NCR

Personal Computer

Owner's Manual

FEDERAL COMMUNICATIONS COMMISSION
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Third Edition, November 1984

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Owner's Manual

Contents

Introduction

Welcome to the world of computing on your NCR PERSONAL COMPUTER Model 4, and welcome to the worldwide family of satisfied NCR customers.

You already found out how easy it is to start using your NCR Personal Computer. You opened the carton and took out the "GETTING STARTED" booklet. Then you followed the steps depicted in the booklet. You spent time using the NCR PAL diskette to develop familiarity with the NCR Personal Computer. You learned software concepts. You explored various types of applications.

NCR PAL will be useful in the future any time an additional member of your firm or family, or a friend, has the opportunity to learn to use the NCR Personal Computer.

A FEW QUESTIONS AND ANSWERS

You may want to know just what NCR has provided or can provide to help you to become productive and confident with your computer as quickly and easily as possible. You may also wonder what is the best sequence of reading manuals and performing hands-on exercises for mastering the use of your computer.

This information is stated in question form, followed by brief answers which direct you to the proper resources.

WHAT ARE THE MANUALS IN THE BOX?

Three manuals, including this *OWNER'S MANUAL* you are reading, were packed in the "Documentation and Accessories" box. Each of these manuals has one or two diskettes in the back.

OWNER'S MANUAL With One Diskette Labeled "User Diagnostics"

This manual gives you a general introduction to your NCR Personal Computer. The *Introduction* chapter which you are now reading presents an overview of the purpose and contents of each of your manuals and diskettes. The *Information For Beginners* chapter describes computer system components, concepts and typical uses.

The *Exploring Your Computer* chapter describes the standard and optional hardware and software features. It also includes sections on "Installing Your Computer", "Mastering Your Keyboard", "Care of Your Computer", "Relocating Your Computer" and "If You Get Radio/TV Interference".

The *Installing Options* chapter should be read by any owner who has options to install. Use the information in the chapter plus the instructions included with each feature kit purchased.

The *Troubleshooting* chapter describes the use of the User Diagnostics diskette for both periodic preventive testing and as-needed corrective testing and fault isolation.

The Appendices include charts showing Keyboard Functions, Technical Data and System Switch Settings. A Glossary and an Index are included at the back of the manual.

NCR-DOS Manual with Two Diskettes Labeled "NCR-DOS" and "NCR TUTOR"

The *NCR-DOS* manual is a detailed reference to the features and use of the NCR-DOS operating system software which is standard for this computer. To direct the system, you give instructions called "Commands" to the operating system. To learn how to enter NCR-DOS commands, read the "How To Use This Manual" guide and the first four chapters before using the NCR TUTOR diskette.

The *Working With DOS* chapter leads you through formatting and making backup copies of your disks, and other frequently performed operations, and discusses disk drive identification and configuration. It outlines the use of the on-line "HELP" facility which gives you a description of any DOS command and guidance as to how to use it. Multiple operating system considerations and guidelines are presented. Following instructions in the chapter, you have a backup copy of your NCR-DOS master diskette automatically made.

The *Files and Directories* chapter of the *NCR-DOS* manual teaches you the concepts and naming conventions for files and directories. The *Learning About Commands* chapter teaches you about commands — types, options, entry conventions and batch files.

The *Commands* chapter describes each NCR-DOS command individually, giving its purpose, its syntax and comments which include examples of its use. One unique feature of NCR-DOS is RAM-Disk, which is described under the DEVICE command. RAM-Disk enables you to access an area of memory as if it were a disk drive, permitting much faster processing of the data on that "drive".

The recommended exercise after finishing chapter four is to insert and run the NCR TUTOR diskette, which is in the back of the manual. NCR TUTOR graphically reviews what you have studied so far and helps you feel more comfortable with the use of NCR- DOS.

The *Editing And Function Keys* chapter details the use of special editing keys in the entry of NCR-DOS command lines. These keys save you some keyboard entry effort by allowing you to repeat all or parts of the last previously entered command line and add or change characters as needed. The *Line Editor (EDLIN)* chapter shows you how to use the same special editing keys while creating or modifying data files.

NCR-LINK, the final chapter, tells you how to use the LINK software to process object code files for assembled or compiled programs into machine-usable form. Appendices include information on Advanced Configuration Options, Installing Software, and Errors and Messages. A Glossary and an Index are included at the back of the manual.

GW-BASIC Manual With One Diskette Labeled "GW-BASIC"

GW-BASIC is the standard program development software for your NCR Personal Computer. When you are ready to write or modify programs yourself, the manual is a comprehensive reference to the features, instructions and programming techniques available in the GW-BASIC language. The diskette contains both the GW-BASIC language editor and the GW-BASIC run-time interpreter software.

BASIC language is the most popular for small business and home computers because it is easiest for most people, novice or professional, to learn to use for the first time. Also BASIC has broad enough and powerful enough capabilities to permit programming almost any application.

GW-BASIC adds a variety of high-resolution graphic display capabilities to earlier BASIC language implementations, making the range of possible uses even greater.

WHAT OTHER MANUALS ARE AVAILABLE?

A variety of different application software programming language products will be available from NCR. You should contact your local authorized NCR dealer or NCR representative for more information and availability.

In addition, for owners who want to get more deeply involved with the technical aspects of programming or hardware, and for those who are capable of servicing their own computers, three additional manuals are available:

NCR-DOS PROGRAMMER'S MANUAL With One Diskette Labeled "MS-MACRO Assembler"

This manual is a very technical software reference containing detailed information on several topics:

- The MS-MACRO Assembler Language
- NCR-DOS initialization, disk allocation, control blocks and work areas
- The DEBUG utility, which provides a controlled program testing environment with dump, patch, trace and other features
- Expanded description of the NCR-LINK utility
- Writing and installing your own device drivers (if you interface with any non-standard devices)
- System calls and interrupts

The *NCR-DOS PROGRAMMER'S MANUAL* is available through your authorized NCR dealer or your NCR representative, by ordering NCR stock number G6B1-0204-0000.

TECHNICAL REFERENCE Manual

This manual is a very technical hardware reference containing detailed pictures and descriptions of standard and optional hardware components, such as:

- The power supply
- The main processor board (MPB)
- Flexible and fixed disk drives
- Printers available from NCR
- Optional feature kits

The *TECHNICAL REFERENCE* manual is available through your authorized dealer or NCR representative, by ordering NCR stock number D1-0162-A.

HARDWARE MAINTENANCE AND SERVICE Manual With One Diskette Labeled "Service Diagnostics"

This manual describes in detail the procedures for both preventive and corrective maintenance for your NCR Personal Computer and each hardware component.

The *HARDWARE MAINTENANCE AND SERVICE* manual is available through your authorized NCR dealer or your NCR representative, by ordering NCR stock number D1-0163-A.

WHAT DO YOU DO NEXT?

Information For Beginners

If you are relatively new to computing, you should now read through the *Information for Beginners* chapter of this manual. You may also find the Glossary in this manual helpful when you encounter terminology you do not understand.

Are You A Computer Expert?

Experienced computer users will not need to read everything in this manual. You will probably skip the *Information for Beginners* chapter, the *Installing Options* chapter (unless you specifically need it) and the *Troubleshooting* chapter (unless you run into trouble). Later you should come back and read at least Troubleshooting. For now, you should read through the *Exploring Your Computer* chapter before going on to the *NCR-DOS* manual.

Do You Want More Information?

You may be interested in reading some of the history of the development of computing, or a more comprehensive text on computer concepts. If you are, possible sources of appropriate books are public or company libraries, college or university libraries, your dealer, your NCR representative, or a bookstore.

Any of several magazines targeted for small computer owners may help to expand your knowledge. Joining a local computer club or visiting a local computer show could broaden your exposure to computing.

Do You Want To Run Applications Now?

After you have read the chapters you need in this manual, you are ready to go on and read the first four chapters of the NCR-DOS manual, practice with the NCR TUTOR diskette, and proceed to run whatever applications you desire. We ask you to do just one more thing first, please -

BEFORE YOU GO ON!

SEND YOUR INSTALLATION QUALITY REPORT CARD

An NCR Installation Quality Report Card is included inside your "Getting Started" booklet. You should send this card in to NCR right away, in order that we can continue to serve you in the future.

HELP US HELP YOU

NCR cares about the degree of satisfaction you attain from the use of your NCR Personal Computer. The quality and clarity and ease of use of these and other publications are a major factor in your learning to use this computer. NCR devotes extensive resources to the preparation and production of these publications. We would greatly appreciate your taking the time, after you have worked with this documentation for a while, to fill out and send in the postage-paid Reader's Comments Card bound into the back of this manual. We would like to know how well these publications serve your needs. Thank you.

Information for Beginners

DEFINITION OF A COMPUTER

A computer is a machine that performs tasks by processing information as directed by logically-organized sets of instructions. The sets of instructions are called "programs".

Computers come in many sizes, shapes and types. A computer system can be so large that its parts are located throughout an entire building, or even in several cities. It can also be so small that the entire system can rest on your desk top.

CAPABILITIES OF A COMPUTER

A computer can only perform a few basic arithmetic and data handling operations. It can add, subtract, compare one quantity to another, and move and modify data. In most computers, even multiplication and division are actually performed through repetitive addition or subtraction. It normally executes operations in sequence, but it can be told to "jump" or "branch" out of sequence to another instruction in the program, either unconditionally (every time) or conditionally (for example, when the result of a compare operation sets an "Equal" indicator). Every time a computer performs a task, even one that involves reading or writing words and sentences, the computer must perform one or more of the basic operations.

ADVANTAGES OF A COMPUTER

The computer is such a powerful tool because of the advantages computing has over earlier methods of processing data or calculating.

- Speed — A computer can perform thousands of arithmetic operations and comparisons in the time it takes to read this sentence.

- Accuracy — A computer gives exactly the same answer to the same calculation or comparison no matter how often it occurs, as long as the same program is used.

- Storage and Recall — A computer stores programs, master files, transaction files, historical data files and tables of information. This data can be read back into the computer any number of times without any additional manual effort for the purpose of updating, summarizing, reporting or comparing. A data element, such as a check amount, a phone number or an order quantity, needs to be entered only once even though the data may be used several times by different programs.

LIMITATIONS

Although a computer has tremendous capabilities and may appear to have a very fast and efficient mind, it does not have qualities of the human mind, such as intuition, deductive reasoning, or subjective judgment. The computer's decisions can only be objective (is the color RED or BLUE, is the answer YES or NO?), never subjective (which is prettier?).

The computer must be told what to do at all times by programs. Within its capabilities, the limitations on what your computer can do for you are imposed by its physical makeup (hardware — amount of storage, speed of processing, existence of optional features such as a printer), by the degree of cleverness, thoroughness and precision with which the programs you use are designed and written, and by your imagination.

BRIEF HISTORY OF COMPUTING

For centuries, mathematicians and other scientists attempted to conceive machines which would speed up, or in some cases make possible, the solution of complex formulas and equations.

THE PUNCHED CARD

Around the turn of the century, Herman Hollerith of the United States government Bureau of the Census devised the first punched card and card processing equipment as a means of capturing, sequencing, summarizing and reporting census data.

MECHANIZED ACCOUNTING

From about the 1920's into the 1950's, two forms of mechanical processing of business information, mostly accounting data, became common.

Punched card accounting machines of several types — sorters, collators, reproducers, tabulating machines, etc., used replaceable plugboards. Each unique task required a specially-wired board.

Carriage-style accounting machines were developed with typewriter-style keyboards plus function and numeric keys. Many of these machines used specially-built replaceable "program bars" (or "form bars") for each task. A "program bar" was a steel bar approximately the width of the carriage, to which an assortment of differently shaped metal "lugs" or "stops" were attached. Each stop contacted appropriate sensors on the body of the machine. Different shapes told the machine when to move and stop the carriage, wait for keyboard input, add the value entered to a machine total, print a value or a total, etc.

THE ELECTRONIC AGE

As electronic technology emerged and advanced in the years leading up to World War II, mathematicians and engineers at leading universities and elsewhere researched ways to use electronic technology to accomplish the goal of a computing machine.

Electronic components gradually replaced some mechanical components, such as totals storage devices, in punched card and carriage-style accounting machines. But the ways the machines functioned remained essentially the same.

THE STORED PROGRAM CONCEPT

One of the most critical developments was the emergence of the idea of a stored program computer. In a stored program computer, replaceable programs (sets of instructions) accomplish the definition and control of the machine's current task, in contrast to the punched card accounting machine with its replaceable boards or the carriage-style accounting machine with its program bars.

DIGITAL COMPUTERS

Another concept, which made stored programs practical, was the digital computer, in which all values, inputs, outputs and the program itself, are represented as digits, or numbers.

Gradually, stored program digital computers became more common and eventually dominant as electronic technology matured.

MAXI, MINI, MICRO

Since that beginning, many manufacturers, both existing companies and totally new companies, have entered the computer business. Millions of digital computers of various sizes have been built.

For several years, one trend was toward larger and larger processors. Univac's LARC (Livermore Atomic Research Computer) and IBM's

STRETCH are examples of the extremely large and powerful machines whose capabilities far exceed the dreams of the ancient mathematicians.

Meanwhile, over the years, electronic technology continued to advance at a rapid rate, dramatically decreasing the size, cost and electrical power requirements for computer hardware.

Minicomputers, or "minis", began to be produced in large numbers in the 1960's. With processors about the size of suitcases, but more powerful than some earlier room-sized computers, minis sometimes took over tasks previously assigned to large computer "mainframes". More often, minis were used where previously the use of a computer was impractical due to both size and cost.

In the 1970's, electronics components became so much smaller that first dozens, then hundreds, then thousands of components could be integrated onto a tiny silicon wafer, or 'chip'. The microprocessor, the 'computer on a chip', began to be produced in volume.

Microprocessors, or "micros", like minis before them, are used in places where computers could not be considered before. Micros perform under the hoods of millions of cars, in the controls of many recent TV sets, ranges and ovens, in electronic video and arcade games, and in virtually every bank teller machine, point-of-sale terminal, or freestanding cash register built in the last several years.

SMALL BUSINESS AND HOME COMPUTERS

Finally, of course, every home and small business 'personal-size' computer, such as your NCR Personal Computer, contains at least one microprocessor as its "heart". Some personal computers have more than one microprocessor, each performing specific tasks.

USES OF A COMPUTER

Computers are used for thousands of different tasks in business, government, education, and homes. Computers manage information quickly and efficiently. Thus, in any situation where information is to be managed, use of a computer may be appropriate. Most businesses and many households can benefit greatly from the use of computers. As you become familiar with your computer, you will discover many new and exciting jobs it can do for you.

BUSINESS

Computers are used for a multitude of purposes in the business world. Some of these are:

- Performing accounting functions — payroll, payables, receivables, general ledger, taxes, cost accounting, and spreadsheet presentations.

- Maintaining inventories and processing orders for manufacturers, distributors, and retailers.

- Building and maintaining files of customers, vendors, manufacturers, clients, employees and others with whom the business deals, and producing reports from this data base.

- Processing sales, purchases, billings, and other transactions of the business; maintaining transaction history; projecting future transaction volume and type.

- Controlling reservations for airlines, hotels/motels, and rental cars. A worldwide network interconnects all major airlines to allow exchange of information on ticketing, lost luggage, weather, etc.

- Word processing, office automation, electronic mail.

GOVERNMENT

Computers are used by governments at all levels — city, county, state and national. Many of the pioneering computer installations were in the U.S. Federal Government. Some of the world's largest computer installations are in the U.S. Federal Government. Some examples of government computer uses are:

- Social Security Administration and Internal Revenue Service and state and local tax agencies' processing, checking, record-keeping, and check-writing.

- Control and monitoring of space flights, from the early Vanguard days to and beyond the Space Shuttle.

- Weather forecasting.

- As a network that connects the FBI and most other federal, state and local law enforcement agencies for wanteds, outstanding warrants, fingerprint identification and other criminal justice purposes.

- Military command and control networks, air defense, missile control and guidance, weapons system development project planning and control systems, worldwide communications.

EDUCATION

Schools at all levels, from primary to post-graduate, use computers in many ways in teaching and research as well as in record-keeping. Some uses are:

- Student record-keeping and printing of grade reports.
- Teaching of computer literacy, programming and other data processing and related subjects.
- Planning and control of research projects and processing of results.
- Computer-assisted learning.
- Research in artificial intelligence, robotics, computer-aided diagnosis, etc.
- Maintaining records of alumni and fund donors.

HOMES

Common uses of computers in the home are:

- Entertainment with games.
- Education for the whole family, adults as well as children:
  - in computer programming.
  - in other subjects, like math, for which programmed-instruction diskettes or cartridges were developed.
- Keeping track of personal finances and other household book-keeping.
- Tax preparation.
- Building, maintaining and using files of addresses, telephone numbers and birthdates.

- Word processing, for preparation of letters, term papers and essays without retyping for changes and corrections.

With attachment of one or more special adapters, the home computer can:

- Monitor home security, and turn lights/radios on/off at predetermined times.

- Control heating, air-conditioning and other appliances.

Adding a communications adapter and a modem (see Glossary) allows the home computer to "talk" (exchange data) with other small computers or with larger computers over telephone lines.

One common hookup is with one of the national or regional information source services. Through such a service, the home computer user can:

- Send and receive electronic mail. You can leave messages for and get messages from other users of the service (friends, strangers, children away at college).

- Obtain stock market quotations, and worldwide news and sports event results.

- Exchange software with other users.

Another, less common arrangement is for a person whose professional duties can be performed from a computer terminal, such as a computer programmer or a technical writer, to actually work from a home computer which is dialed-up as a terminal from the employer's central computer.

Where available, bank-from-home and shop-from-home services can also be used by a home computer owner who installs the necessary communications adapter and modem.

PARTS OF A COMPUTER SYSTEM

The components of any computer system, from the largest to the smallest, are divided into two categories:

- Hardware

- Software

HARDWARE

The term hardware refers to all of the physical parts of a computer system. Hardware components include:

- Central Processing Unit (CPU)
- Memory (Internal)
- Memory (External) — disk drives and disks, tape drives and tapes.
- Input Devices — keyboards, etc.
- Output Devices — cathode ray tube (CRT), display screens, printers.
- Communications Adapters, Modems
- Cables, Circuit Boards

Each hardware component performs a particular function and plays a specific role in processing data.

Central Processing Unit (CPU)

The CPU is the "heart" of a computer. The actual "processing" of data is done in the CPU. The CPU contains all the arithmetic and logical circuitry in the computer, and often has a component called the Arithmetic and Logic Unit (ALU). All other circuitry in the computer is essentially for data transfer — to/from the CPU, internal memory, external memory — under the control of the CPU.

The execution of the instructions of the program which is currently in the computer is also performed in the CPU. Each machine-language instruction is in turn loaded into an instruction register and decoded into either specially-wired circuits or unique microcoding to accomplish the steps of that specific instruction.

The CPU contains control circuitry, including a next instruction address register; greater, less than, and equal indicators to reflect the result of the latest comparison instruction executed; arithmetic overflow and zero result indicators; in many cases, one or more sets of "address registers" (storage areas each large enough to store a memory address, such as the base address for a block of coding, a block of data, or a table of information; a return point for a branch out-of-line; or an interrupt routine address).

Data to be processed arithmetically or logically are normally fetched from internal memory into the CPU under control of the CPU. Data resulting from CPU operations are stored back into internal memory.

Memory

Memory is the term used to describe the various hardware devices the computer uses to "remember", or store, both data and the sets of instructions (programs) needed to process the data. Two types of memory are used: internal and external.

Internal Memory — The storage area within the computer to which the CPU has direct access is called internal memory. The "memory size" of the computer is normally stated as the number of bytes of internal memory, such as 128KB, 640KB, where K (Greek Kilo, or thousand) represents 2^{10} or 1024 bytes.

Two primary types of internal memory are used: Random Access Memory (RAM), sometimes called "User Memory" in smaller personal computers, and Read Only Memory (ROM).

RAM memory is used as temporary memory. Only the programs and data with which the computer is currently working are in memory at any instant. The operating system programs and the application programs are read, under CPU control, from external storage into internal memory at the start of the day or the start of the specific run.

Data files are read from external memory into internal memory as needed. In fact, unless a data file is relatively small, only the portion of the file currently being accessed is read into internal memory. Portions of files are read either sequentially or randomly, depending on the characteristics of the external memory hardware and the design of the application program.

Data is also input into internal memory from an input keyboard or other device if required by the program.

After processing is done on the data in internal memory, data modified or added or created is written out to external memory. Information to be printed or displayed to the operator on the CRT is also transferred from internal memory, under CPU control.

When the current program is finished, the next set of application programs and data to be processed replaces the information in the internal memory.

Information in RAM memory is recorded electronically, but is "volatile". That is, its content is maintained by a constant small

electric current; the information is lost if that current is interrupted (for example, if the machine is turned off or a power outage occurs).

ROM memory, by contrast, is permanent; the information stored is not affected if the power to the computer is turned off. Information stored in ROM when it is manufactured can not be changed.

One almost universal use of ROM memory is to contain a routine to set up ("boot") the machine for processing whenever the power is turned on. This routine normally loads the operating system software from external memory and then passes control to the operating system.

Another use of ROM in some small business and personal computers is to contain BASIC language interpreter routines.

External Memory — External memory includes all forms of data storage other than internal memory. Most external memory devices magnetically record information on, and read information from, some form of magnetic disks or tapes. Other types of external memory (used much less in recent years) are non-magnetic, such as punched cards or punched paper tape.

External memory devices which record and read magnetically are of two primary types:

- Disk Drives
  - Hard disk drives use either a single disk, or a stack of disks (a disk "pack"). Each disk is a rigid circle of plastic or aluminum with a metal oxide coating on one or both sides.

    Removable hard disks are disks, or disk packs, that can be physically removed from the drive.

    Fixed hard disks are disks that are permanently installed in the drive.
  - Flexible disk drives use a single soft circle of plastic material with a metal oxide coating on one or both sides. The flexible disk (diskette) is always removable.

    The industry standard sizes of diskettes are 8 inch and 5-1/4 inch.

    Either size diskette can be single- or double-density (bits per inch, bpi, of recorded information), single or double-sided, and soft-sectored or hard-sectored.

- Magnetic Tape Drives
  - Devices normally referred to as magnetic tape drives use reels of industry standard tapes with a metal oxide coating on one side.
  - Cassette tape drives use industry standard digital cassettes.
  - Cartridge tape drives use industry standard tape cartridges.

General characteristics of external memory are:

- It is an extension of main memory in that information recorded in external memory is written there initially from internal memory, under CPU control, and read back into internal memory for processing.
- It is "permanent"; that is, the information is not lost if power is turned off.
- Except for fixed disks, it uses removable, replaceable, interchangeable storage elements (disks, diskettes, magnetic tapes). This means that any number of storage elements can be created or stored. Each can be kept for as long a period of time as needed.

  Thus, a computer owner can maintain a "library" of program files and data files many times larger than the amount that can be attached and available to the computer at one time.
- It is modifiable. Modified or entirely new data can be recorded in place of the data previously recorded when the storage element (disk, diskette, magnetic tape) is attached to, or inserted into, the external memory device (disk drive, tape drive).

Input Devices

Input devices are those through which programs and data are read into the computer's internal memory, under CPU control, for use in processing.

Virtually all external memory devices, notably disk and tape drives, are used for input. This input, however, is re-input of data previously recorded either by this computer or by another computer or data capture device.

Input devices through which original entry of program instructions or data can be made include the keyboard, light pens and "mouse" devices.

Many computers also receive input over communications lines from original entry terminals, programmable terminals (which process the data before sending it), and other computers.

Output Devices

Output devices are those to which data and programs are transferred from internal memory, under CPU control, during or after processing.

Much of a computer's output is to external memory (disks, diskettes, magnetic tapes) for future recall.

Instructions or questions to the operator, as well as final output from many functions, are frequently displayed on a CRT.

Hard-copy output of the final results from many processing functions is printed, if a printer is present.

Many computers also send, or return, output over communication lines to terminals or other computers.

SOFTWARE

"Software" is a term that has come into general use to categorize the portions of any computer system that are not hardware. Software consists of the programs (sets of instructions) that are used to process data, to create other programs, and to control the computer's operation.

The distinction between the three main types of software programs lies primarily in the purpose for which each type is used. The three are:

- System Software — Operating systems, run-time interpreters and utilities
- Program Development Software — Editors, compilers, assemblers and linkers
- Application Software — Payroll, billing, games, word processing, etc.

The language in which you write a program is called a source language. The file created by entering source language instructions into the computer is referred to as source code. Depending on the source language used, the source code may be translated (by a compiler or assembler) which produces object code. The object code is usually machine-language code (the language the CPU understands).

On some computers, the object code is directly executable. In many cases, the object code requires further processing (by a linker) into an executable "load module" which the CPU and operating system can use.

System Software

System software can be defined as those standard programs whose presence is essential for operation of the computer. System software consists of:

- Control programs (the "operating system") that permit and initiate the running of all other kinds of programs, such as application programs.
- Run-time interpreter routines.
- Utility programs.

Most computer manufacturers supply with the hardware a primary operating system, any necessary run-time interpreters, and a comprehensive set of utility programs. Some computer users will want to use multiple operating systems. These, and additional system software, can be obtained either from the manufacturer (or dealer) or a software development company.

The Operating System — An operating system provides an orderly link between the hardware and software of a computer system. It is a program, or collection of programs, that control all other programs in the computer, allocate the computer's resources (memory, disk space, printer, etc.) and prepare the computer to accept the commands or instructions of other programs.

The operating system provides the communication channel or link between you and your computer by means of prompts and commands. A prompt is a message or other signal displayed by the operating system to you indicating that you should make a decision or perform some action before the system can continue. In some cases, you are given a specific set of choices, such as Y/N (Yes/No). In other cases, the system has completed a task, or portion of a task, and you enter one of the set of commands recognized by the particular operating system. These commands direct the system to perform tasks like:

- Begin the next program desired
- Rename or delete a file

- Display the directory (list of contents) of a disk

NCR-DOS, supplied with your NCR Personal Computer, is an example of an operating system.

Run-Time Interpreter Routines — If a computer system executes directly from source code, the computer needs a run-time interpreter, with routines which perform specific sets of machine-language operations to accomplish the purpose of each instruction.

The GW-BASIC interpreter supplied with your NCR Personal Computer is an example of a run-time interpreter.

Utility Programs — Utility programs are programs needed by every computer user to perform very common functions, such as text editing of data or program source code, copying, comparing or sorting data files, formatting of disks or diskettes, etc. Utility programs can be called in by operating system commands, or they can be accessed like application programs.

Program Development Software

A programming "language" consists of a specific set of source coding instructions, data description techniques, and conventions, and procedures that are used to create programs in that language. The language also includes control instructions that direct the program development software (or run-time interpreter) to translate the source code into object code which is (after any necessary linking and conversion) machine-understandable.

The final machine-language object code (or interpreter routines) actually tells the computer what to do — what operations to perform in what sequence.

Program development software consists of special programs (editors, assemblers, compilers and linkers). These programs make it possible for other programs to be written or modified, translated into machine language, or stored until they are used.

The primary program development software, like system software, is often supplied by the computer manufacturer; additional program development software can be obtained from the manufacturer (or dealer) or a software development company.

If you are going to write any new programs for your NCR Personal Computer, or make changes to any accounting, game, or other programs you buy or acquire, you will use program development

software. However, if you purchase or acquire all of your applications from others, you may not need to learn to use this software. (You may have to run LINK on some purchased software.)

Editors — An editor is a program development program, or group of programs, that allows you to create or modify source coding for one language, store the coding if your desire, and test and run the program directly from the source coding. This testing and running requires use of a run-time interpreter for the language.

GW-BASIC, for which you received a manual and diskette, is an example of an editor.

Assemblers — An assembler is a program development program, or group of programs, that translates source coding written in the computer's assembly language into object code. An assembly language is called a "low-level" programming language because, in general, each program statement generates one machine-language instruction. For example, "ADD" tells the assembler to generate the machine instruction for Add.

The exceptions to one-for-one translation are called Macro-instructions, or "Macros". A typical Macro is a single statement to get the next data record from a file of records. The assembler includes, from its Macro library, the standard set of machine instructions necessary to locate the record, read a data block from external memory if necessary, test for read errors, and set a register or other pointer to the beginning address of the record in internal memory.

The MS-MACRO Assembler, available through your NCR Personal Computer dealer, is an example of this type of software.

Compilers — A compiler is a program, or group of programs, that translates source coding written in one of several programming languages into object code. These languages are called "high-level" languages because, usually, each program statement generates several machine-language instructions. Languages of this type may be designed to be more like common English, such as BASIC (Beginner's All-purpose Symbolic Instruction Code) and COBOL (COmmon Business-Oriented Language), or to use as closely as possible normal mathematical/scientific notation, such as FORTRAN (Formula Translation) and ALGOL (Algorithmic Language). They also may be procedure-oriented languages, such as Pascal (named for the computing pioneer Blaise Pascal) and PL/1 (Programming Language 1).

Compilers for GW-BASIC, COBOL, FORTRAN, and Pascal for your NCR Personal Computer are available from your dealer.

Linkers — These programs process one or more object code modules which have been output from compiler(s) or assembler(s) into one load module, to create a program the computer can run.

Application Software

Application software is the computer industry's terminology for the programs or sets of programs that you use to perform specific business, government, academic, or personal functions.

Examples of these functions, as discussed earlier in the "Uses of a Computer" section of this chapter, include:

- Accounting, inventory and order management.
- Processing sales, purchases, billings and other transactions.
- Word processing, office automation, electronic mail.
- Processing tax and Social Security data.
- Controlling and monitoring space flights and military operations.
- Student record-keeping, teaching programming, and research.
- Entertainment and education in the home.
- Personal finances and correspondence.
- Communicating with information source services and, through them, with other computer users.
- Bank-at-home, shop-at-home and even work-at-home arrangements.

System software and program development software, discussed in the preceding sections, do not accomplish actual data processing. Instead, they exist for the purpose of utilizing and creating application software.

Application programs do the actual processing of business, government, school and personal data. To perform different tasks, you need

different sets of application programs. For example, if you process data for your household budget, then want to correct the draft of a term paper, you need to switch from your personal finance software to your word processing software.

Application software is acquired from a variety of sources. Computer manufacturers develop and sell some applications. The manufacturers contract with independent software development companies for the rights to distribute some applications. Many applications are sold directly by independent software development companies. Users develop some of their own applications, and sometimes share these applications with other users.

A wide variety of applications is available for your NCR Personal Computer. Any application software marketed by NCR or by independent companies specifically for the NCR Personal Computer may be used, as well as some application software originally developed for use on other manufacturers' personal computers.

HOW DATA IS REPRESENTED/RECORDED/READ

THE BINARY SYSTEM

Electronic circuits and magnetic storage devices are capable of carrying or storing or recognizing only two "states", either voltage is present (high) or absent (low); magnetizable (ferrite) particles are either lined up in the same direction (polarized) for a high, or unpolarized for a low state.

For convenience, one state is considered to have the value "1"; the other, the value "0". Every character of information — data, programs, machine statuses — is represented by a pattern of 1's and 0's. This form of representation is known as the "binary" system. "Bi" is the Latin prefix for two, as in bicycle (two wheels) or biennial (once every two years).

Each individual element in the pattern is called a "bit" (binary digit). In most computers, the smallest addressable element is a group of 8 bits, known as a "byte". Within 8 bits, the number of possible combinations is 2^8 or 256.

It is also convenient to think of each bit location in magnetic storage or electrical circuitry as if it were a switch. Figure 2-1 shows two such figurative switches, one "ON" (1), the other "OFF" (0). Figure 2-2 shows the switch configuration representing an "A". Figure 2-3 shows, without the switch representation, the bit pattern for a "D".

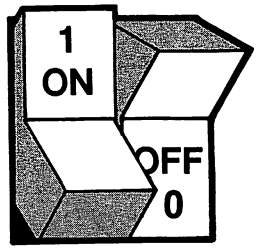


Figure 2-1 Switch representation — binary "1" and "0"

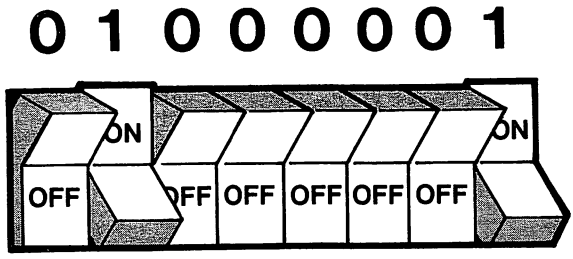


Figure 2-2 Switch representation — "A"

Figure 2-3 Binary representation — "D"

Most computers represent data in accordance with the American Standard Code for Information Interchange, referred to as ASCII (Ask-ey) Code. In ASCII, as shown in Figure 2-4, 128 possible unique characters are defined, from 0000 0000 (NUL) through 0111 1111 (DEL).

NCR ASCII CODE CHART

B_8 ↓ B_5 / B_4–B_1 →		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
0001	1	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
0010	2	⌀	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
0011	3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
0100	4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0101	5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
0110	6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
0111	7	p	q	r	s	t	u	v	w	x	y	z	{	¦	}	~	DEL

Figure 2-4 ASCII code chart

Another code used in many computers is EBCDIC (Extended Binary Coded Decimal Interchange Code), which uses B_8 as a data bit and thus has 256 possible unique characters.

RECORDING DATA IN INTERNAL MEMORY

The ability of hardware designers to package more and more memory into smaller and smaller spaces has been a major factor in the reduction in size from the days when Univac I, as the "state of the art", required a bedroom-sized memory and processor enclosure to hold a memory of 10,000 12-bit words.

In the Univac I, bits were stored as electrical pulses re-circulated through tanks of liquid mercury. Soon that and other early storage techniques were superceded by the use of magnetic core memories. Each ferrite core, shaped like a tiny donut, represented one bit of information. From 16K to 64K bytes of data could be stored in a core array about the size of a suitcase. Core memories, in turn, have been followed by metal oxide semiconductor (MOS) memories. Integrated circuits using MOS technology makes possible the storage of 64K or more bits on a single, small chip.

Thus, your NCR Personal Computer, as an example of today's "state of the art", can have up to 640K 8-bit bytes within its relatively small cabinet along with the CRT, disk drives, main processor and other circuit boards, and power supply.

RECORDING DATA IN EXTERNAL MEMORY

Hard Disks

The fixed disk available on the NCR Personal Computer can store 10,485,760 bytes (10 megabytes, or 10 MB). Since the maximum capacity of each diskette used in your flexible disk drives(s) is 368,640 bytes (360 KB, see next section), you can see that if you have, or add, a fixed disk drive, one fixed disk gives you the capacity of over 28 diskettes, greatly expanding your external memory capacity. If you need the larger capacity, the fixed disk is very valuable to you.

Flexible Disks

The flexible disk, or diskette, is a thin circular piece of soft plastic covered with a metallic oxide coating on one or both sides. Each diskette is permanently contained in a square protective jacket. The diskette spins within the jacket when it is mounted in the disk drive and the drive mechanism is on. When not in the disk drive, the diskette is stored in a protective heavy paper envelope for protection.

Two industry-standard sizes of diskettes are most common — 8 inch and 5-1/4 inch diameter. Since your NCR Personal Computer, like many other small computers, uses the 5-1/4 inch diskettes, the characteristics of that size diskette will be examined in detail:

- Diskettes can be single-sided or double-sided. Your computer can record data only on one side of a single-sided diskette, or on both sides of a double-sided diskette.

- Single- or double-sided diskettes look alike in their protective jackets. The magnetic recording surface of the diskette shows through three openings on each side of the jacket: the center opening, where the mechanism that spins the diskette makes contact; the small circular hole near the center opening, used for reading an "indexing", or positioning, signal from the diskette; and the larger oval opening, through which data is written to and read from the diskette.

  CAUTION:

  - It is most important that you not touch the recording surfaces, because, in doing so, you might damage the diskette and lose all of the information stored on it.

  - It is also important to keep the diskette away from anything that is magnetized, such as other components, radios, jewelry, telephones, etc.

- A small notch, called a "write protect notch" (or "write permit notch"), is on the edge of most diskettes. On a 5-1/4 inch diskette, if the write protect notch is not covered, you can record data on the diskette. If it is covered with opaque tape, you won't be able to. Adhesive tabs are supplied with the diskette. If you want to protect the data recorded on your diskette, you simply cover the write protect notch with an adhesive tab (cellophane and similar tapes are not satisfactory, since they are not opaque). The tab is easily removed, should you want to write on your diskette at another time.

- Diskette labels are at the top (when the oval opening is at the bottom). A manufacturer-supplied software diskette such as NCR-DOS or NCR TUTOR usually has one wide label across the top. Blank diskettes normally have a smaller square or rectangular "permanent" label at the top left which includes the manufacturer's name and certification. The user label, or "temporary" label, is then placed at the top right. On this label, you write identifying information, such as names of files and programs on the diskette or a legend like "NCR-DOS BACKUP", plus date created and volume number if you enter one when you format the disk. Whenever the information on the disk is replaced by newly-recorded information, you also replace the label with a new one.

  CAUTION: Be sure to use a felt marker or other kind of soft tipped pen when you are writing on the diskette labels, as ball-point pens may damage the diskette surface.

- Although the metallic oxide coating over the diskette surface is uniform, it is, for purposes of recording and reading data, considered to consist of concentric circles of magnetizable spots. Each circle is called a "track". On a standard 5-1/4 inch diskette, 40 tracks are defined to exist on each side of the diskette. Tracks are numbered 0 through 39 on one side, and, if the diskette is double-sided, 40 through 79 on the other side, as shown in Figure 2-5.

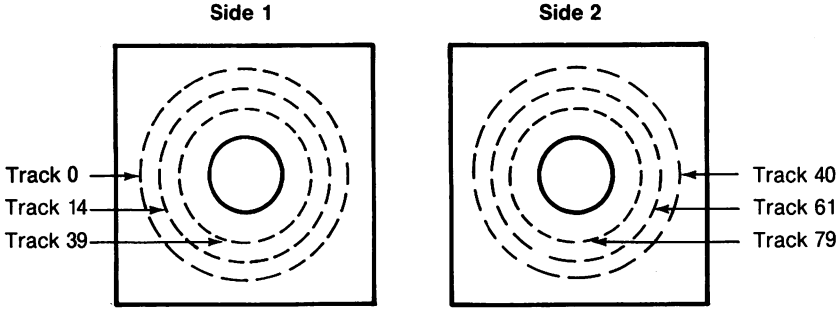


Figure 2-5 Diskette track layout

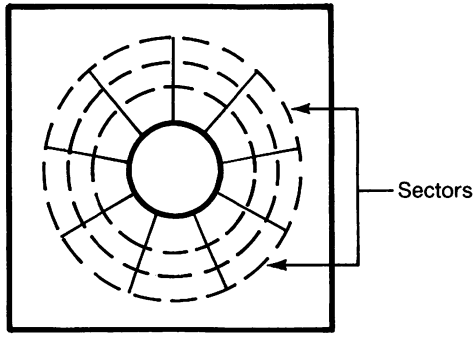


Figure 2-6 Diskette sectors

- Each track is further divided into "sectors" as shown in Figure 2-6. On a standard 5-1/4 inch diskette, either 8 or 9 sectors per track can be defined. Recording or reading of data by most programs, including application programs, is performed one sector at a time. Thus the data in each sector can be referred to as a "data block" or a "physical record" (see Figure 2-7). Each data block or physical record can be treated by the software as containing one "logical record" (the record of one account, one customer, one order, etc.), or part of one larger logical record, or multiple logical records. (A set of related logical records, such as all customer records, comprises a "file".)

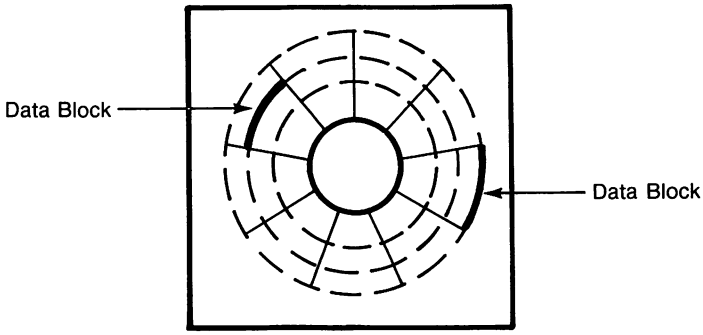


Figure 2-7 Diskette data blocks

- Each sector on the standard 5-1/4 inch diskette contains 512 bytes. Thus, the maximum storage capacity of a double-sided, double-density diskette is: 512 bytes per sector x 9 sectors per track x 40 tracks per side x 2 sides per diskette = 368, 640 bytes. A single-sided diskette's capacity is half that, or 184,320 bytes.

- Each new diskette must be "formatted" before any data can be stored on it. Formatting consists of recording a track and sector address and a test pattern of bits in every sector of every track of the diskette, reading the test pattern back from each sector to verify write and read accuracy, and creating a file directory so that subsequent programs can create and use files on the diskette.

  NOTE: When you buy diskettes for your NCR Personal Computer, make certain you get diskettes that are double-density, double- (or single-) sided and soft-sectored. Tell your dealer or mail-order house that the diskettes are for use on the NCR PERSONAL COMPUTER Model 4. If you happen to buy diskettes that are already formatted, it is even more critical to make certain that they are formatted for your NCR Personal Computer.

- Diskettes are removable and interchangeable. You can create as many as you need and store them for as long as you need. You can reuse each diskette as often as required, either to reread the stored information or to replace it with new information.

- Each diskette can contain, up to its capacity, any desired mix of program and data files. This attribute is especially useful if your

machine has one disk drive, since you do not need to continually alternate between program diskettes and data diskettes.

RELATIONSHIP BETWEEN HARDWARE, SOFTWARE AND DATA

In order for a computer to operate at all, the hardware and software must work together. Normally, the computer (hardware) needs to contain both an operating system (software) and a application program (software) to perform any task.

Another element that must be present for productive performance of any task is the appropriate data. Data can be anything from a file of customers, inventory, budget information, or hyperspace hazards (in space-war games) to a set of transactions indicating orders, checks written, or joystick movements directing your spaceship to avoid the hazards.

The critical concept is that the term data does not define part of your computer system. However, the existence of data, and the need to process, rearrange, summarize, store and report data, justify and caused the computer's existence.

A rough analogy is to consider the data in a computer system to be comparable to the passengers (including the driver) and their belongings in an automobile or other motor vehicle. The computer system (hardware plus software) may, like an automobile, be large and elegant or compact and simple, imported or domestic, used or new. Most importantly, though, the computer system, like the automobile, serves no useful purpose alone. It only serves productively when it transports (processes) its passengers (data) from one place (form) to another.

Exploring Your Computer

This chapter describes the specific parts that comprise the NCR PERSONAL COMPUTER Model 4. Both standard and optional hardware and software are discussed.

NCR PERSONAL COMPUTER HARDWARE

The NCR Personal Computer consists of a main Display Unit and a Keyboard. The computer is available in six different models, and has a variety of options that can be added to each model. Expansion boards from non-NCR ("third party") manufacturers can be used with the NCR Personal Computer, as well as expansion boards offered by NCR. Your dealer or NCR representative can help you select the hardware options you want.

DISPLAY UNIT

The standard Display Unit is made up of the following parts:

- Cabinet
- Power supply
- 1 or 2 flexible disk drive(s) or one flexible disk drive and one fixed hard disk drive
- 12-inch monochrome CRT display or 12-inch color CRT display
- Processor Board with:
  - 8088 Microprocessor
  - 128 KB Random Access Memory (RAM)
  - 8 KB Read Only Memory (ROM)
  - RS 232C Serial Interface

  - Centronics Parallel Interface (for printer)
  - Plug-in board option expansion slots
  - Volume Control
- Flexible disk drive controller plug in board.
- Fixed disk drive controller plug in board, if the unit includes a fixed disk.
- Video controller plug in board.

DISPLAY SCREEN

Two types of CRT displays are available for your NCR Personal Computer, depending on the model purchased:

- A 12-inch monochrome display which:
  - Has a green phosphor screen
  - Displays up to 25 lines of 80 characters per line
  - Has video attributes of normal, blink, reverse and highlight
  - Has a brightness adjustment
- A 12-inch color display which:
  - Can display 16 colors
  - Displays up to 25 lines of 80 characters per line
  - Has graphics capabilities with resolution of up to 640 x 200 pixels (picture elements)
  - Has a brightness adjustment

DISK DRIVES

The NCR Personal Computer, depending on the model purchased, is configured with a single flexible disk drive, two flexible disk drives, or a single flexible disk drive and a fixed disk drive. Configuration changes may be accomplished through the use of option kits. (See the "Options" section of this chapter.)

KEYBOARD

Your keyboard has five types of keys:

- Alphanumeric keys — similar to a normal typewriter keyboard.
- Program function keys — the two rows of keys on the left of the keyboard. The definition and use of these keys varies with the software in use.
- User Function Keys — used to modify the effect of other keys when you give instructions to your software.
- Cursor Movement Keypad — the block of keys between the alphanumeric keypad and the numeric keypad. Used for quicker activation of cursor movements.
- Numeric Keypad — The four rows of keys at the right of your keyboard. Composed of numbers, cursor control keys and other function keys.

Detailed explanation of the function and use of each key is given in the "Mastering Your Keyboard" section of this chapter. In addition, a quick reference keyboard chart is provided in *Appendix A*.

MODELS

The NCR Personal Computer is available in six basic models. The standard internal RAM memory size for all models is 128 KB. The models are:

- Model number 3284-1101
  - 12-inch monochrome display
  - 1 flexible disk drive
- Model number 3284-1102
  - 12-inch monochrome display
  - 2 flexible disk drives
- Model number 3284-1103
  - 12-inch monochrome display
  - 1 flexible disk drive
  - 1 fixed disk drive
- Model number 3284-1201
  - 12-inch color display

256K
DOS 2.11

- 1 flexible disk drive

- Model number 3284-1202
  - 12-inch color display
  - 2 flexible disk drives

- Model number 3284-1203
  - 12-inch color display
  - 1 flexible disk drive
  - 1 fixed disk drive

OPTIONS

This section describes the options that are available from NCR for use with your NCR Personal Computer. Please consult your dealer or NCR representative for further details, and for information on additional options that may have been offered by NCR in later product releases.

These options can be installed by your authorized NCR Personal Computer dealer or by an NCR representative. Or, with a few exceptions, you can elect to install the options yourself. If you are installing options yourself, refer to both the next chapter in this manual, *Installing Options*, and to the instructions included with each option for directions.

Monitor Expansion

The display capability of your system can be expanded with these kits:

- Monochrome Adapter Board (Feature kit number 3284-K141)

  This video adapter board is standard on the monochrome display units (Model number 3284-110x). It can also be used in any one of the color display units (Model number 3284-120x) to add an external monochrome monitor to the system.

- Color Graphics Adapter Board (Feature kit number 3284-K140)

  This adapter board is standard in the color display units (Model number 3284-120x). It can be used in any one of the monochrome display units (Model number 3284-110x) to add an external color monitor to the system. In low and medium resolution modes, the adapter is capable of displaying color graphics. In high resolution mode, only black and white graphics are displayed.

Memory Expansion

Each basic model of the NCR Personal Computer comes with a 128 KB RAM internal memory. By adding memory chips, you can have up to 256 KB RAM on the main processor board. To increase the memory size beyond 256 KB, you must add a memory expansion board. This allows the memory to be expanded up to 640 KB RAM.

You can expand the existing memory by using the following kits:

- 64 KB Memory Modules (Feature kit number 3284-K100)

  This kit contains nine memory chips and installation instructions for upgrading the existing memory in increments of 64 KB, either on the main processor board or on the memory expansion board.

- 128 KB Memory Modules (Feature kit number 3284-K102)

  This kit contains sufficient memory modules to add 128 KB to either the main board or the memory expansion board.

- Memory Expansion Board with 64 KB RAM (Feature kit number 3284-K101)

  This board can hold up to 384K bytes RAM. Its addition to the PC allows the expansion of the main memory (RAM) from a maximum of 256K bytes up to 640K bytes. This memory board comes with 64 KB memory, and can be expanded by using combinations of the K100 feature kit (increments of 64 KB), and the K102 feature kit (increments of 128 KB).

NOTE: It is important that all memory expansion be done systematically. Consult your dealer or NCR representative for advice about memory expansion. For example, you must have 256 KB on the main processor board in order to use the expansion board.

Disk Drive Expansion

You can expand the disk drive capacity of your NCR Personal Computer in several ways with the following hardware feature kits:

- Second Flexible Disk Unit (Feature Kit number 3284-K110)

  This kit allows you to add a second flexible disk drive to either a monochrome display unit with one flexible disk drive (Model number 3284-1101), or a color display unit with one flexible disk drive (Model number 3284-1201). This option should be installed by qualified service personnel since the installation requires the removal of the cabinet top cover.

- Integrated 10MB Fixed Disk Unit (Feature Kit Number 3284-K111)

This kit allows you to add a hard disk drive to your NCR Personal Computer, and should be installed by qualified service personnel since the installation requires the removal of the cabinet top cover. If you have either a monochrome or a color display unit with two flexible disk drives (Model numbers 3284-1102 or 3284-1202), one of the flexible disk drives must be removed before the Fixed Disk Unit may be installed.

Consult your dealer or NCR representative for more details about which combination of disk drives will work best for you.

Printer

A printer enables you to produce printed (hard) copy with your NCR Personal Computer. You can attach either a parallel printer or a serial printer to the NCR Personal Computer.

- If you choose a parallel printer you will need:

  Parallel Printer Cable (Feature kit number 3284-K120)

  This is an accessory cable which allows the connection of a Centronics-type parallel printer to the Parallel Interface, a standard feature of your NCR Personal Computer.

- If you choose a serial printer, you will need:

  RS 232C Printer Cable (Feature kit number 3284-K121)

  This is an accessory cable which allows the connection of a serial, RS 232C type, printer to a serial Asynchronous Communications Port, a standard feature of your NCR Personal Computer. It can also be connected to an Asynchronous Communications Adapter (Feature kit number 3284-K130), which is listed in the next section, "Communication Devices".

Communication Devices

If you want to attach an additional communications device such as a modem to your NCR Personal Computer, you will need at least the first and possibly both of the following:

- RS 232C Communication Cable (Feature kit number 3284-K122)

  This is an accessory cable which allows a modem to be connected either to the serial Asynchronous Communications Port (a standard feature of your NCR Personal Computer) or to an Asynchronous Communications Adapter Plug-in Board (Feature kit number 3284-K130).

- RS 232C Asynchronous Communications Adapter (Feature kit number 3284-K130)

  This is an add-on, plug-in board which provides the capability of connecting an additional serial, RS 232C, device such as a printer, plotter or modem to your NCR Personal Computer. This is in addition to any peripheral device which is already connected to the internal Asynchronous Communications Port.

If you plan to connect your computer to an NCR Decision Net Local Area Network (LAN), you need the first three, and possibly the fourth, of the following:

- Decision Net Transporter Board (Feature kit number 3273-K700)

  This board connects your NCR Personal Computer to the NCR Decision Net LAN.

- Decision Net Tap Box (Feature kit number 3273-K702)

  The tap box is the hardware required to physically connect your NCR Personal Computer to the NCR Decision Net LAN.

- NCR-DOS 2.11 Networking Software (Feature Kit number G0B0-0014)

  This software provides the communications capabilities on the network.

- Decision Net Repeater (Feature kit number 3273-K704)

  This option provides the capability of extending the length of the LAN. Normally the maximum length of the non-repeated LAN is 1000 feet. Each repeater extends that length by 1000 feet (the maximum length is 4000 feet).

Consult your NCR representative for further details about the Decision Net options.

NCR PERSONAL COMPUTER SOFTWARE

Your NCR PERSONAL COMPUTER Model 4 comes complete with a comprehensive set of software programs. You are able to run one of the broadest selections of application software available in the small business and home computer field.

The key system software and program development software components were carefully selected to be those that best satisfy the needs of both a new computer user and an experienced professional. Ease of learning, ease of use, and ability to accomplish a wide variety of tasks

for you were selection criteria for the software, as well as compatibility with software in wide use on other personal computers. This compatibility enables your NCR Personal Computer to use a considerable number of application software programs originally developed on other computers.

This section briefly reviews the standard and optional software delivered with or available for your NCR Personal Computer. Optional software offered by NCR is available through your authorized NCR dealer or through an NCR representative. Other optional software may be purchased through your dealer, through other dealers, by mail order, or directly from non-NCR ("third party") software development companies.

The software, standard and optional, available to you is divided mainly into the three primary categories of software:

- System software — operating systems, run-time interpreters and utilities
- Program development software — editors, compilers, assemblers and linkers
- Application software — Payroll, billing, games, word processing, etc.

In addition, two other categories of software are provided to you:

- User diagnostic software — Preventive or corrective hardware troubleshooting, fault isolation
- Familiarization and tutorial software

Each software element provided under each category is briefly discussed. Directions to the appropriate manual or other source for more specific and detailed information is also given.

STANDARD SYSTEM SOFTWARE

NCR-DOS Operating System

The NCR-DOS (Disk Operating System) is supplied as the standard operating system for your NCR Personal Computer. NCR-DOS is operationally compatible with the popular and widely-used MS-DOS and PC-DOS operating systems used on other personal computers. Standard commands work the same with NCR-DOS as with either of the other operating systems. In addition, NCR-DOS has an on-line HELP Facility that provides immediate guidance should you need it when using the software.

Your *NCR-DOS* manual gives complete instructions on the functions and use of NCR-DOS. The NCR-DOS software diskette is in the back of the manual.

GW-BASIC Run-Time Interpreter

The GW-BASIC program development software supplied with your NCR Personal Computer is a program editor; that is, it enables you to create or modify BASIC language source code and then execute directly from the source code. This requires use of a run-time interpreter, which contains routines that perform specific sets of machine language operations to accomplish the purpose of each source instruction.

The GW-BASIC run-time interpreter programs are part of the software on the GW-BASIC diskette, which is in the back of your GW-BASIC manual.

NCR-DOS Utilities

Utility programs such as COMP (compare files), DISKCOPY, DISKCOMP, DEBUG, FORMAT (diskettes), are considered to be "external commands" in NCR-DOS, and a program object file is loaded into the computer to perform the function when each such command is entered. The Line Editor function is considered a separate program, loaded in response to the entry of the program name EDLIN.

Your *NCR-DOS* manual gives complete instructions on the functions and use of external commands and the Line Editor (EDLIN). These programs all are included on the NCR-DOS software diskette in the back of the manual.

OPTIONAL SYSTEM SOFTWARE

Many users will want to use multiple operating systems with their NCR Personal Computers. A discussion on multiple operating system considerations, and directions for partitioning the fixed disk, if you have one, to serve multiple operating systems are given in your *NCR-DOS* manual.

NCR will, in subsequent product releases, make available additional operating systems for the NCR Personal Computer. Contact your authorized NCR dealer or NCR representative periodically for information on the latest offerings.

STANDARD PROGRAM DEVELOPMENT SOFTWARE

GW-BASIC Editor

The standard program development language for the NCR Personal Computer is GW-BASIC. GW-BASIC is a version of the popular BASIC language with expanded high-resolution graphics capabilities.

With the GW-BASIC editor, you can create or modify source coding for programs you write, or modify acquired BASIC programs. You may store the coding to diskette (or disk). You can test and run the program directly from the source coding in memory or from the stored source coding using the GW-BASIC run-time interpreter.

Your *GW-BASIC* manual gives complete descriptions of all the instructions and functions of GW-BASIC. The GW-BASIC software diskette is in the back of the manual.

NCR-LINK

The standard software for processing object code files for assembled or compiled programs into machine-usable form is NCR-LINK.

Your *NCR-DOS* manual tells you how to use the LINK software, which is on the NCR-DOS diskette. A more detailed description of the LINK utility is in the *NCR-DOS PROGRAMMER'S MANUAL.*

OPTIONAL PROGRAM DEVELOPMENT SOFTWARE

MS-MACRO Assembler

The assembler language for your NCR Personal Computer is fully described in the *NCR-DOS PROGRAMMER'S MANUAL.* The MS-MACRO Assembler diskette is in the back of the manual.

Compilers

Compilers for GW-BASIC, COBOL, FORTRAN and Pascal languages are available. Each has the necessary diskette(s) with the manual which describes the language and its use.

APPLICATION SOFTWARE

No specific application software is included as standard, since the needs of different NCR Personal Computer owners vary so widely.

Your dealer or NCR representative is your primary source for application software and for information describing what applications are available that will successfully perform on the NCR

Personal Computer. Each application includes any appropriate diskette(s) along with the instructions for use.

Three methods of incorporating the NCR-DOS (or compatible) operating system with the application software are in common use:

- The application diskette is self-contained. It includes both the operating system and compiled or assembled object code linked into .EXE format (and usually converted to .COM format). The program may be loaded automatically by an AUTOEXEC batch file. If not, you are told by the instructions what to enter in response to the system prompt (A>).

- The application diskette contains compiled or assembled object code in .EXE or .COM format as above, but without the operating system. The instructions tell you to load your NCR-DOS diskette, and tell you what response to give to the system prompt (A>). You need to remove the NCR-DOS diskette while the application is in use if you have a single diskette drive system, or if the application design requires (and tells) you to do so.

- The application diskette contains compiled or assembled code in .OBJ format, which requires that you perform a LINK run before you can use the software. The directions in the NCR-LINK chapter of your *NCR-DOS* manual, along with the instructions you receive with the application, enable you to perform the LINK and then to run the application.

Unless the application software is copy-protected (the label usually indicates when this is true), you should make a backup copy like you do for all important diskettes. If you have the fixed disk, you may want to place applications software into the DOS partition of the fixed disk. When you do so, you would normally use the ASSIGN command (for example ASSIGN A=C B=C) to locate the data files on the fixed disk also.

USER DIAGNOSTIC SOFTWARE

USER DIAGNOSTICS

This diskette is included in the back of this manual. The *Troubleshooting* chapter of this manual describes its use.

For the user who chooses to maintain his own NCR Personal Computer, much more detailed diagnostic and service information is published in the *HARDWARE MAINTENANCE AND SERVICE* manual available from NCR.

FAMILIARIZATION AND TUTORIAL SOFTWARE

NCR PAL

This familiarization diskette, included in your 'GETTING STARTED' booklet, gave you your first "hands-on" introduction to the NCR Personal Computer.

NCR TUTOR

This diskette, included in your *NCR-DOS* manual, helps you master the NCR-DOS commands and concepts.

INSTALLING YOUR COMPUTER

You have probably already unpacked and assembled your computer system, plugged it in and run the NCR PAL familiarization diskette.

Before you proceed further, you should review the detailed instructions in this section for site (location) selection and preparation and for unpacking, connection, power-on procedures and diagnostic testing of your computer.

SITE SELECTION AND PREPARATION

Select a "permanent" location for your NCR Personal Computer that has:

- No heavy traffic or dust
- No extremes in temperature or humidity
- No direct sunlight or close-by heating system (sunlight and heat can damage the unit and the disks)
- Room for sufficient airflow for cooling the unit
- An adequate number of electrical outlets for the computer and any associated peripheral units
- Properly grounded outlets (3-hole receptacles)
- Adequate circuit capacity (circuit breaker or fuse rating less current required for lights and other devices plugged into circuit)
- If possible, no radio or TV receivers on same circuit

- Room to put the power cables and interconnecting cables out of the way

- A work surface strong enough to support the weight of the computer and peripherals (refer to *Appendix B, Technical Data,* for weights)

- Enough work surface and storage space for work in progress and finished work

UNPACKING

If you did not previously complete the unpacking of your computer, you should do so now:

1. Remove components and packing as shown in the "Getting Started" booklet.

2. If you have found any damage either when the package was received or as you unpacked the unit, report it immediately to your dealer or NCR representative.

3. Save the packing materials, including the cardboard disk drive insert(s), for future repacking and relocation of the system.

4. Arrange the components on your workspace in such a manner that you can reach over and behind them.

5. Before you plug in any power cords, make certain the power switch on the lower right front corner of your unit is turned OFF. (Press the bottom of the switch.)

CONNECTION

If your units are not already connected, the following sequence is recommended:

1. Turn the main display unit on the work surface so that the rear panel faces toward you.

2. Place your keyboard next to the display unit and connect the keyboard cable to the main unit.

3. Connect the power cord to the main unit, THEN to a properly grounded outlet.

4. Now arrange the components of your computer for comfortable use.

   NOTE: Since some models of printers may cause the work surface to vibrate, you may want to set your printer (if any) on a separate surface or a soft pad to isolate the vibrations.

POWER-ON PROCEDURES

Now closely observe the "Power-on self-test" which is performed by the program in the computer's ROM memory each time the machine is turned on.

1. Turn the power switch ON. (Press the top of the switch.)

2. When power is turned on, the program performs a self-diagnosis that is primarily a memory check.

3. A whirring motor noise from the disk drive is normal.

4. A blinking cursor appears on the screen.

5. You should hear a beep. This indicates that the system has completed its power-on self-test.

   If you hear nothing, or if you hear sounds other than those described:

   - Turn power switch OFF.
   - Check that your wall outlet is working properly (use a lamp that you know works).
   - Repeat the power-on self-test procedure.
   - If the test is still not successful, call your dealer or NCR representative for advice or to arrange to take the computer in for service. Or, if you purchased a maintenance agreement, follow the instructions you received with the agreement.

6. If the test is successful, and you purchased any optional equipment that you plan to install yourself:

   - Turn to the *Installing Options* chapter in this manual.
   - Follow the instructions in that chapter and the instructions packaged with the option.

- Take your time. An improper installation will cost far more time to correct than the time "saved" by hurrying.

- Return to this section and continue.

7. Now perform a whole system power-on test. Your NCR Personal Computer is now fully assembled and arranged for comfortable use. This test, plus the diagnostic testing in the next section, assures that all components are functioning.

   - Turn the display brightness control completely clockwise for best cursor visibility.

   - Turn the display power switch ON.

   - Turn ON any other installed devices.

   - Watch and listen for the following indications:

     - The cursor (_) appears on the display screen.

     - Memory is checked again. The beep sounds.

     - Messages may appear on the screen. (Ignore for now.)

     - Sounds may come from your optional equipment.(Ignore for now.)

   - If the above indications did not all occur, turn to the *Troubleshooting* chapter in this manual.

   - If all tests are successful to this point, readjust the brightness control for comfortable viewing and proceed.

DIAGNOSTIC TESTING

Diagnostic testing as described in the *Troubleshooting* chapter should be performed:

- The first time you connect and power-up your computer in its "permanent" location.

- Whenever you move the computer to another location.

- When you know or suspect that you have hardware problems. When this is the case, follow directions in the *Troubleshooting* chapter.

To perform preventive diagnostic testing:

1. Take the User Diagnostics diskette from the back of this manual.
2. Turn the display unit power switch OFF. Turn all other devices OFF.
3. Turn the drive access lever to open drive A.
4. Insert the User Diagnostics diskette into drive A.
5. Turn the display unit power switch ON.
6. Turn all other devices ON.
7. Compare the displays on the CRT screen with those shown in the *Troubleshooting* chapter. If any differences exist that indicate problems, you will be given servicing directions.

MASTERING YOUR KEYBOARD

The keyboard is used to enter or "input" information into your NCR Personal Computer. The keys are used in different ways for different programs, and not all keys are used in each program. In other words, some keys are "application dependent." Their functions vary according to criteria established by the program in use. The manual for a specific program will explain which keys will be used, and for what functions.

Your NCR Personal Computer comes with NCR-DOS. This chapter describes the keyboard functions defined by this operating system.

KEYBOARD FEATURES

This section describes the features of the keyboard. These features include:

- Keyboard Rollover
- Auto-Repeat

Keyboard Rollover

The keyboard has "rollover" capability. That is, several keys can be pressed almost simultaneously and they will be registered in sequence. The keys will not jam; thus, rollover capability increases operator input speed.

Auto-repeat

Most of the keys on the keyboard have auto-repeat capability. When a key with this capability is held down, it will repeat either until it is released or until another key is pressed.

NOTE: When you first begin to experiment with the keyboard, do not be afraid to press different keys "just to see what happens." You can not damage the hardware by playing with the keys and controls. You can affect the software, however; so do not experiment when you are using important files and programs. There will be ample opportunity for experimentation when you are more familiar with the computer, but first read the following information carefully.

KEY DESCRIPTIONS

This section provides descriptions of the keys and their functions. In addition, a quick reference keyboard chart is provided in *Appendix A*.

Keytips

The keys are labeled with letters, numbers, and symbols. The labels designate the functions of the keys. Some keys have one function, some keys have several functions. With the exception of the Scroll Lock/Break key, the functions of each key are identified by a label on the top of the key (the "Break" function is identified by a label on the front of the key). The different functions of a key can be accessed in the following ways:

- Press the key alone. This accesses the "unshifted" value of the key. The unshifted value is:
  - The function or symbol on the bottom of the keytip.
  - The lowercase representation of the alphabetic letter on the keytip.
  - A function designated by the program being used.
- Press the key along with either shift key. This accesses the "shifted" value of the key. The "shifted" value is:
  - The function or symbol on the top of the key.
  - The uppercase representation of the alphabetic letter on the keytip.
  - A function designated by the program being used.

- Press the key along with the Ctrl key. This accesses the "control" value of the key. The "control" value is:
  - The function labeled on the front of the key.
  - A function designated by the program being used.

Key Configuration

The keyboard is arranged into groups of keys according to the function they perform. On the left side of the keyboard are the program function keys. The central part of the keyboard contains the alphanumeric (typewriter) keys and a few user function keys. The right side of the keyboard contains the cursor movement keys and the numeric keypad.

Program Function Keys

These keys are used in working with application programs. They are marked F1 thru F10. What each one does depends on the individual program being run. The instructions for a program explain which program function key to use and how to use it. They are also user-definable through a utility program supplied on your NCR-DOS system diskette. An explanation of how to use this utility program is included in the *NCR-DOS* manual. F1 thru F6 also are used as special editing keys by NCR-DOS and by the Line Editor (EDLIN) utilities as described in the *NCR-DOS* manual.

Function Keys

The function keys are listed below and are explained in the paragraphs that follow. These keys are used to perform specific functions that are seldom program dependent. You may recognize several of them as being similar to the keys on a typewriter:

- Escape
- Tab
- Control
- Shift
- Alternate
- Backspace
- Enter
- Print Screen
- Capitals Lock
- Insert

Escape — The Esc key marks the current line (the line with the cursor) with a \, meaning the line is to be ignored. The cursor is moved down to the start of the next line.

Tab — This key's function is similar to the tab function of a typewriter. Press the Tab key to move the cursor to preset positions on the line. You will need a word processing package to select your own tabs.

Control — The Ctrl key is used to access alternate functions of keys. To access alternate functions, hold Ctrl and press the key which has the desired alternate function.

Shift — The Shift keys (wide arrows) are similar to the shift keys of a typewriter. The Shift keys enable you to type uppercase letters as well as access the "shifted" values of keys. The shifted value of a key is the symbol or function printed on the upper half of the key.

Alternate — The Alt key is also used to modify functions of other keys. To access the alternate functions, hold down the Alt key and press the key which has the desired function.

Backspace — The Backspace key (←) moves the cursor to the left one position each time it is pressed. If a character is in the position to which the cursor is moved, it will be erased.

Enter — The Enter key (↵) moves the cursor from the end of one line to the beginning of the next. It works much like the carriage return key of a typewriter. This key is also used to enter a typed-in command. In NCR-DOS, the Enter key is used to terminate entry sequences, and is often referred to as the Carriage Return (<CR>) key.

Print Screen — When pressed alone, this key prints an asterisk. When used with the Shift key, it outputs all of the data on the screen to the printer. Printing continues until the entire screen display is printed. When used with the Ctrl key, the Prt Sc key prints what you type until pressed again.

Capitals Lock — This key switches the alpha keyboard between shifted mode and unshifted mode. Any letter printed when Caps Lock is activated will be uppercase. A small keytip light gives a visual indication that caps lock is in effect.

Insert — The Ins key activates "insert mode." When insert mode is activated, characters can be entered at the current position of the cursor. Characters that were already on the line are moved to the right to make room for the new characters entered. If more characters are entered than can fit on the line, a new line is automatically created for the characters which overflowed the line.

Typewriter Keys

These keys are identical to those on a typewriter. The typewriter keys are used to write commands or type text.

Cursor Movement Keypad

This keypad includes the following keys:

- Control
- Delete
- Page Up
- End
- Page Down
- Cursor Up
- Cursor Left
- Home
- Cursor Right
- Cursor Down

These keys are placed in easily accessible positions for convenience of operation. The Ctrl key provides the same function as the Ctrl key on the left side of the keyboard. It is described in the "Function Keys" section. The other keys have duplicates found on the numeric keypad. They are described in the "Numeric Keypad" section.

NOTE: The cursor movement keys correspond to the non-numeric (keytip light OFF) values only of the numeric keypad; however, the keys on the Cursor Movement Keypad are active at all times.

Numeric Keypad

The numeric keypad contains the numeric keys and duplicate cursor movement keys. Several keys on the numeric keypad are active at all times:

- Number Lock
- Scroll Lock
- Minus
- Plus
- Enter

Number Lock — When pressed alone, Num Lock switches the numeric keypad between numeric input mode and cursor movement control mode.

To activate the numeric keys, press the Num Lock key. The Num Lock key is a toggle switch. When the keytip light is on, the numeric keys are operational; when the keytip light is off, the cursor movement keys are operational.

When pressed with the Ctrl key, the Num Lock key suspends the operation in process. The operation is reactivated by pressing any key other than Ctrl, Shift, Alt, and Del.

Scroll Lock/Break — When this key is pressed while holding down the Ctrl key, it stops the running of a command program.

Numeric Keys 0, 1-9 — The keys numbered 0 and 1-9 are used interchangeably with the corresponding keys in the "Typewriter Keys" section to perform numeric data entry.

Enter — The Enter key (↵) in the lower right-hand corner of the keyboard duplicates the functions of the Enter key described in the "Function Keys" section.

Decimal Point — Places decimal points in numeric operations.

Minus — The Minus key (-) is used in numeric functions. It is used for subtraction.

Plus — The Plus key (+) is used in numeric functions. It is used for addition.

NOTE: When the Num Lock key has been pressed to deactivate the numeric keypad, the following keys on the numeric keypad become operational. These keys are duplicates of the keys on the Cursor Movement keypad and they perform the same functions.

- Home
- Cursor Up
- Page Up
- Cursor Left
- Cursor Right
- End
- Cursor Down
- Page Down
- Insert
- Delete

Home — The Home key returns the cursor to the top left corner of the screen.

Cursor Up — This key moves the cursor up one line each time it is pressed. (It is inactive in DOS.)

Page Up — In many applications the Pg Up key accesses the previous "page" (screen) of information, but it is inactive in DOS.

Cursor Left — This key moves the cursor one character to the left. It deletes the characters as it passes. If held down, it moves multiple spaces.

Cursor Right — This key moves the cursor one character to the right. It doesn't delete the characters as it passes. If held down, it moves multiple spaces.

End — The End key moves the cursor to the last character in the current line. (It is inactive in DOS.)

Cursor Down — In many applications this key moves the cursor down one line each time it is pressed; however, it is inactive in DOS.

Page Down — The Pg Dn key scrolls to the next page of information. (It is inactive in DOS.)

Insert — The Ins key activates "insert mode". When insert mode is activated, characters can be entered at the current position of the cursor. Characters that were already on the line are moved to the right to make room for the new characters entered. If more characters are entered than can fit on the line, a new line is automatically created for the characters which overflowed the line.

Delete — The Del key is used to remove characters from text. It will not affect programs, only data that is entered by the user.

CARE OF YOUR COMPUTER

GOOD OPERATING HABITS

You should practice a regular routine of care when using your computer. Train yourself to be conscious of the little details that could affect your NCR Personal Computer's performance.

- Never remove or insert the plug when the power switch is ON.
- Do not eat, drink, or smoke in the computer environment.
- Store the diskettes after each use. Always store them in their protective envelopes and try to keep them in some type of closed cabinet.
- Cover the computer and any peripherals if the system won't be in use for an extended period of time. You could make this a daily habit if you are concerned about dust and particles in the air.
- Do not touch the exposed parts of the diskettes.
- Do not bend the diskettes.
- Do not write on the diskette labels with anything but a soft felt-tip pen.
- Keep the diskettes clear of small particles such as dust, food, tobacco, etc.
- Keep the diskettes away from other equipment that may have magnetized components. There are many possibly magnetized items that may be in your computer environment: radios, charm bracelets, telephones, electric pencil sharpeners, etc.

You should also develop habits to protect your data from harm due to human error.

- Update your backup copies as you change the originals.
- If you're working with new information in volume, periodically store the information on a diskette. This will reduce your loss should the information in the computer's memory be lost. Some programmers store their work to disk every 15 minutes; do what you feel is comfortable.

PERIODIC CHECKS

Make it a habit to periodically check your computer and its peripherals for any problems that may have arisen since installation. Here are a few points to consider:

- Are the connections secure?

- Has any magnetized hardware been moved into the computer environment? Remember that magnetized objects might damage the diskettes and can affect the computer's memory. This is very important; even jewelry can have magnetic properties, so be careful.

- Is the computer environment still as static free as possible?

- Are the air circulation vents uncovered? They should be exposed at all times.

- Is the computer near a window or heater, or something else that could seasonally affect the environment?

PREVENTIVE MAINTENANCE

Unless you are capable of performing your own service, and you purchase the *HARDWARE MAINTENANCE AND SERVICE* manual, your computer should be repaired only by a qualified technician. There are steps you can take to keep your unit in working order, however. You can remove dust that could get into the computer and affect its performance by cleaning the unit periodically. Clean the display and the cabinets as needed using the following steps:

1. Turn off the unit.

2. Wipe the screen with a soft cloth and an ammonia-based glass cleaner, a very mild detergent solution, or a water dampened cloth. Dry the screen with a soft cloth.

3. Wipe the cabinet with a cloth slightly dampened by a mild detergent solution, but be careful not to damage the unit by allowing liquid to get inside the cabinet.

Disk heads should be cleaned once a month. More frequent cleaning may be necessary depending on how much the system is used. If you use an abrasive cleaning diskette, cleaning time should not exceed 30 seconds. Contact your dealer or NCR Customer Service representative to determine which head cleaning method is best for your computer environment.

RELOCATING YOUR COMPUTER

PREPARATION

This section describes and illustrates the necessary steps you must take before moving your NCR Personal Computer. Whether you are planning to move your NCR Personal Computer a short distance or a long distance, you need to make the same initial preparations to the system.

If you have a system with both a flexible disk drive and a fixed disk drive, you need to prepare each of them differently before moving your NCR Personal Computer.

Preparing The Flexible Disk Drive(s)

1. Find the cardboard insert(s) that were in the flexible disk drive(s) when you first unpacked the system. If you have misplaced the insert(s), you may use old, "scrap" diskette(s) in place of the cardboard insert(s).

2. Insert the cardboard piece(s) or scrap diskette(s) in the drive(s), just as you would insert a diskette.

3. Turn the drive access lever(s) to the "lock" position. This causes the read/write head(s) to retract, and keeps the head(s) locked in that position.

   NOTE: If you do not protect the head(s) with the cardboard insert(s) or the "scrap" diskette(s), the head(s) could be severely damaged during the move.

Preparing The Fixed Disk Drive

To prepare the fixed disk drive for moving, you need to use the User Diagnostics diskette which is in the back of this manual. (Refer to the "Identify the Installed Devices" and "Select the Desired Tests" sections of the *Troubleshooting* chapter.) Take the diskette out of the manual, then proceed according to the following directions:

1. Insert the User Diagnostics diskette into drive A.

2. Turn the power switch ON.

3. Enter **C** in response to the copyright screen:

4. Enter **Y** in response to the INSTALLED DEVICE LIST.

5. Enter **3** (Prepare to Relocate Fixed Disks) in response to the User Diagnostics menu.

   NOTE: This causes the disk read-write head to move over track X, the position designated for moving your system.

6. Press **E** to Exit. Press **C** to continue.

7. Enter **E** to Exit the diagnostics and return to the system prompt (A>).

8. Remove the User Diagnostics diskette from drive A.

Preparing The Rest Of The System

1. Turn the power switches OFF on all units.

2. Disconnect the main unit cable from the wall outlet; then disconnect all the cables from the rear of the unit. Note where the cables are connected as you pull them off to facilitate reconnection and set up at the new location.

3. Protect the connectors by wrapping them with suitable material such as foam sheets, heavy paper, etc.

4. Coil the cables, and tape them securely to the top of the display unit.

Your NCR Personal Computer is now ready to be moved. If you want to move it a long distance, turn to "Moving a Long Distance".

MOVING A SHORT DISTANCE

If you are moving the NCR Personal Computer a short distance (that is, within the same building), each unit can be carried by one or two people; however, using a cart will make the move easier.

When you move the system, keep the following points in mind:

- Each unit should be moved separately; do not try to carry more than one piece at a time.

- Always use both hands to lift the units.

- You may want to have another person help you lift the heavier units.

- Have an extra person available to open doors, or to call the elevator.

MOVING A LONG DISTANCE

During a long distance move, the original cartons and packing materials that your NCR Personal Computer arrived in will provide the best protection for the system.

Pack the unit in the original carton and packing material using the following procedure:

1. Place each unit in a plastic bag. Don't forget to insert the protective cardboard tabs into the flexible disk drive.
2. Position the cushioning material on each unit, and carefully place the unit in its packing box.
3. Check to be sure that the cushioning material is correctly positioned around the unit, and make sure that the equipment is secured inside the packing box. To avoid damage, the unit must be packaged so that it won't slide around in the box. Add more cushioning if necessary.
4. Tape the boxes shut with strong packing tape.

Your NCR Personal Computer is now ready to be moved a long distance.

SET UP AT THE NEW LOCATION

After your NCR Personal Computer has arrived at its new location, carefully unpack, set up, and cable the system according to the instructions given in the "Installing Your Computer" section of this chapter.

IF YOU GET RADIO/TV INTERFERENCE

The following excerpt from section 15.838, Chapter I, Title 47-Telecommunications, published by the U.S. Federal Communications Commission, applies to your NCR PERSONAL COMPUTER Model 4:

> This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B

computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient the receiving antenna.

Relocate the computer with respect to the receiver.

Move the computer away from the receiver.

Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems".

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-000- 00345-4.

Installing Options

Because there are many option kits available, and more planned, the installation procedures in this chapter cover the major ones only. Installation procedures are included with any purchased options. Briefly, the information presented here tells you how to remove the access door, identifies the main processor, or "mother" board, locates the "system" switches and the slots for the option adapter boards, and details board insertion and switch settings. Also, how to remove and reinstall the cabinet and disk drives.

ADDING CIRCUIT BOARDS

POWER PRECAUTIONS

CAUTION:

1. Make certain that power switch is OFF.

2. Unplug power cord from the wall socket and then from the back of the unit.

ACCESS DOOR REMOVAL

1. Remove the door screw shown in Figure 4-1.

2. Grasp the right side of the door and pull out at the bottom.

3. Grasp the bottom edge and pull down gently. The top edge will come free as the two formed-in lugs slide out of their matching slots in the back panel.

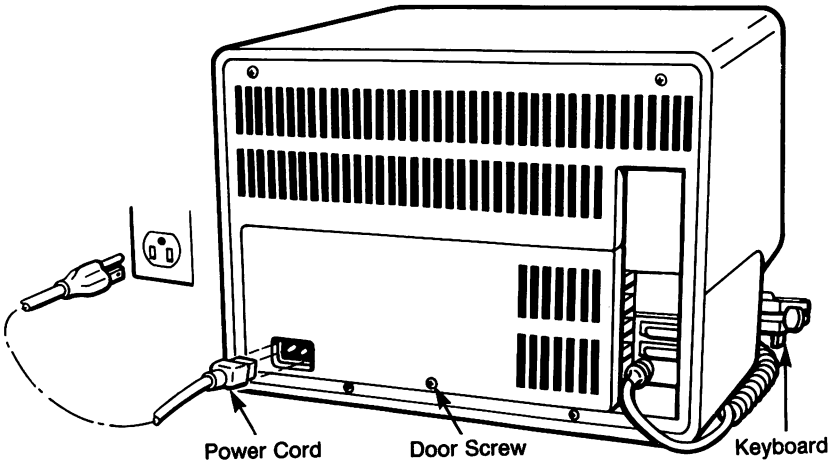


Figure 4-1 Access door removal

MAIN PROCESSOR BOARD

What you can see of the main processor board is shown in Figure 4-2. All expansion and/or adapter boards have been removed to unclutter the view.

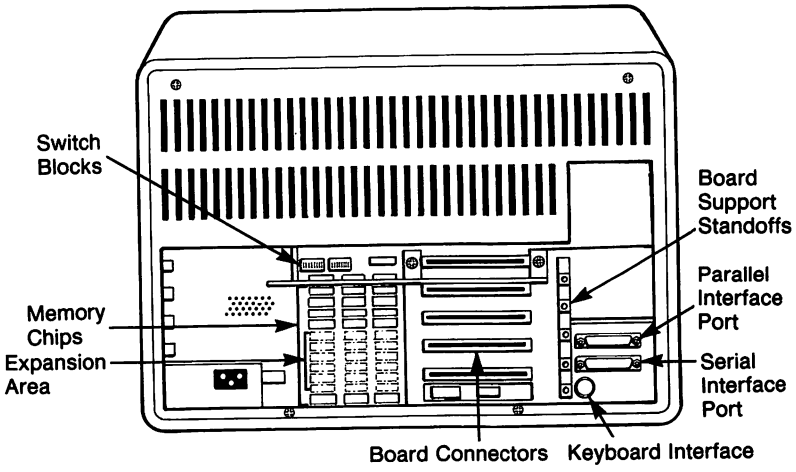


Figure 4-2 Main board

EXPANSION BOARDS

Board Slots Available

If you have a standard flexible disk model, two of the five slots would be occupied as shown in Figure 4-3. If you have a fixed disk model, an additional slot will be occupied. The bottom board is the only one that must be left in that position, since it is short. The remaining slots may be used any way you wish.

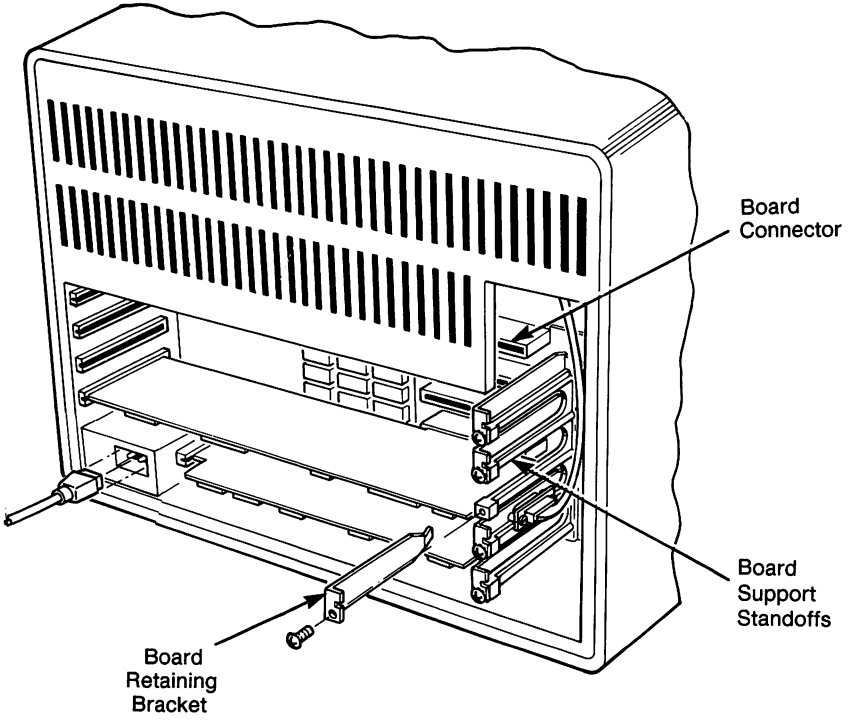


Figure 4-3 Expansion board slots

Board Insertion/Removal

The adapter board that comes in the computer has a retaining bracket as shown in Figure 4-4. To insert a new board, do the following:

1. Remove the screw from an empty support standoff.

2. If you have physically moved prior to picking up your expansion board, you should touch the standoff bracket before sliding the board out of the protective plastic envelope. The components on the board are very sensitive to static discharges. If you have not moved appreciably, the act of removing the screw discharged you adequately.

3. If the kit has a cable, first plug the cable into the board connector and screw it down.

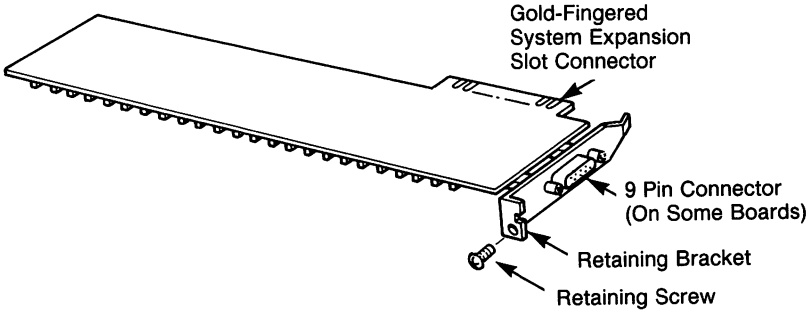


Figure 4-4 Retaining bracket installation

4. Line up the board with the support bracket on the right side. Align the board with its corresponding guide on the left side if a full length board is being installed.

5. Push the board in gently but firmly until it is securely plugged into its connector.

6. Replace the screw taken out in step 1. Make sure it is tight.

7. To remove a board reverse the process. It may be easier to withdraw the board from its connector by wiggling it slightly left to right with a rocking motion while pulling it outward.

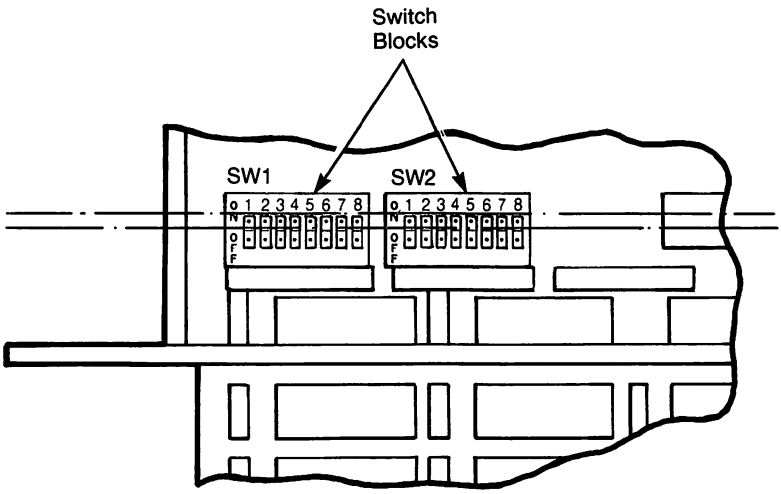


Figure 4-5 Switch blocks (detail)

SPECIFIC OPTIONS

MONOCHROME DISPLAY, NON-GRAPHICS

This option can only be used to add an additional monochrome display to a color unit by installing a Monochrome Monitor Adapter Board. To activate this option, you will need to reset switches in the first switch block "SW1". The switches are partially hidden by the board in the top slot. You may want to remove the board to make switches more accessible. (See Figure 4-5).

SW1 switches 5 and 6 indicate the type of monitor. Using a ball-point pen, or a similar object, set switches 5 and 6 to OFF to use a monochrome display. (Leave the remaining switches set as they are.) Insert the board as previously described and replace the rear access door. Figure 4-6 shows a representative cable connection.

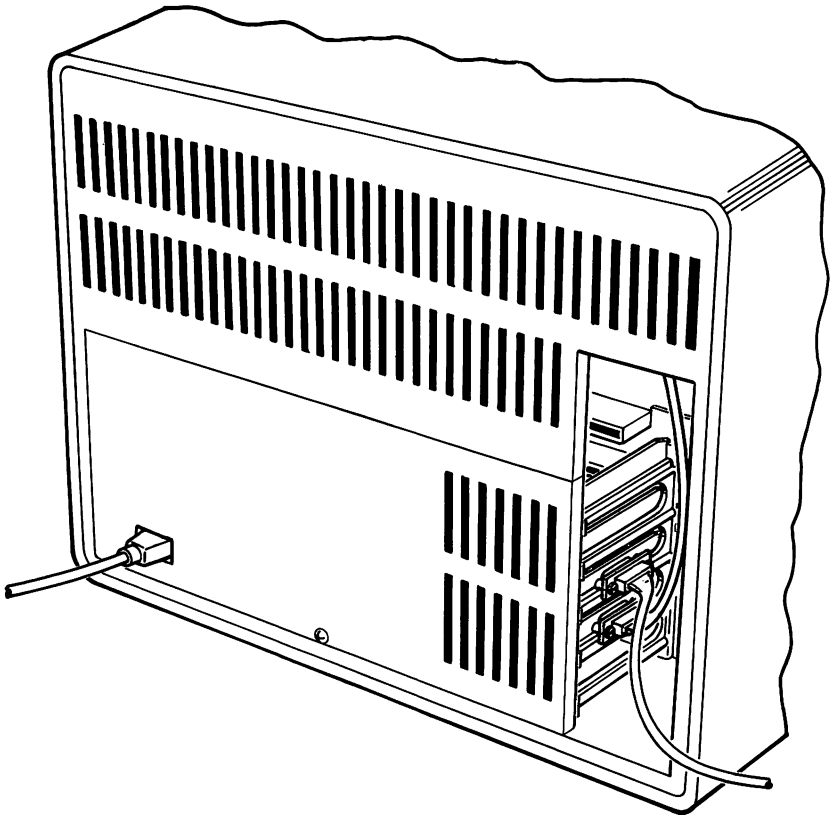


Figure 4-6 Adapter cable connection

COLOR DISPLAY, GRAPHICS

If you have a monochrome display, this option allows you to add a second monitor by installing a Color/Graphics Monitor Adapter Board. There are three video outputs available from this board:

1. RGB Output — normally used if only one monitor is added. A color monitor must always be used with this connection.

2. Composite video used with a coaxial cable-connected monitor.

3. A second composite video to be used with an RF modulator for connecting a standard television set as a monitor. Both composite video outputs may be used for either color or monochrome monitors.

Since this board is standard on systems ordered with color monitors, it may not be installed in such systems as an option.

The RGB color monitor may be used in one of three "modes":

- Low resolution (SCREEN 0, GW-BASIC command) — 160x100 pixels
- Medium Resolution (SCREEN 1, GW-BASIC command) — 320x200 pixels
- High resolution (SCREEN 2, GW-BASIC command) — 640x200 pixels

Low and medium resolution modes will display color graphics. High resolution mode can only display in monochrome.

To activate the color monitor option, you will need to reset switches in switch block "SW1". The switches are partially hidden by the board in the top slot as described before. You may want to remove the board to make the switches more accessible. See Figure 4-5. Using a ball-point pen, or a similar object, set SW1 switch 5 to ON and 6 to OFF. (Leave the remaining switches set as they are.) Plug the adapter cable into the board receptacle, insert the board as previously described, and replace the rear access door. Figure 4-6 shows a representative cable connection.

NOTE: Switches 5 and 6 on SW1 are required to both be OFF as long as there is a monochrome display in the system. Other settings are for systems that have only color displays.

EXPANDED MEMORY

You can increase your system memory by adding an expansion board and adding chips in increments of 64 KB up to the 640 KB maximum. Each 64 KB of expansion consists of nine chips. Up to eighteen chips can be inserted in the main board, which brings the total memory capacity to 256 KB. To add chips to the main board, do the following:

1. You may have to remove installed adapter boards to get at the chip sockets. See Figure 4-2 to locate sockets.
2. Make sure that pin 1 of the chip you are adding is in the same orientation as those already installed. See Figure 4-7 for the correct orientation.

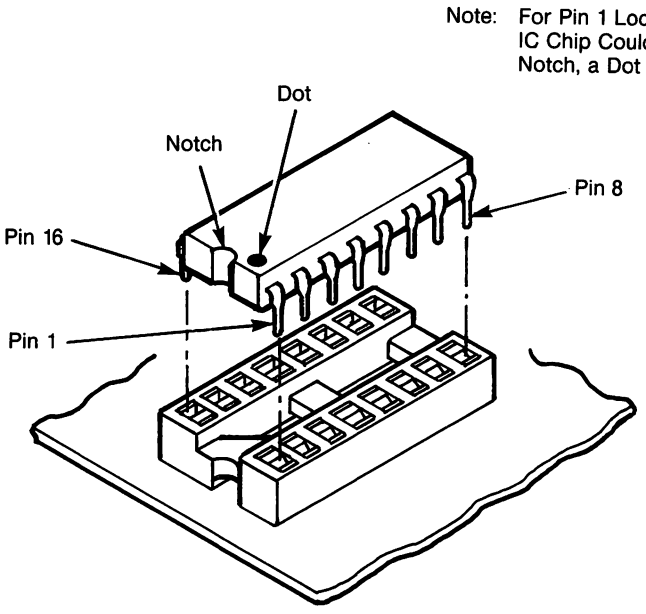


Figure 4-7 Memory chip insertion

3. Locate the specific sockets to be used. Figure 4-8 shows which specific sockets are used for each of the two 64 KB memory increments which can be added to the MPB. Of the twelve rows of three chips or sockets, the top five rows and the bottom row are populated at the factory with the initial minimum 128 KB memory. Rows 6-7-8 are sockets for the first 64 KB increment, from 128 KB to 192 KB. Rows 9-10-11 are sockets for the second increment, from 192 KB to 256 KB.

   Note that the main processor board must be fully populated with 256 KB before a memory expander board can be added.

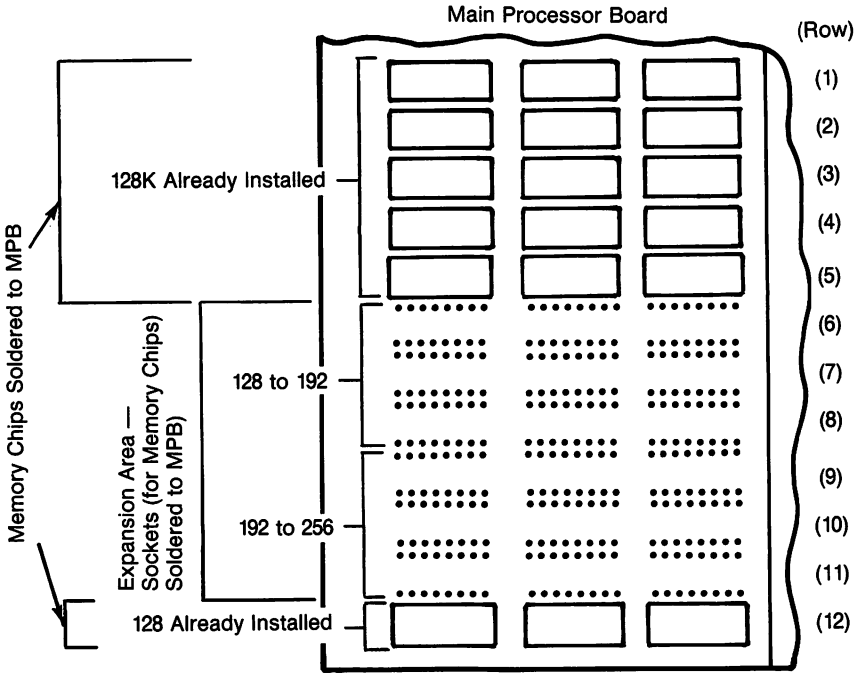


Figure 4-8 Memory Expansion Sockets

4. GENTLY push each chip into its proper socket; check that all pins (legs) are actually in the holes.

5. To activate this option, you will need to set switches in the second switch block labelled "SW2" as shown in Figure 4-9. Using a ball-point pen, or a similar object, set switches, as shown in the table, to reflect your new total memory capacity.

MEMORY SIZE	BLOCK SW2 1	2	3	4	5
192 KB	ON	ON	OFF	ON	ON
256 KB	ON	OFF	OFF	ON	ON
ADAPTER BOARD NEEDED BEYOND THIS POINT					
320 KB	ON	ON	ON	OFF	ON
384 KB	ON	OFF	ON	OFF	ON
448 KB	ON	ON	OFF	OFF	ON
512 KB	ON	OFF	OFF	OFF	ON
576 KB	ON	ON	ON	ON	OFF
640 KB	ON	OFF	ON	ON	OFF

Switches on the adapter board must also be set to reflect the amount of memory installed on it. Installation instructions for the adapter board show its switch settings.

SERIAL AND PARALLEL PORTS

These ports are located above the keyboard connector on the rear panel (see Figure 4-2). The parallel port is available only for use with a printer. The serial port may be used to connect a serial printer, an RS232C compatible modem for telecommunications, or any other RS232 terminal device.

The serial port is controlled by switches 6, 7, and 8 of switch block SW2 shown in figure 4-5. See figure 4-9 for correct settings. If the port is active, it can only be defined to the NCR-DOS operating system as Communications Adapter 1 (COM1). When the MPB serial port is COM1, a second serial interface on an expansion adapter board can only be defined as COM2. When the MPB port is inactive and a two-port adapter board is used, the two ports on the expansion board are defined as COM1 and COM2. The unit as shipped is configured for COM 1.

PARALLEL PRINTER CONNECTION

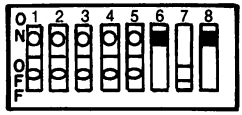
If you have a parallel printer, all you have to do is plug it in the parallel port connector shown in Figure 4-2.

SERIAL PRINTER CONNECTION

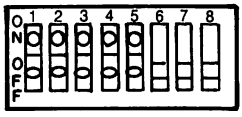
For a serial printer, plug it in the serial port connector, shown in figure 4-2, make sure SW2 switch settings are correct and use the NCR-DOS MODE command to enable the port for this use.

WARNING

Printer connection must be made using shielded cables only. Failure to use shielded cables is likely to cause interference to radio and tv reception.



Serial port Enabled (COM1)



Serial Port Disabled

SW2			MPB Serial Port Definition	Explanation
6	7	8		
Off	Off	Off	Undefined	Inactive. Either no Communications Adapters are defined or COM1 (and possibly COM2) are defined on an expansion adapter board.
On	Off	On	COM1	First adapter is on MPB. These switches do not indicate if there is a current COM2 defined.

Figure 4-9 SW2 Serial Port Switch Settings

CABINET REMOVAL AND INSTALLATION

1. Remove the access door as previously described on page 4-1.

2. Remove all adapter cards that are installed in the computer using the procedure described above in the Board Insertion/Removal section. If a cable is attached to a connector on the end of the board, unscrew the connector and unplug the cable. To keep the retaining screw from getting lost, screw it loosely by hand back into the board support standoff. Remember to touch a standoff bracket to drain away any static charge before moving any boards.

3. Remove the keyboard plug and any other cables plugged into the back of the computer.

4. Remove the two top rear cabinet screws and lay safely aside. Refer to Figure 4-10.

5. Remove cabinet top by firmly pushing forward on the top, rear corners of the cabinet until forward motion of the top is obtained.

NOTE: Since the cabinet top and the mating cabinet bottom fit together tightly, it may be necessary to "bump" the cabinet top forward, from the top, rear corners, to gain initial separation.

After sliding cabinet top forward approximately two inches, lift "up" while continuing forward motion to clear cabinet top from the unit. Lay cabinet top safely aside.

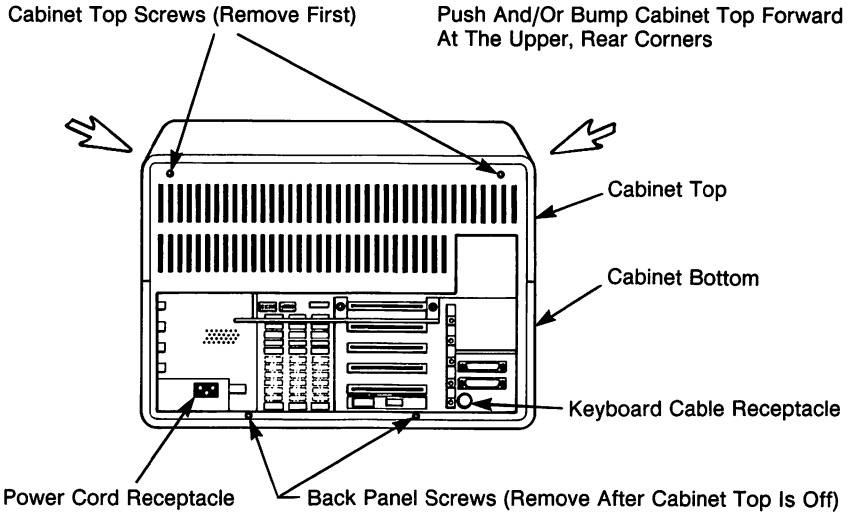


Figure 4-10 Rear View of PC Unit

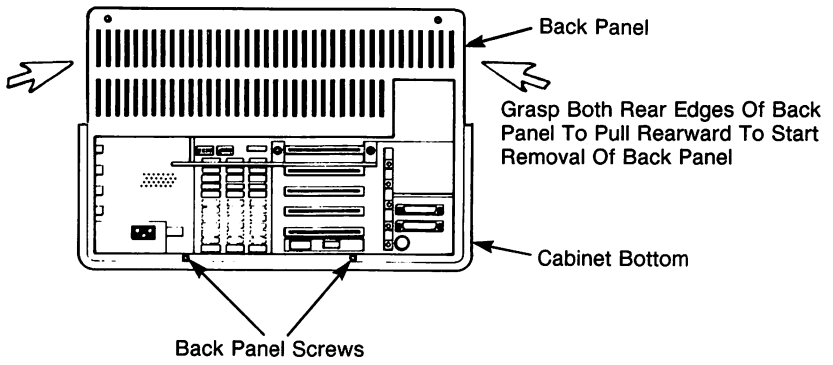


Figure 4-11 Rear View of PC Unit

WARNING

Your computer's CRT (Cathode Ray Tube) will hold a dangerous level of voltage long after unit is turned-off and/or unplugged. Do not place hands on or otherwise touch the CRT in the area of the anode cap (Rubber covered plug on top of CRT).

Cabinet removal does not require your access to the anode cap area at all and with the power cord removed, there is no danger of electrical shock if these Installation Instructions are followed.

6. Continuing to refer to Figure 4-10, and also to Figure 4-11, remove the two lower back panel screws and lay them aside.

7. Grasp both sides of the back panel where indicated in Figure 4-11 and firmly pull straight rearward. It will probably be necessary to apply a rocking motion as the panel is firmly pulled to the rear to overcome the close fit between the panel and the inside of the cabinet bottom.

8. As the panel slides rearward about two to three inches, it is necessary to disengage the video cable grommet from the slot in the extension of the back panel as shown in Figure 4-12. Once the cable with grommet is free from the slot in the back panel extension, the back panel is to be slid fully rearward until clear of the PC unit. Lay the back panel safely aside.

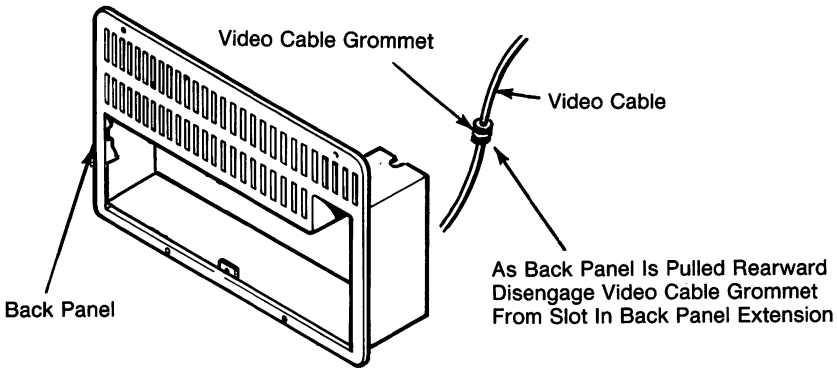


Figure 4-12 Disengage Video Cable & Grommet From Back Panel

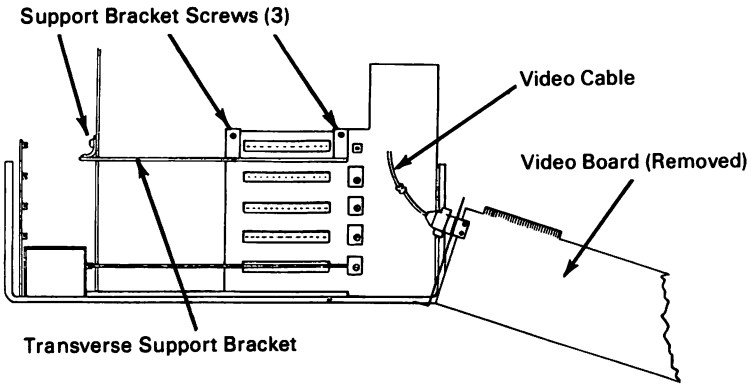


Figure 4-13 Rear View of PC Unit. Removal of Video Board & Removal of Transverse Support Bracket

9. Locate the transverse support bracket which is installed directly below the top MPB connector. Refer to figure 4-13 and remove the bracket and lay the bracket and the three screws aside.

NOTE: The third support bracket mounting screw must be accessed from the side of the unit, just in front of and below the unit cooling fan. A magnetized screwdriver will be helpful for efficient removal of this screw.

Remember to carefully retain each of the parts and screws you have removed because they will be needed to reassemble the unit.

To reassemble the unit reverse the above disassembly procedure.

FLEXIBLE DISK DRIVE

Replacing a Disk Drive

Remove the cabinet as previously described. Refer to Figure 4-14 for parts illustrations.

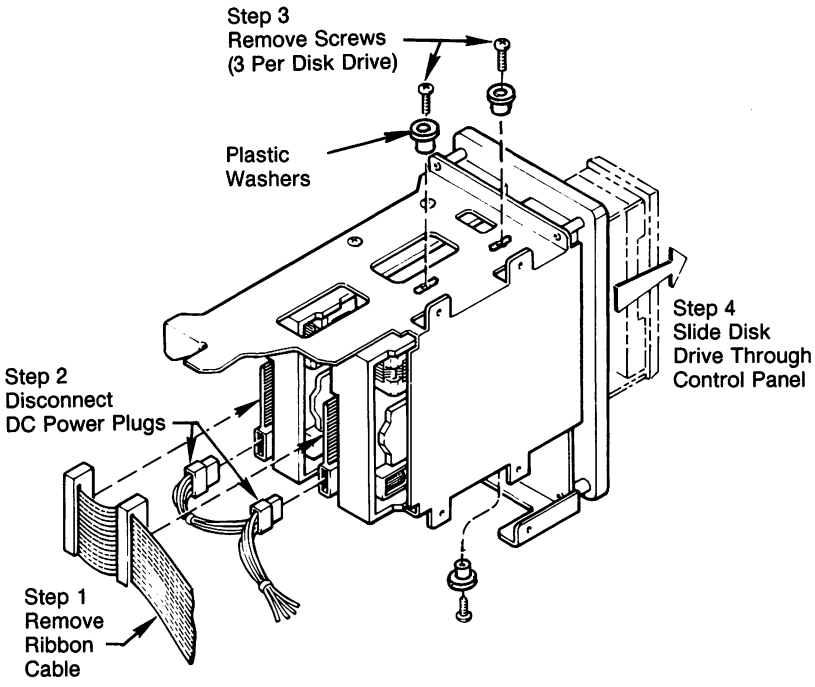


Figure 4-14 Flexible Disk Drive Removal

1. Disconnect the ribbon cable attached at the back of the flexible drive(s).

2. Disconnect the DC power plug from the flexible disk unit(s).

3. Remove the three drive retaining screws and plastic washers for the disk drive unit being removed. Two screws are located on the top drive bracket and the third screw is on the underside of the bottom drive bracket near the control panel.

4. Slide the disk drive forward through the control panel to remove.

5. Position the new flexible disk drive unit as shown in Figure 4-15 and install the jumpers as required.

The flexible disk drives of the system are selected by connecting a jumper (strap) between certain contacts of the header jumper. The following diagrams illustrate the location of the header jumpers and

terminating resistor pack on the flexible disk drive unit. It also shows a blow-up of the header jumpers, with their identification. Note that jumpers PM and ML are always installed and the other jumper is positioned for drive A, B, C, or D. The terminating resistor pack is installed only on the highest numbered drive. Remove and discard the pack if unused on the drive being replaced.

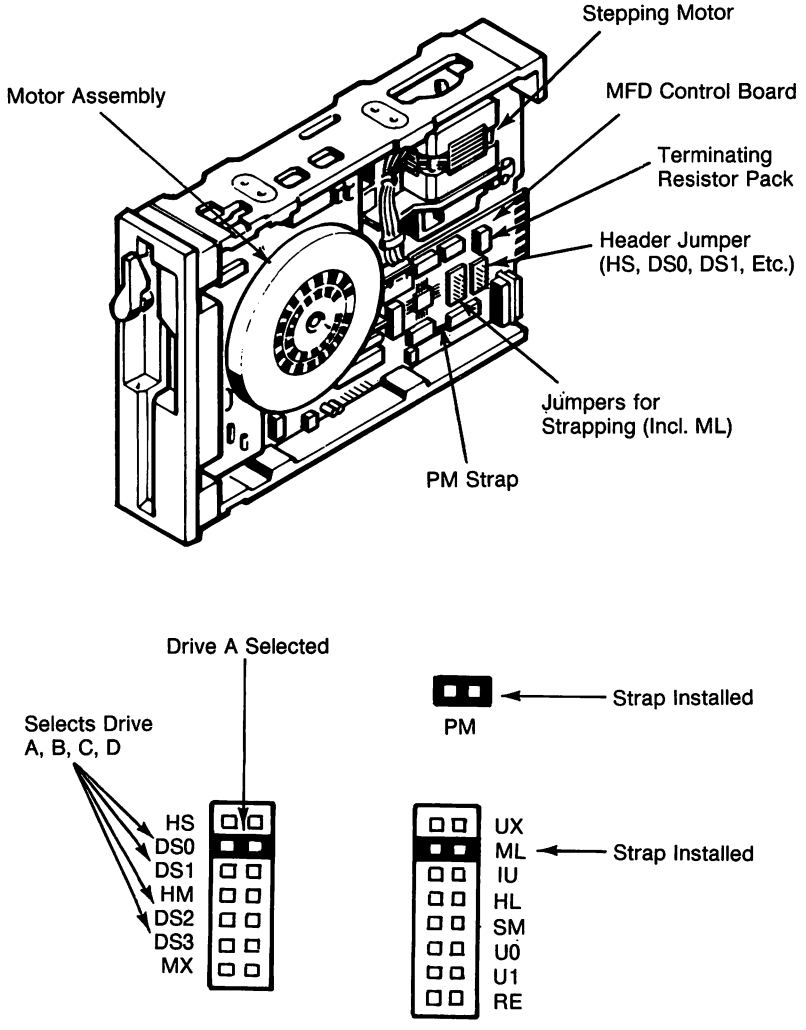


Figure 4-15 Disk Drive and Disk Drive Jumper Locations

6. Insert the new Drive Unit into the PC and align the mounting holes in the drive with those in the drive bracket.

7. Pick-up the three screws and plastic washers and place a plastic washer on each of the three screws, with the largest diameter of the washer against the underside of the screw head. Refer to Figure 4-14 and insert two screw/washers into the two top mounting slots. Make sure that smallest diameter of plastic washers are seated into slots in drive bracket and then into the threaded holes of the flexible drive. Snug, but do not yet fully tighten these two screws.

8. Also as indicated in Figure 4-14, insert the bottom screw and washer and snug but not yet fully tighten, again making sure the washer seats in the drive bracket slot.

9. The purpose for the drive bracket slots being elongated is to permit some "adjustment" of the disk drive unit relative to the rest of the PC unit. If necessary, loosen all three screws slightly and slide the flexible drive unit either forward or rearward so that the front plate of the drive and the front face of the front panel are aligned (parallel). This step is not critical and is more for cosmetic than functional purposes. Then fully tighten all three mounting screws.

10. Reconnect the power and ribbon cable connectors to the new flexible disk drive as they were on the old drive unit.

11. Proceed to reassemble the cabinet.

Installation of Second Flexible Disk Unit

Remove the cabinet as previously described. Refer to Figures 4-14 and 4-15 for parts illustration.

1. For a PC unit that has only one disk drive, remove the flat plastic escutcheon plate through the front of the "outboard" drive position. The plate simply snaps out of the front panel rectangular opening. Refer to Figure 4-16. Store the plate or discard at your option.

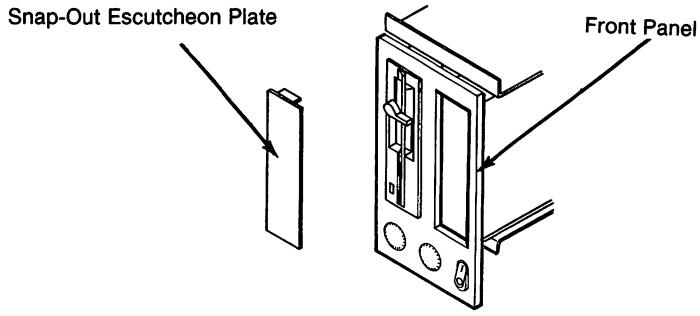


Figure 4-16 Remove Escutcheon Plate (if present)

2. Install jumpers and terminating resistor pack as described in Figure 4-15 and the related paragraphs. Note that the terminating resistor pack is to be present only on the highest numbered flexible drive. Remove it from the lower numbered drive and discard.

3. Carefully insert the rear end of the flexible drive unit into the rectangular opening in the front panel. Slide and jockey the flexible drive unit rearward through the opening until fully inserted in place and the two upper and one lower mounting holes align with the matching, elongated holes in the drive bracket.

   When properly inserted, the plastic front of the flexible drive unit will be aligned within the rectangular opening in the front panel.

4. Pick-up the three screws and plastic washers and place a plastic washer on each of the screws with the largest diameter of the washer against the underside of the screw head. Refer to Figure 4-14 and insert two screw and washers into the two top mounting slots. Make sure that smallest diameter of plastic washers are seated into slots in the drive bracket and that the screws are aligned to go into the threaded holes of the flexible drive. Snug, but do not yet fully tighten these two screws.

5. Also as indicated in Figure 4-14 insert the bottom screw and washer and snug but do not yet fully tighten, again making sure the washer seats in the drive bracket slot.

6. The purpose for the drive bracket slots being elongated is to permit some "adjustment" of the disk drive unit relative to the rest of the PC unit. If necessary, loosen all three screws slightly and slide the flexible drive unit either forward or rearward so that the front plate of the drive and the front face of the front panel are aligned (parallel). This step is not critical and is more

for cosmetic than functional purposes. Then fully tighten all three mounting screws.

The next several steps involve attaching the cables to the rear of the flexible drive, refer to Figure 4-14 for additional clarity.

7. Attach the 4-pin DC Power Plug to the mating receptacle at lower rear corner of the flexible drive unit. The connection is "keyed" and will only connect in proper electrical manner.

8. Pick up the ribbon cable from the disk drive kit. This cable will replace the existing ribbon cable connected to the single drive unit. The new cable has two connectors on one end allowing a parallel connection of both flexible disk drives.

9. First, note how the present ribbon cable is routed from the controller card to the disk drive. The new cable must be routed in the same manner.

10. Disconnect the existing ribbon cable at both ends. Store the cable or discard at your option.

11. Install the new ribbon cable as shown in Figure 4-14. Route the cable in the same fashion as the previous one and connect the single-connector end to the controller card in the rear of the computer.

12. In adding a second disk drive unit, verify the setting of Switch Block 1 (SW1) of the Main Processor Board (MPB). This particular switch indicates to the system the existence of a second disk drive. The switch 7 (in SW1) must be set to the "OFF" position. The SW1 and SW2 switch blocks are located on the back of the MPB directly behind the topmost Plug-In Board position near the left rear side. Refer to the appendix of this manual for positions.

13. Proceed to reassemble the cabinet.

FIXED DISK DRIVE

Your NCR Personal Computer is already equipped with either one or two 5 1/4" flexible disk drives. The Personal Computer can, of course, have a maximum of two integrated disk drives installed, either two flexible drives or one flexible drive and one fixed disk drive.

Therefore, if your unit has two flexible disk drives, installation of a fixed disk drive will require removal of the flexible disk drive from the outboard drive location.

If your unit has only one flexible disk drive, installation of a fixed disk drive adds a disk drive to the outboard drive location.

In either case, after installation of a fixed disk drive, the result is a PC equipped with one flexible disk drive and one 10 MB fixed disk drive.

CAUTION

It is always good practice when handling or working with electronic equipment, assembled boards or components, to observe caution with regard to "Static Electricity" that you may have built up on your person. Immediately before performing any step that involves handling or touching boards or components, touch a finger to a metal surface such as a worktable, chair, cabinet or to a frame or board support standoff of the PC unit. This will minimize the risk of discharge caused damage to the electronic devices.

Remove the computer cabinet as described previously in the Cabinet Removal and Installation section.

WARNING

Your computer's CRT (Cathode Ray Tube) will hold a dangerous level of voltage long after unit is turned off and/or unplugged. Do not place hands on or otherwise touch the CRT in the area of the anode cap (Rubber covered plug on top of CRT).

The installation of a fixed disk drive does not require your access to the anode cap area at all and with the power cord removed, there is no danger of electrical shock if these Installation Instructions are followed.

Removal of Second Flexible Disk Drive

If your PC unit is equipped with only one disk drive, you may ignore this section and proceed directly to the section titled "Installation of Fixed Disk Drive Unit."

For units with two disk drives, it is first necessary that the "outboard" (B) drive is removed according to the following steps.

1. Position your unit with the now exposed right (disk drive) side facing you. Unplug the two cable connections, as shown in Figure 4-17, from the "outboard" disk drive.
   - Ribbon Cable Connector
   - Power Harness Connector (Will connect to Fixed Disk Unit)

   Also, refer to Figure 4-18 and unplug the second connector on the ribbon cable from the rear of the "inboard" disk drive.

   Go ahead and now connect the endmost ribbon cable connector (the one you removed from the outboard drive) to the rear of the "inboard" disk drive.

   The net result is that the "inboard" disk drive is now reconnected to the ribbon cable endmost connector and the inner ribbon cable connector is left not connected to anything, but simply lays up against the inner chassis side frame.

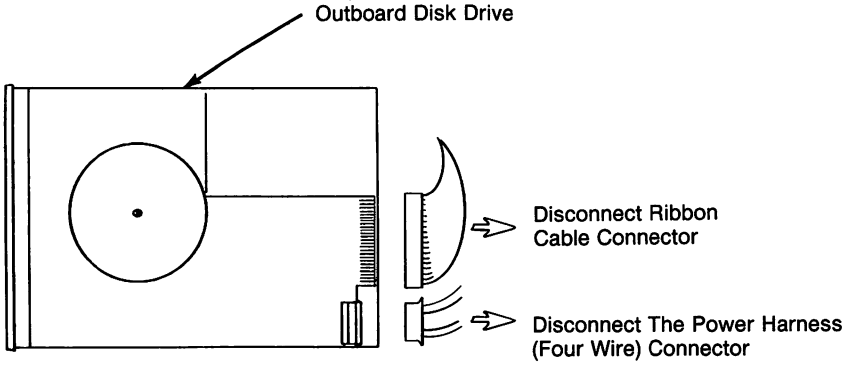


Figure 4-17 Right side view. Disconnecting outboard disk drive cables

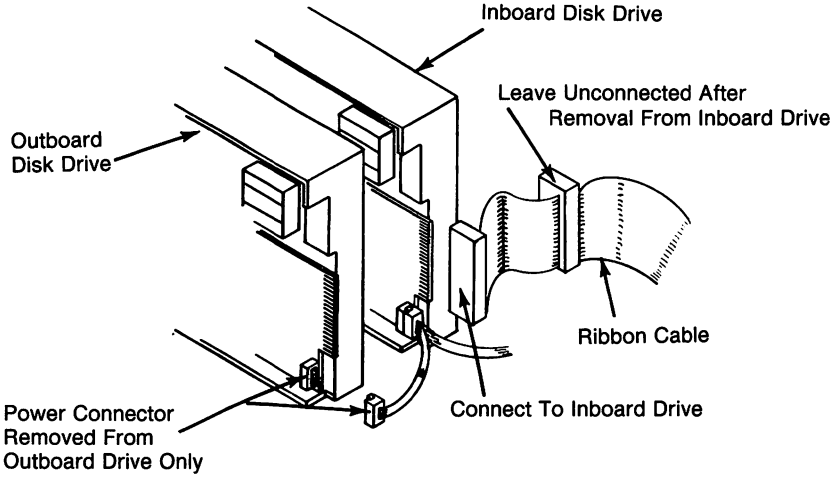


Figure 4-18 Right, rear quarter view. Changing connection to inboard disk drive

2. Now proceed to remove the "outboard" disk drive from the unit. The disk drive is mechanically attached by three screws, two above the drive and one below the drive.

   Refer to Figure 4-19 and remove the two upper screws and their washers. Then move the front of PC unit to an edge of your worktop such that you can gain access to the bottom mounting screw from underneath. Remove the bottom screw and its' washer.

   Then carefully slide the entire outboard disk drive straight out through the rectangular opening in the front panel. Lay the drive carefully down with the "outboard" side up.

NOTE: The three retaining screws for the fixed disk have metric threads and the three screws used to retain the flexible disk have inch threads. Do not exchange these screws from one drive to another of a different type.

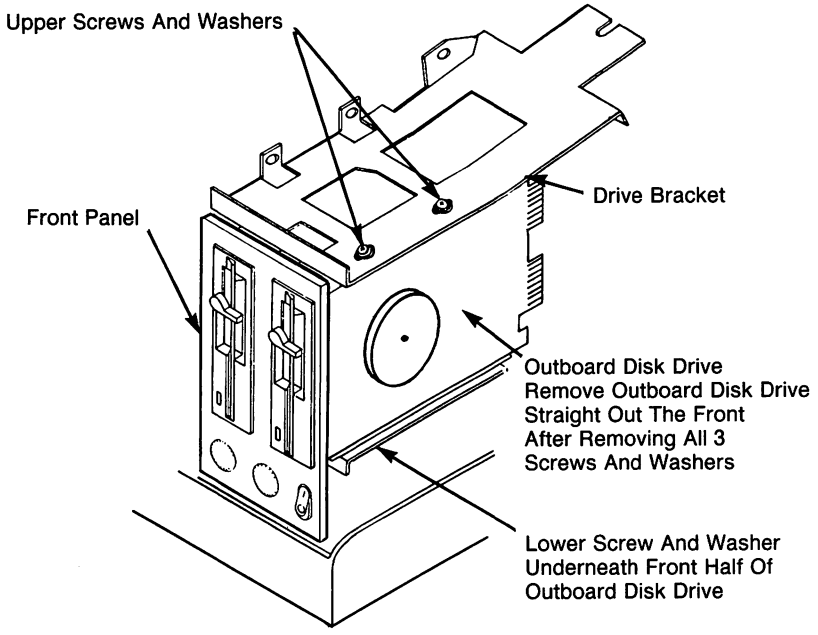


Figure 4-19 Removing Outboard Drive

3. Refer to Figure 4-20. With the removed, outboard disk drive laying on its side, outboard side up, locate the resistor pack "J3", which is positioned just to the left (forward) of the edge connector. Carefully, with fingertips, remove the 14 pin pack by pulling steadily, straight up until it is free of its receptacle.
4. This pack (J3) must now be inserted into the same receptacle position on the now exposed "inboard" (A) disk drive. Carefully insert it into the "J3" receptacle on the "inboard" drive, maintaining the same orientation it had in the now removed "outboard" (B) drive. Be sure the pack (J3) is seated squarely and completely in the receptacle for "J3" on the inboard (A) drive.

   Carefully store the removed outboard disk drive for safe keeping.

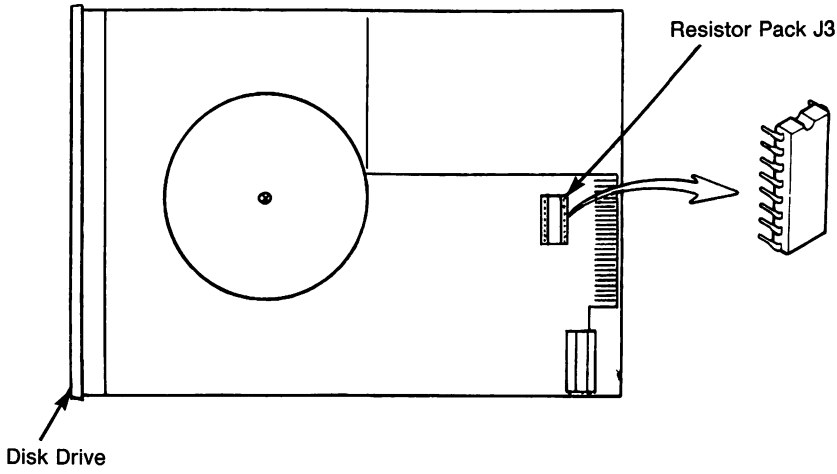


Figure 4-20 Moving "J3" From Outboard to Inboard Drives

Installation of Fixed Disk Drive

1. For a PC unit that had only one disk drive, remove the flat plastic escutcheon plate through the front of the "outboard" drive position. The plate simply snaps out of the front panel rectangular opening. Refer to Figure 4-16. Store the plate or discard at your option.

2. Pick up the 10MB fixed disk unit and the insulator sheet. Refer to Figure 4-21 and position the insulator sheet around three sides of the drive unit so that the holes in the insulator sheet and the holes in the top (2 holes) and bottom (1 hole) of the drive unit align.

   The insulator sheet will cover the top, bottom and inward-facing side of the fixed disk drive unit when properly oriented.

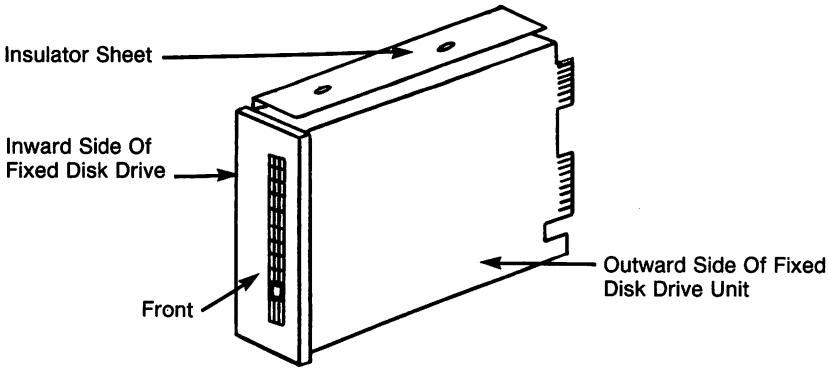


Figure 4-21 Positioning insulator sheet around fixed drive unit

3. Carefully insert the rear end of the fixed drive unit into the rectangular opening in the front panel, still holding the insulator sheet around the drive unit. Slide and jockey the fixed unit and insulator sheet together rearward through the opening until fully inserted in place and the two upper and one lower mounting holes align with the matching, elongated holes in the drive bracket. It will be necessary to perform slight "jockeying" of the insulator sheet to gain alignment.

   When properly inserted, the plastic front of the fixed drive unit will be aligned within the rectangular opening in the front panel and the insulator sheet will be covering the top, inward side and bottom of the fixed drive with the holes aligned with the holes in the fixed drive and the elongated holes in the drive bracket. Refer to Figure 4-22 for additional pictorial assistance.

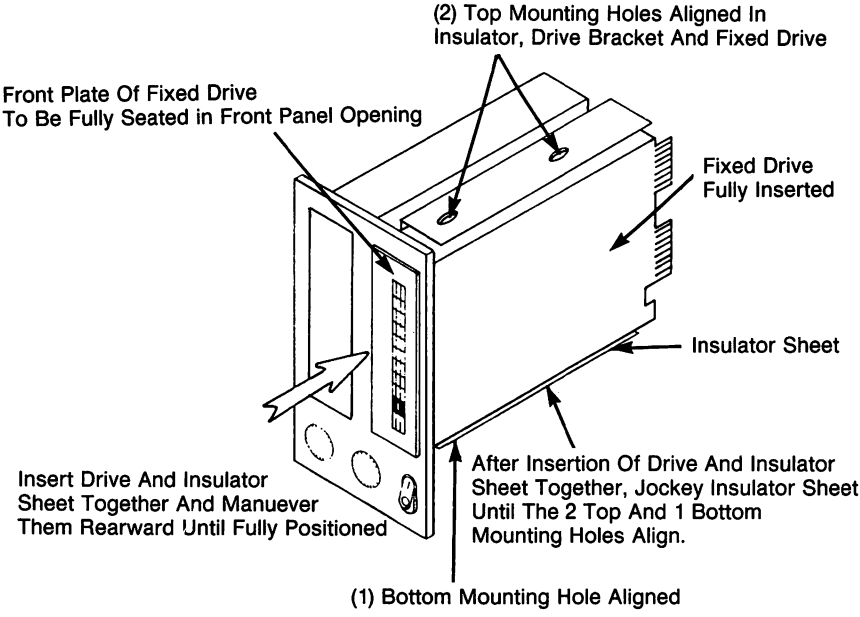


Figure 4-22 Installing fixed drive unit into P.C. unit (drive bracket not shown)

4. Pick-up the three screws and plastic washers. Place a plastic washer on each of the three screws with the largest diameter of the washer against the underside of the screw head. Refer to Figure 4-23 and insert two screw/washers into the two top mounting slots. Make sure that smallest diameter of plastic washers are seated into slots in drive bracket and that the screws are aligned to go through the holes in the insulator sheet and then into the threaded holes of the fixed drive. Snug, but do not yet fully tighten these two screws.
5. Also as indicated in Figure 4-23, insert the bottom screw and washer and snug but do not yet fully tighten, again making sure the washer seats in the drive bracket slot and the screw goes through the hole in the insulator.
6. The purpose for the drive bracket slots being elongated is to permit some "adjustment" of the disk drive unit relative to the rest of the PC unit. If necessary, loosen all three screws slightly and slide the fixed drive unit either forward or rearward so that the front plate of the drive and the front face of the front panel are aligned (parallel). This step is not critical and is more for

cosmetic than functional purposes. Then fully tighten all three mounting screws.

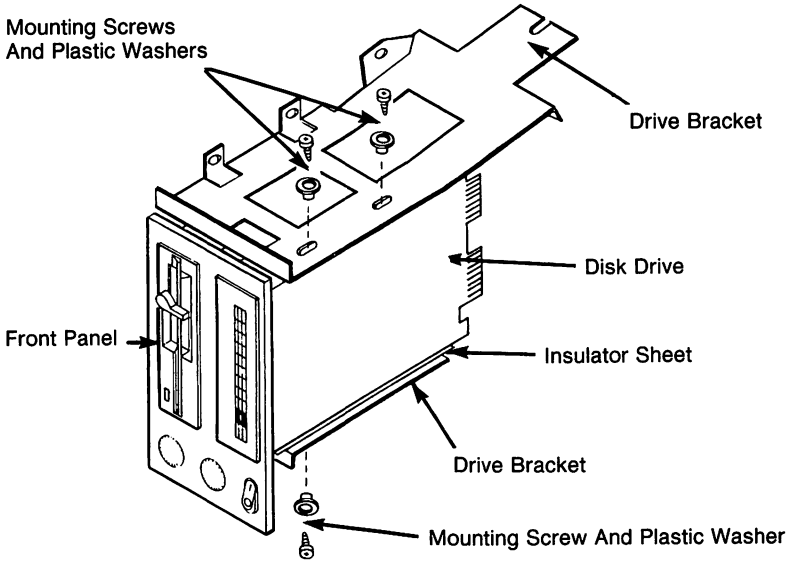


Figure 4-23 Securing fixed drive into PC

The next several steps involve attaching the cables to the rear of the fixed drive, refer to Figure 4-24 for additional clarity.

7. Attach the 4 pin power harness connector to the mating "J2" receptacle at lower rear corner of the fixed drive unit. The connection is "keyed" and will only connect in proper electrical manner.
8. Pick up the two ribbon cables from the fixed disk kit. These two cables (34 wire and 20 wire) must be added to the unit to provide logic connection from the fixed drive to the controller board (which is added later).
9. First install the wide (34 wire) ribbon cable. The solid color coded edge of the cable goes toward the bottom when viewed from the right (disk drive) side of the unit. connect the ribbon cable connector to the lower of the two edge connectors at the ear of the fixed drive. The connector is "keyed" to prevent improper assembly.
10. Then install the narrow (20 wire) ribbon cable, connecting the larger of the two end connectors to the remaining (upper) edge

connector at the rear of the fixed drive. The connector is "keyed" to prevent improper assembly.

You now have both logic cables and the power harness connections complete at the fixed drive and must proceed to "route" these two ribbon cables down through the chassis of the PC unit.

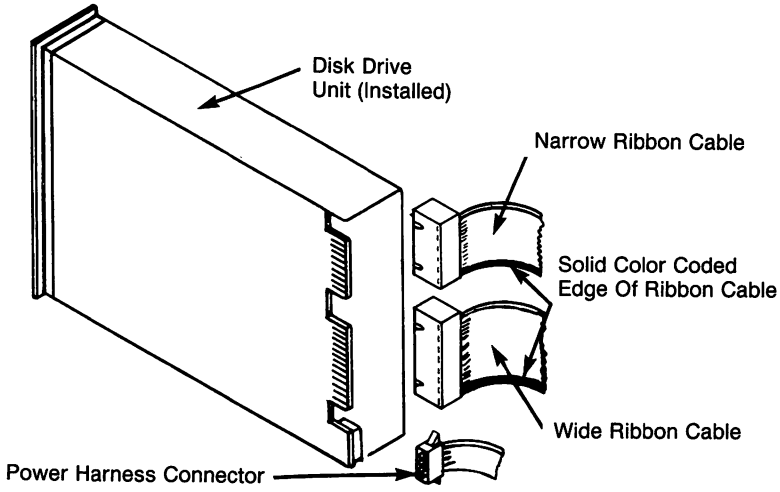


Figure 4-24 Connecting cables to fixed drive unit

11. Route the widest ribbon cable first. Refer to Figure 4-25 and feed the edge between the chassis frames such that the cable lays "flat side to flat side" with the "inboard" disk drive ribbon cable already present in the unit. The chassis framing can be "pryed" slightly to increase the gap between the chassis pieces and assist in routing the ribbon cable into place.
12. Then route the narrower ribbon cable edge through the same gap, again "flat side to flat side" with the other two ribbon cables using same routing.
13. Again referring to Figure 4-25, the ribbon cables should now be routed through and in place, as shown, with the free end connectors laying on top of the bottom most Plug-In Board at the rear of the P.C. unit.

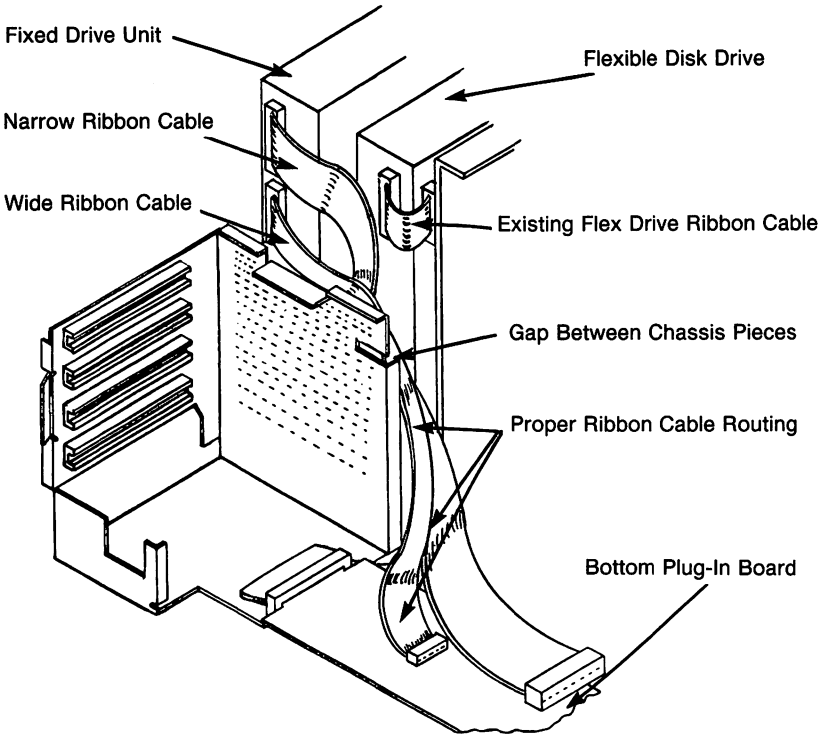


Figure 4-25 Routing of ribbon cables through chassis (rear quarter view)

14. Before you actually install the Controller Plug-In Board, verify the setting of Switch 7 in Switch Block 1 (SW1) of the Main Processor Board (MPB). Refer to the appendix in this manual for positions.
15. Next, pick up the Fixed Drive Controller Plug-In Board from the fixed disk kit. Install in accordance with directions in the section on Board Insertion/Removal.
16. Next, assemble the two unconnected ribbon cable connectors to the connectors on the bottom, rearward/right edge of the now installed Controller Plug-In Board (Refer to Figure 4-26).

    Connect the wide ribbon cable first with the solid color coded wire edge to the left as viewed from the rear. Care must be taken for proper pin alignment before carefully but firmly pressing straight up to complete connection at J1.

    Then connect the narrow remaining ribbon cable in a similar manner at J2 with the solid color coded wire edge to the left.

Make sure that the two ribbon cables you are connecting are not twisted more than a half turn between the gap where they feed between the chassis members and the final connection to the Controller Board connectors.

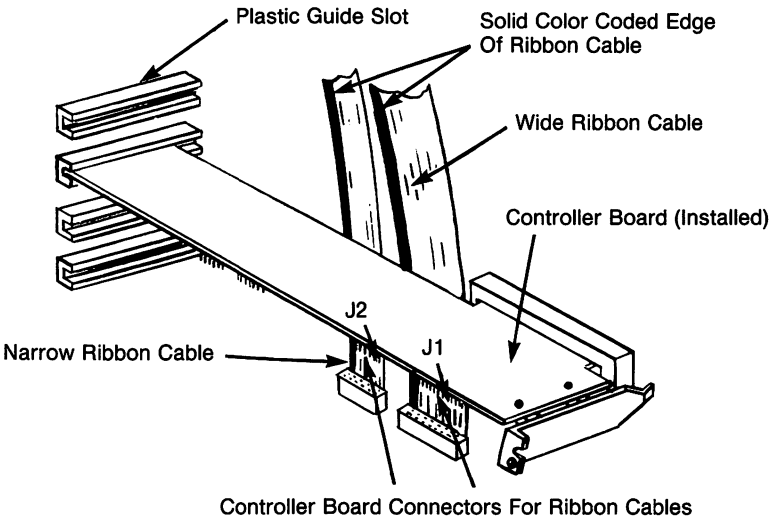


Figure 4-26 Connecting ribbon cables to bottom of controller board

17. Installation is now complete, proceed to reassemble the cabinet.

Troubleshooting

This chapter provides instruction for the USER DIAGNOSTICS (Version 2.0 or later) diskette found in the back of this manual. These DIAGNOSTICS can be used to aid in determining the hardware problems you may encounter with your NCR PERSONAL COMPUTER Model 4.

It is recommended that you skim this chapter to familiarize yourself with the options available.

The DIAGNOSTICS present optional test selections, status and error conditions, and test patterns on your CRT display screen. You can choose to run all the tests once, all the tests continuously, or each test independently. Tests that apply to components not present in your system will not be run. The test results enable you to isolate the malfunction(s) and, in some instances, correct them.

To start the DIAGNOSTICS:

1. Insert the diskette into drive A and turn the drive access lever to the horizontal position.
2. Turn the power switch to "ON" if it is "OFF"; if it is "ON" press Ctrl, Alt, and Del keys simultaneously.

To exit the DIAGNOSTICS:

1. Open drive access lever A.
2. Remove the DIAGNOSTICS diskette from drive A.
3. Turn your computer off.

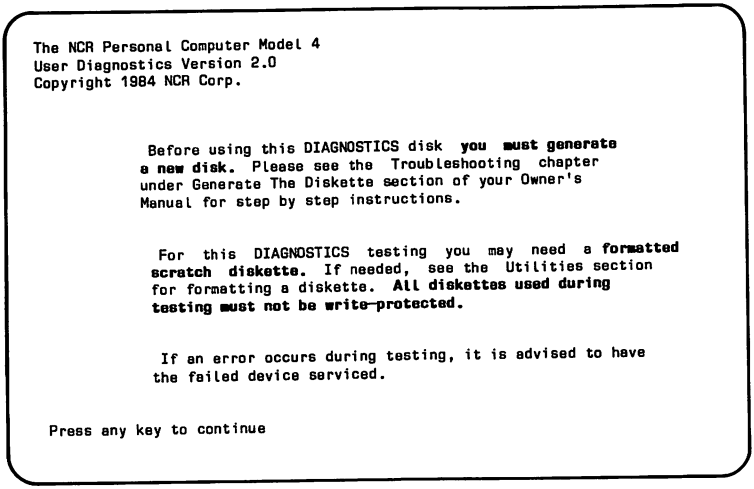
No specific menu selection for exiting from the USER DIAGNOSTICS is displayed at any time.

MENU HELP SCREENS

While running the DIAGNOSTICS, to obtain quick information about menu choices without referring back to this chapter, press the F1 key. This key will always display the online user HELP screens.

ORIENTATION SCREEN

The USER DIAGNOSTICS begin with the Orientation Screen. The copyright and other valuable information for the new user are displayed on this first screen.



VERIFY THE CONFIGURATION

Once you have read the Orientation Screen and have entered a key, the USER DIAGNOSTICS tests the Main Processor Board switches to determine which components are present. These DIAGNOSTICS are designed to test your base configuration components. This may include a maximum of two flexible disk drives, up to 640 Kb memory, one hard disk drive, one parallel printer, the serial and parallel ports on the main processor board, one color monitor, one monochrome monitor, and one keyboard. Any additional components will not be recognized, and therefore will not be highlighted. Your system's components are highlighted in the CONFIGURATION MENU similar to the example given below. Check that the highlighted components are in fact the ones you have on your computer. The X's in "XXX Kb Memory", "X Flexible Disk Drive(s) and Controller", and "X Hard Disk Drive(s) and Controller" should be filled in with the correct values for your computer. If the highlighted components are correct and the X's are substituted correctly, then enter a 'Y' to proceed to the MAIN MENU and *you are ready to skip to the GENERATE THE DISKETTE section* of this chapter.

The CONFIGURATION MENU display:

```
NCR PERSONAL COMPUTER DIAGNOSTICS - VERSION 2.0

     CONFIGURATION MENU

     XXX Kb Memory
     Main Processor Board
     Keyboard
     X Flexible Disk Drive(s) and Controller
     X Hard Disk Drive(s) and Controller
     Monochrome Display
     Color/Graphics Display
     Parallel Port
     Serial Port
     Printer

  Is this configuration correct (Y/N)?
```

However, if the highlighted components and/or the X's are not correct, you should enter "N" as a response to the prompt. Then the program responds with:

```
PLEASE TURN YOUR SYSTEM OFF.  MAKE SURE THE SYSTEM  SWITCHES ARE SET
CORRECTLY AND ALL DEVICES ARE SECURELY PLUGGED IN,  THEN TURN ON YOUR
SYSTEM  TO REBOOT.  IF THE PROBLEM STILL EXISTS, THE DEVICE OR SYSTEM
NEEDS SERVICING.
```

Follow the instructions above. Look in Appendix C of your Owner's Manual for information on system switch settings. Now you should recheck the list. If the list is not correct, and you cannot find a reason

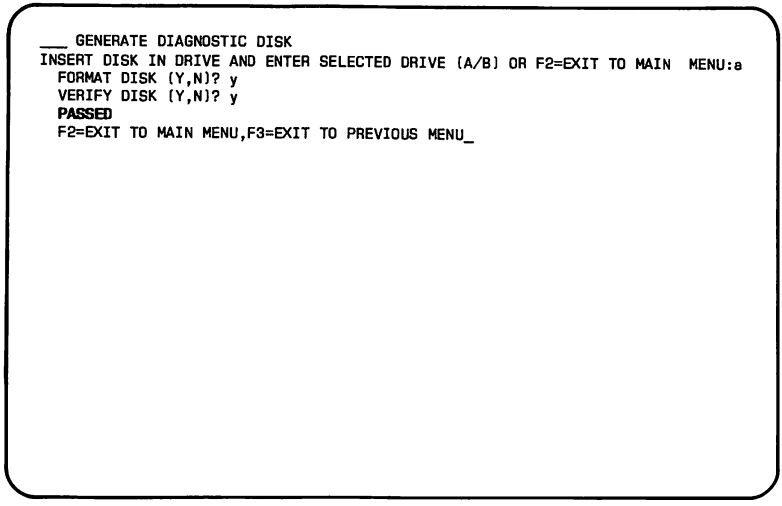
for the discrepancy, call your dealer or NCR representative for advice. Or, if you purchased a Maintenance Agreement, follow the instructions in the Agreement.

GENERATE THE DISKETTE

When a 'Y' is entered after the CONFIGURATION MENU, the MAIN MENU is displayed on the screen. Before the USER DIAGNOSTICS diskette is used for the first time, it must be copied to a second diskette. The original diskette is write-protected to preserve your master copy and cannot be used for testing. You should use a non-write-protected copy of the DIAGNOSTICS since write- protection will produce invalid errors during some of the tests. The best way to copy the DIAGNOSTICS is to use the Generate Diagnostics Disk function located in the UTILITIES MENU.

When the MAIN MENU is displayed, enter "**C**" to select the UTILITIES MENU. Then enter "**2**" to select the Generate Diagnostics Disk function. Insert a diskette, formatted or unformatted, upon which the copy is to be made, into either drive A or drive B. (The USER DIAGNOSTICS diskette from which the routines were loaded can be removed at any time after the DIAGNOSTICS are booted into the system, and can be left out during the remainder of the testing.)

Enter drive designation "**A**" or "**B**" when prompted; then enter "**Y**" or "**N**" in response to **FORMAT DISK (Y,N)?**. Also enter "**Y**" or "**N**" in response to **VERIFY DISK (Y,N)?**. VERIFY checks for a successful format. After successfully formatting, copying and verifying, a **PASSED** (successful copy) message is displayed as seen in the example below:



Press F2 to return to the MAIN MENU or press F3 to return to the UTILITIES MENU.

(Alternately, the diskette can be generated using the NCR-DOS DISKCOPY command.)

The generated diskette should be labeled as the USER DIAGNOSTICS copy, kept in the back of this manual or in safe storage, and used for all testing. The original diskette should be kept as a backup, and used only for making copies. It also should be stored safely.

MAIN MENU

You are now ready to run the MAIN MENU tests. This menu is presented each time the user chooses to return to the MAIN MENU at the completion of a specific test, or when F2 is pressed to halt a test during execution. The MAIN MENU gives the operator the following choices:

- Run All Tests (one time) (Menu item 1)
- Test A Specific Component (or type) (Menu items 2 - A)
- Run Utilities (Menu item C)
- View MAIN MENU HELP Screen (Press F1)

- Initiate A Continuous Test Run (Press ALT and any item number, 1 thru B)

The MAIN MENU display:

```
NCR PERSONAL COMPUTER DIAGNOSTICS - VERSION 2.0

      MAIN MENU

1  Run All Tests

2  XXX Kb Memory
3  Main Processor Board
4  Keyboard
5  X Flexible Disk Drive(s) and Controller
6  X Hard Disk Drive(s) and Controller
7  Monochrome Display
8  Color/Graphics Display
9  Parallel Port
A  Serial Port
B  Printer

C  Utilities
     (Error Log,Disk Utilities,Head Relocation)

Enter a highlighted selection number:_

F1=HELP,ALT and TEST 1 through B=CONTINUOUS RUN,F2=STOP CONTINUOUS RUN
```

A specific test may be run continuously by holding down the ALT key while entering the selection number or letter. The test will run until the F2 key is pressed. If the number "1" is entered while the ALT key is being held down, the series of tests 2 through A are repeated continuously until F2 is pressed.

DIAGNOSTIC SELECTIONS

The following sections describe the results of each selection path chosen from the MAIN MENU. Each individual test option from the MAIN MENU along with the messages associated with that particular test are shown as seen on the screen. The messages generated for the Run All Tests option correspond to the ones generated while running tests 2 through A independently. The error messages are logged in the ERROR LOG which can be found under option C, UTILITIES.

If an error message is displayed while running your USER DIAGNOSTICS, the device which failed should be taken in for servicing unless otherwise noted with the screen displays below.

RUN ALL TESTS (Selection 1)

When selection number "1" is chosen from the MAIN MENU screen, the separate tests for specific devices (selections 2 through A) are automatically run in sequence. The test for any device which is not present is skipped.

First Screen — CAUTION

The following messages are displayed if they pertain to your configuration:

```
Leave the DIAGNOSTICS disk in drive A.
Insert a formatted scratch disk in drive B.

Please disconnect the printer cable from either the printer
or the computer before continuing.

F2=EXIT TO MAIN MENU,ANY KEY TO CONTINUE_
```

CAUTION

The Flexible Disk Diagnostic Tests are destructive to any disk other than the DIAGNOSTICS disk. **BEFORE CONTINUING,** make certain that you have the DIAGNOSTICS diskette and/or a formatted scratch diskette(s) inserted in each flexible disk drive(s). If any other diskette is left in, data and/or programs on it will be written over by test patterns. If a write-protect tab is left on the test disk, an error will result.

If you have a parallel printer, you must disconnect it from your computer before you begin this test. Unplugging the printer from the wall or turning it off is **not sufficient.** The printer interferes with the Parallel Port Test and an error will occur if you do not disconnect one end of the printer cable.

The program does not stop again after this point.

NOTE: If no formatted disks are available, and one or two are needed at this point, press F2 to return to MAIN MENU, select the UTILITIES function (**C**) and, from the Utilities menu, select Format Flexible Disk (**3**). Then restart the Run All Tests function.

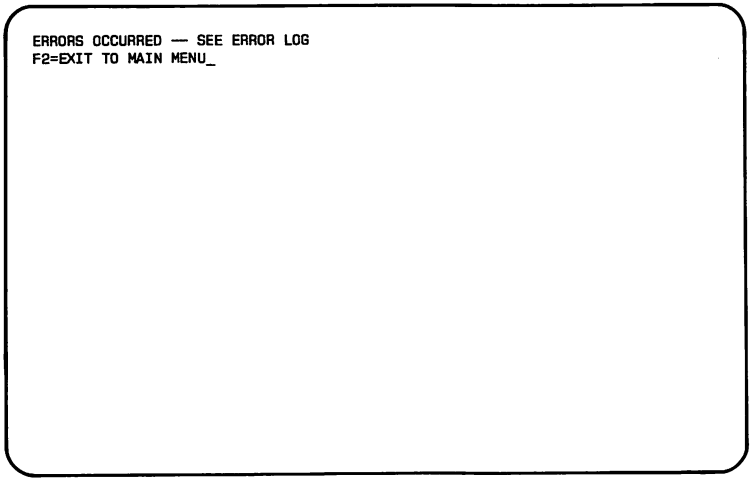
Automatic Completion

An error message, if appropriate, is displayed after the test during which the error was detected; however, the program does not stop.

After the first screen, the program runs to successful or unsuccessful completion of all tests regardless of test results. To stop the process at the end of a device test (all sub-tests for the device will still be completed), press F2. The DIAGNOSTICS will return to the MAIN MENU upon completion of the current test or group of tests.

Upon successful completion of all tests, the message **PASSED ALL TESTS** and the prompt to return to the MAIN MENU is displayed.

If any error(s) was detected, the display is:



Press F2 to return to the MAIN MENU. To see the errors, select the UTILITIES function (selection number "**C**"). Next select Error Log ("1"), and then Display Log (also "1").

SCREEN DISPLAYS FOR SELECTIONS 2 THROUGH B

Press the space bar or any key to continue in response to the prompt. The following screen displays are representative of those that will appear. For each sub-test, either the "PASSED" message or one of the listed error messages will be displayed. The displays are:

Memory Tests (Selection 2)

```
___ RAM PATTERN
PASSED
     or
ERROR ON MAIN PROCESSOR BOARD DUE TO
RANDOM ACCESS MEMORY (RAM) PATTERN ERROR
     or
ERROR ON EXPANSION BOARD DUE TO
RANDOM ACCESS MEMORY (RAM) PATTERN ERROR
___ RAM ADDRESS
PASSED
     or
ERROR ON MAIN PROCESSOR BOARD DUE TO
RANDOM ACCESS MEMORY (RAM) ADDRESS ERROR
     or
ERROR ON EXPANSION BOARD DUE TO
RANDOM ACCESS MEMORY (RAM) ADDRESS ERROR
```

Memory Tests (Selection 2)

```
___ RAM PARITY
PASSED
     or
ERROR ON MAIN PROCESSOR BOARD DUE TO
RANDOM ACCESS MEMORY (RAM) PARITY ERROR
     or
ERROR ON EXPANSION BOARD DUE TO
RANDOM ACCESS MEMORY (RAM) PARITY ERROR
___ FIRMWARE CHECKSUM
PASSED
     or
READ ONLY MEMORY (ROM) CHECKSUM ERROR

F2=EXIT TO MAIN MENU,F3=EXIT TO PREVIOUS MENU
```

Memory Tests (Selection 2) (continued)

Main Processor Board Tests (Selection 3)

```
___ DMA
PASSED
     or
DIRECT MEMORY ACCESS (DMA) CONTROLLER ERROR
___ FLEXIBLE DISK
PASSED
     or
FLEXIBLE DISK CONTROLLER BOARD ERROR
___ INTERVAL TIMER
PASSED
     or
INTERVAL TIMER ERROR
___ INTERRUPT CONTROLLER
PASSED
     or
INTERRUPT CONTROLLER ERROR
___ PPI
PASSED
     or
PROGRAMMABLE PERIPHERAL INTERFACE ERROR
___ CRT, MONO
PASSED
     or
MONOCHROME CRT CONTROLLER BOARD ERROR
```

Main Processor Board Tests (Selection 3)

```
___ CRT, COLOR
PASSED
     or
COLOR CRT CONTROLLER BOARD ERROR
___ SERIAL
PASSED
     or
SERIAL PORT (COM1) ERROR
___ HARD DISK
     or
HARD DISK CONTROLLER BOARD ERROR
___ CPU
PASSED
     or
CENTRAL PROCESSING UNIT (CPU) ERROR

F2=EXIT TO MAIN MENU,F3=EXIT TO PREVIOUS MENU
```

Main Processor Board Tests (Selection 3) (continued)

Keyboard Tests (Selection 4)

For Selection 1, "RUN ALL TESTS" the following screen is displayed:

```
___ KEYBOARD PORT
PASSED
   or
KEYBOARD OR KEYBOARD PORT ERROR

 F2=EXIT TO MAIN MENU,F3=EXIT TO PREVIOUS MENU
```

For Selection 4, "KEYBOARD TESTS" the following screen is displayed:

```
___ KEYBOARD PORT
___ KEYBOARD

F1 F2  ESC 1  2  3  4  5  6  7  8  9  0  -  =  BS      DEL PU     NL    SL

F3 F4  TAB Q  W  E  R  T  Y  U  I  O  P  [  ]  CR  CTL END PD  HM ↑  PU -

F5 F6  CTL A  S  D  F  G  H  J  K  L  ;  '  `           ↑     ←  5  →

F7 F8   ↑  \  Z  X  C  V  B  N  M  ,  .  /  ↑  PS   ←  HM  →  END ↓  PD +

F9 F10 ALT                SP                CL INS      ↓     INS   DEL CR

ENTER KEY CODES TO BE TESTED AND VERIFY THAT THE
CORRECT CODE APPEARS ON THE CRT DISPLAY.
ENTER F1 AND F10 IN SEQUENCE TO EXIT TEST.
DO THE CHARACTERS AND CODES DISPLAYED MATCH THE ONES ENTERED? (Y/N)_
```

The last line in the display directs the operator to **ENTER F1 AND F10 IN SEQUENCE TO EXIT TEST.** Whether any other keys have been pressed or not, pressing these two keys results in a final prompt.

After all keys have been pressed, followed by the F1/ F10 entry, a prompt is displayed which asks you if the key symbols displayed match the keys entered. An entry of "**Y**" indicates a successful completion of the test and results in the **PASSED** display. An entry of "**N**" indicates unsuccessful completion and results in an **error message** display. Pressing F2 or F3 after the **PASSED** or **error message** display returns the program to the MAIN MENU, since that was the last previous menu.

Flexible Disk Drive Tests (Selection 5)

When running selection 1, "Run All Tests", there is not a pause between the drive A test and drive B test. Therefore, both drives will be tested. A non-write protected disk must be in both drives before testing begins, otherwise errors will result.

NOTE: Drive A is always tested before drive B.

```
___ READ/WRITE - DRIVE A
WARNING — This test is destructive to any disk other than
the diagnostic disk.
Insert disk to be used in drive under test.
PASSED
   or
DRIVE A READ ERROR: If drive door open, close; retest.
   or
DRIVE A WRITE ERROR: If write protected, remove tab; retest.
   or
DRIVE A FORMAT ERROR: If drive door open, close; retest.
___ READ/WRITE - DRIVE B
WARNING — This test is destructive to any disk other than
the diagnostic disk.
Insert disk to be used in drive under test.
PASSED
   or
DRIVE B READ ERROR: If drive door open, close; retest.
   or
DRIVE B WRITE ERROR: If write protected, remove tab; retest.
   or
DRIVE B FORMAT ERROR: If drive door open, close; retest.

F2=EXIT TO MAIN MENU,F3=EXIT TO PREVIOUS MENU
```

Hard Disk Drive Tests (Selection 6)

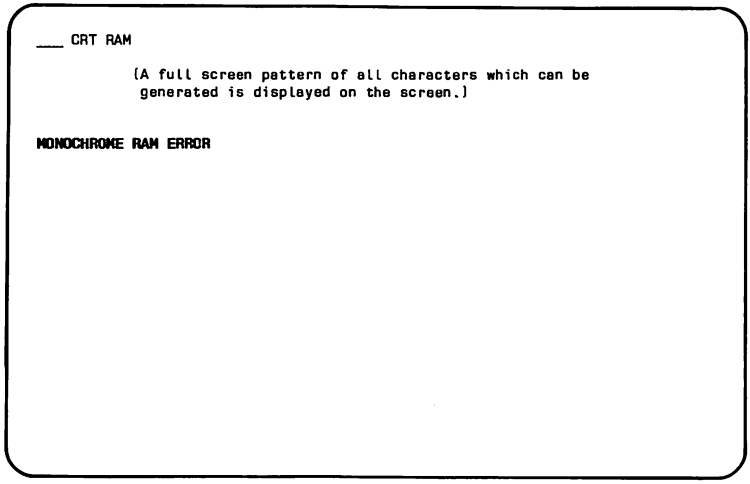
```
___ READ/WRITE MAINTENANCE TRACK
PASSED
    or
HARD DISK CONTROLLER BOARD ERROR
    or
HARD DISK NOT READY ERROR
    or
HARD DISK FORMAT ERROR
    or
HARD DISK WRITE ERROR
    or
HARD DISK READ ERROR
    or
HARD DISK ERROR
___ READ ONLY SECTOR 0
    or
HARD DISK CONTROLLER BOARD ERROR
    or
HARD DISK NOT READY ERROR
    or
HARD DISK READ ERROR
    or
HARD DISK ERROR

F2=EXIT TO MAIN MENU,F3=EXIT TO PREVIOUS MENU
```

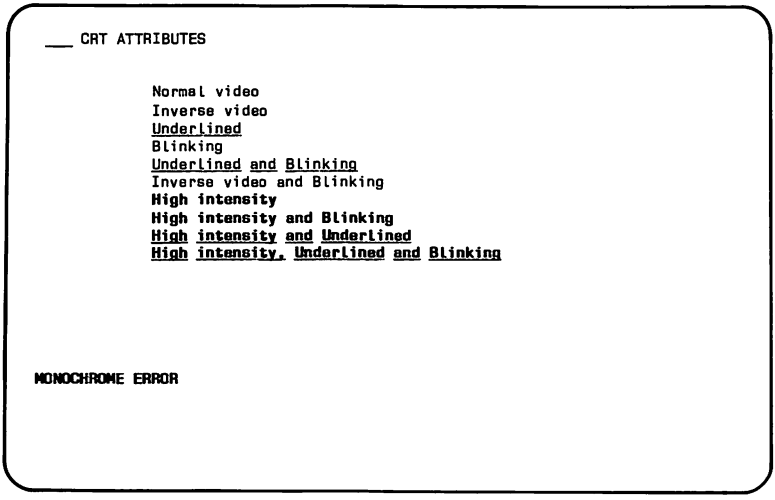
Monochrome Display Tests (Selection 7)

NOTE: This test consists of a series of screens designed to test the CRT attributes. Error messages may occur after each screen but a **PASSED** message is only displayed at the end of the series when the entire test was successful. Running this test under "Run All Tests" (selection 1) or continuously (ALT 1 or ALT 7) exercises the CRT, but you are not asked whether or not the screens are correct. If the information on the screen is not correct, errors will not be detected. If you are running this test separately (selection number 7), your screen should look like the ones following and you should respond to the prompt with a Yes if the display on your screen is correct and No if it is not. The test will not continue if an error occurs.

```
___ CRT, MONOCHROME
MONOCHROME ERROR
```

```
IS THE CURSOR A SOLID BLOCK AND POSITIONED HERE?(Y/N)
MONOCHROME ERROR
```

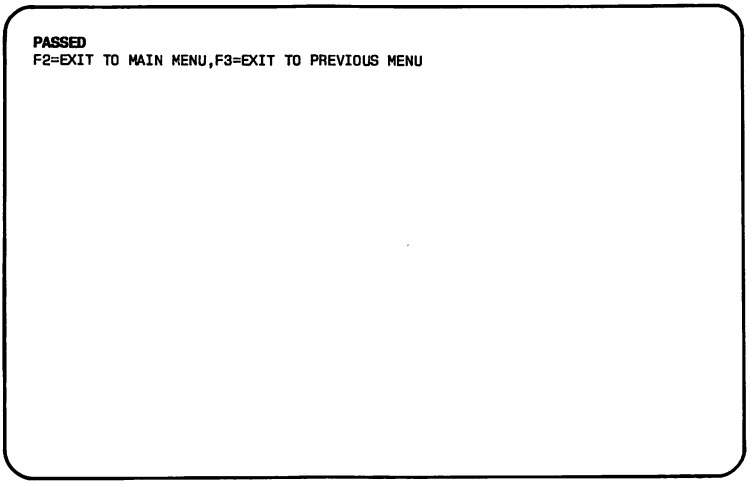




(Each line should display its description)

```
___ CHARACTER SET

          (A seven line pattern of all characters which can be
           generated is displayed on the screen.)

MONOCHROME ERROR
```

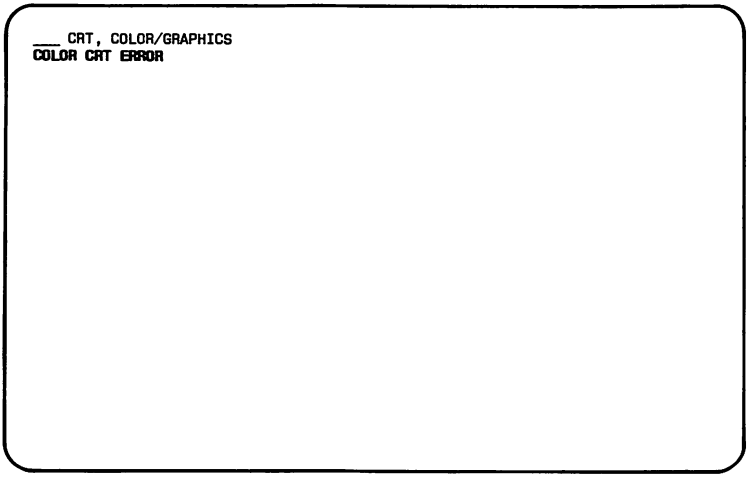
```
___ SCROLL TEST
    These lines should scroll from bottom to top

          (These two lines start at the bottom of the screen and
           scroll until they reach the top.)

MONOCHROME ERROR
```



Color/Graphics Display Tests (Selection 8)

NOTE: Running this test continuously (ALT 1 or ALT 8) exercises the CRT, but you are not asked whether or not the screens are correct. If the information on the screen is not correct errors will not be detected.

This test runs in the same manner as the Monochrome Display Test.



```
IS THE CURSOR A SOLID BLOCK AND POSITIONED HERE?(Y/N)
COLOR CRT ERROR
```

```
___ CRT RAM

          (A full screen pattern of all characters which can be
           generated is displayed on the screen.)

COLOR CRT RAM ERROR
```

```
___ CRT ATTRIBUTES

          Normal video
          Inverse video
          Blue highlight
          Blinking
          Blue highlight and blinking
          Inverse video and blinking
          High intensity
          High intensity and blinking
          High intensity and blue highlight
          High intensity, blinking and blue highlight

          White on blue
          White on green
          White on red
          Blue on white
          Green on white
          Red on white


COLOR CRT ERROR
```

(Each line should be displayed as described)

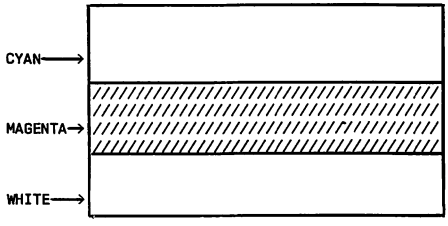
```
___ CHARACTER SET

          (A seven line pattern of all characters which can be
           generated is displayed on the screen.)

COLOR CRT ERROR
```

___ SCROLL TEST
These lines should scroll from bottom to top

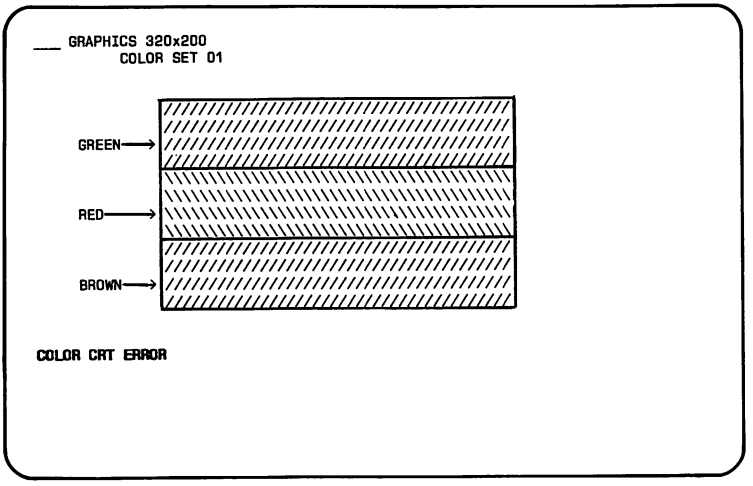
(These two lines start at the bottom of the screen and
scroll until they reach the top.)

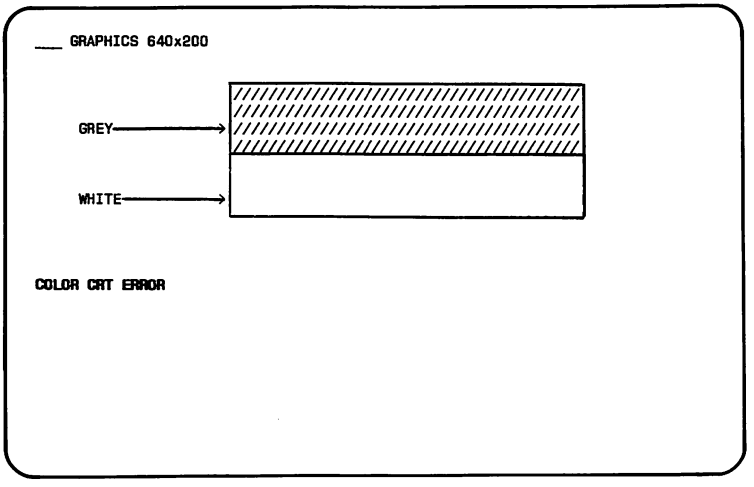
COLOR CRT ERROR

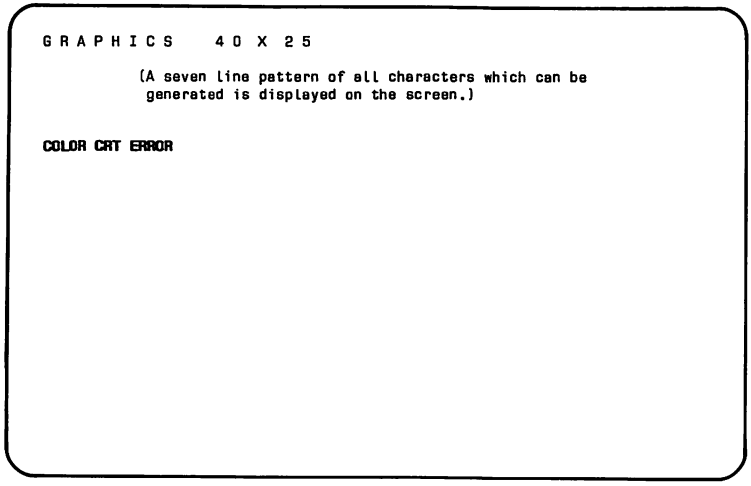
___ GRAPHICS 320x200
COLOR SET 00



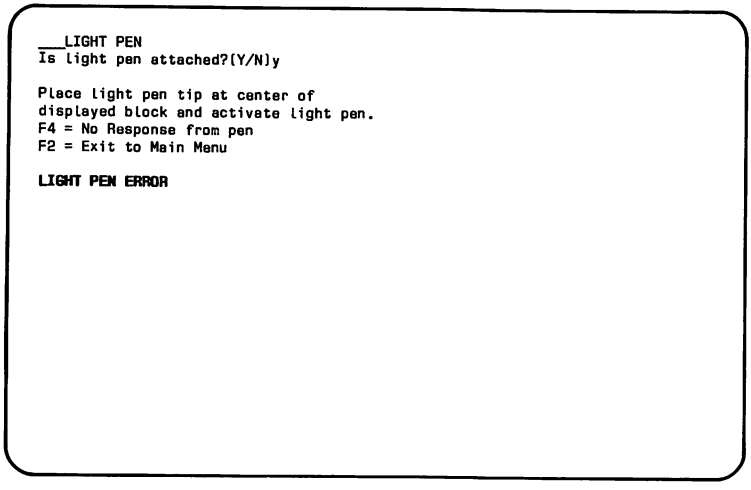
COLOR CRT ERROR


GRAPHICS 320x200
COLOR SET 01
GREEN
RED
BROWN
COLOR CRT ERROR


GRAPHICS 640x200
GREY
WHITE
COLOR CRT ERROR



You are prompted as to whether you have a light pen or not. The light pen is an optional peripheral which allows you to make selections by touching the pen on lighted areas of the screen. Selection 1, "Run All Tests", does not include this test.



```
PASSED
F2=EXIT TO MAIN MENU,F3=EXIT TO PREVIOUS MENU
```

Parallel Port Tests (Selection 9)

```
___ PARALLEL PORT
Please disconnect the printer cable from either the printer or the computer.
 PASSED
     or
 PARALLEL PORT ERROR: If applicable, disconnect printer cable; retest.

 F2=EXIT TO MAIN MENU,F3=EXIT TO PREVIOUS MENU
```

NOTE: If you have a parallel printer, you must disconnect it from your computer before you begin this test. Unplugging the printer from the wall or turning it off is **not sufficient.** The printer interferes with the Parallel Port Test and an error will occur if you do not disconnect one end of the *printer cable.*

Serial Port Tests (Selection A)

```
___ SERIAL PORT: COM1
PASSED
    or
SERIAL PORT (COM1) ERROR

F2=EXIT TO MAIN MENU,F3=EXIT TO PREVIOUS MENU
```

Printer (Selection B)

If your configuration includes a printer, selection "**B**" from the MAIN MENU displays the Printer Tests menu screen:

```
NCR PERSONAL COMPUTER DIAGNOSTICS - VERSION 2.0

        PRINTER

1  Generic Printer
2  PC-Compatible Printer

Enter selection number:_

F1=HELP,F2=EXIT TO MAIN MENU
ALT and TEST 1 through 2=CONTINUOUS RUN,F2=STOP CONTINUOUS RUN
```

Any parallel printer can be tested using the "generic" printer test. Only a printer which is designed to respond to PC-specific control codes for additional functional capability can be tested using the "PC-Compatible" printer test.

Each of the two available tests is selected by entering the corresponding number (1 or 2). If the number for a specific test is entered while the ALT key is being held down, that test is run continuously until F2 is pressed. When F2 is pressed, the program returns to the MAIN MENU.

A serial printer is not included in this test.

Generic Printer Test

This test sends a pattern of ASCII characters to the printer. The name of the test is displayed while the test is in progress:

```
___ GENERIC PRINTER
PASSED
   or
PRINTER ERROR: Check for printer on or out of paper; retest.
```

PC-Compatible Printer Test

If selection 2 of the Printer test menu is chosen, the PC-Compat- ible Printer test is run. This test sends a pattern of ASCII characters to the printer followed by several lines which are displayed according to their description. If your printer is not PC-compatible and you run this test the typed lines will not match their description.

While this test runs, your screen should display:

```
___PC-COMPATIBLE PRINTER
PASSED
   or
 PRINTER ERROR: Check for printer on or out of paper; retest.
```

UTILITIES (Selection C)

Enter the letter "C" to access a set of UTILITY routines. These UTILITIES perform functions that are related to or needed during diagnostics and/or maintenance operations. The UTILITY functions available include:

- Error Log
- Generate Diagnostics Disk
- Format Flexible Disk
- Position Head For Relocation

The display of the menu screen for the Utility functions is:

```
NCR PERSONAL COMPUTER DIAGNOSTICS - VERSION 2.0

        UTILITIES

1  Error Log
2  Generate Diagnostics Disk
3  Format Flexible Disk
4  Position Head For Relocation

Enter selection number:_

F1=HELP,F2=EXIT TO MAIN MENU
```

Error Log

If selection 1 of the UTILITIES MENU is chosen, the ERROR LOG MAINTENANCE screen is displayed:

```
NCR PERSONAL COMPUTER DIAGNOSTICS - VERSION 2.0

     ERROR LOG MAINTENANCE

1  Display Log
2  Display Log From Disk
3  Write Log to Disk
4  Print Log
5  Delete Log

Enter selection number:_

F1=HELP,F2=EXIT TO MAIN MENU,F3=EXIT TO PREVIOUS MENU_
```

Display Log — The error log stored in the computer's memory is displayed on the screen.

Display Log from Disk — An error log, which has previously been stored on a flexible disk, is read into memory from the disk and then displayed on the screen. NOTE: If an error occurs, refer to the Flexible Disk Drive Test (selection 5).

Write Log to Disk — The error log presently in memory is written to a specific location on the disk which will overwrite a previously written log. Either the DIAGNOSTICS disk or a formatted scratch disk may be used. Data may be destroyed on any other disk. Make sure the target disk is not write-protected. NOTE: If an error occurs, refer to the Flexible Disk Drive Test (selection 5).

Print Log — Prints the log which is currently in memory to the printer. Your system configuration must include a parallel printer. The log will not be printed if the printer is serial. NOTE: If an error occurs, refer to the Printer Test (selection B).

Delete Log — Deletes the current log from memory. This does not delete a log from a flexible disk.

If F3 is pressed, the program returns to the UTILITIES menu. If F2 is pressed, the program returns to the MAIN MENU.

NOTE: Whenever the DIAGNOSTICS disk is rebooted the log in memory is cleared. If you want to save it, you must write the log to a disk before turning off the computer or rebooting.

Generate Diagnostic Disk

If selection 2 of the UTILITIES MENU is chosen, a copy of the DIAGNOSTIC disk is generated by writing the diagnostic code which is in memory onto a scratch disk.

If an error occurs during generation, refer to the Flexible Disk Drive Test (selection 5).

Format Flexible Disk

If selection 3 of the UTILITIES MENU is chosen, a flexible disk will be formatted.

If an error occurs during formatting, refer to the Flexible Disk Drive Test (selection 5).

Position Head For Relocation

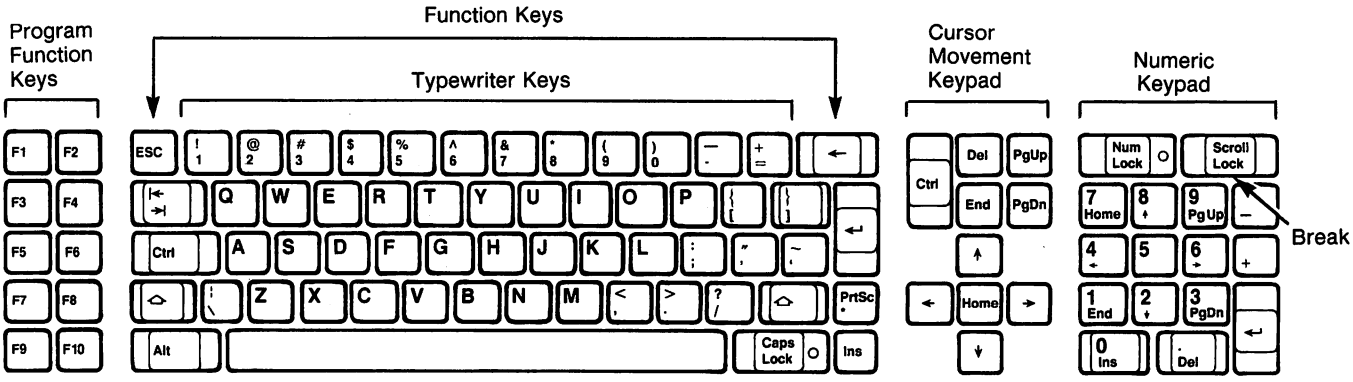
If selection 4 of the UTILITIES MENU is chosen, the head of the hard disk drive will be positioned to prevent damage when the computer is moved.

If an error occurs during positioning the head, refer to the Hard Disk Drive Test (selection 6).

NOTE: If your hard disk head is not positioned correctly before moving the unit, the main directory and/or valuable data could be lost. *Therefore, this utility must always be run before transporting a hard disk unit.*

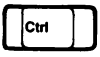
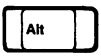
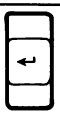
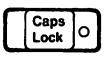
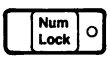
Appendix A

Keyboard Functions



KEYBOARD CHART

KEY FUNCTION CHART

Key/Name	Function	Notes
 Escape	Used to escape from the structure of a program	
 Tab	Used to set and clear tabs.	Upper case set Lower case clear
 Control	Used to access alternate functions of keys	
 Shift	Used to access "shifted" functions of keys	
 Alternate	Used to access alternate functions of keys	
 Backspace	Moves cursor one character to the left with each stroke	Erases characters at cursor position.
 Return	Moves cursor from end of one line to beginning of next. Also used to enter commands.	Referred to as Enter key, or Carriage Return, <CR>
 Capital Lock	Locks alpha keyboard in uppercase mode	Does not access shifted modes of keys, caps lock only causes alpha keys to print uppercase.
	Activates and deactivites numeric keypad. Functions as a toggle switch.	Light on key comes on when numeric keypad is active.
 Home	Returns cursor to top left of screen	7 key is activated when number lock is toggled.
 Cursor Left	Moves cursor one character to the left with each stroke	Deletes characters it passes. 4 key is activated when number lock is toggled.

Key/Name	Function	Notes
1 End	Moves cursor to last character in the line	1 key is activated when number lock is toggled.
8 ↑ Cursor Up	Moves cursor up one line each stroke	8 key is activated when number lock is toggled.
2 ↓ Cursor Down	Moves cursor down one line each stroke (Inactive in NCR-DOS)	2 key is activated when number lock is toggled.
0 Ins Insert	Activates and deactivities "Insert Mode".	0 key is activated when number lock is toggled.
9 PgUp Page Up	Displays previous page of text or program (Inactive in NCR-DOS)	9 key is activated when number lock is toggled
6 → Cursor Right	Moves cursor one character to the right with each stroke.	Deletes characters it passes 6 key is activated when number lock is toggled.
3 PgDn Page Down	Displays next page of text or program.	3 key is activated when number lock is toggled.
. Del Delete	Used to delete portions of text	Decimal point is activated when number lock is toggled.
Scroll Lock	Freezes scrolling information on CRT	When pressed with Ctrl, is Break key.
- Minus	Used to indicate negative values of numbers.	
+ Plus	Used to indicate positive values of numbers.	
PrtSc * Print Screen	Prints asterisk.	When pressed with shift ↑, information on screen is sent to printer.

Technical Data

NCR PC Model 4 — TECHNICAL SPECIFICATIONS				
SIZE	Height		Width	Depth
Processor	14 1/2"		18"	16"
Keyboard	3/4" nearest operator	1 3/4" away from operator	20 3/8"	7 7/8"
WEIGHT				
Processor	50 lbs.			
Keyboard	4 1/2 lbs.			
Nominal Voltage	120 volts ac	Range 104 to 127 volts ac		
Frequency	60 Hertz (59 to 60.6 Hertz)			
Power	116 watts (maximum) 2.5 amp (maximum)			
Cable Length	Power 3 m. Keyboard 1 m. coiled cord (extendable) Parallel Printer 2 m. RS 232 Serial Printer 2 m. RS 232 Communication Cable 2 m.			
ENVIRONMENT	Operating		Power Off	
Temperature	15.6° to 32° C 60° to 90° F		10° to 43° C 50° to 110° F	
Humidity	8% to 80%		20% to 80%	
Product Safety	UL 478 UL listing mark used			
Radio Protection	Class B, Part 15, Sub-part J of FCC Regulations			

MAIN PROCESSOR BOARD	
Central Processing Unit	8088 Microprocessor
RAM/EXPANSION RAM	128 KB (standard); up to 256 KB total optional
EPROM	8 K byte BIOS included
Ports	1 parallel printer part (Centronix) 1 RS 232C serial port 1 Keyboard port 1 Speaker port
Expansion Slots	5 slots, third party compatible

KEYBOARD	
Data Transfer Mode	bidirectional, serial
Number of Conductors	4 four-wire and shield coiled cable
KEY ARRANGEMENT Number of Keys Special Function Keys Numeric Keypad Area Cursor Control	 95 10 program function keys 16 keys 5 cursor positioning keys

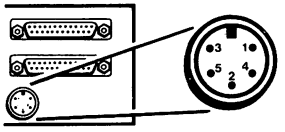
EXPANSION SLOT CONNECTIONS			
A	**Function**	**B**	**Function**
1	-I/O CHECK	1	Ground
2	+D7	2	+Reset Drive
3	+D6	3	+5V
4	+D5	4	IRQ2
5	+D4	5	-5V
6	+D3	6	+DRQ2
7	+D2	7	-12
8	+D1	8	-HRQ I/O
9	+D0	9	+12V
10	+I/O CH RDY	10	Ground
11	+AEN	11	-MEMO
12	+A19	12	-MEMR
13	+A18	13	-IOW
14	+A17	14	-ICR
15	+A16	15	-DACK3
16	+A15	16	+DRQ3
17	+A14	17	-DACK1
18	+A13	18	+DRQ1
19	+A12	19	-DACK0
20	+A11	20	+CLOCK
21	+A10	21	+IRQ 7
22	+A9	22	+IRQ 6
23	+A8	23	+IRQ 5
24	+A7	24	+IRQ 4
25	+A6	25	+IRQ 3
26	+A5	26	-DACK 2
27	+A4	27	+T/C
28	+A3	28	+ALE
29	+A2	29	+5V
30	+A1	30	+OSC
31	+A0	31	Ground

BIOS CONNECTION	
Interrupt	**Function**
0	Divide by zero
1	Single Step
2	Non-maskable interrupt
3	Breakpoint
4	Overflow
5	Print Screen
6	Reserved
7	Reserved
8	Timer (18.2 $\frac{\text{Ticks}}{\text{Sec}}$)
9	Keyboard
A	Reserved
B	Communications
C	Communications
D	Hard Disk
E	Diskette
F	Printer
10	Video
11	Equipment Check
12	Memory Check
13	Diskette/Disk
14	Communications
15	—
16	Keyboard
17	Printer
18	—
19	Bootstrap
1A	Time of Day
1B	Keyboard Break } User
1C	Timer Tick } Supplied
1D	Video Initialization
1E	Diskette Parameters
1F	Video Graphics Characters

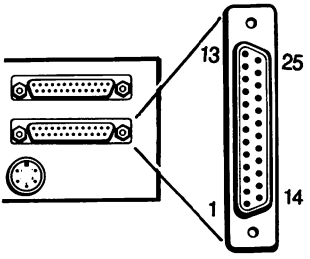
INTERRUPT LEVELS	
1	Timer
2	Keyboard
3	Reserved
4	Communications 2
5	Communications 1
6	Fixed Disks
7	Flexible Disks
8	Printer

PIN ASSIGNMENTS

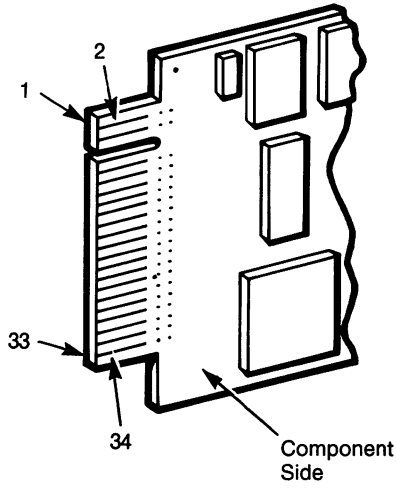
KEYBOARD	
Pin 1	clock
Pin 2	data
Pin 3	reset
Pin 4	ground
Pin 5	+5V
Shell	chassis ground



SERIAL INTERFACE RS232C	
Pin 1	Frame Ground
Pin 2	Transmit Data
Pin 3	Receive Data
Pin 4	Request to Send
Pin 5	Clear to Send
Pin 6	Data Set Ready
Pin 7	Signal Ground
Pin 8	Carrier Detect
Pins 9-19	Unused
Pin 20	Data Terminal Ready
Pin 21	Unused
Pin 22	Ring Indicator
Pins 23-25	Unused

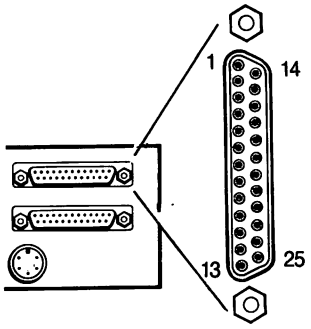


FLEX DISK CONNECTOR	
Pin 1	Ground
2	—
3	Ground
4	—
5	Ground
6	—
7	Ground
8	Index
9	Ground
10	Motor Enable A
11	Ground
12	Drive Select B
13	Ground
14	Drive Select A
15	Ground
16	Motor Enable B
17	Ground
18	Direction
19	Ground
20	Step
21	Ground
22	Write Data
23	Ground
24	Write Enable
25	Ground
26	Track 0
27	Ground
28	Write Protect
29	Ground
30	Read Data
31	Ground
32	Select Head 1
33	Ground
34	—



34 — Pin Keyed
Edge Connector

PARALLEL INTERFACE	
Pin 1	- Strobe
Pin 2	+D0
Pin 3	+D1
Pin 4	+D2
Pin 5	+D3
Pin 6	+D4
Pin 7	+D5
Pin 8	+D6
Pin 9	+D7
Pin 10	- Acknowledge
Pin 11	+ Busy
Pin 12	+ Paper Out
Pin 13	+ Select
Pin 14	- Auto
Pin 15	- Error
Pin 16	- Init
Pin 17	- Select in
Pin 18	Ground
Pin 19	Ground
Pin 20	Ground
Pin 21	Ground
Pin 22	Ground
Pin 23	Ground
Pin 24	Ground
Pin 25	Ground



System Switch Settings

APPENDIX C

System Switch Settings

SW1

POS	1	7	8	Number of Drives
	On	On	On	None
	Off	On	On	1 Drive
	Off	Off	On	2 Drives
POS		3	4	Memory
		Off	Off	128 to 640 K
POS		2		Coprocessor
		Off		Installed
		On		No Coprocessor
POS		5	6	Displays
		Off	Off	Monochrome
		On	Off	Color/Graphics 80 x 25
		Off	On	Color/Graphics 40 x 25

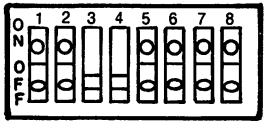
Note: If a monochrome display is connected to your system, switch positions 5 and 6 must always be off

SW2

POS	1	2	3	4	5	Memory
	On	Off	On	On	On	-128
	On	On	Off	On	On	-192
	On	Off	Off	On	On	-256
	On	On	On	Off	On	-320
	On	Off	On	Off	On	-384
	On	On	Off	Off	On	-448
	On	Off	Off	Off	On	-512
	On	On	On	On	Off	-576
	On	Off	On	On	Off	-640
POS	6	7	8			Serial Port
	On	Off	On			Com 1
	Off	Off	Off			Disabled

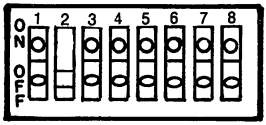
Switch SW 1

Memory

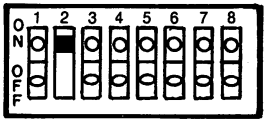


128K to 640K

Coprocessor

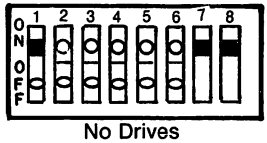


Coprocessor installed

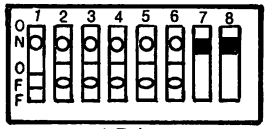


No coprocessor

Drives



No Drives



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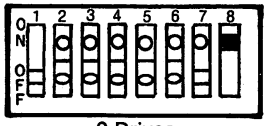

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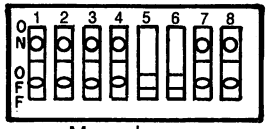

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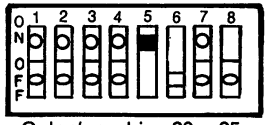
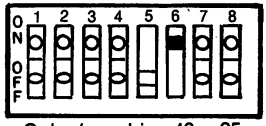


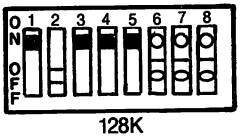
Color/graphics 80 x 25



Color/graphics 40 x 25

Switch SW2

Total system memory



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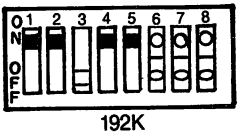

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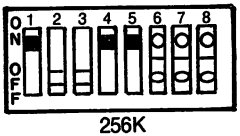

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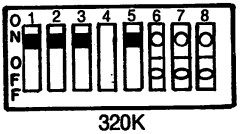

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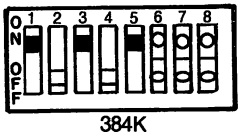

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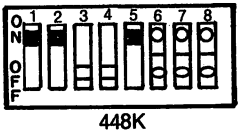

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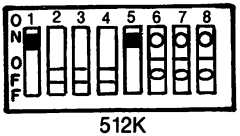

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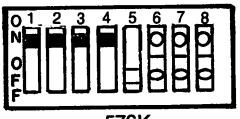

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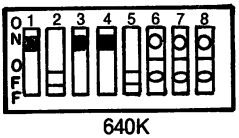

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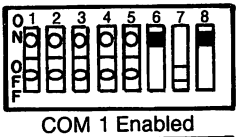
Serial port



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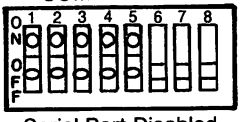

Serial Port Disabled

Glossary

A

ACOUSTIC COUPLER
A low-speed modem which uses a telephone handset to transmit and receive data, and does not need a permanent connection to the line.

ACRONYM
A word formed from the first letter or letters of the words in a name, term or phrase.

ADAPTER
A connector that has a plug for one type of cable or device and a socket for another type. An adapter allows parts of a computer which ordinarily don't fit together to be connected.

ADDRESS
Data is contained in the devices which make up your computer's internal and external memory and the registers in its CPU. Each accessable location within a device is assigned a number, which is known as an "address". In internal memory, the address is a specific byte number. In external memory, the address is a unit number (for example, drive A) and, for disk or diskette drives, the address may include a track number and a sector number. Your computer is able to locate data using these addresses.

APPLICATION PROGRAM
A program that you use on your computer to perform a specific job, such as budgeting or word processing.

ASCII
American Standards Code for Information Interchange. A uniform code in which alphabetic, numeric, and special characters plus several special symbols, are represented by 8-bit configurations.

ASSEMBLE

To prepare an object language program from a symbolic language program by substituting machine operation codes for symbolic operation codes and absolute addresses for symbolic addresses.

ASSEMBLER

A computer program that operates on symbolic input data to produce machine instructions. An assembler generally translates input symbolic codes into machine instructions, item for item, and produces, as an output, the same number of instructions or constants that were defined in the input symbolic codes.

ASYNCHRONOUS

Characterizing different time intervals between events or occurrences.

ASYNCHRONOUS DATA TRANSMISSION

A format for data transmitted across telephone lines in which each character is "framed" by a start bit and a stop bit. Thus, when transmitted asynchronously, each character is 10 bits in length: seven information bits, one parity bit, one start bit, and one stop bit.

B

BACKUP

1. v: The process of duplicating data from one location to another (for example, diskette to diskette or fixed disk to diskette). To prevent total information loss in case the original recording is lost or damaged.
2. n: A copy of a file or disk/diskette.

BASIC

1. Acronym for the programming language Beginner's All-purpose Symbolic Instruction Code. BASIC uses common English words and is relatively easy to use.
2. The computer program which translates statements made in BASIC programming language into instructions to the computer.

BINARY CODE

A system of numbering which uses only two values, zero and one. For example, the ASCII letter D is represented as 01000100.

BIT (BINARY DIGIT)

The smallest element of binary machine language represented by a magnetized spot on a recording surface or a magnetized element of a storage device. Whether the bit represents a 0 or a 1, i.e. is ON or OFF, is determined by ascertaining whether the magnetism was created by a positive or negative electrical charge.

BLOCK

A physical unit of data that can be conveniently stored by a computer on an input or output device. The term is synonymous with physical record. The block is normally composed of one or more logical records or a portion of a logical record.

BPI

Abbreviation for bits per inch. The standard measure for the density of data recording on disks/diskettes/tapes.

BPS

Abbreviation for bits per second. The standard measure for expressing the speed at which data bits are transmitted between devices or over communications lines.

BYTE

A sequence of adjacent bits operated upon as a unit. The smallest addressable memory element; usually represents one character. In your computer, each byte consists of eight bits plus one parity bit.

C

CATHODE RAY TUBE (CRT)

A vacuum tube in which a beam of electrons can be focused to a small point on a luminescent screen and can be varied in position and intensity to form a pattern. The CRT can be used as an output terminal for computer systems.

CENTRAL PROCESSING UNIT (CPU)

The central processor or the computer system contains the internal memory unit (memory), the arithmetic logic unit (ALU), and the input/output control unit (I/O Control).

COBOL (COMMON BUSINESS ORIENTED LANGUAGE)
A specific computer language by which business data processing procedures may be precisely described in a standard form. The language is intended as a means for directly presenting any business program to any suitable computer for which a COBOL compiler exists and also as a means of communicating such procedures among individuals.

CODING
Writing instructions for a computer either in machine or non-machine language.

COMMAND
An instruction which tells the operating system what you want to do.

COMMUNICATION ADAPTER
A hardware component that prepares data for transmission through a telephone line. The adapter for serial bit transmission systems converts data into a serial bit stream for output to a telephone line (serialization). For input to a terminal or computer, a similar adapter reconstructs the serial bit stream into parallel character format (deserialization).

COMPILER
A computer program that operates on symbolic input data to produce machine instructions. A compiler is more powerful than an assembler. It is able to replace certain input items with a series of instructions. The program which results from compiling is a translated and expanded version of the original program.

COMPONENT
One item of a total system. For example, your keyboard is a component of your NCR Personal Computer.

COMPUTER
A device capable of accepting data in the form of facts and figures, applying prescribed processes to the data and supplying the results of these processes as meaningful information. This device usually consists of input and output devices, storage, arithmetic and logic units, and a control unit. Usually, an automatic, stored-program machine is implied.

COMPUTER-ASSISTED INSTRUCTION (CAI)
A data processing application in which a computer system is used to assist in the instruction of students. The application usually involves a dialog between the student and a computer program which informs the student of mistakes as they are made.

CONVERSATIONAL MODE
A data transmission method in which every transaction originating at a remote point requires a response from the central computer's files.

CPS
Abbreviation for characters per second. It is a standard way of measuring the printing speed of a printer.

CPU
See Central Processing Unit.

CRT
See Cathode Ray Tube.

CURSOR
The pointer on the CRT screen that indicates the current position on the screen of the CRT terminal. The underline character is the visual image on the CRT screen of the cursor's position.

CYLINDER
The tracks of a disk storage device that can be accessed without repositioning the access mechanism.

D

DATA
Any information -- letters, numbers, symbols -- which is input to, or output from, the computer for storage or manipulation.

DATA BASE
A collection of data fundamental to an enterprise.

DEBUG
To locate and correct any errors in a computer program.

DEFAULT
A value or direction automatically selected by the computer program unless you specify a different one.

DESTINATION FILE
A file designated to receive information that is output from a computer run.

DIAGNOSTICS
Procedures used to identify and isolate problems within the computer or its peripherals.

DIRECTORY
A list of file names kept on each disk or diskette.

DISKETTE
A thin, flat piece of flexible plastic which looks like a phonograph record. It is coated with magnetic material and is encased in a protective paper jacket. Data is recorded and stored on a diskette. Flexible Disk, Floppy Disk, Disk, Flexible Diskette, Floppy Diskette, Floppy, Mini Disk are all common names used to refer to a removable diskette.

DISKETTE ENVELOPE
A heavy paper envelope in which diskettes are stored except when in use.

E

EBCDIC
Extended Binary Coded Decimal Interchange Code; a 256-character data representation code.

EDIT
To modify the form or format of data, e.g., to insert or delete characters such as page numbers or decimal points.

ELECTRONICS
Pertaining to the application of that branch of science which deals with the motion, emission and behavior of currents of free electrons, especially in vacuum, gas or phototubes and special conductors or semiconductors. Contrasted with "electric" which pertains to the flow of large currents in wires only.

EPROM
Erasable Programmable Read Only Memory. A type of memory chip inside of a computer. It is considered to be Read Only Memory, but programs on EPROM chips can also be erased through ultraviolet exposure. New programs can then be stored on the EPROM chip.

ERASE
In the context of a computer, to remove data from internal memory or from a disk/diskette/tape.

F

FIELD
A unit of data within a record or area. A logical grouping of contiguous characters.

FILE
A set of related records grouped and identified together; the records in a file may be sequenced according to a key contained in each record.

FORMATTED DISKETTE
A diskette which has been prepared for use with a particular computer system.

FORTRAN (FORMULA TRANSLATOR)
A programming system, including a language and a compiler, allowing programs to be written in a type of mathematical language. These programs are subsequently translated by a computer into machine language.

H

HARD COPY
Computer output which is produced by a printer.

HARD DISK
A thin, flat, circular piece of rigid plastic or aluminum on which data and information is stored. Hard disks are able to store much more data than flexible diskettes.

HARDWARE
The mechanical, magnetic, electronic and electrical devices or components of a computer.

HEAD
A device which reads, records, or erases information in a storage unit. The head is usually a small electromagnet used to read, write or erase information on a magnetic surface. It could also be the set of perforating or reading fingers and block assembly for punching or reading holes in paper tape.

HEXADECIMAL DIGIT
A whole number in the hexadecimal (base 16) scale of notation. This digit can be expressed in any one of sixteen different characters: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e, f.

I

I/O
Abbreviation for "input and output". Input is the data received by the CPU from devices connected to it. Output is that which is sent from the CPU to those devices.

INFORMATION
A meaningful collection of data.

INITIALIZE
To set counters, switches, and addresses to zero or other starting values at the beginning of, or at prescribed points in, a computer routine.

INSTRUCTION
A set of characters, together with one or more addresses, that defines an operation and which, as a unit, causes the computer to operate accordingly on the indicated quantities. A term associated with software operation.

INTERFACE
The connection between two (or more) electronic devices or software programs which enables them to transfer information.

K

KB (or K)
Abbreviation for kilobyte. A common measure of computer storage equalling 1024 bytes.

KEY
The field by which a file of records is sorted into order. Same as label.

L

LANGUAGE
A defined set of characters that is used to form symbols, words, etc., and the rules and connections for combining these into meaningful communications.

LOAD
To copy a program or file from a diskette into the working storage of the computer.

LOGGING ON
Giving the computer (particularly if it is a part of a larger system) information such as your name and a password in order to be able to use the system.

LOGICAL RECORD
Same as RECORD. Contrast with physical record (Block).

LOOP
A programming technique whereby a group of instructions is repeated with modification of some of the instructions in the group, and/or with modification of the data being operated upon.

M

MACHINE INSTRUCTIONS
Instructions which a processor can directly recognize and execute.

MACHINE LANGUAGE
A language designed for interpretation and use by a computer system without translation.

MACRO INSTRUCTION
A source language instruction that has the capability of generating more than one machine language instruction.

MAINFRAME
When computers were larger, mainframe referred to the CPU of the system because it was mounted in a heavy-duty frame. Now it simply refers to a large, multi-function computer or a large computer that has many terminals connected to it.

MAIN MEMORY
Internal memory; the temporary memory that is maintained electrically in the computer.

MANAGEMENT INFORMATION SYSTEM (MIS)
The specific type of data processing system that is designed to furnish management with information that may be of assistance in the making of decisions.

MASTER FILE
A file of semipermanent information which is usually updated periodically.

MB
Abbreviation for "megabyte". A measure of computer storage equalling 1024 X 1024 bytes (1,048,576 bytes).

MEDIA
Describes various ways to carry information. For example: cassettes, diskettes, tapes, etc. are types of media used by a computer.

MEMORY
The part of the computer that stores information. Personal computers always have some amount of internal memory capacity made up of memory chips; this amount can vary greatly.

MENU
A CRT display listing the possible actions which you can choose to have your computer perform.

MICROCOMPUTER
The smallest kind of a computer whose CPU consists of one chip, called the microprocessor.

MICRO INSTRUCTION
A basic or elementary machine instruction.

MICRO PROGRAM
A program that consists of micro instructions.

MNEMONIC
Computer instructions written in a meaningful notation. An abbreviation that is easy to remember, e.g., CALCBAL for calculate the balance.

MODEM
Modulator-Demodulator. A device which converts (modulates) serialized digital signals (usually output from a communications adapter) to acoustic signals for transmission over a telephone line and converts (demodulates) incoming acoustic signals to serialized digital signals.

O

OPERATING SYSTEM
A set of interrelated software modules which provides the framework for the orderly assignment of a computer installation's resources to the execution of a variety of applications.

OPERATION
A program step undertaken or executed by a computer, e.g., addition, multiplication, comparison, data movement. The operation is usually specified by the operation code of an instruction.

OPERATION CODE
The symbols that designate a basic computer operation to be performed.

OUTPUT
The final result of the computer's manipulating and processing of data. It is sent from the internal storage of a computer to output devices such as a printer or a display, or to external storage.

P

PAD CHARACTER
A character introduced to use up time while a function (usually mechanical) is being accomplished — for example, a carriage return or a form eject.

PARALLEL TRANSMISSION
The technique used to transmit an entire character at one time by using separate channels or separate frequencies on one channel. (Parallel transmission is contrasted with serial bit transmission in which the bits of a character travel in serial fashion one after the other.)

PARAMETER
A variable that is given a constant value for a specific purpose or process.

PARITY
A method used by most of the computer industry to determine if hardware has correctly sent and received data characters. If hardware checks for even parity, it considers valid all characters moved between units, memory registers, or memories whose total number of ON bits is even. If hardware checks for odd parity, it considers valid all characters moved between units, memory registers, or memories whose total number of ON bits is odd.

PARITY BIT
The extra bit that computer hardware adds to a character or group of characters prior to moving the character between units, memory registers, or memories. Hardware sets the bit either OFF or ON to develop either an odd or even number of ON bits in the character. When this character is received, hardware checks the parity to determine if the data was correctly received or if a parity error exists.

PASCAL
A high-level, procedure-oriented programming language named for computing pioneer Blaise Pascal.

PASSWORD
A unique string of characters that a program, computer operator, or user must supply to meet security requirements before gaining access to data.

PCB
Printed Circuit Board. A board containing electronic circuits. The circuits are strips of metal printed on a flat piece of plastic. This new type of circuitry helped make computers smaller.

PERIPHERAL

A device which is separate from the computer but which works in conjunction with it, such as a printer, a keyboard, a disk drive, etc.

PHYSICAL RECORD

See BLOCK. On disk or diskette, usually one sector. Contrast with Logical Record, or Record.

PL/1

A high-level programming language designed for use in a wide range of commercial and scientific computer applications.

PROGRAM

1. (n.) A sequenced set of instructions for the computer to follow in order to perform a desired operation.
2. (v.) To prepare a list of instructions for the computer to follow.

PROTOCOL

A general term for the set of rules, requirements, sequences, and procedures for transmitting information between computer(s) and terminal(s) in a particular type of communications network (for example, SDLC).

R

RAM

Random Access Memory. The type of internal memory of a computer in which data can be written to, read from, erased, or stored in any order. RAM is maintained by electrical current and makes up much of the internal memory.

RECORD

1. (n.) A group of one or more data elements (fields) containing related information about a common subject (for example, one customer). One or more records comprise a file (for example, a customer file).
2. (v.) To copy, or set down, information in some form for future reference. To make a transcription of data by a systematic alteration of the condition, property or configuration of a physical medium, such as placing information on magnetic tape or magnetic disc by magnetic spots.

RECORDING SURFACE
The magnetic surface on a disk/diskette/tape to which information can be written and from which it can be read.

RECORD KEY
A key whose content identifies a record within a file.

REFERENCE NAME TAG

- A label assigned to a specific step in a routine for the convenience of the programmer. The symbol used is independent of the location of the step within a routine.
- A label which identifies a file, record, area, or field.

REGISTER
A term used to designate a specific computer unit for storing a group of bits or characters.

ROM
Read Only Memory. Instructions which control essential operations of the computer are stored permanently in ROM. You can only read from ROM; you cannot change its contents.

S

SCREEN
The display surface of a CRT display device.

SCROLL
To roll lines down a CRT screen in order to review text or information. Most screens only show 25 lines at a time, so scrolling is useful in viewing large files of information.

SDLC/SNA
Synchronous Data Link Control/Synchronous Network Architecture. It is the name of a type of communications protocol which computers use.

SECTOR
A portion of each of the tracks on a disk or diskette. There are usually nine sectors on a diskette track.

SECURITY
Prevention of access to or use of data or programs without authorization.

SEEK
To position the access mechanism (read/write head) of a disk drive at a specified location (track).

SERIAL FEE
To change from parallel-by-bit (8 or 9 channels or wires) to serial-by-bit (1 channel or wire).

SOFTWARE
The non-physical portion of your system. Any kind of program within the electrical circuits of a computer is software.

SOURCE-DESTINATION FILE
A file which is used for both input and output during a computer run.

SOURCE FILE
A file containing information used as input to a computer run.

SOURCE LANGUAGE
A language that is an input to a given translation process.

SOURCE LINE
A coding line within a source program.

SOURCE PROGRAM
A program coded in other than machine language that must be translated into machine language before being executed.

STORAGE
1. Another word for "memory".
2. External storage refers to the disks, diskettes and tapes which store information outside of the computer.

STORAGE CAPACITY
The amount of data that can be stored in a computer memory.

SYNCHRONOUS
Having constant time intervals between events or occurrences.

SYNCHRONOUS DEVICE

A term applied to a device in which the performance of a sequence of operations is controlled by equally spaced clock signals or pulses.

SYNCHRONOUS DATA TRANSMISSION

A transmission mode in which regularly timed clock pulses are used to provide synchronization between the transmitting and receiving devices on a communication line. Synchronous transmission reduces overhead, compared with asynchronous transmission, by eliminating the need to send individual start and stop bits for each character transmitted.

SYNTAX

The rules of a computer language which must be followed when using the language.

SYNTAX ERROR

Usually a message displayed on the screen indicating an error in the syntax of a statement in the program being run.

T

THIRD PARTY

A term referring to compatible hardware and software manufactured by a company other than NCR.

TRACKS

A series of concentric rings on a disk or diskette. Data can be written to or read from the tracks by the read-write head. For example, there are forty tracks on each side of a 5 1/4-inch diskette.

TRANSACTION DATA

A set of data in a data processing system, a record of occurrence of a new event or transaction in which the incidence of the data is essentially random and unpredictable.

TRANSACTION FILE

A file containing current information related to a data processing activity and used to update a master file.

U

UTILITY ROUTINE

A standard routine used to assist in the operation of the computer, e.g., a sorting routine, or a printout routine.

V

VARIABLE

A symbol whose numeric value changes from one repetition of a program to the next, or changes without each repetition of a program.

W

WRITE PROTECT NOTCH

A small notch located on an edge of most diskettes. It permits data to be recorded on that diskette. If the notch is not present or is covered over with an appropriate opaque sticker, recording can not be done on that diskette.

INDEX

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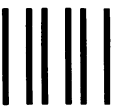

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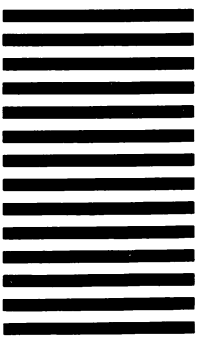

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