National 315

THE RANDOM-SEQUENTIAL SYSTEM
FEATURING ...

CRAM

CARD RANDOM ACCESS MEMORY

INDEX

THE NATIONAL 315

ELECTRONIC DATA PROCESSING SYSTEM

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THE NATIONAL 315
ELECTRONIC DATA PROCESSING SYSTEM

The National 315 System is a compact, Modular, electronic data processing system, broadly expandable so that it can be applied as a small scale system or built up to one with large scale capacities. It incorporates new design concepts which make this flexibility possible. Each of the many features were designed to provide maximum versatility for handling business data. The 315 System offers the advantages of electronic data processing to many businesses and organizations that have not yet found an installation economically feasible.

The 315 System is designed expressly for processing business data and provides the proper balance of components and data handling instructions for efficient business use. It has the speed and capacity to efficiently handle engineering and scientific problems.

All components of the 315 System are of solid-state construction and have been designed to provide over-all system compatability and maximum efficiency.

One of the most outstanding advantages of the National 315 is that it offers unlimited flexibility and new opportunities in the basic approach to processing. The new unique use of magnetic cards in removable and mailable cartridges permits high-speed random access or in-line processing over an unprecedented range of information. Since multiple cartridges can be on-line at the same time, batch or sequential processing may also be performed, retaining the old file while creating the new. The magnetic card files can be used . . . like a magnetic tape . . . like a drum . . . or like a disk.

High performance, reliable magnetic tapes are also available as part of the National 315 configuration. Either magnetic card files or magnetic tapes can be employed, or both are available on the same system.

Systems requirements of most organizations will indicate a need for both random and sequential processing of data. A single 315 System permits batched sequential processing, random processing, and remote interrogation, according to the nature of the data, and the demands of the moment.

WIDE RANGE OF SYSTEM ASSEMBLY

The System is expandable from the minimum low cost basic system to a large capacity powerful system, covering a wide range of application and volume requirements. The Processor, compact and low-cost, has accessibility to large scale files, inputs and outputs.

TIME-SHARING AND AUTOMATIC PROGRAM INTERRUPT

In order to provide maximum time-sharing and efficiency in operation, most of the peripheral components of the National 315 System have an automatic interrupt feature. The Magnetic Character Sorter-Readers, High Speed Line Printers, Card Punches, Inquiry Units, and Magnetic Card Random Access Units each possess this interrupt feature. Also, each of these units is capable of independent operation after being activated by the Processor.

Under permissive control these units may interrupt, be reactivated, and continue their operation independently while the Processor returns to the primary program. Thus, the National 315 can coordinate the operation of a number of peripheral units, each performing input, output, or file operations at its own independent rate of speed.

DEPENDABLE DESIGN AND CONSTRUCTION

The logic of the National 315 is designed for maximum dependability, and construction tolerances are set beyond those of "worst case" conditions of heat, voltage fluctuation, and aging. The

logic is built largely from standardized plug-in card circuits; for example, only one type of flip-flop card is used throughout the Processor.

METHODS OF INPUT

The National 315 System handles all common types of input media at high speed. Data may be entered into the system by reading punched cards, punch paper tape, or magnetic ink characters.

METHODS OF OUTPUT

The National 315 System provides output of data through the High-Speed Printer, Paper Tape Punch, or Card Punch.

MAGNETIC TAPE FILE OPERATION

Magnetic Tape is provided for the storage of information to accomplish sequential file updating. It is also used as an interim means of storage in off-line conversion of input to magnetic tape and when "working tapes" are utilized in operations such as sorting.

MAGNETIC CARD FILE OPERATION

One of the most outstanding features of the National 315 System is "CRAM," or the Card Random Access Memory." This revolutionary means of storing data on magnetic cards means that data need not be sorted in order to process it against a file, and the entire file need not be read to update a portion of it. In addition to providing random ability, it will transfer information at an extremely high rate of speed.

CENTRAL PROCESSOR

The National 315 Processor is a general purpose, alpha-numeric electronic digital computer. It contains the magnetic core memory, logic, arithmetic elements and electronic circuits which control the flow of data and all peripheral units.

The Processor memory is of high-speed magnetic core construction and is available from 2,000 to 40,000 12 bit slab memory capacity.

OPERATOR CONTROL

A central Control Console provides supervision of the 315 System. Through the Console, the operator can control the Processor and peripheral units ... observe ... and monitor processing functions. A Console Typewriter provides direct communication with the Processor memory.

AUTOMATIC CHECKING

Numerous internal checks continually monitor the accuracy of the system and guard against incipient malfunction. Typical are the parity and inadmissible character check ... automatic read-back of magnetic tape and magnetic cards as the information is being recorded ... the electronic tests which precede each use of magnetic tape or magnetic cards to ensure that the operator has not inadvertently set switches improperly ... These internal automatic tests are supplemented by the TEST instruction which may be programmed to ensure proper setup of certain units prior to their use. Console switches are designed to protect against inadvertent or improper use, and interlocks are provided on peripheral units to guard against operator error.

315 DATA PROCESSOR
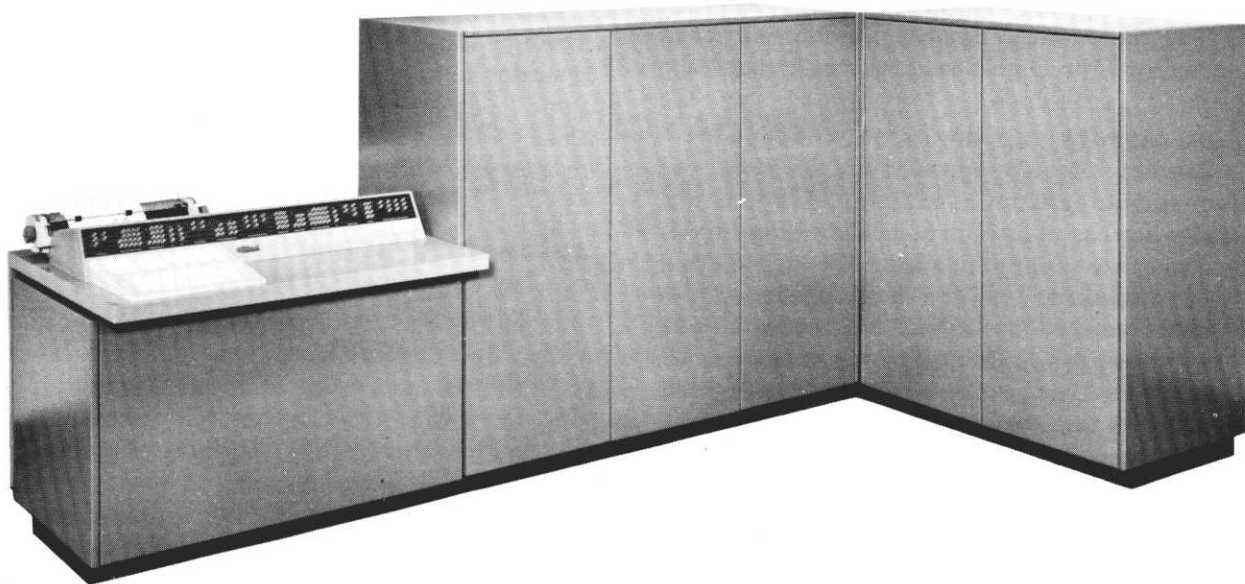
315 DATA PROCESSOR

The National Data Processor is the central control and processing unit in the Electronic Data Processing System. It is a high-speed, alphanumeric computer processor which serves three principal functions: (1) Data Reorganization, (2) Arithmetic Computation, and (3) Control of Peripheral Units.

The Processor contains a high-speed main memory of magnetic core construction and is available in capacities of from 6000 digits to 120,000 digits. The memory provides the storage for the program, or sequential operations, and decisions that are executed to obtain the desired results. The memory is also used for temporary storage of data when received from input, while computing and processing, and prior to writing on magnetic tape or magnetic cards or output to punched media or printed form.

The 315 Processor performs control functions by causing the necessary circuits to align in the proper sequence in order to execute each individual instruction. It also controls the internal flow of data and the transfer of data between the memory and associated peripheral units. Standard arithmetic and logical commands are provided, and in addition, there are specialized business type instructions.

The Processor construction employs printed circuits, transistors, magnetic cores, and other solid-state devices which reduce space, power requirements and air conditioning costs; while at the same time providing greater reliability.

From one to eight magnetic tape handlers can be operating directly on line to the processor, and in addition up to sixteen magnetic card handlers may be on line at the same time, allowing a tremendous file capacity on line to the processor at one time.

With appropriate buffering units, varying combinations of input and output peripherals in different combinations may be controlled from the 315 Data Processor.

315 PROCESSOR SPECIFICATIONS

Alpha-numeric Data Processor operates automatically under stored program control.

    Model 315-1 Basic Processor
    Model 315-2 Bank Processor
    Model 315-3 File Processor
    Model 315-4 Bank-File Processor

Magnetic Core Memory: Basic 6,000 digit memory expandable to 120,000 digit memory.

Basic Cycle Rate: 6 micro-seconds (0.000006/second)

Solid State Design: Transistors, Printed Circuits, Magnetic Cores

Simplified Control Console for system supervision

Single address type of instruction

Double-Stage instructions for the more complex commands

Variable length operands—ability to specify number of slabs

NEAT-315—"Nationals Electronic Autocoding Technique for 315"— and COBOL—automatically translates plain language of the programmer into 315 Processor code

32 Index Registers available to modify instructions according to certain conditions without actually changing the original instruction

32 Special Registers for Link, Jump and Sequence functions

12 bit slab structure—2 alpha-numeric, or 3 numeric digits

Modular construction

Automatic Unit Interrupt Facility under program control

Control over peripheral equipment:

    362-3 Paper Tape Reader
    383-1 Punched Card Reader, Low Speed
    380-3 Punched Card Reader, High Speed
    402   Buffered Magnetic Character Sorter-Reader
    340-3 High Speed Line Printer
    371-3 Paper Tape Punch
    354 Card Punch Buffer
    332-202 Magnetic Tape Handler (24 and 40 KC)
    332-203 Magnetic Tape Handler (24, 40 and 60 KC)
    353 Card Random Access File (CRAM) (100 KC)

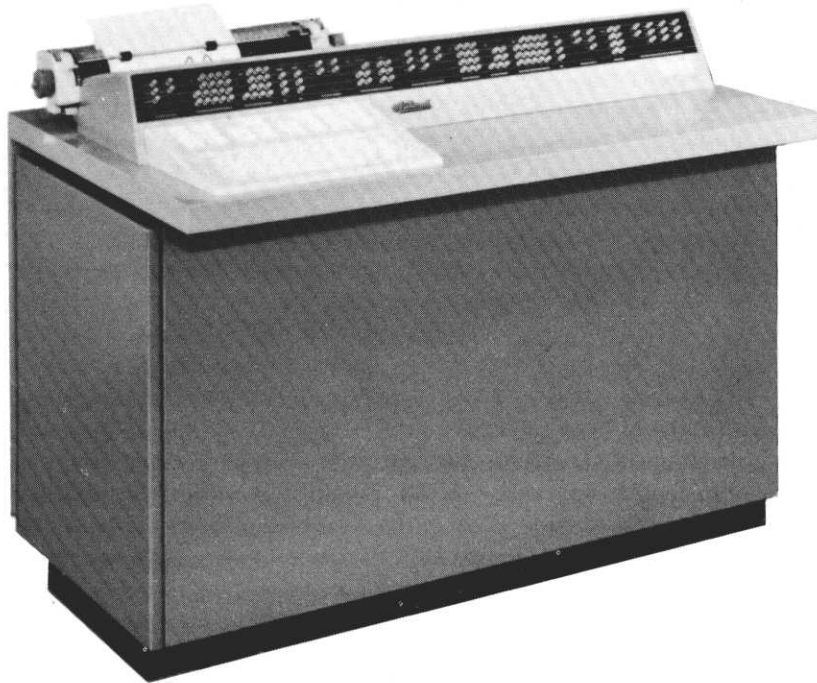Power Requirements: 3.0 KVA @ 110 volt, single phase, 60 cycle

Weight: 1,325 lbs.

Size: Width 105″, Depth 24″, Height 52″

Air Conditioning Required: 1 ton

315 CONTROL CONSOLE

315 CONTROL CONSOLE

The Control Console of the National 315 Electronic Data Processing System enables the operator to centrally control and monitor all processing functions. The panel is designed for simple, efficient supervision and provides only what is necessary for the operator, as the needs of the service engineers have been placed within individual components of the system.

An electric typewriter provides direct communication with the Processor memory. Data can be entered into the memory through the typewriter keyboard. The Processor can transmit data to the typewriter for output through the typewriter printer. Thus, through the Console Typewriter, the operator can interrogate the memory, input programs, and enter instructions to modify a program.

SPECIFICATIONS

Complete Monitoring of entire system

Binary coded decimal display of main memory address

Complete indication of cause of error halt

Direct printout of desired information on console printer

Program modification facility

Single cycle operation ability

Provides facility for entire system monitoring by one person

8 option switches

Human engineering principles of design

Powered from Processor

PUNCHED PAPER TAPE READER

362-3 PUNCHED PAPER TAPE READER

The National 362-3 Punched Paper Tape Reader provides input from punched paper tape at the rate of 1,000 characters a second. The Tape Reader is designed to handle 5, 6, 7 or 8 channel paper tape.

Translation of any code into 315 Code is performed by table lookup between characters, so that reading proceeds at full speed.

The number of input options are unlimited. Tape acceleration is .5 milliseconds. The reader will halt on a single character, after detection of stop code in tape, or under control of the Processor.

Automatic checking circuits are provided for parity check on checkable codes.

PUNCHED PAPER TAPE READER

NATIONAL 315 ELECTRONIC DATA PROCESSING SYSTEM

SPECIFICATIONS

Reads and checks 1,000 characters per second

Type of reading: photoelectric

Types of input:

    5 channel punched paper tape, any code

    6 channel punched paper tape, any code

    7 channel punched paper tape, any code

    8 channel punched paper tape, any code

Number of input options: unlimited

Tape Acceleration: .5 milliseconds

Tape Halt: Stops on a single character

Automatic checking circuits for parity check on checkable codes

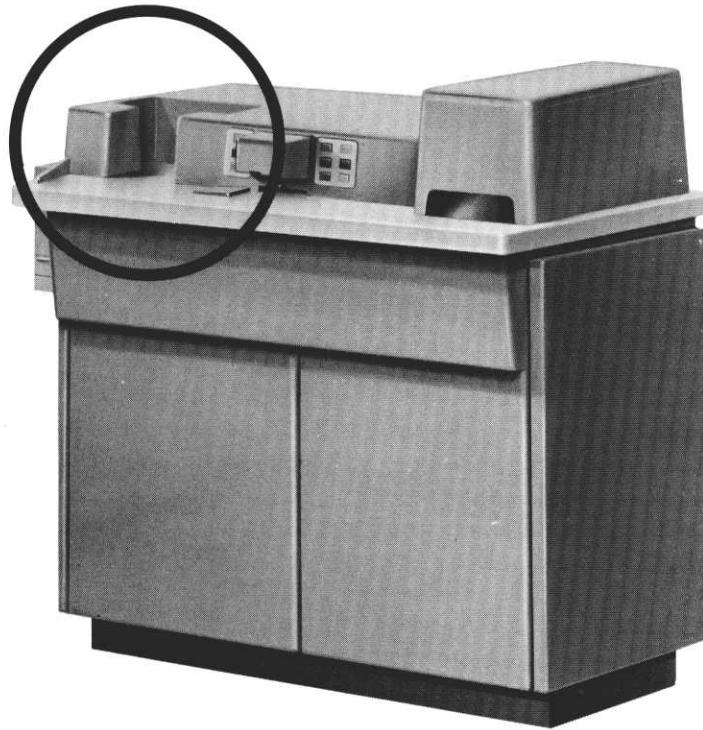Power Requirements: 1.0 KVA @ 110 volts, 60 cycle, single phase

Weight: 250 lbs.

Size: width 43″, depth 24″, height 48″

Air Conditioning Required: ⅓ ton

PUNCHED CARD READER

383-1 PUNCHED CARD READER

The National 383-1 Punched Card Reader provides input from punched cards at a rate of 400 cards per minute.

Conventional punched card code is read by the Card Reader which makes existing card systems completely compatible. Cards are merely placed on the receiving tray where they are moved forward and through the optical reading station one at a time. On leaving the reading station, the cards are ejected into the stacking tray in the same sequence as they were entered. Each tray holds a capacity of 700 cards, and is of a design that permits easy loading and unloading.

Reliability of operation is assured by a column check on card position and a feed check on card transport.

PUNCHED CARD READER

SPECIFICATIONS

Reads and checks all card columns at 400 cards per minute

Type of reading: Photoelectric

Types of input: 80 column cards

Reads a portion, or the complete card

Cards may be read continuously, in batches of any quantity,
    or one at a time

Input and Output Tray Capacity: 700 cards each tray

Complete freedom in reading non-standard punching configurations
    such as binary, multiple-punching, split column, etc.
    Translation into Processor's internal code is performed
    by table lookup between card columns, so that reading
    always proceeds at full speed.

Checking Features: Column check on card position and feed
    check on card transport

Timesharing possible through Demand Interrupt

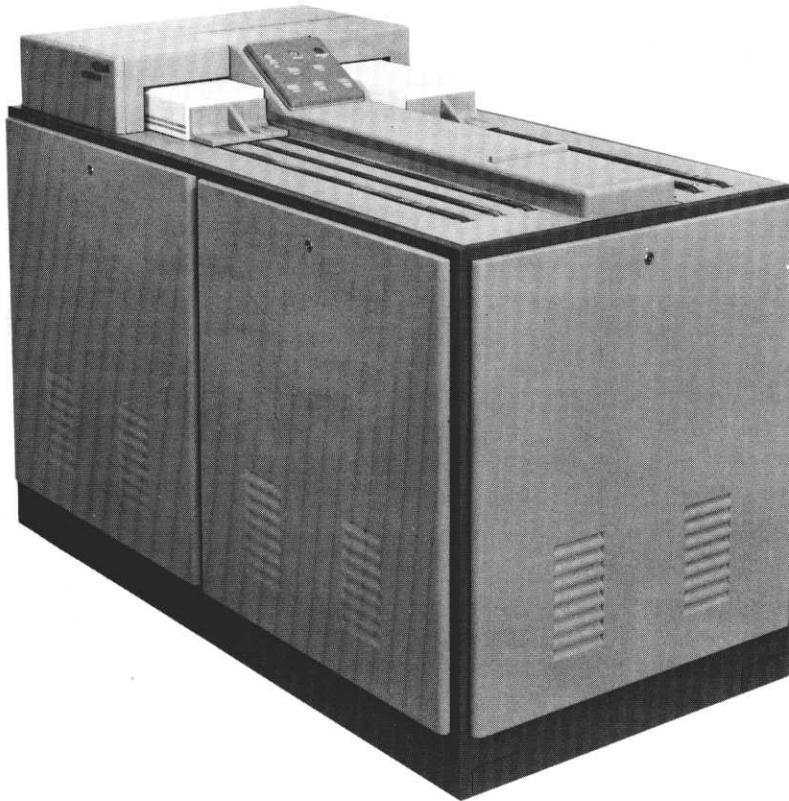Power Requirements: 1.0 KVA @ 110 volt, single phase, 60 cycle

Weight: 250 lbs.

Air Conditioning Requirement: ⅓ ton

Size: Width 43″, Dept. 24″, Height 48″

HIGH-SPEED CARD READER

380 HIGH SPEED CARD READER

The National 380-3 High-Speed Card Reader provides input from punched cards at the rate of 2,000 cards a minute.

Conventional punched card code is read by the Card Reader which makes existing card systems completely compatible. Cards are merely placed on the receiving tray where they are moved forward and through the optical reader one at a time. On leaving the read station, the cards are turned and fed into the output stacking tray in the same sequence as they were entered in the input tray. Each tray holds a capacity of 5,000 cards and its open design, easily accessible to the operator, permits continuous reading by loading and unloading during the operation.

Reliability of operation is assured by column check on card position and a feed check on card transport.

Time sharing is possible through utilization of the Demand Interrupt feature.

SPECIFICATIONS

Reads and checks all card columns at 2,000 cards a minute

Mode of reading:

    Code: 12 bits read directly into processor
memory, one column per slab

    Decode: start with first column, even number
of characters, decode through matrix
in reader.

Type of reading: Photoelectric

Type of input: 80 column cards

Reads either a portion, or the complete card

Cards may be read continuously, in batches of any quantity, or one at a time

Input and Output Tray Capacity: 5,000 cards each tray

Reliability Checks: Column check on card position and feed
check on card transport.

Time sharing possible through Demand Interrupt

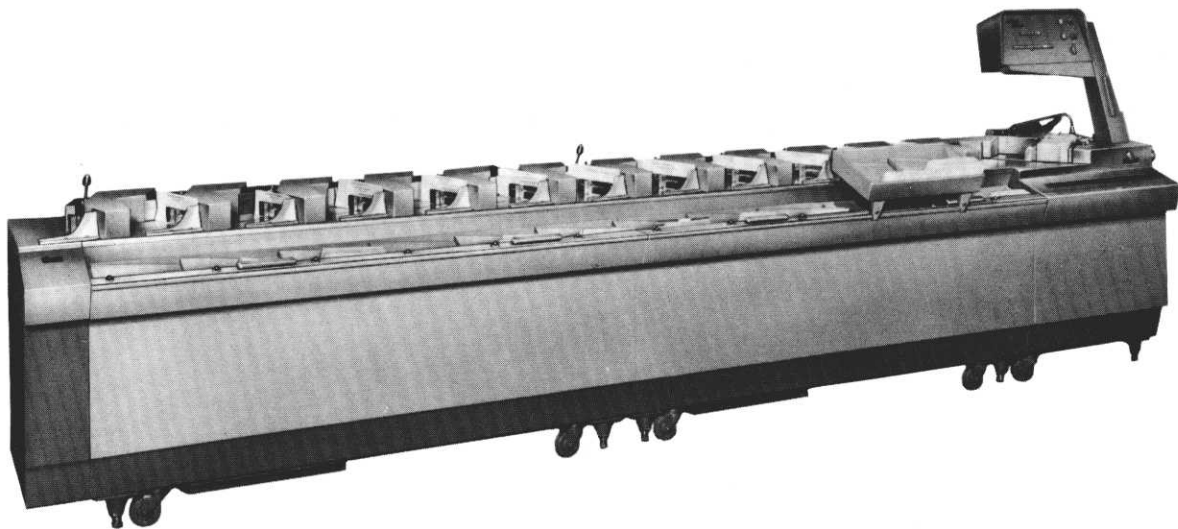Power Requirements: 5.5 KVA, 50 amp/phase, single phase, 110V, 60 cycle

Weight: 1000 lbs.

Size: width 63″, depth 33″, height 42″

Air Conditioning Requirement: 1½ tons

MAGNETIC CHARACTER SORTER

NATIONAL 315 ELECTRONIC DATA PROCESSING SYSTEM

402-1 MAGNETIC CHARACTER SORTER

The Pitney-Bowes National 402-1 Magnetic Character Sorter has a document handling rate of 750 items per minute. It will read and sort inter-mixed documents of various lengths, widths, and thickness. The equipment is designed to read and translate the Type E13B magnetic ink type font.

The Magnetic Character Sorter can operate under control of the Model 315 Processor. It is pro-grammable to sort encoded items on a whole num-ber or block basis in any desired order, as per instructions received directly from the Processor program. Single document or continuous feed con-trol can be accomplished with time-sharing pos-sible between documents, thru use of Demand Interrupt feature. Magnetic characters are read and transferred directly to the memory of the 315 Processor.

There are twelve sorting compartments for the physical separation of the documents . . . one for each digit, zero through 9, one for items that are inadvertently left uncoded or otherwise caused to be rejected, and one special purpose compartment.

SPECIFICATIONS

Reads and sorts 750 items per minute

Will handle all properly encoded documents whose dimensions
are within the following range:

Width dimension:	Minimum 2½″	Maximum 4¼″
Length dimension:	Minimum 5¼″	Maximum 10″
Thickness:	Minimum .003″	Maximum .007″

12 Receiving Compartments—1200 to 1500 documents

Programmable to sort magnetically encoded items on a whole number
or block number basis, in any desired order, as per
Processor program, or on a digital basis as designated
by its control panel

Endorsing feature if desired

Up to four (4) Sorter-Readers may be on-line at one time

Power Requirements: 6.0 KVA at 208/120 wye voltage, 3 phase
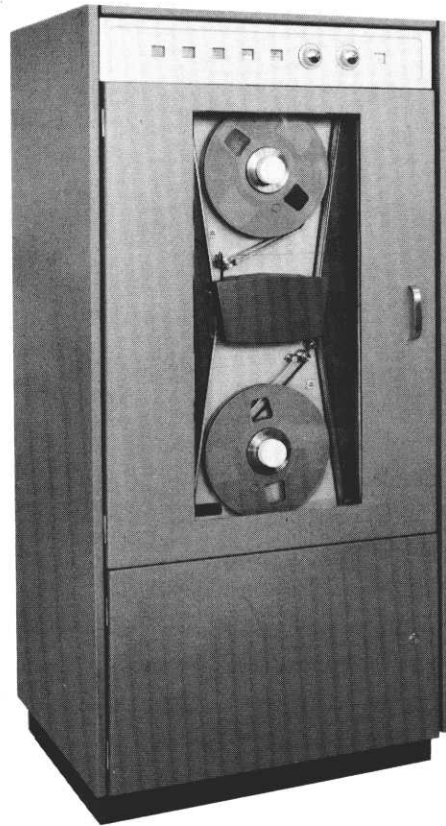
Frequency: 60 CPS, plus or minus 1%

Weight: 2,200 lbs.

Size: Width 180″, Depth 29″, Height 57″

Air Conditioning Requirement: 2 tons

MAGNETIC TAPE HANDLER

NATIONAL 315 ELECTRONIC DATA PROCESSING SYSTEM

332-202 MAGNETIC TAPE HANDLER

Model 332-202 Magnetic Tape Handler—Up to eight Magnetic Tape Handlers under control of Processor. Recording density is 333 alpha-numeric characters per inch with a tape transport speed of 120 inches per second. Data Transfer rate is 40,000 characters a second.

332-203 MAGNETIC TAPE HANDLER

If desired, a recording density of 500 characters per inch providing a data transfer rate of 60,000 characters a second is available, selectively with 40,000 characters per second. This is available on Model 332-203.

Both the 332-202 and the 332-203 Magnetic Tape Handlers have provision for 24,000 characters per second to provide compatibility with IBM Magnetic Tape Systems.

Both models incorporate the simultaneous write-read feature which enables data to be read and verified for correctness immediately after writing. Other automatic checks to insure accuracy and reliability include character parity and record parity checks.

MAGNETIC TAPE HANDLER

SPECIFICATIONS

Data Transfer Rate:

    Model 332-202 24,000 and 40,000 characters a second

    Model 332-203 24,000, 40,000 and 60,000 characters a second

Recording Density:

    Model 332-202 200 alpha numeric characters per inch

                    333 alpha numeric characters per inch

    Model 332-203 200 alpha numeric characters per inch

                    333 alpha numeric characters per inch

                    500 alpha numeric characters per inch

Tape Transport Speed: 120 inches per second

Mode of Recording: variable length records, 2 to 16,000 alpha-numeric characters

Reel Capacity: 3,600 feet per reel, ½″ Mylar, 1 mil

Use Lockout: Optional on rewind
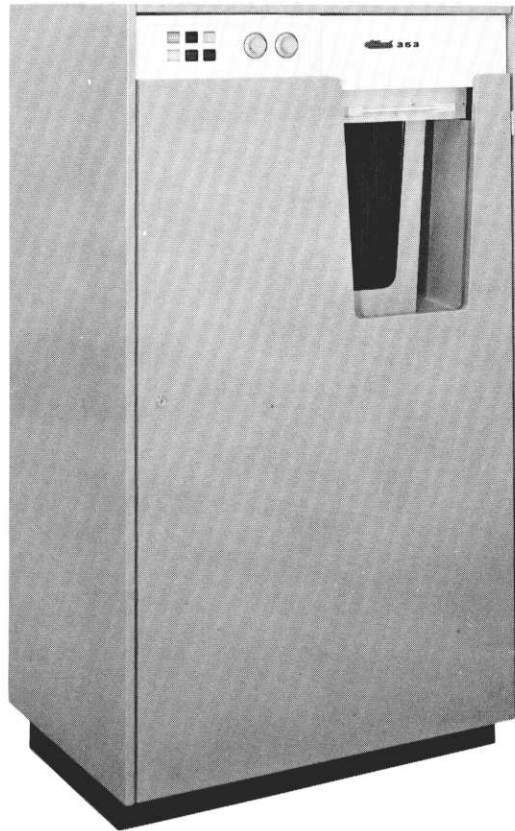
Power Requirements: 2.2 KVA, 110V, 60 cycle, single phase

Weight: 400 lbs.

Size: width 30″, depth 24″, height 60″

Air Conditioning Requirement: ⅔ ton.

MAGNETIC CARD RANDOM ACCESS FILE

NATIONAL 315 ELECTRONIC DATA PROCESSING SYSTEM

353 MAGNETIC CARD RANDOM ACCESS FILE

The National 353 Magnetic Card Random Access File provides for high-speed random processing and is also one of the *fastest sequential file systems available today*. The data recording is done on magnetic cards, 3¼" x 14", each containing seven recording tracks, each track having a capacity of 3,100 alpha-numeric characters. 256 magnetic cards are housed in a removable cartridge, with a total capacity of 5,555,200.

Data is transferred to the processor at the rate of 100,000 alpha-numeric characters per second,

or 150,000 numeric characters per second.

The Magnetic Card Handler is only on-line when receiving a command from the processor, through use of the Unit Interrupt facility.

Up to sixteen Magnetic Card Handlers may be connected to the Processor at one time, permitting up to sixteen Magnetic Card Files accessible with a capacity of nearly 89 million alpha-numeric characters.

Each cartridge can be removed and another inserted in a matter of seconds.

MAGNETIC CARD RANDOM ACCESS FILE

SPECIFICATIONS

Data Transfer Rate:

    Model 353— 100,000 alpha-numeric characters per second

Recording Density:

    Model 353— 250 characters per inch

Type of Recording Medium: $3\frac{1}{4}''$ x 14'' Mylar Card

Number of Recording Tracks: seven

Capacity per track: 3,100 alpha-numeric characters

Number of Cards Per Cartridge: 256

Capacity Per Cartridge: 5,555,200 alpha-numeric characters

Number of Magnetic Card Handlers on-line: up to 16 at one time

Unit Interrupt Facility: when card is in read-write position

Power Requirements: 3.0 KVA, 27 amps/phase, 110V, single phase, 60 cycle

Size: width 35'', depth 24'', height 60''

Weight: 500 lbs.

Air Conditioning Requirement: $\frac{5}{8}$ ton

CARD 117

$$64 \quad +32 \quad +16 \quad \quad +4 \quad \quad +1 \quad = 117$$

Rods set for Card 118
Card 117 cannot drop
because it is held here

1"

12½"   14"

0 1 2 3 4 5 6
INFORMATION TRACKS

½"

3¼"
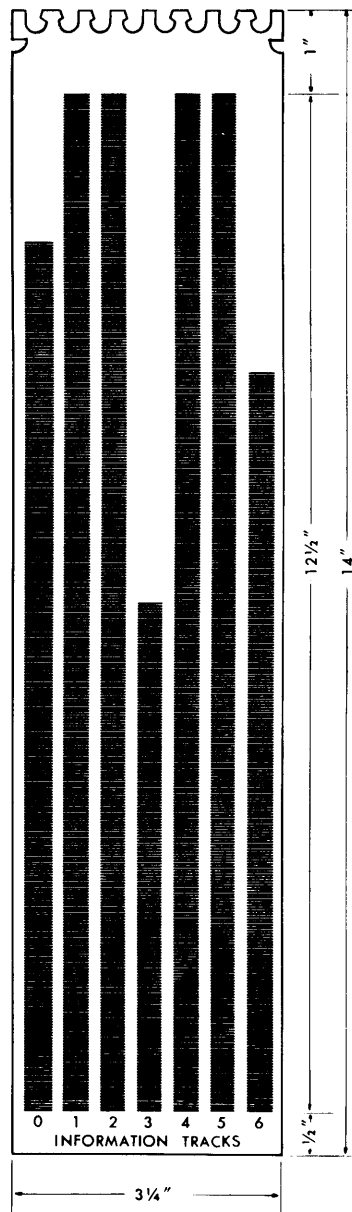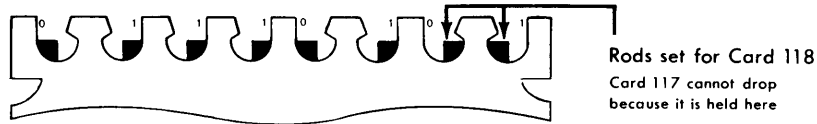
7 Tracks Per Card
3,100 Alpha Characters or
4,650 Decimal Digits Per Track
32,550 Digits Per Card
256 Cards Per Cartridge
8,332,800 Decimal Digits Per Cartridge

RODS

256 CARDS

GATE CLOSED

GATE OPEN

DRUM

READ

WRITE
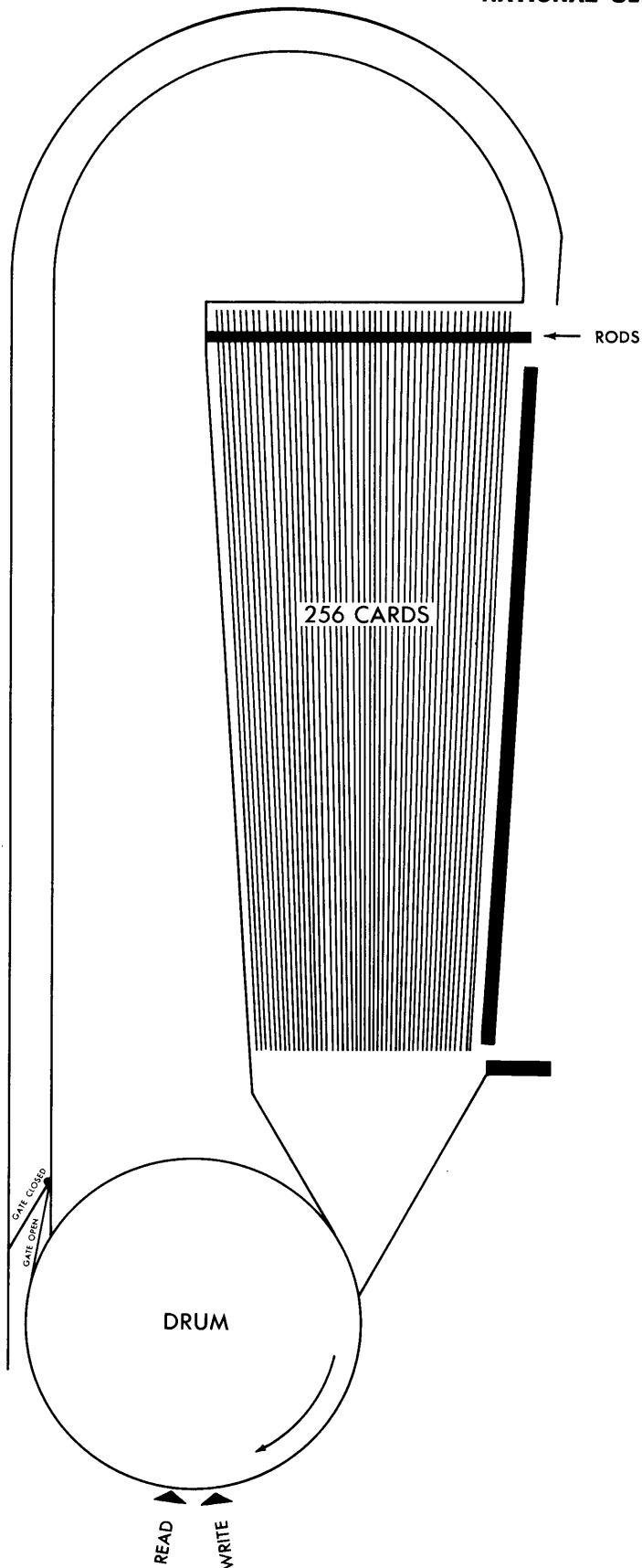
A deck of 256 magnetic cards hang from 8 electronically controlled rods. The rods can be positioned to drop any one of the uniquely notched magnetic cards.

Once dropped from the rods, the magnetic card wraps around a revolving drum. The card rotates over 7 write-read heads that permit reading or recording data at the rate of 100,000 characters or 150,000 digits per second.

Upon completion of the reading and recording, the gate to the raceway opens and the card is automatically returned to the rods through a tunnel of moving air.

ORGANIZATION OF DATA ON CRAM CARDS

NATIONAL 315 ELECTRONIC DATA PROCESSING SYSTEM

Card Random Access Memory (CRAM) has the ability to access or store data in different, independent file areas. The types of independent file areas that can be established with CRAM are illustrated below.

INDEPENDENT FILE AREAS WITH MULTIPLE CRAM UNITS

FILE AREA #1	FILE AREA #2	FILE AREA #3	FILE AREA #4
CRAM #1	CRAM #2	CRAM #3	CRAM #4
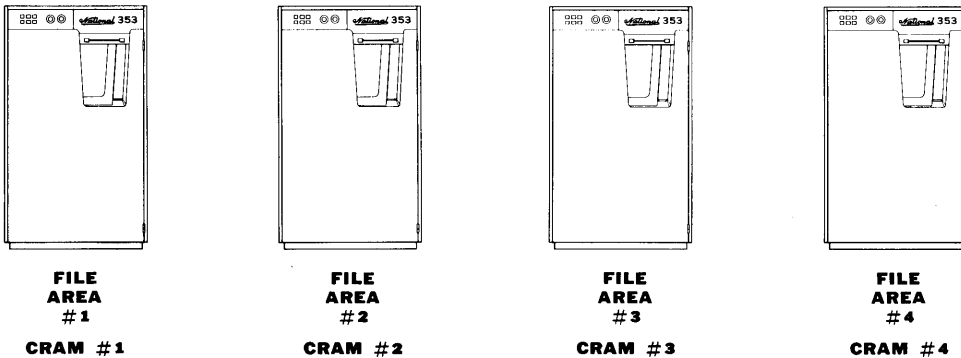
Up to 16 independent CRAM file areas.

INDEPENDENT FILE AREAS WITHIN A SINGLE CRAM CARTRIDGE

FILE AREA #1	FILE AREA #2	FILE AREA #3	FILE AREA #4
CARDS NO. 00-63	CARDS NO. 64-127	CARDS NO. 128-191	CARDS NO. 192-255
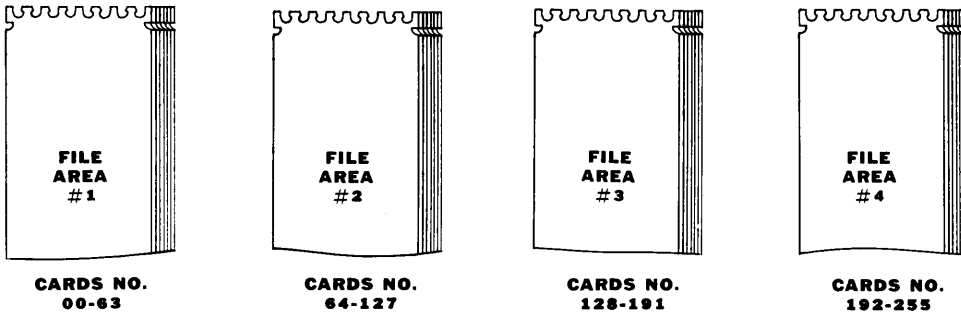
A CRAM cartridge can be divided into any number of independent file areas. Each Cram card could store a different type of data.

INDEPENDENT FILE AREAS WITHIN A SINGLE CRAM CARD

FILE AREA #1	FILE AREA #2	FILE AREA #3	FILE AREA #4
CHANNEL 0-1	CHANNEL 2-3	CHANNEL 4-5	CHANNEL 6
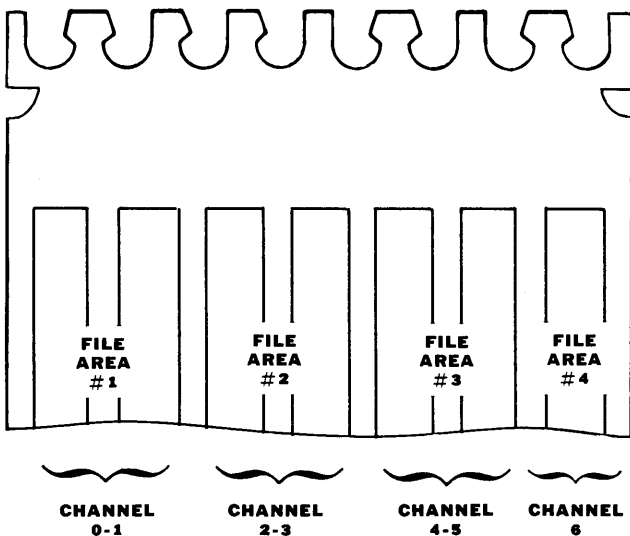
Each of the seven channels could be an independent file area, storing a specific type of data.

ORGANIZATION OF DATA ON CRAM CARDS

A single CRAM can provide four independent file areas for merging items in a sort routine.

FILE AREA #1

FILE AREA #2

FILE AREA #3
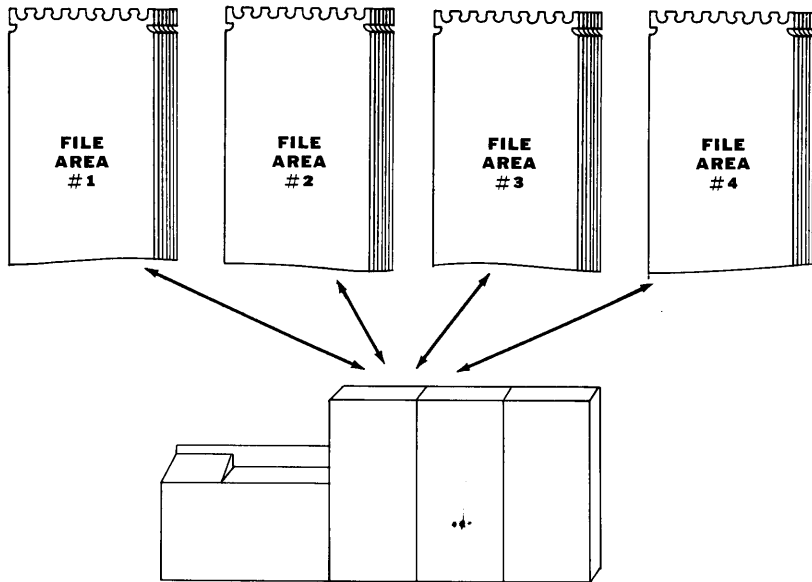
FILE AREA #4

Sorted strings from file areas #1 & 2 are merged and written out alternately to file areas #3 & 4. File areas #3 & 4 are then merged and written out alternately to file areas #1 & 2. The size of the sorted string doubles with each merge. The merging of items from two areas and the writing out to two other sections continues until all items are sorted into a single string.

A single CRAM can provide independent file areas for all the data necessary in an updating routine.

CURRENT TRANS. DATA

MASTER FILE DATA

REPORT DATA
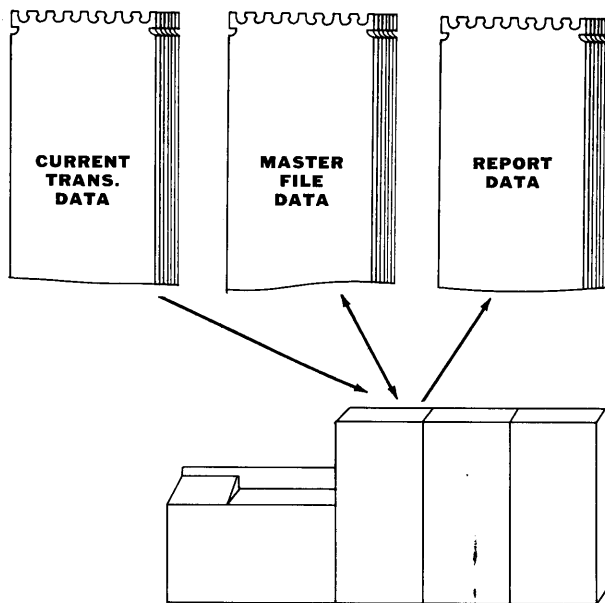
Current transaction information can be read into memory and used to update master file data stored within the same CRAM unit. As report information is generated it will also be stored within the same Cram unit.

The above are only examples of the various types of data that can be stored within a single cartridge of cards. It illustrates the power of a single CRAM to perform many processing routines that normally require multiple magnetic tape handlers.

HIGH-SPEED LINE PRINTER
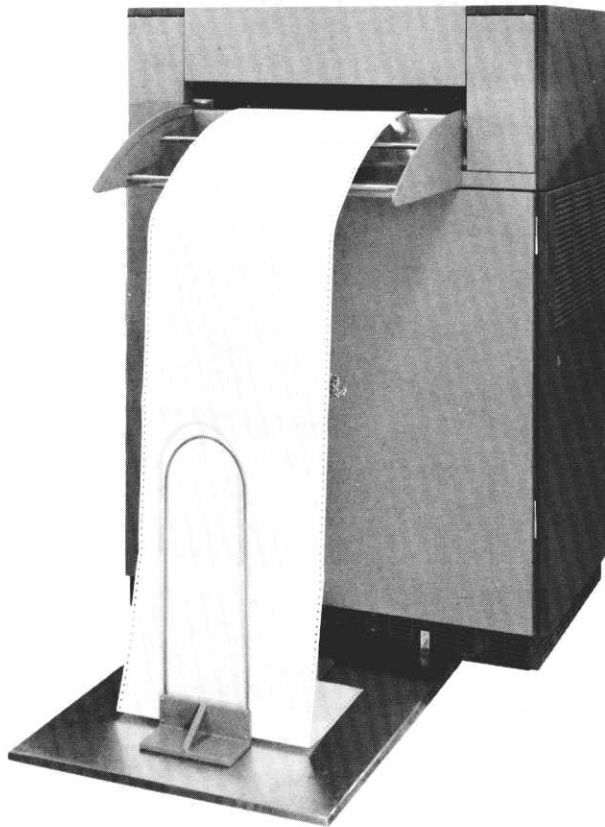
340-3 HIGH-SPEED LINE PRINTER

The National 340-3 High-Speed Line Printer provides printed output at the rate of 680 alphanumeric lines per minute, or 900 numeric lines per minute.

Since the production of some records or reports require the skipping of many lines, the 340-3 Printer has the time-saving ability to skip vertically between print lines at the rate of 5,040 lines per minute, regardless of the number of lines. The control of skipping is accomplished by either program control, or by means of a punched tape-control-loop on the Printer.

Interrupt feature for optimum time sharing is a part of the 340-3 Printer, allowing processing time to be shared between print cycles.

A Model 344 Multiple List Attachment is available permitting a Printer to operate as three (3) independent listers with separate paper transports on each.

Multiple carbon copies are available.

HIGH-SPEED LINE PRINTER

SPECIFICATIONS

Print Speed: 680 alpha-numeric, or 900 numeric lines per
minute, 120 characters per line

Number of characters: 56 on each of 120 print wheels

Size of forms: Four to 22 inches wide, continuous form, printed or plain

Paper Feed: 5,040 vertical lines per minute, regardless of number of lines

Vertical Format: Varied by program or plastic loop

Multiple Copy: Original and five copies

Reliability: Provision for checking of acceptable characters.

Time Sharing: Interrupt Feature allows for maximum time-sharing

Multiple List: Model 344 Multiple List Attachment permits a
printer to operate as three (3) independent
listers with separate paper transports on each

Power Requirements:

2.5 KVA, 23 amps/phase, 110V, single phase, 60 cycle

344 Multi List Paper Feed attachment requires an additional 1.5 KVA

Weight: 1000 lbs.

Size: width 80″, depth 24″, height 52″

Air Conditioning Requirement:

340 Printer: 1 ton

344 List Attachment: ½ ton

PAPER TAPE PUNCH
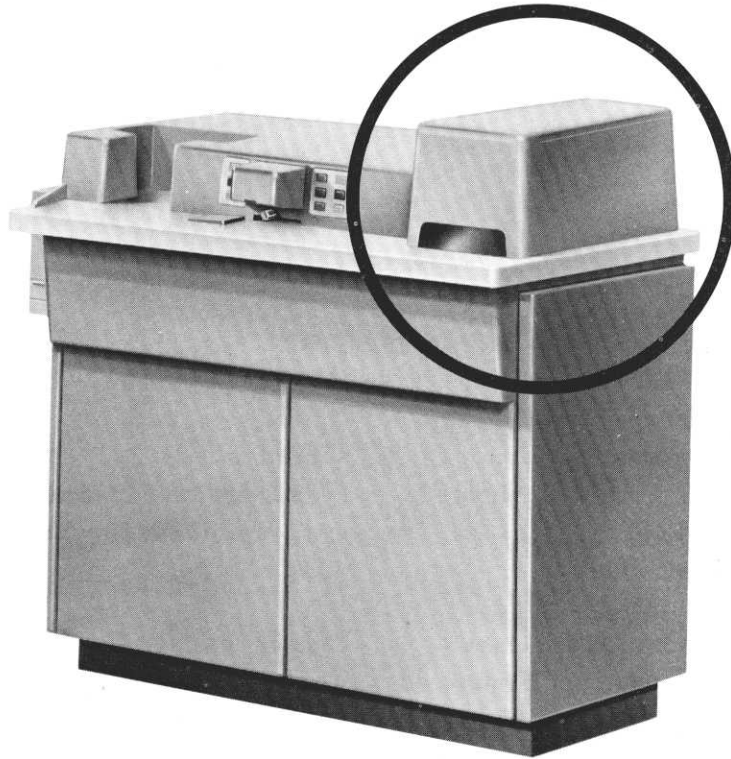
371-3 PAPER TAPE PUNCH

The National 371-3 Paper Tape Punch provides output of data from the 315 Electronic Data Processing System in the form of punched paper tape.

Any code may be output. This flexibility provides system compatibility and communication with external system requirements involving paper tape reading equipment.

Alpha-numeric data can be punched in paper tape at the rate of 110 characters per second.

Punching density is ten characters per inch.

SPECIFICATIONS

Paper Tape punching speed: 110 characters per second

Output Codes: Unlimited

Punching Density: 10 characters per inch

Automatic Checking Circuits for reliability

Power Requirements: 1.0 KVA, 9 amps/phase, 110 volt 60 cycle single phase

Weight: 250 lbs.

Size: width 43″, depth 24″, height 48″

Air Conditioning Requirements: ½ ton

CARD PUNCH BUFFER

354 CARD PUNCH BUFFER

The National 354 Card Punch Buffer provides output of data from the 315 Electronic Data Processing System in the form of punched cards.

The punched card output is in the format of the 80 column card.

The Card Punch Buffer controls the 100 a minute Card Punch, or the 250 a minute Card Punch.

The unit buffer provides automatic program interrupt.

Up to four (4) punching units may be on-line at any one time with the processor. There may be an inter-mix of printers and card punches on-line up to four at any one time.

CARD PUNCH BUFFER

SPECIFICATIONS

Card Punching Speed: 100 cards per minute

250 cards per minute

Output Code: 80 column card code

Auto Interrupt Facility: permits maximum time-sharing

Multiplexing: Up to four card punches or printers may be used on-line with processor at one time

Power Requirements: 0.5 KVA 5 amps/phase, 110V 60 cycle single phase

Weight: 600 lbs.

Size: width 43″, depth 24″, height 52″

Air Conditioning Requirement: ⅓ ton

435-2 INTERCONNECTING DEVICE

The 435-2 Universal Interconnecting Device is designed for use with multiple 315 Systems where it is desirable to switch peripheral units from one System to another. Any unit which is to be switched between Systems must be cable connected to the 435-2 Interconnector. A maximum of three peripheral units other than magnetic files, may be switched between systems by one 435-2 Interconnecting Device. It requires one module to switch one 315 peripheral unit between Systems.

When switching magnetic files (353 or 332) between Systems, it is possible to switch an entire trunk line or up to eight magnetic files with one module.

Switching is done automatically by solenoid operated switches which are actuated by pushbuttons located on the console panel of the 435-2 unit. No cables need to be manually shifted.

The 435-2 Interconnecting Device is available in one, two or three module units.

SPECIFICATIONS

Models Available:

    435-201 (1 Module)

    435-202 (2 Modules)

    435-203 (3 Modules)

Power Requirements: .05 KVA at 120 volts, single phase, 60 cycles

Weight: 100 lbs.

Size: width 30″, depth 24″, height 26″

Air Conditioning Requirements: none

SECTION A — 315 GENERAL TERMS, CONDITIONS AND POLICIES

BASIC LEASE

The basic rental period shall be a minimum of one (1) year. The basic monthly rental for any component may be increased by National, to National's then current rates, at any time after the expiration of the initial term, provided National gives the user at least ninety (90) days written notice of such increase.

In the event National makes a general reduction in the basic monthly rental of the National 315 System or components, the basic monthly rental, as specified, shall be reduced, to the extent applicable, beginning the first calendar month following such reduction.

The basic monthly rental during the first thirty (30) calendar days of operation of the system shall be 1/176th of the basic monthly rental, multiplied by the hours of actual use or the basic monthly rental, whichever is the smaller amount. This optional method of determining the basic monthly rental for the first thirty (30) days shall not apply to components subsequently added to the system.

TERM

The initial term of rental shall be a pre-determined period, and shall continue thereafter until terminated by the user or National. Either party may terminate the agreement at the end of the initial term, or at the end of any calendar month, thereafter, provided written notice of such termination is given to the other party at least ninety (90) days in advance.

DELIVERY

National will make the best effort to deliver according to schedule, but will not be liable for any damages if this schedule is not met.

USE OF SYSTEM

The basic monthly rental entitles the user to the use and service of the system during the prime shift. "Prime Shift" shall mean the period designated by the user as its primary period of system use and shall consist of eight (8) continuous hours each day scheduled by the user for any five (5) days each week, Sundays and holidays excluded; provided National is given written notice of such schedule at least thirty (30) days in advance. The eight (8) continuous hours each day may be interrupted by a one (1) hour meal period.

The user may also schedule additional shifts which shall be subject to the charges set forth below. "Additional Shift" shall mean a period of either four (4) or eight (8) continuous hours in any one day scheduled by the user in accordance with clause (a) under "Charge for Use and Service Outside Prime Shift"; provided National is given written notice of such schedule at least thirty (30) days in advance, and such schedule is for not less than one (1) calendar month. Any additional shift consisting of eight (8) continuous hours each day may be interrupted by a one (1) hour meal period.

In addition to the above, during the first one hundred eighty (180) days of the term, the user shall have the right to unlimited use of the system outside the prime shift and on an occasional or random basis thereafter, without scheduling such use with National and without charge. This does not entitle the user to service during such periods of use. In the event service is requested by the user, it shall be furnished at the charges specified in (b) and (c) below.

The user shall make the system available to National at mutually convenient scheduled times for the purpose of performing preventative maintenance.

CHARGE FOR USE AND SERVICE OUTSIDE PRIME SHIFT

(a) Additional shifts—regular shift usage and service scheduled monthly in advance.

—2% of the basic monthly rental to add an additional 4 hour shift on a sixth day of every week, Sundays excluded.

—2.75% of the basic monthly rental to add an additional 4 hour shift on Sunday of every week.

—3% of the basic monthly rental to add an additional 8 hour shift on a sixth day of every week, Sundays excluded.

—4% of the basic monthly rental to add additional 8 hour shift on Sunday of every week.

—10% of the basic monthly rental to add an additional 4 hour shift to each of the five days of the prime shift.

—15% of the basic monthly rental to add an additional 8 hour shift to each of the five days of the prime shift.

(b) Other usage and scheduled service.

The user shall have the right to unlimited use of the system during the first one hundred-eighty days of the term of this agreement and on an occasional or random basis thereafter. The user shall also have the right to request service coverage during such periods of use by giving National twenty-four (24) hours advance notice. National shall provide such service at an hourly

charge of $1.50 per $1,000.00 and major fraction of $1,000.00 of the basic monthly rental, or $12.00 per hour, whichever is greater, exclusive of Sundays and holidays. On Sundays and holidays, the hourly charge shall be $3.00 per $1,000.00 and major fraction of $1,000.00 of the basic monthly rental or $24.00 per hour, whichever is greater.

(c) Emergency unscheduled service.

National shall use its best efforts to provide service during any periods of use when service has not been scheduled. The charges shall be $18.00 per man-hour, excluding Sundays and holidays and $24.00 per man-hour for Sundays and holidays with a minimum charge of two hours per man. The service time shall include travel time to and from the site.

SUPPLIES

Monthly rental charges do not include payment for supplies. National agrees to sell to user at its then current established prices and upon its regular invoice terms, supplies such as ribbons, magnetic tapes and paper tapes, for use on the system.

PAYMENT

The basic monthly rental and any additional use and service charges shall be billed on a calendar month basis. The basic monthly rental shall be billed monthly in advance and any additional use and service charges shall be billed monthly as accrued. Basic monthly rental charges for fractional parts of a calendar month shall be computed at the rate of 1/30th of the monthly charge for each day of such fractional part of the calendar month.

TRANSPORTATION CHARGES

The user shall pay transportation charges on all shipments to the place of use, f.o.b. place of manufacture, including rigging and drayage at the place of use. Upon expiration of the term of this agreement the user shall pay transportation charges back to the factory of National at Dayton, including rigging and drayage at the place of use. National shall provide transit insurance. All shipments shall be made in accordance with specifications of National.

SITE PREPARATION

The user shall furnish prior to delivery of the system and at its own expense, adequate space, air conditioning, humidity control and regulated electrical power in accordance with specifications of National. National shall advise user in planning and laying out the site and shall supply user with specifications for the site in ample time to permit user to have the site prepared prior to delivery of the system. The user shall provide at the site, adequate and suitable working facilities and space for maintenance personnel.

CABLES

National shall provide one set of cables for the immediate computer area. In the event that the user shall require cables for the printer and/or sorter of more than twenty feet in length, National shall supply the same at user's expense.

TRAINING PERSONNEL

National, at no charge to the user, shall provide training for an adequate number of operating and programming personnel for the user. Up to the date of installation, such training shall be conducted at Dayton, or at the user's site at the user's option. After the date of installation such training shall be conducted at a place to be agreed upon by National and the user. The training shall include the staff the user selects to program and operate the system and any additional staff that may be needed for any subsequent addition to the system. The user shall have the right, without charge, to send replacement personnel resulting from normal turnover to any training school established by National for training purposes.

PROGRAMMING SUPPORT AND DIRECTION

A representative of National will be assigned to assist and direct user's programming and systems personnel as necessary. Additional assistance such as mathematicians shall be available for consultation with user as needed.

PROGRAM TESTING

National shall provide the user with time on a National 315 Electronic Data Processing System, for the purpose of testing the user's programs, in the amount of ten (10) hours per $1,000.00 of the basic monthly rental and at no charge for such use. In the event all of such time is not used prior to the date the system is certified by National as ready for use, the user may use the remaining time during the first thirty (30) days of the term of this agreement. Such program testing time used prior to the date the system is certified as ready for use shall be scheduled at the convenience of both National and the user. In the event the user requires more testing time than provided above, National shall make time available to the user at the regular rate charged therefore by National's Data Processing Centers.

National shall also furnish to the user, without charge, operating service and utility routines for the system including all new routines becoming available during the term of this agreement.

RISK OF LOSS

National shall assume all risks of physical loss or damage to the system during the term hereof because of the elements, fire, explosion, theft,

attempted theft or other cause, with the exception of the negligence of the user, its agents, servants or employees. In the event of such loss or damage not due to the negligence of the user, its agents, servants or employees, the user's liability for further rent shall be abated during the time necessary for National to repair or replace the system and the term of this agreement shall be extended for a like period.

LIABILITY FOR INJURY OR DAMAGE

National shall not be liable for any claim, demand, action, cause of action, liability or damages arising out of injury to the person or damage to the property of (1) the user, (2) employees of the user, (3) persons designated by the user for training, or (4) any other person, other than agents or employees of National, designated by the user for any purpose, prior to or subsequent to acceptance, delivery, installation and use of the System either at National's site or at the user's place of business, provided that any said claim, demand, action, cause of action, liability or damage arises out of, or in connection with, use of the System and is not caused by National's negligence. In the event National should be negligent with respect to the system, its liability, therefor, shall be limited to damages caused directly by such negligence and in such event National shall not be liable for consequential or special damages.

FEDERAL EXCISE TAXES

The monthly rental does not include any provision for the Federal Manufacturer's Excise Tax imposed upon the sale or rental of business machines, and in the event the Internal Revenue Service, by appropriate ruling, determines, or it is otherwise determined, that all or any part of the components leased hereunder are subject to such tax, the monthly rental paid, or to be paid hereunder, shall be appropriately adjusted to permit National to recoup any such tax which may be levied against National upon rentals received.

STATE SALES, PROPERTY, USE AND GROSS RECEIPTS TAXES

National, as the legal owner, shall pay all personal property taxes levied on the system; however, the rentals hereinabove specified are without consideration of any sales, use or gross receipts taxes imposed on the rentals or use and the user hereby agrees to pay said taxes, if any, in addition to said rentals.

In the event the monthly rental is increased because of excise, sales, use or gross receipts taxes, such increase shall not be added to the basic monthly rental when computing the charge for extra shifts of usage and service.

ASSIGNMENT

The user shall not assign or otherwise transfer this agreement, transfer or sublet the system or components thereof, or permit its removal from the premises where originally delivered and installed without the written approval of National; provided, however, that nothing herein contained shall prohibit the user from using the system to perform services for its customers.

MODIFICATIONS AND ALTERATIONS

The user shall not make any modifications or changes to the system or any component thereof without the prior written approval of National. National agrees to make available any new components developed for the 315 System at the release price of the new components, provided the components are compatible with the user's system.

GENERAL PROVISIONS

(a) If the rentals due hereunder shall be in default thirty (30) days after payment is due, or if a petition in bankruptcy shall be filed by the user, or if the user shall be adjudged a bankrupt or insolvent by any court, or if a receiver or trustee in bankruptcy or a receiver of the property of the user shall be appointed in any suit or proceeding brought by or against the user, or if the user shall make an assignment for the benefit of creditors, or if this agreement shall by operation of law pass to any person other than the user, or if the user shall assign or otherwise transfer this agreement, transfer or sublet the system or components thereof, or permit its removal from the premises where originally installed without a written approval of National, then, and in each and every instance, if such shall continue for fifteen (15) days after written notice thereof by National to the user, National shall have the option to terminate this agreement by giving written notice to the user, and shall have the right to immediate possession and removal of the system and components thereof, and the term hereby granted shall cease, determine and come to an end without prejudice to any remedies which might otherwise be used. The title to the system and components thereof shall remain in National during the term of this agreement and thereafter.

(b) All drawings, diagrams, specifications and other material furnished by National and relating to the use and service of the system, including the information contained therein, shall remain the property of National and may not be reproduced or distributed in any way except with the written permission of National. The user further agrees to receive in confidence all information relative to the design details, operating characteristics and/or coding systems supplied directly

or indirectly by National; provided that if the user shall use reasonable effort to maintain such confidence, consistent with the effort which it employs with respect to preservation of its own confidential information, or if such confidential information is disclosed pursuant to judicial or governmental action, the user shall not be liable for any disclosures nevertheless resulting. It is agreed that this restriction shall not apply to any information that may be established to be in the public domain.

SECTION B — NATIONAL'S INTEGRATED CUSTOMER SERVICES

A user of National Electronic Data Processing equipment is entitled to a wide range of Integrated Customer Services in order to provide for the best possible installation and continued operations. There are four main areas of assistance which are included in the Customer Support area—Training, Programming Research, Customer Support, and Site Preparation. These services are furnished without charge. The other associated services which fall outside the Customer Support function are maintenance, supplies, and back-up services of National's Data Processing Centers.

TRAINING

Basically, five instruction courses for data processing personnel are offered to customers of National Data Processing Systems. These courses are designed for all levels of data processing experience. These courses are further designed to efficiently handle any particular configuration of equipment as specified by an NCR customer.

One of three initial courses may be elected by an NCR customer for their basic programming course. These options are all three-week basic programming schools. The emphasis in these schools is based on the following programming systems (1) Elementary Assembly System, (2) Advanced Assembly System, (3) COBOL. Option one is recommended for those users of very basic card or paper tape input-output systems. Option number two is for those customers desiring to program in an assembler-compiler medium. Option three is strongly recommended by National as it has strived diligently to make its version of COBOL as efficient as possible. Even when a course is based on COBOL the assembly languages and control systems are discussed to the point of the students having a working knowledge of them.

All programming schools are based upon a maximum amount of class participation. Each school is designed on a building-block pattern that will allow the students, regardless of their previous background, to start from the very basic concepts of a computer and data processing and to be able eventually to design and program a very large systems problem.

A one-week COBOL school is offered for those customers of both a 304 and 315 nature that either did not desire to have COBOL taught to them during the initial phase of their installation or who wish to have other persons become familiar with COBOL and yet not actually become intimately familiar with either the 304 or 315 Data Processing Systems.

One of the above mentioned courses will be offered to each National customer on that customer's site unless said customer should be located in one of the major cities of the United States in which National runs a continuous curriculum of schools in one of its field education centers. In this case their schooling would be conducted at that center. Any of National's customers may attend as many of these schools as they desire in any of the field education centers mentioned.

Additional courses can be arranged for executive orientation and covering those areas where it is felt that additional instruction is warranted.

These classes, and all classroom materials, manuals, forms, etc. are provided free of charge to National's customers.

A full complement of manuals exists for programming National systems as well as covering the various standard routines (tape housekeeping, PACE*, SORT, Libraryn, NEAT*, COBOL, etc.).

SITE PREPARATION

Another area of customer service is Site Preparation. A staff of engineers is available to assist customers in preparing the physical environment for their National EDP System. When a National Data Processing System is purchased or leased, an NCR Planning Engineer will consult with the customer until the site is completed and the system installed. Some of the major responsibilities of the Planning Engineer are to:

*Service Mark

Assist in arranging a proper layout for the various component units to achieve maximum operating efficiency.

Provide the necessary information, specifications and prints required to produce the engineering drawings for architectural, electrical and air conditioning changes.

Make a periodic review of engineering drawings until they are completed.

Make a periodic inspection of actual site construction with a final inspection upon completion.

Maintain continuous liaison with the customer's Data Processing Co-Ordinator.

In addition to these services a detailed Site Preparation Manual containing diagrams, illustrations, and charts is furnished. The information contained in this Manual will prove extremely valuable in the preparation and maintenance of a site for a National EDP System.

CUSTOMER SUPPORT

Still another area of service to National's customers is the activity known as Customer Support. This all-important function provides liaison between the customer and the various necessary functions and departments of The National Cash Register Company. The Customer Support representative's services are available until the system is well established as an integral part of the customer's operations.

The Customer Support representative is available to review, assist, and make recommendations to the customer regarding his programming techniques, systems approach, debugging procedures, etc. He will also answer technical questions about the Central Processor or peripheral equipment and can serve as an "on-the-spot" programming instructor supplementing the Dayton Training Staff. The Customer Support representative also aids in the preparation of a site for the National EDP System.

PROGRAMMING RESEARCH

NCR has mounted a continued and sustained effort in the area of Programming Research. The goal of simple, straightforward, and intelligible programming systems has always been foremost in NCR computing systems. NEAT (National's Electronic Autocoding Technique), developed and now operating with National Data Processing Systems, is a system of proven merit and universal acceptance among users.

In addition to developing NEAT, the Programming Research Staff has also developed such standard routines as Sort, Tape Utility, Libraryn, and specialized scientific routine to name just a

few. These routines are available to all users of National Data Processing Systems.

Work is proceeding on an English Language Translator of the COBOL type. The COBOL language will provide English language coding which is simple, straightforward, and compatible with translators currently being prepared for many computing systems. National is well along in providing efficient mechanization of this language, both within the translator itself and in the object program being produced.

SUPPLIES

Supplies are an associated area of Customer Service. All supplies necessary for the operation of National Electronic Data Processing System can be purchased from NCR. If desired, NCR will provide the specifications so that the materials may be obtained from other sources of supply.

While National does not manufacture magnetic tape, the specifications listed for our suppliers require that the tapes they supply must meet the highest requirements. If even so much as one bit of data is dropped from a 3600 foot reel of tape, the tape is rejected. All magnetic tapes are tested at our factory on production tape handling units before being released for customer usage.

EQUIPMENT MAINTENANCE

Maintenance is still another area of National's Integrated Customer Services. When a National Electronic Data Processing System is purchased, a yearly maintenance contract is available. This contract provides the services of qualified technicians who will render preventive and corrective maintenance. When a system is leased, the cost of maintenance is included in the lease price.

NATIONAL DATA PROCESSING CENTERS

NCR's own Data Processing Centers are available for use by our customers to round out the Integrated Customer Services field. Processing time is provided to allow check-out and debugging of customers' routines prior to delivery of their own system. The Data Processing Centers can be called upon to provide back-up service whenever required. During "peak-periods," the Data Processing Centers can be used for off-line conversion or many perform some actual processing to help level the peak. During busy periods when it is not convenient for the customer to use his own system because of scheduling requirements, the Data Processing Centers can provide time to implement debugging and development of new programs. Should it become desirable for the customer to expand his system, the Data Processing Centers can carry the work load during the conversion period.

SECTION C — 315 SITE PREPARATION DATA

I. INTRODUCTION

When the 315 Data Processing system is purchased or leased, an NCR Planning Engineer will consult with the customer until the site is completed and the system is installed. Some of the major responsibilities of the Planning Engineer are to:

1. Provide technical assistance for site selection.
2. Assist in arranging the 315 units to achieve maximum operating efficiency and facilitate maintenance.
3. Provide specific design conditions (environmental) required for the 315 units.
4. Submit recommendations and suggestions for Architectural, Electrical and Mechanical layouts.
5. Review Engineering Drawings when they are completed.
6. Be available for consultation during actual site construction and make a final inspection upon completion.
7. Determine specific delivery requirements for the particular installation.
8. Maintain continuous liaison with the customer's Data Processing Coordinator.

II. PLANNING SCHEDULE

The installation of a 315 Data Processing system requires careful, long-range planning. No simple formula exists for creating a schedule that world be applicable to all installations. However, the suggested schedule outlined below should be reasonably adhered to if costly "crash basis" situations are to be avoided. Note: The lead times specified below are in reference to the scheduled delivery date of the 315 system at the customer's site.

Eleven Months:
1. Preliminary consultation between NCR Planning Engineer and the customer to study and evaluate the various site locations that are available.
2. Site Preparation manual made available to customer.

Ten Months:
1. Site location selected.
2. Group meeting between NCR Planning Engineer and customer to discuss material contained in the Site Preparation manual.

Eight Months:
1. Required architectural changes defined.
2. A tentative layout of the 315 units should be agreed upon by the customer and NCR.

3. Work initiated on the Engineering Drawings required for complete site alterations. That is, Architectural, Electrical and Mechanical (Air Conditioning).

Six Months:
1. All Engineering Drawings should be completed and reviewed by the customer and the NCR Planning Engineer.
2. Customer should review delivery quotations on such major items as air conditioning equipment.

Five Months:
1. Material lists and supporting specifications completed.
2. Physical alteration of Data Processing Center should be started or in progress.

Four Months:
1. Control cables will be ordered by the NCR Planning Engineer in accordance with the finalized layout of the 315 units. After this date, no basic changes in layout should be made.

Three Months:
1. Review of site preparations by customer and Planning Engineer.

One Month:
1. Site preparations completed. A survey to be made by the Planning Engineer to determine specific requirements for moving 315 units from customer's receiving platform to the Data Processing Center.

III. SITE SELECTION

After an order is placed or lease signed with National for a 315 system, the NCR Planning Engineer will seek your management's viewpoints on:

1. Possible site locations that management may already have under consideration.
2. The over-all arrangement of units within the proposed Data Processing Center.
3. The impression or show-case effect the installation is to convey.
4. Plans for future expansion.

Consideration of site location must necessarily begin at an early date because the actual site should be selected well in advance (8-10 months) of the scheduled delivery of the 315 system. A proper site location will materially reduce construction costs and save time and money where future expansion is required. In addition, experience has shown that over-all operating efficiency of the Data Processing Center is influenced by site location.

IV. DESIGN AND LAYOUT

The specific considerations involved in designing an efficient Data Processing Center will vary from installation to installation. Physical site features will differ together with the operational or functional requirements of the 315 System. Some of the basic considerations related to physical layout follow below. However, the customer's Data Processing Coordinator (or equivalent) must be consulted for operational requirements that should be taken into consideration in designing the site.

V. AIR CONDITIONING

A separate air conditioning system is generally recommended for the Data Processing Center because the 315 system must be capable of absolutely reliable operation, 24 hours a day, 7 days a week, and must be protected against sudden changes in outside temperature and humidity throughout the year.

A. Temperature

The ambient room air within the Data Processing Center must remain within a range of 64 to 78 degrees Fahrenheit. This is a minimum-maximum operating range and should not be considered a design condition. The recommended temperature for optimum operation is approximately 74 degrees.

B. Humidity

The relative humidity with the Data Processing Center must remain within a range of 40 to 60 per cent. This is a minimum-maximum operating range and should not be considered a design condition. The recommended condition for optimum operation is approximately 50 per cent.

VI. POWER REQUIREMENTS

See 315 specification sheet below.

315 SYSTEM SPECIFICATIONS

	Description	Load in KVA	Load in Amps/Phase	Air Cond. Required (Tons)	(BTU's)	W	Size D	H	Weight	Floor Ld. lb./sq. ft.
C-315-1, 2, 3, 4	Processor	3.0	27	1	12,000	105	24	52	1325	101
C-316-1, 2, 3	Memory	1.0	9	⅓	4,000	43	24	52	500	93
C-332-2	Magnetic Tape	2.2	20	⅔	8,000	30	24	60	400	87
C-340-3 & 357-1	Printer & Buffer	2.5	23	1	12,000	80	24	52	1000	100
C-353-1	CRAM	3.0	27	⅚	10,000	35	24	60	500	115
C-354-1	Card Punch Buffer	0.5	5	⅓	4,000	43	24	52	600	112
C-355-1	Check Sorter Buffer	0.5	5	⅓	4,000	43	24	52	600	112
C-362-3	Paper T. Reader									
C-371-3	Paper T. Punch	1.0	9	⅓	3,400	43	24	48	250	47
C-383-1	Card Reader									
C-380-3	High Speed Card Reader	5.5	50	1½	18,000	63	33	42	1000	70
C-344-1	Multi List Paper Feed	1.5	14	½	6,000	on printer			150	—
C-402-1	Check Sorter	See Note	See Note	2	18,000	180	29	57	2200	74
C-435-2	Interconnecting Device	.05	5	0		30	24	26	100	16

NOTE: Power Requirements: All units in a 315 system operate on a nominal 110 volt, single phase, 60 cycles except the Magnetic Character Sorter (C-402-1) which operates on a nominal 3 phase 208/120 wye voltage. The Sorter requires 7.2 KVA or 22.0 amps per phase.

SECTION D— PROGRAMMING THE NATIONAL 315

In the design of the 315 Business Data Processing System, the National Cash Register Company has been fully aware of the importance of programming ease and efficiency. Such considerations cannot be neglected in the planning and evaluations of any system's true economy. For all users, programming costs represent a very important item which cannot be overlooked. Equally important is the proper phasing of program preparation. Sufficient pre-planning and scheduling must have been done so that each user is assured of pre-installation program preparation and the availability of promised program packages with the first machine delivery. The NCR 315 system programming plan is such that not only will advanced programming aids be available with 315 delivery but that program testing and machine experience will be possible long before installation.

A. PROGRAMMING EASE

The entire 315 internal programming philosophy was developed with full comprehension of three factors: implementation cost economy, internal speed, and the implication of each instruction upon advanced automatic coding techniques. It should be pointed out here that the tremendous internal speed of every 315 instruction allows National to provide sophisticated coding techniques at relatively minimal cost in final systems performance. Another important factor in the actual development and implementation of autocoding techniques is experience. Every National 304 system now in operation throughout the country has from its inception relied completely and successfully on NCR's programming packages. These have included the NEAT II Assembly-Compiler system, STEP (Standard Tape Executive Program), LIBRARYN, SORT I and II, The Automatic Debugging System, the Scientific and Engineering Package, and many service and operating routines. Our 304 users are now looking forward to the 304 COBOL English Language Coding System which will soon be available.

The entire package of programs designed for the 315 will be termed "NEAT-315" (National's Electronic Autocoding Techniques for the 315). The entire NEAT-315 project has been planned to give maximum programming and operating ease while allowing full utilization of 315 power and flexibility. NEAT-315 consists of:

(1). *The 315 COBOL Translator.* A COBOL Translator capable of accepting COBOL (Common Business Oriented Language) '61 will be available for our first 315 users. This program will accept all of the required COBOL '61 vocabulary and will

have all those elective features of the language which will be useful to the 315 user. This program will allow the translation of a "near English" business code into a running 315 program. The advantages of such a system are apparent: ease of training, ease of programming, good final program documentation, compatibility of coding with 304 users and users of other computers. These are just some of the features which COBOL will provide the 315 user. The 315 COBOL Translator will not only incorporate all the simplified coding features of COBOL but the NCR version has been built with special emphasis on efficient operation both by the Translator and in the final running "object" program. Both factors are vitally important if an installation is to rely heavily on COBOL.

The NCR 315 COBOL will have the advantage of being the second in a family of such programs. The experience gained from the 304 version will be invaluable in final specifications, implementation, and operation of COBOL 315.

Naturally as COBOL '62 with its more advanced features (Report Generator, Sort Generator, etc.) is developed, these features will be included as soon as possible into the NCR 315 version. In the meantime, certain functions will be included in COBOL 315 so as to make the Translator not only a Business Compiler but an excellent Scientific Compiler as well.

This version will be completely compatible with the other 315 programs discussed below and indeed many of these, such as the Advanced Assembler, the Tape Operating System, the CRAM Operating System, and the Sort Generator will be used to implement, and also as phases of the COBOL Translator.

(2). *The Advanced Assembler and Compiler* will be a fully developed symbolic, free form coding system. This system will allow programming at the 315 level with complete symbolic references and operations. A system of Macro Instruction Integration will be utilized which will allow in-line, closed, or generated subroutines. This system will allow a given installation to include "their own" commands in a completely free form. Naturally, NCR will supply many Macros for the system which can be considered simply as extensions to the 315's already powerful command structure. These Macros will include Input, Output, and Priority programs (these will greatly simplify the programmer's control problems), Automatic decimal point alignment, report editing subroutines, and special purpose subroutines for such functions as check digit calculations, table lookup, and scientific calculations. A set of Pseudo Commands will

allow the programmer complete control over the assembly process itself. Other features which will be incorporated in this system are the semi-automatic assigning of index registers and the integration of the entire assembly process with the final debugging, library, and tape or CRAM operating system. Several important factors, often neglected, which will be inherent in this system are speed of assembly and compiling, the ability to operate on a minimal tape system (5 tapes, or 2 CRAMs, card or paper tape reader, and printer), and smooth, tested (on the 304) operational procedures.

(3). *The Elementary Assembly* is provided which is operational without any tape or CRAM units. This provides a simple symbolic 315 coding language with many features of the Advanced Assembler. Programs written in this language can be processed by the Advanced Assembly.

(4). *The Operating System.* This system is similar to the STEP package, which is in operation with all 304s. The Operating System will handle all errors and bad spots on magnetic tape; it will also accomplish tape labeling, tape alternating, rescue points and console operator messages. In other words, the NEAT-315 Operating System will provide all those features consistent with and necessary for proper magnetic tape handling and supervision. The Operating System provides automatic program to program linking and a simple, efficient, tape-dating system.

A similar CRAM Operating System is also provided as part of NEAT-315. This system, called PACE (PAckaged Cram Executive) not only provides those functions for CRAM which have been outlined above for tape but will actually supervise and properly control all programs which manipulate CRAM.

(5). *The Libraryn Program* will work in coordination with the operating system. This program will allow simplified control over changing, adding, deleting, and re-arranging of programs stored on an operation library tape or on a CRAM cartridge. Similar flexibility for changes of Macros and other subroutines used with the Advanced Assembly will also be possible with the Libraryn Program.

(6). *The Tape Sort Generator Program* will create 315 machine code to sort any reasonable file of information. The programs generated will adapt to any size or type of key, will handle fixed or variable length items, will utilize either 2, 3, or 4 way tape merges, and will allow program intervention on first or last passes. Both the generator program and the produced sorting programs will be tied in with the over-all Tape Operating System.

(7) *The CRAM Sort Generator Program* will create 315 code to sort (using CRAMs) any reasonable file of information. The programs generated will adapt to any size or type of key, will handle fixed or variable length items and will allow program intervention on first or last passes. The programs generated will sort using 1, 2, or 4 CRAM units. Sort times are extremely fast because of the high transfer rate of the CRAM and the ability of the sort programs to share many of the CRAM card drops. Both the generator program and the produced sorting programs will be tied in with the over-all CRAM Operating System.

(8). *The Debugging Supervisor* will provide a well-organized over-all operating procedure for code checking which is compatible with the complete system. This technique, already being used on the 304, will allow many programs with their associated test data to be run by a normal machine operator. Sufficient information about each run will be gathered for later desk checking by the programmer. Such a technique not only decreases the machine time necessary for debugging but eliminates the changing of many "test data tapes or CRAMs" prior to each checking run. The system also allows simple changes to code and data prior to each test.

(9). *The Scientific Package.* This set of programs and subroutines will have a complete "floating-point" arithmetic program consistent with normal 315 coding. (The speed of the 315 shows to great advantage here as a floating point 3-address add instruction, takes approximately *one* millesecond.) A complete set of algebraic and transcendental function subroutines as well as matrix manipulation routines and other desirable programs will also be available.

(10). *Service Routines.* Initial Set Up, Memory Print Outs, Tape Print Outs, CRAM Print Outs, Tape and CRAM utility programs, Selective Tracing, and various tape utility programs are available to provide maximum operator efficiency and to increase the over-all workability of the 315 system.

All these programs are being planned to fit into a complete and fully integrated package. As other advanced peripherals and features are announced for the 315, this package will be extended to include new gear. These programs have been designed with three underlying concepts: (1) Simplify programming, (2) ease the operator's task, in almost all cases let the 315 make the decisions as the human is always the weakest link in a computer system, and (3) plan a best NCR users' method for most standard procedures. While the first two concepts are obvious, the third is equally important. NCR has computer experts who can outline once and for all a "best way" to advance

tapes, establish proper tape or CRAM and library conventions, or set up debugging procedures. These should not be the worry of each installation and with the 315-NEAT system, they need not be.

B. PROGRAM PREPARATION

NCR will provide adequate pre-installation program checking for all 315 users. For the later users, this will cause little or no concern as 315s will be available at various National Data Processing Centers throughout the country. For the early user, however, this is a problem of necessary concern. Fully realizing this problem, National offers the following solution. In January of 1961, the following programs were made available for running on the 304.

(1). The Elementary 315 Assembly assembles symbolic 315 Language to internal 315 running programs. This assembly is identical to that outlined in #3 above except it is running on the 304.

(2). The 315 Simulator. This is a program which, although running on the 304, will make the 304 accept and operate upon 315 code exactly as if the 315 itself was in operation. In other words, a program to make the 304 "look like" a 315 internally. Although operations on such a system are always very slow in proportion to actual 315 running times, most 315 programs can be entirely debugged on such a Simulator.

(3). The 304 COBOL Translator was made available in August of 1961. This program will translate to 304 code, a COBOL Language exactly as used on the 315. While it is true that such translation will be of no direct benefit to the 315 user, it is anticipated that since the translation process weeds out many errors, a trial translation (even to the 304) will find these errors, and train the 315 user in the COBOL process.

With such techniques it will be possible for your programming staff, even if you are an early user, to grow familiar and code check many programs for the 315 prior to your own delivery. As the first production 315 will remain at NCR Dayton for program check out, you can be assured of actual 315 runs prior to delivery. As the NCR programming staffs of both Hawthorne and Dayton will have both the 304 simulator and the first two 315 computers to work with, you can also be assured that National's intention of supplying those 315 programs outlined above will be fulfilled for the first 315 user. A similar (although less extensive) set of programs was promised and delivered with the first 304.

C. NATIONAL'S PHILOSOPHY OF PROGRAMMING

The National Cash Register Company is completely aware of its responsibility to each user in the area of programming. Success in this area is as important as delivering reliable superior hardware. The programs outlined above constitute today's thinking for the 315. More advanced programming systems are being worked on and planned both at NCR and by other groups (NCR is currently participating in at least three cooperative efforts in this area). As these are available and prove feasible, National will certainly implement those systems which best fit its customers' needs and desires.

The following pages highlight diversified applications of the National 304 System. This 304 data processing experience has provided National System Consultants with facts and results that can be extremely profitable to you in the application of the National 315 Random-Sequential System.

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