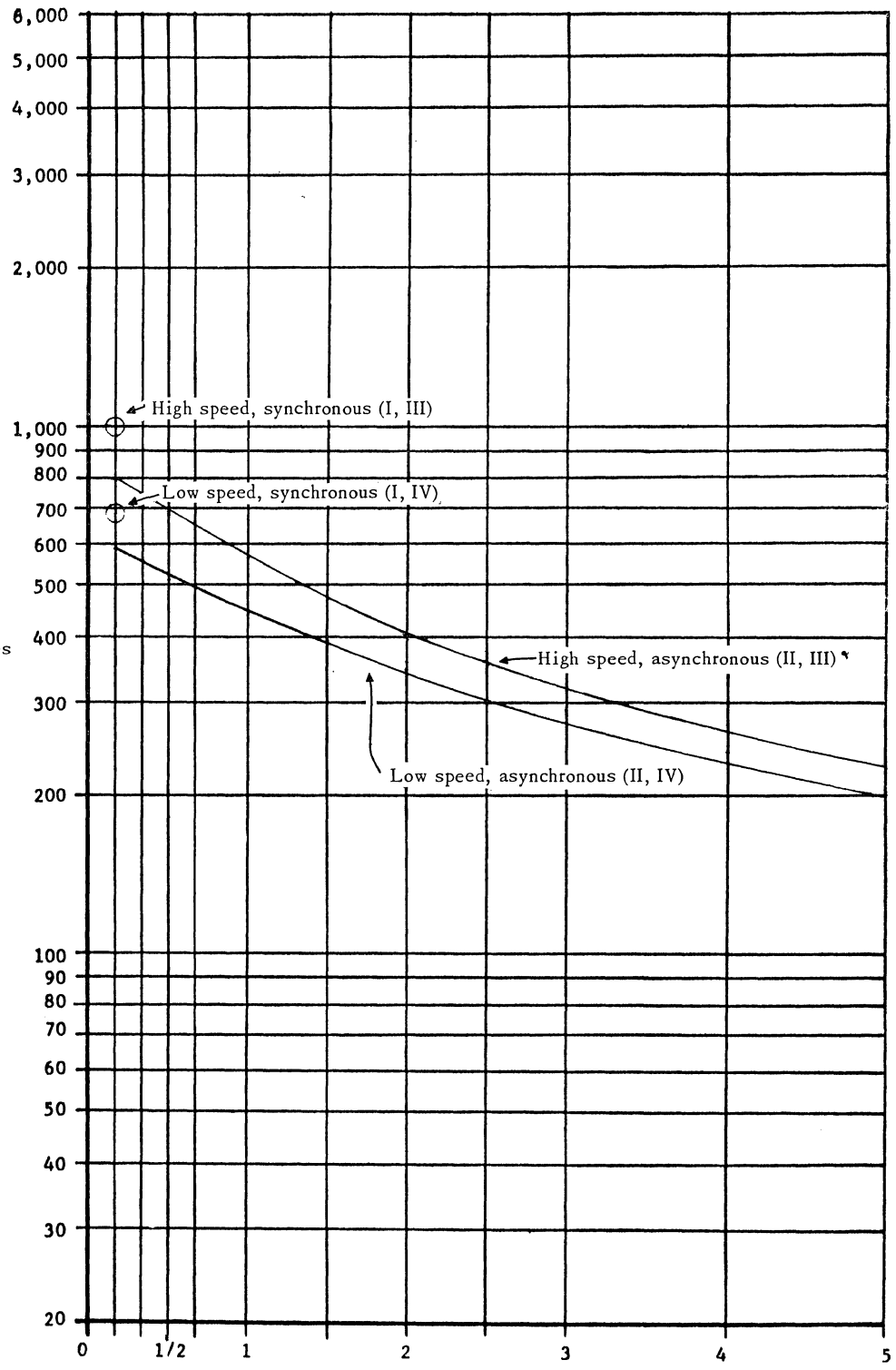
.731 Volumes handled: . . . . paper stack 12-14 inches high.
.732 Replenishment time: . . 1 minute.
printer must be stopped.
.733 Adjustment time: . . . . 1 minute.
.734 Optimum reloading
period: . . . . . 27 mins.
Basis: 2-part sets, 17 inches long, at 1-inch line spacing.

.8 ERRORS, CHECKS AND ACTION

Errors	Check or Interlock	Action
Recording:	none.	
Output block size:	1 full line	stop computer, alarm.
Invalid code:	all valid.	
Exhausted medium:	advance sensing	stop computer, alarm.
Imperfect medium:	none.	
Time conflicts	interlock	wait.
Exhausted ribbon:	none.	
Low paper:	check	stop computer at end of present page, alarm.
Printer inoperable:	check	stop computer, alarm.

§ 081.

EFFECTIVE SPEED
(Model 333)



INPUT-OUTPUT: PRINTER (MODEL 335)

§ 082.

.1 GENERAL

.11 Identity: . . . . . On-Line Printer.
Model 335.
O-LP 335.

.12 Description

Model 335 printer provides high speed line printing capability for the 301 system up to 1,075 single-spaced lines per minute. Output format is 160 characters per line, and six lines per inch vertically. As an option, vertical pitch may be specified as 8 or 10 lines per inch. When a restricted set of 47 characters is specified, printing can be done at 1,075 lines per minute, and when the full set of 63 characters is used, Model 335 can print 835 lines per minute. At one-inch line spacing, printing speed drops to about 570 lines per minute.

Two Model 335 printers may be used in the system. If two are operated in the system, however, maximum printing speed is limited to 715 lines per minute on each one.

The printer uses the standard rotating drum printing technique and prints one line from one computer instruction. Paper skipping speed is 25 inches (150 single-spaced lines) per second. The printer controller requires 80 computer memory cycles for each character in the printed character set (47-64 characters) for each line printed. All paper movement is performed independent of the computer.

Under manual selection, the rotational speed of the engraved printing drum may be lowered, giving maximum printing speeds of 715 and 600 lines per minute.

There is another printer, Model 333, which can print 120 characters per line at approximately the same speeds as Model 335.

.13 Availability: . . . . . March, 1962.

.14 First Delivery: . . . . March, 1962.

.2 PHYSICAL FORM

.21 Drive Mechanism

.211 Drive past the head: . . sprocket drive push and pull.
.212 Reservoirs: . . . . . none.

.22 Sensing and Recording Systems

.221 Recording system: . . . on-the-fly hammer stroke against engraved drum.
.222 Sensing system: . . . . none.

.23 Multiple Copies

.231 Maximum number
Interleaved carbon: . 1 + 5.
Carbon creep: . . . . no.
.233 Types of master
Multilith: . . . . . yes.
Xerox: . . . . . yes.
Spirit: . . . . . yes.

.24 Arrangement of Heads

Use of station: . . . . . printing.
Stacks: . . . . . 1.
Heads/stack: . . . . . 160.
Method of use: . . . . . prints one line at a time.

.25 Range of Symbols

Numerals:	10	0 to 9.
Letters:	26	A to Z.
Special:	28 (including space)	see below.*
Alternatives:		by special request.
FORTRAN set:		yes.
Basic COBOL set: . . .		yes, with all electives.
Total:	64.	

* In restricted set

	Balance of full set	
- minus	(open parenthesis	÷ divide
+ plus	) closed parenthesis	↑ up arrow
, comma	" quote	= equal
' apostrophe	10 subscript 10	@ at the rate of
. period		
* asterisk	[open bracket	% percent
& ampersand	] close bracket	: colon
/ slant	; semicolon	# number
□ lozenge	< less than	$ dollar
CR credit	> greater than	
space		

.3 EXTERNAL STORAGE

.31 Form of Storage

.311 Medium: . . . . . paper fanfold, multi-set.
.312 Phenomenon: . . . . . printing of engraved characters.

.32 Positional Arrangement

.321 Serial by: . . . . . one line at 6 lines per inch; 6 or 8 and 6 or 10 lines per inch options available.
.322 Parallel by: . . . . . 160 columns at 10 per inch.
.323 Bands: . . . . . 1.
.324 Track use: . . . . . all for data.
.325 Row use: . . . . . all for data.

§ 082.

.33 Coding: . . . . . as in Data Code Table No. 1.

.35 Physical Dimensions

.351 Overall width: . . . . . 4 to 19 inches.
.352 Length: . . . . . 0.5 to 17 inches.
.353 Maximum margins:
Left: . . . . . 1.5 inch.
Right: . . . . . 1.5 inch.

.4 CONTROLLER

.41 Identity: . . . . . On-Line Printer Control. Model 396-1 and Model 396-2.

.42 Connection to System

.421 On-line: . . . . . 2 controllers maximum; one Model 396-1 and one Model 396-2. If Model 396-1, 2 used, Model 316, for Model 333 Printer, may not be used.
.422 Off-line: . . . . . none.

.43 Connection to Device

.431 Devices per controller: 1.
.432 Restrictions: . . . . . first printer connected to Model 396-1; second printer connected to Model 396-2. Both printers must be same model (335).

.44 Data Transfer Control

.441 Size of load: . . . . . 160 characters per line.
.442 Input-output areas: . . core storage.
.443 Input-output area access: . . . . . each character.
.444 Input-output area lockout: . . . . . none.
.445 Table control: . . . . . none.
.446 Synchronization: . . . . automatic.

.5 PROGRAM FACILITIES AVAILABLE

.51 Blocks

.511 Size of block: . . . . . one line of 160 characters.
.512 Block demarcation Output: . . . . . counter.

.52 Input-Output Operations

.521 Input: . . . . . none.
.522 Output: . . . . . one block.
.523 Stepping: . . . . . combined as "output then step forward" 0 to 14 lines.
.524 Skipping: . . . . . combined as "output then step forward", choice of two paper tape loop tracks as alternate to step. Up to 44 lines.
.525 Marking: . . . . . none.
.526 Searching: . . . . . none.

.53 Code Translation: . . . automatic variable output using a table set up in HSM.

.54 Format Control: . . . . none.

.55 Control Operations

Disable: . . . . . no.
Request interrupt: . . . no.
Select format: . . . . . no.
Select code: . . . . . yes, any code.
Unload: . . . . . no.

.56 Testable Conditions

Disabled: . . . . . yes.
Busy device: . . . . . yes.
Nearly exhausted: . . . no.
Busy controller: . . . . yes.
Paper advancing: . . . . yes.
Exhausted: . . . . . no.

.6 PERFORMANCE

.61 Conditions

I: . . . . . synchronous.
II: . . . . . asynchronous.
III: . . . . . high speed.
IV: . . . . . low speed.
V: . . . . . with SMC.
VI: . . . . . without SMC.

.62 Speeds

.621 Nominal or peak speed: I & III: 1,075 lines/min.*
II & III: 835 lines/min.
I & IV: 715 lines/min.
II & IV: 600 lines/min.

* Printing in Normal Mode, and no punched card instruction in Simultaneous Mode.

.622 Important parameters
Printing timing tolerances: . . . . . + 3%, - 5.5%.
Skipping speed: . . . . 150 lines per second.
.623 Overhead: . . . . . paper advance time.
.624 Effective speeds: . . . II & III; 36,000/(39 + 4N) lines/min.
II & IV; 36,000/(56 + 4N) lines/min.
N = No. lines advanced.

§ 082.

.63 Demands on System

Component	Condition	m. sec. per line	or	Percentage
Processor:	I & III & VI	40		71.
Processor:	I & III & V	see Note 2.		
Processor:	II & III & VI	56		73.
Processor:	II & III & V	36		51.
Processor:	I & IV & VI	68		81.
Processor:	I & IV & V	27		32.
Processor:	II & IV & VI	84		84.0.
Processor:	II & IV & V	36		36.

Notes
1. Single-space printing.
2. I & III not possible with SMC (V).
3. If two Model 335 printers used, operation must be at low speed (715 or 600 l. p. m.).
4. Includes print table access time.

.7 EXTERNAL FACILITIES

.71 Adjustments

Adjustment	Method	Comment
Vertical alignment:	knob.	
Horizontal alignment:	knob.	
Width:	knob	tractor adjustment.
New paper loop:	operator.	

.72 Other Controls

Function	Form	Comment
Paper tension adj.:		fine adjustment of paper stock.
Select print drum speed:	switch	selects high or low speed.
Fine adjustments of tractors:	vernier.	
Phasing:		synchronization pulse timing adjustment.
Penetration:		print hammer/print roll fine adjustment.
Top of form positioning:		align paper at form stop.

.73 Loading and Unloading

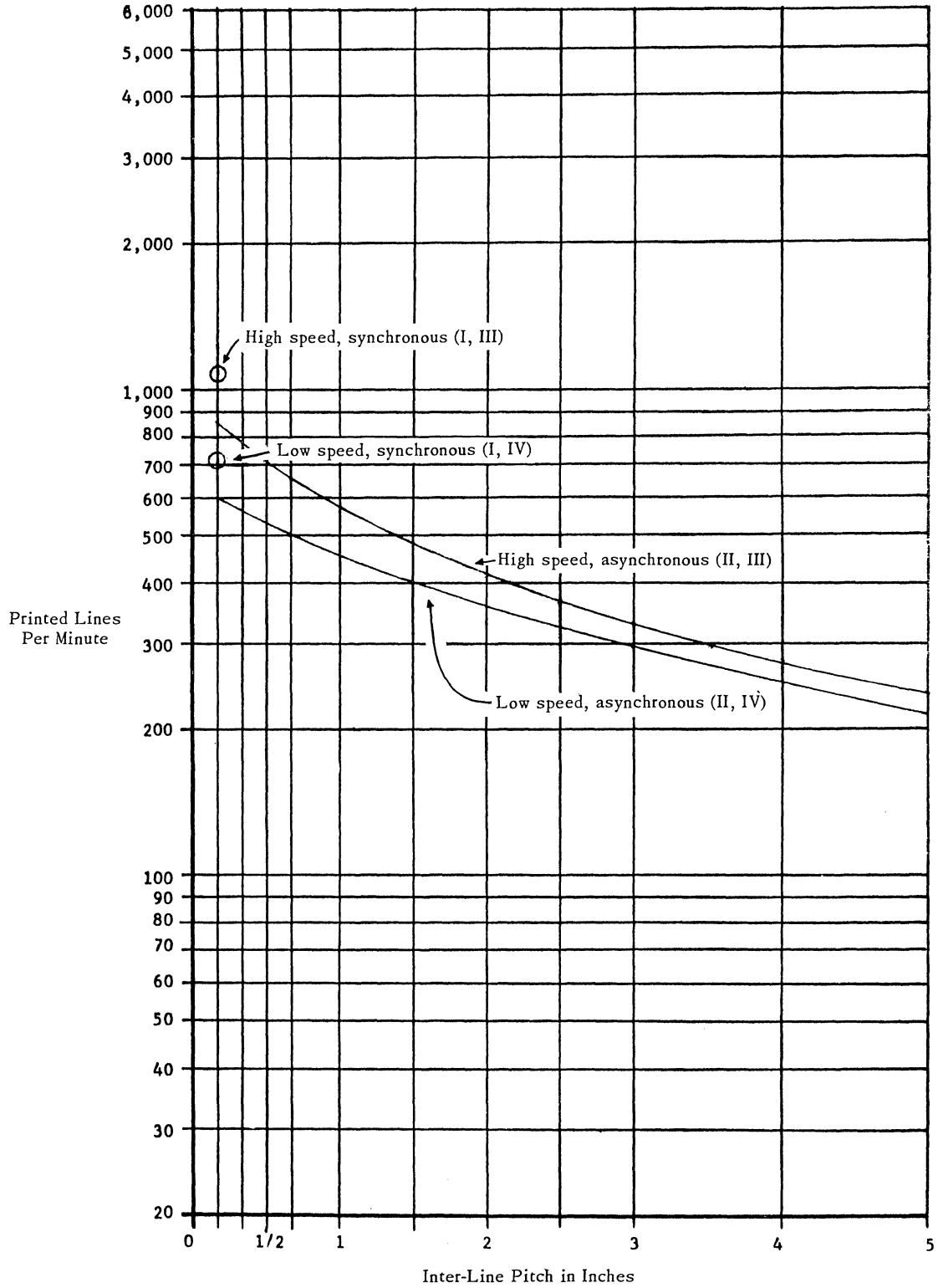
.731 Volumes handled: . . . paper stack 12 - 14 inches high.
.732 Replenishment time: . . 1 minute; printer must be be stopped.
.733 Adjustment time: . . . 1 minute.
.734 Optimum reloading period: . . . . . 26 mins.
Basis: . . . . . 2-part sets, 17 inches long, at 1-inch line spacing.

.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Recording:	none.	
Output block size:	1 full line	stop computer, alarm.
Invalid code:	all valid.	
Exhausted medium:	advance sensing	stop computer, alarm.
Imperfect medium:	none.	
Timing conflicts:	interlock	wait.
Exhausted ribbon:	none.	
Low paper:	check	stop computer at end of present page, alarm.
Printer inoperable:	check	stop computer, alarm.

§ 082.

EFFECTIVE SPEED
(Model 335)



INPUT-OUTPUT: HI-DATA TAPE GROUP

§091.

.1 GENERAL

.11 Identity: . . . . . Hi-Data Tape Group. Model 381. H-DTG.

.12 Description:

This is a group of three, four, or six magnetic tape units in one cabinet, sharing common control and switching circuits. Provision is made for sets of three facing out from its front and back, respectively. Two of these cabinets may be connected to a 301 system. Although only one tape unit in each group of six may be reading or recording at one time, all of the other five in each cabinet may be rewinding. Rewinding takes place independently of the computer after initiation. Records are stored in variable-length blocks. Recording is performed in the forward direction, while reading takes place in either the forward or backward direction. Reading and recording take place at the peak rate of 10,000 characters per second.

A single reel of tape when being used to store blocks of 1,000 characters has a capacity of 4,320 blocks. The reading rate may be as high as 9,000 characters per second under these conditions, if consecutive read instructions are given by the end of each block. In this case, tape will continue moving at full speed.

.13 Availability: . . . . . September, 1961.

.14 First Delivery: . . . . . September, 1961.

.2 PHYSICAL FORM

.21 Drive Mechanism

.211 Drive past the head: . . . pinch roller friction.
.212 Reservoirs
Number: . . . . . 2 per drive.
Form: . . . . . swinging arm.
Capacity: . . . . . 26 inches.
.213 Feed drive: . . . . . electric motor.
.214 Take-up drive: . . . . . electric motor.

.22 Sensing and Recording Systems

.221 Recording system: . . . magnetic head.
.222 Sensing system: . . . . . magnetic head.
.223 Common system: . . . . yes.

.23 Multiple Copies: . . . . . none.

.24 Arrangement of Heads

Use of station: . . . . . read or write (6 separate tape units in Group).

Stacks: . . . . . 1.
Heads/stack: . . . . . 7.
Method of use: . . . . . 1 row at a time.

.3 EXTERNAL STORAGE

.31 Form of Storage

.311 Medium: . . . . . plastic tape with magnetizable coating.
.312 Phenomenon: . . . . . magnetization.

.32 Positional Arrangement

.321 Serial by: . . . . . 1 to N rows at 333.3 rows/inch: N limited by size of High Speed Memory.
.322 Parallel by: . . . . . 7 tracks.
.324 Track use
Data: . . . . . 6.
Redundancy check: . . . 1.
Timing: . . . . . 0 (self-clocking).
Control signals: . . . . 0.
Unused: . . . . . 0.
Total: . . . . . 7.
.325 Row use
Data: . . . . . all.
Redundancy check: . . . 0.
Timing: . . . . . 0.
Control signals: . . . . 0.
Unused: . . . . . 0.

.33 Coding: . . . . . as in Data Code Table No. 1.

.34 Format Compatibility: . RCA 301 only.

.35 Physical Dimensions

.351 Overall width: . . . . . $\frac{1}{2}$ inch.
.352 Length: . . . . . 1,230 feet on 8-inch diameter reel.

.4 CONTROLLER

.41 Identity: . . . . . Hi-Data Tape Group Control, Models 318 and 319.

.42 Connection to System

.421 On-line: . . . . . 2 max; Model 318 controls first Group, Model 319 controls second Group. Model 319 cannot be used if Model 341 or 351 Control is used. Models 318 and 319 cannot be used if Models 342 or 352 Control is used.
.422 Off-line: . . . . . none.

.43 Connection to Device

.431 Devices per controller: . 1 Group.
.432 Restrictions: . . . . . none.

§ 091.

.44 Data Transfer Control

.441 Size of load: . . . . . 1 to N characters, limited by size of available core storage.
.442 Input-output areas: . . . core storage.
.443 Input-output area access: . . . . . each character.
.444 Input-output area lockout: . . . . . none.
.445 Table control: . . . . . none.
.446 Synchronization: . . . . automatic.

.5 PROGRAM FACILITIES AVAILABLE

.51 Blocks

.511 Size of block: . . . . . 1 to N characters, limited by size of available core storage.
.512 Block demarcation
Input: . . . . . gap for input.
Output: . . . . . variable counter for output.

.52 Input-Output Operations

.521 Input: . . . . . 1 block forward or backward; input stopped by gap or limit cut-off. Characters in High Speed Memory are in "forward" order regardless of direction of read.
.522 Output: . . . . . 1 block forward.
.523 Stepping: . . . . . none.
.524 Skipping: . . . . . none.
.525 Marking: . . . . . End File, End Data, End Block, End Information symbols.
.526 Searching: . . . . . none.

.53 Code Translation: . . . . matched codes.
.54 Format Control: . . . . none.

.55 Control Operations

Disable: . . . . . no.
Request interrupt: . . . no.
Select format: . . . . . no.
Select code: . . . . . no.
Rewind: . . . . . yes.
Unload: . . . . . no.

.56 Testable Conditions

Disabled: . . . . . yes.
Busy device: . . . . . yes.
Output lock: . . . . . no.
Nearly exhausted: . . . yes, 80 inches min.
Busy controller: . . . . yes.
End of medium marks: . yes, at beginning.
Tape moving backward: . yes.
Exhausted: . . . . . no.

.6 PERFORMANCE

.61 Conditions

I: . . . . . without Simultaneous Mode Control.
II: . . . . . with Simultaneous Mode Control.

.62 Speeds

.621 Nominal or peak speed: . 10,000 char/sec.
.622 Important parameters
Switching between units: . . . . . 10 msec ± 20%.
Up to speed: . . . . . 7 msec ± 10%
Density: . . . . . 333.3 rows/inch.
Running speed: . . . . . 30 inches/sec.
Read mode to write mode: . . . . . 25 msec.
Interblock gap: . . . . . 0.34 inches (avg).
Full rewind time: . . . . 3 minutes.
.623 Overhead: . . . . . 11 msec per block.
.624 Effective speeds: . . . . 10,000 N(N + 110) char/sec, where N = char/block (see graph).

.63 Demands on System

Component	Condition	msec. per block	or	Percentage of transfer time
Processor:	I	11 + 0.100C	or	100.
HSM:	II	0.007C	or	7.

.7 EXTERNAL FACILITIES

.71 Adjustments: . . . . . none.

.72 Other Controls

Function	Form	Comment
Write-enable:	ring on spool	ring permits recording.
Manual erase:	button	erases tape when moving forward.
Energize motors and servo system:	button.	
Manual wind:	button.	forward or backward.
Manual rewind:	button	positions tape at start of reel.

.73 Loading and Unloading

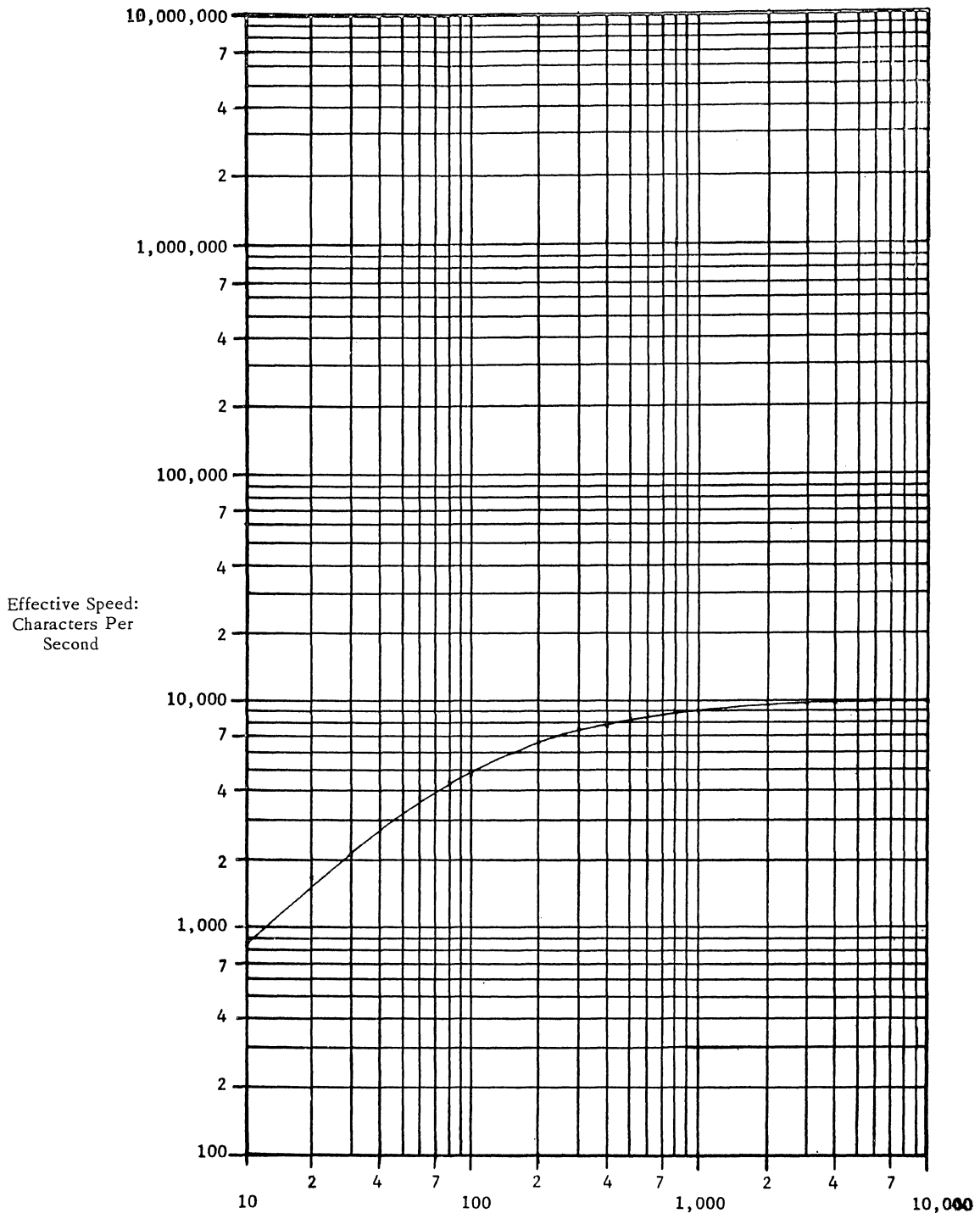
.731 Volumes handled: . . . . reel of 1,200 feet minimum usable, or 4,800,000 char less 113 per block gap.
.732 Replenishment time: . . 1 minute max. device needs to be stopped.
.734 Optimum reloading period: . . . . . 8.2 minutes.

.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Recording:	echo parity	stop processor, alarm.
Reading:	row parity	stop processor, alarm.
Input area overflow:	limit counter interlock	cut-off and indicator.
Output block size:	limit counter interlock	cut-off and indicator.
Invalid code:	all codes good.	
Exhausted medium:	photo sensing stations	stop processor, alarm.
Imperfect medium:	none.	
Timing conflicts:	interlock	wait.
Inoperable device:	check	stop processor, alarm.

§ 091.

EFFECTIVE SPEED
(Model 381)



N. B. These speeds take full advantage of "hot starts" in which there is no deceleration between blocks.

INPUT-OUTPUT: TAPE STATION (581)

§092.

.1 GENERAL

.11 Identity: . . . . . Tape Station.
Model 581.
MT 581.

.12 Description

581 Tape Stations provide high-speed data transfer to and from the Processor, either adding to or replacing the capabilities of the Hi-Data Tape Group. Not only does the 581 Tape Station provide greater storage per reel than the Hi-Data Tape Group, but 581 tapes provide a compatibility medium with the RCA 501 and 601 EDP Systems. This compatibility allows tapes from one system to be read on another, although programmed code translation is required. One or two of the tape stations may be added to the 301 system and, in addition, the Hi-Data Tape Groups may be replaced by up to twelve 581 Tape Stations. Although only one station in each group of six may be reading or writing, any number of stations may be rewinding simultaneously.

Recording takes place in the forward direction, while reading may be in either direction. The peak transfer rate is 33,333 characters per second. The recording system makes a parity check on the record head current ("echo" check). Data is recorded in two separate bands simultaneously to lessen the effect of possible tape surface imperfections. Read-back senses data in both bands; a "one" need be sensed in only one band to be accepted as a "one". Data is transferred into the Processor one character at a time.

Information is recorded in variable length blocks. A single reel of tape, when being used to store blocks of 1,000 characters, has a capacity of 8,430 blocks. The reading rate may be as high as 30,000 characters per second under these conditions, if consecutive read instructions are given at the end of each block. In this case, tape will continue moving at full speed.

No computing can be done during a tape input or output operation unless the Simultaneous Mode Control, Model 392, is added to the system.

.13 Availability: . . . . . September, 1959

.14 First Delivery: . . . . . September, 1959

.2 PHYSICAL FORM

.21 Drive Mechanism

.211 Drive past the head: . . . pinch roller friction.

.212 Reservoirs
Number: . . . . . 2.
Form: . . . . . bin which senses tape weight.
Capacity: . . . . . 25 feet.

.213 Feed drive: . . . . . electric motor.

.214 Take-up drive: . . . . . electric motor.

.22 Sensing and Recording Systems

.221 Recording system: . . . magnetic head.

.222 Sensing system: . . . . magnetic head.

.223 Common system: . . . . combined.

.23 Multiple Copies: . . . . none.

.24 Arrangement of Heads

Use of station: . . . . . reading or recording.
Stacks: . . . . . 1.
Heads/stack: . . . . . 16 (8 dual).
Method of use: . . . . . one row at a time.

.3 EXTERNAL STORAGE

.31 Form of Storage

.311 Medium: . . . . . plastic tape with magnetizable coating.

.312 Phenomenon: . . . . . magnetization.

.32 Positional Arrangement

.321 Serial by: . . . . . 1 to N rows at 333.3 rows per inch.
N limited by available core storage.

.322 Parallel by: . . . . . 16 tracks.

.323 Bands: . . . . . 2; duplicate patterns.

.324 Track use
Data: . . . . . 6.
Redundancy check: . . 1.
Timing: . . . . . 1.
Control signals: . . . . 0.
Unused: . . . . . 0.
Total: . . . . . 8.

.325 Row use
Data: . . . . . all.

.33 Coding: . . . . . as in Data Code Table No. 1.

.34 Format Compatibility

Other device or system	Code translation
RCA 501 EDP System:	. .by program.
RCA 601 EDP System:	. .by program.

.35 Physical Dimensions

.351 Overall width: . . . . . 0.75 inch.

.352 Length: . . . . . 2,400 feet on a 10.5 inch diameter reel.

§092.

.4 CONTROLLER

.41 Identity: . . . . . Adapter, 393-1.
Adapter, 393-2.
Dual Tape Channel (2 x 6), 341.
Dual Tape Channel (2 x 12), 342.

.42 Connection to System

.421 On-line: . . . . . A. 393-1 for 1 MT 581; or 394-1 for 1 MT 582.
B. 393-1 and 393-2 for 2 MT 581; or 394-1 and 394-2 for 2 MT 582.
C. 341 or 342 for 6 or 12 MT 581.
D. 351 or 352 for 6 or 12 MT 582.

Rules: Either group A or B may be connected to system at the same time as either group C or D.
If C is connected to system, only one H-DTG Control, Model 318, may be connected to system.
If D is connected to system, neither H-DTG may be used.

.422 Off-line: . . . . . none.

.43 Connection to Device

.431 Devices per controller: 1 MT 581 on Adapter 393-1.
1 MT 582 on Adapter 394-1.
1 MT 581 on Adapter 393-2 if 2 MT 581 used in group.
1 MT 582 on Adapter 394-2 if 2 MT 582 used in group.
3 to 6 MT 581 on Dual Tape Channel 341.
8 to 12 MT 581 on Dual Tape Channel 342.
3 to 6 MT 582 on Dual Channel 351.
8 to 12 MT 582 on Dual Tape Channel 352.

.44 Data Transfer Control

.441 Size of load: . . . . . 1 to N char, limited by available core storage.
.442 Input-output areas: . . . core storage.
.443 Input-output area access: . . . . . each character.
.444 Input-output area lockout: . . . . . none.
.445 Table control: . . . . . none.
.446 Synchronization: . . . . automatic.

.5 PROGRAM FACILITIES AVAILABLE

.51 Blocks

.511 Size of block: . . . . . 1 to N char, limited by available core storage.

.512 Block demarcation
Input: . . . . . gap on tape.
Output: . . . . . limit counter.

.52 Input-Output Operations

.521 Input: . . . . . one block forward or backward; input stopped by gap or limit cut-off.
Characters in HSM are in forward order regardless of direction of read.
.522 Output: . . . . . one block forward.
.523 Stepping: . . . . . none.
.524 Skipping: . . . . . none.
.525 Marking: . . . . . End file, End Data, End Block codes.
.526 Searching: . . . . . none.

.53 Code Translation: . . . matched codes.

.54 Format Control: . . . . none.

.55 Control Operations

Disable: . . . . . no.
Request interrupt: . . . no.
Select format: . . . . . no.
Select code: . . . . . no.
Rewind: . . . . . yes.
Unload: . . . . . no.

.56 Testable Conditions

Disabled: . . . . . yes.
Busy device: . . . . . yes.
Output lock: . . . . . no.
Nearly exhausted: . . . yes.
Busy controller: . . . . . yes.
End of medium marks: . yes (at beginning).
Tape moving backward: . yes.
Exhausted: . . . . . no.

.6 PERFORMANCE

.61 Conditions

I: . . . . . without SMC.
II: . . . . . with SMC.

.62 Speeds

.621 Nominal or peak speed: . 33,333 char/sec.
.622 Important parameters
Switching between units (with Dual Tape Channels): . . . . . 10 μ sec.
Up to speed: . . . . . 2.5 m.sec.
Start distance: . . . . . 0.075 $\pm$ 0.050 in.
Start-write delay: . . . 3.5 m.sec. (includes up to speed time).
Read-stop distance: . . 0.115 to 0.190 in.
Write-stop distance: . . 0.215 to 0.358 in.
Write-to-read switching time: . . . 4.5 $\pm$ 0.9 m.sec.
Read-to-write switching time: . . . 10 μsec.
Density: . . . . . 333.3 rows/inch.
Running speed: . . . . 100 in/sec.
Interlock gap: . . . . 0.34 in min.
0.46 in avg.
Full rewind time: . . . 5 minutes.

§092.

.623 Overhead: . . . . . 3.5 m.sec per block (tape moving at full speed).

.624 Effective speeds: . . . 33,333 N/(N + 113) char/sec.

.63 Demands on System

Component	Condition	m.sec per block	or	Percentage of transfer time
Processor:	I	3.5 + 0.030C	or	100.
Processor:	II	0.007C	or	23.

.7 EXTERNAL FACILITIES

.71 Adjustments: . . . . . none.

.72 Other Controls

Function	Form	Comment
Write enable:	ring on spool	ring permits recording.
Energize motors and servo system:	button.	
Stabilize:	button	allows proper loading of tape bins.
Manual wind:	button	forward or backward.
Manual rewind:	button	positions tape at start of reel.
Manual erase:	button	while winding tape forward.
Switch station to computer control:	buttons	local or remote (computer control).

.73 Loading and Unloading

.731 Volumes handled

Storage	Capacity
Reel of 2,350 feet minimum usable: . .	9,400,000 characters, less 113 char per block gap.

.732 Replenishment time: . . 1 minute. tape station must be stopped.

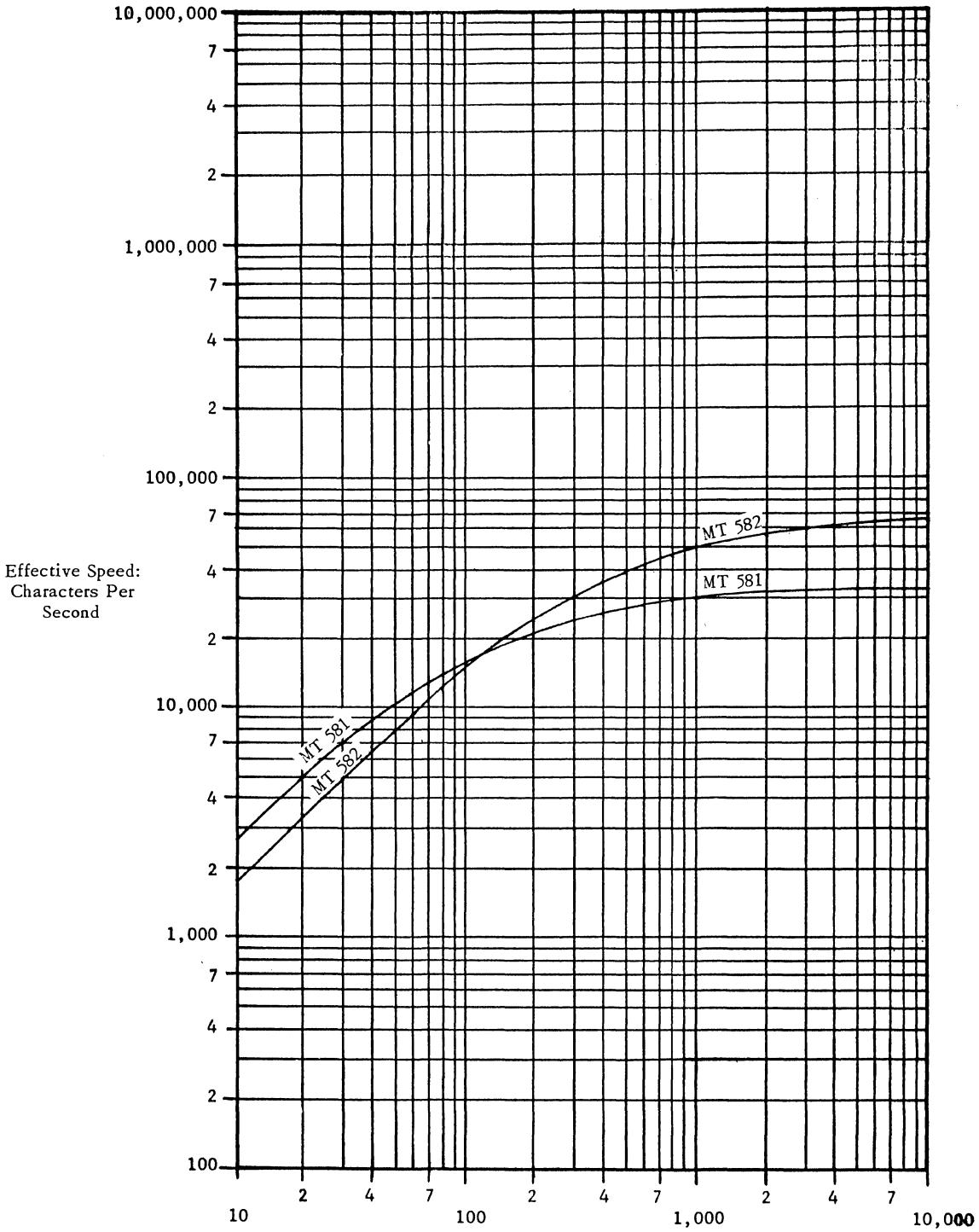
.734 Optimum reloading period: . . . . . 4.7 minutes.

.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Recording:	echo parity	stop computer, alarm.
Reading:	row parity	stop computer, alarm.
Input area overflow:	limit counter interlock	cut-off and indicator.
Output block size:	limit counter interlock	cut-off and indicator.
Invalid code:	all codes valid.	
Exhausted medium:	interlock	stop computer, alarm.
Imperfect medium:	none.	
Timing conflicts:	interlock	wait.
Inoperable device:	check	stop computer, alarm.

§ 092.

EFFECTIVE SPEEDS
(Model 581)



N. B. These speeds take full advantage of "hot starts" in which there is no deceleration between blocks.

INPUT-OUTPUT: TAPE STATION (582)

§ 093.

.1 GENERAL

.11 Identity: . . . . . Tape Station.
Model 582.
MT 582.

.12 Description

582 Tape Stations provide high-speed data transfer to and from the Processor, either adding to or replacing the capabilities of the Hi-Data Tape Group. Not only does the 582 Tape Station provide greater storage per reel than the Hi-Data Tape Group, but 582 tapes provide a compatibility medium with the RCA 501 and 601 EDP Systems. This compatibility allows tapes from one system to be read on another, although programmed code translation is required. One or two of the tape stations may be added to the 301 system, and in addition, the Hi-Data Tape Groups may be replaced by up to twelve 582 Tape Stations. Although only one tape station in each group of six may be reading or writing, any number of tape stations may be rewinding simultaneously.

Recording takes place in the forward direction, while reading may be in either direction. The peak transfer rate is 66,667 characters per second. The recording system incorporates a read-after-write row parity check. Data is recorded in two separate bands simultaneously to lessen the effect of possible tape surface imperfections. Read-back senses data in both bands; a "one" need be sensed in only one band to be accepted as a "one". Data is transferred into the Processor one diad (two characters) at a time.

Information is recorded in variable length blocks. A single reel of tape, when being used to store blocks of 1,000 characters, has a capacity of 13,800 blocks. The reading rate may be as high as 49,000 characters per second under these condi tions, if consecutive read instructions are given at the end of each block. In this case, tape will continue moving at full speed.

No computing can be done during a tape input or output operation unless the Simultaneous Mode Control, Model 392, is added to the system.

.13 Availability: . . . . . January, 1962.

.14 First Delivery: . . . . January, 1962.

.2 PHYSICAL FORM

.21 Drive Mechanism

.211 Drive past the head: . . pinch roller friction.
.212 Reservoirs
Number: . . . . . 2.
Form: . . . . . bin which senses tape weight.
Capacity: . . . . . 25 feet.
.213 Feed drive: . . . . . electric motor.
.214 Take-up drive: . . . . . electric motor.

.22 Sensing and Recording Systems

.221 Recording system: . . . magnetic head.
.222 Sensing system: . . . . magnetic head.
.223 Common system: . . . two-gap head.

.23 Multiple Copies: . . . . none.

.24 Arrangement of Heads

Use of station: . . . . . reading.
Stacks: . . . . . 1.
Heads/stack: . . . . . 16 (8 dual).
Method of use: . . . . . one row at a time.

Use of station: . . . . . recording.
Distance: . . . . . 0.2 inch ahead of read head.
Stacks: . . . . . 1.
Heads/stack: . . . . . 16 (8 dual).
Method of use: . . . . . one row at a time.

.3 EXTERNAL STORAGE

.31 Form of Storage

.311 Medium: . . . . . plastic tape with magnetizable coating.
.312 Phenomenon: . . . . . magnetization.

.32 Positional Arrangement

.321 Serial by: . . . . . 1 to N rows of 666.7 rows per inch; N limited by available core storage.
.322 Parallel by: . . . . . 16 tracks.
.323 Bands: . . . . . 2; duplicate patterns.
.324 Track use
Data: . . . . . 6.
Redundancy check: . . 1.
Timing: . . . . . 1.
Control signals: . . . 0.
Unused: . . . . . 0.
Total: . . . . . 8.
.325 Row use
Data: . . . . . all.

.33 Coding: . . . . . as in Data Code Table No. 1.

.34 Format Compatibility

Other device or system	Code translation
RCA 501 EDP System (MT 582):	by program.
RCA 601 EDP System (MT 582, MT 681):	by program.
Tape Station Model 681:	by program.

§ 093.

.35 Physical Dimensions

.351	Overall width:	0.75 inch.
.352	Length:	2,400 feet on a 10.5 inch diameter reel.

.4 CONTROLLER

.41	Identity:	Adapter, 394-1. Adapter, 394-2. Dual Tape Channel (2 x 6), 351. Dual Tape Channel (2 x 12), 352.

.42 Connection to System

.421	On-line:	A. 393-1 for 1 MT 581; or 394-1 for 1 MT 582. B. 393-1 and 393-2 for 2 MT 581; or 394-1 and 394-2 for 2 MT 582. C. 341 or 342 for 6 or 12 MT 581. D. 351 or 352 for 6 or 12 MT 582. Rules: Either group A or B may be connected to system at the same time as either group C or D. If C is connected to system only one H-DTG Control, Model 318, may be connected to system. If D is connected to system, neither H-DTG may be used.
.422	Off-line:	none.

.43 Connection to Device

.431	Devices per controller:	1 MT 581 on Adapter 393-1. 1 MT 582 on Adapter 394-1. 1 MT 581 on Adapter 393-2 if 2 MT 581 used in group. 1 MT 582 on Adapter 394-2 if 2 MT 582 used in group. 3 to 6 MT 581 on Dual Tape Channel 341. 8 to 12 MT 581 on Dual Tape Channel 342. 3 to 6 MT 582 on Dual Tape Channel 351. 8 to 12 MT 582 on Dual Tape Channel 352.

.44 Data Transfer Control

.441	Size of load:	1 to N char, limited by available core storage.
.442	Input-output areas: . .	core storage.
.443	Input-output area access:	each character.
.444	Input-output area lockout:	none.
.445	Table control:	none.
.446	Synchronization:	automatic.

.5 PROGRAM FACILITIES AVAILABLE

.51 Blocks

.511	Size of block:	1 to N char, limited by available core storage.
.512	Block demarcation	
	Input:	gap on tape.
	Output:	limit counter.

.52 Input-Output Operations

.521	Input:	one block forward or backward; input stopped by gap or limit cut-off. Characters in HSM are in forward order regardless of direction of read.
.522	Output:	one block forward.
.523	Stepping:	none.
.524	Skipping:	none.
.525	Marking:	End File, End Data, End Block codes.
.526	Searching:	none.

.53	Code Translation: . . .	matched codes.
.54	Format Control:	none.

.55 Control Operations

Disable:	no.
Request interrupt: . . .	no.
Select format:	no.
Select code:	no.
Rewind:	yes.
Unload:	no.

.56 Testable Conditions

Disabled:	yes.
Busy device:	yes.
Output lock:	no.
Nearly exhausted: . . .	yes.
Busy controller:	yes.
End of medium marks:	yes (at beginning).
Tape moving backward:	yes.
Exhausted:	no.

.6 PERFORMANCE

.61 Conditions

I:	without SMC.
II:	with SMC.

.62 Speeds

.621	Nominal or peak speed:	66,667 char/sec.
.622	Important parameters	
	Switching between units (with Dual Tape Channels):	10 μ sec.
	Up to speed:	2.5 m.sec.
	Start distance:	0.075 $\pm$ 0.050 in.
	Start-write delay: . .	3.5 m.sec. (includes up to speed time).
	Read-stop distance: .	0.115 to 0.190 in.
	Write-stop distance: .	0.415 to 0.558 in.
	Write-to-read switching time:	7.0 m.sec.

(Continued)

§ 093.

.622 Important parameters (Contd.)

Read-to-write switching time:	10 μ sec.
Density:	666.7 rows/inch.
Running speed:	100 in./sec.
Interblock gap:	0.54 in. min. 0.66 in. avg.
Full rewind time:	3.2 minutes.
Read-after-write data delay:	2.0 m.sec.
Read-after-write stop delay:	2.0 m.sec.

.623 Overhead: . . . . . 5.5 m.sec per block (tape moving at full speed).

.624 Effective speeds: . . . 66,667 N/(N + 367) char/sec.

.63 Demands on System

Component	Condition	m.sec per block	or	Percentage* of transfer time
Processor:	I	3.5 + 0.015C	or	100.
Processor:	II	0.0035C	or	23.

* transfer takes place by diad (2 characters).

.7 EXTERNAL FACILITIES

.71 Adjustments: . . . . . none.

.72 Other Controls

Function	Form	Comment
Write enable:	ring on spool	ring permits recording.
Energize motors and servo system:	button.	
Stabilize:	button	allows proper loading of tape bins.
Manual wind:	button	forward or backward.
Manual rewind:	button	positions tape at start of reel.
Manual erase:	button	while winding tape forward.

.72 Other Controls (Contd.)

Function	Form	Comment
Switch station to computer control:	buttons	local or remote (computer control).
Long gap:	button	signal to generate proper gap for MT 581-MT 681 compatibility.

.73 Loading and Unloading

.731 Volumes handled

Storage	Capacity
Reel of 2,350 feet minimum usable:	18,800,000 characters, less average of 367 characters per block gap.

.732 Replenishment time: 1 minute. tape station needs to be stopped.

.734 Optimum reloading period: . . . . . 4.7 minutes.

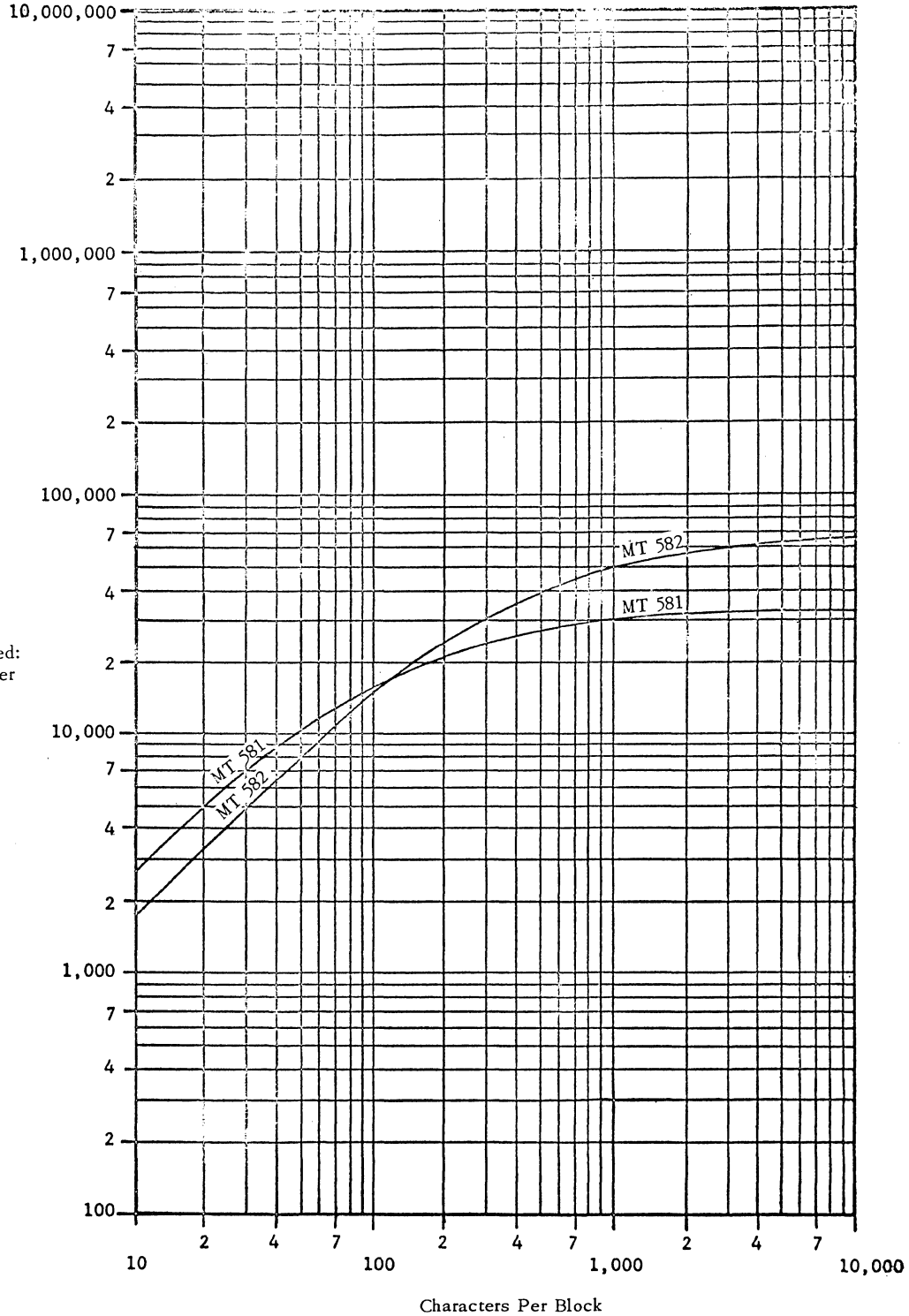
.8 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Recording:	read-after-write row parity	stop computer, alarm.
Reading:	row parity	stop computer, alarm.
Input area overflow:	limit counter interlock	cut-off and indicator.
Output block size:	limit counter interlock	cut-off and indicator.
Invalid code:	all codes valid.	
Exhausted medium:	interlock	stop computer, alarm.
Imperfect medium:	none.	
Timing conflicts:	interlock	wait.
Inoperable device:	check	stop computer, alarm.

§ 093.

EFFECTIVE SPEED

(Model 582)



N. B. These speeds take full advantage of "hot starts" in which there is no deceleration between blocks.

INPUT-OUTPUT: INTERROGATING TYPEWRITER

§ 101.

.1 GENERAL

.11 Identity: . . . . . Interrogating Typewriter. Model 328. IT 328.

.12 Description:

The Interrogating Typewriter is an input-output inquiry station, operated under control of the Interrogating Typewriter Control unit, ITC 398-1. Inquiry messages may be entered into the Processor by an operator. The program must periodically sense whether the Interrogating Typewriter is ready to transmit a message.

The inquiry is processed by the computer program, and the answer may be typed at normal typewriter speeds on the Interrogating Typewriter. Its output capabilities are similar to those of the Monitor Printer.

The Interrogating Typewriter may be operated as a remote inquiry station up to 2,000 feet from the Processor, as an optional feature. Normally it is used near the Processor. Its control unit, ITC 398-1, is located in the Processor cabinet.

.13 Availability: . . . . . April, 1962.

.14 First Delivery: . . . . Scheduled April, 1962.

INPUT-OUTPUT: MONITOR PRINTER

§ 102.

.1 GENERAL

.11 Identity: . . . . . Monitor Printer.
Model 338.
MP 338.

12. Description

The Monitor Printer is a typewriter-like output device which operates under program control. It may be used for such functions as program testing, listing of intermediate or final figures accumulated by the computer program, and the printing of short reports. It operates at a speed of ten characters per second and is capable of printing all of the RCA 301 characters.

The Monitor Printer is operated by the Monitor Printer Control unit, MPC 308, located in the Processor along with other device control units.

.13 Availability: . . . . . March, 1962.

.14 First Delivery: . . . . . March, 1962.

INPUT-OUTPUT: OPTICAL CHARACTER READER

§103.

.1 GENERAL

.11 Identity: . . . . . VIDEOSCAN Document Reader.
Model 5820.
VIDEOSCAN.

.12 Description

The VIDEOSCAN Document Reader is an optical character reader, which can read documents at a maximum speed of 1,500 documents per minute. This device was announced and demonstrated in early 1963. VIDEOSCAN reads up to 79 characters (spaced 10 per inch) on a single printed line on the document, and can read mark sensing fields with an optional Special Feature #102. A special RCA type font set available with the Model 333 and 335 line printers includes the digits 0 through 9 and four special symbols (dash, asterisk, dollar sign, and decimal point). With the mark-reading feature, pencil or pen marks indicate locations interpreted as the digits 0 to 9.

The VIDEOSCAN unit includes a Document Handler, an Optical Character Reader Scanning Station, an electronics rack, and a VIDEOSCAN Control Unit in the central processor input-output area. Single characters are converted to the 301 code in the electronics unit and transferred through the input-output control unit to core storage. Any character which is unreadable is replaced by an octal 57 code.

Document sizes range from 2.5 by 2.5 inch to 4 by 8.5 inch, and thickness ranges from 0.003 to 0.010 inch. Document handling rates are restricted to 750 documents per minute for document widths greater than 4.0 inches. During any one run, all documents must be the same size and thickness. The unreadable rate can be reduced by running the On-Line Printer at the 600 lines per minute rate.

The input hopper can hold a 12-inch stack of documents. There are two program selectable output accept stackers, and one rerun stacker for unreadable documents. The stackers each have a 6-inch capacity. Loading and unloading is possible during operation. The horizontal line of print can be at any location within the margins specified: 0.300 inch minimum at the right and left edges of the document, and 0.5 inch at the top and bottom.

.12 Description (Contd.)

Optional Features

Mark-Reading Station; Special Feature #102: With this Special Feature, mark-reading and character-reading can be accomplished in one pass of the documents. The mark-reading station is 3.5 inches ahead of the character-reading station. Mark-read data is transferred to core storage followed by character data.

The mark-reading area is composed of columns and rows of identification digits. One mark is made in each column to indicate the digit, and columns are spaced at six per inch. The number of columns available is limited only by the document size, except that there are restrictions on the width of the mark-read field when characters are to be read in the same pass.

Off-Line Use

The standard model 5820 can be used off-line for sorting on one special character, the asterisk with a vertical mark through it. This mark is put on normally for the purpose of automatically selecting documents requiring clerical attention after the reading operation is completed.

.13 Availability: . . . . . 9 months, following receipt of order.

.14 First Delivery: . . . . scheduled for September, 1963.

SIMULTANEOUS OPERATIONS

§ 111.

.1 SPECIAL UNITS

.11 Identity: . . . . . Data Record File Mode Control. Model 391.

Simultaneous Mode Control. Model 392.

.12 Description

Without the optional Mode Controls, capability of the system to perform simultaneous operations is limited to rewinding magnetic tapes, advancing paper on the printer, and selecting bands on the Data Disc and Data Record Files. The Processor is fully occupied in controlling all input-output and auxiliary storage transfers except for short periods at the end of each transfer load.

The optional Simultaneous Mode Control provides the control for one independent data transfer and can use any input-output device. Thus operation of any device can be overlapped; selection of the overlapped (simultaneous) mode or the Normal (processor) Mode is effected by the instruction operation code used.

The optional Data Record File Mode Control can have 1 to 4 Data Record Files connected to it in addition to the Data Record Files connected to the Processor. The units connected to the Data Record File Mode Control are addressable only in the Data Record File Mode; the others (one or two) connected directly to the Processor are addressable in the Normal or in the Simultaneous Mode.

Optional Features

Data Record File Mode Control: Each data transfer between the High Speed Memory and a Data Record File connected to the Data Record File Mode Control is controlled by this Mode Control. The data transfer is overlapped by interrupting central processor operation for only 7 microseconds for each character transferred into or out of core store. The Mode Control can control only one transfer at a time.

Simultaneous Mode Control: Each data transfer between the High Speed Memory and a device addressed in the Simultaneous Mode is controlled by this Mode Control. The data transfer is overlapped by interrupting central processor operation for only 7 microseconds for each character transferred into or out of core store. The Simultaneous Mode Control can control only one transfer at a time.

When both Mode Controls are present in the system, the Processor and both Mode Controls can all operate by overlapping their operations.

.12 Description (Contd.)

With the Simultaneous Mode Control one input or output unit may operate in conjunction with the Central Processor or two peripheral units may interleave transfer of data into and out of the core store. The programmer must therefore stagger his I/O control by alternating reading, writing, and processing operations. There are also special switches to inhibit operation of the Simultaneous Mode Control and Data Record File Mode Control.

.2 CONFIGURATION CONDITIONS

I: . . . . . system includes neither Simultaneous Mode Control nor Data Record File Mode.

II: . . . . . system includes SMC but not Data Record File Mode Control.

III: . . . . . system includes both Data Record File Mode Control and Simultaneous Mode Control.

.4 RULES

General

Each controller can control only one transfer at a time, and each controller interrupts the computer for a memory access for each character. (Exceptions are the printer and the 66KC magnetic tape. Refer to sections describing these units for the time demand on the processor storage.) Processing can continue except for these storage interruptions.

The Simultaneous Mode and Data Record File Mode commands, when used, should be given before processing of the previous record is started or before a Normal Mode input-output operation is started to enable maximum utilization of the Simultaneous Mode Control features.

Condition I; no Simultaneous Mode Control and no Data Record File Mode Control.

One of the following operations:

Process instructions
Read or write magnetic tape
Read or punch a card
Print a line
Read or write Data Record File
Read or write Data Disc File

and any number of the following operations, limited only by the system configuration:

Rewind magnetic tapes
Advance paper on line printer
Seek on Data Record and Data Disc Files.

§ 111.

.4 RULES (Contd.)

Condition II; Simultaneous Mode Control Included

Any two of the following operations, depending on the system configuration:

Process instructions
Read a card
Punch a card
Read magnetic tape using Processor
Read magnetic tape using Simultaneous Mode Control
Write magnetic tape using Processor
Write magnetic tape using Simultaneous Mode Control
Print a line
Read Data Record File using Processor
Read Data Record File using Simultaneous Mode Control
Write Data Record File using Processor
Write Data Record File using Simultaneous Mode Control
Read Data Disc File using Processor
Read Data Disc File using Simultaneous Mode Control
Write Data Disc File using Processor
Write Data Disc File using Simultaneous Mode Control

and any number of the following operations, limited only by the system configuration:

Rewind magnetic tapes
Advance paper on line printer
Seek on Data Record and Data Disc Files.

.4 RULES (Contd.)

Condition III; both Simultaneous Mode Control and Data Record File Mode Control Included

Any two of the following operations, depending on the system configuration:

Process instructions
Read a card
Punch a card
Read magnetic tape using Processor
Read magnetic tape using Simultaneous Mode Control
Write magnetic tape using Processor
Write magnetic tape using Simultaneous Mode Control
Print a line
Read Data Record File using Processor
Read Data Record File using Simultaneous Mode Control
Write Data Record File using Processor
Write Data Record File using Simultaneous Mode Control
Read Data Disc File using Processor
Read Data Disc File using Simultaneous Mode Control
Write Data Disc File using Processor
Write Data Disc File using Simultaneous Mode Control

and read or write on Data Record File, and any number of the following operations, limited only by system configuration:

Rewind magnetic tapes
Advance paper on line printer
Seek on Data Record and Data Disc Files

INSTRUCTION LIST

§ 121.

INSTRUCTION					OPERATION
Mnemonic	OP	N	A	B	
					Arithmetic
ADD	+	N	A	B	(A) + (B) → A.
SUB	-	N	A	B	(A) - (B) → A.
OR	Q	N	A	B	(A) OR (B) → A.
AND	T	N	A	B	(A) AND (B) → A.
EXO	U	N	A	B	(A) Exclusive OR (B) → A.
					Arithmetic, using 354/355 Processor
					Fixed point
FXA	@	N	A	B	(A) + (B) → A.
FXS	(	N	A	B	(A) - (B) → A.
FXM	)	N	A	B	(A) x (B) → A.
FXD	&	N	A	B	(A) ÷ (B) → A.
					Floating point
FLA	$	N	A	B	(A) + (B) → A.
FLS	:	N	A	B	(A) - (B) → A.
FLM	"	N	A	B	(A) x (B) → A.
FLD	/	N	A	B	(A) ÷ (B) → A.
					Other
SAC	Z	N	-	B	(Accumulator and/or Product Register) → B.
SHA	=	N	-	B	(Accumulator and/or Product Register) shifted, under control of N, B characters.
					Logic
REG	V	1	A	B	(P) → A, Jump to B.
		2	A		(A) of previous instruction → STA.
		4	A		(B register) → A.
		8	A		(S register) → A.
		&	A		(U register) → A.
CTC	W	1	A	B	Jump to A if PRP set, to B if PRN is set, to next instruction if PRZ is set.
		2	A	B	Jump to A if first overflow set, to B if neither overflow is set, to next instruction if second overflow is set.
		4	A	B	Jump to A if there is a read in Simultaneous Mode, to B if there is a write in Simultaneous Mode, to next instruction if Simultaneous Mode is unoccupied.
		8	A	B	Jump to A if EF/ED Normal set, otherwise to B.
		&	A	B	Jump to A if interrupt set, otherwise to B.
		-	A	B	Jump to A if EF/ED Simultaneous set, otherwise to B.
TA	X	N	A	B	Jump to B if (A) not zero; (A)-1 → A. If N not zero, increment index registers as specified by N.
COM	Y	N	A	B	Compare (A) against (B) from the left and set PRI.
RPT	R	N	0000	0000	Repeat next instruction N times, resetting A and B.
		N	0000	0001	Repeat next instruction N times, resetting A chaining B.
		N	0001	0000	Repeat next instruction N times, resetting A resetting B.
		N	0001	0001	Repeat next instruction N times, chaining A and B.

§ 121.

INSTRUCTION LIST (Contd.)

INSTRUCTION					OPERATION
Mnemonic	OP	N	A	B	
					Logic (Contd.)
IOS	S	N	A	B	Jump to B if device selected by N satisfies condition A.
		X	1		Tape station: . . . . . non-operable
			2		tape in motion
			4		at end of tape
			8		at front of tape
			16		tape in reverse motion
		X	1		Paper Tape: . . . . . non-operable
			2		operating
		X	1		Cards: . . . . . non-operable
			2		operating
		X	1		Printer: . . . . . non-operable
			2		printing a line
			4		advancing paper
		X	1		Data Record File: . . . non-operable
			2		operating (reading or writing)
			4		turntable occupied
		X	1		Data Disc File: . . . . non-operable
			2		operating
			4		arm movement terminated
		X	1		MICR Sorter-Reader: . non-operable
			2		jam
			4		transporting problem
			8		feeder hopper empty
			16		pocket selection ignored
HLT	(period)	ignored	ignored	ignored	Stop computer, after completion of any instruction in Simultaneous Mode.
					Data Transfer
LSL	K	N	A	B	Search left from A to B to find first symbol different from N.
LSR	L	N	A	B	Search right from A to B to find first symbol different from N.
DL	M	N	A	B	Copy N characters from A to B left.
DR	N	N	A	B	Copy N characters from A to B right.
DSL	#	N	A	B	Copy characters from A to B left, delimited by symbol N.
DSR	P	N	A	B	Copy characters from A to B right, delimited by symbol N.
SF	J	N	A	B	Fill area A to B with symbol N.
TRA	A	N	A	B	Translate starting at A using table starting at B, for N entries.
					Internal Storage; Data Record Files
BSN	D	N	0000	B	Get record and ready arm to band B of Processor-controlled File. N specifies initial return of record to cage.
BSM	E	N		B	Get record and ready arm to band B of file N using Record File Mode Control; N also specifies initial return of record to cage.
BRN	F	N	A	XBCD	Read N cells into A starting from cell D using Processor. If C even stop on block delimiter, if B odd return record to cage.
BRS	G	N	A	XBCD	Read N cells into A, using SMC. Control as in OP F.
BWN	H	N	A	XBCD	Write N cells from A, using Processor. Control as in OP F.
BWS	I	N	A	XBCD	Write N cells from A, using SMC. Control as in OP F.

§ 121.

INSTRUCTION LIST (Contd.)

INSTRUCTION					OPERATION
Mnemonic	OP	N	A	B	
RMR	*	N	A	XBCD	Read N cells into A, using DRFMC. Control as in OP F.
RMW	%	N	A	XBCD	Write N cells from A, using DRFMC. Control as in OP F.
					Internal Storage; Data Disc File
TS	D	N	0000	B	N selects File; yoke position from B.
SRN	F		A		Read sectors using Processor into A.
SRS	G		A		Read sectors using SMC into A.
SWN	H		A		Write sectors using Processor from A.
SWS	I		A		Write sectors using SMC from A.
					Input-Output; Paper Tape, Magnetic Tape
RFN	4	N	A	B	Read tape N forward into area from A to B using Processor.
RFS	5	N	A	B	Read tape N forward into area from A to B using SMC.
RRN	6	N	A	B	Read tape N backward into area from A to B using Processor.
RRS	7	N	A	B	Read tape N backward into area from A to B using SMC.
TWN	8	N	A	B	Write tape N forward from area from A to B using Processor.
TWS	9	N	A	B	Write tape N forward from area from A to B using SMC.
RWD	;	N			Rewind tape N.
					Input-Output; Punched Cards
CRN	0	X	A	0000	Read card into area starting at A using Processor.
CRS	1	X	A	0000	Read card into area starting at A using SMC.
CPN	2		A	B	Punch card from area from A to B using Processor.
CPS	3		A	B	Punch card from area from A to B using SMC.
					Input-Output; Printer
PAN	B		0000	BBB0	Print one line starting at BBB0 using Processor; no paper advance.
		N	0000	BBB1	Print one line starting at BBB0 using Processor; advance N lines.
			0000	BBB2	Print one line starting at BBB0 using Processor; advance using tape loop (tab).
			0000	BBB3	Print one line starting at BBB0 using Processor; advance and change page.
PAS	C	N		B	Print as in B Operation, using SMC.
					Input-Output: MICR Sorter-Reader
	;	0	0000	B	Start feeding documents on MICR device if B = 1. Stop feeding documents on MICR device if B = 0.
	6	0	A	B	Read one MICR document into area from A to B using Processor.
	7	0	A	B	Read one MICR document into area from A to B using SMC.
	8	0	A	A	Selects pocket in MICR device based on character in A.

RCA 301 AUTOMATIC ASSEMBLY SYSTEM FILE DESCRIPTOR

TITLE FCP EXAMPLE

PROGRAMMER John Doe | DATE 2/27/62

COLUMNS	INFORMATION	USE OF ENTRY
1-6	FILEA,	Select a unique character for each file from 0-9 and A-I.
7-8	T,	Indicate the input-output media: C = card, T = tape.
9-11	DD,	Assign a device character: for tape, assign two device characters. Repeat the first device character if only one tape station is assigned to the file. For input card files, indicate the appropriate device character.
12-20	MASTER,	Label identification item for label procedures: enter NONE if not appropriate.
21-24	010,	Active time value expressed in days; 000 must appear if entry is not appropriate.
25-26	C,	Label-Type Indicator; B = beginning label only, C = both beginning and ending, N = no labels.
27-32	NONE,	Tag of own coding to be executed for beginning label. Enter NONE if not appropriate.
33-38	NONE,	Tag of own coding to be executed for ending label. Enter NONE if not appropriate.
39-40	Y,	Is this file always present when the program is run? Y = yes, N = no.
41-42	N,	Is this file batched? Y = yes, N = no. (Always N for card files.)
43-46	010,	Enter numbers of records per batch or total number of read or punch areas for card files; 000 must appear for non-batched tape files.
47-51	0100,	Enter maximum size of a batch. This total includes each E/I symbol associated with each data record and the terminal E/F of the batch. 0000 must appear if the file is not batched.
52-56	0080,	Enter size of largest record in the file including terminating E/I. (0080 for cards.)
57-58	N,	Execute I-O commands in the simultaneous mode? Y = yes, N = no.
59-60	B,	Type of file: I = input, O = output, B = both input and output.
61	N	Is rerun controlled by this file? Y=yes, N=no.
62-71		Punched blanks in these columns.
72-74		Program IDEN.
75-80	000050	Sequence Number.

28-00-089

AUERBACH / BNA

RCA 301 AUTOMATIC ASSEMBLY SYSTEM FILE DESCRIPTOR

TITLE FCP EXAMPLE

PROGRAMMER John Doe

DATE 2/27/62

COLUMNS	INFORMATION	USE OF ENTRY
1-6	F1LEB,	Select a unique character for each file from 0-9 and A-I.
7-8	T,	Indicate the input-output media: C = card, T = tape.
9-11	EE,	Assign a device character: for tape, assign two device characters. Repeat the first device character if only one tape station is assigned to the file. For input card files, indicate the appropriate device character.
12-20	MASTER,	Label identification item for label procedures: enter NONE____if not appropriate.
21-24	000,	Active time value expressed in days; 000 must appear if entry is not appropriate.
25-26	C,	Label-Type Indicator; B = beginning label only, C = both beginning and ending, N = no labels.
27-32	NONE,	Tag of own coding to be executed for beginning label. Enter NONE_if not appropriate.
33-38	NONE,	Tag of own coding to be executed for ending label. Enter NONE_if not appropriate.
39-40	Y,	Is this file always present when the program is run? Y = yes, N = no.
41-42	N,	Is this file batched? Y = yes, N = no. (Always N for card files.)
43-46	000,	Enter numbers of records per batch or total number of read or punch areas for card files; 000 must appear for non-batched tape files.
47-51	0000,	Enter maximum size of a batch. This total includes each E/I symbol associated with each data record and the terminal E/F of the batch. 0000 must appear if the file is not batched.
52-56	0080,	Enter size of largest record in the file including terminating E/I. (0080 for cards.)
57-58	N,	Execute I-O commands in the simultaneous mode? Y = yes, N = no.
59-60	B,	Type of file: I = input, O = output, B = both input and output.
61	N	Is rerun controlled by this file? Y=yes, N=no.
62-71		Punch blanks in these columns.
72-74		Program IDEN.
75-80	000180	Sequence Number.

28-00-089

RCA 301 AUTOMATIC ASSEMBLY PROGRAM SHEET

TITLE FCP EXAMPLE — HEADER

PROGRAMMER John Doe — DATE 2/27/62

TAG (18–22)	OP (23–25)	N (26–32)	ADDRESS FIELD (33–71)	IDEN (72–74)	NUMERIC SEQUENCING (75–80)
	RMK		301 FCP EXAMPLE-REMOVE OBSOLETE RECORDS		000010
	LBL	BEGIN	29,STANDARD BEGIN INCLUDES IDEN,REEL#,		000020
	LBL	END	10,STANDARD &BOTH WRITEN & PURGE DATE		000030
	SHR		FILEA,FILEB EFFICIENT MEMORY UTILIZAT		000040
	(SEE FILE DESCRIPTOR)				000050
	RCD		400 SIZE OF LARGEST MESSAGES		000060
DECID	BST		8 PREVIOUSLY SET SENTINAL,		000070
	(SEE FILE DESCRIPTOR)		SAME MESSAGE SIZE IN BOTH		000080
	RCD		400 INPUT & OUTPUT		000090
	BST		8		000100
	SEG	7	START OF ACTUAL PROGRAM		000110
START	OPN		FILEA,INPUT INCLUDES INIT OF PARAMET,		000120
	OPN		FILEB,OUTPUT LABEL CHECKS & POSITIONING		000130
NOTSO	RED		FILEA,,OUT READ MESSAGE,SENSE EF		000140
	COM	8	NGOOD,DECID MESSAGE ACCEPTABLE?		000150
	TPN		GOOD,GOOD YES,WRITE		000160
	TRS		STP,NOTSO NO, DELETE		000170
GOOD	WRT		FILEB,VARIABLE		000180
OUT	CLO	RWD	FILEA,INPUT-FILE CLOSE INCLUDES END		000190
	CLO	RWD	FILEB,OUTPUT-FILE LABEL EXECUTION AND		000200
	HLT	0	/,/ REWOUND AT BTL IF SPECIFIED		000210
NGOOD	CON	8	E/B REJECT SENTINEL CONSTANT		000220

28-00-033

PAGE 1 OF 2

RCA 301 AUTOMATIC ASSEMBLY PROGRAM SHEET

TITLE			HEADER
	PROGRAMMER	DATE	

18 22 TAG	23 25 OP	26 32 N	33 71 ADDRESS FIELD	72 74 IDEN	75 80 NUMERIC SEQUENCING
	E,N,D		S,T,A,R,T, ,T,O, ,B,E,G,I,N,N,I,N,G, ,A,F,T,E,R, ,A,U,T,O, ,I,N,S		0,0,0,2,3,0

28-00-033

PAGE 2 OF 2

§ 132.

.1 SOURCE PROGRAM EXCERPT

301 COBOL NARRATOR PROGRAM SHEET

TITLE INVENTORY UPDATING RUN	
PROGRAMMER	DATE

```
SEQUENCE
NUMBER
1    6 7 8   12                                                           IDENT 73  80
001000   CONSTANT SECTION.
         77 ERROR-1; SIZE IS 33; CLASS ALPHABETIC; VALUE "AGENCY COUNTERS
       -     "DO NOT BALANCE -".
         77 ERROR-2; PICTURE A(32); VALUE "AGENCY AMOUNTS DO NOT BALANCE -
       -     " ".
         77 ERROR-3; SIZE 29; CLASS ALPHABETIC; VALUE "RECORD COUNTS DO NO
       -     "T AGREE -".

001100   PROCEDURE DIVISION.
         DECLARATIVES.
         ABLE SECTION 00. USE AFTER ENDING REEL LABEL PROCEDURE
             ERROR-FILE.
         ERROR-LABEL. ADD BLOCK-COUNT TO ERROR-OUT.
001110   END DECLARATIVES.
001200   HOUSEKEEPING SECTION 01.
001300   INITIALIZE-FILES. OPEN INPUT MASTER-FILE; OUTPUT NEW-MASTER-FILE,
             ERROR-FILE, PROCUREMENT-FILE. ACCEPT TODAYS-DATE FROM SPECIAL
       -     -INPUT. MOVE "P" TO P-CODE.
001400   LOAD-TABLES. MOVE ZEROS TO AGENCY-COUNTER (ENTRY), AGENCY-AMT (EN
       -     TRY). ADD 1 TO ENTRY.
001500   EXECUTE-LOAD. PERFORM LOAD-TABLES 7 TIMES.
001700   MAIN-PROCESSING SECTION 00.
001710   MAST-IN. READ MASTER-FILE; AT END GO TO CLOSE-RUN. ADD 1 TO MASTE
       -     R-IN. IF ID-CODE IN MASTER-FILE IS NOT EQUAL TO "R" MOVE "A"
             TO ID-CODE IN MASTER-FILE THEN GO TO ERR-OUT.
```

PAGE 5 OF 7

RCA 301 UMAC PROGRAM SHEET

TITLE SAMPLE PROGRAM 1

PROGRAMMER R. Dash DATE 7/4/62

C	STATEMENT NUMBER		UMAC STATEMENTS	CARD NUMBER
1	2 5	6	7 76	80
C			SAMPLE PROGRAM 1 R. DASH	
			FIX ALL I,N	
			FUNCTION SQRT : LBJ, ATAN : LBI	
C			READ PARAMETER	
			READ, N	
			PRINT AND LABEL, N	
			SPACE 4	
			DO 5 I = 1, N	
			READ, X1, Y1, X2, Y2, X3, Y3	
			PRINT AND LABEL, X1, Y1, X2, Y2, X3, Y3	
C			COMPUTE LENGTH OF SIDES	
			AB = SQRT F ((X2 - X1) ** 2 + (Y2 - Y1) ** 2)	
			AC = SQRT F ((X3 - X1) ** 2 + (Y3 - Y1) ** 2)	
			BC = SQRT F ((X3 - X2) ** 2 + (Y3 - Y2) ** 2)	
C			COMPUTE AREA	
			S = (BC + AC + AB)/2	
			AREA = SQRT F (S * (S - BC) * (S - AC) * (S - AB))	
C			COMPUTE RADIUS OF INSCRIBED	
C			AND CIRCUMSCRIBED CIRCLES	
			RINSC = AREA/S	
			FOURA = 4. * AREA	
			RCIRC = BC * AC * AB/FOURA	

PAGE 1 OF

28-00-094

DATA CODE TABLE NO. 1

§141.

.1 USE OF CODE: . . . . . Internal Code, Magnetic Tape 1/, Paper Tape 1/, Printer, Data Disc File, Record File.

.2 STRUCTURE OF CODE

.21 Character Size: . . . . . 6 bits plus odd parity bit, except tape codes which are even parity.

.22 Character Structure

.221 More significant pattern: . . . . . 2 bits: 16, 32.

.222 Less significant pattern: . . . . . 4 bits: 1, 2, 4, 8.

.23 Character Codes

LESS SIGNIFICANT PATTERN	MORE SIGNIFICANT PATTERN			
	0	16	32	48
0	0	&˜	minus -	"
1	1	A	J	/
2	2	B	K	S
3	3	C	L	T
4	4	D	M	U
5	5	E	N	V
6	6	F	O	W
7	7	G	P	X
8	8	H	Q	Y
9	9	I	R	Z
10	Note 2/	+	EI	EB
11	#	.	$	,
12	@	;	*	%
13	(	:	ED	•
14	)	'	EF	=
15				

Notes: 1/ Tape code is complement of 301 internal code. On tape, gap is denoted by no punches (paper tape) or no characters (magnetic tape).

2/ This code is interpreted as space or underscore.

3/ EB = End of Block.
ED = End Data.
EF = End File.
EI = End Information.
• = ISS = Item Separator.

DATA CODE TABLE NO. 2

§ 142.

.1 USE OF CODE: . . . . . Punched card input-output.

.2 STRUCTURE OF CODE

.21 Character Size: . . . . . 1 column.

.23 Character Codes

UNDERPUNCH	OVERPUNCH			
	None	12	11	0
None	Note 1	&	minus -	
12				
11				
0	0	+ 0	"	
1	1	A	J	/
2	2	B	K	S
3	3	C	L	T
4	4	D	M	U
5	5	E	N	V
6	6	F	O	W
7	7	G	P	X
8	8	H	Q	Y
9	9	I	R	Z
8-2		+	EI	EB
8-3	#	.	$	,
8-4	@	;	*	%
8-5	(	:	ED	• 2/
8-6	)	'	EF	=
8-7				

Notes: 1/ A blank column is interpreted as a blank or underscore.
2/ ISS (item separator) symbol.

DATA CODE TABLE No. 3

§ 143.

.1 USE OF CODE: . . . . internal coding sequence.

.2 STRUCTURE OF CODE

In ascending sequence:

0	minus (-)
1	J
2	K
3	L
4	M
5	N
6	O
7	P
8	Q
9	R
Note †	EI
#	$
@	*
(	ED ‡
)	EF ‡
&	"
A	/
B	S
C	T
E	U
F	V
G	W
H	X
I	Y
+	Z
.	EB ‡
;	,
:	%
'	• ‡
	=

† This code is interpreted as space or underscore.

‡ EB = End of Block.
ED = End Data.
EF = End File.
EI = End Information.
• = ISS = Item Separator.

PROBLEM ORIENTED FACILITIES

§151.

.1 UTILITY ROUTINES

.11 Simulators of Other Computers: . . . . . none.

.12 Simulation by Other Computers: . . . . . none.

.13 Data Sorting and Merging

Tape Merge 30
Record size: . . . . . preset for each run.
Block size: . . . . . accepts any, chooses own optimum.
Key size: . . . . . preset for each run.
File size: . . . . . 10 reels.
Number of tapes: . . . 4 or 6.
Date available: . . . ?
Description: . . . . . 1 to 10 way merge of sequenced files.

Tape Sort 31
Record size: . . . . . preset for each run.
Block size: . . . . . accepts any, chooses own optimum.
Key size: . . . . . preset for each run.
File size: . . . . . 99 reels.
Number of tapes: . . . up to 12.
Date available: . . . . ?
Description: . . . . . 2 to 10 way, one pass merge, or "1-way" sequence check; uses re-run tape; can use alternators; requires 20K HSM.

.14 Report Writing: . . . . . none.

.15 Data Transcription

Magnetic Tape to Printer
Reference: . . . . . TAPE TO PRINTER.
Date available: . . . . September 1961.
Description: . . . . . transcribe 501 type tapes to printed output.

Magnetic Tape to Card
Card to Magnetic Tape
Reference: . . . . . TAPE TO CARD; CARD TO TAPE.
Date available: . . . . September 1961
Description: . . . . . uses 501 tapes with either 501 or 301 code, provides column splitting, rearrangements and editing.

.16 File Maintenance: . . . . none.

.17 Other

ABSTRACT
Date available: . . . . . September, 1961
Description: . . . . . lists for a magnetic tape the names of files, numbers of blocks, and fixed sample from each block.

ASSEMBLER CARD CONDENSER
Date available: . . . . September, 1961.
Description: . . . . . combined instruction cards produced by the Automatic Assembly System Program into six (6) instructions per card format. This routine would consolidate cards, thereby decreasing loading time.

CARD PRINT
Date available: . . . . . December 15, 1961
Description: . . . . . prints information from punched cards to the printer. This routine could be used for checking the contents of card test data.

LOADER PRINT
Date available: . . . . September, 1961.
Description: . . . . . prints the contents of program instruction cards. For programs that are coded in machine language, this routine could be used to check the contents of program instruction cards.

.2 PROBLEM ORIENTED LANGUAGES: . . . . . none.

PROCESS ORIENTED LANGUAGE: COBOL 61

§ 161.

.1 GENERAL

.11 Identity: . . . . . RCA 301 COBOL Narrator. COBOL 61.

.12 Origin: . . . . . CODASYL committee.

.13 Reference: . . . . . 301 COBOL Narrator, Users' Reference 93-05-002.

.14 Description

The RCA 301 COBOL Narrator covers all of the Required COBOL facilities and many electives. (A general description of COBOL and a detailed list of all possible electives is included in The Users' Guide, 4:161.) In addition, there are special extensions to improve object program performance on low activity file processing. Both fixed and variable sized items can be used freely.

Deficiencies

None.

Electives

# 2:	"=" sign only.
# 3, 5, 6, 8, 9, 10:	
# 11, 13:	accepted but only as a comment, no "DEPENDING" elective.
# 14:	"L" but not "DEPENDING."
# 17:	
# 19:	not "DEPENDING."
# 20:	
# 21:	in one program all labels must be standard or all non-standard.
# 24:	ENTER AASP language.
# 25:	except "REPLACING" (Parameter names) facility.
# 26:	only option 2.
# 27, 28, 30:	
# 33:	up to size 18 digits.
# 34, 35, 36 37, 38, 39:	
# 40, 41:	all except option to specify standard "SUPERVISOR."
# 42, 43, 45:	
# 46:	re-start only at end of reel, no multi-file reels.
# 47:	
# 48:	see 25.
# 49:	

Extensions

Facilities to increase the object program efficiency for low activity files will be available later in 1962. First, there are read and write verbs (RELEASE) for complete blocks instead of only records and second, there is a verb to access the identities of the first and last records in a block.

.15 Publication Date: . . . . Initial, June, 1961. Extended, February, 1962. Further extension expected late 1962.

.2 PROGRAM STRUCTURE

.21 Divisions

IDENTIFICATION: . . .	name of author; name and data of program.
ENVIRONMENT:	describes translating and target computers and relates I/O units to files, names to units.
DATA:	describes the data items and shows the structure of records, files, working storage and constants.
PROCEDURE:	describes the procedures in an imperative form.

.22 Procedure Entities

PROCEDURE DIVISION:	sections and/or paragraphs.
SECTION:	paragraphs.
PARAGRAPH:	sentences.
SENTENCE:	imperative, conditional and compiler directing statements.
STATEMENT:	COBOL words.

.23 Data Entities

FILE:	records.
RECORD:	elementary items or group items.
GROUP ITEM:	elementary items or group items; up to 48 levels of group items are possible.
ELEMENTARY ITEM: .	characters.

.24 Names

.241 Simple name formation

Alphabet:	A to Z, 0 to 9, and hyphen.
Size:	30 characters maximum.
Avoid key words: . . .	yes.
Formation rule: . . .	at least one letter; no hyphen as first or last character.

§ 161.

.242 Designators
- Procedures
  - PROCEDURE
    - DIVISION: . . . . . labeled with name.
    - SECTION: . . . . . SECTION is part of header.
    - PARAGRAPH: . . . . none.
    - SENTENCE: . . . . no name allowed.
  - Data: . . . . . none.
  - Equipment: . . . . . standard names, e.g., PAPER-TAPE-READER.
  - Comments: . . . . . begin with key word NOTE.
  - Translator control: . none.

.25 Structure of Data Names

.251 Qualified names
- Example: . . . . . TOTAL IN MASTER.
- Multiple qualifiers: . yes.
- Complete sequence: . optional.
- Broken sequence: . . . yes.

.252 Subscripts
- Number per item: . . 0 to 3.
- Applicable to: . . . . group item or elementary items.
- Class may be
  - Special index variable: . . . . . no.
  - Any variable: . . . . yes.
  - Literal: . . . . . yes.
  - Expression: . . . . . no.
- Form may be
  - Integer only: . . . . yes.
  - Signed: . . . . . only positive.

.253 Synonyms
- Preset: . . . . . yes.
- Dynamically set: . . . no.

.26 Number of Names: . . . unlimited.

.27 Region of Meaning of Names

.271 Universal names: . . . all.
.272 Local names: . . . . . none.

.3 DATA DESCRIPTION FACILITIES

.31 Methods of Direct Data Description

.311 Concise item picture: . yes.
.312 List by kind: . . . . . no.
.313 Qualify by adjective: . . NUMERIC.
.314 Qualify by phrase: . . . CLASS IS NUMERIC.
.315 Qualify by code: . . . . no.
.316 Hierarchy by list: . . . yes.
.317 Level by indenting: . . optional.
.318 Level by coding: . . . . mandatory.

.32 Files and Reels

.321 File labels
- Variable layout: . . . card files only, description and/or own coding or library, or standard throughout or none.
- Control totals: . . . . use own coding.
- Identity control: . . . description, or library, or USE.
- Multi-reel: . . . . . description, or library, or USE.

.322 Reel labels
- Variable layout: . . . tape files only, description or library or standard or none.
- Block count: . . . . . description, or USE.
- Multi-files: . . . . . none directly, but can be arranged in program.

.33 Records and Blocks

.331 Variable record size: . preset, or dynamic.
.332 Variable block size: . . preset, or dynamic.
.335 Choice of record size: . description.
.336 Choice of block size: . description.
.337 Sequence control: . . . SEQUENCED ON, recognized but no action taken.
.338 In-out error control: . automatic.
.339 Blocking control: . . . . automatic.

.34 Data Items

.341 Designation of class: . description.
.342 Possible classes
- Integer: . . . . . yes.
- Fixed point: . . . . . yes.
- Floating point: . . . . no.
- Alphabetic: . . . . . yes.
- Alphameric: . . . . . yes.

.343 Choice of external radix: . . . . . none.
.344 Possible radices: . . . only decimal.
.345 Justification: . . . . . description, or automatic left for alpha and point alignment for numeric.
.346 Choice of code: . . . . description.
.347 Possible codes: . . . . standard only.
.348 Item size
- Variable size: . . . . preset or dynamic.
- Designation: . . . . . picture or phrase. variable by delimiter in data.
- Range
  - Fixed point numeric: 1 to 18 characters in arithmetic.
  - Alphameric: . . . . no limit.

.349 Sign provision: . . . . . optional.

§ 161.

.35 Data Values

.351 Constants
- Possible sizes
  - Integer: . . . . . 1 to 18 characters in arithmetic.
  - Fixed point: . . . . . 1 to 18 characters in arithmetic.
  - Alphabetic: . . . . . 1 to 120 characters.
  - Alphameric: . . . . 1 to 120 characters.
- Subscriptible: . . . . by redefining.
- Sign provision: . . . . optional.

.352 Literals: . . . . . same as constants.

.353 Figuratives
- Examples: . . . . . ZERO, ZEROES, ZEROS, SPACE, SPACES, ALL "literal."

.354 Conditional variables: . yes.

.36 Special Description Facilities

.361 Duplicate format: . . . COPY.

.362 Re-definition: . . . . . REDEFINES.

.363 Table description
- Subscription: . . . . . mandatory.
- Multi-subscripts: . . by hierarchy of levels.
- Level of item: . . . . group item or elementary item.
- Implied subscript at lower level: . . . . . yes.

.364 Other subscriptable entities: . . . . . none.

.4 OPERATION REPERTOIRE

.41 Formulae: . . . . . none.

.42 Operations on Arrays: . none.

.43 Other Computation

.431 Operator list
- ADD: . . . . . unrounded addition, to.
- SUBTRACT: . . . . . unrounded subtraction, from.
- MULTIPLY: . . . . . unrounded multiplication, by.
- DIVIDE: . . . . . unrounded division, into.

.432 Operands allowed
- Mixed scaling: . . . . yes.
- Mixed radices: . . . . no.
- Literals: . . . . . yes.
- Restrictions: . . . . . must be pure numeric, no decimal points allowed in data.

.433 Statement
- Mixed verbs: . . . . . no.
- Multi-results: . . . . yes.
- Size limits: . . . . . none.
- Multi-operand: . . . . yes.
- Implied results: . . . last named operand.

.434 Rounding of results: . . optional ROUNDED in procedures, else truncated.

.435 Special cases
- x = -x: . . . . . SUBTRACT X FROM 0 GIVING X.
- x = x + 1: . . . . . ADD 1 TO X.
- x = x + y: . . . . . ADD Y TO X.
- x = x ÷ y: . . . . . DIVIDE Y INTO X.
- x = xy: . . . . . MULTIPLY Y BY X.
- x = remainder ÷ y: . . DIVIDE Y INTO X GIVING Z; MULTIPLY Y BY Z; SUBTRACT Z FROM X.

.436 Typical cases
- x = y + z: . . . . . ADD Y, Z GIVING X.

.44 Data Movement and Format

.441 Data copy example: . . MOVE X TO Y.

.442 Levels possible: . . . . group items.
elementary items.

.443 Multiple results: . . . . MOVE X TO Y, Z.

.444 Missing operands
- Excess sources: . . . MOVE CORRESPONDING.
- Excess destinations: . MOVE CORRESPONDING.

.445 Size of operands
- Exact match: . . . . . only group items.
- Alignment rule
  - Numbers: . . . . . decimal point.
  - Alpha: . . . . . left justified.
- Fuller rule
  - Numbers: . . . . . zeroes.
  - Alpha: . . . . . blanks.
- Truncating rule
  - Numbers: . . . . . at each end.
  - Alpha: . . . . . at right.
  - Variable size destination: . . . . yes.

.446 Editing possible
- Change class: . . . . description.
- Change radix: . . . . no.
- Delete editing symbols: no.
- Insert editing symbols
  - Actual point: . . . . description.
  - Suppress zeroes: . . description.
  - Insert: . . . . . $, . *+- CR DB blank, 0
  - Float: . . . . . $+- *

.447 Special moves: . . . . . MOVE ZEROES TO X.
moves between fixed and variable sized items.

.448 Code translation: . . . none.

.449 Character manipulation: EXAMINE; to replace and/or count the number of occurrences of a given character in a data item.

.45 File Manipulation

- Open: . . . . . OPEN.
- Close: . . . . . CLOSE.
- Advance to next record: READ; WRITE; including paper ADVANCING.
- Step back a record: . . none.
- Set restart point: . . . library or description.
- Restart: . . . . . none.
- Start new reel: . . . . . CLOSE REEL.
- Start new block: . . . . none.
- Search on key: . . . . . none.
- Rewind: . . . . . automatic for CLOSE file but can say NO REWIND.
- Unload: . . . . . REWIND, LOCK.

§ 161.

.46 Operating Communication

.461 Log of progress: . . . . STOP literal, shows literal to operator.
DISPLAY; to display low volume data on typewriter or on-line printer.
.462 Messages to operator: . same as log.
.463 Offer options: . . . . . own COBOL coding using DISPLAY and ACCEPT.
.464 Accept option: . . . . . ACCEPT; to receive low volume data from magnetic or paper tapes or cards.

.47 Object Program Errors

Error	Discovery	Special Actions
Overflow:	ON SIZE ERROR	own COBOL coding.
In-out:	automatic	automatic.
Invalid data:	none	none.

.5 PROCEDURE SEQUENCE CONTROL

.51 Jumps

.511 Destinations allowed: . sections.
paragraphs.
.512 Unconditional jump: . . GO TO X.
.513 Switch: . . . . . separate paragraph, named Y containing only a GO TO X statement.
.514 Setting a switch: . . . . ALTER Y TO PROCEED TO Z.
.515 Switch on data: . . . . . GO TO X, Y, Z DEPENDING ON W.

.52 Conditional Procedures

.521 Designators
Condition: . . . . . IF.
Procedure: . . . . . implied.
.522 Simple conditions
Expression v Expression: . . . no.
Expression v Variable: . . . . no.
Expression v Literal: . . . . . no.
Expression v Figurative: . . . no.
Expression v Condition: . . . . no.
Variable v Variable: . . . . yes.
Variable v Literal: . . . . . yes and reverse.
Variable v Figurative: . . . yes and reverse.
Variable v Condition: . . . . yes.
Conditional value: . . . . . yes.
.523 Conditional relations
Equal: . . . . . IS UNEQUAL TO.
IS (NOT) EQUAL TO.
EQUALS.
Greater than: . . . . . IS (NOT) GREATER THAN.
EXCEEDS.
Less than: . . . . . IS (NOT) LESS THAN.
Greater than or equal: none.
Less than or equal: . none.
.524 Variable conditions: . . NOT POSITIVE; does include zero.
POSITIVE; does not include zero.
NOT NEGATIVE; does include zero.
NEGATIVE; does not include zero.
(NOT) NUMERIC.
(NOT) ALPHABETIC.
(NOT) ZERO.
.525 Compound conditionals
IF x AND y: . . . . . many times, not mixed with OR.
IF x OR y: . . . . . many times, not mixed with AND.
IF x DO a AND y DO b: yes.
IF x DO a OR y DO b: yes.
.526 Alternative designator: ELSE, or OTHERWISE.
.527 Condition or alternative: yes.
.528 Typical examples: . . . IF X IS POSITIVE AND Y IS POSITIVE ADD X TO Y, ELSE IF Z IS POSITIVE MOVE Z TO Y.

.53 Sub-routines

.531 Designation
Single statement: . . . name of paragraph or section, in a cue.
Set of statements
First: . . . . . name of first.
Last: . . . . . name of last.
.532 Possible sub-routines: . series of paragraphs or sections.
.533 Use in-line program: . yes.
.534 Mechanism
Cue with parameters: none.
Cue without parameter: . . . . . PERFORM A THRU B.
Formal return: . . . . implied.
Alternative return: . . EXIT.
.535 Names: . . . . . all univeral.
.536 Nesting limit: . . . . . none.
.537 Automatic recursion allowed: . . . . . none.

.54 Function Definition by Procedure: . . . . . none.

.55 Operand Definition by Procedure: . . . . . none.

.56 Loop Control

.561 Designation of loop
Single procedure: . . PERFORM A.
USE . . .
First and last procedures: . . . . . PERFORM A THRU B.
.562 Control by count
Literal: . . . . . yes.
Data: . . . . . yes.
Example: . . . . . PERFORM A AGE TIMES.

§ 161.

.563 Control by step
Parameter
Special index: . . . . none.
Any variable: . . . . VARYING AGE FROM 1 BY 1 UNTIL.
Step: . . . . . any variable.
Criteria: . . . . . any conditional expression.
Multiple parameters: no.
.564 Control by condition
Example: . . . . . UNTIL B IS NEGATIVE.
Combined with step: . optional.
.565 Control by list: . . . . no.
.566 Nesting limit: . . . . . none.
.567 Jump out allowed: . . . yes.
.568 Control variable exit status: . . . . . available always.

.6 EXTENSION OF THE LANGUAGE: . . . . . none.

.7 LIBRARY FACILITIES

.71 Identity: . . . . . 301 COBOL library.

.72 Kinds of Libraries

.721 Fixed master: . . . . . no.
.722 Expandable master: . . yes.
.723 Private: . . . . . yes.

.73 Storage Form: . . . . . magnetic tape.

.74 Varieties of Contents: . data descriptions/divisions; environment divisions; identification divisions.
file and reel labels.
routines.
data descriptions.
input-output control and assignments.
re-start procedure.
own coded routines.

.75 Mechanism

.751 Insertion of new item: . library maintenance routine.
.752 Language of new item: . COBOL or AASP.
.753 Method of call: . . . . . COPY statement.
INCLUDE statement.

.76 Types of Routine

.761 Open routines exist: . . yes.
.762 Closed routines exist: . yes.
.763 Open-closed is variable: . . . . . yes.

.8 TRANSLATER CONTROL

.81 Transfer to Another Language: . . . . . ENTER AASP language.

.82 Optimizing Information Statements: . . . . . special verbs for low activity files.
size of file.
range of size of item.
specify segments for overlays.

.83 Translater Environment: . . . . . library call.
description.

.84 Target Computer Environment: . . . . . library call.
description.

.85 Program Documentation Control: . . . . . yes, by non-COBOL statements.

.9 TARGET COMPUTER ALLOCATION CONTROL

.91 Choice of Storage Level: . . . . . priority of segments.
SAME AREA description.

.92 Address Allocation: . . RENAMES, overlapping groups.
REDEFINES.

.93 Arrangement of Items in Words in Unpacked Form: . . . . . not applicable.

.94 Assignment of Input-Output Devices: . . . environment division.
library description.

.95 Input-Output Areas: . . environment division.
library description.

PROCESS ORIENTED LANGUAGE: UMAC

§ 162.

.1 GENERAL

.11 Identity: . . . . . UMAC, University of Miami Algebraic Compiler.

.12 Origin: . . . . . Jay F. W. Pearson, Jr. Data Processing Center University of Miami, Fla.

.13 Reference: . . . . . RCA 301 Programs Application Library #97-20-031 Supplemental Information for the RCA 301 UMAC System (July, 1962).

.14 Description

UMAC is a language derived from basic FORTRAN, but has so many changes that, for practical purposes, it would be necessary to re-write all except the mathematical part of a program before running it on the RCA 301. A full FORTRAN compiler for the Scientific RCA 301 is being written.

The input-output facilities are particularly different from those of FORTRAN, because no equivalent to the FORMAT facility of FORTRAN exists in UMAC. All input-output is treated alike, packed into cards, card images, or lines of seven numeric values. A single statement can specify an array in all I/O transfers.

The rigid conventions in FORTRAN of dividing the integers from the floating point variables is somewhat relaxed, allowing free specification of initial letters of the name for use in determining which mode is to be used.

Most of the arithmetical and trigonometric functions are available but the logical function, such as MAXimum value x, y, etc., must be programmed. The subroutine mode has not been used; two functions, JUMP TO n, and JUMP BACK have been provided instead, and partially fill the gap. No compiler-directing statements are available.

.2 PROGRAM STRUCTURE

.21 Divisions

Arithmetic Statements: . . . . variable = expression.

Control Statements: . GO TO and IF to provide conditional jumps on data.
DO to provide loops.
PAUSE and STOP to allow operator action.
TEST to provide conditional jumps on environment.
CHANGE PAGE, SPACE, VERTICAL TAB, to provide format control.

Input-output Statements: . . . . READ, PUNCH, PRINT, READ TAPE, WRITE TAPE, each followed by either a list of variables or arrays.
END FILE, BACKSPACE, or REWIND for physical control.

Specification Statements: . . . . FIX ALL to define which names will belong to fixed point variables.
DIMENSION, to define array sizes.
FUNCTION to define all functions.

.22 Procedure Entities

Program: . . . . . statements.
functions.

Statements: . . . . character blanks are ignored.

Functions: . . . . . in machine code included at run time.

.23 Data Entities

Arrays: . . . . . all variables.

Items: . . . . . floating point variables or constants.
integer (fixed point) variables or constants.

Labels: . . . . . item names which can be only used for printing immediately above the item.

.24 Names

.241 Simple name formation

Alphabet: . . . . . A to Z, 0 to 9.
Size: . . . . . 1 to 5 characters.
Avoid key words: . no.
Formation rule: . . first character must be alphabetic.

.242 Designators

Procedures
Statements: . . . 1 to 9999.
Function: . . . . no special restriction.

§ 162.

.242 Designators (Contd.)

Data	
Integer	
variables: . . .	must start with an alphabetic which has been quoted in a "FIX ALL" statement.
Floating point: .	must start with alphabetic which has not been quoted in a "FIX ALL" statement.
Arrays:	must not end with F.
Equipment	
Card:	implied by verbs READ, PUNCH.
Magnetic Tape: .	implied by word TAPE.
Printer:	implied by verb PRINT.
Comments:	C in column 1 of the card.
Translator	
control:	key words; DIMENSION, FIX ALL.

.25 Structure of Data Names

.251 Qualified names: . .	none.
.252 Subscripts	
Number per item: .	3.
Applicable to: . . .	any fixed point expression.
Form may be: . .	integer only.
.253 Synonyms:	no.

.26 Number of Names

.261 All entities:	no limit.
.262 Procedures:	no limit.
.263 Data	
Files:	names not used.
Record formats: .	names not used, standard format only.
Items:	no limit.
Data levels: . . .	not used.
.264 Equipment	
Card readers: . .	1.
Card punches: . .	1.
Printers:	1.
Magnetic Tape	
Units:	10 absolute addresses.

.27 Region of Meaning of Names: all universal.

.3 DATA DESCRIPTION FACILITIES

.31 Methods of Direct Data Description

.311 Concise item picture:	no.
.312 List by kind:	no.
.313 Qualify by adjective:	no.
.314 Qualify by phrase:	no.
.315 Qualify by code: . . .	yes, the code being given in FIX ALL.
.316 Hierarchy by list: . .	no.
.317 Level by indenting: .	no.
.318 Level by coding: . . .	no.
.319 Others	
Qualify by use: . .	arrays listed in DIMENSION statement.
.32 Files and Reels: . .	own coding.

.33 Records and Blocks

.331 Record size:	fixed at one digit number.
.332 Block size:	fixed at one card image, containing up to seven numbers.
.338 In-out error control:	automatic.
.339 Blocking Control: . .	always 7 numbers per card image.

.34 Data Items

.341 Designation of class:	by name.
.342 Possible classes	
Integer:	yes (called fixed point variables).
Fixed point:	only integers.
Floating point: . . .	yes.
Alphabetic:	only variable names.
Alphameric:	only variable names.
.343 Choice of external radix:	none.
.344 Possible radices: . .	only decimal.
.345 Justification:	right justified on output.
.346 Choice of code: . . .	implied by choice of equipment.
.347 Possible codes	
Card:	see Data Code Table No. 2.
Paper Tape:	see Data Code Table No. 1.
Magnetic Tape: . .	see Data Code Table No. 1.
Printer:	see Data Code Table No. 1.
.348 Item size	
Variable size: . . .	fixed.
Range	
Fixed point numeric:	-99,999,999 to+99,999,999
Floating point numeric: . . .	10^{-100} to 10^{+99}, or zero in magnitude.
Alphameric:	max 5 characters.
.349 Sign provision: . . .	optional.

.35 Data Values

.351 Constants	
Possible sizes	
Integer:	1 to 8 digits.
Fixed point: . . .	none except integers.
Floating point: . .	1 to 8 significant digits, with 2 digit exponent.
Alphabetic: . . .	none.
Alphameric: . . .	none.
Subscriptable: . . .	yes.
Sign provision: . .	optional on input.
.352 Literals	
Possible sizes	
Integer:	1 to 8 digits.
Fixed point: . . .	none, except integers.
Floating point: . .	1 to 8 significant digits, with 2 digit exponent.
Alphabetic: . . .	none.
Alphameric: . . .	none.
Sign provision: . .	optional, on input.
.353 Figuratives:	own coding.
.354 Conditional variables:	computed GO TO.

§ 162.

.36 Special Description Facilities

.361 Duplicate format: . . none (all format fixed).
.363 Table description
Subscription: . . . mandatory.
Multi-subscripts: . up to three, maximum value set at compilation time in DIMENSION statement.
Level of item: . . variable only.

.364 Other subscriptable entities: . . . . . none.

.4 OPERATION REPERTOIRE

.41 Formulae

.411 Operator list

+ :	addition, never unary.
- :	subtraction, can be unary.
* :	multiplication.
/ :	division.
** :	exponentiation.
= :	is set equal to.
ABSF:	absolute value of a floating point variable.
† XABSF:	absolute value of a fixed point variable.
† LOGF:	natural log.
† EXPF:	exponentiation.
† SINF:	sine.
† COSF:	cosine.
† ATANF:	arctangent.
† SQRTF:	square root.
† LOGXF:	log 10.
† EXPXF:	10^X.

† The name of these routines is left free in UMAC, and must be specified by the user in calling statements. The names quoted are the standard FORTRAN names for these functions.

.412 Operands allowed

Classes:	numeric only.
Mixed scaling: . .	yes, in floating point.
Mixed classes: . .	only in exponentiation and subscripts.
Mixed radices: . .	no.
Literals:	yes.

.413 Statement structure

Parentheses	
a - b - c means: .	(a - b) - c.
a + b x c means: .	a + (b x c).
a / b / c means: .	(a / b) / c.
a^{bc} means: . . .	$(a^b)^c$.
Size limit:	149 characters (spaces ignored) 125 operands, operators, and parentheses.
Multi-results: . .	no.

.414 Rounding of results: . truncation of integers at each step of expression.

.415 Special cases

	Fixed	Floating
x = -x:	K = -K	X = -X.
x = x + 1:	K = K + 1	X = X + 1.
x = 4.7 y:	K = 47/10 * K	X = 4.7 * Y.
x = 5 x 10^7 x y^2:	K = 50000000 + L * L	X = 5. E 7 + Y * Y.
x = y integer part:	K = y	K = Y, X = K.
x = |y|:	K = XABSF (J)	X = ABSF (Y).

.416 Typical examples: . X = (0. - B + SQRTF (B * B - 4. * A * C)) / 2. / A.

.42 Operations on Arrays

.421 Matrix operations: . . . . none.
.422 Logical operations: . . . . none.
.423 Scanning: . . . . . none.
.424 Input-Output: . . . . yes, using key word ARRAY.

.43 Other
Computation: . . . none.

.44 Data Movement and Format

.441 Data copy example: . Y = X.
.442 Levels possible: . . items.
.443 Multiple results: . . none.
.444 Missing operands: . not possible.
.445 Size of operands: . . only one size available.
.446 Editing possible: . . only change of class.
.447 Special moves: . . . none.
.448 Code translation: . . not required.
.449 Character manipulation: . . . not available.

.45 File Manipulation

Open:	own coding.
Close:	own coding.
Advance to next record:	READ, WRITE, PUNCH, PRINT.
Step back a record:	BACKSPACE.
Set restart point: . .	none.
Restart:	none.
Start new reel: . . .	own coding.
Start new block: . .	implied in each input-output statement.
Start new page: . .	CHANGE PAGE.
Advance n lines: . .	VERTICAL TAB n.
Position paper as directed by paper loop:	SPACE n.
Search on key: . . .	none.
Rewind:	REWIND.
Unload:	none.

.46 Operating Communication

.461 Log of progress: . . none.
.462 Messages to operator: . . . . via display in "A" register.
.463 Offer options: . . . PAUSE, followed by manual setting of interrupt button on the console.
.464 Accept option: . . . TEST interrupt setting.

.47 Object Program Errors

Error	Discovery	Special Actions
Overflow:	TEST verb	as coded.
In-out:	?	?
Invalid data:	input routine	stops with print-out.

§ 162.

.5 PROCEDURE SEQUENCE CONTROL

.51 Jumps

.511 Destinations allowed: . . . . . statement.
.512 Unconditional jump: . . . . . GO TO N.
.513 Switch: . . . . . GO TO M (35, 47, 18).
.514 Setting a switch: . . not available.
.515 Switch on data: . . . not available.

.52 Conditional Procedures

.521 Designators
Condition: . . . . IF.
Procedure: . . . . implied.

.522 Simple conditions
Expression v Expression: . . . no.
Expression v Variable: . . . . no.
Expression v Literal: . . . . . no.
Expression v Figurative: . . . always zero.
Expression v Condition: . . . . no.
Variable v Variable: . . . . no.
Variable v Literal: . . . . . no.
Variable v Figurative: . . . always zero.
Variable v Condition: . . . . no.
Conditional value: . no.

.523 Conditional relations
Equal: . . . . . } jointly in each
Greater than: . . . } IF statement against
Less than: . . . . } zero.
Greater than or equal to: . . . . no.
Less than: . . . . no.

.524 Variable conditions: . always zero.
.525 Compound conditionals: . . . no.
.526 Alternative designator: . . . . none.
.527 Condition on alternative: . . . . none.
.528 Typical examples: . . IF (X ** 2 - 3.) 29, 37, 18 means go to statement Nos. 29, 37, and 18 if $x^2 - 3$ is respectively less than, equal to, or greater than zero.

.53 Subroutines

.531 Designation
Single statement: . same as set.
Set of statements
First: . . . . . named in a JUMP TO n statement.
Last: . . . . . followed by a JUMP BACK statement.

.532 Possible subroutines: . . . only one level permitted.
.533 Use in-line in program: . . . . . one.
.534 Mechanism
Cue with parameters: . . . none.
Cue without parameter: . . . JUMP TO n.
Formal return: . . JUMP BACK.
Alternative return: . . . . . none.

.535 Names: . . . . . not possible.
.536 Nesting limit: . . . . 1.
.537 Automatic recursion allowed: . . . . . no.

.54 Function Definition by Procedure: . . . . . none.

.55 Operand Definition by Procedure: . . . . . none.

.56 Loop Control

.561 Designation of loop
Single procedure: . . none.
First and last procedures: . . . . current place to specifically numbered statement; e.g., DO 173 I = 1, N, 2.
.562 Control by count: . . none.
.563 Control by step
Parameter
Special index: . . . no.
Any variable: . . . integer variables only.
Step: . . . . . positive integers.
Criteria: . . . . . greater than.
Multiple parameters: . . . no.
.564 Control by condition: . none.
.565 Control by list: . . . no.
.566 Nesting limit: . . . . 8.
.567 Jump out allowed: . . yes.
.568 Control variable exit status: . . . . . available.

.57 Diagnostics: . . . . . none.

.6 EXTENSION OF THE LANGUAGE: . . . . can write new function in the library.

.7 LIBRARY FACILITIES

.71 Identity: . . . . . UMAC library.

.72 Kinds of Libraries

.721 Fixed master: . . . . no.
.722 Expandable master: . . yes.
.723 Private: . . . . . no.

.73 Storage Form: . . . . cards or tape.

.74 Varieties of Contents: . . . . . functions.

§ 162.

.75 Mechanism

.751 Insertion of new item: . . . . . manual.
.752 Language of new item: . . . . . machine coding.
.753 Method of call: . . . FUNCTION statement.

.76 Types of Routine

.761 Open routines exist: . no.
.762 Closed routines exist: . . . . . yes.
.763 Open-closed is variable: . . . . . no.

.8 TRANSLATOR CONTROL

.81 Transfer to Another Language: . . . . . no (functions may be written in machine code.)

.82 Optimizing Information Statements

.821 Process usage statements: . . . . no.
.822 Data usage statements: . . . . no.

.83 Translator Environment: . . . choice of cards, paper tape, or magnetic tape I/O.

.84 Target Computer Environment: . . . own coding

.85 Program Documentation Control: . . . . . printing of object program optional.

.9 TARGET COMPUTER ALLOCATION CONTROL

.91 Choice of Storage Level: . . . . . no.

.92 Address Allocation: . no.

.93 Arrangement of Items in Words and Unpacked Form: . . . . . predetermined.

.94 Assignment of Input-Output Devices: . . yes.

.95 Input-Output Areas: . predetermined, at
120 characters for printer
80 characters for card and tape input.
80 characters for card and tape output.

MACHINE ORIENTED LANGUAGE: ASSEMBLY LANGUAGE

§ 171.

.1 GENERAL

.11 Identity: . . . . . RCA 301 Automatic Assembly System Language.

.12 Origin: . . . . . RCA.

.13 Reference: . . . . . 93-19-000.

.14 Description

This is a straightforward assembly language which incorporates suitable macro-operations to avoid the coding of multiplication, division, and input-output control. The addressing system is simple but flexible. Subroutine control is simple. Although program overlays must be written in each program, no special facilities are provided for this, nor is editing of input and output formats.

Macros are provided for Input-Output file control of punched tape, cards and magnetic tape.

The tape version of the Assembler has the RIS Macro instruction which reads in the next segment. Through this Macro program, overlays may be written. This version also includes as Macros the Floating Decimal Arithmetic Package.

.15 Publication Date: . . . May, 1961.

.2 LANGUAGE FORMAT

.21 Diagram

RCA 301 Automatic Assembly Program Sheet.

Title					Header
			Date		
18 22	23. 25	26 32	33 70	71 74	75 80
TAG	OP	N	Address Field	Iden.	Numeric Sequencing

.22 Legend

TAG: . . . . . procedure name.
OP: . . . . . mnemonic op code.
N: . . . . . extension of op code. length of operands. repeat counter, etc.
ADDRESS FIELD: . . . . A and B addresses.
IDEN: . . . . . used to identify lines of code.
NUMERIC SEQUENCING: number used to sequence lines of code.

.23 Corrections: . . . . . no automatic method for card version. The tape version provides three verbs for correction of pseudo-code.

.231 Insertions: . . . . . INS (for insertion after a given line).
.232 Deletions: . . . . . DLT (for deletion after a given line).
.233 Alterations: . . . . . RPL (for replacement of single line).

.24 Special Conventions

.241 Compound addresses: . . (tag or integer) ± (tag or integer).
.242 Multi-addresses: . . . . no.
.243 Literals: . . . . . no.
.244 Special coded addresses: . . . . . " means this address.
.245 Other
#: . . . . . indirect address.
/: . . . . . address is computed.

.3 LABELS

.31 General

.311 Maximum number of labels: . . . . . no limit.
.312 Common label formation rule: . . . . . yes, all called tags.
.313 Reserved labels: . . . . STA, STP, only.
.315 Designators: . . . . . none.
.316 Synonyms permitted: IDN pseudo.

.32 Universal Labels: . . . . only if program not divided by HED pseudos.

.321 Labels for procedures
Existence: . . . . . optional.
Formation rule: . . . . 1 to 5 char. from A to Z, 0 to 9 but not all numeric.
Others: . . . . . symbolic N must be 2 characters.

.322 Labels for library routines: . . . . . none.

§171.

.323 Labels for constants: . . same as procedures.
.325 Labels for records: . . . same as procedures.
.326 Labels for variables: . . same as procedures.

.33 Local Labels

.331 Region: . . . . . started by each HED pseudo.
.332 Labels: . . . . . same as universals.

.4 DATA

.41 Constants

.411 Maximum size constants
Integer
Decimal: . . . . . 38 digits.
Octal: . . . . . none.
Fixed numeric
Decimal: . . . . . 38 digits.
Floating numeric
Decimal: . . . . . 8 and 2 digits.
Alphabetic: . . . . . 38 digits.
Alphameric: . . . . . 38 digits.
.412 Maximum size literals: . none.

.42 Working Areas

.421 Data layout
Implied by use: . . . . yes.
Specified in program: no.
.422 Data type: . . . . . not required.
.423 Redefinition: . . . . . implied by use.

.43 Input-Output Areas

.431 Data layout: . . . . . implied.
.432 Data type: . . . . . not required.
.433 Copy layout: . . . . . no.

.5 PROCEDURES

.51 Direct Operation Codes

.511 Mnemonic
Existence: . . . . . mandatory.
Number: . . . . . 53.
Example: . . . . . SKP.
Comment: . . . . . 2 or 3 alpha.
.512 Absolute: . . . . . none.

.52 Macro-Codes

.521 Number available
Input-output: . . . . . 9.
Arithmetic: . . . . . 2.
Math functions: . . . . 0.
Error control: . . . . 0.
Restarts: . . . . . 0.
Floating point: . . . . 4.
.522 Examples
Simple: . . . . . SF.
Elaborate: . . . . . none.
.523 New macros: . . . . . none.

.53 Interludes: . . . . . none.

.54 Translator Control

.541 Method of control
Allocation counter: . . yes.
Label adjustment: . . . yes.
Annotation: . . . . . yes.
.542 Allocation counter
Set to absolute: . . . . DST pseudo.
Set to label: . . . . . DAC pseudo.
Step forward: . . . . . no.
Step backward: . . . . no.
Reserve area: . . . . BST, BEN pseudo.
.543 Label adjustment: . . . BST, BEN pseudo.
Set labels equal: . . . IDN pseudo.
Set absolute value: . . . no.
Clear label table: . . . HED pseudo.
.544 Annotation
Comment phrase: . . . RMK pseudo.
Title phrase: . . . . . no.

.6 SPECIAL ROUTINES AVAILABLE

.61 Special Arithmetic

.611 Facilities: . . . . . multiplication macros for 8 x 8, 10 x 10, 17 x 17 and division 10 x 10, 17 x 17; also floating add, subtract, divide and multiply.
.612 Method of call: . . . . . macro.

.62 Special Functions: none.

.63 Overlay Control: . . . . control of overlays is maintained through the use of the SEG and RIS verbs. Through the use of the SEG verb, the user is able to identify each of his segments, and through the use of the RIS verb, he is able to automatically call in these segments.

.64 Data Editing: . . . . . none.

.65 Input-Output Control

.651 File labels: . . . . . defined by description.
.652 Reel labels: . . . . . automatic standard.
.653 Blocking: . . . . . description.
.654 Error control: . . . . . automatic.
.655 Method of call: . . . . . macro.

.66 Sorting: . . . . . none.

.67 Diagnostics: . . . . . see "Consolidata".

§171.

.7 LIBRARY FACILITIES: . none.

.8 MACRO AND PSEUDO TABLES

.81 Macros

Code	Description
MPY:	.multiply.
DIV:	.divide.
FAD:	.floating add.
FSB:	.floating subtract.
FMY:	.floating multiply.
FDV:	.floating divide.
OPN:	.open file.
RED:	.read a record
WRT:	.write a record.
RLS:	.release output batch.
CLO:	.close reel, or file.
RIS:	.read in next segment.

.82 Pseudos:

Code	Description
CON:	.to set constant.
DST:	.sets allocation counter.
NUM:	.to set number.
BST:	.define start location of a block.
BEN:	.define last location of a block.
DAC:	.used to set parameters for dynamically relocatable routines.
IDN:	.set tags equal.
AFA:	.assists in forming addresses dynamically from data such as sense bits.
RMK:	.identifies comments, remarks.
HED:	.introduces a new section of program with local names.
END:	last program card.
LBL:	.in-out label description.
SHR:	.in-out share storage areas.
RCD:	.data record description.
SEG:	.identify beginning of segment and set allocation counters.
RPL:	.replace a line of pseudo-code.
INS:	.insert after a line of pseudo-code.
DLT:	.delete after a line of pseudo-code.

PROGRAM TRANSLATOR: COBOL 61

§181.

.1 GENERAL

.11 Identity: . . . . . RCA 301 COBOL NARRATOR Translator.

.12 Description

This translator requires a 301 with six tapes and a 20,000 character store. Up to three additional tapes and a 40,000 character store may be utilized to decrease translation time. The target computer may include all mixtures and combinations of the various types of available units, such as 10,000, 20,000, or 40,000 characters stores, Record File, Simultaneous Mode, Cards, Magnetic or Paper Tape. The input can be on paper tape, punched cards or magnetic tape. The translator can accept 501 COBOL-60 as well as COBOL-61. The object program is efficient and the translation has low overheads. All listings are produced on-line.

.13 Originator: RCA

.14 Maintainer: RCA

.15 Availability: July, 1962

.2 INPUT

.21 Language

.211 Name: . . . . . COBOL-61 plus electives see section 161.14.
501 COBOL-60.

.212 Exemptions: . . . . . none.

.22 Form

.221 Input media: . . . . . cards.
paper tape.
magnetic tape.

.222 Obligatory ordering: . . Not necessary if sequence nos. are included.

.223 Obligatory grouping: . . . By DIVISIONS and certain SECTIONS.

.23 Size Limitations

.231 Maximum number of source statements: . . . unlimited

.232 Maximum size source statements: . . . . . no limit.

.233 Maximum number of data items: . . . . . 99,999/file.

.234 Others
Files: . . . . . 18.

.3 OUTPUT

.31 Object Program

.311 Language name: . . . . 301 machine code.

.312 Language style: . . . . machine code.

.313 Output media: . . . . . paper or magnetic tape record file cards.

.32 Conventions

.321 Standard inclusions: . . . object program in 301 library format.
rerun provided.
I/O logging provided.
Input-Output controlled by FCP.

.322 Compatible with: . . . . . all 301 standards.
object program in 301 library format.
rerun provided.
I/O logging provided.
Input-Output controlled by FCP.

.33 Documentation

Subject	Provision
Source program:	updated listing of source program; listing 1.
Object program:	machine code listing; listing 3.
Storage map:	listing of file, constant & working storage; listing 3.
Restart point list:	compiler restart points listed; listing 2.
Language errors: . . .	list of language errors & error warning; listing 2.
Cross Reference: . . .	references to procedures; listing 3.
	references to data areas; listing 3.
Notes:	all listings on-line.
	all listings may be by-passed.

.4 TRANSLATING PROCEDURES

.41 Phases and Passes

Translation Phase: . . .	one scan on entire source program.
	three passes on the data division.
	six passes on the procedure.
Generation Phase: . . .	three passes on procedure.
Allocation Phase:	multi-pass, depending on size.

.42 Optional Modes

§181.

.421 Translate: . . . . . translate only.
.422 Translate and run: . . . no.
.423 Check only: . . . . . possible stop at intermediate point.
.424 Patching: . . . . . only in symbolic coding using FILE MAINTENANCE routine.
.425 Up-dating: yes, corrections can be submitted for recompilation.

.43 Special Features

.431 Alter to check only: . . . none.
.432 Fast unoptimized translate: . . . . . no.
.433 Short translate on restricted program: . . no.

.44 Bulk Translating: . . . . none.

.45 Program Diagnostics: . . none included during translation.
output tape for SAMPLER.

.46 Translator Library

.461 Identity: . . . . . 301 COBOL library
.462 User restriction: . . . . none.
.463 Form
Storage medium: . . . magnetic tape.
Organization: . . . . . by COBOL division.
.464 Contents
Routines: . . . . . unrestricted.
Functions: . . . . . any COBOL division and own-code.
Data description: . . . yes.
Record descriptions: . yes.
.465 Librarianship
Insertion: . . . . . by separate library maintenance routine.
Amendment: . . . . . by separate library maintenance routine.
Call procedure: . . . . COBOL options; COPY from library; INCLUDE from library.

.5 TRANSLATOR PERFORMANCE

.51 Object Program Space

.511 Fixed overhead

Name	Space, char
Sum of difference tables:	200.
Standard areas:	30.
Loader routine:	370.
Loader work & print areas:	170
Standard data area: . .	10.
Standard exit:	10.

.512 Space required for each input-output file: . . . . as controlled by program description.
.513 Approximate expansion of procedures: . . 7 to 1 variable data.
3 to 1 fixed data.

.52 Translation Time: . . . (5 + (7P + D)/70) mins approx.
P = simple procedure statements.
D = data entries.

.53 Optimizing Data: . . . . COBOL segmentation (segment-limit, priority numbers).
segmentation of Input-Output.
eliminate duplicates and nesting of literals.

.54 Object Program Performance: . . . . . manufacturer claims only slightly reduced performance except for times for editing and complex subscripts which are moderately reduced.

.6 COMPUTER CONFIGURATIONS

.61 Translating Computer

.611 Minimum configuration: 20,000 character store.
6 tape units.
1 printer.
1 card reader or paper tape reader.
.612 Advantages of larger configurations: . . . . . decrease translation time with larger store and up to 3 additional tapes.

.62 Target Computer

.621 Minimum configuration: . . . . . 10,000 character store.
1 tape unit or card reader, or record-file.
.622 Usable extra facilities: . any 301 hardware including all mixtures and combination of the various types of units available.

.7 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Missing entries:	check	error warning or stoppage.
Unsequenced entries:	check	entries sequenced.
Duplicate names:	check	error warning.
Improper format:	check	error warning or stoppage.
Incomplete entries:	check	error warning.
Target computer overflow:	check	error warning or stoppage.
Inconsistent program:	check	error warning.

.8 ALTERNATIVE TRANSLATORS: . . . . none.

PROGRAM TRANSLATOR

§182.

.1 GENERAL

.11 Identity . . . . . RCA 301 Automatic Assembly System Processor

June, 1961.
Document 93-19-000.
AASP.

.12 Description:

This is straightforward assembler available in two versions: one is based on punched cards and requires two feeds of data; the other is based on magnetic tapes and requires but one. The output is in a form suitable for inclusion in either a card or tape library. The assembler itself may be part of the library and run under SRS control.

There are no special modes of operation for patching or updating a current program in the card version. In the magnetic tape version, there is a "User's Corrector", which corrects entries.

The operating speed is about 120 cards per minute, but the card system is only effectively sixty cards per minute because two passes are necessary through the cards. On magnetic tape, the second pass is very quick.

.13 Originator: . . . . . RCA Commercial Systems Dept., EDP Division Camden 8, N. J.

.14 Maintainer: . . . . . Originator.

.15 Availability: . . . . . August, 1961, using card system, AASP-C.

February, 1962, using magnetic tape system, AASP-T.

.2 INPUT

.21 Language

.211 Name: . . . . . RCA 301 AAS Language.
.212 Exemptions: . . . . . none.

.22 Form

.221 Input media: . . . . . paper tape, or punched card, or magnetic tape.
.222 Obligatory ordering: . . none.
.223 Obligatory grouping: . . none.

.23 Size Limitations

.231 Maximum number of source statements: . . no limit.
.232 Maximum size source statements:. . . . . limited by format.
.233 Maximum number of data items: . . . . . none.

.3 OUTPUT

.31 Object Program

.311 Language name: . . . . . RCA 301.
.312 Language style: . . . . . computer relocatable code.
.313 Output media: . . . . . punched cards - AASP-C
magnetic tape - AASP-T.

.32 Conventions

.321 Standard inclusions: FCP (File Control Processor), Fixed Point Multiply and Divide Floating Point Arithmetic } Subroutines
.322 Compatible with: . . . . Standard LOADER routines.

.33 Documentation

Subject	Provision
Source program:	. . . .listing A.
Object program:	. . . .listing B.
Storage map:	. . . . . .yes.
Restart point list:	. . . .no.
Language errors:	. . . .listing A.

.4 TRANSLATING PROCEDURE

.41 Phases and Passes

Card system: . . . . . two passes.
Tape system: . . . . . one card, one tape pass.

.42 Optional Modes

•.421 Translate: . . . . . yes.
.422 Translate and run: . . . no.
.423 Check only: . . . . . no.
.424 Patching: . . . . . yes in tape version.
.425 Up-dating: . . . . . no.

.43 Special Features

.431 Alter to check only: . . . no.
.432 Fast unoptimized translate: . . . . . no.
.433 Short translate on restricted program: . . no.

§182.

.44 Bulk Translating: . . . . no.

.45 Program Diagnostics: . . see Consolidata.

.46 Translator Library: . . none.

.5 TRANSLATOR PERFORMANCE

.51 Object Program Space

.511 Fixed overhead: . . . . . none.
.512 Space required for each input-output file: . . . . twice max block size + max record size.
.513 Approximate expansion of procedures: . . . . . unity.

.52 Translation Time

.521 Normal translating: . . . 1 + 0.0175 s mins AASP-Card. 2 + 0.0085 s mins AASP-Tape.

.53 Optimizing Data: . . . . none.

.54 Object Program Performance: . . . . . unaffected.

.6 COMPUTER CONFIGURATIONS

.61 Translating Computer

.611 Minimum configuration: 1 group HDTG; tape version only.
10,000 char HSM
1 printer.
1 paper tape or card reader.
1 paper tape or card punch.
.612 Larger configuration advantages: . . . . . larger HSM, more tape units, more tags.

.62 Target Computer

.621 Minimum configuration: none.
.622 Usable extra facilities: all.

.7 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Missing entries:	check	listings.
Unsequenced entries:	monotonic check	alarm.
Duplicate names:	check	take first, flag others.
Improper format:	check	flag on listing.
Incomplete entries:	check	flag on listing.
Target computer overflow:	check	flag, can continue.
Tag table overflow:	check	alarm.

.8 ALTERNATIVE TRANSLATORS: . . . . none.

PROGRAM TRANSLATOR: UMAC

§ 183.

.1 GENERAL

.11 Identity: . . . . . University of Miami, Algebraic Compiler, UMAC. RCA Publication 97-20-031.

.12 Description

The UMAC Translator is primarily punched card oriented, and while magnetic tape and punched tape versions are available, these media are used to simulate card input and output.

Key points a programmer should watch while writing a UMAC program are the number of names he uses (this should not exceed 327 if at all possible) and the amount of storage available to him in the target computer. The latter is important, because a simple UMAC statement averages some 100 characters, and a heavy overhead of 9,000 characters of object space are pre-empted by the translator.

Translation time is strongly dependent upon configuration. Originally, UMAC was a card system, in which each generated machine instruction was punched twice, which costs approximately 2.0 seconds for each instruction.

However, if three magnetic tapes are available, this double punching is not needed and translation time can be reduced from some 10 seconds per UMAC statement to about 1 to 2 seconds per statement.

The translator makes no provision for diagnostics to be inserted in the object program, but does provide a good listing showing the machine and assembly languages and some part of each source statement side-by-side.

.13 Originator: . . . . . Jay F. W. Pearson, Jr. University of Miami.

.14 Maintainer: . . . . . RCA (Systems Development) Camden, N. J., September, 1962; after field test revision in May, 1962.

.2 INPUT

.21 Language

.211 Name: . . . . . UMAC; Section 701:162.
.212 Exemptions: . . . . . none.

.22 Form

.221 Input media: . . . . . punched cards or punched paper tape.
.222 Obligatory ordering: . . all statements in logical sequence.
.223 Obligatory grouping: . . none.

.23 Size Limitations

.231 Maximum number of source statements: . . indefinite.
.232 Maximum size source statements: . . . . . 149 characters excluding blanks.
.233 Maximum number of data items: . . . . . 329 for each translator cycle.
.234 Others
Maximum number of nested DO's: . . . 8.
Maximum number of operands, operators, or parentheses per statement: . . . . . 125.

.3 OUTPUT

.31 Object Program

.311 Language name: . . . machine language.
.313 Output media: . . . . magnetic tape or punched card.

.32 Conventions

.321 Standard inclusions: . UMAC fixed subroutine deck.

.33 Documentation

Subject	Provision
Source program: . .	full print-out, Listing I. edited print-out, Listing II.
Assembly instruction:	Listing II.
Object program: . .	Listing II.
Storage map: . . .	none.
Restart point list: . .	none.
Language errors: . .	on-line print-outs for six specific and two general errors. a register display for 5 specific cases.

.4 TRANSLATING PROCEDURE

.41 Phases and Passes

Phase I: . . . . . translation of the source language into a one-to-one assembly language, which is stored on cards or on tape. The original source language program, without the assembly language, is printed (Listing 1).

§ 183.

.41 Phases and Passes (Cont'd)

Phase II: . . . . . reading the output of Phase I, and producing a machine-language program in storage. This program can optionally be output on cards or paper tape.

documentation in Phase II consists of a full print-out of the machine instruction and assembly instruction, with a partial print-out of the source program.

.42 Optional Mode

.421 Translate: . . . . . yes.
.422 Translate and run:. . . yes with magnetic tape version.
.423 Check only: . . . . . yes.
.424 Patching: . . . . . no.
.425 Updating: . . . . . no.

.43 Special Features

.431 Alter to check only: . . . . . yes, (mandatory after error located).
.432 Fast unoptimized translate: . . . . . no.
.433 Short translate on restricted program: . . no.

.44 Bulk Translating: . . . no, the translator program is in two parts, which overwrite each other during translation.

.45 Program Diagnostics

.451 Tracers: . . . . . no.
.452 Snapshots: . . . . . no.
.453 Dumps: . . . . . no.

.46 Translator Library: . . none.

.5 TRANSLATOR PERFORMANCE

.51 Object Program Space

.511 Fixed Overhead
Name: . . . . . Fixed Subroutine Package.
Space: . . . . . 9,000 characters.
Comment: . . . . . includes floating point, I/O control, mathematical routines, etc.
.512 Space required for each input-output file: . . . 80 char.
.513 Approximate expansion of procedures:. . 10 to 1.

.52 Translation Time

.521 Normal translating: . . 100 + 2.5 S seconds. (Card version)
60 + 0.5 S seconds. (Tape version)
where S is the number of instructions generated.

.522 Checking only: . . . . not available.

.53 Optimizing Data: . . . none.

.54 Object Program Performance

Type	Time	Space
Elementary algebra	unaffected	unaffected.
Complex formulae:	unaffected	unaffected.
Deep nesting:	unaffected	unaffected.
Heavy branching:	unaffected	unaffected.
Single subscripts:	increased	50 char added.
Complex subscripts:	doubled	50 char added.
Data editing:	unaffected	unaffected.
Overlapping operations:	not available.	not available.

.6 COMPUTER CONFIGURATIONS

.61 Translating Computer

.611 Minimum configuration: . . . . . RCA 301 with 20,000 position high speed memory.
Model 323 Card Reader.
Model 334 Card Punch.
Model 333 Printer.
.612 Larger configuration advantages: . . . . . faster compilation and output; particularly with 2 or 3 magnetic tapes.

.62 Target Computer

.621 Minimum configuration: . . . . . RCA 301 with 10,000 position high speed storage.
Model 323 Card Reader.
.622 Usable extra facilities: . . . . . paper tape units.
magnetic tape units.
additional storage.

.7 ERRORS, CHECKS AND ACTION

Error	Check or Interlock	Action
Missing entries:	none.	
Unsequenced entries:	none.	
Duplicate names:	none.	
Improper format:	check	halt, with display or print-out.
Incomplete entries:	none.	
Target computer overflow:	check	print-out in Phase II.
Inconsistent program:	some checks	print-out.
Size limitations exceeded:	some checks	print-out.

.8 ALTERNATIVE TRANSLATORS: . . . . . none.

OPERATING ENVIRONMENT: SRS CARD

§ 191.

.1 GENERAL

.11 Identity: . . . . . RCA 301 Service Routine System (Card Library). SRS Card.

.12 Description

This is one of a set of Service Routine Systems. There are separate systems oriented toward punched card, paper tape, magnetic tape and magnetic record file operation. Many of the executive routines are available in several systems with only minor changes made necessary by different input-output units; e.g., a system for paper tape is similar to that for punched cards and one for magnetic records is similar to that for magnetic tape. Even in a card oriented system, magnetic tapes may be attached and some executive routines, such as program libraries, used with them.

Automatic run-to-run control is provided through the EXECUTE function of the system.

The LOADER routine allows programs to be relocated in HSM. All service routines are floatable.

In order to avoid extensive manual manipulations at the Console, a special service routine EXECUTE is available. It is always incorporated in service routines such as LOADER and can be incorporated in individual programs. It operates by using short sequences of instructions pre-punched on cards (or paper tape) with space for some parameters. Routines containing EXECUTE require a few instructions to recognize, jump into and return from the special control cards.

There is a sophisticated Input-Output File Control routine incorporated in most programs which handles punched tape and cards as well as magnetic tape.

.13 Availability . . . . . September, 1961.

.2 PROGRAM LOADING . . punched cards or punched tape in sequence.

.3 HARDWARE ALLOCATION

.31 Storage

.311 Segmenting of routines: incorporated in programs.
.312 Occupation of working storage: . . . . . incorporated in programs.
.313 Choice of location: . . assignment by the programmer or operator and located by the LOADER routine.

.32 Input-Output Units

.321 Initial assignment: . . . incorporated in program.
.322 Alternation: . . . . . incorporated in program using FCP.
.323 Reassignment: . . . . . by operator.

.4 RUNNING SUPERVISION

.41 Simultaneous Working: none--must be incorporated in program.

.42 Multi-running: . . . . none.

.43 Multisequencing: . . . none.

.44 Errors, Checks, and Action

Error	Check or Interlock	Action
Loading input error:	none.	
Allocation impossible:	none.	
In-out error - single:	check	stop, alarm.
Overflow:	indicator	program choice.
Invalid instructions:	check	stop, alarm.
Program conflicts:	interlock	wait.

.45 Restarts

.451 Establishing restart points: . . . . . none - must be incorporated in program.
.452 Restarting process . . effected by operator's manual forcing of jump instruction.

.5 PROGRAM DIAGNOSTICS

.51 Dynamic

.511 Tracing: . . . . . TRACER, up to 9,999 steps
.512 Snapshots: . . . . . use HSM PRINT.

.52 Post Mortem: . . . . HSM PRINT routine can be loaded to print contents of HSM; it can be altered to cover any one area.
TAPE PRINT routine can be loaded into memory and can print the entire contents or selected contents of a tape.
MEMORY DUMP TO CARDS punches out on cards the contents of specified areas of HSM.

.6 OPERATOR CONTROL

.61 Signals to Operator . . stop instruction displayed on console.

§ 191.

.62 Operator's Decision: manual forcing of jump instruction or restart, or insertion of EXECUTE card.

.63 Operator's Signals

.631 Inquiry: . . . . . none.
.632 Change of normal progress: . . . . . console manipulation, or insertion of EXECUTE card.

.7 LOGGING: . . . . . incorporated in program, or by insertion of EXECUTE cards.

.8 PERFORMANCE

.81 Program Loading Time: input limited.

.82 Reserved Equipment

Arithmetic tables: . . .	200
Loader routine:	370
Multiply-Divide parameters:	55
Standard area:.	18
Debugging area *. . .	1,120
Print table:	100
Total:	1,863

* Only if debugging facilities being used.

.83 Running Overhead: . . . negligible except for overlays.

OPERATING ENVIRONMENT: SRS CARD

§ 191.

.1 GENERAL

.11 Identity: . . . . . RCA 301 Service Routine System (Card Library). SRS Card.

.12 Description

This is one of a set of Service Routine Systems. There are separate systems oriented toward punched card, paper tape, magnetic tape and magnetic record file operation. Many of the executive routines are available in several systems with only minor changes made necessary by different input-output units; e.g., a system for paper tape is similar to that for punched cards and one for magnetic records is similar to that for magnetic tape. Even in a card oriented system, magnetic tapes may be attached and some executive routines, such as program libraries, used with them.

Automatic run-to-run control is provided through the EXECUTE function of the system.

The LOADER routine allows programs to be relocated in HSM. All service routines are floatable.

In order to avoid extensive manual manipulations at the Console, a special service routine EXECUTE is available. It is always incorporated in service routines such as LOADER and can be incorporated in individual programs. It operates by using short sequences of instructions pre-punched on cards (or paper tape) with space for some parameters. Routines containing EXECUTE require a few instructions to recognize, jump into and return from the special control cards.

There is a sophisticated Input-Output File Control routine incorporated in most programs which handles punched tape and cards as well as magnetic tape.

.13 Availability . . . . . September, 1961.

.2 PROGRAM LOADING . . punched cards or punched tape in sequence.

.3 HARDWARE ALLOCATION

.31 Storage

.311 Segmenting of routines: incorporated in programs.
.312 Occupation of working storage: . . . . . incorporated in programs.
.313 Choice of location: . . assignment by the programmer or operator and located by the LOADER routine.

.32 Input-Output Units

.321 Initial assignment: . . . incorporated in program.
.322 Alternation: . . . . . incorporated in program using FCP.
.323 Reassignment: . . . . . by operator.

.4 RUNNING SUPERVISION

.41 Simultaneous Working: none--must be incorporated in program.

.42 Multi-running: . . . . none.

.43 Multisequencing: . . . none.

.44 Errors, Checks, and Action

Error	Check or Interlock	Action
Loading input error:	none.	
Allocation impossible:	none.	
In-out error - single:	check	stop, alarm.
Overflow:	indicator	program choice.
Invalid instructions:	check	stop, alarm.
Program conflicts:	interlock	wait.

.45 Restarts

.451 Establishing restart points: . . . . . none - must be incorporated in program.
.452 Restarting process . . effected by operator's manual forcing of jump instruction.

.5 PROGRAM DIAGNOSTICS

.51 Dynamic

.511 Tracing: . . . . . TRACER, up to 9,999 steps
.512 Snapshots: . . . . . use HSM PRINT.

.52 Post Mortem: . . . . HSM PRINT routine can be loaded to print contents of HSM; it can be altered to cover any one area.
TAPE PRINT routine can be loaded into memory and can print the entire contents or selected contents of a tape.
MEMORY DUMP TO CARDS punches out on cards the contents of specified areas of HSM.

.6 OPERATOR CONTROL

.61 Signals to Operator . . stop instruction displayed on console.

§ 191.

.62 Operator's Decision: manual forcing of jump instruction or restart, or insertion of EXECUTE card.

.63 Operator's Signals

.631 Inquiry: . . . . . none.
.632 Change of normal progress: . . . . . console manipulation, or insertion of EXECUTE card.

.7 LOGGING: . . . . . incorporated in program, or by insertion of EXECUTE cards.

.8 PERFORMANCE

.81 Program Loading Time: input limited.

.82 Reserved Equipment

Arithmetic tables: . . .	200
Loader routine:	370
Multiply-Divide parameters:	55
Standard area:.	18
Debugging area *. . .	1,120
Print table:	100
Total:	1,863

* Only if debugging facilities being used.

.83 Running Overhead: . . . negligible except for overlays.

OPERATING ENVIRONMENT: SRS TAPE

§ 192.

.1 GENERAL

.11 Identity: . . . . . RCA 301 Service Routine System (Tape Library). SRS-Tape.

.12 Description

This is one of a set of Service Routine Systems. There are separate systems oriented toward punched card, paper tape, magnetic tape and magnetic record file operation. Many of the executive routines are available in several systems with only minor changes made necessary by different input-output units; e.g., a system for paper tape is similar to that for punched cards and one for magnetic records is similar to that for magnetic tape. Even in a card-oriented system, magnetic tapes may be attached and some executive routines used with these, such as program libraries.

This system provides a TAPE PROGRAM TRANSCRIBER routine for transcribing programs to a program library tape. Once stored on tape, program may be run automatically in tape sequence, or the library tape may be searched for running selected programs such as service routines.

In order to avoid extensive manual manipulations at the Console, a special service routine EXECUTE is available. It is always incorporated in service routines such as LOADER and can be incorporated in individual programs. It operates by using short sequences of instructions pre-punched on cards (or paper tape) with space for some parameters. Routines containing EXECUTE require a few instructions to recognize, jump into and return from the special control cards.

There is a sophisticated Input-Output File Control routine incorporated in most programs which handles punched tape and cards as well as magnetic tape.

This system of alternatives using card or DRF libraries can be used with output from AASP. There is a sophisticated Input-Output File Control routine incorporated in most programs which handles punched tape and cards as well as magnetic tape.

.13 Availability: . . . . . October, 1961.

.2 PROGRAM LOADING

.21 Source of Programs

.211 Libraries: . . . . . are loaded from the master library tape which has programs stored in alphameric order; the programs are inserted by the search phase of the INSERTION routine.

.212 Independents: . . . . . as loaded by operator from punched card files.

.22 Library Subroutines: . . none.

.23 Loading Sequence:

The INSERTION routine offers two options for inserting programs into memory--an automatic (run-to-run) phase and a search phase: the sequence of programs stored on tape is determined by the way a particular program library tape is to be used. If independent programs are to be transcribed to tape, they will be transcribed in alphameric order for insertion using the search phase. Programs constituting a run or related runs will be contained on the Program Library Tape (usually a special PLT) in the desired order of running. The sequence of the programs on tape can be varied by using the FILE MAINTENANCE routine. The alphameric storing of programs (such as on the Master PLT) allows programs to be run in any order indicated by the order of parameters which call the specific programs into memory. In the automatic insertion phase, there is a break sequence option which allows programs to be inserted and run in an order other than the order of their placement on tape.

.3 HARDWARE ALLOCATION

.31 Storage

.311 Segmenting of routines: incorporated in programs.

.312 Occupation of working storage: . . . . . incorporated in programs.

.313 Choice of location: . . . assigned when transcribing to tape.

.32 Input-Output Units

.321 Initial assignment: . . . incorporated in program.

.322 Alternation: . . . . . incorporated in program using FCP.

.323 Reassignment: . . . . . by operator.

.4 RUNNING SUPERVISION

.41 Simultaneous Working: . none -- must be incorporated in program.

.42 Multi-running: . . . . . none.

.43 Multisequencing: . . . . none.

§ 192.

.44 Errors, Checks, and Action

Error	Check or Interlock	Action
Loading input error:	none.	
Allocation impossible:	none.	
In-out error - single:	check	stop, alarm.
Overflow:	indicator	program choice.
Invalid instructions:	check	stop, alarm.
Program conflicts:	interlock	wait.

.45 Restarts

.451 Establishing restart points: . . . . . none -- must be incorporated in program.

.452 Restarting process: . . . effected by operator's manual forcing of jump instruction.

.5 PROGRAM DIAGNOSTICS

.51 Dynamic

.511 Tracing: . . . . . "TRACER" can be limited to N instructions executed, N=1(100) 9900.

.512 Snapshots: . . . . . ADDRESS STOP allows the interruption of a program after a special instruction has been executed a designated number of times, and is used in conjunction with the HSM PRINT.

CONSOLIDATA is a program-testing system designed to consolidate on a tape the object program all test data and validation routines (SAMPLE, TRACER, MEMORY PRINT and TAPE PRINT). This system enables automatic selection of the mode of operation i.e., sampling or tracing of the program.

.52 Post Mortem: . . . . . "DATA PRINT" parameters control HSM and output tapes.

HSM Print routine can be altered to cover any one area.

TAPE PRINT routine can print the entire or selected contents of a tape.

.6 OPERATOR CONTROL

.61 Signals to Operator: . . stop instruction displayed on console.

EXECUTE CARDS CAN BE USED.

.62 Operator's Decision: . . manual forcing of jump instruction or restart.

.63 Operator's Signals

.631 Inquiry: . . . . . none.

.632 Change of normal progress: . . . . . console manipulation.

.7 LOGGING: . . . . . names of loaded programs.

.8 PERFORMANCE

.81 Program Loading Time: input limited.

.82 Reserved Equipment

Arithmetic Tables: .	200
Insertion Area: . . .	370
Multiply & Divide Parameters:	55
Standard Areas: . . .	54
Debugging Area: . .	1,120
Print Table:	100
Total	1,899

.83 Running Overhead . . . negligible except for overlays.

NOTES ON SYSTEM PERFORMANCE

§ 201.

.1 GENERALIZED FILE PROCESSING

General

The high-speed addition and subtraction facilities of the 354 and 355 Processors are not particularly useful in the File Processing problems on the RCA 301 system. For the fast arithmetic circuits to be useful, data fields must be a fixed length of digits. When they are not, move instructions are required for unpacking and packing the fields, and the time required for this offsets the faster arithmetic speeds. Where fields are longer than eight digits, the fast arithmetic circuits are not usable without greater than eight-digit precision subroutines (to use the fast arithmetic circuits); these are not yet available.

The multiplication and division facilities of the 354 and 355 Processors provide much faster speeds than the 303-305 Processors offer through subroutines. Data movement times become insignificant in view of the overall multiply-divide time saved. However, one must check the amount of time spent in such operations within the overall program to decide whether the additional cost of the 354/355 Processors is justified. The cost of the fast processors is about 50 per cent higher than that of the standard processors.

.11 Standard File Problem A

All configurations use the Model 323 Card Reader to read File 3, the detail file, at a speed of 600 cards per minute. The printer used in all configurations is the Model 333, printing at a maximum effective speed of about 500 lines per minute with 1-inch line spacing. Configuration I has Files 1 and 2, the master files, on punched cards, two cards per record or block. Card Reader Model 323 is used in Configuration I to read the Master File input, and the timing is based on an activity factor (F) of 1.0. Configurations II, III, and IV have magnetic tape Master Files input and output. Configuration II uses the Hi-Data Tape Group (10KC character rate), and Configurations III and IV use the 581 and 582 tape units operating at 33,333 and 66,667 characters per second, respectively.

All configurations except the minimum tape system (Configuration II) use the Simultaneous Mode Control, Model 392. This is used for overlapping printer and tape operations with internal processing.

Timing for configuration II, using the Simultaneous Mode Control (designated Configuration IIS) is also shown. In this Configuration, magnetic tape and/or the printer operations are calculated as overlapped with processing. The additional cost over the standard Configuration II is $608 per month.

.12 Standard File Problem B, C, and D

These problems are variations of Problem A, and are described fully in the Users' Guide, Section 4:200.12 to 4:200.14. Problem B doubles the number of master records per block (record size halved); Problem C halves the number of master records per block (record size doubled); and Problem D trebles the amount of computation per transaction.

NOTES ON SYSTEM PERFORMANCE (Contd.)

§ 201.

.2 SORTING

.21 Standard Problem

Times are presented (Standard EDP Reports estimates) for sorting 80-character records of a master file, based on tape passing time in Problem A with the activity factor (F) equal to zero. Configuration II uses a two-way merge technique and Configurations III and IV use a three-way merge technique. Details of the timing estimating procedure are given in the Users' Guide, Section 4:200.21.

.3 MATRIX INVERSION

.31 Standard Problem

The standard problem estimate of the Users' Guide is used. The estimate is based on the time for floating point cumulative multiplication. Times are shown for floating point subroutines, which would be used on the 303/304/305 Processors, and using the floating point arithmetic circuits of the 354/355 Processor.

.32 Standard Routine

Timing for the manufacturer's Matrix Inversion routine, using subroutines for floating point arithmetic, is shown. This routine finds the inverse of a matrix, and also multiplies a second matrix by the inverse.

.4 GENERALIZED MATHEMATICAL PROCESSING

Floating point times are shown, using Configuration VI, 6-Tape Business/Scientific. Results are shown for subroutines for floating point operations, used by the 303/304/305 Processor, and for the floating point unit of the 354/355 Processor. Input and output are on punched cards, with card punching performed through the Simultaneous Mode Control feature.

RCA 301
SYSTEM PERFORMANCE

SYSTEM PERFORMANCE

WORKSHEET DATA TABLE 1

Worksheet	Item		Configuration I	II	IIS	III	IV	IV with 354/355 Processor	Reference
1 Input-Output Times	Char/block	(File 1)	108	1,080	1,080	1,080	1,080	1,080	4:200.112
	Records/block	K (File 1)	1	10	10	10	10	10	
	msec/block	File 1 = File 2	200/1,200	140	140	46	32	32	
		File 3	100	100	100	100	100	100	
		File 4	118	118	118	118	118	118	
	msec/switch	File 1 = File 2	0	10	10	0	0	0	
		File 3	0	0	0	0	0	0	
		File 4	0	0	0	0	0	0	
	msec/penalty	File 1 = File 2	26/14	7	7	7	7	7	
		File 3	13	13	13	13	13	13	
		File 4	59	59	59	59	59	59	
2 Central Processor Times	msec/block	a1	2.3	2.3	2.3	2.3	2.3	2.3	4:200.1132
	msec/record	a2	5.9	5.9	5.9	5.9	5.9	5.5	
	msec/detail	b6	0.4	0.4	0.4	0.4	0.4	0.4	
	msec/work	b5 + b9	39.3	39.3	5.4	5.4	5.4	5.4	
	msec/report	b7 + b8	4.4	4.4	4.4	4.4	4.4	4.4	
3 Standard Problem A F = 1.0	msec/block for C. P. and dominant column.	a1	2	2	2	2	2	2	4:200.114
		a2 K	6	59	59	59	59	55	
		a3 K	44	442	442	442	442	103	
		File 1 Master In	200	140	7 140	7 46	7 32	7 32	
		File 2 Master Out	14 1,200	140	7 140	7 46	7 32	7 32	
		File 3 Details	100	1,000	800 0	800 0	800 0	800	
		File 4 Reports	118	1,180 1,180	590 1,180	590 1,180	590 1,180	590 1,180	
		Total	484 1,200	2,963 1,180	1,907 1,460	1,907 1,272	1,907 1,244	1,564 1,244	
4 Standard Problem A Space	Unit of measure	(character)							4:200.1151
		Std. routines	5,250	5,250	5,250	5,250	5,250	5,250	
		Fixed	1,125	1,125	1,125	1,125	1,125	1,125	
		3 (Blocks 1 to 23)	162	162	162	162	162	162	
		6 (Blocks 24 to 48)	301	301	301	301	301	301	
		Files	724	2,560	2,560	2,720	2,720	2,720	
		Working	108	108	108	108	108	108	
		Total	7,670	9,506	9,506	9,666	9,666	9,666	

SYSTEM PERFORMANCE

WORKSHEET DATA TABLE 2						
Worksheet	Item			Configuration VI		Reference
5 Standard Mathematical Problem A	Fixed/Floating point			Floating point using subroutines and 303/304/305 Processor	Floating point using automatic features in 354/355 Processor	4:200.413
	Unit name	input		323 Card Reader	323 Card Reader	
		output		334 Card Punch	334 Card Punch	
	Size of record	input		2 cards	2 cards	
		output		2 cards	2 cards	
	msec/block	input	T_1	250	250	
		output	T_2	1,200	1,200	
	msec penalty	input	T_3	250	250	
		output	T_4	0	0	
	msec/record		T_5	-	0.2	
	msec/5 loops		T_6	384	34.4	
	msec/report		T_7	1	1	
7 Standard Statistical Problem A	Unit name					4:200.512
	Size of block					
	Records/block		B			
	msec/block		T_1			
	msec/penalty		T_3			
	C. P.	msec/block	T_5			
		msec/record	T_6			
		msec/table	T_7			

SYSTEM PERFORMANCE

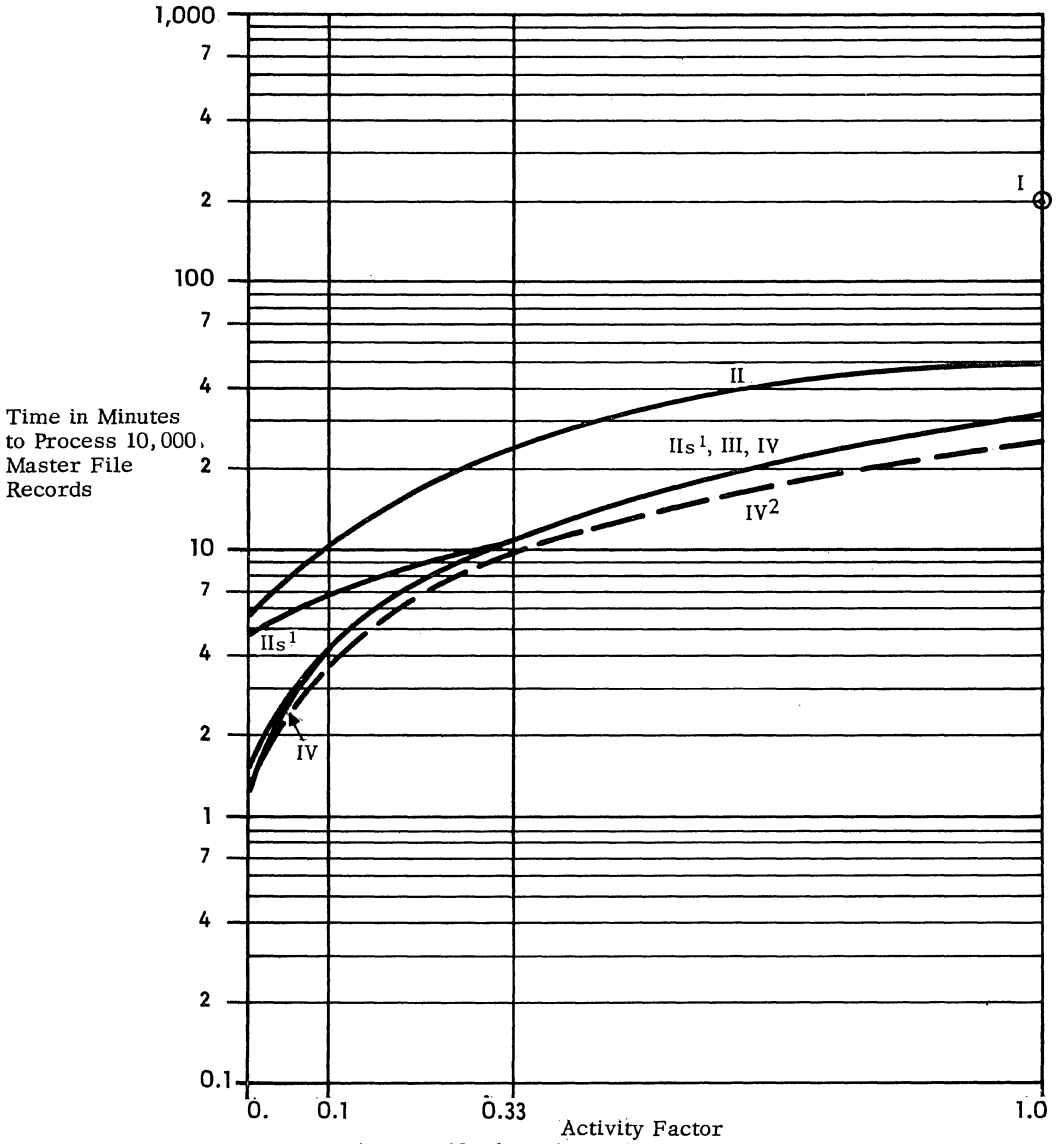
§ 201.

.1 GENERALIZED FILE PROCESSING

.11 Standard File Problem A

.111 Record Sizes
Master File: . . . . . 108 characters.
Detail File: . . . . . 1 card.
Report File: . . . . . 1 line.

.112 Computation: . . . . . standard.
.113 Timing Basis: . . . . . using estimating procedure outlined in Users' Guide, 4:200.113.
.114 Graph: . . . . . see graph below
.115 Storage space required
Configuration I: . . . 7,670.
Configuration II: . . . 9,506.
Configuration III: . . . 9,666.
Configuration IV: . . . 9,666.



(Roman numerals denote standard System Configurations.)

Notes:

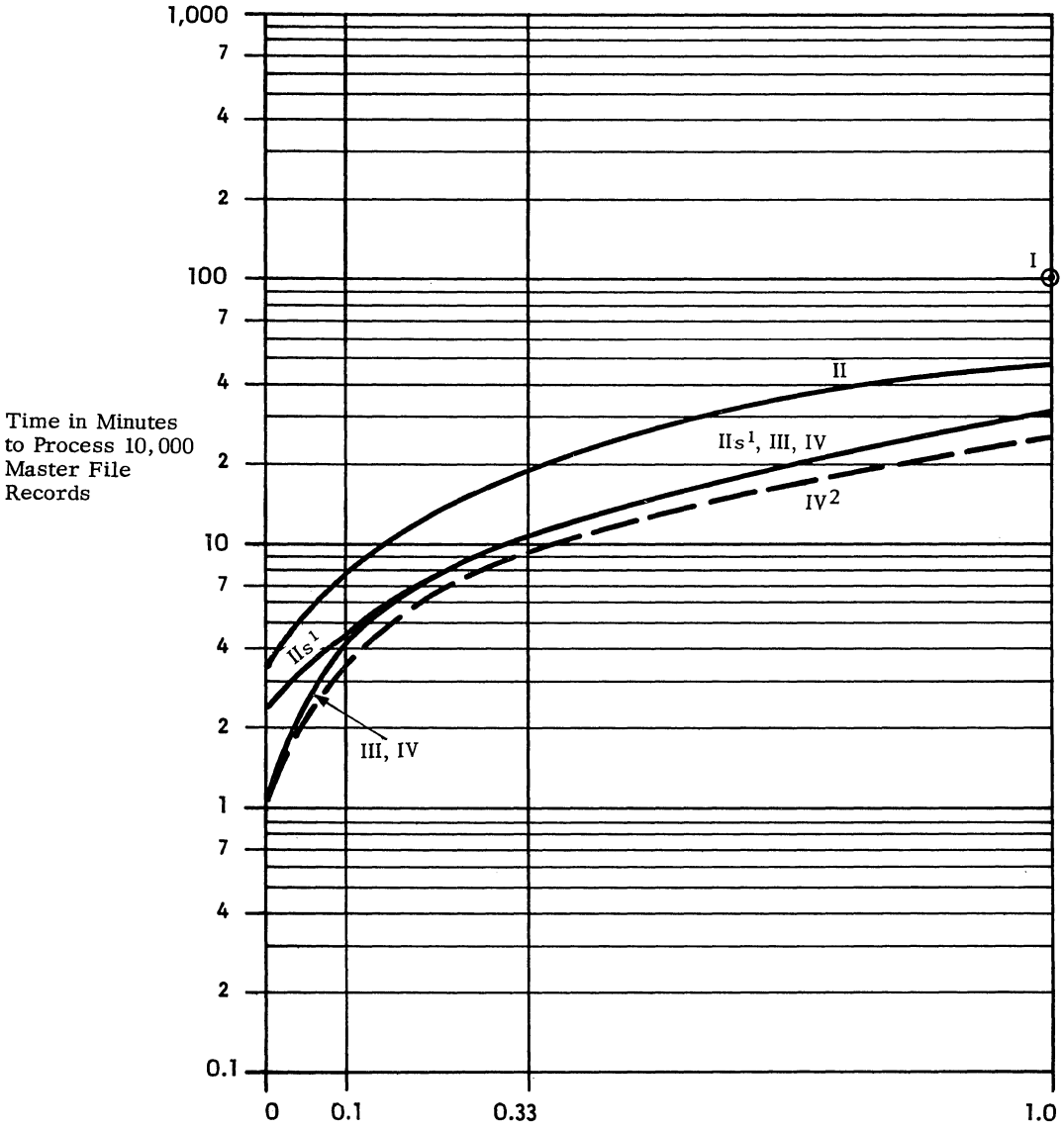
1. with SMC unit.
2. using 354/355 Processor (i.e., with arithmetic unit).

§ 201.

.12 Standard File Problem B

.121 Record Sizes
Master File: . . . . . 54 characters.
Detail File: . . . . . 1 card.
Report File: . . . . . 1 line.

.122 Computation: . . . standard.
.123 Timing Basis: . . . using estimating procedure outlined in Users' Guide, 4:200.12.
.124 Graph: . . . . . see graph below.



(Roman numerals denote standard System Configurations.)

Notes:

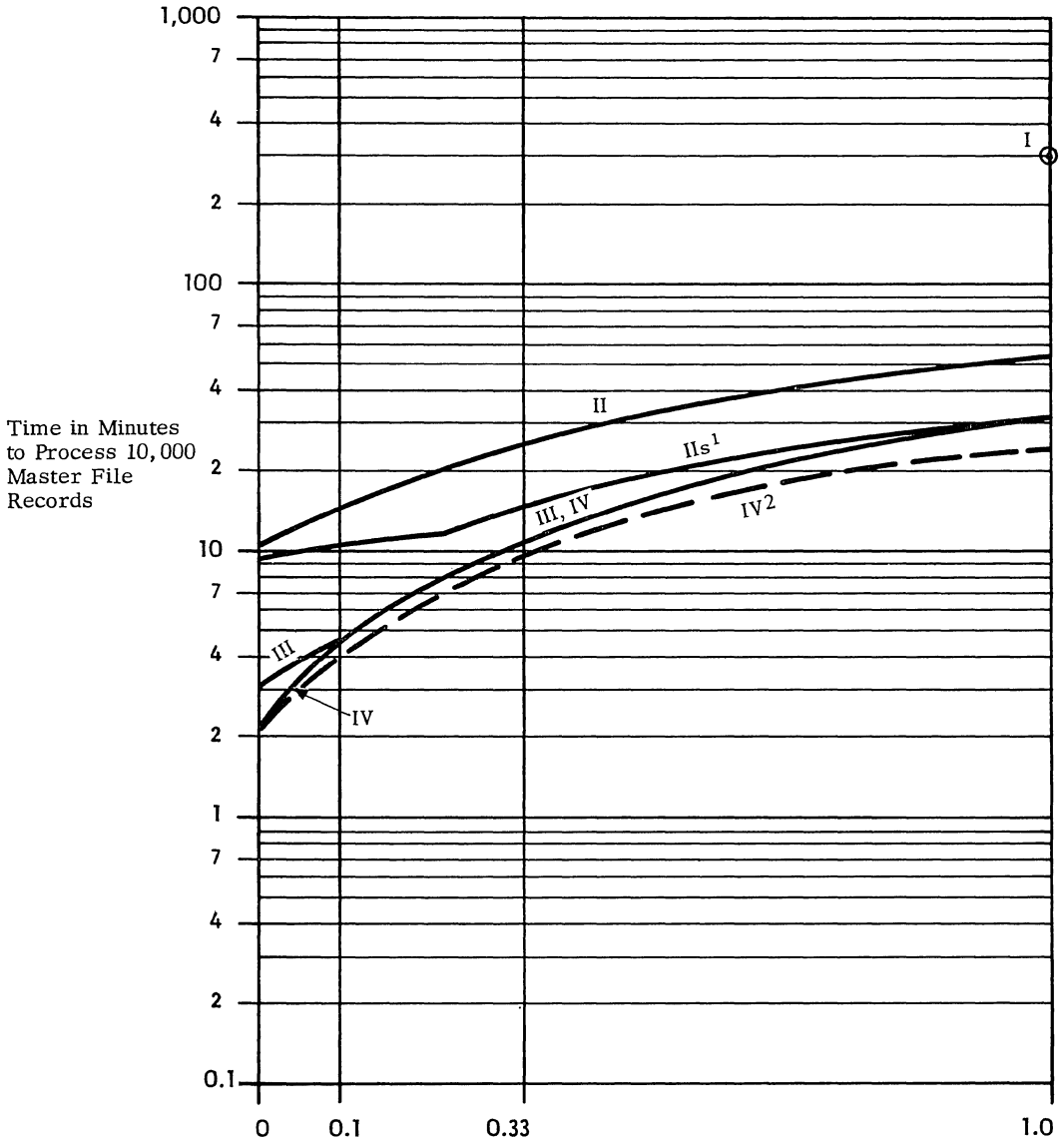
1. with SMC unit.
2. using 354/355 Processor (i.e., with arithmetic unit).

§ 201.

.13 Standard File Problem C

.131 Record Sizes
Master File: . . . . . 216 characters.
Detail File: . . . . . 1 card.
Report File: . . . . . 1 line.

.132 Computation: . . . . standard.
.133 Timing Basis: . . . . using estimating procedure outlined in Users' Guide, 4:200.13.
.134 Graph: . . . . . see graph below.



(Roman numerals denote standard System Configurations.)

Notes:

1. with SMC unit.
2. using 354/355 Processor (i.e., with arithmetic unit).

§ 201.

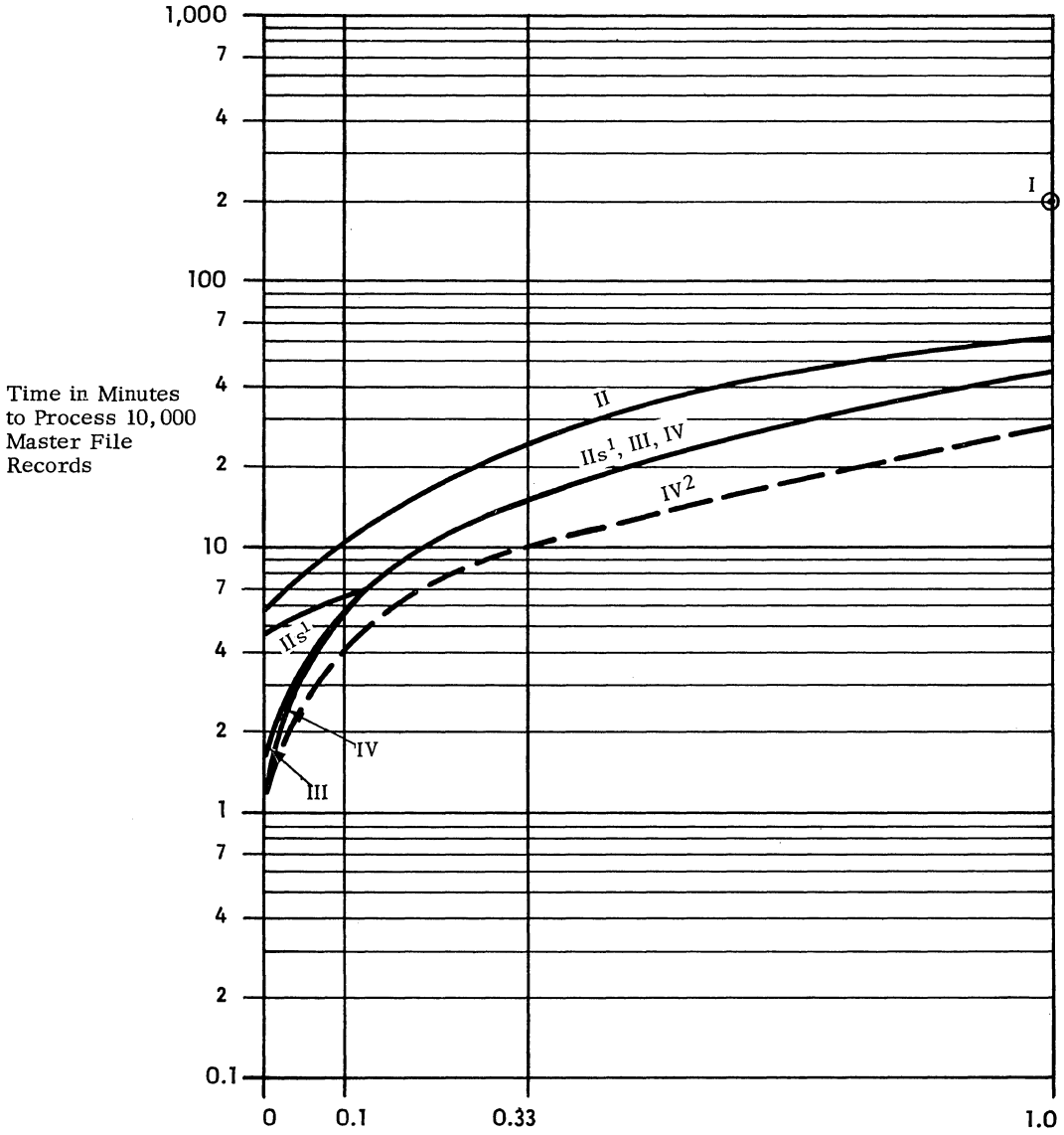
.14 Standard File Problem D

.141 Record Sizes
Master File: . . . .108 characters.
Detail File: . . . .1 card.
Report File: . . . .1 line.

.142 Computation: . . . trebled.

.143 Timing Basis: . . . using estimating procedure outlined in Users' Guide, 4:200.14.

.144 Graph: . . . . . see graph below.



(Roman numerals denote standard System Configurations.)

Notes:

1. with SMC unit.
2. using 354/355 Processor (i.e., with arithmetic unit).

§ 201.

.2 SORTING

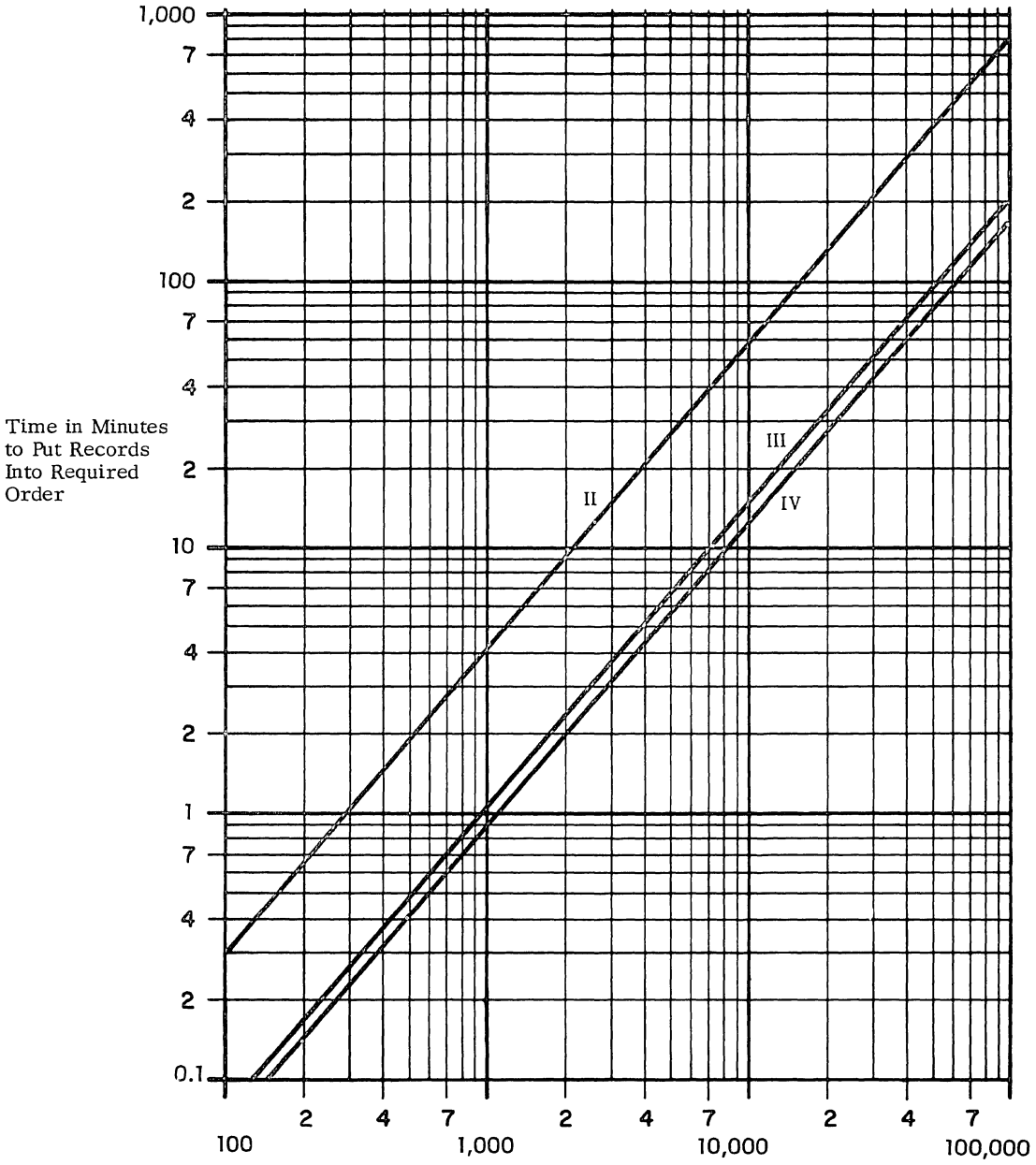
.21 Standard Problem Estimates

.211 Record size: . . . . 80 characters.

.212 Key size: . . . . . .8 characters.

.213 Timing basis: . . . .using estimating procedure outlined in Users' Guide, 4:200.213.

.214 Graph: . . . . . .see graph below.



(Roman numerals denote standard System Configurations.)

§ 201.

.3 MATRIX INVERSION

.31 Standard Problem Estimates

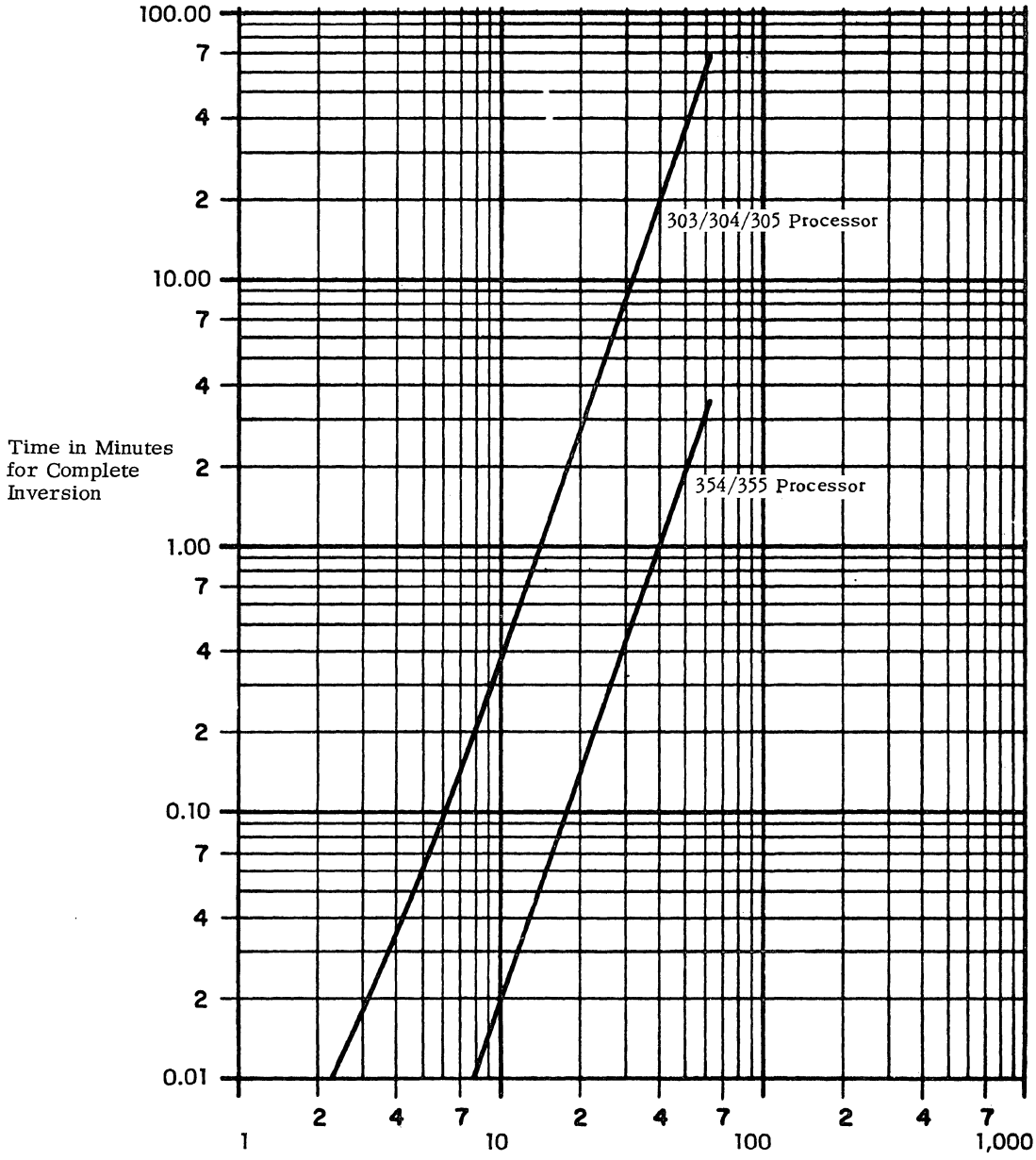
.311 Basic parameters: . . .general, non-symmetric matrices, using floating point to at least 8 decimal digits.

.312 Timing basis: . . . . using estimating procedure outlined in Users' Guide, 4:200.312

.313 Graph: . . . . . see graph below.

.314 Maximum size of matrix

Number of locations in core storage	Matrix size
10,000:	30 x 30
20,000:	44 x 44
40,000:	63 x 63



§ 201.

.32 Matrix Inversion Times

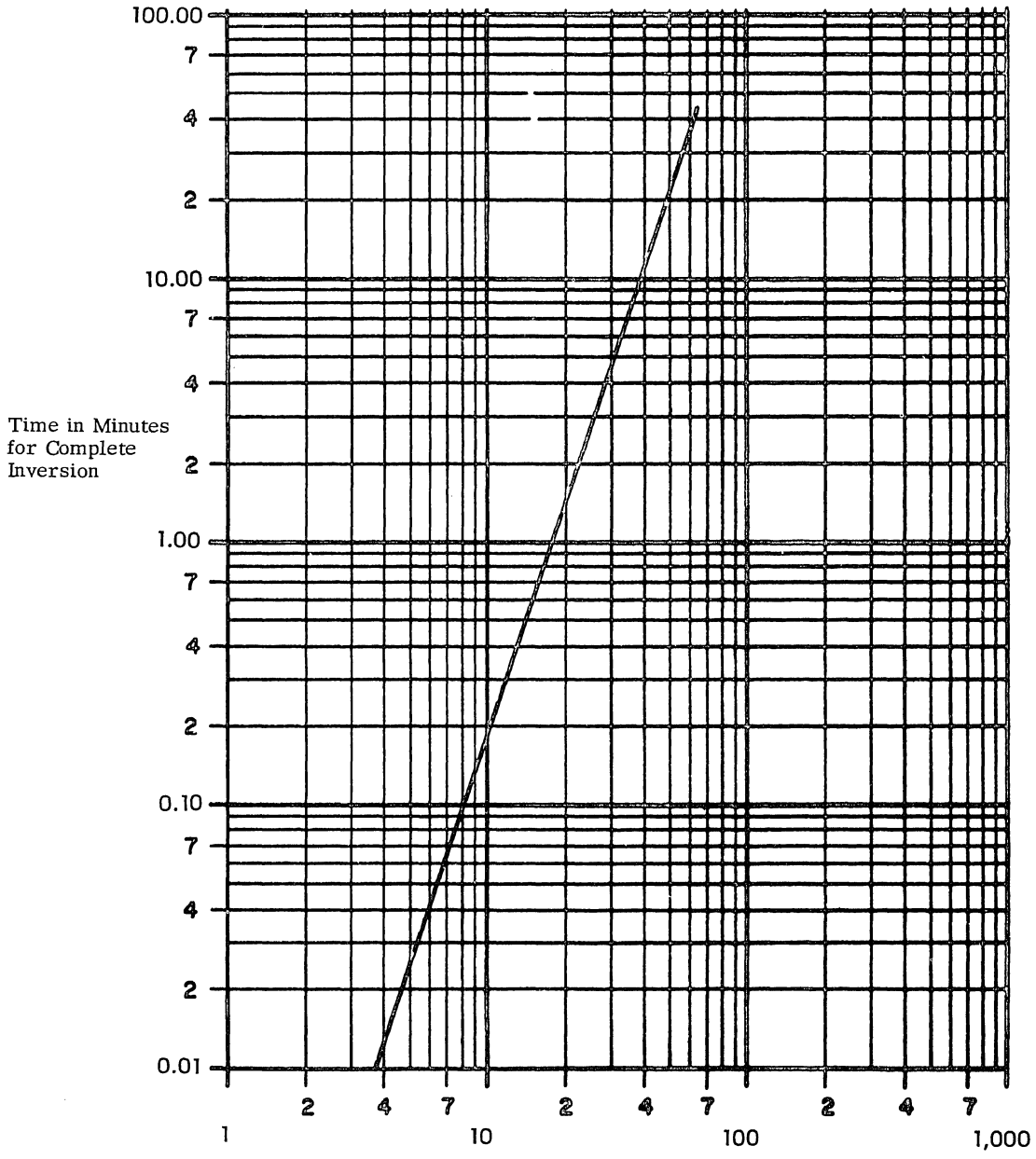
.321 Basic parameters: . . .general, non-symmetric matrices, using floating point to at least 8 decimal digits.

.322 Timing basis: . . . .Matrix Inversion subroutine description, using 303/304/305 Processor.

.323 Graph: . . . . . see graph below.

.324 Maximum size of matrix

Number of locations in core storage	Matrix size
10,000:	26 x 26
20,000:	40 x 40
40,000:	50 x 60



§ 201.

.4 GENERALIZED MATHEMATICAL PROCESSING

.41 Standard Mathematical Problem A Estimates

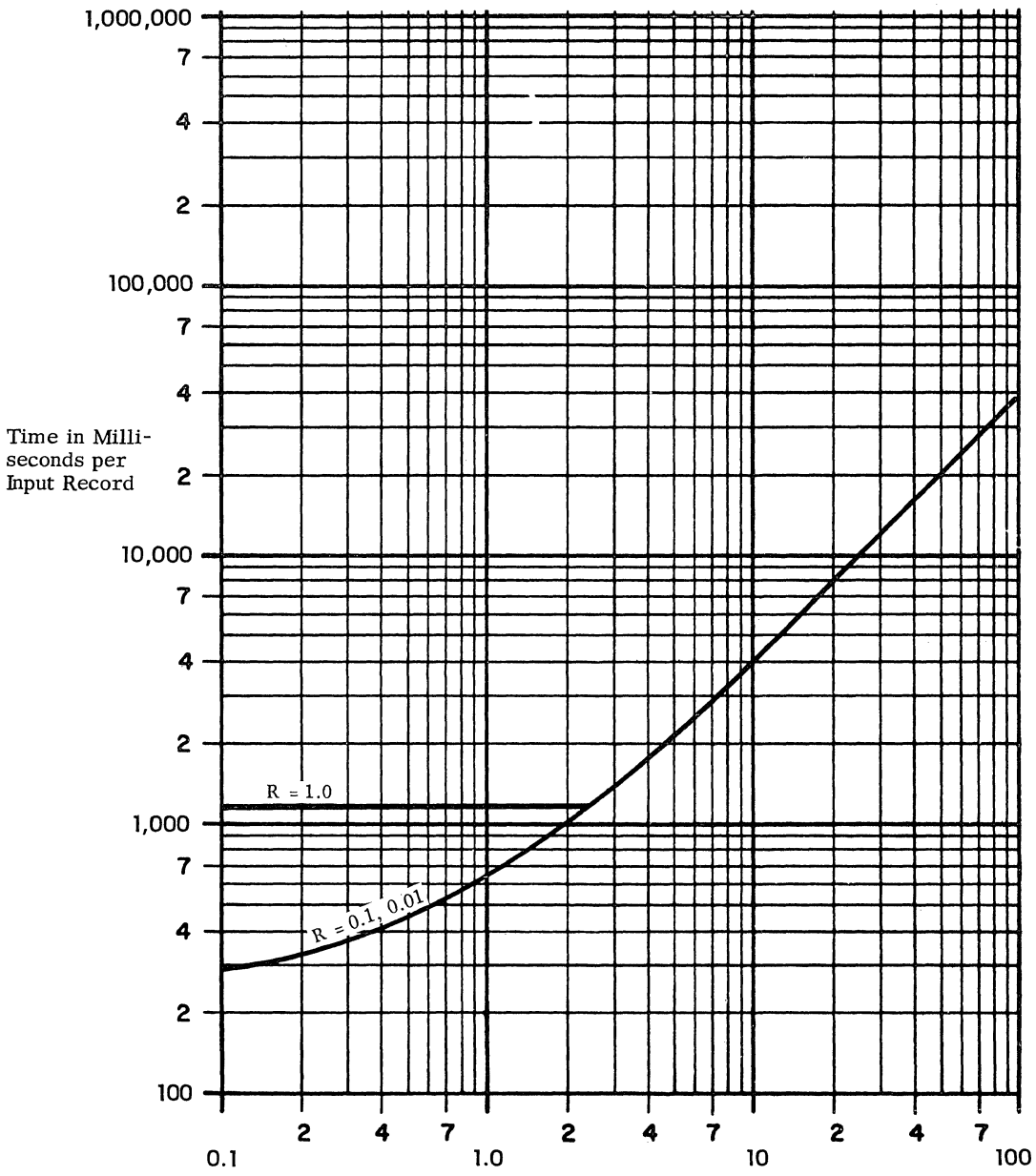
.411 Record sizes: . . . . . 10 signed numbers, avg. size 5 digits, max. size 8 digits.

.412 Computation: . . . . . 5 fifth-order polynomials. 5 divisions. 1 square root.

.413 Timing basis: . . . . . using estimating procedure outlined in Users' Guide, 4:200.413.

.414 Graph: . . . . . see graph below, for 305 Processor using floating point subroutines.

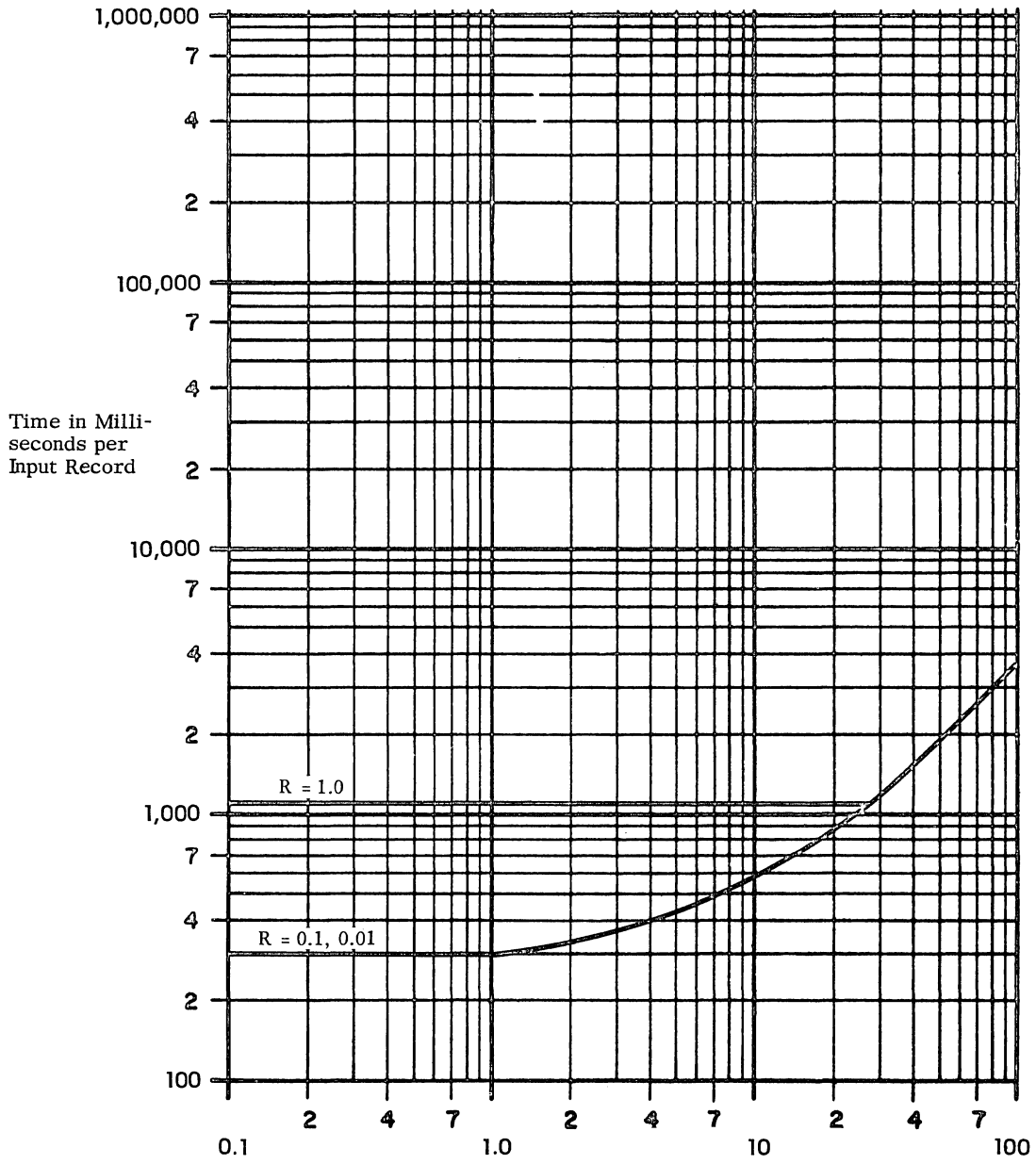
CONFIGURATION VI; SINGLE LENGTH (8 DIGIT PRECISION); FLOATING POINT
R = NUMBER OF OUTPUT RECORDS PER INPUT RECORD



§ 201.

.415 Graph: . . . . . see graph below, for 355 Processor with built-in floating point arithmetic.

CONFIGURATION VI; SINGLE LENGTH (8 DIGIT PRECISION); FLOATING POINT
R = NUMBER OF OUTPUT RECORDS PER INPUT RECORD



RCA 301
PHYSICAL CHARACTERISTICS

RCA 301 PHYSICAL CHARACTERISTICS

			Processor	PTRP Control	CR Control	CP Control	O-LP Control	O-LP Control	DRF Control	H-DTG Control	Paper Tape Reader Punch	Paper Tape Reader	Card Reader	Paper Tape Punch	Card Punch	On-Line Printer	On-Line Printer	Interrogating Typewriter	Monitor Printer	Data Record File	Data Disc File
IDENTITY	Unit Name		Processor	PTRP Control	CR Control	CP Control	O-LP Control	O-LP Control	DRF Control	H-DTG Control	Paper Tape Reader Punch	Paper Tape Reader	Card Reader	Paper Tape Punch	Card Punch	On-Line Printer	On-Line Printer	Interrogating Typewriter	Monitor Printer	Data Record File	Data Disc File
	Model Number		303; 304; 305	311	314-1R; 314-2R	315	316-1; 316-2	396-1; 396-2	317-1; 317-2	318; 319	321	322	323	331	334	333	335	328 & Console	338	361	366-1
PHYSICAL	Height × width × depth, in.		75 × 132 × 20[1]	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	60 × 34 × 24	60 × 34 × 24	56 × 46 × 27	60 × 34 × 24	48 × 48 × 30	56 × 71 × 31	56 × 71 × 31	38 × 36 × 38	38 × 36 × 38	48 × 36 × 27	58 × 82 × 45
	Weight, pounds		3,100[2]								250	250	600	200	1,000	1,150	1,150	250	250	600	4,000
	Maximum cable lengths		15' to Power Supply	15' to Reader 15' to Punch	75' to Reader	15' to Punch	25' to Printer	25' to Printer	75' to Data Record File	100' to H-DTG	25' Power 15' Control	25' Power 15' Control	75' Control	25' Power 15' Control	15' Control	25' Control	25' Control Cable	15' Control. 2,000' Control Optional.	15' Control	25' Power 75' Control	100' Processor
ATMOSPHERE	Storage Ranges	Temperature, °F.																			
		Humidity, %																			
	Working Ranges	Temperature, °F.	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85
		Humidity, %	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65
	Heat dissipated, BTU/hr.		9,200	500	500	900	1,200	1,200	700	600	5,500	4,800	6,200	5,500	6,500	5,500	5,500	700	700	4,100	19,100
	Air flow, cfm.																				
	Internal filters		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ELECTRICAL	Voltage	Nominal	208/230*	d-c power furnished by System Power Supply	d-c power furnished by System Power Supply	d-c power furnished by System Power Supply	d-c power furnished by System Power Supply	d-c power from Processor Power Supply	d-c power furnished by System Power Supply	d-c power furnished by System Power Supply	d-c power furnished by System Power Supply	d-c power furnished by System Power Supply	208/230*	d-c power furnished by System Power Supply	208/230*	208/230*	208/230*	115	115	Furnished by System Power Supply	208/230
		Tolerance	±10%										±10%		±10%	±10%	±10%	±10%	±10%		±10%
	Cycles	Nominal	60										60		60	60	60	60	60		60
		Tolerance	±½ cycle										±½ cycle		±½ cycle		±½ cycle	±½ cycle	±½ cycle		±½ cycle
	Phases and lines		1φ, 3 wire										1φ, 3 wire		1φ, 3 wire	1φ, 3 wire	1φ, 3 wire	1φ, 3 wire	1φ, 3 wire		1φ, 3 wire
	Load KW @ p.f. of 0.8		2.7	0.14	0.15	0.27	0.35	0.35	0.2	0.16	1.6 total	1.4	1.8 total	1.6 total	1.9 total	1.6 total	1.6	0.2	0.2	1.2	5.6
NOTES			58°F max. dew point.	58°F. max. dew point. 3 rows of cards in Processor.	58°F. max. dew point. 4 rows of cards in Processor.	58°F. max. dew point. 5 rows of cards in Processor.	58°F. max. dew point. 5 rows of cards in Processor.	58°F. max. dew point. 5 rows of cards in Processor.	58°F. max. dew point. 4 rows of cards in Processor.	58°F. max. dew point. 4 rows of cards in Processor.	58°F. max. dew point.	58°F. max. dew point.	58°F. max. dew point. *Also 115 V. ±10%, 60 cy. 1φ	58°F. max. dew point.	58°F. max. dew point. *Also 115 V. ±10%, 60 cy. 1φ	58°F max. dew point. *Also 115 V. ±10%, 60 cy. 1φ	*Also 115 V. ±10% 60 cy. 1φ			58°F max. dew point.	58°F max. dew point. *Additional 0.4 KW furnished by System Power Supply.

[1] Increase of 44" in width for each additional rack of 12 rows.
[2] Add 500 pounds for each additional rack of 12 rows.
*Also 120/115 V. ±10% 60 cy. 1φ.

RCA 301 PHYSICAL CHARACTERISTICS–Cont'd.

IDENTITY	Unit Name		Data Disc File	Data Disc File	Data Disc File	MICR Sorter-Reader Control	Hi-Data Tape Group	Data Record File Mode Control	Simul-taneous Mode Control	581 Adaptor	582 Adaptor	581 Dual Tape Channel (2×6)	581 Dual Tape Channel (2×12)	582 Dual Tape Channel (2×6)	582 Dual Tape Channel (2×12)	729II Adaptor	Tape Station	Monitor Printer Control	Interro-gating Typewriter Control	Tape-writer	Tape-writer-Verifier	System Powor Supply
	Model Number		366-2	366-3	366-4	371	381	391	392	393-1; 393-2	394-1; 394-2	341	342	351	352	390-1; 390-2	581, 582	308	398-1	325	326	Sub-unit of Processor
PHYSICAL	Height×width×depth, in.		58×92×45	58×102×45	58×112×45	Note 1	74×44×20	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	69×44×19	Note 1	Note 1	10×22×21	10×35×24	(*)
	Weight, pounds		4,400	4,700	5,000		1,200										900			90		(*)
	Maximum cable lengths		100' Proc-essor	100' Proc-essor	100' Proc-essor	50' to Sorter Reader	100' to Control	75' to Data Record File		100' to Tape Station	100' to Tape Station	100' to each Tape Station	100' to each Tape Station	100' to each Tape Station	100' to each Tape Station	30' to Tape Unit	100' to Adapter or Tape Channel	15' Monitor Printer	15' to I.T., standard. 2,000' op-tional	Off-line	Off-line	15' to Processor
ATMOS-PHERE	Storage Ranges	Temperature, °F.																				
		Humidity, %																				
	Working Ranges	Temperature, °F.	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	65 - 85	70 - 80	Limits of operator	Limits of operator	65 - 85
		Humidity, %	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	20 - 65	Limits of operator	Limits of operator	20 - 65
	Heat dissipated, BTU/hr.		19,100	19,100	19,100	700	14,000 max. 9,500 standby	1,700	800	700	900	2,500	2,800	2,500	2,800	1,400	2,900 max. 1,400 standby	200	1,200	685	820	7,200
	Air flow, cfm.																					
	Internal filters		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	---	---	Yes
ELEC-TRICAL	Voltage	Nominal	208/230	208/230	208/230	d-c power from Processor Power Supply	208/230	d-c power from Processor Power Supply	d-c power from Processor Power Supply	d-c power from Processor Power Supply	d-c power from Processor Power Supply	d-c power from Processor Power Supply	d-c power from Processor Power Supply	d-c power from Processor Power Supply	d-c power from Processor Power Supply	d-c power from Processor Power Supply	115/208/230	d-c power furnished by System Power Supply	d-c power furnished by System Power Supply	115	115	208/230
		Tolerance	±10%	±10%	±10%		±10%										±10%			±10%	±10%	±10%
	Cycles	Nominal	60	60	60		60										60			60	60	60
		Tolerance	±½ cycle	±½ cycle	±½ cycle		±½ cycle										±½ cycle					±½ cycle
	Phases and lines		1φ, 3 wire	1φ, 3 wire	1φ, 3 wire		1φ, 3 wire										1φ, 3 wire			1φ, 3 wire	1φ, 3 wire	1φ, 3 wire
	Load KW @ p.f. of 0.8		5.6*	5.6*	5.6*	0.2	4.1 max.	0.5	0.22	0.2	0.25	0.65	0.8	0.65	0.8	0.4	0.85/0.4	0.6	0.3	0.2	0.24	2.1
NOTES			58° F max. dew point. *Additional 0.4 KW furnished by System Power Supply	58° F max. dew point. *Additional 0.4 KW furnished by System Power Supply	*Additional 0.4 KW furnished by System Power Supply	58° F max. dew point. 5 rows of cards in Processor.	58° F max. dew point.	58° F max. dew point. 8 rows of cards in Processor.	58° F max. dew point. 5 rows of cards in Processor.	58° F max. dew point. 4 rows of cards in Processor.	58° F max. dew point. 6 rows of cards in Processor.	58° F max. dew point. 10 rows of cards in Processor.	58° F max. dew point. 12 rows of cards in Processor.	58° F max. dew point. 15 rows of cards in Processor.	58° F max. dew point. 17 rows of cards in Processor.	58° F max. dew point. 7 rows of cards in Processor.	58° F max. dew point.	58° F max. dew point. 2 rows of cards in Processor.	58° F max. dew point. 3 rows cards in Processor.			*Included in Proc-essor specifica-tions

PRICE DATA

§ 221.

CLASS	IDENTITY OF UNIT		PRICES		
	No.	Name	Monthly Rental* $	Monthly Maintenance $	Purchase $
CENTRAL PROCESSOR	303	Processor and 10,000 char. store	1,803	86.50	89,400
	304	Processor and 20,000 char. store	2,421	109.00	112,900
	305	Processor and 40,000 char. store	4,069	236.00	193,600
	354	Processor and 20,000 char. store	3,966	177.00	192,100
	355	Processor and 40,000 char. store	5,614	327.00	271,400
		Optional Equipment			
	392	Simultaneous Mode Control	608	36.50	27,900
STORAGE	361	Data Record File	309	137.00	14,900
	317-1	DRF Control	129	9.00	6,250
	317-2	DRF Control	247	15.50	11,900
	391	DRF Mode Control	711	43.25	32,800
	366-1	Data Disc File, 22 million char.	3,090	589.00	141,000
	366-2	Data Disc File, 44 million char.	4,635	879.00	211,500
	366-3	Data Disc File, 66 million char.	6,695	1,267.00	305,500
	366-4	Data Disc File, 88 million char.	7,725	1,462.00	352,500
INPUT-OUTPUT	321	Paper Tape Reader-Punch (7-level)	175	24.50	7,800
		5-,7-level read modification for 321	108	—	4,400
		5-,7-level punch modification for 321, 331 (operator's choice)	82	—	3,360
	322	Paper Tape Reader	361	36.50	14,500
	331	Paper Tape Punch (7-level)	160	23.00	7,150
	311	Paper Tape Control	124	7.75	5,900
	330	Card Reader-Punch	567	45.00	30,000
	323	Card Reader	361	43.50	15,850
	314-1R	Card Reader Control	134	9.00	6,900
	334	Card Punch	206	23.00	8,900
	315	Card Punch Control	283	17.50	13,750
	369-1	Card Reader-Punch Control	597		30,200
	333	On-line Printer 120 col.	721	262.00	32,200
	335	On-line Printer 160 col.	1,154	419.00	51,500
	316-1	On-line Printer Control	155	10.25	7,850
	316-2	On-line Printer Control	350	20.50	15,500
	396-1	On-line Printer Control	264	18.00	13,400
	396-2	On-line Printer Control	597	36.00	26,500
	381	Hi-Data Tape Group (6 units)	1,566	515.00	74,900
	381-3	Hi-Data Tape Group (3 units)	839	276.00	40,200
	381-4	Hi-Data Tape Group (4 units)	1,040	343.00	49,900
	318	Hi-Data Tape Group Control (1x6)	386	23.50	17,900
	319	Hi-Data Tape Group Control (1x6)	386	23.50	17,900
	581	Tape Station 33 Kc.	567	193.00	29,700
	582	Tape Station 66 Kc.	901	207.00	43,260

§ 221.

PRICE DATA (Contd.)

CLASS	IDENTITY OF UNIT		PRICES		
	No.	Name	Monthly Rental* $	Monthly Maintenance $	Purchase $
INPUT-OUTPUT (Contd.)	393-1	Tape Station Adapter (581)	330	21.00	15,900
	393-2	Tape Station Adapter (581)	381	24.25	18,500
	394-1	Tape Station Adapter (582)	659	42.00	31,800
	394-2	Tape Station Adapter (582)	758	48.00	36,600
	341	581 Dual Tape Channel, 2x6	1,030	70.75	49,000
	342	581 Dual Tape Channel, 2x12	1,494	103.00	71,100
	351	582 Dual Tape Channel, 2x6	2,060	142.00	98,000
	352	582 Dual Tape Channel, 2x12	2,575	178.00	122,500
	390-1	729 II Adapter	850	53.50	37,100
	390-2	729 II Adapter	850	53.50	37,100
	5820	Videoscan Document Reader (optical character reader)	3,450	483.00	145,900
	102	Mark Reading Option	110	15.50	4,700
	371	MICR Sorter-Reader Control	536	33.50	25,500
	338	Monitor Printer	196	24.75	7,300
	308	Monitor Printer Control	170	10.75	8,100
	328	Interrogating Typewriter	352	29.00	9,960
	398-1	Interrogating Typewriter Control	242	15.25	11,500
	325	Tapewriter (Off-line)	113	19.00	3,300
	326	Tapewriter-Verifier (Off-line)	155	24.50	4,500

*Single Shift availability.