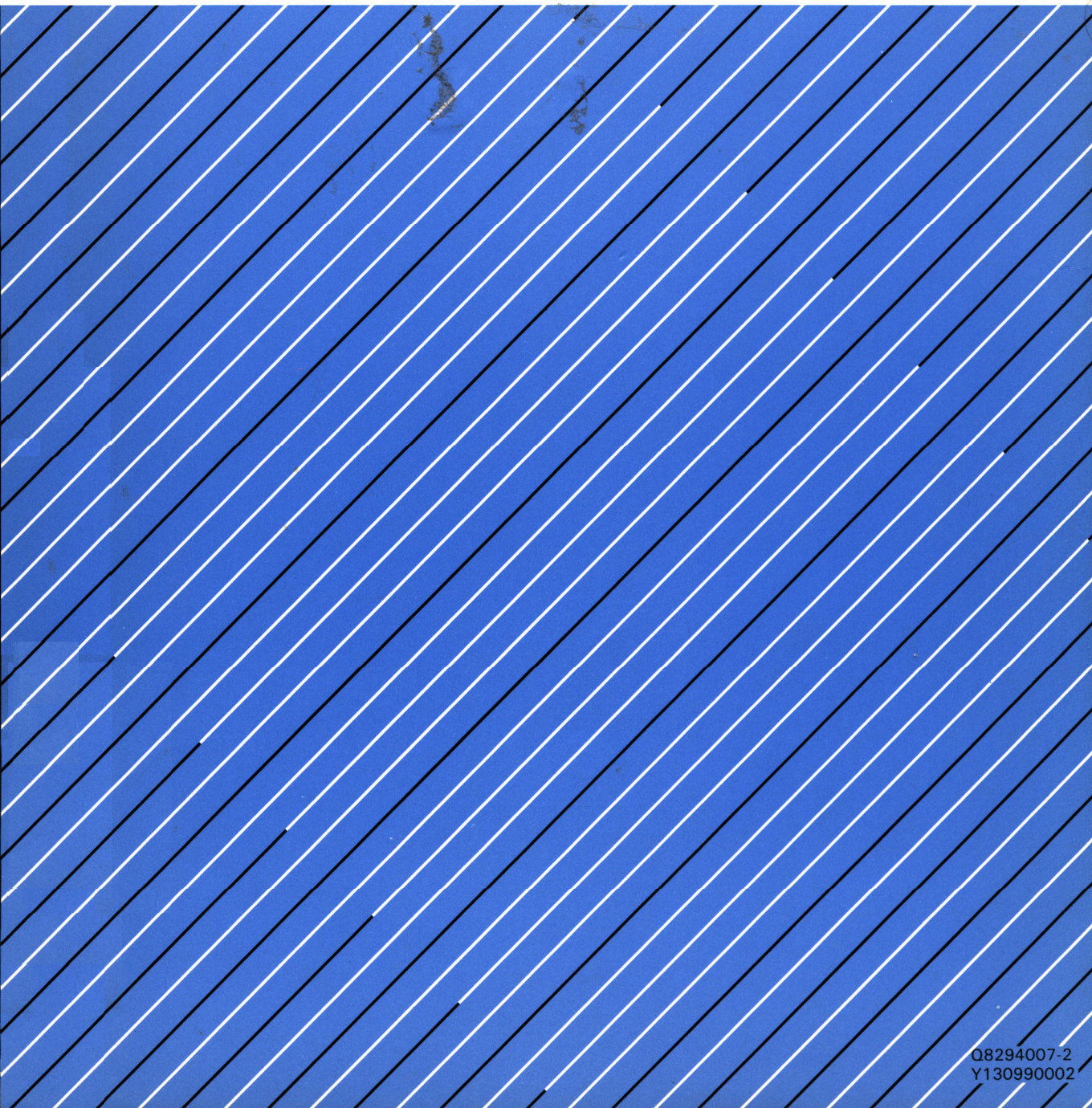
EPSON

QX-10

OPERATION MANUAL



Q8294007-2
Y130990002

QX-10

OPERATION MANUAL

NOTICE:

* The contents of this manual are subject to change without notice.
* All efforts have been made to ensure the accuracy of the contents of this manual. However, should any errors be detected, EPSON would greatly appreciate being informed of them.
* The above notwithstanding, EPSON can assume no responsibility for any errors in this manual or their consequences.

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INTRODUCTION

Congratulations on your purchase of the QX-10, a small business computer which offers unprecedented performance and flexibility for a computer in its class. With its MultiFonts CP/M® operating system and powerful MultiFonts BASIC language, the QX-10 accomodates a wide range of programs and peripheral equipment which can make it an indispensable member of your office family, whether used for text editing, scientific calculations, or conventional data processing. In its basic configuration, the QX-10 provides 192K bytes of user memory; this can be expanded to up to 256K bytes through the addition of expansion memory. It has three standard interfaces for telecommunications and peripheral equipment, as well as five option slots to allow the addition of interface cards for a variety of specialized equipment. Your QX-10 can also be equipped with an interface for a color display monitor.

This manual covers all of the basic hardware configurations of the QX-10 up to its maximum memory capacity of 256K bytes, as well as the standard interfaces, the color display interface, and the MultiFonts CP/M operating systems. MultiFonts BASIC for the QX-10 is described in the QX-10 MultiFonts BASIC Reference Manual. Chapters 1 to 3 describe the hardware and optional equipment and procedures for unpacking the QX-10 and setting it up, and explain how to power up the QX-10 under the CP/M operating system. Chapters 4 and 5 introduce the MultiFonts CP/M operating system and explain use of the MultiFonts CP/M commands. Chapter 6 describes the various standard interfaces and the color display interface. Chapter 7 goes into more detail with descriptions of CP/M's basic disk operating system and basic input/output system interface. Specifications, details on the eight international character sets provided, and MultiFont style selection, and use of the QX-10 diagnostic programs are covered in the Appendices.

To ensure that you get off to a smooth start, be sure to read Chapters 1 to 3 with particular care.

NOTES:

1. *CP/M® is a registered trademark of Digital Research™.*
2. *MultiFonts BASIC (Copyright 1982 Microsoft and Epson) is software developed by Epson which is upward compatible with the BASIC-80 specifications of Microsoft, Inc.*

CAUTION

Do not use power cables other than the one supplied.

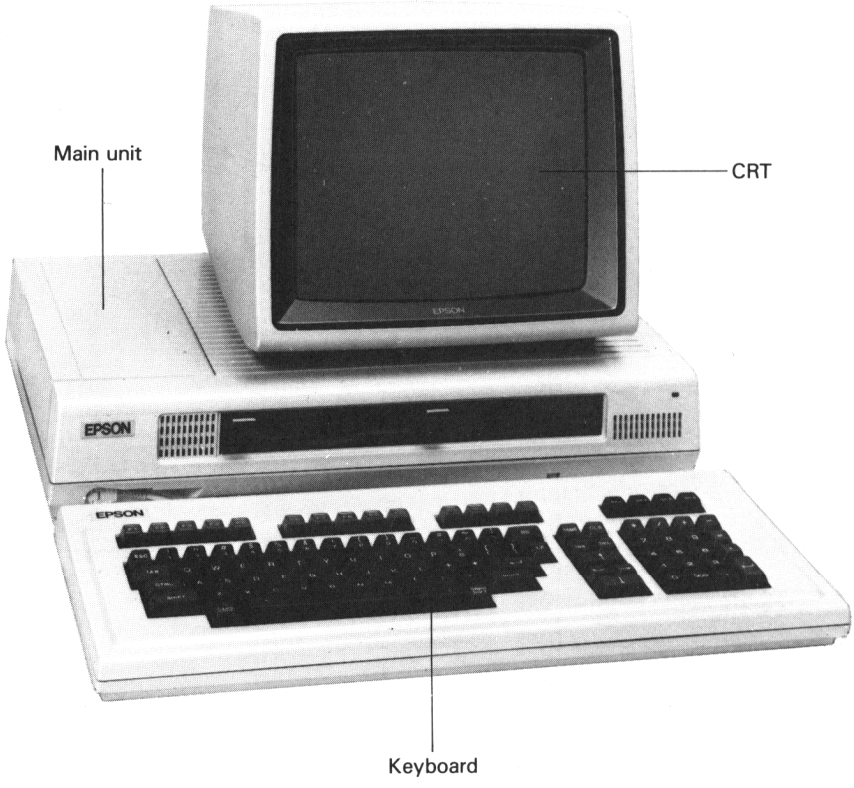
Chapter 1 SYSTEM CONFIGURATION

This chapter describes the hardware of the QX-10, explains funtions of the keys and outlines expansion options which are available for the QX-10.
The symbols used to indicate binary, decimal and hexadeciml numbers in the explanation of special function key and the remainder of this manual are as follows.

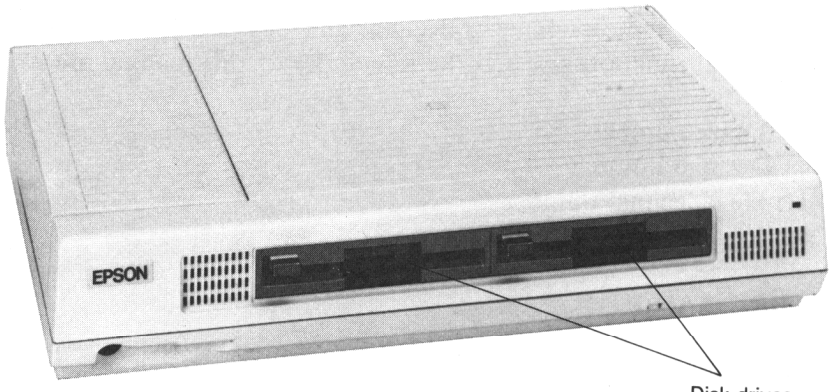
( )$_2$: Binary number
( )$_D$: Decimal number
XXH: Hexadecimal number

1.1 Basic System

The hardware of the QX-10 consists of a CRT display monitor, a keyboard, and a main unit.

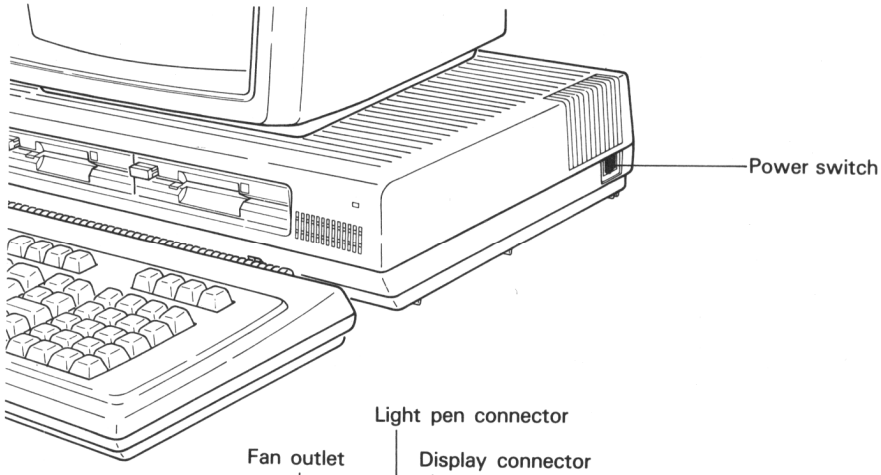


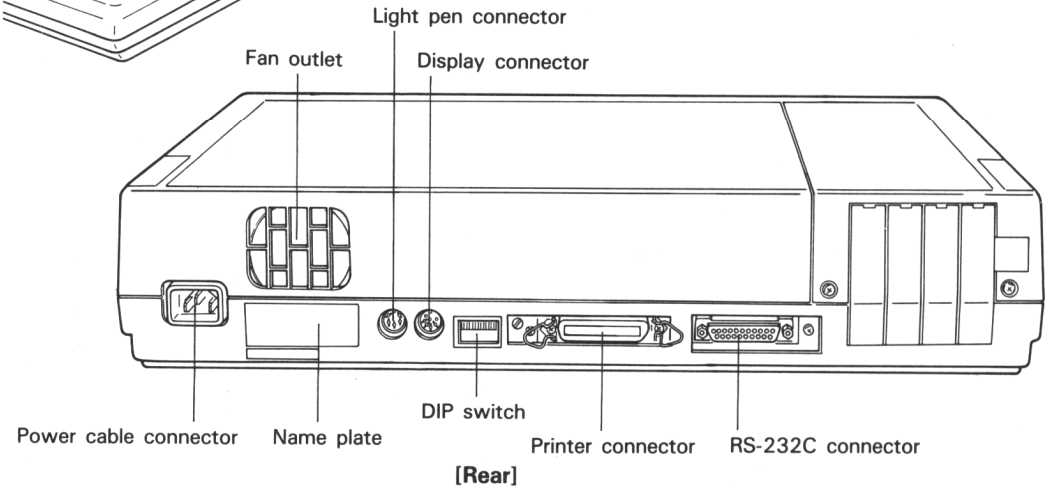
1.1.1 Main unit



[Front]

The main unit includes the system's μPD780-1 CPU (Z80A compatible), the main memory RAM chips, twin disk drives, interfaces for peripheral equipment, and the computer system's power supply, and is connected to the display monitor and keyboard through DIN connectors. All QX-10 power is controlled by a single switch on the back right side of the main unit.



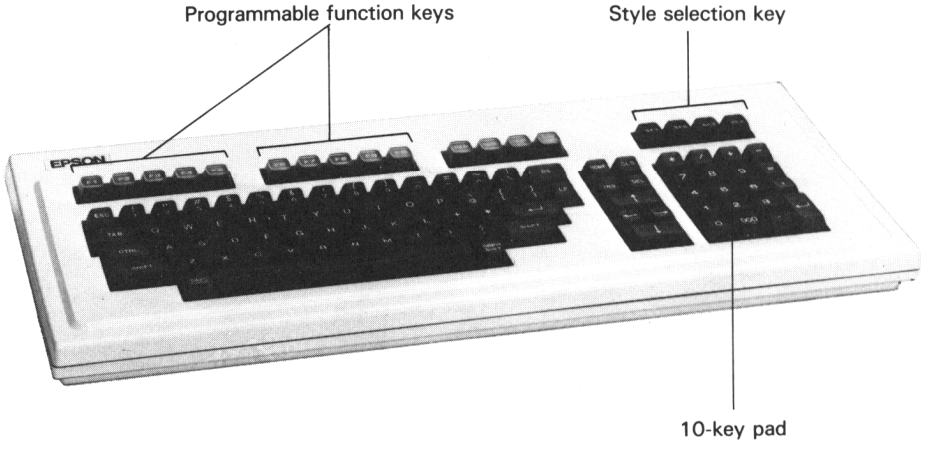


[Rear]

1.1.2 Keyboard unit

The layout of character keys on the QX-10's keyboard varies from country to country. All layouts provided are those which are commonly accepted as standard in the country in which each unit is sold. The keyboard also includes a 10-key pad, and is equipped with 10 programmable function keys and a number of special keys; use of these keys is described below.

Data is transferred between the keyboard and CPU through a serial interface built into the main unit.



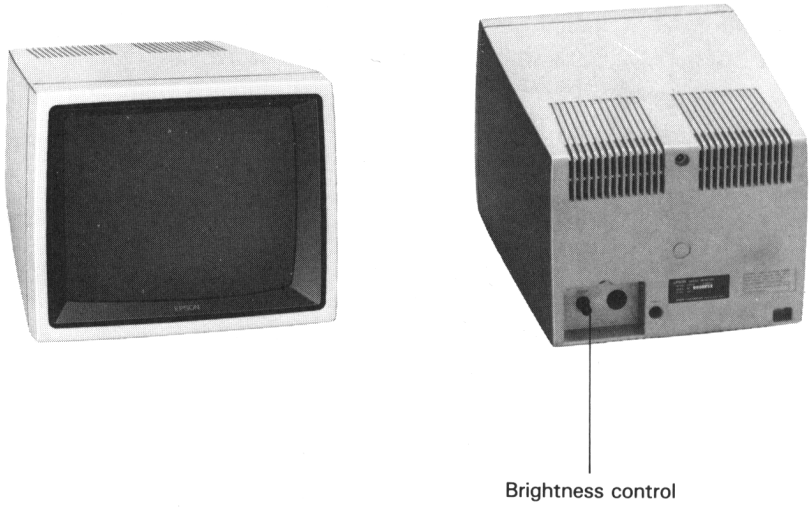
1.1.3 CRT display unit

The high resolution 12″ CRT display used is specially designed for the QX-10; resolution in the horizontal direction is 640 dots and resolution in the vertical direction is 400 dots.

In the non-MFBASIC mode, the maximum number of 1-byte characters which can be displayed are 2000 (25 × 80 character lines). (Each 1-byte character is displayed in a dot matrix of 7 × 13 dots.)

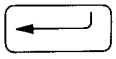
In the MFBASIC mode, the maximum number of 1-byte characters which can be displayed are 1600 (20 × 80 character lines) and the maximum number of 2-byte characters which can be displayed is 800 (20 × 40 character lines). (Each 2-byte characters is displayed in a dot matrix of 14 × 17 dots.)

A brightness control is provided next to the cable connector on the rear panel. Turning it to the right increases brightness, and vice versa.



1.2 Special Keys

The functions of the special keys at the CP/M command level are as shown below. For their functions in the MFBASIC mode, refer to the QX-10 MFBASIC Reference Manual.



This key is used to terminate a command line. Pressing this key enters a CR code $(13)_D$.

Pressing this key erases the character to the left of the cursor and moves the cursor one position to the left.

Pressing this key enters a LF code $(10)_D$.

Pressing this key enters a ESC code $(27)_D$. This key can be used to enter escape sequences from the keyboard.

Pressing this key enters a TAB code $(9)_D$, that is it moves the cursor 8 columns to the right.

This key is used together with other keys to enter control codes $(0)_D$ through $(31)_D$. Pressing this key together with keys whose codes correspond to $(64)_D$ (@) to $(95)_D$ (_) enters the code which is equal to the key code minus $(64)_D$.

Pressing this key enters a HOME code $(11)_D$.

Pressing this key enters a CLS code $(12)_D$.

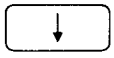
Pressing this key enters code $(17)_D$.

Pressing this key enters a DEL code $(127)_D$.

Pressing this key enters a Cursor Right code $(28)_D$.

Pressing this key enters a Cursor Left code $(29)_D$.

Pressing this key enters a Cursor Up code $(30)_D$.

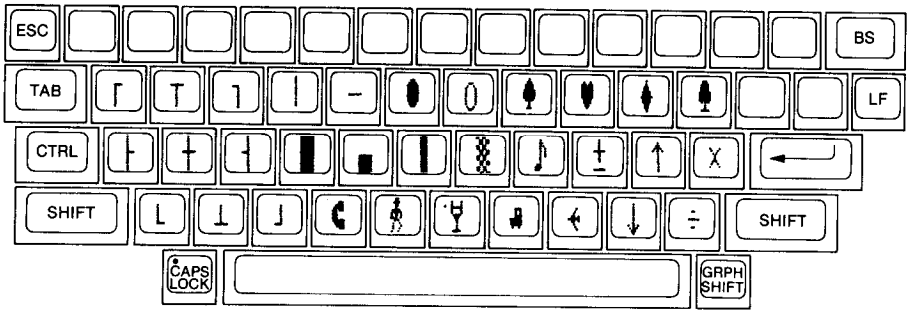


Pressing this key enters a Cursor Down code $(31)_D$.

Pressing this key allows the upper case letters to be entered when the letter keys are pressed. This state is maintained until the CAPS LOCK key is pressed again. The red LED built into this key lights when this key is pressed. Pressing the SHIFT key in this state allows lower case letters to

be entered. This key does not affect the keys other than those for the letters of the alphabet.

GRPH SHIFT — Pressing this key allows the graphic codes assigned to the keys shown below to be entered.



BREAK — Pressing this code enters a BREAK code $(3)_D$, resulting in a warm boot of the CP/M system.

PAUSE — Pressing this key enters a PAUSE code $(19)_D$.

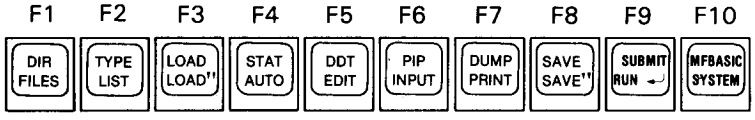
SCRN DUMP — Pressing this key causes the current screen contents to be output to the LST device (normally the printer) in bit image format.

HELP — Pressing this key enters a HELP code $(0)_D$.

Style selection keys SF1 through SF4

These keys are not effective in the normal mode. In the MF mode, pressing these keys makes it possible to select one of the multiple character fonts. The LED built into each style selection key lights when the key is ON. (For multiple character fonts, see Appendix L.)

Programmable function keys F1 through F10



Each programmable function key enters the character string assigned by the system or user PFKSET table. (See 5.4 PFKSET command).

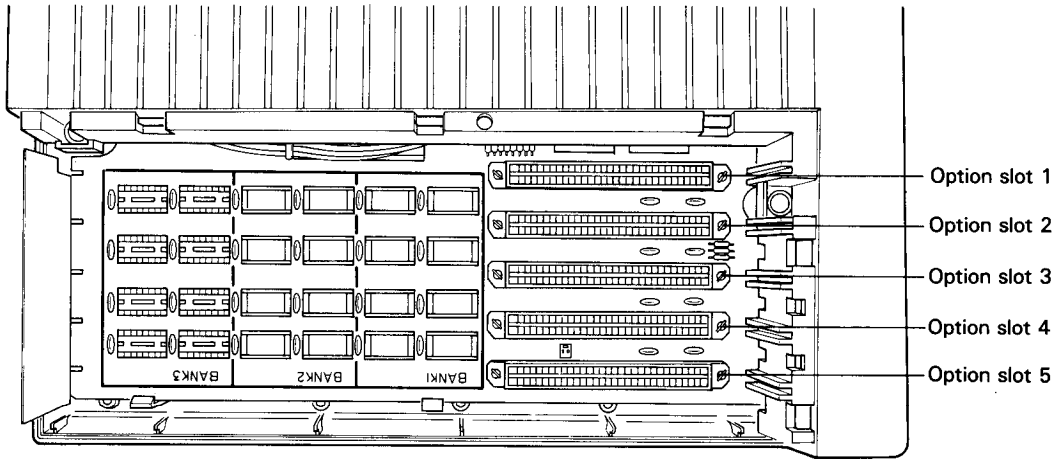
1.3 Expanded Configuration

The basic QX-10 is equipped with 192K bytes of RAM. This can be expanded to 256K bytes through the addition of eight 64K bit RAM chips. See Section 6.5 for installation of expansion RAM.

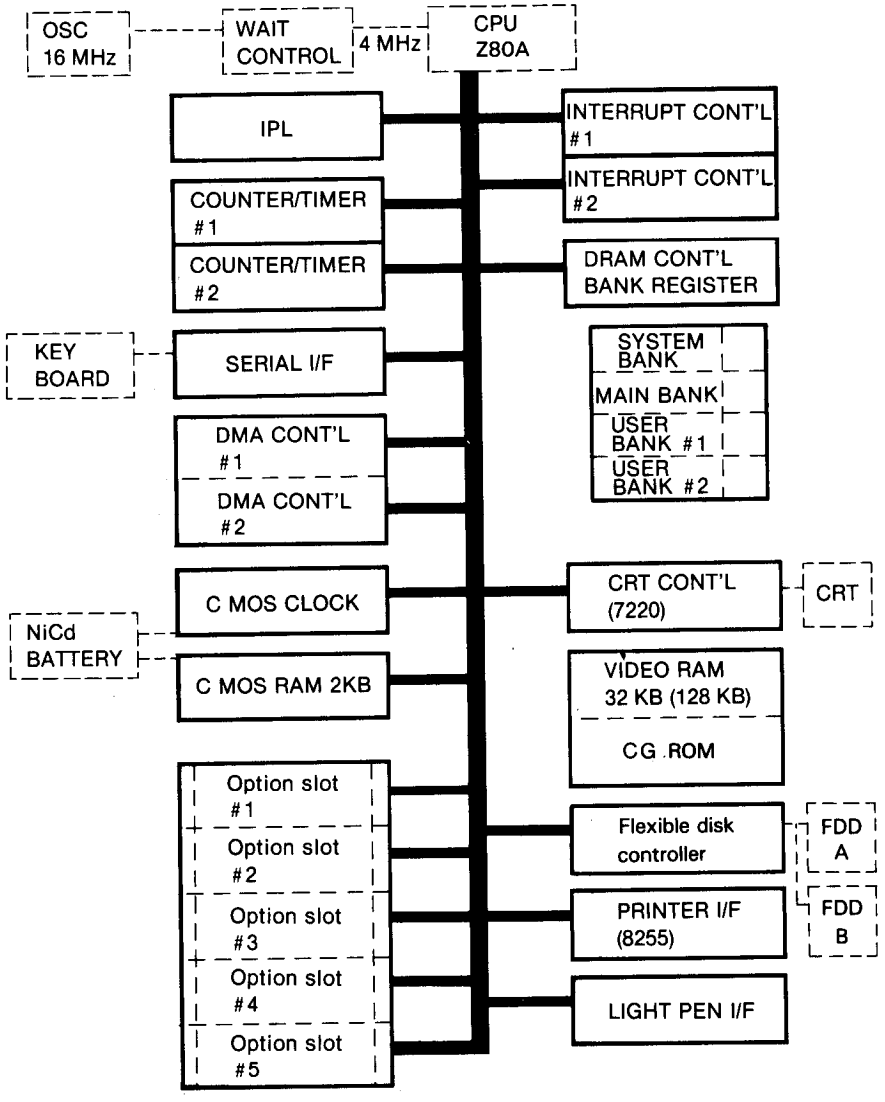
The MultiFonts character generator ROM card is required to use multiple fonts characters. This card can be inserted in any of the five option slots. If the MFONT comand is executed without this card, the message "No MultiFonts Option Board!" appears on the display.

Standard interface circuits provided for peripheral equipment include a Centronics-compatible interface for connection to printers, a light pen interface, a keyboard interface, and an RS232C interface for telecommunications or connection to RS232C-compatible equipment.

The QX-10's five option slots make it possible to add a variety of interfaces for special peripheral equipment. These include an IEEE488 interface for general purpose applications such as telemetry, an optical fiber interface for communications via optical cables, and a direct modem for data transmission.



A block diagram of the QX-10 system is shown in the figure below.



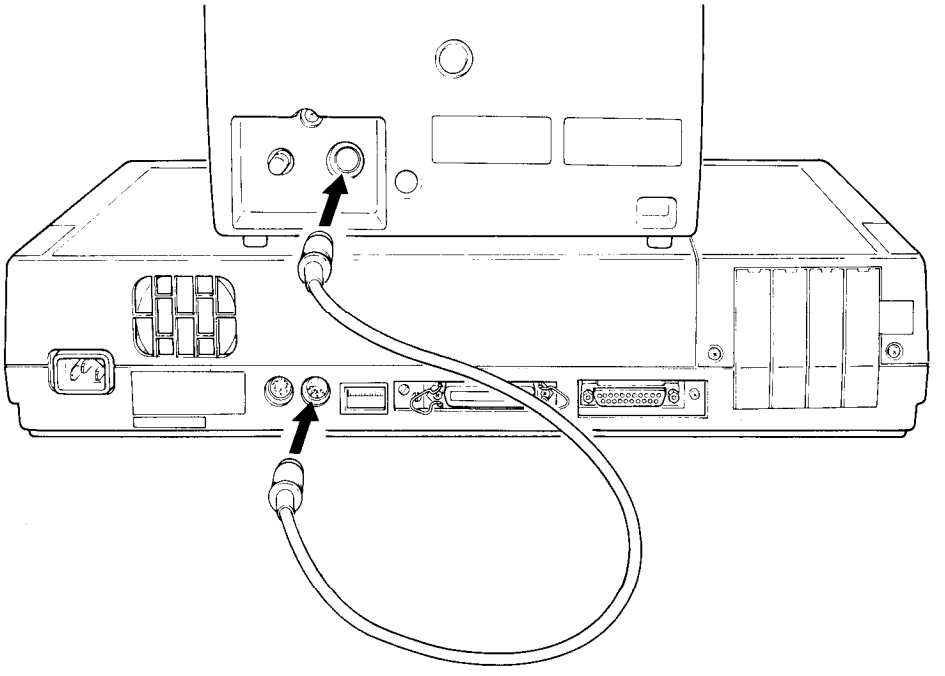
Chapter 2 UNPACKING / SETUP INSTRUCTIONS

For those who have worked with other small business computers, one of the nicest features of the QX-10 is that all of its components including the display, disk drives, and the computer itself are powered off of one wall outlet and controlled with a single power switch. This makes it extremely easy to set up the system as will readily become apparent as you follow the instructions given below.

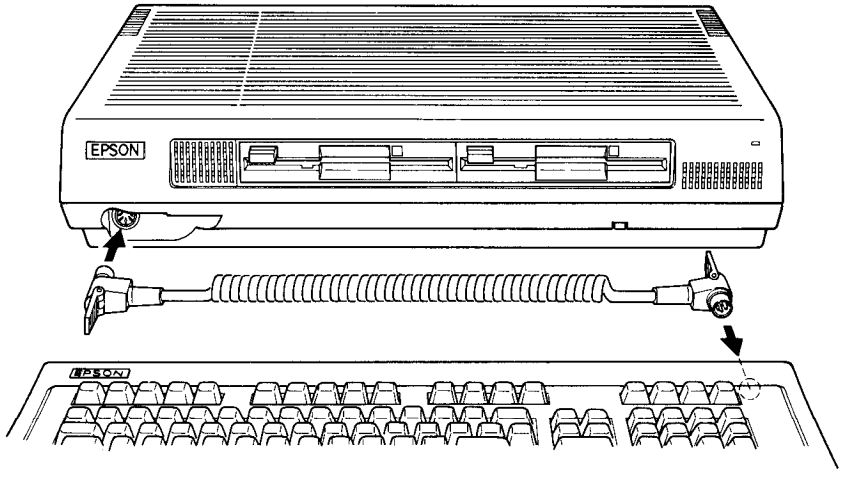
The QX-10 is shipped in three boxes which contain the main unit, keyboard, and CRT display monitor. Cables for connecting the keyboard and display to the main unit are included in the boxes with those units. Open the box containing the main unit by pulling off the tape on top (do not cut the box with a knife, etc.), then carefully lift out the unit with both hands and place it on a stable desk. Remove the packing materials from the unit. Check the label on the back of the main unit and confirm that its electrical requirements (voltage, power frequency, etc.) match those provided in your geographical area; however, do not plug the main unit in at this time.

NOTE:
The power cables of units sold in the United Kingdom are not equipped with a plug; an appropriate plug must be provided by the user.

Next, open the box containing the display monitor and place it on the desk next to the main unit. Remove its packing materials, then place the display on top of the main unit. Plug either end of the cable into the connector marked MONITOR on the back of the main unit (the round DIN connector with 8 pin holes), then plug the other end into the connector on the back of the display. (See 6.4 Color Display Interface for connection of color display CM-10.)



Next is the keyboard. Open the box containing the keyboard and place it on the desk in front of the main unit and display. Plug either end of the cable into the connector socket on the left front of the main unit, then plug the other end into the socket on the back of the keyboard.



Finally, push the drive lock buttons located next to each of the two disk drives and remove the magnetic head protection sheet from each drive. Keep these sheets; they serve to protect the heads from damage during transport and should be inserted in the main unit whenever it is moved.

This completes setup of the basic system. For connection of peripheral devices such as printers, see the manual provided with the relevant device.

The next chapter of this manual discusses procedures for powering up the system, loading the operating system, and making backup copies of the system disk. Before going on, however, take a moment to read the following general precautions concerning use of the QX-10.

1. Avoid using the QX-10 in any location which is subject to extreme temperature fluctuations, high concentrations of dust, or high humidity. Protect the machine from exposure to direct sunlight, strong shocks or vibration, and corrosive gases.

2. Be sure to maintain a space of at least 15 cm behind the back of the main unit; this is necessary to provide ventilation for the unit's cooling system. Heat is also passively radiated from the top of the display monitor; therefore, books and other objects should not be placed on top of the display.

3. Keep cups of coffee and other fluids away from the machine; in the event that any type of liquid is spilled into the machine, turn it off immediately and call your Epson dealer at once. If you are a smoker (or have smokers in your office), keep cigarettes, ashtrays, and so forth out of the vicinity of the machine. The disk drives are particularly susceptible to problems due to contamination with cigarette ashes and the like.

4. If you make heavy use of the disk drives, it is a good idea to clean the drive heads occasionally. This can be done using a head cleaning sheet; see the package containing the sheets for details.

5. Before using the machine, check to ensure that all cables are properly connected, that the power cables for the computer and all peripherals are plugged in, and (if you have connected a printer) that printer paper is properly loaded, and that the printer ribbon is not twisted.

Chapter 3 OPERATION OF THE QX-10

This chapter describes procedures for powering up the QX-10, loading its operating system, and making backup copies of the system disk. Since you will start handling disks at this point, some comments are in order on the disks used with the QX-10 and their handling.

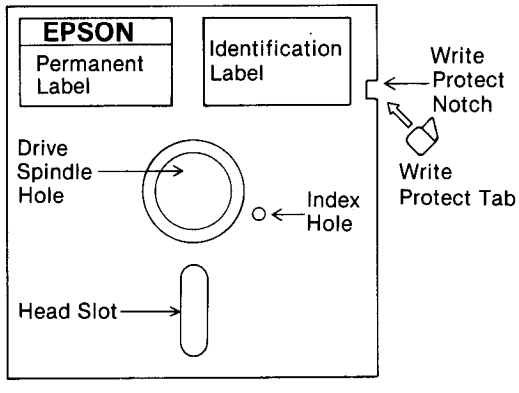
3.1 Flexible Disks

The QX-10 uses double sided, double density disks with a diameter of 5 1/4 inches. Although disks produced by other manufacturers can be used with the QX-10, variations in composition of magnetic media make it impossible to guarantee that such disks will provide normal results.

When formatted, a disk has 40 tracks per side, each of which is divided into 16× 256-byte sectors. This provides a total data storage capacity of 320K bytes per disk; however, since 32K bytes are used for storage of system information, 2K bytes are used for the file directory, and 8K bytes are reserved as alternate tracks, the total file storage capacity of each disk is 278K bytes.

Disks are generally sold in boxes of 10 each, and individual disks are contained in cardboard envelopes. These envelopes protect the disks' magnetic recording medium (visible through the head slot) from dirt and scratches which could destroy data. After removing a disk from either of the drives, be sure to promptly insert it in its protective envelope, then return the envelope to its box for storage. Avoid stacking disks one on top of another for storage, and be careful to avoid folding or bending them; deformed disks can result in irregular drive operation, and may cause damage to the drive itself. When handling disks, keep your fingers away from the head slot; touching the magnetic recording medium will result in an accumulation of grease on the drive heads, and possibly impair their ability to read and write data. To prevent this, hold disks on the label side (the side opposite from the head slot).

Apply identification labels to disks only in the location shown in the figure below. When a disk must be relabeled, peel off the old label before applying a new one; do not apply one identification label on top of another.



Whenever possible, write on the label before applying it to the disk. If you must write on a label after it has been applied to a disk, use a soft tip felt marker and write gently.

Write protect tabs are used to prevent data from being written to flexible disks, preventing the contents of disks from being accidentally erased.

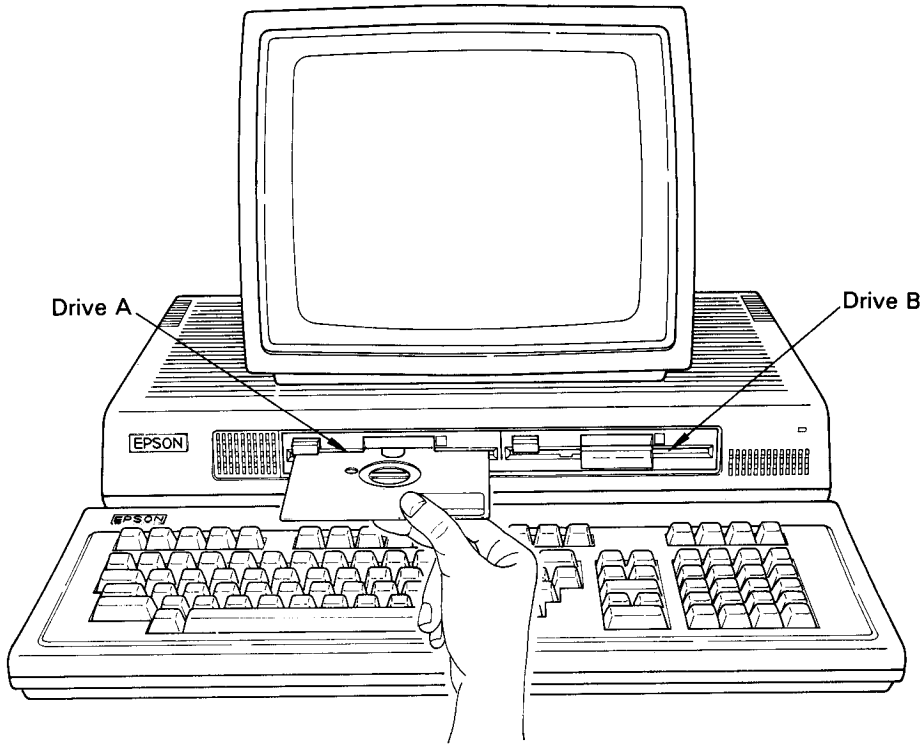
Since data is recorded on a magnetic medium, care must also be taken to keep disks away from magnets and equipment which generates magnetic fields. Failure to observe this precaution is likely to result in destruction of the operating system disk or valuable data. Also take care to protect disks from extreme temperatures. The usable temperature range for disks is from 10 to 50°C. Since disks can be deformed by exposure to high temperatures, do not store disks next to heaters or in places where they might be exposed to direct sunlight.

One of the disks supplied contains the CP/M operating system. Since the computer cannot operate without this system, your first action after turning on the power should be to make one or more backup copies of the system disk. Procedures for doing this are explained below.

3.2 System Activation

Powering up the system is simplicity itself. Just turn on the switch located near the back of the right side of the unit. This can be done with the system disk installed in drive A (the drive on the left); for the moment, however, leave both drives empty.

When you turn on the power, you will notice that the red LED power indicator on the right front of the main unit lights and, after a moment, that the red LED above drive A lights. This indicates that the QX-10 is running and waiting for the system disk to be inserted. Remove the system disk from its envelope and cover its write-protect notch with a write-protect tab (one of the silver-colored tabs included in boxes of new disks). Insert the system disk into drive A (the drive on the left) with the head slot toward the inside of the main unit.

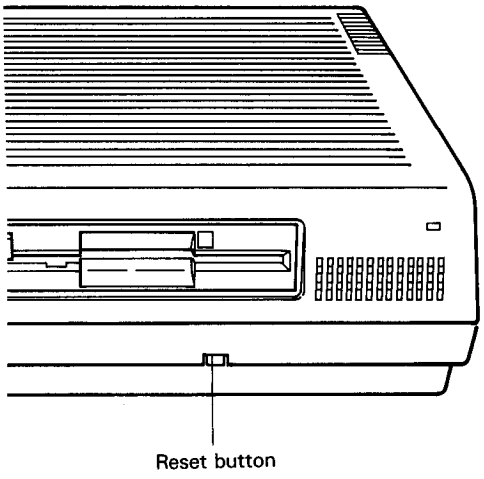


Push the disk in until it reaches the back-stop, then continue pushing until it clicks into place. (If the disk does not go in smoothly, do not apply force; pull it back out and start over, being careful to properly align it with the drive entrance. Forcing the disk can damage it, resulting in destruction of its contents, improper drive rotation, and a variety of other problems.)

After inserting the disk, push the drive button; this enables the drive, allowing the boot strap loader to start loading the operating system. The screen is cleared and the image shown below is displayed.

```
EPSON MultiFonts CP/M vers 2.2 M X.X

A>
```

If the operating system is not loaded (this may occur if the system disk is not inserted within 10 minutes after the power has been turned on), press the reset button on the front right side of the QX-10.



If the disk does not contain the system program, the speaker beeps and the message "CAN NOT COLD BOOT!!" appears on the CRT display. In this case, turn off the power and insert a disk containing the system and perform the above procedure. Before going any further, make a copy of the system disk. This is done as follows.

3.3 Copying the System Disk

Leave the system disk in drive A, insert a blank disk in drive B, and press the drive button. (If you use other than an Epson disk for this purpose, format it first by entering FORMAT and pressing the RETURN [↵] key. See Paragraph 5.4.5.) After doing this, type the underlined letters shown in the figure below. After typing each group of letters, press the RETURN key where indicated by the return symbol [↵].

```
A>SYSGEN ↵
QX-10 SYSGEN  ver. X.X

Source Drive Name ( or RETURN to skip ) A
Source on A, then press RETURN ↵
Function complete
Destination Drive Name ( or RETURN to reboot ) B
Destination on B, then press RETURN ↵
Function complete
Destination Drive Name ( or RETURN to reboot ) ↵

A>PIP B:=A:*.*[V]

COPYING -
.OSTAB.SYS
DESTINATION IS R/O, DELETE (Y/N)?
```

The above sequence copies the entire contents of the disk in drive A to that in drive B. The message "DESTINATION IS R/O, DELETE (Y/N)?" appears whenever a file whose type is SYS is to be copied. Since these files have already been created by the SYSGEN command, press the N key when this message is displayed. (If the Y key is pressed, files generated by SYSGEN may be changed.) After copying has been completed, remove the original disk from drive A (by pressing the drive button) and store it in a safe place, then remove the copy from drive B and insert it in drive A. Confirm that the system has been copied by pressing the CTRL and C keys together to warm boot the system (a warm boot stops system operation, then starts it back up again from its initial condition). Hereafter, this copy is what is referred to by the term "system disk."

3.4 Initialization

The settings of the printer type supported, the RS-232C communication format, date and time and the international character set must be initialized with the CONFIG command when the system disk is first used. For details on the CONFIG command, see Section 5.4.

3.5 The QX-10 Diagnostic Programs

A variety of diagnostic programs are provided on the EPSON diagnostic disk. These are used to check operation of the QX-10's hardware, including the keyboard, main memory and peripheral devices. Ordinarily, the user need not be concerned with these programs; however, in the event of trouble, they can help you provide your EPSON service representative with information required to restore the system to normal operation in the shortest possible amount of time. Procedures for executing the diagnostic programs are described in Appendix E. When trouble is encountered, execute the diagnostic programs and inform your service representative of the results.

Chapter 4 EPSON MultiFonts CP/M

4.1 Introduction

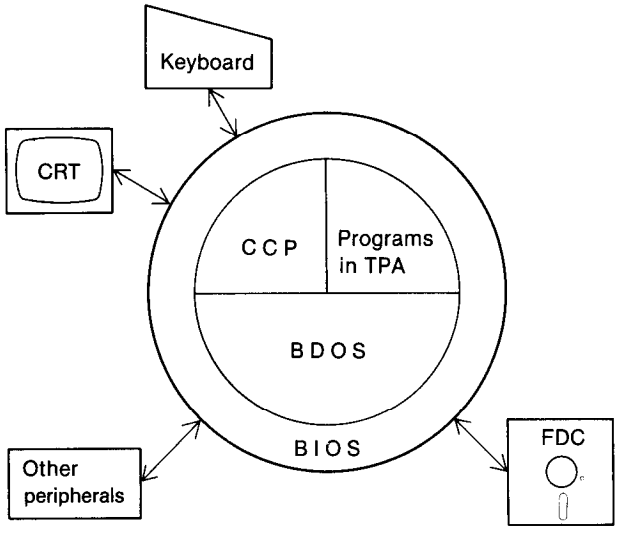
The QX-10 uses the MultiFonts CP/M operating system which is an expanded version of CP/M version 2.2, one of the most popular operating systems for small business computers and personal computers. CP/M is an abbreviation for Control Program for Microprocessors. This operating system was developed by Digital Research and has achieved such popularity because programs developed under CP/M can be used without modification on any computer using the CP/M operating system; many application programs for this system are commercially available. EPSON has added a variety of useful functions to CP/M version 2.2 in developing MultiFonts (MF) CP/M.

The MF CP/M operating system for the QX-10 provides international character sets for 8 countries: the United States, England, Germany, France, Spain, Italy, Denmark and Sweden. Any of these character sets can be selected for display and printout with the CONFIG command or by sending the following codes in succession to the console.

ESC	C	U	U.S.A. (ASCII)
ESC	C	E	England
ESC	C	F	France
ESC	C	G	Germany
ESC	C	I	Italy
ESC	C	S	Spain
ESC	C	W	Sweden
ESC	C	D	Denmark

The character set can also be switched using the OPTION COUNTRY statement of MultiFonts BASIC (MFBASIC). See the QX-10 MultiFonts BASIC Reference Manual for details.

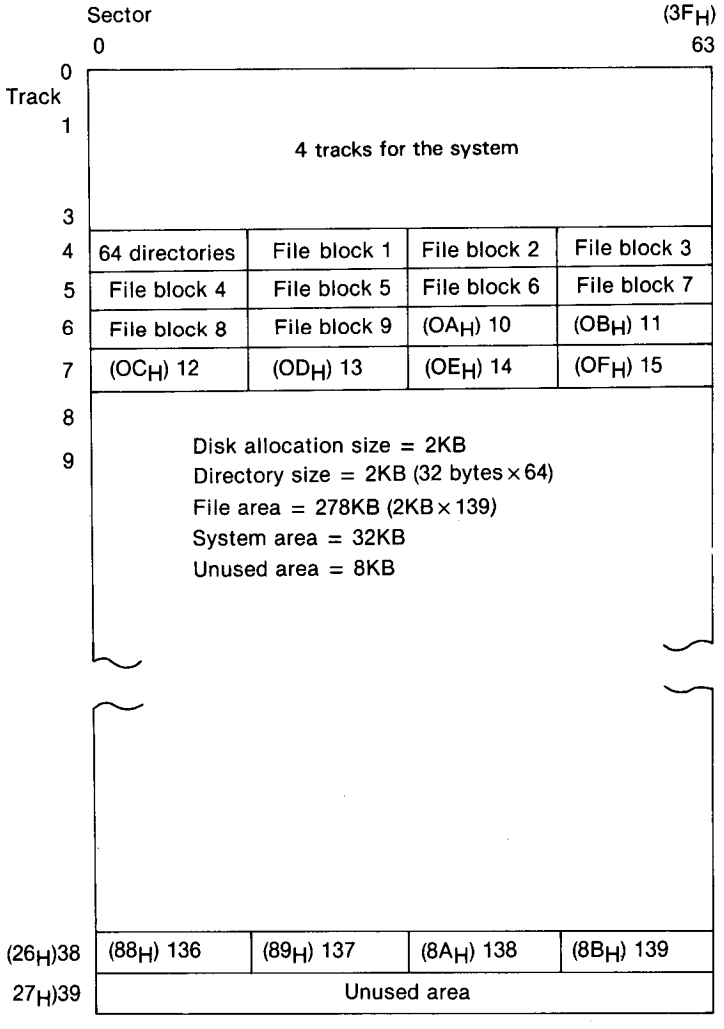
The CP/M system consists of 3 program modules: CCP (the Console Command Processor), BIOS (the Basic Input/Output System) and BDOS (the Basic Disk Operating System). The relationship between these modules and other components of the system is shown below.



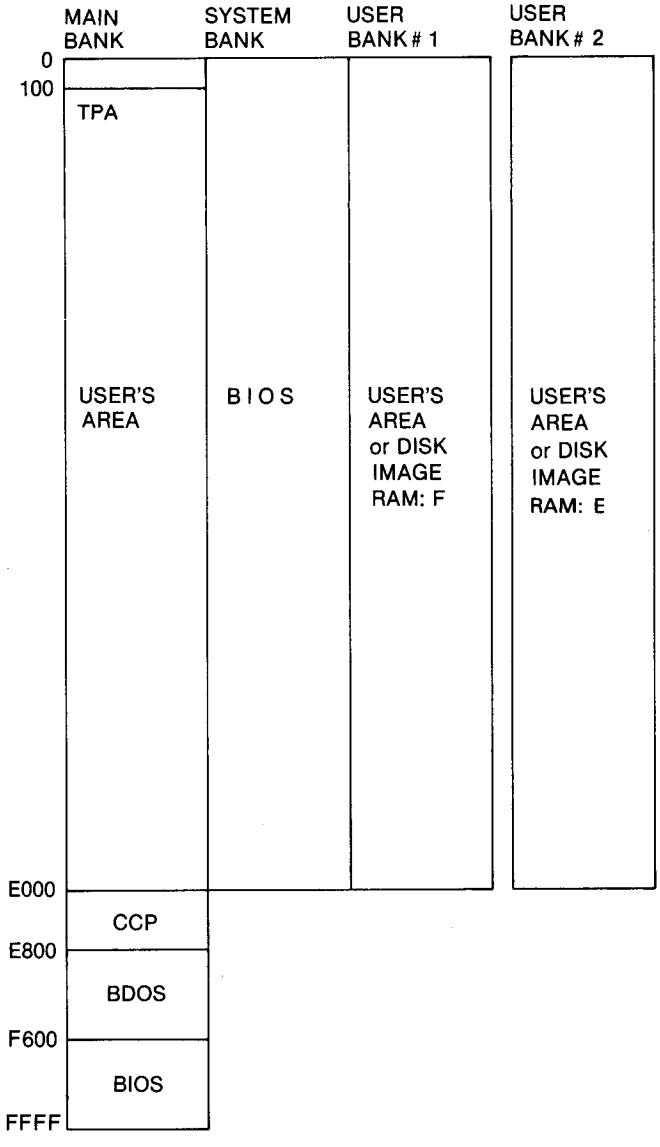
CCP reads and interprets commands input from the keyboard. BIOS provides an interface between peripheral devices and the other modules of CP/M. BDOS performs disk file management, and is the nucleus of CP/M. BIOS and BDOS are explained in more detail in Chapter 7. For further details, refer to any of the various books available on CP/M.

4.2 Starting MF CP/M

The CP/M operating sytem for the QX-10 is supplied in the form of a flexible disk, which is referred to as the system disk. The configuration of the system disk is shown below.



It is recommended that a copy of the system disk be used for day-to-day operation. Copies can be made using the procedures described in Chapter 3. To start CP/M, insert a copy of the system disk in drive A, then turn on the QX-10's power switch; this automatically loads the system program into the computer's memory. The memory map after loading is as shown below.



The following prompt (the system prompt) is displayed on the CRT screen after the system has been loaded; this indicates that the disk drive currently logged in (the disk drive currently under control of the system) is drive A, and that the system is ready to accept entry of commands. At this time, the system is said to be at the command level.

A>

Drive A is always logged in when the power is turned on, and remains logged in until another drive is logged in. This is done by typing the following from the keyboard.

B: 

The system then responds as follows. (If no disk is installed in drive B when that drive is logged in for the first time, the speaker will beep and the FDD TIMEOUT-XX message is displayed.)

B>

To return to drive A, type:

A: 

4.3 System Files

4.3.1 File directory

CP/M and other programs are recorded on the system disk in the form of files. It is possible to display a list of the files recorded on a disk by executing the DIR (directory) command. Type

DIR ↵

following the system prompt; names of files and their types are then displayed on the screen as follows.

```
A>DIR
A: MOVCPM  COM : .OSTAB  SYS : .PFKTAB  SYS : .FOREIGN SYS
A: .GAIJI  SYS : PIP     COM : SUBMIT   COM : ED       COM
A: STAT    COM : ASM     COM : LOAD     COM : DDT      COM
A: SYSGEN  COM : DUMP    COM : XSUB     COM : DUMP     ASM
A: BIOS    ASM : CBIOS   ASM : DEBLOCK  ASM : DISKDEF  LIB
A: FORMAT  COM : CONFIG  COM : PFKSET   COM : DIRINIT  COM
A: TERM    COM : DISKCOPY COM : CHARADEF COM : MFONT    COM
A: NORM    COM : AUTOST  COM : MFBASIC  COM :
A>
```

4.3.2. File names

All programs and data are stored as files. A file name identifies a particular file or group of files on a disk. Individual files are stored under "unambiguous" file names (ufn); "ambiguous" file names (afn) are used to identify groups of files.

- **Unambiguous file names**

An unambiguous file name identifies a single file. It consists of a file name and a file type (typ), which are separated by a period (.) as shown below.

filename.typ

The file name consists of up to 8 characters and the file type consists of up to 3 characters. All alphanumerics and special characters other than the following can be used in file names.

< > . , ; : = ? * [ ] _ % | ( ) / \

- **Ambiguous file names**

Ambiguous file name is used to find files whose file names and/or file types include common character strings. The form for specifying ambiguous file names is similar to that used for unambiguous file name, except that the question mark (?) can be used as a wild card character to indicate any character of a filename in a particular position. An example of an ambiguous file name is shown below.

```
AB?D.C?M
```

Some of the files to which this file name could apply are as follows.

```
ABCD.COM
ABZD.COM
ABCD.CAM
```

The asterisk (*) can also be used as a wild card character in place of eight question marks for a file name or three question marks for a file type. That is,

```
*.*
```

is equivalent to

```
????????.???
```

Of course either the file name or file type may be uniquely specified as

```
filename.*
```

or

```
*.typ
```

4.3.3. Drive names

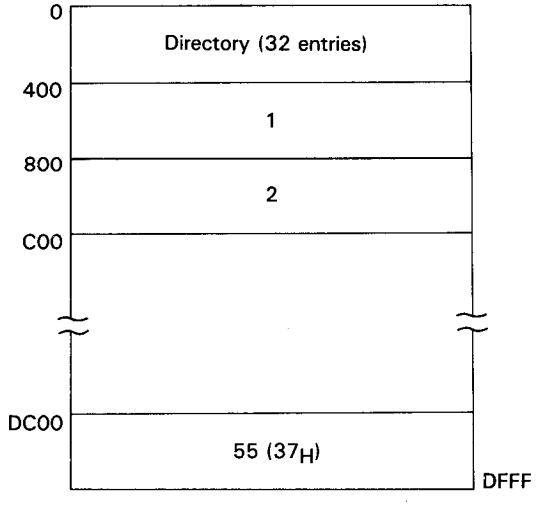
When a file stored on a disk in a drive other than that currently logged-in drive is specified, the drive name must be specified ahead of the file name as shown below.

```
>A DIR B:*.COM
>A PIP LST:=B:SAMPLE.PRN
```

- **Disk Image RAM**

CP/M for the QX-10 supports 2 disk drives plus 2 virtual disk drives in memory. Therefore, drive names A, B, E and F may be specified in commands. Drive names A and B are assigned to the standard disk drives. Drive name E is assigned to a 56K byte memory area (user bank #2) which becomes available when optional RAM chips are installed for 256K byte system. Drive name F is assigned to a 56K byte memory area which is usually used as the user area for MultiFonts BASIC (user bank #1). (Drive F cannot be used by MultiFonts BASIC.) These memory areas can be used as if they were disks. Each memory area has the directory area and data can be accessed in file units by system commands. The maximum number of directory entries is 32. These memory areas are referred to as disk image RAM.

Since the access speed of the disk image RAM is several times as great as that of flexible disks, it is convenient when assembling programs. The contents of disk image RAM are lost when the power is turned off.
The layout of disk image RAM is as follows.



4.3.4 Logical device names

The CP/M operating system for the QX-10 supports 4 logical I/O devices, CON:, RDR:, PUN: and LST:. These logical device names can be treated as file names as shown below.

```
PIP LST:=ABC.PRN
```

The above command outputs the contents of file ABC.PRN on PRN: (printer unless IOBYTE is changed).

4.4 CP/M Operation Mode

The CP/M system for the QX-10 operates in either the normal or MultiFonts (MF) mode.

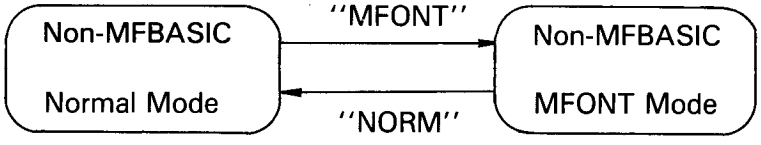
4.4.1 Normal mode

This is the mode entered immediately after the CP/M is cold started or the NORM command is executed in the MF mode. In the normal mode, all keys on the keyboard except the style selection keys can be used for data entry. The character set used in this mode is that specified by the CONFIG command or "ESC" + "C" + "country code key" (see 4.1). Each character is displayed as a matrix of 7 (horizontal) × 13 (vertical) dots.

4.4.2 MultiFonts mode (MF mode)

This is the mode entered after the MFONT command is executed in the normal mode. In this mode, the style of characters displayed can be selected with the style selection keys. The international character sets which can be used in this mode are the same as with the normal mode. Each character is displayed as a matrix of 14 (horizontal) × 17 (vertical) dots in the style specified by the style selection keys.

Since style information is not included in the internal character codes for Multiple Font characters, they are not printed on the printer or transmitted through the RS-232C interface in the same style as displayed. To return to the normal mode, execute the NORM command.



4.5 CP/M BDOS Error Messages

The system reports four types of errors related to BDOS operation. These error conditions are indicated with message.

```
Bdos Err On d: error
```

Here, "d:" is the name of the drive on which the error occurred and "error" is one of the following.

```
Bad Sector
Select
R/O
File R/O
```

Bad Sector
This message indicates that the disk drive or flexible disk is defective. This error also occurs when no flexible disk is installed in the drive when access is attempted. This error condition can be cleared by one of the following actions: (1) rebooting the system (that is, pressing the BREAK key or CTRL plus C keys), or (2) pressing the [←┘] key. With the latter method, the error is ignored and program execution continues. However, note that this method does not ensure integrity of the flexible disk.

Select
This error occurs when a drive other than A through F is specified; the condition can be cleared by pressing any key.

R/O
This error occurs when an attempt is made to write data to a flexible disk which has been designated as read-only by the STAT command, BDOS function or a write protect tab. This condition can be cleared by pressing the BREAK key (or CTRL and C keys together). This error also occurs when a write is attempted without making a warm boot after the disk has been replaced or moved to another drive.

File R/O
This error occurs when an attempt is made to write a file for which the read only attribute is set. This condition is recovered by pressing any key.

Chapter 5 CP/M COMMANDS

Three types of commands are supported by the CP/M operating system for the QX-10: Control key commands, built-in commands and transient commands. Control key and built-in commands are included in CCP, and are not listed in the directory of the system disk. The programs for transient commands are stored as individual program files on the system disk with file type .COM assigned.

5.1 Control Key Commands

Control key commands are entered by pressing a specific key while holding down the CTRL key. These commands are as listed below.

CTRL and C :	Performs warm boot of CP/M.
CTRL and E :	Physically terminates a line.
CTRL and H :	Performs the same function as the "BS" key.
CTRL and I :	Performs the same function as the "TAB" key.
CTRL and P :	Entering this command once causes all information displayed on the CRT to be printed on the printer (LST:). Entering it again restores normal operation.
CTRL and R :	Redisplays the current command line.
CTRL and S :	Entering this command once suspends any operation. Entering it again restarts operation.
CTRL and U :	Invalidates the current entry and moves the cursor to the top of the next line.
CTRL and X :	Deletes the current entry and moves the cursor to the top of the current line.
CTRL and Z :	Terminates input from the console.

5.2 Built-in Commands

Built-in commands are resident in main memory and are executed immediately when they are entered. In the explanations below, drives E and F are also applicable where drive B is indicated.

Built-in commands of the MF CP/M are as follows.

DIR

ERA

REN

SAVE

TYPE

USER

DIR (Directory)

The DIR command lists the names of all files satisfying the specified ambiguous file name (afn) on the display screen. The format is

DIR afn

As a special case,

DIR

is used to list the names of all the files on the currently logged disk. This is equivalent to "DIR *.*".
A drive name other than that currently logged in can also be specified as follows.

DIR B:afn

If any key is pressed while the directory is being listed, listing stops and the system returns to the command level.

Example 1

The following example lists all files on the disk in drive A.

```
A>DIR
A: MOVCPM  COM : .OSTAB  SYS : .PFKTAB  SYS : .FOREIGN SYS
A: .GAIJI  SYS : PIP     COM : SUBMIT   COM : ED       COM
A: STAT    COM : ASM     COM : LOAD     COM : DDT      COM
A: SYSGEN  COM : DUMP    COM : XSUB     COM : DUMP     ASM
A: BIOS    ASM : CBIOS   ASM : DEBLOCK  ASM : DISKDEF  LIB
A: FORMAT  COM : CONFIG  COM : PFKSET   COM : DIRINIT  COM
A: TERM    COM : DISKCOPY COM : CHARADEF COM : MFONT    COM
A: NORM    COM : AUTOST  COM : MFBASIC  COM :
A>
```

In the figures in this chapter, characters entered from the keyboard by the operator are underlined.

Example 2

The following example lists the names of files in drive A, which satisfy the ambiguous file name DUMP.*.

```
A>DIR DUMP.*
A: DUMP    COM : DUMP    ASM
A>
```

Example 3

The following example lists the names of files on the disk in drive B which satisfy the ambiguous file name D???.*.

```
A>DIR B:D???.*
B: DDT      COM : DUMP     COM : DUMP     ASM
A>
```

Note that the file with the file name DUMPS.COM is not listed because D???.* is satisfied only by filenames beginning with D which have 4 or fewer characters.

ERA (Erase)

The ERA commands erases a specific file or all files that satisfy a specified ambiguous file name from the currently logged in disk. The format of this command is as follows.

```
ERA ufn
or ERA afn
```

A drive other than that currently logged in can also be specified as shown below.

```
ERA B:filename.typ
```

Examples

ERA ABC.ASM	Erases file ABC.ASM.
ERA *.*	Erases all files on the currently logged disk. In this case, the system displays the message ALL FILES (Y/N) to prompt for confirmation that all files are to be erased. Enter Y to erase all files; enter N if command excution is to be terminated.
ERA B:*.BAS	Erases all files on drive B that satisfy ambiguous file name *.BAS.

Note: Files with the R/O attribute cannot be erased.

REN (Rename)

The REN command changes the name of a file. The format for this command is as follows.

```
REN ufnl=ufn2
```

This changes the file name from ufn2 to ufnl.
A drive name can be specified before either or both file names (in the latter case, the same drive name must be specified for both file names). If a drive name precedes ufnl, it is assumed that the same drive name precedes ufn2, and vice versa.

NOTE:
If ufn2 already exists on the specified disk, the message "FILE EXISTS" is displayed and no change is made.

SAVE

The SAVE command saves the contents of the specified number of pages (256 byte blocks) of the transient program area (which starts at address 100H) on a disk under the specified filename. The format for this command is as follows.

SAVE n ufn

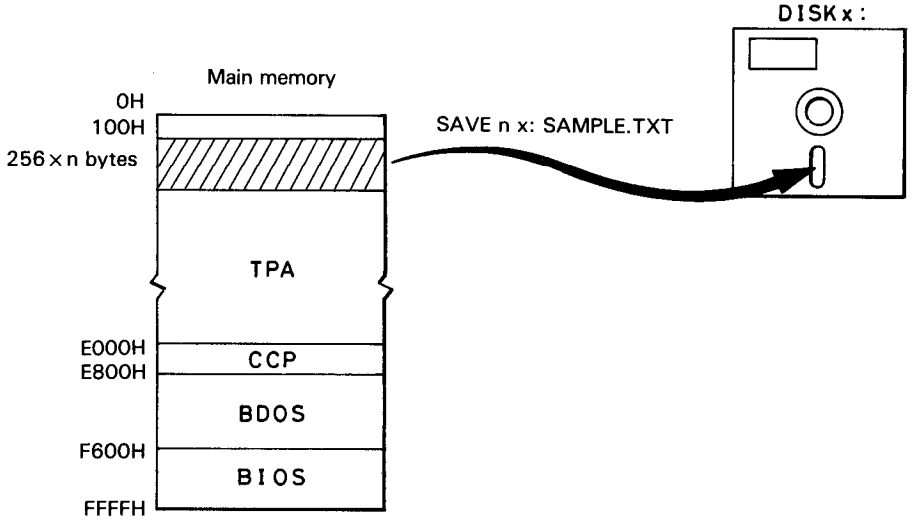
Here, n represents the number of pages to be saved. A drive number can be specified preceding the file name as follows.

SAVE n B:ufn

Examples:

SAVE 3 ABC.ASM — Saves the contents of the memory area from 100H to 3FFH on the currently logged in disk under the file name ABC.ASM assigned.

SAVE 10 B:D.BAS — Saves the contents of the memory area from 100H to 0AFFH on the disk in drive B under the file name D.BAS.



TYPE

The TYPE commands displays the contents of the specified ASCII file in the currently logged disk. The format for this command is as follows.

TYPE ufn

A drive other than that currently logged in can also be specified as shown below.

TYPE B:ufn

If any key is pressed during execution of the TYPE command, display is interrupted and the system returns to the command level.

```
A>TYPE SAMPLE.PRN

0100                    ORG     100H
0100 0E0D               MVI     C,0DH
0102 CD0FEA             CALL    0EA0FH
0105 C9                 RET
0106                    END

A>
```

USER

The USER command allows different users to specify their own logical directories on the same disk. The logical directory 0 is automatically specified after cold start. The user can open another logical directory with the USER command. The format for this command is as follows.

```
USER n
```

Here, n is the user number (an integer from 0 to 15) which specifies a logical directory. When a logical directory is specified, only files cataloged in the specified directory can be accessed; that is, files generated under one user number cannot be accessed under any other user numbers.

5.3 Standard Transient Commands

The standard transient commands are included as program files on the system disk, and are not resident in main memory. When a transient command is typed following the system prompt, the corresponding program file is loaded in the transient program area, then executed.
Standard transient commands are briefly explained below. For details, see any of the various publications available on CP/M.

In explanations of subcommands, Z represents the CTRL and Z keys pressed together.

Standard transient commands of the MF CP/M are as follows.

ASM.COM

DDT.COM

DUMP.COM

ED.COM

LOAD.COM

MOVCPM.COM

PIP.COM

STAT.COM

SUBMIT.COM

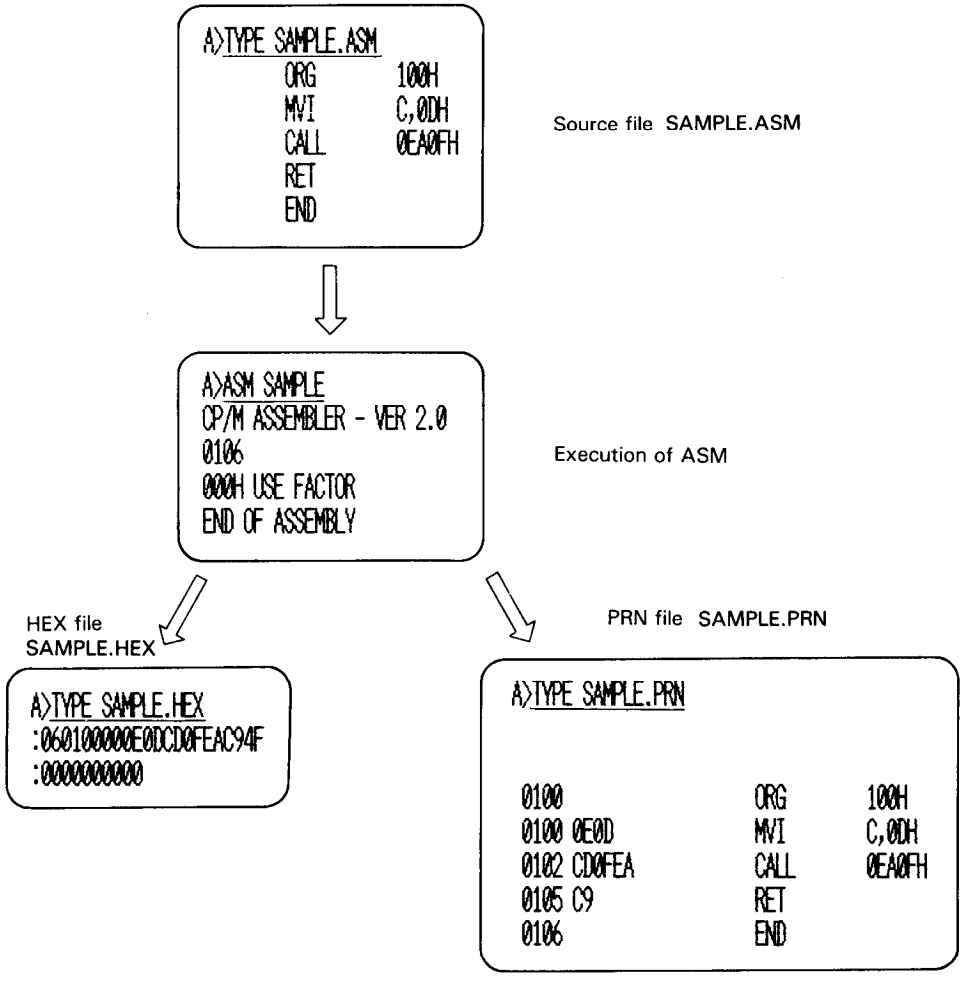
SYSGEN.COM

XSUB.COM

ASM (Assembler)

The ASM command loads and starts the Intel 8080 assembler program. This program reads source files generated with the ED command, converts them to machine language programs in Intel "HEX" format, and produces assembly list files. Although the QX-10 uses a Z80 compatible CPU, some mnemonics peculiar to the Z80 cannot be used in source files when using this assembler. For the full set of Z80 mnemonics, you may use an optional assembler program such as MAC or M80.

The file type of the source file must be ASM, that of the object file is automatically set to HEX and that of the list file is automatically set to PRN.



The general format for the ASM command is shown below.

Format 1

ASM dr:filename

Assembles the source file "filename.ASM" from the disk in the specified file, then saves the object file "filename.HEX" and the list file "filename.PRN" on the same disk. dr can be omitted if the disk is in the drive which is currently logged in.

Format 2

ASM filename.shp

Assembles the source file "filename.ASM" from the disk in drive s, outputs the object file "filename.HEX" to the device specified by h, and outputs the list file "filename.PRN" to the device specified by p.

s: drive name (A, B, E and F)

h: drive name (A, B, E and F)
Specify Z if no object file is to be created.

p: drive name (A, B, E and F),
Specify Z if no list file is to be created, or X to output the list file to the console. (The list file can also be output to the printer by pressing the CTRL and P keys together prior to assembly.)

Examples

A>ASM SAMPLE ↵

This example assembles SAMPLE.ASM from the disk in drive A, then outputs SAMPLE.HEX and SAMPLE.PRN to the same disk.

A>ASM B:SAMPLE ↵

This example assembles SAMPLE.ASM from the disk in drive B, then outputs SAMPLE.HEX and SAMPLE.PRN to the same disk.

A>ASM SAMPLE.BBA ↵

This example assembles SAMPLE.ASM from the disk in drive B, then outputs SAMPLE.HEX to the same disk, and outputs SAMPLE.PRN to the disk in drive A.

A>ASM SAMPLE.AZX ↵

This example assembles SAMPLE.ASM from the disk in drive A and outputs SAMPLE.PRN to the console, but does not create an object file.

A>ASM SAMPLE.AZZ ↵

This example assembles SAMPLE.ASM, but does not create object or list files. Since program errors are displayed with this format, it is often used to check for program errors.

Error messages

When the assembler detects errors in the source program during assembly, it displays the relevant line(s) with an error message appended to the left end of the line as shown below.

```
A>ASM SAMPLE1
CP/M ASSEMBLER - VER x.x
E                       MOV     C A
E0000 40                MVI     B,0DH
V0001 CD0000            CALL    0EA0FH
U0004 1E00              MVI     E,ABC
0007
000H USE FACTOR
END OF ASSEMBLY

A>
```

Error message	Typical causes
D	Incorrect data expression in data area
E	Incorrect expression which cannot be computed by assembler
L	Incorrect use of label (duplicate label)
N	Use of features not implemented
O	Expression too complicated
P	Phase error: Label does not have the same value on a subsequent pass.
R	Improper register specification
S	Syntax error
U	Undefined label
V	Value of operand or expression is out of range.

DDT (Dynamic debugging Tool)

The DDT command loads and executes the dynamic debugging tool, a debugger which operates at the machine language level. Enter this command using one of the following formats.

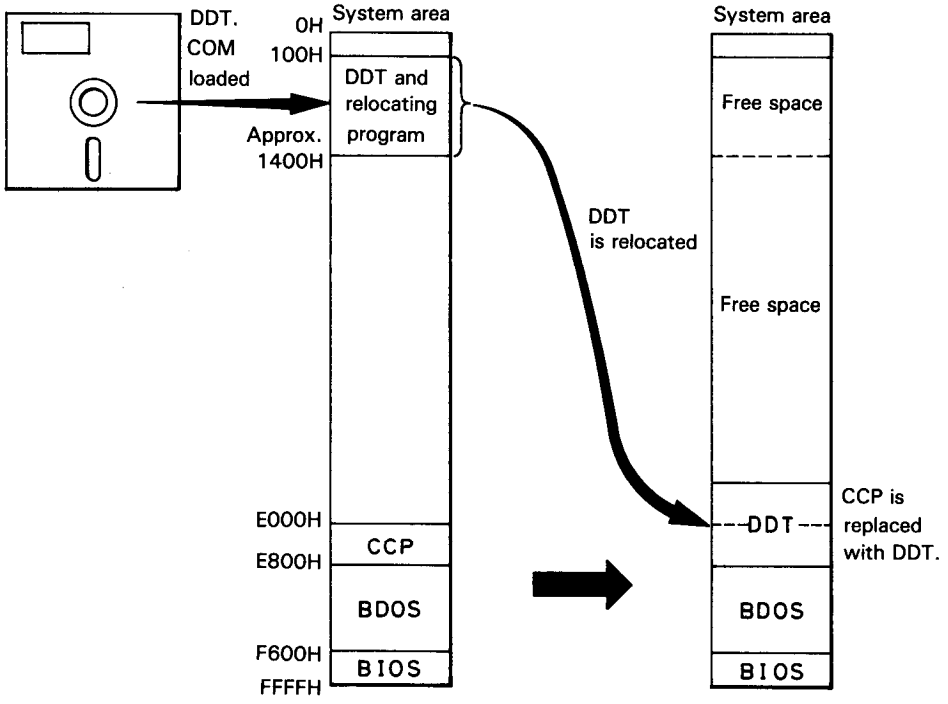
```
DDT
```

This format loads the DDT into main memory. Files to be processed are loaded with a subcommand.

```
DDT filename.COM
DDT filename.HEX
```

This format loads filename.COM or filename.HEX into main memory for debugging.

The DDT subcommands are as follows. These may be entered when the subcommand prompt "–" is shown on the display. The DDT command can be terminated by entering subcommand G0 or pressing CTRL and C together.



After DDT (plus the relocating program) has been loaded in the memory area starting at 100H, DDT is relocated to the memory are below BDOS by the relocating program. After relocation has been completed, the prompt "–" appears on the screen.

lufn

This subcommand catalogs file name ufn in the default file control block at address 5CH.

R or Roffset

These subcommands load the file specified in the default file control block into memory. The starting address of the memory area into which the file is loaded is 100H (or 100H + offset) when the file is of the COM type; when a HEX type file is loaded, the starting address of the memory area is that specified in the program (plus the offset, if specified). The offset must be specified as a hexadecimal numer.

Example

```
-IABC.COM ↵
-R ↵
```

This example loads file ABC.COM into the memory area starting at address 100H.

Hnnnn mmmm

This subcommand calculates the results of nnnnH + mmmmH and nnnnH − mmmmH.

Example

```
-H100 1F00 ↵
2000 E200
```

The value on the left is the result of addition and that on the right is the result of subtraction. Results of up to 4 digits are displayed, and overflow and underflow errors are ignored.

D, Daddress or Daddress1 address2

This command displays the contents of the main memory area starting at "last display address + 1" in both hexadecimal and ASCII form. The starting address for display when the DDT command is first activated is 100H.

Example 1

```
-D ↵
```

This subcommand displays the contents of memory starting at 100H on 12 lines of the screen.

Example 2

```
-D200 ↵
```

This subcommand displays the contents of memory starting at 200H on 12 lines of the screen.

Example 3

-D100 200 ↵

This subcommand displays the contents of the memory area from 100H to 200H.

Faddress1 address2 c

This subcommands fills the memory area from address1 to address2 with the hexadecimal constant c.

Example

-F0195 01A3 4C ↵

This subcommands fills the memory area from 0195H to 0lA3H with 4CH.

Maddress1 address2 address3

This subcommand transfers the contents of the memory area from address1 to address2 to the area starting at address3.

Saddress

This subcommand is used to change the contents of memory.

Example

-S100 ↵

0100 01

To change the contents, type the new data 02 and press the ↵ key. The contents of address 100H are changed to 02, then the next address is displayed for modification as follows.

0100 01 02 ↵

0101 BC

Pressing the ↵ key by itself increments the address without changing its contents.

0100 01 02

0101 BC ↵

0102 . ↵

—

Typing "." instead of new data terminates the subcommand.

Aaddress

This subcommand assembles 8080 mnemonic instructions entered following the indicated addresses. Numeric values specified in operands must be hexadecimal number. (However, "H" must not be appended to the numbers.)

Example

```
-A100
0100_
```

Type a mnemonic instruction and press the ↵ key.

```
0100 LXI SP,80 ↵
0103_
```

This causes the machine language instruction corresponding to the above mnemonics to be loaded into the area from 100H to 102H.
Pressing the ↵ key by itself terminates the subcommand.

```
0100 LXI SP,80
0103 ↵
-_
```

In this case, the contents of address 103H is not changed.

L, Laddress or Laddress1 address2

This subcommand lists the contents of the specified memory area in 8080 mnemonics.

Example 1

```
-L ↵
```

This example lists 11 lines of memory contents, starting at "last list address + 1". Immediately after the DDT command is activated, the last address is 100H.

Example 2

```
-L100 105 ↵
```

This example lists the contents of memory from 100H to 105H.

X or Xr

This subcommand displays the register contents and flag settings, and allows you to change their contents.

Example 1

```
-X ↵
```

Displays the register contents.

Example 2

```
-XP ↵
P=0100
```

Displays the contents of the program counter. To change its contents, type a new address and press the ↵ key.

```
P=0100 0200 ↵
```

G

The G subcommand starts execution of a program loaded by the DDT command. Execution starts at the address specified in the subcommand, and up to two break points can be set. The general format for this subcommand is as follows.

```
Gaddr,bp1 bp2
```

Here, bp1 and bp2 indicate break points. Any parameters can be omitted; if the starting address is omitted, execution starts at the current address contained in the program counter.

Example 1

```
-G ↵
```

Starts execution from the program counter address.

Example 2

```
-G100,120↵
*120
-
```

Starts execution at address 100H and stops execution at address 120H.

Tm

This subcommand traces m steps of the program starting at the program counter address. Flag setting, register contents, and program mnemonics are displayed for each step traced. If m is omitted, the subcommand traces one step. Pressing any key stops tracing.

Um

This subcommand traces m steps of the program starting at the program counter address. Trace results are displayed only for the last instruction executed.

DUMP

The DUMP command displays the contents of the specified file on the screen in hexadecimal form. Each 16-byte section of the file is displayed on one line, with the starting address of each section listed to the left of each line. The format for this command is as follows.

DUMP ufn

DUMP dr:ufn

Example

```
A>DUMP SAMPLE.ASM

0000 20 20 20 20 20 20 20 20 4F 52 47 20 20 20 20 20
0010 20 20 20 31 30 30 48 0D 0A 20 20 20 20 20 20 20
0020 20 4D 56 49 20 20 20 20 20 20 20 20 43 2C 30 44
0030 48 0D 0A 20 20 20 20 20 20 20 20 43 41 4C 4C 20
0040 20 20 20 20 20 20 30 45 41 30 46 48 0D 0A 20 20
0050 20 20 20 20 20 20 52 45 54 0D 0A 20 20 20 20 20
0060 20 20 20 45 4E 44 0D 0A 1A 1A 1A 1A 1A 1A 1A 1A
0070 1A 1A 1A 1A 1A 1A 1A 1A 1A 1A 1A 1A 1A 1A 1A 1A

A>
```

The ED command allows the user to generate new text files or to edit existing files. The format for the ED command is as follows.

```
ED dr:filename.typ
```

The file name may be either the name of a new file or an existing file. Specify the name of an existing file to edit it; specify a new name to create a new file.

When the ED command is entered to create a new file, the display appears as follows.

```
A>ED B:SAMPLE.ASM

NEW FILE
   : *
```

When the ED command is entered to edit an existing file, the display appears as follows.

```
A>ED B:SAMPLE.ASM
   : *
```

In either cases, an asterisk is displayed as shown below to prompt for entry of sub-commands.

ED subcommands

nA

Appends the n lines of text from the disk to the contents of the edit buffer.

0A

Appends text from the disk to the contents of the edit buffer until half of the edit buffer is filled.

±B

Moves the character pointer (CP) to the beginning (+) or end (−) of the text in the edit buffer.

±nL

Moves the CP ±n lines from the current line and locates it at the beginning of the new line.

±n
Moves the CP ±n lines from the current line, locates it at the beginning of the new line, and displays that line. (= ±nLT)

0
Moves the CP to the beginning of the current line and displays the current line. (=0LT)

Moves the CP to the beginning of the next line and displays that line. (Same as with LT.)

n:
Moves the CP to the beginning of line n.

±nC
Moves the CP ±n characters from its current position.

±nT
Displays the ±n lines from the current CP position.

0T
Displays the current line from its beginning to the CP position.

n::mT
Displays the text from line n to line m.

±nP
Displays the ±n pages from the current CP position. (1 page = 23 lines)

nFstring
Finds the n'th occurence of the character string following the current CP position and locates the CP to the end of that string.

nNstring
Appends the remainder of the text from the disk and performs the same function as nFstring.

±nD
Deletes the n characters preceding (-) or following (+) the CP position.

±nK
Deletes the n lines preceding (-) or following (+) the line on which the CP is located. When + is specified, the current line is deleted; otherwise, it is excluded.

I
Enters the insert mode to allow insertions to be made.

Istring∧Z
Inserts the specified string at the current CP position.

Istring ⏎
Inserts the specified string and a CR/LF in the current CP position to generate a new line.

R
Inserts lines previously saved as temporary file X$$$$$$$.LIB (with the nX subcommand) at the current CP position.

Rfilename
Inserts a file of type LIB at the current CP position. (The file must exist on the disk which contains the original source file or on which the new file is to be stored.)

nSstring1∧Zstring2
Replaces the n'th occurence of string1 following the current CP position with string2, then locates the CP at the end of string2.

nJstring1∧Zstring2∧Zstring3
Inserts string2 following the first stringl following the current CP position, then deletes all characters from the end of string2 to the beginning of string3. string3 is not deleted. This operation is repeated n times.

nX
Appends the n lines of the text following the CP to the contents of temporary file X$$$$$$$.LIB.

0X
Empties temporary file X$$$$$$$.LIB.

±U
+U causes all characters to be converted to upper case as they are entered; −U resets this function.

nMsubcommand
Repeats the specified subcommand n times.

Msubcommand
Repeats the specified subcommand until the end of buffer is reached. (=0M, 1M)

±V
−V makes line numbers invisible. +V resets this mode.

0V
Displays the amount of free space and total size of the edit buffer.

nZ
Delays display by approximately 1/4n seconds.

nW
Saves the n lines from the beginning of the edit buffer to temporary file filename.$$$. Lines saved are deleted from the edit buffer.

E
Saves the contents of the edit buffer and the remainder of the source file to the disk and terminates the ED command.

H
Saves the contents of the edit buffer and the remainder of the source file to the disk, deletes the contents of the edit buffer, and restarts the ED command for the same file name.

O
Cancels and clears all preceding editing operations to allow editing to be started over.

Q
Terminates the ED command; no change is made on the original file.

n:subcommand
Moves the CP to the beginning of line n and executes subcommand.

:nsubcommand
Executes subcommand for the text between the CP and line n.

NOTES:

* *The CP is an abbreviation for character pointer.*
* *The + symbol can be omitted.*
* *n can be omitted when it is 1.*
* *When # is specified as n for subcommands A and W, all lines of the text are indicated.*
* *More than one command can be entered at the same time.*
* *When any of subcommands I, S, J, R and F are entered in uppercase, lowercase characters in the text are converted to uppercase characters. Therefore, these subcommands must be entered in lowercase when the text includes lowercase characters.*
* *Line editing can be done using control keys during ED operation. Pressing the CTRL and L keys together inserts a CR/LF in the text without using the [←┘] key.*

When the ED command is terminated with subcommand E, the type of the original file is changed to BAK and it remains on the disk so that it is used as a backup file.

Error messages

When an error occurs during editing, the ED command displays the message

```
BREAK "X" AT C
```

Here, C is the command which caused the error and X is one of the following.

?:	Incorrect command
>:	Edit buffer full
#:	Subcommand cannot be executed the number of times specified.
0:	LIB file cannot be opened by subcommand R.

Example 1

The following example generates the command procedure file used in the example for the SUBMIT command.

```
A>ED SAMPLE.SUB [←┘]
NEW FILE
    : *I [←┘]
   1: FORMAT [←┘]
   2: SYSGEN [←┘]
   3: PIP B:=A:*.* [←┘]
   4:^Z
    : *E [←┘]
A>
```

LOAD

The LOAD command converts Intel "HEX" format object files generated with the ASM command into executable machine code files (with file type COM assigned) and saves them on the specifed disk.
The example below converts SAMPLE.HEX to SAMPLE.COM and saves it to the disk in drive A.

```
A>LOAD SAMPLE

FIRST ADDRESS 0100
LAST  ADDRESS 0105
BYTES READ    0006
RECORDS WRITTEN 01


A>
```

Whether SAMPLE.COM has been saved can be checked with the STAT command as follows.

```
A>STAT SAMPLE.*

 Recs  Bytes  Ext Acc
    1     2k    1 R/W A:SAMPLE.ASM
    2     2k    1 R/W A:SAMPLE.BAK
    1     2k    1 R/W A:SAMPLE.COM
    1     2k    1 R/W A:SAMPLE.HEX
    2     2k    1 R/W A:SAMPLE.PRN
Bytes Remaining On A: 58k

A>
```

MOVCPM

The MOVCPM command allows the user to reconfigure the CP/M system for different memory sizes. The format for this command is as follows.

MOVCPM	Reconfigures the system for the available memory, but does not record the new system on the disk.
MOVCPM n	Reconfigures the system for a memory of n kilobytes; does not record the new system on the disk. n must be a number from 26 to 59.
MOVCPM n *	Reconfigures the system for a memory of n kilobytes and records the new system on the disk. n must be a number from 26 to 59.
MOVCPM * *	Reconfigures the system for the available memory and records the new system on the disk.

NOTE:
The new system can be used without rebooting, however the last asterisk must be specified in order to save the new system to the disk.

When the MOVCPM command is entered, the following message appears on the screen (assuming that a 32K CP/M system is being reconfigured.)

```
A>MOVCPM 32 * [←┘]

CONSTRUCTING 32k CP/M vers x.x
READY FOR "SYSGEN" OR
"SAVE 59 CPM32.COM"

A>
```

The new CP/M system is now in the TPA awaiting SYSGEN or SAVE. To modify the BIOS portion of the system, save it, then load it into memory again with the DDT command; now you can modify the BIOS portion of the system. (If you want to make a major modification, it is easier to create your own BIOS.)
You can merge files such as CBIOS.COM and BOOT.COM with the new CPM32.COM system when you load it into memory with DDT, or you can modify them while testing the new system. Finally, use SYSGEN to save the new system onto the first two tracks of a new system disk in drive B. For example,

A>SYSGEN [↵]

QX10 SYSGEN

Source Drive Name (or RETURN to skip) [↵]

([↵] is pressed because the system is already in memory.)

Destination Drive Name (or RETURN to reboot) B
Destination on B, then press RETURN [↵]

Function complete
Destination Drive Name (or RETURN to reboot) [↵]

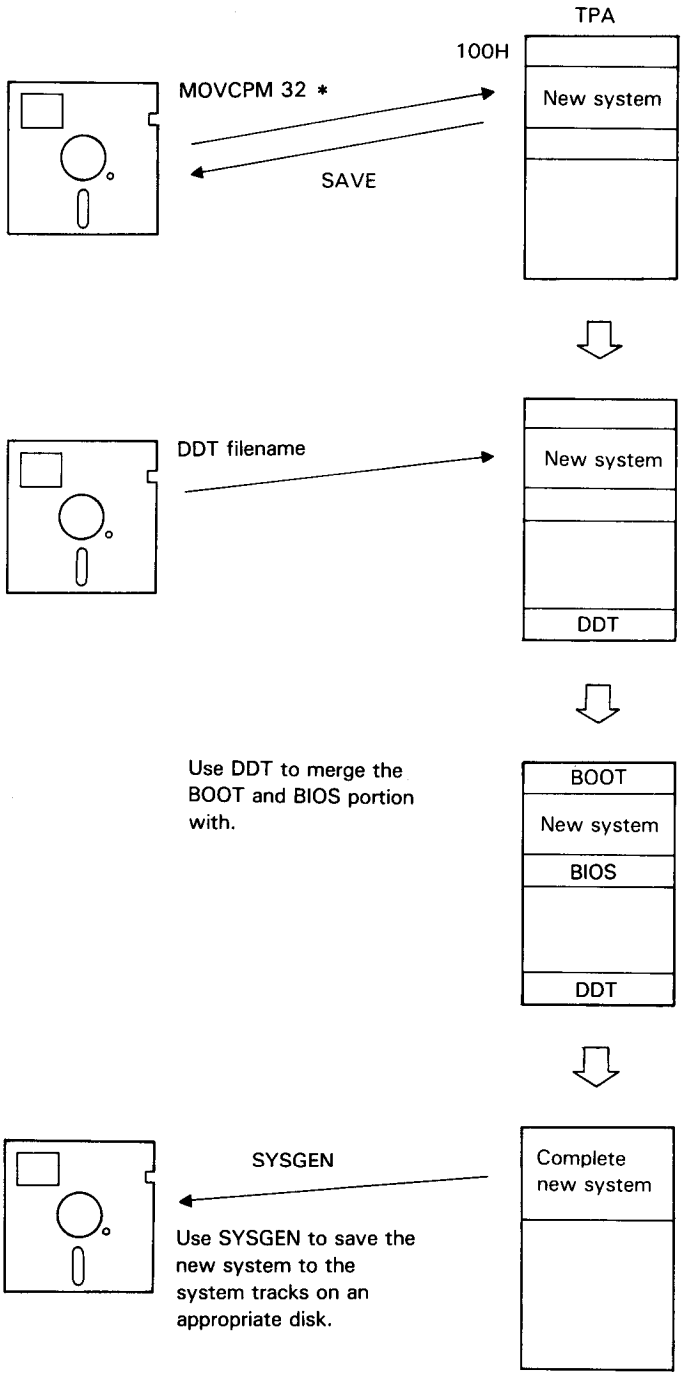
A>PIP B:=A:*.*[V] [↵]

....

.... (Copying message)

A>

The above procedures are shown in the figure below.


TPA
100H
MOVCPM 32 *
SAVE
New system
DDT filename
New system
DDT
Use DDT to merge the
BOOT and BIOS portion
with.
BOOT
New system
BIOS
DDT
SYSGEN
Use SYSGEN to save the
new system to the
system tracks on an
appropriate disk.
Complete
new system

If you have a copy of new CP/M as a file with type COM assigned, you can use the following procedures.

```
A>SYSGEN CPM.COM ↵

QX10 SYSGEN vers x.x

Destination Drive Name (or RETURN to reboot)

.....
```

For modification of BIOS and creation of your own BOOT program, refer to Digital Research's CP/M Version 2.2 Alteration Guide.
For comparison of the reconfigured system with the original system, refer to Appendix B.

NOTE:
The following commands cannot be used with a 26K to 56K CP/M system which has been reconfigured with the MOVCPM command.

CHARADEF

MFONT

NORM

MFBASIC

MOVCPM

AUTOST

Operation of the following transient commands is limited under the reconfigured CP/M system as shown below.

FORMAT:	Drives E and F cannot be specified.
CONFIG:	Printers and countries cannot be selected. "Data char" cannot be set to 6 bits/char or less.
DIRINIT:	Drives E and F cannot be selected.
TERM:	"Data char" cannot be set to 6 bits/char or less.

The following commands are used in the same manner as with the MF CP/M.

PIP
SUBMIT
ED
STAT
ASM
LOAD
DDT
SYSGEN
DUMP
XSUB
PFKSET
DISKCOPY

PIP (Peripheral Interchange Program)

PIP is used to transfer data between peripheral devices. This command was used in Chapter 3 to copy the system disk. The general format for this command is as follows.

```
PIP destination = source [param]

PIP ↵

*destination = source1[param], source2[param], ...
```

The destination may be a logical output device, or a drive name or file name, such as LST:, CON:, B: or B:ABC.COM; source may be a logical input device or a file name preceded by a drive name; e.g. RDR:, A:*.* or A:ABC.COM. Two or more sources may be specified, and any of about 20 options may be specified; these must be specified within square brackets ([ ]), exactly as shown in the general format above. Since this command is very useful, reference to other publications on CP/M is recommended to become familiar with it.

Example 1

```
A>PIP
*LST:=A:SAMPLE.PRN
```

This lists the contents of SAMPLE.PRN on the printer (LST:).

Example 2

Copying one file from drive A to drive B

```
A>PIP B:=A:EXAMPLE.DAT[V]
```

Option [V] specifies that the file is to be verified after copying is completed.

Example 3

Copying all files from drive A to drive B

```
A>PIP B:=A:*.*[V]
```

When this command is executed, the message "COPYING" appears on the display as shown below, followed by the name of each file as it is copied.

```
COPYING
MOVCPM.COM
PIP.COM
SUBMIT.COM
  .
  .
```

(PIP parameters)

[B] (Block)
When [B] is specified, PIP performs block mode transfer. That is, PIP loads data received into a buffer until an ASCII "X-off" character (CTRL-S) is received, then saves data from the buffer to the destination device and clears the buffer to receive more data.

[Dn] (Delete)
When [Dn] is specified, PIP deletes characters exceeding column n of each line.

[E] (Echo)
When [E] is specified, data transferred is also output to the console.

[F] (Form feed)
When [F] is specified, form feed characters (0CH) are removed from data transferred.

[Gn]
When [Gn] is specified, data can be transferred from another user area.

[H] (Hex format)
When [H] is specified, PIP checks to confirm that data transferred is in Intel HEX format. (If not, operation is terminated.)

[I] (Ignore null)
When [I] is specified, PIP ignores null records (00:) and checks to confirm that data transferred is Intel HEX format. (If not, operation is terminated.)

[L] (Lowercase)
When [L] is specified, all uppercase characters are converted to lowercase characters.

[N] (Line number)
When [N] is specified, line numbers are added to the beginning of each line. Specifying "N2" adds zeros to the beginning of each line number.

[O] (Object files)
When [O] is specified, PIP ignores the physical end of file code (1AH) during concatenation and transfer. This makes it possible to transfer files other than ASCII files.

[Pn] (Page eject)
When [Pn] is specified, PIP makes a page eject every n lines. When n is 1 or omitted, 60 is assumed.

[Qstring^Z] (Quit)
When [Qstring^Z] is specified, PIP quits transfer when the specified string is detected.

[Sstring^Z] (Start)
When [Sstring^Z] is specified, PIP searches the data to be transferred for the specified string, then starts transfer from the point at which it is detected.

[R] (Read)
Specifying [R] makes it possible to transfer .SYS files. (The [W] parameter is set automatically when [R] is specified.)

[Tn] (Tab)
When [Tn] is specified, the tab width for transfer is set to n columns.

[U] (Uppercase)
When [U] is specified, all lowercase characters are converted to uppercase characters.

[V] (Verify)
When [V] is specified, each file is verified as it is copied.

[W] (Write in R/O)
When [W] is specified, the R/O attributes of destination files are ignored.

[Z] (Zero parity)
When [Z] is specified, parity bits of data received are turned to zero.

NOTE:
When the system disk is copied using the PIP command, the message "DESTINATION IS R/O, DELETE (Y/N) ?" appears whenever a file whose type is SYS is to be copied. Since these files have already been created by the SYSGEN command, press the N key when this message is displayed. (Do not specify either the [R] or [W] parameter.)

STAT (Statistical Information)

The STAT command provides general statistical information about files and devices. It is also used to specify the attributes of files and peripheral devices.
This command is entered in many formats as shown below.

File related formats

STAT

This format displays the amount of free space on the disk in the currently logged-in drive and other drives which have been at least once used, as well as their R/W attribute.

STAT dr:

This format displays the amount of free space on the disk in the specified drive.

STAT dr:filename.typ

This format displays the size and attributes of the specified file(s).

STAT dr:filename.typ $S

This format displays the size and attributes of the specified file(s) in detail.

STAT dr:filename.typ $R/O

This format sets the specified file to read only.

STAT dr:filename.typ $R/W

This format makes it possible to read or write the specified file(s).

STAT dr:filename.typ $SYS

This format sets the SYS attribute of the specified file(s).

STAT dr:filename.typ $DIR

This format sets the DIR attribute of the specified file(s).

Device related formats

STAT DEV:
This format displays the current physical-to-logical device assignments (that is, the contents of IOBYTE).

STAT VAL:
This format displays instructions for specifying the operand of the STAT command as follows.

```
Temp R/O Disk: d:=R/O
Set Indicator: d:filename.typ $R/O $R/W $SYS $DIR
Disk Status: DSK: d:DSK:
User Status: USR:
Iobyte Assign:
CON:= TTY: CRT: BAT: UC1:
RDR:= TTY: PTR: UR1: UR2:
PUN:= TTY: PTP: UP1: UP2:
LST:= TTY: CRT: LPT: UL1:
```

Iobyte Assign indicates the permissible logical-to-physical device assignments.

STAT DSK:
This format displays the status of the currently logged-in drive and other drives which have been used at least once.

STAT USR:
This format displays the current user number and user numbers which have active files on the current disk.

STAT dr:=R/O
This format sets the specified drive to read only. The read only state remains effective until a cold or warm start is made.

STAT logical:=physical:
This format assigns the specified physical device to the specified logical device.

SUBMIT

The SUBMIT command allows several CP/M commands and programs to be executed in sequence. This requires using the ED (editor) command to create a command procedure file containing the commands and programs to be executed. The file type must be "SUB".

Example

The following example makes it possible to generate a backup copy of the system disk by executing one SUBMIT command. Assume that command procedure file SAMPLE.SUB containing the following has been created with the ED command.

```
FORMAT

SYSGEN

PIP B:=A:*.*[V]
```

Typing the following executes the above commands in sequence.

```
A>SUBMIT SAMPLE
```

Wildcard names can be specified for files and commands in SUB type files using $1, $2, $3, and so forth. In this case, the actual file/command names must be specified in the SUBMIT command as shown below.

```
A>SUBMIT filename a1 a2 a3 .....
```

Here, al is the actual file name corresponding to $1, a2 is that corresponding to $2, and so forth.

SYSGEN (System generator)

The SYSGEN command makes a copy of the CP/M operating system on a new disk. (This command was used in Chapter 3 to make a copy of the system disk.) It does not copy transient commands or other program files.

After the SYSGEN command has been activated, follow the instructions given in messages displayed.

```
A>SYSGEN
QX-10 SYSGEN  ver X.X

Source Drive Name ( or RETURN to skip ) A
Source on A, then press RETURN ←┘
Function complete
Destination Drive Name ( or RETURN to reboot ) B
Destination on B, then press RETURN ←┘
Function complete
Destination Drive Name ( or RETURN to reboot )
```

After the SYSGEN command has been activated, disks in both the source and destination drives can be changed any number of times and any number of copies can be made.

NOTE:
The SYSGEN command for the QX-10 is not the same as that used with other computers, so system disks for another computer cannot be made using the SYSGEN command for the QX-10.

XSUB

The XSUB command allows the SUBMIT command to read the console buffer, that is, specifying XSUB in the command procedure file for the SUBMIT command allows subcommands and data to be included in the command procedure file.

Example

Assume that command procedure file TEST.SUB is as follows.

```
XSUB
DDT
I$1.HEX
R
GO
SAVE 1 $2.COM
```

Executing the following command executes the above commands in sequence.

```
A>SUBMIT TEST GOOD BAD
```

Here, GOOD corresonds to $1 and BAD corresponds to $2.

5.4 Transient Commands Unique to the QX-10

The commands described below are unique to the QX-10 and are not explained in publications on standard CP/M.

Transient commands unique to the QX-10 are as follows.

AUTOST
CHARADEF
CONFIG
DIRINIT
DISKCOPY
FORMAT
MFBASIC
MFONT
NORM
PFKSET
TERM

CHARADEF

The CHARADEF command allows you to design dot matrix patterns (which can be displayed or printed by application programs), and store them on a system disk. These patterns are referred to as user-defined characters. The dot matrix for a user-defined character consists of 14 × 18 dots. Although all matrix dots are displayed on the CRT screen, the uppermost row of dots is not printed on paper; this row is used to determine proportional spacing of each character when printed on EPSON MX series printers (except the MX-80). Up to 66 characters can be defined and stored on the disk. Each user-defined character is coded as a 2-byte internal code from F7AC to F7ED. Internal codes F7A0 to F7AB are already defined by the system. However, they can be redefined with this command.

Operating Procedures

(1) Type "CHARADEF" and press the [←┘] key.

(2) Message

Source drive name (or RETURN to skip)

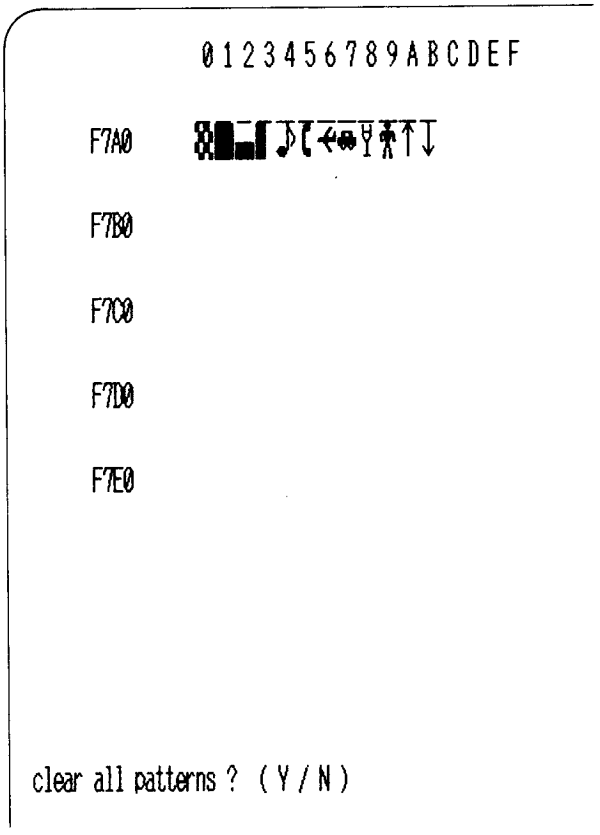
appears on the display. Type the source drive name (e.g., A). Then,

Source on A, then press RETURN_

appears on the display. Confirm that the disk is set in the source drive and press the [←┘] key.

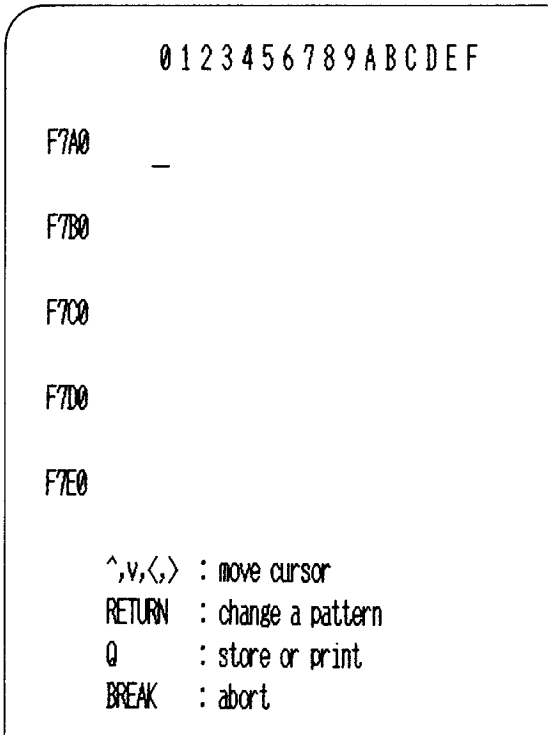
Note:
If the [←┘] key is pressed without specifying the source drive name, the character patterns used are those read by the bootstrap loader when the cold start was made.

(3) User-defined character patterns are read from the specified disk and displayed as follows.

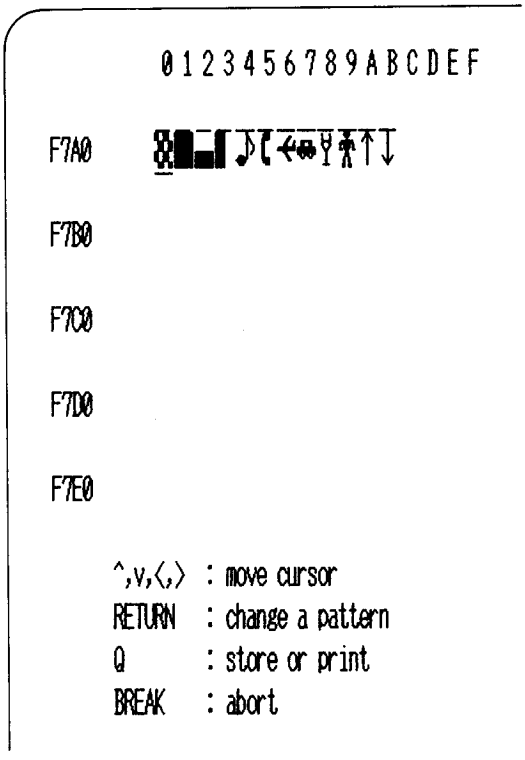


Hexadecimal numbers at the top and left side indicate the internal codes for user-defined characters.

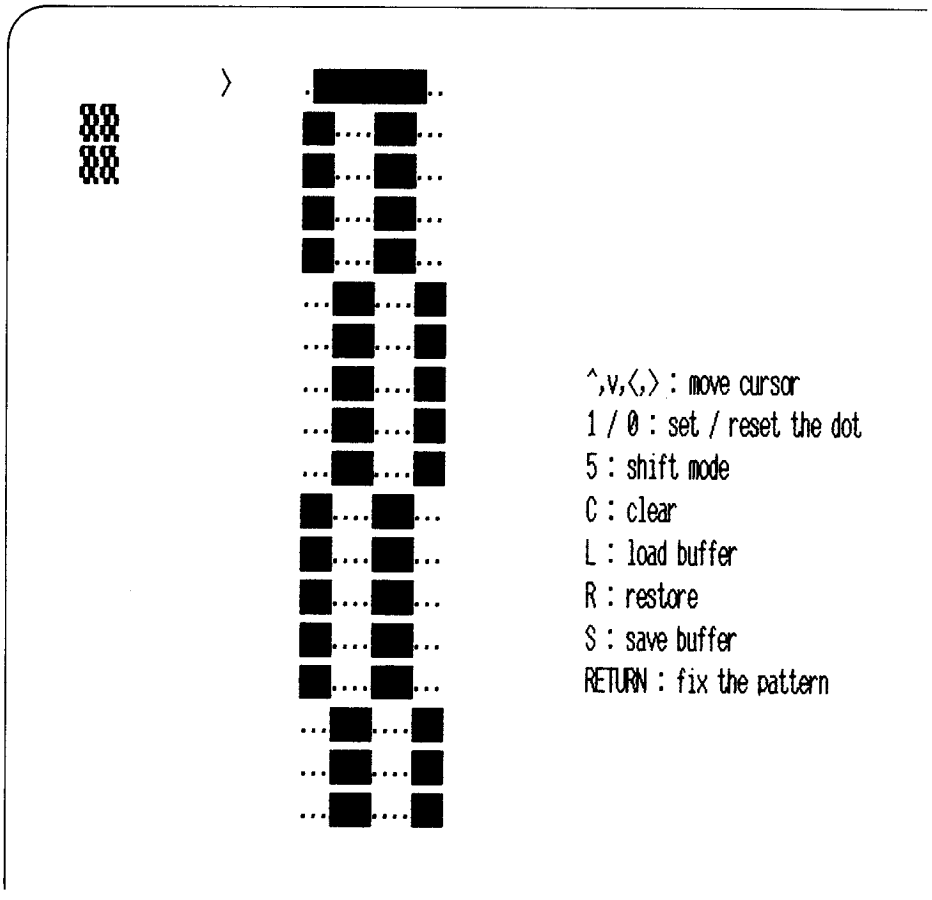
(4) If you want to redefine all patterns including those defined by the system, press the "Y" key; otherwise, press the "N" key. If the "Y" key is pressed, the display changes as follows.



(5) If the N key is pressed at step 3), the display changes as follows.



(6) In either case, use the cursor keys to move the cursor to the position corresponding to the code whose pattern is to be set. Then, press the [←┘] key to display the character pattern in enlarged form as shown below.

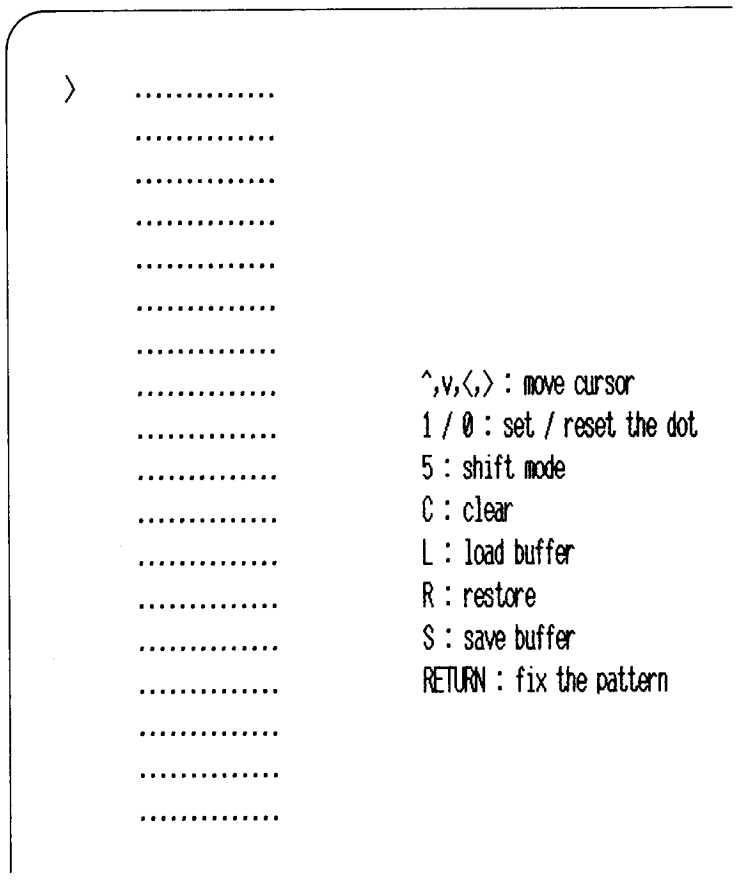


The uppermost row of dots contains the proportional spacing data for printing. (See the explanation of proportional spacing data below.)

(7) You can define your own pattern using the keys indicated in the lower left corner of the display.

[C] (Clear)

This key clears the current user character pattern.



[S] (Save buffer)

This key saves the defined character pattern in memory. The saved pattern can be loaded again by the "L" key (unless the CHARADEF command is terminated).

[L] (Load buffer)

This key replaces the pattern currently being displayed with that last saved.

[R] (Restore)

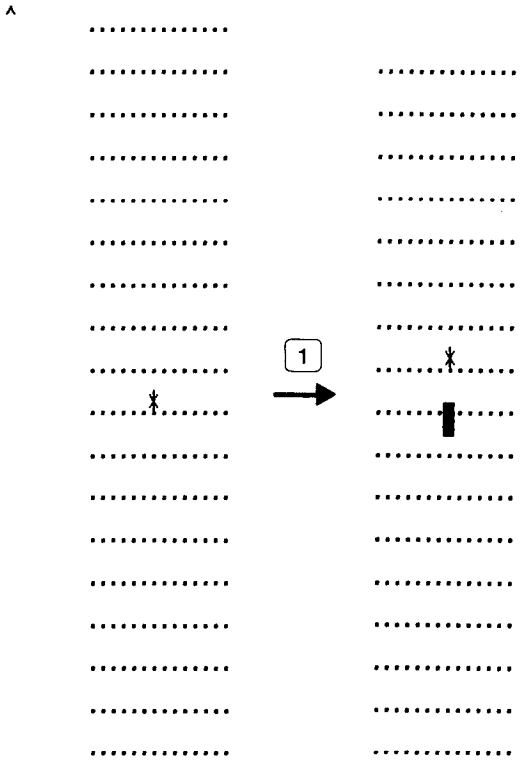
This key restores the pattern which was last fixed.

[↑], [↓], [←] and [→] (Move cursor)

These keys move the cursor up, down, right and left. The direction of cursor movement is indicated to the upper left of the pattern with Λ , V, < and >.

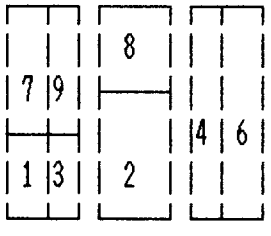
[1] and [0] (Set/reset dot)

These keys are used to set or reset the dot at the cursor position. Pressing "1" sets the dot and moves the cursor in the currently indicated direction. Pressing "0" resets the dot and moves the cursor in the currently indicated direction.



[5] (Shift mode)

This key divides the pattern area into two or four sections with horizontal and vertical lines which cross at the cursor position and makes it possible to shift the pattern within one section in the specified direction. The section to be shifted is specified by a numeric key other than 0 and 5 as shown below.



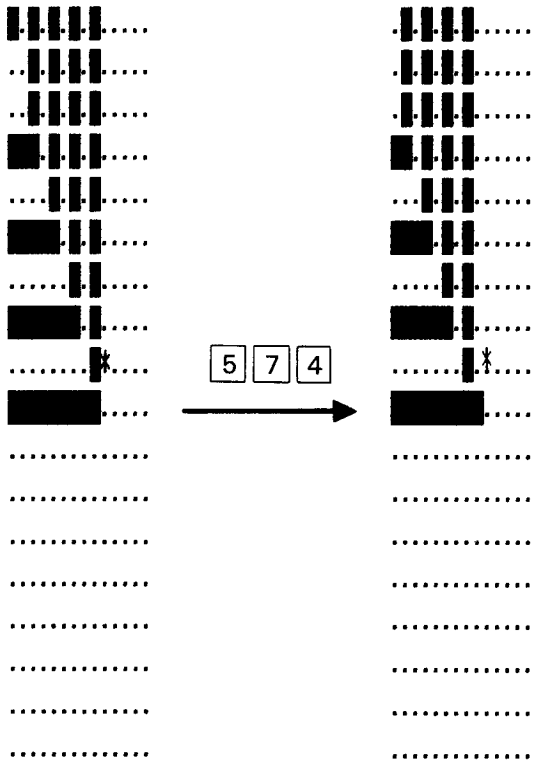
5 : cancel shift mode

The direction of shift can then be specified by the "2", "4", "6" or "8" key as follows.

[2] : Down
[4] : Left
[6] : Right
[8] : Up

For example, when the following keys are pressed in sccession with the cursor located as shown at left below, the pattern changes as shown at right below.

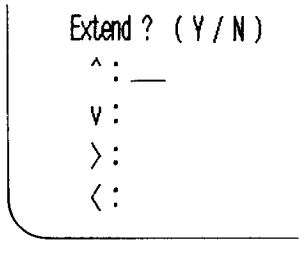
[5] → [7] → [4]



Pressing the "5" key again has no effect on the pattern.

[↵]

Pressing this key causes the following message to be displayed at the bottom left of the screen.



When user-defined characters are displayed on the CRT screen, the characters are separated from each other characters by two dots even if all dots within the patterns are set, so the screen is not filled with set dots. However, spaces can be filled with dots by extending the user-defined pattern. To fill the space above a pattern, extend it in the upward direction by pressing the "Y" key when the display is as shown above. The cursor then moves to the "V:" position. Press the "Y" key to extend the pattern downward, and so forth. If you don't want to extend the pattern in the indicated direction, press the "N" key. Pressing the [←┘] key terminates specification of extension, with "N" assumed for all the remaining directions. The display then changes as follows.

```
Extend ? (Y/N)
  ^ : Y
  v : N
  > : Y
  < : N

Print ? (Y/N)__
```

If you press the Y key, the QX-10 will tell you to connect an EPSON printer (excluding the MX-80). After connecting the printer, the pattern defined can be printed by pressing the [←┘] key. Three lines of 10 characters each are printed in the non-proportional mode, followed by three lines of 10 characters each printed in the proportional mode, as shown below.

```
F7A8
Y Y Y Y Y Y Y Y Y Y
Y Y Y Y Y Y Y Y Y Y
Y Y Y Y Y Y Y Y Y Y
Y Y Y Y Y Y Y Y Y Y
Y Y Y Y Y Y Y Y Y Y
Y Y Y Y Y Y Y Y Y Y
```

The display then changes as shown in step 5). Pressing the "N" key causes the display to change as shown in step 5).

(8) Press the "Q" key to store the pattern defined on the disk. The message

Destination drive name (or RETURN to skip)__

then appears on the screen; type the name of the drive containing the CP/M system disk, then press the [←┘] key after the following message is displayed.

Destination on A, then press RETURN__

(9) The following message then appears on the screen.

```
Print? (Y/N)_
```

Pressing the "Y" key at this point prints all user-defined characters as follows.

```
F7A0
F7B0
F7C0
F7D0
F7E0
```

In the example above, the upper line of characters is printed with non-proportional spacing while the lower is printed with proportional spacing.
After printing or pressing the "N" key, the message

```
Source drive name (or RETURN to skip)_
```

appears again, allowing characters to be defined for another drive. Press the BREAK key to terminate the CHARADEF command.

Proportional printing

All the EPSON printers except the MX-80 support proportional printing, in which appropriate spaces are printed between characters to provide a balanced appearance. To achieve this, characters sent to the printer must contain proportional spacing information. Proportional spacing information for user-defined characters is contained in the uppermost horizontal line of 14 dots. When the printer is in the proportional printing mode, it prints as follows. When any of the dots of the uppermost line of a user-defined character are set, a one dot space is added at the position corresponding to the left end of the proportional spacing information line and a two dot space is added to the position corresponding to the right end of the line when the character is printed. That is, the user-defined character is printed in a dot matrix of 4×18 dots to 17×18 dots, depending on the width of the uppermost line. If the width of the user-defined character pattern exceeds the width determined by the uppermost line, part of the character will not be printed. If no dot is set in the uppermost line, the user-defined character will not be printed at all.

CONFIG

The CONFIG command makes it possible to reconfigure the system for different printers and RS-232C communication formats, to set the clock, and to select one of the 8 international character sets.

NOTE:

The CONFIG command changes the contents of the system disk. Therefore, if the system disk is write protected, it is not reconfigured even though message "configuration completed" is displayed. Be sure to remove the write protect tab before executing the CONFIG command.

Operating procedures

(1) Type CONFIG following the system prompt and press the [←┘] key. The following message will then be displayed.

```
QX-10 CONFIGuration  ver X.X

printer  : MX-80/II,III    alter (y/n) ?
```

The message above indicates that the MX-80/TYPEII or MX-80/TYPEIII printer can be connected. If you are using another type of printer, press the Y key. If not, press the N key.

(2) If the Y key is pressed, the display changes as follows.

```
QX-10 CONFIGuration  ver X.X

printer  : MX-80/II,III    select 1-8 or RETURN ?

                    MX-80/I       —1
                    MX-80/II,III  —2
                    MX-82/II,III  —3
                    MX-100/II,III —4
                    FX-80         —5
                    FX-100        —6
                    RX-80         —7
```

Press the number corresponding to your printer.

(3) Press the [←┘] key; the display changes as follows.

```
QX-10 CONFIGuration  ver X.X

printer   : MX-80/II,III
rs232c    : bit rate= 300  parity= no      stop bit= 1   data char= 8bit
alter (y/n) ?
```

Press the Y key if you want to change the RS-232C communication format. If not, press the N key, the display then changes as shown in step 5).

(4) The display changes as follows when the Y key is pressed in step 3). Press appropriate keys according to the format to be set. For example, if you want to change the bit rate to 2400 bps and use even parity, type "C" and "1", then press the [←┘] key.

```
QX-10 CONFIGuration  ver X.X

printer   : MX-80/II,III

rs232c    : bit rate= 300  parity= no      stop bit= 1   data char= 8bit

select A-9 or RETURN ?
          bit rate        parity          stop bit      data char

            9600 -A         no      -0      1   -3        0-5bit -6
            4800 -B         yes even -1     1.5 -4        6bit   -7
            2400 -C         yes odd  -2     2   -5        7bit   -8
            1800 -D                                       8bit   -9
            1200 -E
             900 -F
             600 -G
             400 -H
             300 -I
             200 -J
             150 -K
             135 -L
             110 -M
              75 -N
              50 -O
```

(5) The display changes as follows.

```
QX-10 CONFIGuration  ver X.X

printer   : MX-80/II,III
rs232c    : bit rate= 2400  parity= yes even  stop bit= 1    data char= 8bit
date,time : 01/20/83 19:54:50
reset (y/n) ?
```

If you want to set the clock, press the Y key. If not, press the N key; the display then changes as shown in step 8).

(6) If the Y key is pressed in step 5), the message "Enter the date as MM/DD/YY" appears. Enter the date in the following format.

MM(month)/DD(day)/YY(year) [↵]

(7) The message "Enter the time as HH:MM:SS" appears. Enter the time in the following format.

HH(hour):MM(minute):SS(second) [↵]

(8) The display changes as follows.

```
QX-10 CONFIGuration  ver X.X

printer   : MX-80/II,III
rs232c    : bit rate= 300   parity= no       stop bit= 1    data char= 8bit
date,time : 01/21/83 05:50:11
language  : USASCII   alter (y/n) ?
```

If you want to select a character set other than that specified, press the Y key. Otherwise, press the N key; configuration will then be completed.

(9) If the Y key is pressed at step 8), the display changes as follows.

```
QX-10 CONFIGuration  ver X.X

 printer   : MX-80/II,III

 rs232c    : bit rate= 2400  parity= yes even  stop bit= 1   data char= 8bit

 date,time : Today is Thursday   Jan 20 1983   at 08:02:00

 language  : USASCII   select 1-8 or RETURN ?

                    USASCII —1
                    FRENCH  —2
                    GERMAN  —3
                    ENGLISH —4
                    DENISH  —5
                    SWEDISH —6
                    ITALIAN —7
                    SPANISH —8
```

Type the number corresponding to the country of the character set to be selected, then press the [←┘] key. Configuration is completed when the following message is displayed.

```
configuration completed

A>
```

DIRINIT

The DIRINIT command erases and initializes the disk's file directory. When this command is executed, the contents of all files on the disk are lost.

Operating procedures

(1) Type "DIRINIT" following the system prompt, then press the [←┘] key.

```
A>DIRINIT
QX-10 DIRectory INITialize  ver X.X


Destination drive name ( or RETURN to reboot )
```

(2) Set the disk whose directory is to be initialized in either drive, then type the drive name (A, B, E or F). In the following example, the disk is set in drive B and "B" is typed.

```
A>DIRINIT
QX-10 DIRectory INITialize  ver X.X


Destination drive name ( or RETURN to reboot ) B
Destination on B, then press RETURN
Function complete

Destination drive name ( or RETURN to reboot )
```

(3) Press the [←┘] key. When initialization is completed, the message "Destination drive name (or RETURN to reboot)" is displayed again. If you have another disk whose directories are to be initialized, return to step 2); otherwise, press the [←┘] or [BREAK] key.

Example

The following figure shows the display after the directory of disk image RAM E has been initialized.

```
A>DIRINIT
QX-10 DIRectory INITialize  ver X.X


Destination drive name ( or RETURN to reboot ) E
Destination is RAM E, then press RETURN
Function complete

Destination drive name ( or RETURN to reboot )
```

NOTE:
The following message will be displayed if a non-existent drive name is entered. Enter the correct drive name.

Invalid drive name (Use A - F)

Destination drive name (or RETURN to reboot)

DISKCOPY

The DISKCOPY program has three functions: formatting a disk, making a copy of another disk on the formatted disk, and verifying the copy; copying the entire contents of a disk and verifying the copy; and comparing the contents of two disks.

Operating procedures

(1) Type "DISKCOPY" and press the [←┘] key.
(2) The following message appears on the screen.

```
A>DISKCOPY

QX-10 DISKCOPY  ver X.X

Press F or C or V  ( or RETURN to reboot )
        Format and Copy and Verify ---- F
        Copy and Verify ------------- C
        Verify ---------------------- V
```

Press the "F" key to format a disk and make a copy of another disk; press the "C" key to copy a disk; or press the "V" key to compare two disks.

Formatting and copying a disk

a. When the "F" key is pressed, the following message appears on the screen.

[Format & Copy & Verify]

* Source drive name (or RETURN to reboot)_

b. Enter the source drive name (A or B).
c. If drive A is specified, the following message appears on the screen.

* Source on A, then press RETURN_

d. Press the [←┘] key; the following message then appears.

* Destination drive name (or RETURN to reboot)_

e. Enter the destination drive name. If drive B is specified, the following message appears.

* Destination on B, then press RETURN_

f. Press the [←┘] key, and the following message appears.

Set diskettes on A and B, then press RETURN_

g. Insert the source disk in drive A and the disk which is to be formatted (and on which the copy is to be made) in drive B. Then, press the [←┘] key.
h. After the function has been completed the display changes as shown below.

```
A>DISKCOPY

QX-10 DISKCOPY  ver X.X

Press F or C or V  ( or RETURN to reboot )
       Format and Copy and Verify ---- F
       Copy and Verify ------------- C
       Verify ---------------------- V
F

[ Format & Copy & Verify ]
* Source drive name  ( or RETURN to reboot ) A
* Source on A, then press RETURN
* Destination drive name  ( or RETURN to reboot ) B
* Destination on B, then press RETURN
# Set diskettes on A and B, then press RETURN
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
Function complete

Continue ? ( Y/N )
```

Pressing the "Y" key allows you to continue formatting and copying with other disks starting at step f.
Pressing the "N" key terminates operation and displays the following message on the screen again.

```
Press F or C or V (or RETURN to reboot)
    Format and Copy and verify ---------- F
    Copy and Verify---------------------- C
    Verify------------------------------- V
```

Pressing the BREAK key (or "CTRL" + "C") causes the following message to be displayed.

* Change CP/M system disk and press RETURN__

This message also appears if the BREAK key (or "CTRL" + "C") key is pressed when a prompt for key entry is displayed, or if the [←┘] key is pressed when the message "(or RETURN to reboot)" is displayed.
Insert the system disk in drive A and press the [←┘] key; the system then returns to the command level.

Disk copy

a. When the "C" key is pressed, the following message appears on the screen.

[Copy and Verify]

* Source drive name (or RETURN to reboot)__

b. Enter the source drive name.

c. If drive A is specified, the following message appears on the screen.

* Source on A, then press RETURN__

d. Press the [←┘] key and the following message appears.

* Destination drive name (or RETURN to reboot)__

e. Enter the destination drive name. If drive B is specified, the following message appears.

* Destination on B, then press RETURN__

f. Press the [←┘] and the following message appears.

* Set diskettes on A and B, then press RETURN__

g. Insert the source disk in drive A and a formatted new disk in drive B and press the [←┘] key.

h. After copying is completed, the display becomes as follows.

```
A>DISKCOPY

QX-10 DISKCOPY  ver X.X

Press F or C or V  ( or RETURN to reboot )
       Format and Copy and Verify ---- F
       Copy and Verify ------------- C
       Verify ---------------------- V
C

[ Copy & Verify ]
* Source drive name  ( or RETURN to reboot ) A
* Source on A, then press RETURN
* Destination drive name  ( or RETURN to reboot ) B
* Destination on B, then press RETURN
# Set diskettes on A and B, then press RETURN
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
Function complete

Continue ? ( Y/N )
```

Pressing the "Y" key allows you to continue copying starting at step a.
Pressing the "N" key terminates copying and displays the following message on the screen again.

```
Press F or C or V (or RETURN to reboot)

    Format and Copy and verify ---------- F

    Copy and Verify---------------------- C

    Verify------------------------------- V
```

Pressing the BREAK key (or "CTRL" + "C") causes the following message to be displayed.

```
* Change CP/M system disk and press RETURN_
```

This message also appears if the BREAK key (or "CTRL" + "C") key is pressed when a prompt for key entry is displayed, or if the [←┘] key is pressed when the message "(or RETURN to reboot)" is displayed.
Insert the system disk in drive A and press the [←┘] key; the system then returns to the command level.

Verify

a. If the "V" key is pressed in step (2), the following message appears on the screen.

[Verify]

* Source drive name (or RETURN to reboot)__

b. Enter the source drive name. If drive A is specified, the following message appears.

* Source on A, then press RETURN__

c. Press the [←┘] key and the following message appears.

* Destination drive name (or RETURN to reboot)__

d. Enter the destination drive name. If drive B is specified, the following message appears.

* Destination on B, then press RETURN__

e. Press the [←┘] key and verification starts.

f. After verification is completed, the display changes as shown below.

```
A>DISKCOPY

QX-10 DISKCOPY  ver X.X

Press F or C or V  ( or RETURN to reboot )
       Format and Copy and Verify ---- F
       Copy and Verify ------------- C
       Verify ---------------------- V
V

[ Verify ]
* Source drive name  ( or RETURN to reboot ) A
* Source on A, then press RETURN
* Destination drive name  ( or RETURN to reboot ) B
* Destination on B, then press RETURN
* Set diskettes on A and B, then press RETURN
00  01  02  03  04  05  06  07  08  09  10  11  12  13  14  15  16  17  18  19
20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35  36  37  38  39
Function complete

Continue ? ( Y/N )
```

Pressing the "Y" key allows you to continue verifying starting at step e.
Pressing the "N" key terminates verification and displays the following message on the screen.

```
Press F or C or V (or RETURN to reboot)

    Format and Copy and verify ---------- F

    Copy and Verify---------- C

    Verify---------- V
```

Pressing the BREAK key (or "CTRL" + "C") causes the following message to be displayed.

```
* Change CP/M system disk and press RETURN_
```

This message also appears if the BREAK key (or "CTRL" + "C") key is pressed when a prompt for key entry is displayed, or if the [←┘] key is pressed when the message "(or RETURN to reboot)" is displayed.
Insert the system disk in drive A and press the [←┘] key; the system then returns to the command level.

Error messages

The following error messages may appear during execution of the DISKCOPY command.

Message	Meaning
Invalid drive name (Use A or B or C or D)	An invalid drive name was specified. Specify A or B.
(Use B or C or D) or (Use A or C or D)	Specify a drive other than the source drive.
Permanent error, press RETURN to try again	A read or write error has occurred on the disk. Press to retry the read or write, or press the BREAK key (or "CTRL" + "C") to abort.

NOTE:
The DISKCOPY command cannot be used for drives E and F.

FORMAT

The FORMAT command formats a new disk and writes ID information on the disk after formatting it. The ID information includes the track numbers, sector numbers and sector size. The operating system refers to this ID information when writing or reading disk data; therefore, no data can be read or written if this information is destroyed.

Tracks 0 through 6 are formatted when the destination is a disk image RAM while tracks 0 through 39 are formatted when the destination is a flexible disk drive.

After formatting, all data bytes on the disk are filled with the hexadecimal code E5H ($(229)_D$).

Operating procedures for formatting a flexible disk

(1) Type the following characters when the system prompt is displayed.

A>FORMAT ↵

(2) Insert the disk to be formatted into drive B and press the B key.

(3) Press the ↵ key.
Track numbers are displayed as each track is formatted.

(4) When formatting is completed, the following message is displayed.

Continue ? (Y/N)

Press the Y key if you want to format another disk, then remove the disk formatted previously and insert the next disk in drive B. (Return to step 3.)
Press the N key in response to the above message when no new disk is to be formatted.

Operating procedures for formatting a disk image RAM

(1) Type "FORMAT" when the system prompt is displayed.

A>FORMAT ↵

(2) Type a name of disk image RAM when the message "Destination Drive Name ? (or RETURN to reboot)" is displayed.
(3) Performs steps 3) and 4) of the operating procedures for formatting a flexible disk.

Example 1

The figure below shows the display after the disk in drve B has been formatted.

```
A>FORMAT

QX-10 FORMAT   ver X.X

Destination Drive Name ? ( or RETURN to reboot ) B
Destination on B, then press RETURN
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39

Function complete

Continue ? (Y/N)
```

Example 2

The figure below shows the display after disk image RAM E has been formatted.

```
A>FORMAT

QX-10 FORMAT   ver X.X

Destination Drive Name ? ( or RETURN to reboot ) E
Destination is RAM E, then press RETURN
00 01 02 03 04 05 06

Function complete

Continue ? (Y/N)
```

Example 3

The figure below shows a display as it appears when formatting is inhibited because the disk is write protected.

```
A>FORMAT

QX-10 FORMAT   ver X.X

Destination Drive Name ? ( or RETURN to reboot ) B
Destination on B, then press RETURN
00
PERMANENT ERROR, press RETURN to reboot
```

MFBASIC

See the QX-10 MultiFonts BASIC Reference Manual.

MFONT

The MFONT command sets CP/M in the MultiFonts (MF) mode. If this command is executed without the MultiFonts character generator ROM card, the message "No MultiFonts Option Board !" appears on the display. In this case, the system remains in the non-MF mode.

NORM

The NORM command sets CP/M in the normal (non-MF) mode.

PFKSET

The PFKSET command allows you to assign character strings stored in the system's PFK table or your own PFK table to programmable function keys. Once made, these assignments are effective until the system power is turned off. This command also allows you to change either PFK table.

Format

PFKSET

Assigns strings to the programmable function keys from the system's PFK table.

PFKSET /L

Loads the PFK table from the disk and allows you to change the contents of the system's PFK table.

PFKSET x:ufn

Assigns strings to the programmable function keys from file ufn in drive x.
PFK is assumed as the file type if no file type is specified.

PFKSET x:ufn /L

Allows you to change the contents of your own PFK table or generate a new one. If the file type is omitted, PFK is assumed.

Operating procedures

Assigning strings to programmable function keys

Type "PFKSET" or "PFKSET x:filename.typ" and press the [←┘] key; PFK assignments are then made from the system's PFK table or your own PFK table, respectively.

● **Changing the PFK table**

Use the following procedures to change the contents of the system's PFK table.

(1) Type "PFKSET /L" and press the [←┘] key. The system's PFK table is then listed as follows.

```
* CP/M function key list
      PF1    DIR Δ
      PF2    TYPE Δ
      PF3    LOAD Δ
      PF4    STAT Δ
      PF5    DDT Δ
      PF6    PIPΔ
      PF7    DUMP Δ
      PF8    SAVE Δ
      PF9    SUBMIT Δ
      PF10   MFBASIC Δ

* BASIC function key list
      PF1    FILES Δ
      PF2    LIST Δ
      PF3    LOAD "Δ
      PF4    AUTO Δ
      PF5    EDIT Δ
      PF6    INPUT Δ
      PF7    PRINT Δ
      PF8    SAVE "Δ
      PF9    RUN¥¥Δ
      PF10   SYSTEM¥Δ
```

(2) To change characters in the list, move the cursor to the position of each character to be changed using the [↑], [↓], [→] and [←] keys, then type the new characters. Use the DEL and INS keys to delete or insert characters. "△" indicates the end of each character string, and is not included in the string assigned. A string may contain control characters such as [←┘] and "BREAK". These control characters are indicated in the list by "↑" followed by the alphabetic character whose ASCII code is equal to that of the control character plus $(64)_D$. For example [←┘] $(13)_D$ is represented by "↑" followed by M $(77)_D$.

↑M

However, control characters corresponding to the following keys cannot be included in strings assigned to PFKs because they are used as function keys for the

PFKSET command.

[↑] , [↓] , [→] and [←] : Move the cursor.

[DEL] : Deletes the character at the cursor position.

[HOME] : Moves the cursor to the position of the lst character of the first string in the PFK in the list.

[ESC] : Initiates the command mode.

(3) After changes in the lists have been completed, press the "ESC" key; the subcommand prompt "*" then appears on the display to prompt you to enter a subcommand. Type a subcommand from the subcommands listed below, followed by [←┘] .

E: Changes the PFK table on the disk without changing the current PFK assignments.

M: Changes the PFK table on the disk and assigns the string in the table to the programmable function keys.

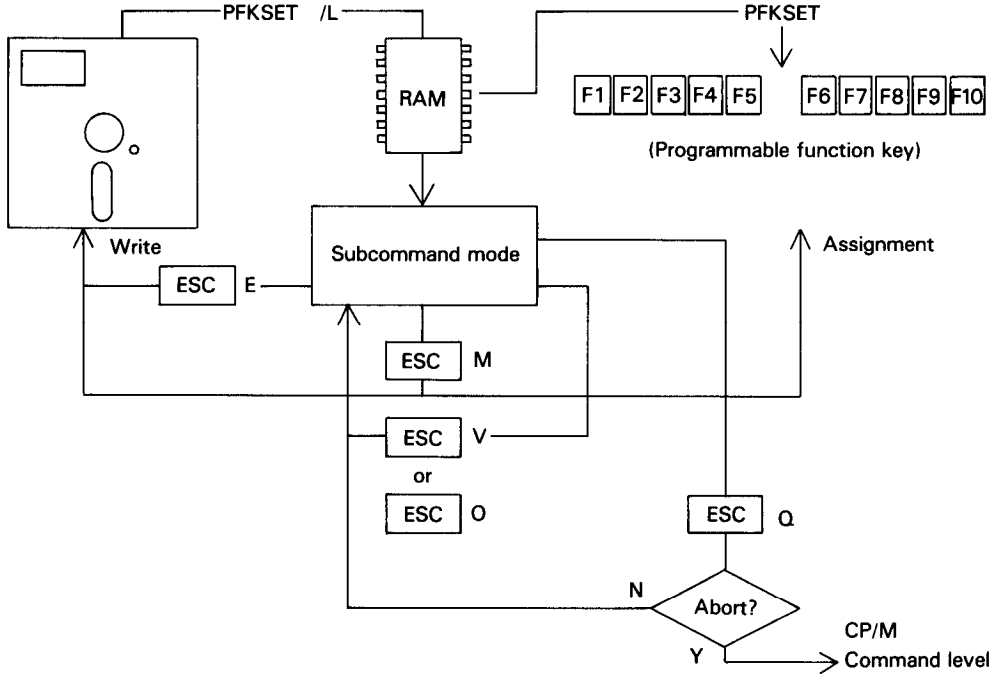
V: Terminates the command mode to allow further changes to be made in the PFK list.

O: Terminates the subcommand mode and restores the PFK list to its original state to allow changes to be started over.

Q: Displays the following message.

ABORT (Y/N)

Pressing the Y key terminates the PFK command and redisplays the system prompt without changing the PFK table. Pressing the N key does nothing, and subcommand prompt "*" is displayed again.



Perform the following steps to change your own PFK table.

(1) Type "PFKSET x:ufn /L" and press the [←┘] key. Your own PFK table will then be listed.

(2) Change the contents of the table in the same manner as with the system PFK table.

Error messages

Error messages which may appear during execution of the PFKSET command are as listed below.

Error messages	Typical causes
? Command error:	The command input format is incorrect.
No source file on disk:	The specified file cannot be found in the specified disk.
Invalid drive name Use A or B or C or D : ???	An incorrect drive name was specified. Specify A or B. An incorrect subcommand was entered.
Permanent error, press RETURN to reboot:	A read or write error occurred. Press the [←┘] key to retry the operation; press any other key to terminate execution of the command.
Disk Full, press RETURN to reboot:	The disk is full.
System file "PFKTAB. SYS" not found:	System file "PFKTAB. SYS" is not included in drive A.
Set System Diskette, and press RETURN to restart:	Install a backup system disk and press the [←┘] key to retry or the [BREAK] key to reboot.

Each programmable function key is covered with a transparent plastic cap; these caps can be removed to allow labels to be inserted in the key tops.

TERM

The TERM command makes it possible to use the QX-10 either as a terminal or host computer for remote operation. It also allows specification of various communications conditions, such as bit rate, parity bit, stop bits and word length.

Operating procedures

(1) Type "TERM" and press the [←┘] key, the following message is then displayed.

```
QX-10 TERMinal or Remote  ver X.X

 rs232c   : bit rate= 300  parity= no      stop bit= 1   data char= 8bit

Terminal mode ---- 1
Remote  mode ---- 2
Normal  mode ---- 3
change rs232c ---- X

                  select 1-3 or X ?
```

Select one of the three modes, (Terminal, Remote or Normal), or type "X" to change the RS-232C communication conditions.

Terminal mode
In this mode, the QX-10 operates as a teletypewriter terminal. Characters input from the keyboard are transmitted to the RS-232C port and characters received through the RS-232C port are displayed on the screen. To cancel this mode, press the HELP key.

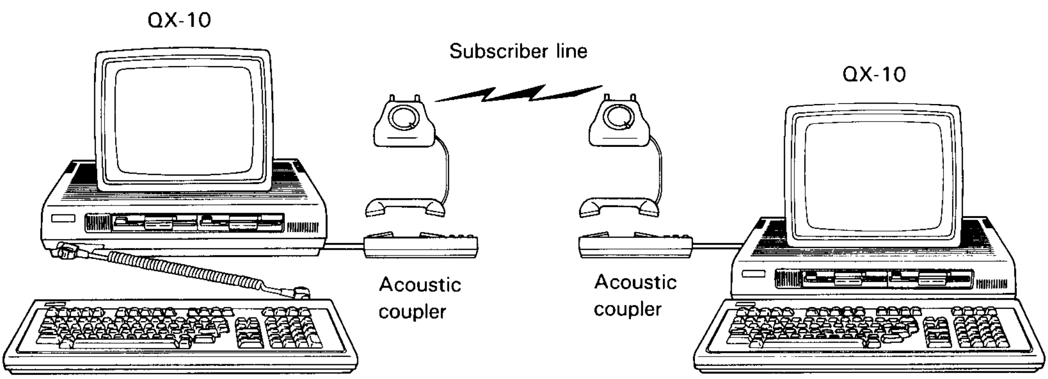
Remote mode
In this mode, the QX-10 operates as a host computer. The keyboard and CRT screen are electrically separated from the CPU and replaced with those of the remote terminal. Characters received from the remote terminal through the RS-232C port are input to the CPU and characters output from the CPU are transmitted to the remote terminal through the RS-232C port. To cancel this mode, the TERM command must be entered from the remote terminal to change the mode from Remote to Normal, then the HELP key must be pressed at the remote terminal.

Normal mode
This mode is selected to cancel the remote mode.

(2) When "X" is typed in step 1), the display changes as follows. The conditions displayed can be temporarily changed by pressing the appropriate keys. Pressing the [←┘] key returns the display to the condition shown in step 1.

```
QX-10 TERMinal or Remote   ver X.X

rs232c   : bit rate= 300  parity= no      stop bit= 1   data char= 8bit

                  select A-9 or RETURN ?

          bit rate      parity          stop bit     data char
           9600 -A        no       -0    1    -3      0-5bit -6
           4800 -B        yes even -1    1.5  -4      6bit   -7
           2400 -C        yes odd  -2    2    -5      7bit   -8
           1800 -D                                    8bit   -9
           1200 -E
            900 -F
            600 -G
            400 -H
            300 -I
            200 -J
            150 -K
            135 -L
            110 -M
             75 -N
             50 -O
```

Example of connection



AUTOST

The AUTOST command makes it possible to start a program automatically when the CP/M system is activated. The program specified will be started whenever CP/M is activated until a different program name is specified by executing the AUTOST command again.

Operating procedures

(1) Type AUTOST and press the [←┘] key. The following message is then displayed.

```
A>AUTOST

QX-10 AUTO-START ver X.X

Do you want to set Auto Start for a program (Y/N) ? _
```

(2) When you want a program to start automatically, press the "Y" key; otherwise, press the "N" key.

(3) If the "Y" key is pressed, the display changes as follows.

```
A>AUTOST

QX-10 AUTO-START ver X.X

Do you want to set Auto Start for a program (Y/N) ? Y
Enter The Auto Start Program Name
*
```

Enter the program name following the prompt ("*"). A command line, such as DIR B: or MFBASIC SAMPLE, can be specified as the program name. Pressing the [←┘] key without entering a program name reboots the system, and the previously cataloged program name is cancelled.

The message "OK? (Y/N)_" appears on the display. If the command name has been entered correctly, press the "Y" key; otherwise, press the "N" key. If the "N" key is pressed, the prompt "*" is displayed again; reenter the program name.

The maximum number of characters which can be entered on the command line is 80.

The figure below shows the display as it appears when the MFBASIC command is to be automatically activated and user program SAMPLE (written in BASIC) is to be executed automatically.

```
A>AUTOST

QX-10 AUTO-START ver X.X

Do you want to set Auto Start for a program (Y/N) ? Y
Enter The Auto Start Program Name
*MFBASIC SAMPLE
        OK ? (Y/N) Y

Function complete

A>
```

(4) If the "N" key is pressed at step 2), control is transferred to CCP and the system prompt "A>" appears. In this case, the previously cataloged command line is not changed.

NOTE:
The program cataloged in the AUTOST command is automatically executed only upon a cold start.

5.5 Others

The system disk contains the following files in addition to the files described in the previous pages.

.OSTAB.SYS
.PFKTAB.SYS
.FOREIGN.SYS
.GAIJI.SYS
DUMP.ASM
BIOS.ASM
CBIOS.ASM
DEBLOCK.ASM
DISKDEF.LIB

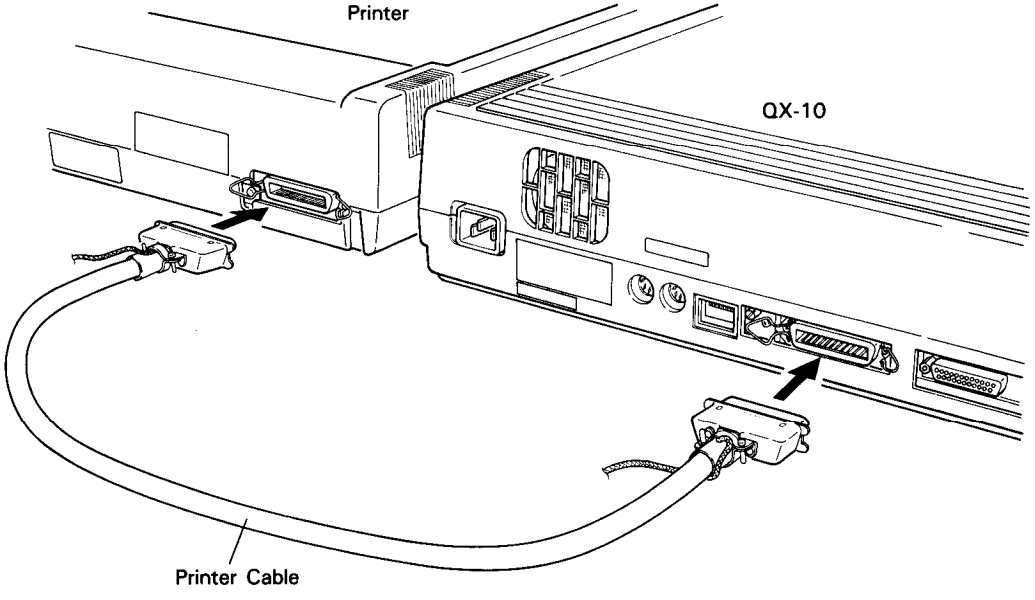
The first four files are system files which are generated and used by the system program. Some of the system functions will not operate if these files are erased. The next four files are included for reference. DUMP.ASM is the ASM file for the DUMP command, BIOS.ASM is the ASM file for the Digital Research's BIOS program and CBIOS.ASM is an example of Digital Research's customized BIOS program which has been tailored for specific devices. DEBLOCK.ASM is the ASM file for a deblocking program. The last file, DISK.LIB, is the disk definition macro library file which is used to generate the disk parameter table and scratch RAM area required for a customized BIOS program. They are automatically generated when this file is assembled with assembler "MAC" distributed by Digital Research.
Refer to CP/M Alteration Guide published by Digital Research for modification of BIOS.

Chapter 6 PERIPHERAL INTERFACES AND OPTIONS

Standard interfaces built into the QX-10 include the printer interface, the light pen interface, the keyboard inteface, and a serial communication interface. Models featuring a color display monitor also include a color display interface. Various options can be added to the system for expanded system configuration. This chapter describes the functions of these interfaces and options, and the manner in which they are used.

6.1 Printer Interface

The printer interface built into the QX-10 allows the system to be connected to any Centronics-standard printer through the standard 36-pin Centronics connector provided on the back panel.



Pin assignments of the printer connector are as follows.

Pin No.	Signal Symbol	Signal Direction	Description of Signal
1	$\overline{STB}$	OUT	Strobe
2	DB0	OUT	Data line 0
3	DB1	OUT	Data line 1
4	DB2	OUT	Data line 2
5	DB3	OUT	Data line 3
6	DB4	OUT	Data line 4
7	DB5	OUT	Data line 5
8	DB6	OUT	Data line 6
9	DB7	OUT	Data line 7
10	$\overline{ACK}$	IN	Acknowledge
11	$\overline{RDY}$	IN	Ready
12	NPA	IN	No paper
13	$\overline{SLO}$	IN	Select out
14	$\overline{ALF}$	OUT	Auto line feed
15	—	—	NC (unused)
16	GL	—	Signal ground
17	FG	—	Frame ground
18	—	—	NC (unused)
19-30	GL	—	Signal ground
31	$\overline{RST}$	OUT	Reset
32	$\overline{ERR}$	IN	Error
33	GL	—	Signal ground
34	—	—	NC (unused)
35	PWF	IN	Power failure
36	—	—	NC (unused)

Note: The direction of signal is as viewed from the Q10SYM board.

The meanings of the various signals are as follows.

$\overline{STB}$
The strobe signal used by the printer to read data. Active low.

DB0 through DB7
Parallel data signals. Active high.

$\overline{ACK}$
This signal indicates that data has been received by the printer and that the printer is ready to receive more data. Active low.

$\overline{\text{RDY}}$
This signal indicates that the printer is ready to receive data. Active low.

NPA
When high, this signal indicates that the printer is out of paper.

$\overline{\text{SLO}}$
When high, this signal indicates that the printer is in the selected state.

$\overline{\text{ALF}}$
This signal directs the printer to automatically make a line feed after each line has been printed. Active low.

$\overline{\text{RST}}$
This signal initializes the printer. Active low.

$\overline{\text{ERR}}$
This signal indicates that a printer error has occurred. Active low.

$\overline{\text{PWF}}$
This signal indicates that the printer power is off. Active low.

It should be noted that some printers which are advertised as Centronics-compatible do not use the full Centronics communication protocol; such printers cannot be used with the QX-10. Printers supported by the QX-10 include all printers of the EPSON MX and FX series and the RX-80 shown in "6.7 Printers." Refer to the individual printer manual or consult your EPSON dealer for details. See Appendix D for control of printers.

NOTE:
All EPSON MX/FX series printers (except the MX-80) and the RX-80 are capable of printing multiple font characters and international character sets.

6.2 Light Pen Interface

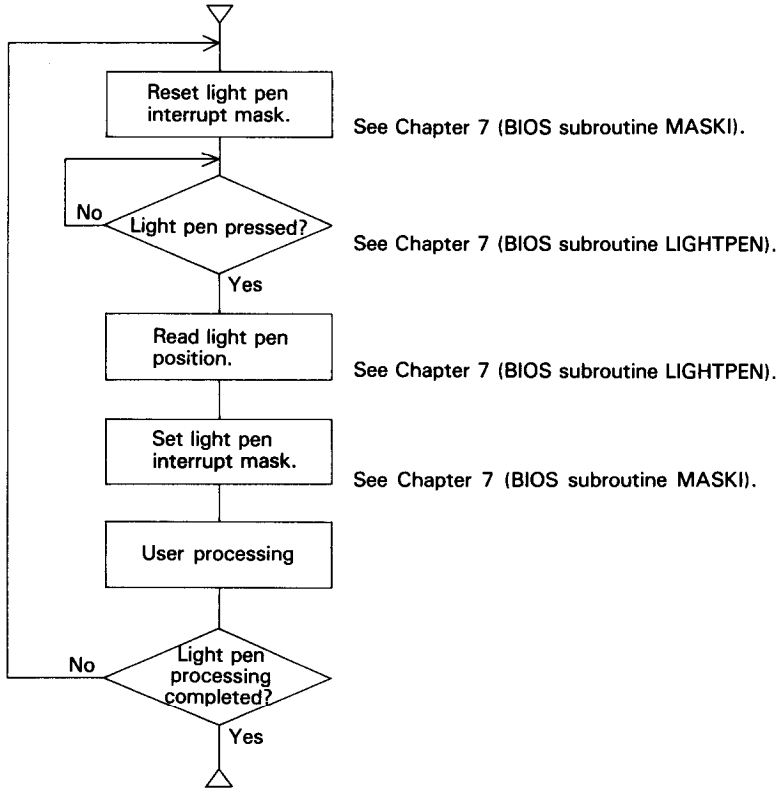
The light pen interface built into the QX-10 allows the optional light pen to be used. The light pen is connected through the DIN connector provided on the back panel. Pin assignements of this connector are as follows.

Pin No.	Signal Symbol	Signal Direction	Description of Signal
1	+5V	—	+5V
2	SIG	IN	Light pen signal
3	+12V	—	+12V
4	SW	IN	Light pen switch
5	GND	—	Ground
E	FG	—	Frame ground

Note: The direction of signal is as viewed from the Q10SYM board.

The screen position at which the light pen is pressed can be obtained by calling BIOS subroutines.

Sample flowchart



6.3 Serial Communication Interface

The built-in serial communication interface supports both synchronous and RS-232C asynchronous communication protocol, with the mode of operation selected by changing the setting of a jumper cable inside the main unit. Synchronous communication (either SDLC or BYSYNC) capability is provided to allow the QX-10 to be used as an intelligent terminal with large computer systems; asynchronous protocol is that which is used for communication with devices using RS-232C protocol, such as serial printers, acoustic couplers, or other QX-10 computers. The jumper is set for asynchronous communication at the time of shipment; therefore this will be referred to hereafter simply as the RS-232C interface. Consult your dealer concerning use of the synchronous serial interface.

See the discussion of the CONFIG and TERM commands for procedures for changing the RS-232C configuration and using the interface under CP/M; procedures for using asynchronous communications protocol with BASIC programs are discussed in the **QX-10 MFBASIC Reference Manual.**

Use of optional RS-232C interface boards allows the system to be connected to up to 5 serial communication lines. An optional RS-232C card can be inserted in any of the five option slots.

6.3.1. Communication speed

One standard RS-232C interface is built into the main unit of the QX-10 and an additional four interfaces can be installed in the option slots for a total of five. The maximum communication speed of interfaces mounted in the option slots is different from that built into the main unit. The main unit RS-232C interface provides a maximum communication speed of 9600 bps; however, that of interfaces mounted in the option slots is 19,200 bps. Further, each of the interfaces can be set to a different communication speed.

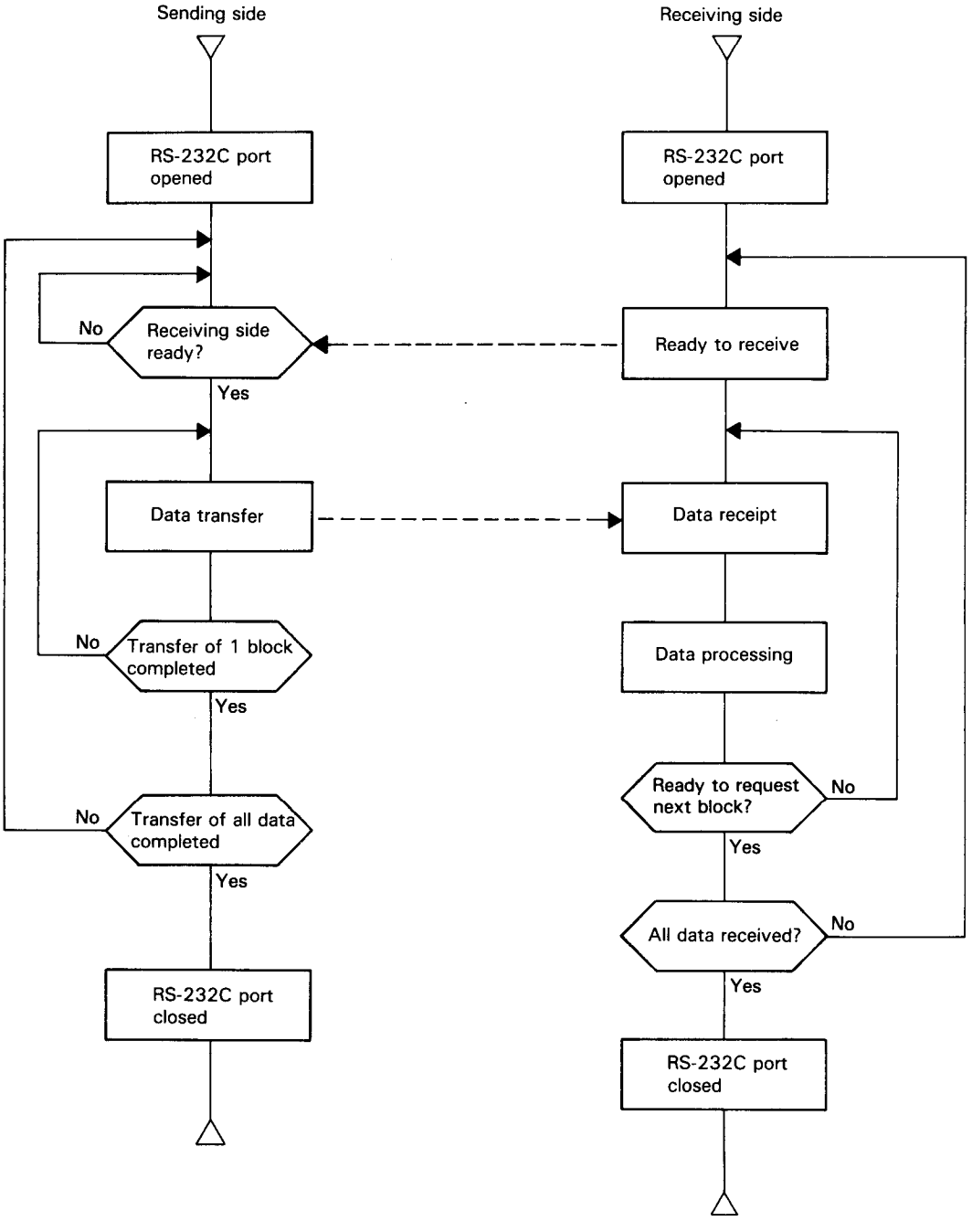
This makes it possible to perform low speed collection processing of data, then to transfer the data at high speed to another device. (There is a high probability that a receive buffer overflow will occur if collection processing of data is performed at a speed greater than or equal to the speed at which collected data is transferred.)

6.3.2. Data reception

The receive buffer may overflow during receipt of data; this is particularly likely to occur when data is being transferred at high speed, but receive data processing is performed slowly. (This will not result in a problem if the receive buffer is larger than the number of data bytes received.) Use the following measures to avoid receive buffer overflows.

Prepare as large a buffer as possible on the receiving QX-10 side. On the send side, the size of one block of data should be set equal to that of the buffer on the receive side, then the sending side waits for the receiving side to become ready. When the receiving side is ready, an entire block is sent without pause. After transmission of each block has been completed, the sending side waits for the receiving side to become ready again, then sends the next block. This is repeated until transmission of all data has been completed. The receiving side takes the data out of the receive buffer and processes it as each block is received. The number of bytes of data processed is counted and, when the number of bytes remaining to be processed has been reduced to a certain level, the receiving side requests transmission of the next block from the sending side. The timing at which this request is sent varies according to the speed of data communication and the speed with which received data is processed; the higher the communication speed and the lower the processing speed, the fewer the number of unprocessed bytes at which the request for transmission is sent. This cycle is repeated until all data has been processed.

Receive buffer overflows are unlikely if the communication speed is set to 1200 bps or less and no significant data processing time is involved. When other interrupt processing or processing with all interrupts disabled is required during data transfer, it is best to have the receiving side send the request for transmission of the next block only after processing has been completed for the entire block received previously.


Sending side
Receiving side
RS-232C port opened
RS-232C port opened
No
Receiving side ready?
Ready to receive
Yes
Data transfer
Data receipt
No
Transfer of 1 block completed
Data processing
Yes
No
Transfer of all data completed
Ready to request next block?
No
Yes
Yes
All data received?
No
Yes
RS-232C port closed
RS-232C port closed

6.3.3 Standard RS-232C interface

The standard RS-232C interface is connected to external devices through a standard DB-25 connector. Pin assignments of this connector are as follows.

Pin No.	Signal Symbol	Signal Direction	Description of Signal
1	FG	—	Frame ground
2	TxD	OUT	Transmitted data
3	RxD	IN	Receive data
4	RTS	OUT	Request to send
5	CTS	IN	Clear to send
6	DSR	IN	Data set ready
7	SG	—	Signal ground
8	CD	IN	Carrier detect
20	DTR	OUT	Data terminal ready

Note: The direction of signal is as viewed from the Q10SYM board.

Pins other than those indicated in the table are not used.
The meanings of the various signals are as follows.

FG (Frame ground)
This terminal is connected to the chassis of the QX-10; ordinarily, it is also connected via the external cable to the corresponding terminal on the other device.

TxD (Send data)
TxD is the signal used from transmitting data from the QX-10 to the device (acoustic coupler, etc.) with which the QX-10 is connected. This is possible when the Clear to send signal is on.

RxD (Receive data)
RxD is the data signal from the acoustic coupler or other RS-232C compatible device to the QX-10.

RTS (Request to send)
RTS is the signal which controls the communication function of the device (acoustic coupler, etc.) connected to the QX-10. The connected device becomes ready to send when this signal is ON.

CTS (Clear to send)
CTS is the signal which indicates whether the connected device is ready to accept data transmissions. Transmission is enabled when this signal is ON and disabled when it is OFF.

DSR (Data set ready)
DSR is the signal which indicates whether the connected device is ready for operation. When this signal is ON, the applicable device is connected to the interface cable and is ready to accept data transmission/reception control signals.

SG (Signal ground)
The SG terminal provides a electrical reference potential which is common to all signal lines. It is connected to the corresponding terminal on the connected device.

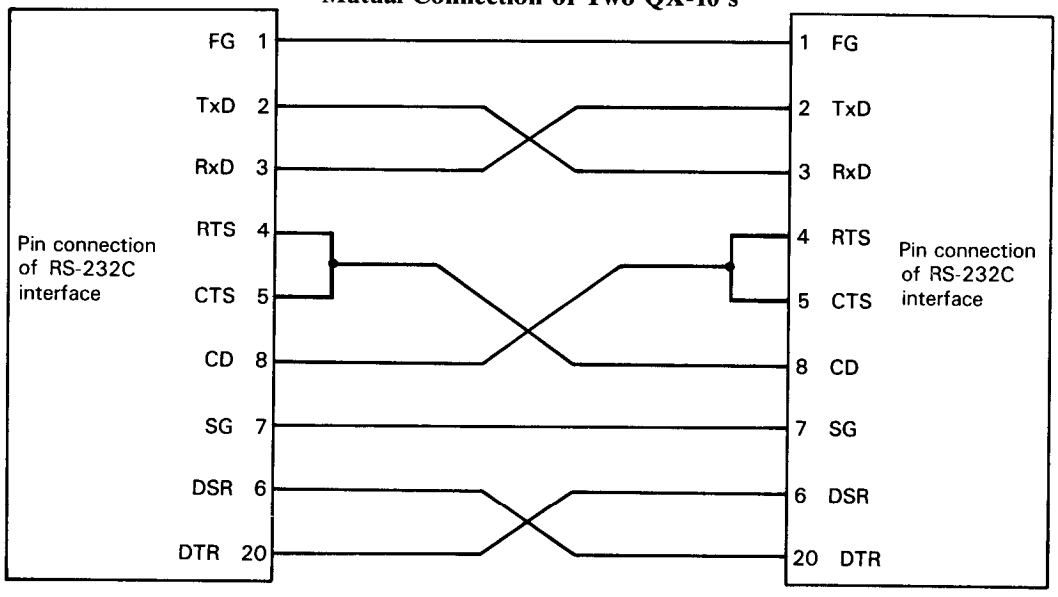
CD (Carrier detect)
The CD terminal is used for detecting the carrier signal from the connected device.

DTR (Data terminal ready)
DTR is the signal output by the QX-10 to the connected device to indicate that it is ready to receive data.

6.3.4 Example of connection of the RS-232C interface

An example of connection of two QX-10's through the RS-232C interface is given below.

Mutual Connection of Two QX-10's



6.3.5 Electrical characteristics of RS-232C signals

Two types of signals are used in RS-232C communications; these are referred to as control signals and data signals. The control signals are DTR, RTS, CTS, DSR, and CD. The data signals are TxD and RxD. The voltage levels of these signals are as follows.

(1) Control signals
ON: +5V to +15V
OFF: −5V to −15V

(2) Data signals
Mark (logical 1): −5V to −15V
Space (logical 0): +5V to +15V

6.3.6 Programming for the RS-232C interface

The RS-232C interface is supported by all versions of CP/M and BASIC supplied by EPSON for the QX-10. With CP/M, the CONFIG and TERM commands make it possible to configure the interface for various communication formats. See the discussions of these commands for details.

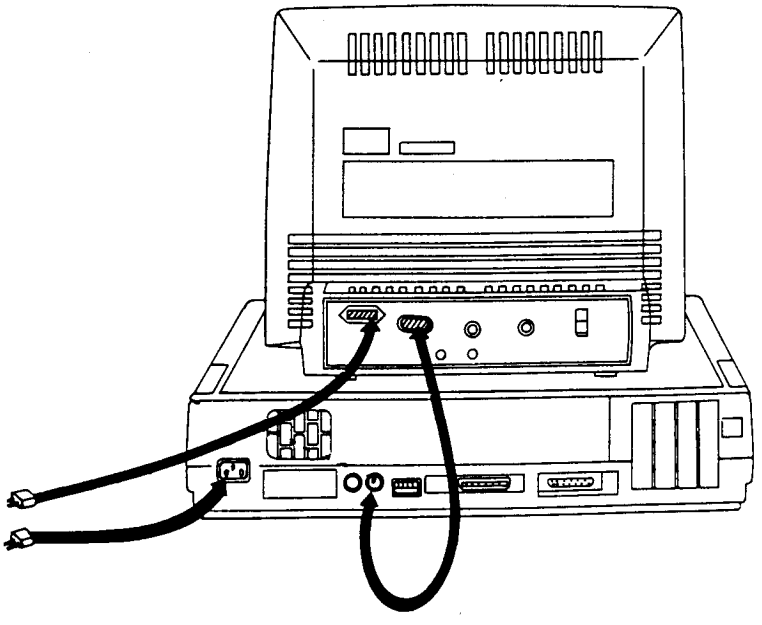
MFBASIC provide a variety of commands which make it easy to communicate through the RS-232C interface. For details, see Chapter 5 of the **QX-10 MFBASIC Reference Manual.**

6.4 Color Display Interface

The color display interface is an optional circuit board which makes it possible to use the QX-10 with the EPSON high-resolution color display monitor CM-10. (Note that installation of this interface by anyone other than an authorized EPSON dealer will void your warranty.) The board provides a 640 – 400 dot display in eight colors, and allows graphics and color to be controlled on a pixel basis. Since this interface uses the same graphic display controller as the interface for the monochrome display, all graphic control functions (such as zoom display, circle drawing, and point-to-point interpolation) are supported.

○ Connecting the CM-10 to the QX-10

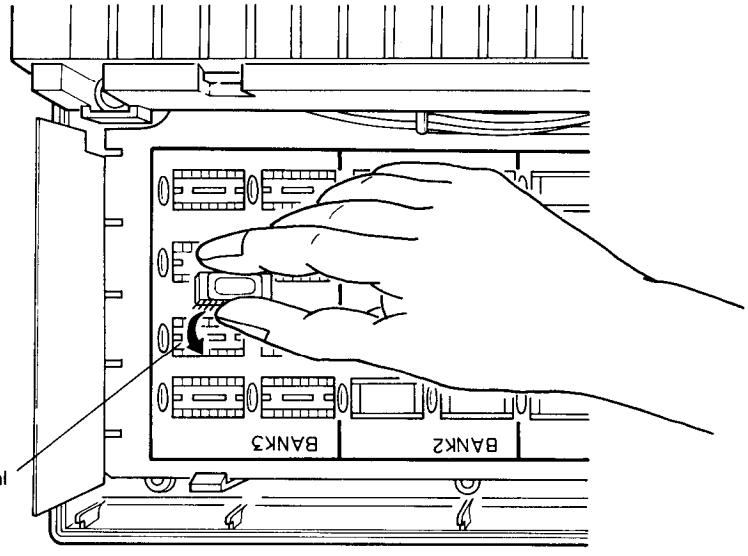
(1) Confirm that the color monitor's power switch is off and plug the power cable provided into the AC INPUT connector.
(2) Insert the power plug into an AC outlet.
(3) Confirm that the QX-10's power switch is off and connect the interface cable provided to the color monitor as shown below and insert the DIN connector of the interface cable into the MONITOR connector on the QX-10's rear panel.



Connection diagram

6.5 Optional RAM Chips

Eight optional RAM chips are inserted in the IC sockets for user memory bank #3 in the option slot compartment to expand the memory size to 256K bytes. The location of the IC sockets is shown below.
Installing the RAM chips makes it possible to use 56K virtual disk drive E (disk image RAM).



IC sockets for optional 64KB RAM

These RAM chips are supplied as standard equipment on units with the German keyboard.

6.6 MultiFont Character Generator ROM Card

This card includes six 128K bits mask ROMs which generate fonts consisting of 14 × 17 dots. The multifont characters include information necessary for proportional spacing.

This card is provided with the QX-10. The MFONT command and some statements of MFBASIC cannot be used when this card is not installed. This card is installed in option slot 5 when the QX-10 is shipped from the factory. However, it can be inserted into any of the five option slots.
See Appendix I.

6.7 Printers

Eleven types of printers can be used with QX-10s which use the MultiFont version of CP/M. These are as listed below.

EPSON	MX-80
	MX-80/II
	MX-80/III
	MX-82
	MX-82/III
	MX-100
	MX-100/III
	FX-80
	FX-100
	RX-80

(1) EPSON MX-80
With this printer, a total of four different character sets can be selected by DIP switch; these are as listed below.

US ASCII
France
England
Germany

This printer cannot prints MultiFont characters and user defined characters since it does not support bit image printing.

Character sets are as specified in the specifications of individual printers.

Proportional printing is not possible.

(2) EPSON MX-80/82/100 (types II and III), FX-80/100, and RX-80
BIOS accomodates these printers by sending the following escape sequence to the printer when it is entered from the console, when transient command CONFIG is executed, or when the OPTION COUNTRY command is executed from MFBASIC.

```
ESC "R" CHR$ (n)
```

These printers can be used to print up to 16 different styles of Multifont characters by entering the appropriate escape sequence from the console, or by means of the OPTION STYLE command or STYLE$ function of MFBASIC. They can also be used to print user defined characters.

• Bit image printing

(i) In the BIT ON mode, character sets are as indicated in the specifications of individual printers.

(ii) In the BIT OFF mode, the bit image printing function of the printer is used to print graphic characters (7FH to 9FH) and, in the MFBASIC mode, 2-byte characters.
Therefore, all control characters other than the following are invalid.

BEL (07H)
LF (0AH)
FF (0CH)
CR (0DH)
ESC (1BH)

Further, escape sequences are limited to those indicated in this publication; those built into the printer itself cannot be used.

• Proportional printing

(i) Proportional printing is not possible in the BIT ON mode.

(ii) These printers contain proportional spacing information which determines the print width for multiple font characters and other 2-byte characters. Characters with widths of from 4 to 17 dots are printed in accordance with this information. It is also possible to disregard the proportional spacing and print characters at fixed spacings (see Appendix G.1). Further, the spacing between characters can be varied and spaces of any desired width can be printed (see Appendix D).

Chapter 7 CP/M SYSTEM INTERFACE

As was described in Chapter 4, the CP/M operating system consists of CCP, BDOS and BIOS. BDOS and BIOS include many subroutines which handle peripheral devices and files, and which can be called by user programs. This chapter describes how to use these subroutines.
Familiarity with assembler programming is a prerequisite for using these subroutines and functions.

7.1 IOBYTE and File Control Block (FCB)

The CP/M operating system supports 4 logical I/0 devices, CON:, RDR:, PUN: and LST:. These names are assigned to physical devices according to the contents of a logical-to-physical assignment table called IOBYTE. IOBYTE is located at address 0003H in main memory. The contents of IOBYTE can be read and changed with the STAT command (STAT DEV:).

```
B>STAT DEV:
CON: is CRT:
RDR: is UR1:
PUN: is UP1:
LST: is LPT:
```

Relationship between physical devices and logical devices

Logical device Bit position	LST: 7 6	PUN: 5 4	RDR: 3 2	CON: 1 0
Physical device	0 0 none	0 0 printer	0 0 keyboard	0 0 Printer (O) keyboard (I)
	0 1 CRT	0 1 none	0 1 none	0 1 CRT (O) keyboard (I)
	1 0 printer	1 0 RS-232C	1 0 RS-232C	1 0 printer (O) RS-232C (I)
	1 1 RS-232C	1 1 none	1 1 none	1 1 RS-232C (O) RS-232C (I)

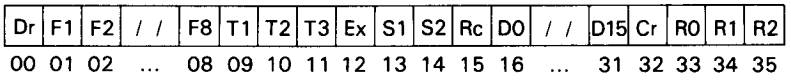
The initial setting of IOBYTE is 10101001, that is LST: corresponds to the printer, PUN: to the RS-232C port, RDR: to the RS-232C port and CON: to both the CRT display (output) and keyboard (input).

(Reference)

The IOBYTE assignments are listed as follows when STAT VAL: is executed. Note that the physical device names indicated do not represent the names of actual physical devices.

	LST:	PUN:	RDR:	CON:
0	TTY:	TTY:	TTY:	TTY:
1	CRT:	PTP:	PTR:	CRT:
2	LPT:	UP1:	UR1:	BAT:
3	UL1:	UP2:	UR2:	UC1:

During file operations, CP/M obtains file information from a table called the file control block (FCB). The information included in the FCB is as shown below.



DR:	Drive code
0:	Logged-in drive
1:	Drive A
2:	Drive B
5:	Drive E
6:	Drive F
F1 - F8:	File name in upper case ASCII
T1 - T3:	File type in upper case ASCII
Ex:	Current extent number
S1:	Reserved for system
S2:	Reserved for system
Rc:	Record count
D0 - D15:	Assigned by CP/M.
Cr:	Record counter
R0 - R2:	Random access record counter

CCP provides an FCB in the system work area which is called a TFCB (temporary FCB); this is used as the default FCB.

7.2 BDOS Function Call

BDOS includes many utility subroutines which input or output data from/to peripherals and handle files. These subroutines are referred to as BDOS functions, and can easily be used by user programs as shown below.

There are 39 BDOS functions which can be used by user programs; any of these can be used by calling address 0005H with a function number in register C and a parameter in register pair DE. Single byte values will be returned in register A while double byte values are returned in register pair HL.

The BDOS functions are listed below. In this list, the entry parameters are those which are passed to BDOS from the user program which calls the function, and the return parameters are those which are passed to the user program from the function called.

Function No.	Explanation	Entry Parameter	Returned value
0:	This function returns control to the CP/M command level.	C: 00H	
1	This function reads a character from CON:	C: 01H	A: Read character
2	This function outputs a character to CON:	C: 02H E: Character to be output	
3	This function reads a character from RDR:	C: 03H	A: Read character
4	This function outputs a character to PUN:	C: 04H E: Character to be output	
5	This function outputs a character to LST:	C: 05H E: Character to be output	
6	This function provides direct console input and output operation. It bypasses all CP/M normal control character functions such as "CTRL" + "P.".	C: 06H E: For input, 0FFH For output, the character to be output.	A: For input, the character read 00H is returned when CON: is not ready.
7	This function returns the current contents of IOBYTE.	C: 07H	A: Contents of IOBYTE
8	This function sets a new value in IOBYTE.	C: 08H E: Value to be set in IOBYTE	
9	This function outputs the character string starting at the specified address and ending with "$" to CON:	C: 09H DE: Starting address of the memory area in which the character string is stored	
10	This function reads a character string from CON: into the buffer area starting at the specified address.	C: 0AH DE: Starting address of the buffer area	Buffer: Character string read from CON:
11	This function reads the status of CON:	C: 0BH	A: CON: status 01H — CON: ready 00H — CON: not ready
12	This function returns the version number of the CP/M system currently in use.	C: 0CH	H: CP/M or MP/M L: Version number
13	This function sets all disks to read/write, selects drive A and sets the default DMA address to 0080H.	C: 0DH	
14	This function selects the specified disk drive.	C: 0EH E: Name of drive to be selected	

Function No.	Explanation	Entry Parameter	Returned value
15	This function opens a file.	C: 0FH DE: FCB address Positions 1 through14 must contain the name of the file to be opened.	A: Directory code 0FFH when the file cannot be found. This function fills the FCB in the main memory with the contents of the corresponding FCB in the directory stored on the disk.
16	This function closes a file.	C: 10H DE: FCB address	A: Directory code 0FFH when the file cannot be found. This function writes the contents of the FCB in the main memory to the directory on the disk.
17	This function searches for a file.	C: 11H DE: FCB address	A: Directory code 0FFH when the file cannot be found.
18	This function is used following function 17 to find the file whose name matches that specified.	C: 12H	A: Directory code 0FFH when the file cannot be found.
19	This function deletes the specified file.	C: 13H DE: FCB address	A: Directory code 0FFH when the file cannot be found.
20	This function reads the next record from the file into memory at the current DMA address.	C: 14H DE: FCB address	A: 00H when the read operation is completed. Other than 00H when the next record contains no data.
21	This function writes 128 bytes of data at the current DMA address to a record of the file specified by the FCB.	C: 15H DE: FCB address	A: 00H when the write operation is completed. Other than 00H when the disk is full.
22	This function generates a new file and catalogs it in the directory.	C: 16H DE: FCB address	A: Directory code 0FFH when the directory is full.
23	This function changes the file name.	C: 17H DE: FCB	A: Directory code 0FFH when the file cannot be found
24	This function returns the log-in vector which indicates drives which are currently on line.	C: 18H	HL: Log-in vector The least significant bit of L corresponds to drive A and the most significant bit of H corresponds to drive P. A "1" bit indicates that the corresponding drive is on line. A: Contains the same value as register L.
25	This function returns the currently logged-in drive.	C: 19H	A: Currently logged-in drive 01H - Drive A 02H - Drive B 05H - Drive E 06H - Drive F

Function No.	Explanation	Entry Parameter	Return Parameter
26	This function changes the DMA address.	C: IAH DE: DMA address	
27	This function returns the base address of the allocation vector.	C: IBH	HL: ALLOC address
28	This function sets the read only attribute for the currently logged-in drive.	C: 1CH	
29	This function returns the R/O vector which indicates drives which are set to read only.	C: IDH	HL: R/O vector
30	This function sets the file attributes. The R/O and system attributes can be set or reset with this function.	C: IEH DE: FCB address	A: Directory code A: FFH (no file)
31	This function returns the BIOS resident disk parameter block (DPB).	C: 1FH	HL: DPB address
32	This function sets or gets the user number.	C: 20H E: 0FFH for getting the current user number	A: User number (GET)
33	This function is similar to function 20; however, a particular record is read according to the contents of positions R0 through R2 in the FCB.	C: 21H DE: FCB address	A: Return code 00H - Normal completion Non-zero - Abnormal completion
34	This function is initiated similarly to function 33. However, the data at the DMA address is written to the disk.	C: 22H DE: FCB address	A: Return code 00H - Normal completion Non-zero - Abnormal completion
35	This function returns the virtual file size to the random record bytes (R0 to R2) of the FCB.	C: 23H DE: FCB address	
36	This function returns the random record position to the random record bytes of the FCB after a series of sequential reads or writes.	C: 24H DE: FCB address	
37	This function resets the specified drives according to the 16-bit drive vector indicating drives to be reset; the least significant bit of the vector corresponds to drive A, and so forth.	C: 25H DE: Drive vector	A: 00H
40	This function is similar to function 34. However, the data written is all 00H.	C: 28H DE: FCB address	A: Return code 00H - Normal completion

For an example of BDOS function call, see Appendix E.

7.3 BIOS Interface

The basic input/output system of CP/M for the QX-10 includes many useful subroutines which can be used by calling their entry addresses from user programs after setting parameters (if required) in applicable registers. Care must be taken to ensure that the entry addresses are correctly specified when calling these subroutines.

7.3.1. Entry Address

The entry addresses of BIOS subroutines are listed below.

BIOS ENTRY

ADDRESS	ENTRY NAME
F600	BOOT
F603	WBOOT
F606	CONST
F609	CONIN
F60C	CONOUT
F60F	LIST
F612	PUNCH
F615	READER
F618	HOME
F61B	SELDSK
F61E	SETTRK
F621	SETSEC
F624	SETDMA
F627	READ
F62A	WRITE
F62D	LISTST
F630	SECTRN
F633	PSET
F636	HCOPY
F639	BEEP
F63C	RSOPEN
F63F	RSCLOSE
F642	RSINST
F645	RSOUTST
F648	RSIN
F64B	RSOUT
F64E	TIMDAT
F651	MEMORY
F654	RSIOX
F657	LIGHTPEN
F65A	MASKI
F65D	LOADX
F660	STORX
F663	LDIRX
F666	JUMPX
F669	CALLX
F66C	GETPFK
F66F	PUTPFK

7.3.2 Functions of BIOS subroutines

In the following explanations, entry parameters are those which must be assigned by user programs calling the BIOS routines.

BOOT F600

BOOT is the entry point for the cold start loader, which runs only when the power is turned on and is not used by the user.

WBOOT F603

WBOOT is the entry point for the warm start bootstrap; this routine loads CCP and BDOS into memory and initializes the system.

CONST F606

CONST is the entry point for the subroutine which reads the console status and sets it in register A.

Result

A: 0	Indicates that the console input buffer is empty.
A: FFH	Indicates that the console input buffer contains a character.

CONIN F609

CONIN is the entry point for the subroutine which sets a character input from the console into register A.

Result

A: Input character

CONOUT F60C

CONOUT is the entry point for the subroutine which outputs a character to the console from register C.

Entry parameter

C: Character to be output to the console

LIST F60F

LIST is the entry point for the subroutine which outputs characters to LST: from register C.

Entry parameter

C: Character to be output to LST:

PUNCH F612

PUNCH is the entry point for the subroutine which outputs a character to PUN: from register C.

Entry parameter

C: Character to be output to PUN:

READER F615

READER is the entry point for the subroutine which read a character from RDR: and sets it in register A.

Result A:

Character input from RDR:

HOME F618

HOME is the entry point for the subroutine which sets the C register to 0 and jumps to SETTRK. This routine is used to set the head to track 0.

SELDSK F61B

SELDSK is the entry point for the subroutine which selects a disk drive in accordance with the entry parameter stored in register C.

Entry parameter

C: 0 — Drive A
C: 1 — Drive B
C: 4 — Drive E (disk image RAM)
C: 5 — Drive F (disk image RAM)

SETTRK F61E

SETTRK is the entry point for the subroutine which selects the track to be accessed.

Entry parameter

BC: 0 - 27 (For drives A and B)
BC: 0 - 6 (For disk image RAM)

SETSEC F621

SETSEC is the entry point for the subroutine which sets the sector number to be accessed.

Entry parameter

C: Sector number to be accessed (0 - 3FH)

SETDMA F624

SETDMA is the entry point for the subroutine which sets the starting address of the 128 byte DMA buffer area used for disk access.

Entry parameter

BC: DMA address

READ F627

READ is the entry point for the subroutine which reads data from a disk drive into the DMA buffer according to parameters set by the SELDSK, SETTRK, SETSEC and SETDMA subroutines.

Result

A: 0 — Normal completion
A: Other than 0 — Abnormal completion

WRITE F62A

WRITE is the entry point for the subroutine which writes data to a disk drive according to parameters set by the SELDSK, SETTRK, SETSEC and SETDMA subroutines.

Entry parameter

C: 0 — Write standard format data.
C: 1 — Write unblocked data.
C: 2 — Write sequential file.

Result

A: 0 — Normal completion
A: Other than 0 — Abnormal completion

LISTST F62D

LISTST is the entry point for the subroutine which reads the printer status and sets it in register A.

Result

A: 0 — Printer not ready
A: FFH — Printer ready

SECTRN F630

SECTRN is the entry point for the subroutine which converts a logical sector number into the corresponding physical sector number.
The entry parameter is stored in register pair BC and the result is returned to register pair HL. With the QX-10, the logical sector number equals the physical sector number, and therefore this entry point is not required.

PSET F633

PSET is the entry point for the subroutine which reads data at the location on the CRT screen specified by the contents of register pair HL, performs the operation (AND, OR, or XOR) specified in register C on the data read and the contents of register B, then sets the result at the original location in the color specified by the contents of register E.

Entry parameters

HL: CRT screen address (0 - 31999)
B: Data
C: 1 = AND, 2 = OR, 3 = XOR
E: Color

0	1	2	3	4	5	6	7
Black	Blue	Red	Violet	Green	Light blue	Yellow	White

Result

B: Same as the input data
C: Resultant data (red)
D: Resultant data (green)
E: Resultant data (blue)
HL: Same as the input data

NOTE:
With the green CRT, the contents of register pair DE may be destroyed.

HCOPY F636

HCOPY is the entry point for the subroutine which prints a hard copy of the CRT screen image on the printer. This subroutine is effective with the combinations of mode, CRT and printer indicated by the circles in the table below.

Printer \ CRT / Mode	Green CRT				Color CRT			
	I	II	III	IV	I	II	III	IV
MX-80	○	×	×	×	×	×	×	×
TYPE 2, MX-82 or MX-100	○	○	○	○	○	○	○	○
TYPE 3, MX-82 or MX-100	○	○	○	○	○	○	○	○
FX-80	○	○	○	○	○	○	○	○
FX-100	○	○	○	○	○	○	○	○
RX-80	○	○	○	○	○	○	○	○

○...Hard copy
×...No operation

I: Non-MFBASIC Normal mode
II: Non-MFBASIC MF mode
III: MFBASIC width 80 mode
IV: MFBASIC width 40 mode

With a color CRT, colors other than the background color are printed out.

BEEP F639

BEEP is the entry point for the subroutine which sounds the keyboard buzzer.

Entry parameter

C: 0 = OFF
FFH = ON
1 to FEH = Buzzer sounds for the specified interval (in 10 msec units)

Result

This subroutine changes the contents of all registers.

RSOPEN F63C

RSOPEN is the entry point for the subroutine which initializes the RS-232C interface for communication according to the condition set with the CONFIG command. This routine changes the contents of all registers.

RSCLOSE F63F

RSCLOSE is the entry point for the subroutine which disables communication through the RS-232C interface. This routine changes the contents of all registers.

RSINST F642

RSINST is the entry point for the subroutine which checks whether a character has been received in the RS-232C interface's receive buffer.

Result

A: 00H Receive buffer is empty.
A: FFH A character is received in the receive buffer.

RSOUTST F645

RSOUTST is the entry point for the subroutine which checks whether the RS-232C interface is ready to send.

Result

A: 00H The RS-232C interface is not ready to send.
A: FFH The RS-232C interface is ready to send.

RSIN F648

RSIN is the entry point for the subroutine which reads in a character from the RS-232C interface.

Result

A: Character received
This subroutine changes the contents of the other registers.

RSOUT F64B

RSOUT is the entry point for the subroutine which sends a character to the RS-232C port.

Entry parameter

C: Character to be sent

This subroutine changes the contents of all registers.

NOTE:
RSOPEN must be called to open the RS-232C port before RSIN or RSOUT is called. Characters which overflow the receive buffer are lost.

TIMDAT F64E

TIMDAT is the entry point for the subroutine which resets or reads the clock (time and date). This routine is called every time warm boot is performed.

Entry parameter

C: 0FFH — Sets the clock with data stored in addresses 0FEF8 through 0FEFFH.

C: 0 — Reads the clock and stores the data read in addresses 0FEF8 through 0FEFFH.

Result

This subroutine changes the contents of all registers.

Memory contents

All data is coded in BCD code.

Address		Data (BCD)
0FEF8H	Year	(19)XX
F9H	Month	01 - 12
FAH	Day	01 - 31
FBH	Hour	00 - 23
FCH	Min.	00 - 59
FDH	Sec.	00 - 59
FEH	Day of week	00 - 06
FFH	Not used	00

F8	F9	FA	FB	FC	FD	FE	FF
Year	Month	Day	Hour	Min.	Sec.	Day of week	Not used

MEMORY F651

MEMORY is the entry point for the subroutine which switches the memory bank (56KB from 0 to ODFFFH) excluding the common area.

Entry parameter

C: 0 Selects the main memory bank.
C: 1 Selects user memory bank #1.
C: 2 Selects user memory bank #2.
C: -1 Selects the system memory bank.

Result

A: 0 Normal completion
A: Other than 0 RAM is not installed.
C: Bank number selected previously (-1 to 2)

The contents of other registers are not changed.

NOTE:
The main memory bank is always selected after cold start or warm boot.

RSIOX F654

RSIOX is the entry point for the subroutine which initializes a RS-232C port in an option slot, disables interrupt from it, inputs and outputs data throught it, and checks its status.
This routine can be used for communications through the RS-232C port on the main board when the required parameters are set.
The functions of this subroutine are explained below.

1. Opening the RS-232C port (OPEN)

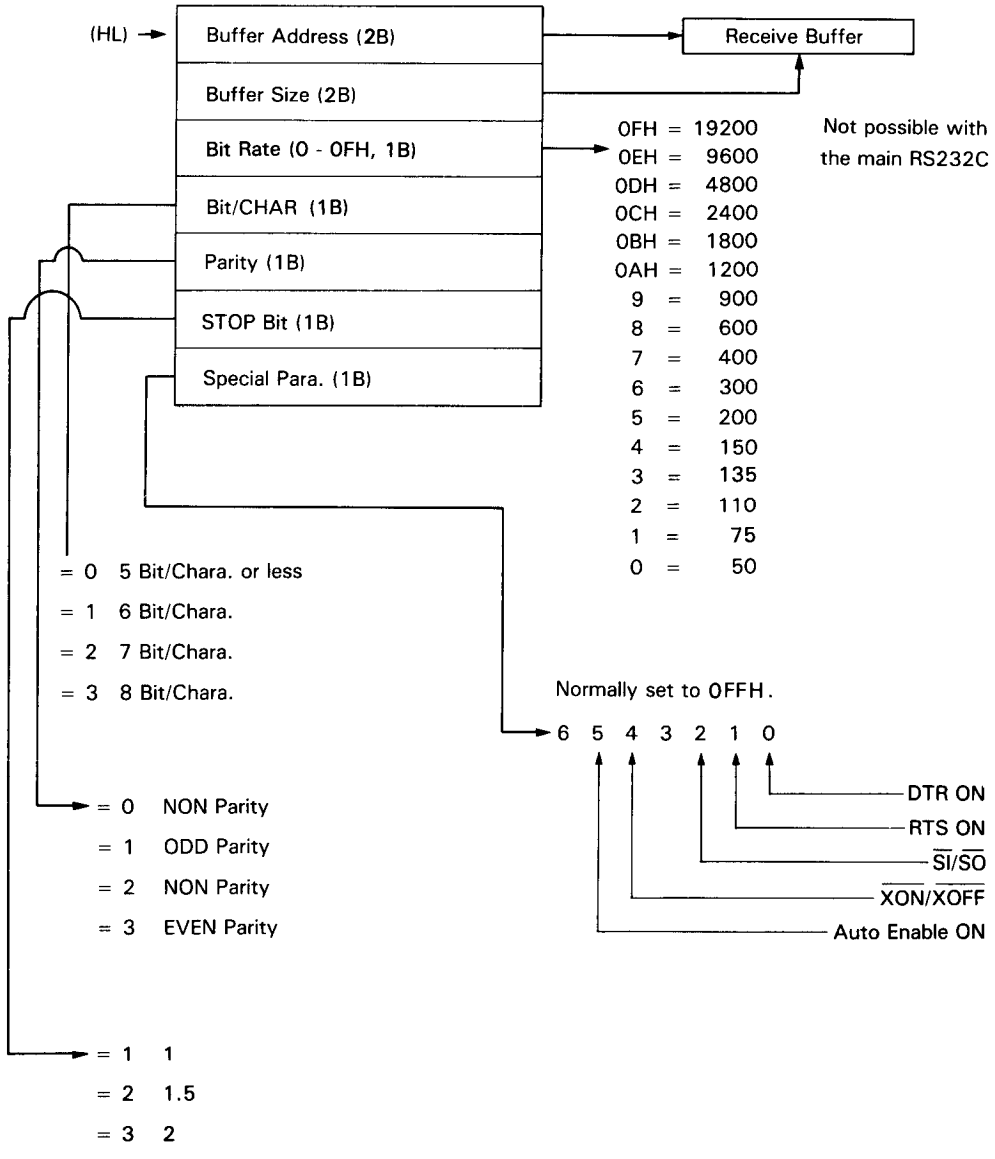
Entry parameters

B: 1XH

X = 0 Main board RS-232C port
1 Option 1, channel A
2 Option 1, channel B
3 Option 2, channel A
4 Option 2, channel B

HL: Parameter block address

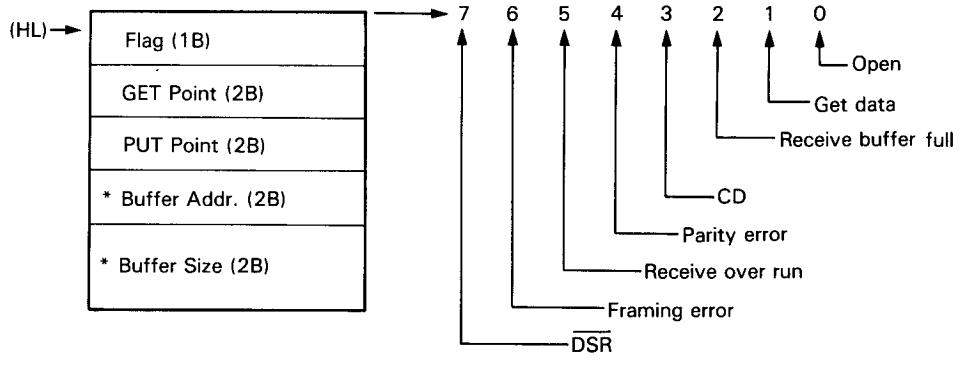
The contents of the parameter block is shown below.



Return parameters

A: 0	Normal open	Z flag = 1
1	No option board	= 0
2	Busy (i.e., used by another program)	= 0
4	Parameter error	= 0
HL:	Not changed	

The contents of the parameter block is as follows.



*: The same as the value set by the user.

2. Closing the RS-232C port (CLOSE)

Entry parameter

B: 2XH

X = 0	RS-232C on the main board
1	Option 1, channel A
2	Option 1, channel B
3	Option 2, channel A
4	Option 2, channel B

Return parameter

None.

3. Checking status (INSTS)

The routine checks whether a character has been received in the receive buffer.

Entry parameters

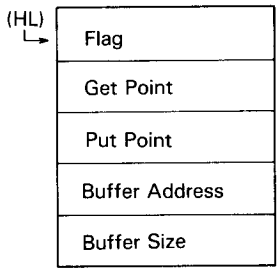
B: 3XH

X = 0	RS-232C on the main board
1	Option 1, channel A
2	Option 1, channel B
3	Option 2, channel A
4	Option 2, channel B

HL: 9 byte block address which is used to store return information.

Return parameter

Z flag = 1 Normal completion
A: 00H No data in the receive buffer
A: FFH A character in the receive buffer
Z flag = 0 The RS-232C port is not open.
A: 3
HL: Not changed



Refer to the parameter block list of the OPEN function.
BC: LOC (the number of characters in the receive buffer)
The contents of the BC register is undefined when error occurs (Z flag = 0).

4. Checking whether the RS-232C is ready to send (OUTST)

Entry parameters

B: 4XH
X = 0 RS-232C on the main board
1 Option 1, channel A
2 Option 1, channel B
3 Option 2, channel A
4 Option 2, channel B
HL: Address of the block which is used to store return information

Return parameters

Z flag = 1 Normal completion
A: 00H Not ready to send
A: FFH Ready to send
Z flag = 0 The RS-232C port is not open.
A: 3
For the HL register contents, refer to the OPEN function.

5. Getting data from the receive buffer (GET)

Entry parameter

B: 5XH

X = 0 RS-232C on the main board
1 Option 1, channel A
2 Option 1, channel B
3 Option 2, channel A
4 Option 2, channel B

HL: Address of the block which is used to store return information

Return parameters

Z flag = 1 Normal completion
A: Receive data
HL: Refer to the OPEN

Z flag = 0 The RS-232C is not open.
A: 3
HL: Return information block address

6. Sending 1 byte data (PUT)

Entry parameters

B: 6XH

X = 0 RS-232C on the main board
1 Option 1, channel A
2 Option 1, channel B
3 Option 2, channel A
4 Option 2, channel B

C: Send data

HL: Address of the block which is used to store return information

Return parameters

Z flag = 1 Normal completion
HL: Refer to the OPEN function.

Z flag = 0 The RS-232C is not open.
A: 3
HL: Not changed

7. Reading status of the control line (CTLIN)

Entry parameter

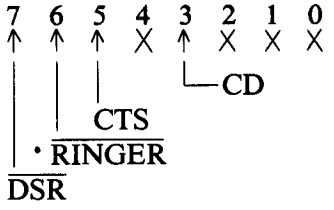
B: 7XH

X = 0 RS-232C on the main board
1 Option 1, channel A
2 Option 1, channel B
3 Option 2, channel A
4 Option 2, channel B

Return parameters

Z flag = 1 Normal completion

A: Conditions of the control line flags



Z flag = 0 The RS-232C port is not open.

A = 3

8. Setting data on the control line (SETCTL)

Entry parameters

B: 8XH

X = 0 RS-232C on the main board

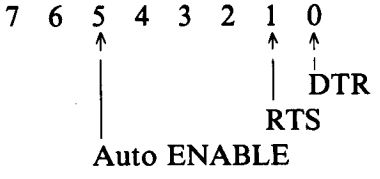
1 Option 1, channel A

2 Option 1, channel B

3 Option 2, channel A

4 Option 2, channel B

C: Set data



Return parameters

Z flag = 1 Normal completion

Z flag = 0 The RS-232C port is not open.

A = 3

9. Checking error status and clearing error flag (ERSTS)

Entry parameter

B: 9XH

X = 0 RS-232C on the main board

1 Option 1, channel A

2 Option 1, channel B

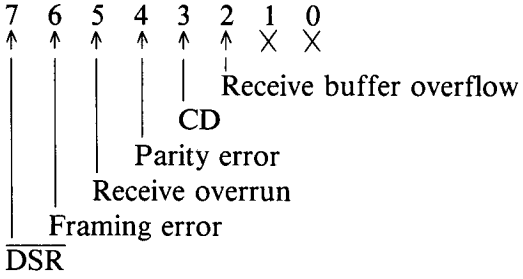
3 Option 2, channel A

4 Option 2, channel B

Return parameters

Z flag = 1 Normal completion

A: Error status



The error status flags are cleared after this.

Z flag = 0 The RS-232C port is not open.

A = 3

10. Checking the use of RS-232C port (SENS)

Entry parameters

B: 0FXH

X = 0 RS-232C on the main board
1 Option 1, channel A
2 Option 1, channel B
3 Option 2, channel A
4 Option 2, channel B

Return parameters

Z flag = 1 The RS-232C port can be opened.

Z flag = 0

A: 1 No option board
2 Busy (i.e., the port is used by another program.)

NOTE:

All the RSOPEN, RSCLOSE, RSINST, RSOUTST, RSIN and RSOUT routines call the RSIOX routine after setting parameters according to the data set by the CONFIG command. At this time, the top address of the parameter block is 0FE65H, the buffer address is 7000H and the buffer size is 200H.

LIGHTPEN F657

LIGHTPEN is the entry point of the subroutine which (1) checks whether the light pen is pressed to the screen and (2) reads the location on the screen where the light pen is touched.

Entry parameter:

C: 2 for function (1)
C: 3 for function (2)

Result

Z flag: 1 Normal completion
Function (1) A: 0 Light pen is not pressed to screen.
A: OFFH Light pen is pressed to screen and the light pen interface contains location data.
Function (2) A: 0 Light pen interface contains no data.
A: Other than 0
Light pen interface contains data.
BC: Horizontal position
• Green CRT
0 to 79 non-MFBASIC normal mode
0 to 39 non-MFBASIC MF mode
MFBASIC width 80 mode
MFBASIC width 40 mode
• Color CRT
0 to 39
DE: Vertical position
• Green CRT
0 to 24 non-MFBASIC normal mode
0 to 399 non-MFBASIC MF mode
MFBASIC width 80 mode
MFBASIC width 40 mode
• Color CRT
0 to 399
Z flag: 0 Error
A: 1 Parameter error

This subroutine changes the contents of other registers.

NOTE:

The light pen interface issues successive interrupts if it is continuously pressed onto the screen or against another object, such as a desk or finger. This prevents the CPU from doing other processing. Remember that the interrupt level of the disk drives is lower than that of the light pen.

MASKI F65A

MASKI is the entry point for the subroutine which sets and resets interrupt masks. Masks can be set and reset regardless of the slot in which each option card is installed.

Entry parameters

B:	0	Unmask interrupts from the option interface specified in register C (that is enables interrupts from the option interface cards).
	1	Masks option level 1. (Disables interrupt)
	2	Masks option level 2.
	3	Masks option level 3.
	4	Masks option level 4.
	5	Masks option level 5.
	6	Masks option level 6.
	7	Masks option level 7.
	9	Masks software timer 1.
	0DH	Masks software timer 1.
	20H	Masks software timer 2.
	0FFH	Masks all option levels (except software timers 1 and 2).
C:	0AH	Software timer 1
	0BH	Software timer 2
	3BH	Light pen
	91H	GPIB (IEEE488 bus)
	98H	Optical fiber
	0A3H	A/D, D/A converter
	0ACH	RS-232C
	0CCH	RS-232C
	0FDH	Multiple font ROM

Result

Z flag:	1	Normal completion
A:	1 to 7	Option interrupt level This value is used as the mask setting parameter.
	9	Software timer 1
	0DH	Software timer 2
	20H	Light pen
Z flag:	0	
A:	1	Option board is not installed.
	4	Parameter error Option ID or interrupt level is incorrect.

This subroutine changes the contents of other registers.

NOTE:
All interrupts except those from the keyboard, standard RS-232C, Multiple font ROM, flexible disk controller and clock are masked when a cold start is made. Therefore, interrupts other than the above cannot be processed unless the corresponding mask is reset with this subroutine. The interrupt levels of option interfaces cards vary according to the slots in which they are installed. Therefore, it is necessary to determine the slot location before resetting a mask.

LOADX F65D

LOADX is the entry point for the subroutine which reads 1 byte of data from the specified memory bank.

Entry parameters

HL: Data address
C: Memory bank number
0: Main bank
1: User bank #1
2: User bank #2 (option)
-1: System bank

Result

A:
0: Normal completion
Other than 0: RAM chips are not installed.
C: Data read
This routine does not change the contents of the other registers.

STORX F660

STORX is the entry point for the subroutine which writes 1 byte of data in a specified memory bank.

Entry parameters

HL: Address in which data is to be written
C: Memory bank number
0: Main bank
1: User bank #1
2: User bank #2 (option)
-1: System bank
A: Data

Result

A:
0: Normal completion
Other than 0: RAM chips are not installed.
This routine will not change the contents of the other registers.

LDIRX F663

LDIRX is the entry point for the subroutine which transfers data between two memory banks.

Entry parameters

Registers

HL: Starting address of the memory area from which data is transferred

DE: Starting address of the memory area to which data is transferred

BC: Number of data bytes to be transferred

Memory

0FEF1H: Source memory bank number (-1 to 2)

0FEF2H: Destination memory bank number (-1 to 2)

Result

Registers

A:

0: Normal completion

Other than 0: RAM chips are not installed.

This routine destroys the contents of all the other registers.

JUMPX F666

JUMPX is the entry point for the subroutine which jumps to a specified address in the specified memory bank.

Entry parameters

IX: Destination address

0FEF2H: Destination bank number (-1 to 2)

This routine does not affect the contents of any registers.

CALLX F669

CALLX is the entry point for the subroutine which calls a specified address in the specified bank.

Entry parameters

IX: Call address

0FEF2H: Destination bank number (-1 to 2)

Result

IY: Contents destroyed; the contents of the other registers are maintained, and the contents of address 0FEF2H are destroyed.

NOTE:

The CALLX subroutine uses 1 level of stack. Therefore, the stack pointer area must be settled in the common RAM area (0E000H - 0FFFFH) and its size must consider 1 level for this routine.

GETPFK F66C

GETPFK is the entry point for the subroutine which sets the character string assigned to a specified programmable function key in a specified memory area.

Entry parameters

B: 0: Function key for non-MFBASIC
1: Function key for MFBASIC

C: Programmable function key number (0 to 9)

HL: Starting address of the memory area in which the character string is set.

Result

HL: Contents maintained; the contents of all the other registers are destroyed.

PUTPFK F66F

PUTPFK is the entry point for the subroutine which assigns the character string stored in a specified memory area to a specified programmable function key. If the specified memory area contains more than 16 characters, only the first 16 are valid.

Entry parameters

B: 0: Function key for non-MFBASIC
1: Function key for MFBASIC

C: Programmable function key number (0 to 9)

HL: Starting address of the memory area which contains the character string to be assigned to the programmable function key. The first byte of the area represents the number of characters contained in the area and the following bytes contain the character string.

Result

HL: Contents maintained; the contents of all the other registers are destroyed.

For examples of BIOS call, see Appendix F.

APPENDICES

Appendix A - Hardware Specifications

CPU	Z80A, 4 MHz
Memory	RAM: 256KB (maximum)
	C-MOS RAM: 2KB (standard, backed up by battery)
	EPROM for IPL
	Video RAM: 32KB
Clock	C-MOS real-time clock (backed up by battery)
Speaker	Permanent-magnet speaker
Interfaces	Printer interface (Centronics compatible)
	RS-232C communication interface
	Light-pen interface
DMA	7 channels
Interrupt levels	15
Counter/timer	6 channels
FDD	5-1/4″ FDD × 2
	320KB × 2 drives
	48 TPI, double sided, double density
Card slots	5
Display	12″ green monitor
	640 × 400 dots
Keyboard	ASCII, France, Germany, etc.
Dimensions	Main unit: 508 (W) × 340 (D) × 103 (H) mm
	Display unit: 312 (W) × 340 (D) × 270 (H) mm
	Keyboard unit: 508 (W) × 224 (D) × 48 (H) mm
	Option card: 280 × 80 (mm)
	Weight: Approx. 18 kg

Environmental conditions

Temperature:	5 to 40°C (operation)
	−30°C to 70° (storage)
Humidity:	10 to 80% (operation, no condensation)
	10 to 90% (storage, no condensation)
Resistance to shock:	Max. 1 G, 1 msec (operation)
	Max. 5 G, 1 msec (storage)
Resistance to vibration:	Max. 0.25 G, 5 to 50 Hz (operation)
	Max. 3 G, 5 to 50 Hz (storage)

Appendix B - CP/M Reconfigured by MOVCPM

A 26K to 59K CP/M system can be reconfigured using the MOVCPM command. However, some of the BIOS subroutines and console escape sequences cannot be used with this new CP/M system. The subroutines which can be used are as follows.

BOOT
WBOOT
CONST
CONIN
CONOUT
LIST
PUNCH
READER
HOME
SELDSK
SETTRK
SETSEC
SETDMA
READ
WRITE
LISTST
SECTRN
BEEP
RSOPEN
RSCLOSE
RSINST
RSOUTST
RSIN
RSOUT
TIMDAT

The console escape sequences which can be used in 26K to 59K CP/M reconfigured using the MOVCPM are indicated below.

ESC *	ESC 8
ESC 0	ESC 9
ESC 1	ESC =
ESC 2	ESC T
ESC 3	ESC Y
ESC 6	ESC 7BH
ESC 7	ESC 7DH

Those which result in no operation are as follows.

ESC)	ESC (

Those which are invalid are as follows.

ESC %	ESC 81H
ESC 4	ESC 82H
ESC 5	ESC 90H
ESC <	ESC 91H
ESC >	ESC 0A0H
ESC C	ESC 0A1H
ESC F	ESC 0B0H
ESC L	ESC 0B1H
ESC P	

The following table compares the reconfigured system with standard MF CP/M.

Comparison of 29K-59K CP/M with MF CP/M

	MF CP/M				
	CP/M reconfigured with MOVCPM	Non-MFBASIC		MFBASIC	
		Normal mode	MF mode	WIDTH 80 mode	WIDTH 40 mode
CP/M size	26K to 59K	63K			
Disk blocking	1024 bytes	1024 bytes			
CP/M functions	Limited	Extended			
Console output Functions	Limited	Extended			
Size of screen	80×25		40×20	80×20	40×20
International character set	Not available	Available			
Application	WORD STAR, DATA STAR DBASE II, FORTRAN-80, CIS COBOL, etc.		TYPE (User defined commands)	MFBASIC etc.	
RAM required	64K	128K 64K for disk image RAM E 64K for disk image RAM F		192K 64K for disk image RAM E	
VRAM	32K	32K to 128K (4 pages) (color: 96K to 384K (4 pages))			
Programmable function keys	Supported				
Printout and display of user defined characters	Not available			Available	
RAM DISK	Not available	56K×2 drives		56K	
RS232C	1 port, no interrupt processing	1 (+2+2) ports, interrupt processing			
Light pen	Not available	Available			
Color CRT	Not available	Available			

Appendix C - Console Control Codes

Control code	Function	1	2	3
ESC "%"	Access CGROM directly	○ (×)	×	×
ESC "("	No operation	△	△	△
ESC ")"	No operation	△	△	△
ESC "*"	Clear screen	○	○	○
ESC "0"	Reverse on	○	○	○
ESC "1"	Reverse off	○	○	○
ESC "2"	Cursor off	○	○	○
ESC "3"	Cursor on	○	○	○
ESC "4"	Underline	△ (○)	○	○
ESC "5"	Underline off	△ (○)	○	○
ESC "6"	Highlight	○ (×)	×	×
ESC "7"	Highlight off	○ (×)	×	×
ESC "8"	Blink	○ (×)	×	×
ESC "9"	Non blink	○ (×)	×	×
ESC "<"	Push cursor position	×	×	○
ESC "="	Set cursor position	○	○	○
ESC ">"	Pop cursor position	×	×	○
ESC "C"	Change character set & keyboard	○	○	○
ESC "F"	Change character style	×	×	○
ESC "L"	Change CRT color	△ (○)	○	○
ESC "P"	Screen dump	○	○	○
ESC "T"	Erase end of line	○	○	○
ESC "Y"	Erase end of screen	○	○	○
ESC 7BH	Secret	○	○	○
ESC 7DH	Non secret	○	○	○
ESC 81H	1byte char. → 2byte char.	×	×	○
ESC 82H	2byte char. → 1byte char.	×	×	○
ESC 90H	Partial scroll	×	×	○
ESC 91H	Partial scroll	×	×	○
ESC 0A0H	INS LED on	○	○	○
ESC 0A1H	INS LED off	○	○	○
ESC 0B0H	Function key check mode on	○	○	○
ESC 0B1H	Function key check mode off	○	○	○

1: Non-MFBASIC, Normal mode
2: Non-MFBASIC, MF mode
3: MFBASIC mode

○: Effective
×: Not effective
( ): With color CRT
△: No operation

The console can be controlled by sending the following codes to CON:.

05H ($(5)_D$): Erases the screen from the current cursor position to the end of that physical line.
07H ($(7)_D$): Beeps the speaker.
08H ($(8)_D$): Moves the cursor one column to the left (back space).
09H ($(9)_D$): Moves the cursor 8 columns to the right (tab).
0AH ($(10)_D$): Moves the cursor down one line (line feed).
0BH ($(11)_D$): Moves the cursor to the top left corner of the screen (home).
0CH ($(12)_D$): Clears the entire screen and moves the cursor to the home position (clear screen (CLS)).
0DH ($(13)_D$): Moves the cursor to the beginning of the next line (carriage return (CR)).
1AH ($(26)_D$): Erases the screen from the current cursor position to the end of the screen.
1CH ($(28)_D$): Moves the cursor one column to the right (→).
1DH ($(29)_D$): Moves the cursor one column to the left (←).
1EH ($(30)_D$): Moves the cursor up one line (↑).
1FH ($(31)_D$): Moves the cursor down one line (↓).

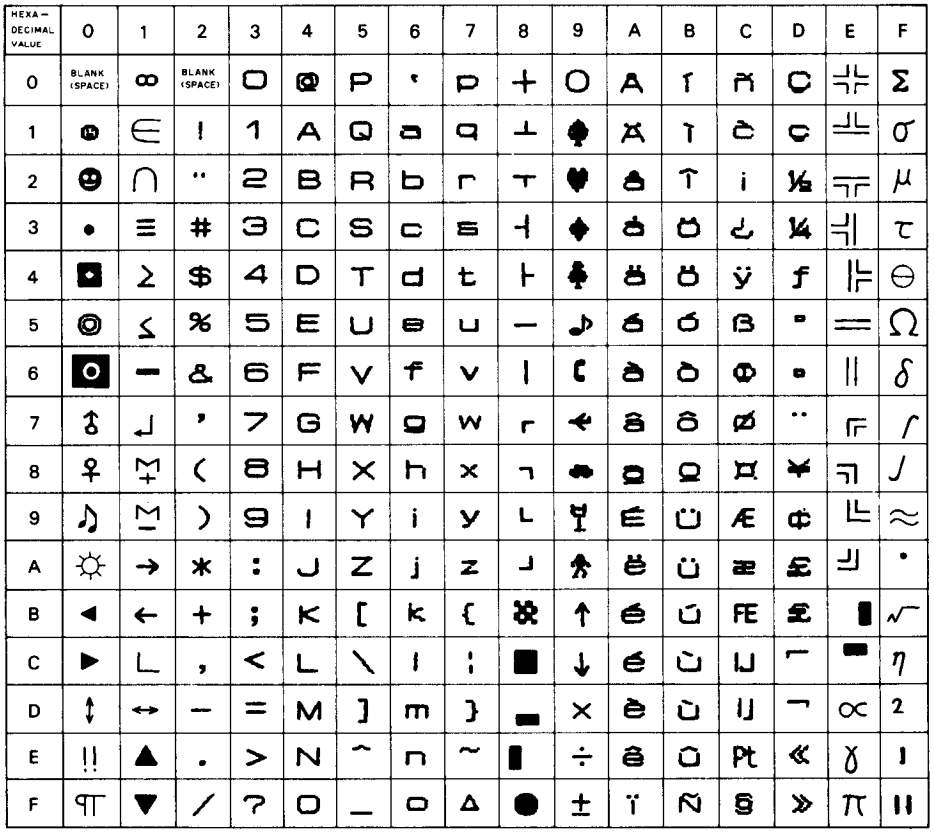
Entering the ESC code (1BH ($(27)_D$)) followed by one or more codes performs various functions as shown below.

ESC "%"

This escape code is valid only in the non-MFBASIC normal mode. The CRT character generator ROM of the QX-10 provides the code system shown in the table. Sending the following sequence to the console makes it possible to display 255 different characters.

ESC "%" CHR$(n)

In the above, n is any integer from 0 to 255.



ESC "("

No operation.

ESC ")"

No operation.

ESC "*"
This escape sequence clears the CRT screen to the background color and positions the cursor in the upper left hand corner of the screen.

ESC "0"
This escape sequence reverses the display.

ESC "1"
This escape sequence terminates reverse display.

ESC "2"
This escape sequence turns off the cursor.

ESC "3"
This escape sequence turns on the cursor.

ESC "4"
This escape sequence causes characters input to be underlined.

ESC "5"
This escape sequence terminates character underlining.

ESC "6"
This escape sequence initiates highlighted display.

ESC "7"
This escape sequence terminates display highlighting.

ESC "8"
This escape sequence initiates blinking display.

ESC "9"
This escape sequence terminates blinking display.

ESC "<"
This escape sequence saves the cursor position, display attributes (reverse, underline, highlight, etc.) and color and, when the first byte of a 2-byte character has alreay been sent to the console, saves that byte. Saving is possible up to 8 levels; further entries of the sequence are invalid.

ESC "="
This escape sequence makes it possible to specify the cursor position; this is done as follows.

```
ESC "=" CHR$ (m+32) CHR$ (n+32)
```

m specifies the vertical cursor position and n specifies the horizontal position. Possible values of m and n are as shown below.

m: 0 to 24 for the non-MFBASIC normal mode
0 to 19 for the non-MFBASIC MF mode, MFBASIC width80 mode, and MFBASIC width40 mode
n: 0 to 79 for the non-MFBASIC normal mode and MFBASIC width80 mode
0 to 39 for the non-MFBASIC MF mode and MFBASIC width 40 mode

ESC ">"

This escape sequence restores the cursor position, attribute, color, and first byte of a 2-byte character most recently saved with ESC "<.

ESC "C"

This escape sequence is used to select one of the eight international character sets and keyboard arrangements as follows.

US ASCII	ESC "CU"
French	ESC "CF"
German	ESC "CG"
English	ESC "CE"
Danish	ESC "CD"
Swedish	ESC "CW"
Italian	ESC "CI"
Spanish	ESC "CS"

ESC "F"

This escape sequence changes the font of 1-byte characters in the MFBASIC width40 mode. This is specified as follows.

ESC "Fn"

Here, n is a 1-digit hexadecimal number.

Example

```
10 PRINT CHR$(27);"F8"
20 PRINT "abcEPSONdef"
RUN

abcEPSONdef
Ok
```

ESC "L"

This escape sequence changes the foreground or background color of the CRT display. The sequence for changing the foreground color is as follows.

```
ESC "L0n"
```

Here, n is an integer with the following meanings.

n	0	1	2	3	4	5	6	7
	Black	Blue	Red	Violet	Green	Light blue	Yellow	White

NOTE:
In the case of the monochrome display, specification of any number other than 0 (black) for n is regarded as equivalent to n = 7 (white).

For the background color, the sequence is as follows.

```
ESC "L1n"
```

Here, n is an integer from 0 to 7 with meanings which are the same as indicated above.

NOTE:
This sequence is not effective in the case of the monochrome display (the background color is always black).

ESC "P"

This escape sequence outputs a hard copy of the display screen contents to the printer. (With certain combinations of mode, CRT and Printer, this escape sequence is not effective in other than the non-MFBASIC normal mode.) When a color display is used, color other than background color is printed out.

ESC "T"

This escape sequence clears the current line from the position of the cursor to the line's end.

ESC "Y"

This escape sequence clears the current screen from the position of the cursor to the screen's end.

ESC CHR$ (&H7B)

This escape sequence causes all characters to be displayed on the screen as blanks (secret mode).

ESC CHR$ (&H7D)

This escape sequence terminates the secret mode.

ESC CHR$ (&H81)

This escape sequence is used as follows in the MFBASIC mode to convert 1-byte characters to 2-byte characters.

```
ESC CHR$ (&H81) CHR$ (n) "f"
```

Here, "n" is a 1-byte character code and "f" is the font (specified as a 1-digit hexadecimal number from 0 to F).

ESC CHR$ (&H82)

This escape sequence is used as follows in the MFBASIC mode to convert 2-byte characters to 1-byte characters.

```
ESC CHR$ (&H82) CHR$ (nl) CHR$ (n2)
```

Here, nl is the first byte of the 2-byte code, and n2 is the second.

ESC CHR$ (&H90)

This escape sequence is specified as follows to scroll up part of the CRT screen.

```
ESC CHR$ (&H90) CHR$ (n) CHR$ (m)
```

This sequence scrolls up the m lines from line n and displays a blank line at line n+m-1. Here, n is an integer from 0 to 19, and m is an integer from 1 to 20. The total of n+m must not be greater than 20.

ESC CHR$ (&H91)

This escape sequence is specified as follows to scroll down part of the CRT screen.

```
ESC CHR$ (&H91) CHR$ (n) CHR$ (m)
```

This sequence scrolls down the m lines from line n and displays a blank line at line n. The values of n and m are as indicated above, and the total of n+m must not be greater than 20.

ESC CHR$(&HA0)

This escape sequence lights the LED built into the INS key.

ESC CHR$(&HA1)

This escape sequence turns off the LED built into the INS key.

ESC CHR$(&HB0)

This escape sequence sets the console in the function key check mode (the mode in which a special check is made of the programmable function keys and numeric pad keys) and turns on FUNCFLG ((&HFED1) = &HFF).

In this mode, when a key is pressed, the internal code corresponding to each key is entered when keys are pressed and the C register is set as follows.

Key	Internal code	C register
PFK1	&HE0	&HFF
PFK2	&HE1	&HFF
PFK3	&HE2	&HFF
PFK4	&HE3	&HFF
PFK5	&HE4	&HFF
PFK6	&HE5	&HFF
PFK7	&HE6	&HFF
PFK8	&HE7	&HFF
PFK9	&HE8	&HFF
PFK10	&HE9	&HFF
00	&HF4	&HFF
(German keyboard only)		
000	&HF5	&HFF
↵	Same as ASCII code	&HFF
*	Same as ASCII code	&HFF
+	Same as ASCII code	&HFF
,	Same as ASCII code	&HFF
—	Same as ASCII code	&HFF
.	Same as ASCII code	&HFF
/	Same as ASCII code	&HFF
=	Same as ASCII code	&HFF
0 to 9	Same as ASCII code	&HFF
	Other keys Same as ASCII code	0

ESC CHR$(&HB1)

This escape sequence resets the function key check mode ((&HFED1) = 0).

The programmable function keys, the "00" key and the "000" key generate more than one code in sequence. For example, the "000" key generates three zeros in sequence.

Appendix D - Printer Escape Sequences

The escape sequences described below are used with EPSON MX printers of types II and III, the FX/80, FX-100, and RX-80; these escape sequences are valid only in the BIT OFF mode.

ESC "a"

This escape sequence causes all 2-byte characters to be printed at constant spacing; the printer's proportional spacing information is disregarded.

ESC "b"

This escape sequence causes 2-byte characters to be printed with proportional spacing. (This is the condition which prevails immediately after a cold start is made.)

Example

```
10 LPRINT CHR$(27);"a";: GOSUB 100
20 LPRINT
30 LPRINT CHR$(27);"b";: GOSUB 100
99 END
100 LPRINT "Quality Personal Computer QX-10"
110 RETURN
Ok
```

```
Quality Personal Computer QX-10

Quality Personal Computer QX-10
```

ESC CHR$ (&H80)

This escape sequence prints spaces of n dots; its format is as follows.

ESC CHR$ (&H80) CHR$ (n)

Here, n is an integer from 0 to 255.

ESC CHR$ (&H81)

This escape sequence affixes a space of n dot's width to the left side of all characters printed. (With double density printing, the default value is 1.) Its format is as follows.

ESC CHR$ (&H81) CHR$ (n)

Here, n is an integer from 0 to 255.

ESC CHR$ (&H82)

This escape sequence affixes a space of n dot's width to the right side of all characters printed. (With double density printing, the default value is 1.) Its format is as follows.

ESC CHR$ (&H82) CHR$ (n)

Here, n is an integer from 0 to 255. (When $128 \leq n \leq 255$, the actual number of dots is given by $(n-256)$, that is, the print head moves backward by $|n-1|$ dot spaces.

ESC CHR$ (&H90)

This escape sequence sets the position of the print head (with double density printing). (This is accomplished by changing the value of the print buffer pointer to indicate the position which is n dots from the beginning of the buffer.) The format for this sequence is as follows.

ESC CHR$ (&H90) CHR$ (n_L) CHR$ (n_H)

n_L: LSB of n
n_H: MSB of n

NOTE:
The last two escape sequences described above are invalid unless they are included in a print line with the code from 7FH to 9FH, 2-byte characters, spaces printed with the escape sequence described in ESC CHR$ (&H80), or the head positioning escape sequence described in ESC CHR$ (&H90).

Appendix E - Example of BDOS Call

A simple program which uses BDOS function 5 is shown below. This program outputs characters from 20H to FFH to the printer. Refer to publications available on CP/M for more sophisticated programs using BDOS functions for file management.

```
0000 =          WBOOT   EQU     0000H
0005 =          BDOS    EQU     0005H
                ;
0100                    ORG      100H
0100 1E20               MVI     E,20H
0102 D5         STAT:   PUSH    D
0103 7B                 MOV     A,E
0104 FEFF               CPI     0FFH
0106 CA1301             JZ      SEND
0109 0E05               MVI     C,5
010B CD0500             CALL    BDOS
010E D1                 POP     D
010F 1C                 INR     E
0110 C30201             JMP     STAT
0113 C30000     SEND:   JMP     WBOOT
0116            BUF:    DS      02H
0118                    END
```

Appendix F - Examples of BIOS Call

Three sample programs which use BIOS calls are shown here. The first program supports the light pen. The second outputs MultiFont characters to the printer. The last dumps the contents of the disk to the printer.

(1) Light pen program

```
ESC       EQU     1BH
CONOUT    EQU     0F60CH
LIGHTPN   EQU     0F657H
MASKI     EQU     0F65AH
;
          LXI     SP,STACK    ;INITIALIZE STACK POINTER
          MVI     C,ESC
          CALL    CONOUT      ;SET REV DISPLAY
          MVI     C,'0'       ;WRITE BLANKS ENTIRE SCRN
          CALL    CONOUT
          LXI     D,80*25
D0:
          PUSH    D
          MVI     C,' '
          CALL    CONOUT
          POP     D
          DCX     D
          MOV     A,E
          ORA     D
          JNZ     D0
          MVI     C,ESC
          CALL    CONOUT
          MVI     C,'1'
          CALL    CONOUT      ;RESET REVERSE DISPLAY

          MVI     C,ESC
          CALL    CONOUT
          MVI     C,'2'
          CALL    CONOUT
D1:
          MVI     B,0
          MVI     C,3BH
          CALL    MASKI       ;ENABLE LIGHTPEN INTERRUPT
D2:
          MVI     C,2         ;WAIT LIGHTPEN ON
          CALL    LIGHTPN
          ORA     A
          JZ      D2
          MVI     C,3
          CALL    LIGHTPN     ;GET POSITION
          MOV     B,E
          PUSH    B
          MVI     B,20H
          CALL    MASK        ;DISABLE LIGHTPEN INTERRUPT
          MVI     C,ESC
          CALL    CONOUT      ;SET DISPLAY LOCATION
          MVI     C,'='
          CALL    CONOUT
          POP     B
          PUSH    B
          MVI     A,32
          ADD     B
          MOV     C,A
          CALL    CONOUT
          POP     B
          MVI     A,32
          ADD     C
          MOV     C,A
          CALL    CONOUT
          MVI     C,' '       ;WRITE BLANK TO DISP LOC
          CALL    CONOUT
          JMP     D1
;
          DS      100
STACK     EQU     $
;
          END
```

(2) MultiFont character printout program

```
CR      EQU     0DH
LF      EQU     0AH
ESC     EQU     1BH
;
CONOUT  EQU     0F60CH
LISTST  EQU     0F62DH
LIST    EQU     0F60FH
;
MFDEMO:                         ;GET PRNTR STATUS
        CALL    LISTST
        STA     PRST
        LXI     H,TABLE1
        SHLD    TSAVE1
        MVI     E,8
MFDEMO1:
        MVI     D,3
MFDEMO2:
        LHLD    TSAVE1
        MOV     C,M
        INX     H
        SHLD    TSAVE1
        PUSH    D
        CALL    CONOUT          ;OUTPUT ESC SEQ FOR
        POP     D               ;EACH COUNTRY
        DCR     D
        JNZ     MFDEMO2
        LXI     H,TABLE2
        SHLD    TSAVE2
        MVI     D,12
MFDEMO3:
        LHLD    TSAVE2
        MOV     C,M
        INX     H
        SHLD    TSAVE2
        PUSH    D
        PUSH    B
        CALL    CONOUT          ;OUTPUT CHAR FOR
        LDA     PRST            ;EACH COUNTRY
        ORA     A
        JZ      X1
X2:     CALL    LISTST          ;WAIT PRNTR READY
        ORA     A
        JZ      X2
        POP     B
        PUSH    B
        CALL    LIST            ;OUTPUT CHAR TO PRNTR
X1:     POP     B
        POP     D
        DCR     D
        JNZ     MFDEMO3
        PUSH    D
        MVI     C,CR
        CALL    CONOUT
        CALL    LISTST
        LDA     PRST
        ORA     A
        JZ      X3
X4:     CALL    LISTST
        ORA     A               ;LINE FEED
        JZ      X4
        MVI     C,CR
        CALL    LIST
X3:     MVI     C,LF
        CALL    CONOUT
        LDA     PRST
        ORA     A
        JZ      X5
X6:     CALL    LISTST
        ORA     A
        JZ      X6
        MVI     C,LF
        CALL    LIST
```

```
X5:     POP     D                       ;
        DCR     E                       ;
        JNZ     MFDEMO1                 ;
        JMP     0                       ;
;
TABLE1:
        DB      ESC,'CU'
        DB      ESC,'CF'
        DB      ESC,'CG'
        DB      ESC,'CE'
        DB      ESC,'CD'
        DB      ESC,'CW'
        DB      ESC,'CI'
        DB      ESC,'CS'
;
;
TABLE2:
        DB      23H,24H,40H,5BH,5CH,5DH
        DB      5EH,60H,7BH,7CH,7DH,7EH
;
TSAVE1: DW      0
TSAVE2: DW      0
;
PRST:   DB      0
;
        END
```

(3) Disk dump program

```
;*****************************************
;*          DISK DUMP PROGRAM            *
;*****************************************
;
SELDSK  EQU     0F61BH          ;BIOS SELDSK ENTRY
SETTRK  EQU     0F61EH          ;BIOS SETTRK ENTRY
SETSEC  EQU     0F621H          ;BIOS SETSEC ENTRY
SETDMA  EQU     0F624H          ;BIOS SETDMA ENTRY
READ    EQU     0F627H          ;BIOS READ ENTRY
;
BDOS    EQU     5               ;BDOS ENTRY
DSTRING EQU     9               ;FUNCTION CODE FOR
                                ;STRING DISPLAY
;
CR      EQU     0DH             ;CARRIAGE RETURN
LF      EQU     0AH             ;LINE FEED
;
        LXI     SP,STACK        ;INIT STACK POINTER
        LXI     H,DSPBUF
        MVI     C,78
        MVI     A,' '           ;CLEAR DISP BUFFER
D0:
        MOV     M,A
        INX     H
        DCR     C
        JNZ     D0
        XRA     A
        STA     DRIVE           ;DRIVE 0
        STA     TRACK           ;TRACK 0
        STA     SECTOR          ;SECTOR 0
D1:
        LDA     DRIVE
        MOV     C,A
        LXI     D,MDRIVE
        CALL    B2ASCII         ;DRIVE NO INTO ASCII
        CALL    SELDSK          ;SELECT DRIVE
        LDA     TRACK
        MOV     C,A
        LXI     D,MTRACK
        CALL    B2ASCII         ;TRK NO INTO ASCII
        MVI     B,0
        CALL    SETTRK          ;SET TRACK
        LDA     SECTOR
        MOV     C,A
        LXI     D,MSECTOR
        CALL    B2ASCII         ;SECT NO INTO ASCII
        CALL    SETSEC          ;SET SECTOR
        LXI     B,DSKBUF
        CALL    SETDMA          ;SET BUFFER ADDRESS
        CALL    READ            ;READ SECTOR
        MVI     C,DSTRING
        LXI     D,HEADMSG
        CALL    BDOS            ;DISP DRIVE, SECTOR
        MVI     C,8             ;AND TRK NO
        LXI     H,DSKBUF
D2:
        PUSH    B
        PUSH    H
        LXI     D,DSPBUF+8
        MVI     B,16
D3:
        MOV     C,M
        CALL    B2ASCII
        INX     H
        INX     D
        DCR     B
        JNZ     D3
        POP     H
        PUSH    H
        LXI     D,DSPBUF+60
        MVI     B,16
D4:
        MOV     A,M
        ANI     7FH
        CPI     20H
        JNC     D5
        MVI     A,'.'
D5:
        CPI     07FH
        JNZ     D55
        MVI     A,'.'
D55:
        CPI     24H             ;*
        JNZ     D56             ;*
        MVI     A,'.'           ;*
```

```
D56:                                    ;*
        STAX    D
        INX     H
        INX     D
        DCR     B
        JNZ     D4
        XTHL
        MVI     C,DSTRING
        LXI     DE,DSPBUF
        CALL    BDOS
        POP     H
        POP     B
        DCR     C
        JNZ     D2
        MVI     C,2                     ;2 LINE FEEDS
D6:
        PUSH    B
        CALL    NEWLN
        POP     B
        DCR     C
        JNZ     D6
        LDA     SECTOR                  ;INCREMENT SECT NO
        INR     A
        STA     SECTOR
        CPI     40H                     ;IF SECT NO < 40H,
        JC      D1                      ;NEXT ACCESS
        XRA     A
        STA     SECTOR                  ;SECTOR NO = 0
        LDA     TRACK                   ;INCREMENT TRK NO
        INR     A
        STA     TRACK
        CPI     28H                     ;IF TRK NO < 28H,
        JC      D1                      ;NEXT ACCESS
        JMP     0                       ;JUMP TO SYSTEM
;
;       BINARY TO ASCII STRING
;
;       INPUT:  BINARY  <C>
;               BUFP    <DE>
;       OUTPUT: BUFP    <DE>
;
B2ASCII:
        PUSH    B                       ;
        MOV     A,C
        RLC
        RLC                             ;MOVE UPPER 4 BITS
        RLC                             ;TO LOWER 4 BITS
        RLC
        ANI     1111B                   ;MASK WITH 0FH
        CALL    B2A                     ;4 BIT BINARY -> ASCII
        STAX    D                       ;SET BUFFER
        INX     D                       ;UPDATE POINTER
        POP     B
        MOV     A,C
        ANI     1111B
        CALL    B2A
        STAX    D
        INX     D
        RET
;
;       4BIT BINARY TO ASCII
;
;       INPUT:  4BIT BINARY <A>
;       OUTPUT: ASCII   <A>
;
B2A:
        ADI     '0'                     ;ADD '0'
        CPI     '9'+1
        RC                              ;END IF '0' TO '9'
        ADI     'A'-'9'-1               ;ADD '7'
        RET
;
;       MAKE NEW LINE
;
;       INPUT/OUTPUT: NONE
;
NEWLN:
        MVI     C,DSTRING               ;
        LXI     D,NEWMSG
        CALL    BDOS
        RET                             ;
;
        RET                             ;
;
*24L24T
NEWMSG: DB      CR,LF,'$'
;
HEADMSG:
        DB      '       DRIVE ('
```

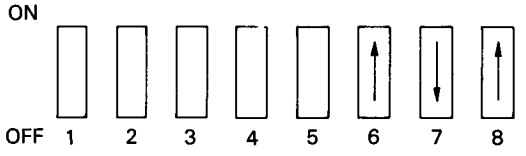
```
MDRIVE:  DB      0,0,') TRACK ('
MTRACK:  DB      0,0,') SECTOR ('
MSECTOR: DB      0,0,')',CR,LF,'$'
;
DRIVE:   DB      0                ;
TRACK:   DB      0                ;
SECTOR:  DB      0                ;
;
DSKBUF:  DS      128              ;
;
DSPBUF:  DS      78               ;
         DB      CR,LF,'$'        ;
;
         DS      100
STACK    EQU     $                ;
;
         END
```

Appendix G - QX-10 diagnostic programs

The QX-10 diagnostic program is supplied as an aid for locating and resolving a problem occuring during use of the QX-10 system. The user can easily check the system failure by executing this program.

1. Preparation

Before executing the diagnostic program, set the DIP switch at the back of the main unit.
The DIP switch position and settings are shown below.



Arrangement of DIP switches

Main memory	V-RAM	DIP switch position							
		1	2	3	4	5	6	7	8
192K	32K	X	X	X	X	X	ON	OFF	ON
	128K	X	X	X	X	X	OFF	OFF	ON
256K	32K	X	X	X	X	X	ON	OFF	OFF
	128K	X	X	X	X	X	OFF	OFF	OFF

X: any position

NOTE
In the explanation below, term "ENTER key" represents the RETURN key [←┘].

2. Operating procedures

2.1 Confirming the result of diagnostic program execution upon power-on sequence

(a) Make sure that the power switch is turned off, insert the power plug to the wall outlet, and turn on the system power switch. Wait for several seconds, the following message is displayed and the red LED on flexible disk drive A turns on.

INSERT DISKETTE

NOTE:
This message is not displayed when the color monitor is used.

(b) When the message above is displayed and the red LED on flexible disk drive A turns on, proceed with 2.2.

(c) When the red LED on the flexible disk drive A turns on but the message above is not displayed, make sure that the connector between the display unit and main unit are properly connected and adjust the brightness control knob at the back of the display unit.
When the message is displayed, proceed with 2.2.; otherwise, turn off the power. In the latter case since trouble with the display unit can be assumed, contact dealers or local offices.

(d) The following events indicate mulfunction of the CPU or trouble with the resident RAM. Turn off the power and contact dealers or local offices.

DIAGNOSTIC CODE 0001 0.01

* The message above is displayed and/or the buzzer sounds continuously.
* When neither the message is displayed, the buzzer sounds, nor the red LED on flexible disk drive A turns on, if the power lamp is turning on, mulfunction of the CPU can be assumed. When the power lamp turns off and the fans at the back of the main unit does not move, power unit failure can be assumed. Confirm that the wall outlet is alive by operating another electrical appliance with the outlet before this check.

DIAGNOSTIC CODE 0002 0.01

The message above indicating that the resident RAM is troubled is displayed and the buzzer sounds for about 1 second. When no message is displayed, check the connection between the display unit and the main unit and adjust the brightness control at the back of the display unit. Then, make sure that the message is normally displayed. If the message is not displayed, display unit trouble can also be assumed.

2.2 Disk insertion

Insert the flexible disk containing the diagnostic porgram in drive A. The diagnostic program is loaded and started. The display screen is cleared and write/read test for the video RAM is performed. When 128K-byte video RAM is tested, any message is displayed for about 30 seconds (10 seconds for 32K-byte video RAM).
When an error is detected for the video RAM, the buzzer sounds for about 2 seconds. (In this case, contact dealers or local offices.) Upon completion of the video RAM test (after 10 seconds for 32K-byte video RAM or about 30 seconds for 128K-byte video RAM), the following message is displayed.

```
Diagnostic Start Now.
```

2.3 Write/read test for the main memory (RAM)

Write/read test for the main memory (RAM) is performed according to the setting of the DIP switch at the back of the main unit. The bank number of the memory being currently accessed is displayed as follows:

```
MEMEORY TEST. Bank No. 0
```

If the test for that bank ends normally, "OK" is displayed following the bank number 0.

```
MEMEORY TEST. Bank No. 0 OK
```

When an error occurs during memory test, the following message is displayed.

```
DIAGNOSTIC CODE 0010 XX
```

XX is a 2-digit hexadecimal number indicating the errorneous RAM with corresponding bit as 1. For example, if XX is 41 (the binary number is 01000001), RAMs corresponding to bits 0 and 6 are troubled.
When an error is detected during memory test, the test for the current bank is terminated. Then, the program proceeds with the next bank indicated by the DIP switch settings. If test for all banks is terminated abnormally, the following message is displayed and the buzzer sounds for about 1 second.
Turn off the power switch and contact dealers or local offices.

```
DIAGNOSTIC CODE 0010     50
```

If no error occurs during memory test, proceed with the next test.

2.4 Keyboard auxiliary test

The validity of keys necessary to execute the diagnostic program is checked. The self test and interrupt of the keyboard is performed. If no interrupt or an unexpected interrupt occurs within 10 seconds, the following message is displayed.

```
DIAGNOSTIC CODE 0030 XX
```

XX indicates the interrupt condition. 88 indicates that no interrupt from the keyboard is generated.
If XX is neither 00, 88, nor FF, an unexpected interrupt is generated. When a normal interrupt is generated, the message above is not displayed. Then the program proceeds with the next step independently of the result of the keyboard self test.

```
Press The '1' Key__
```

Press '1' on the keyboard.

```
Press The '1' Key 1
```

The pressed key is displayed as shown above. If a key which is not specified is pressed or if the key code from the keyboard is not accepted normally, the error key is displayed as follows:

```
DIAGNOSTIC CODE 0035 XX
```

XX is a hexadecimal number which indicates the error key code. When XX is FF, this message indicates that invalid character code is input. When no operation occurs after an error message is displayed, check the connection between the keyboard and the main unit, press the system reset button at the right front of the main unit, and reexecute the keyboard auxiliary test from the beginning. If the second trial results in the same condition, contact dealers or local offices. Press one key out of numbers from 1 to 9 or alphabetic characters, and press the ENTER key according to the message. When an invalid key is pressed, an error message is displayed, which requests the key entry again.

2.5 Loading the diagnostic program

If no error results when the ENTER key is pressed during keyboard auxiliary test, the next diagnostic program is loaded. In this case, the flexible disk containing the diagnostic program must already be inserted in disk drive A. If the diagnostic program cannot be loaded normally, the following message is displayed.

```
DIAGNOSTIC CODE 01aa bb
```

or

```
DIAGNOSTIC CODE 02aa bb
```

When either of these messages is displayed, make sure that the flexible disk containing the diagnostic program is inserted properly in the disk drive. Then, press the reset button and reexecute the test from the beginning.
If the second trial results in the same condition, contact dealers or local offices.
When the flexible disk is not inserted in drive A, the following message is displayed and the program waits until the disk is ready.

```
FDD (Drive A) Not Ready
Insert DIAGNOSTIC FLOPPY In Drive A
```

When the flexible disk is ready, the program is automatically loaded.

2.6 Diagnostic program options

When the diagnostic program is loaded, the screen is cleared and the following menu is displayed.

```
THE QX-10 DIAGNOSTIC Copyright EPSON CORPORATION  -0101083182
Selection An Option
   1 : KEYBOARD TEST
   2 : DISPLAY TEST
   3 : FLOPPY TEST
   4 : PRINTER TEST
   5 : CMOS TEST
   8 : ALL TEST
   9 : EXIT TO SYSTEM FLOPPY DISK
   R : REPEAT TEST
Enter The Action Desired
```

Select one diagnostic program by entering the number of the program. R indicates that the test is executed repeatedly.

Up to 10 items can be entered before pressing the ENTER key. This function allows the tests to be programmed sequentially. When 10th item is entered, the program is automatically executed without accepting the ENTER key. 1 to 5, 8, 9, R, and the ENTER keys can be entered. When the ENTER is pressed without selecting any item, keyboard test, display test, flexible disk test, and printer test are performed for a single time. (This is the same for the case when 1, 2, 3, and 4 are selected.)

When "R" is entered from the keyboard, keyboard test, display test, flexible disk test, and printer test are performed repeatedly. (This is the same for the case when 1, 2, 3, 4, and R are selected.)
When 9 is entered, the diagnostic program execution is terminated and control is ready to be transferred to the CP/M. In this case, the screen is cleared and the following message is displayed.

```
Insert SYSTEM FLOPPY In Drive A And Press ENTER When Ready
```

Insert the system disk in drive A. When the drive is ready, press ENTER. After IPL execution, control is transferred to the CP/M command level.

Select one or more tests and enter the item numbers from the keyboard. When the number of items is 9 or less, be sure to press ENTER.

3. Keyboard test

3.1 Setting the type of keyboard

First, set the type of the keyboard. Once set, it cannot be reset unless IPL is performed.

```
Select KEYBOARD TYPE
    1 : ASCII TYPE
    2 : HASCII TYPE
    3 : JIS TYPE
TYPE (1, 2 Or 3)
```

Enter one of 1, 2 or 3 according to the type of the keyboard. (A number other than 1, 2, and 3 cannot be entered.) Select number 1, and the following confirmation message is displayed.

```
TYPE (1,2 Or 3)= 1 : ASCII TYPE
Type Correct ? (Y/N)
```

When the type of the keyboard is true, enter "Y" and press ENTER. When false, enter "N" and press ENTER. A message for keyboard selection is displayed again, then enter proper number.
When the type of the keyboard is other than ASCII, proceed with the next subsection 3.2.

When ASCII is selected, the following menu for country selection is given.

```
Select ASCII Type
    1 : US ASCII
    2 : ENGLISH
    3 : GERMAN
    4 : FRENCH
    5 : ITALIAN
    6 : SPANISH
    7 : DANISH
    8 : SWEDEN
TYPE =__
```

Select a number from 1 to 8.

```
TYPE = 3 : GERMAN
Type Correct ? (Y/N)__
```

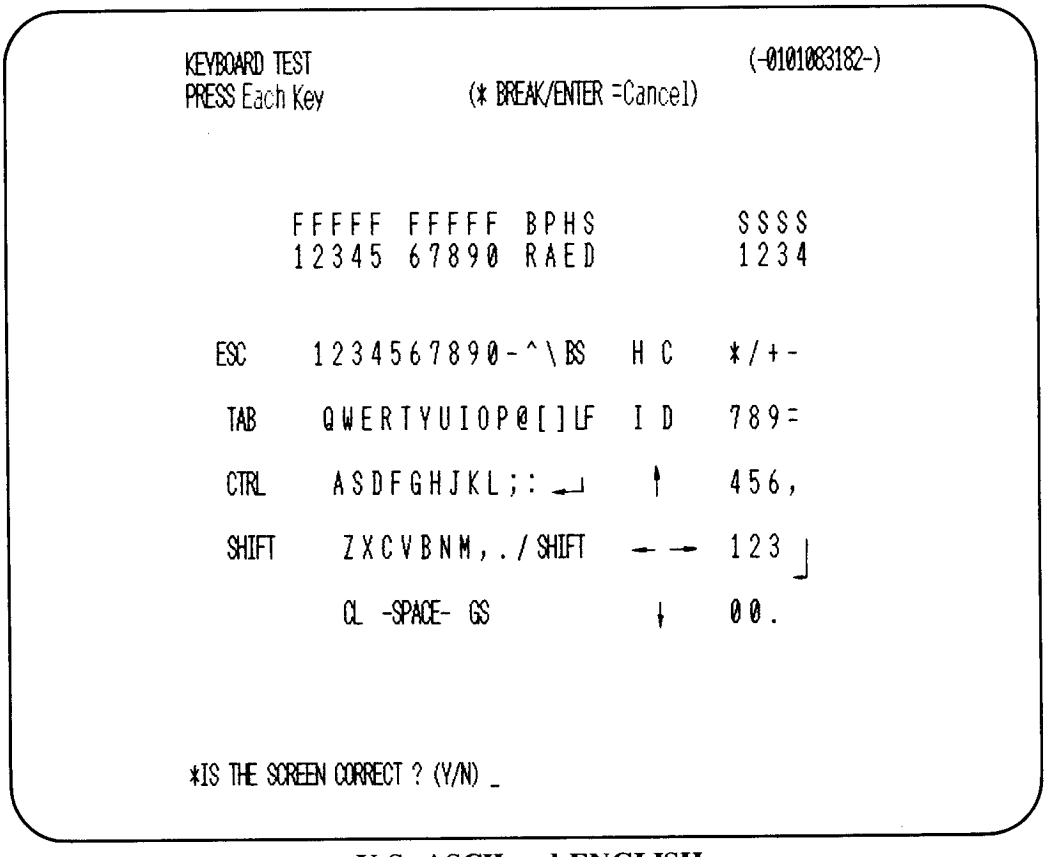
When the confirmation message is displayed, enter the corresponding key (Y or N) and press ENTER. If the N key is pressed, the country selection menu is displayed again.

3.2 The following message for keyboard test is displayed.

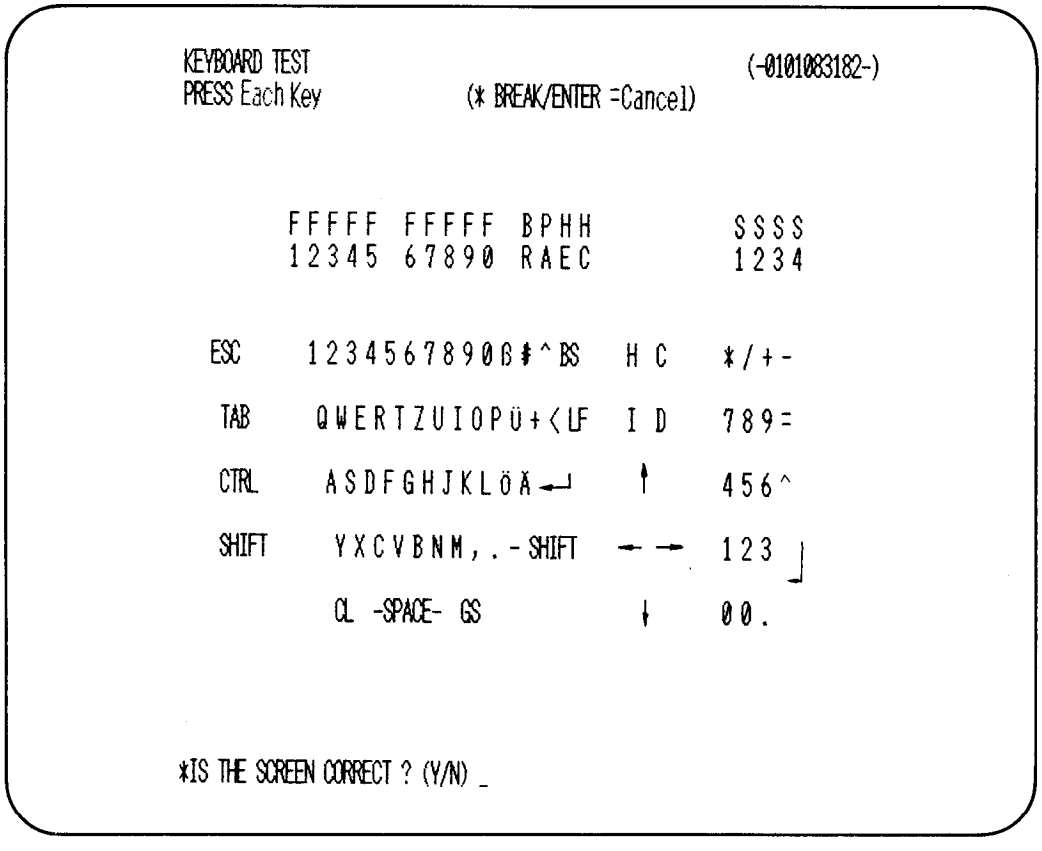
```
KEYBOARD TEST                (-0102020183-)
Press Each key (*BREAK/ENTER = Cancel)



* Is The Screen Correct ? (Y/N)__
```

3.3 Execution

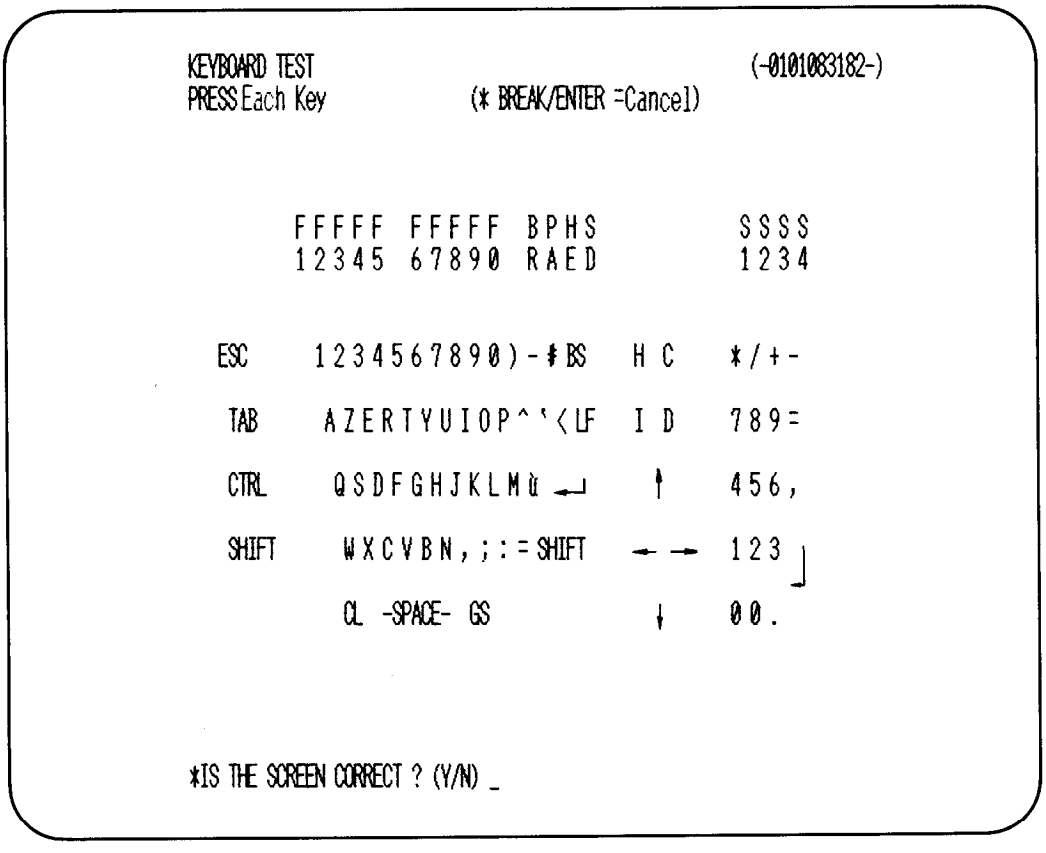
Press all keys on the keyboad. Then the following result is displayed on the screen. Typamatic keys blink when pressed continuously.



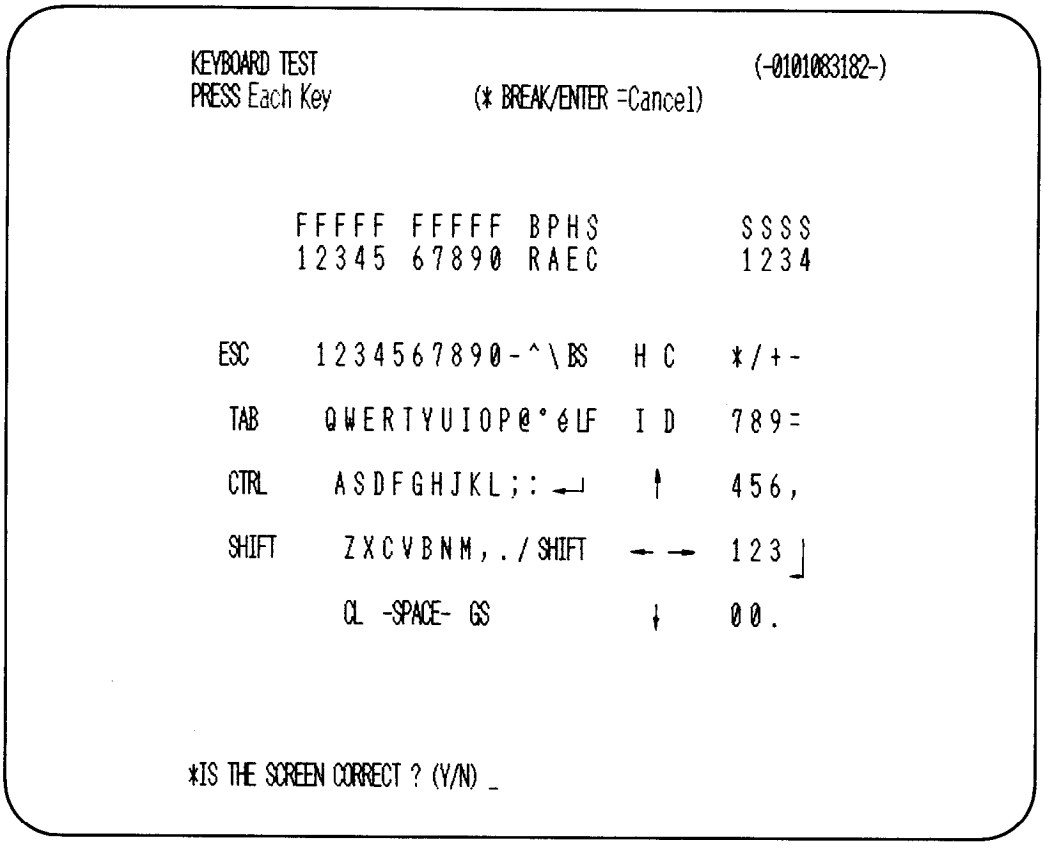
U.S. ASCII and ENGLISH


KEYBOARD TEST
PRESS Each Key
(* BREAK/ENTER =Cancel)
(-0101083182-)
FFFFF FFFFF BPHH SSSS
12345 67890 RAEC 1234
ESC 1234567890ß´^ BS H C */+-
TAB QWERTZUIOPÜ+< LF I D 789=
CTRL ASDFGHJKLÖÄ 456^
SHIFT YXCVBNM,.-SHIFT 123
CL -SPACE- GS 00.
*IS THE SCREEN CORRECT ? (Y/N) _

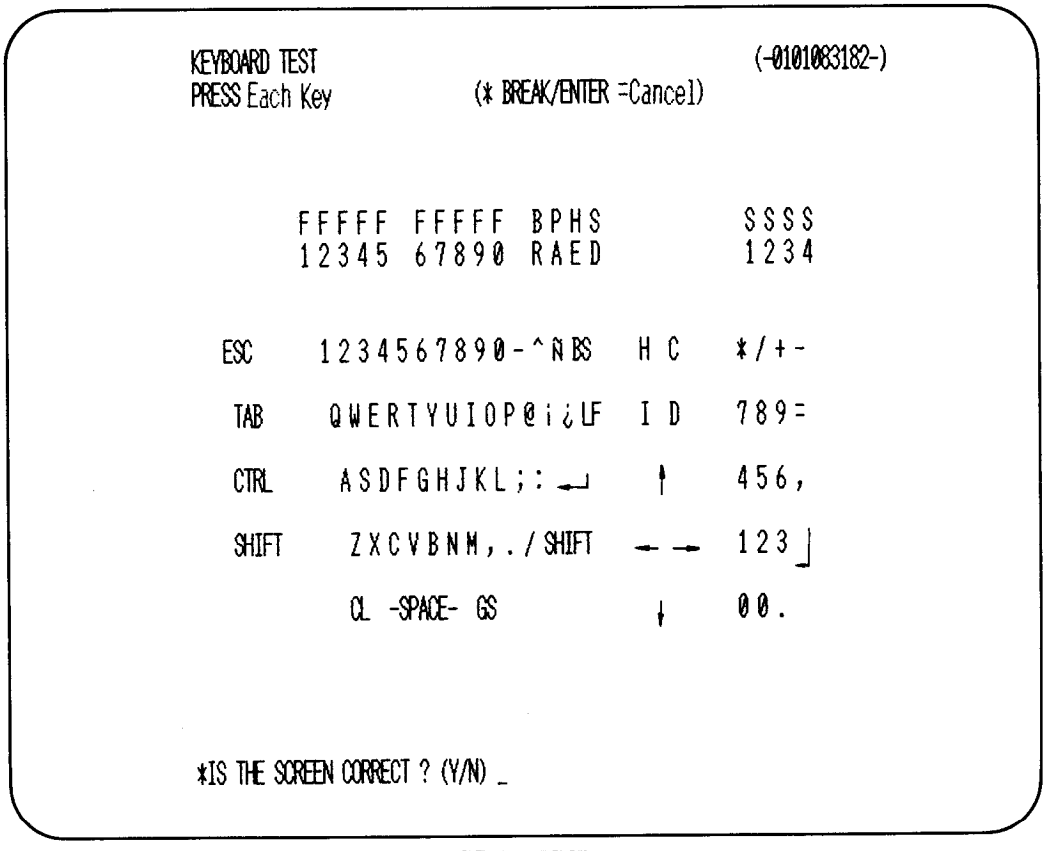
GERMAN


KEYBOARD TEST
(-0101083182-)
PRESS Each Key
(* BREAK/ENTER =Cancel)
FFFFF FFFFF BPHS
SSSS
12345 67890 RAED
1234
ESC 1234567890)-# BS H C */+-
TAB AZERTYUIOP^ ` < LF I D 789=
CTRL QSDFGHJKLM% 456,
SHIFT WXCVBN,;:= SHIFT 123
CL -SPACE- GS 00.
*IS THE SCREEN CORRECT ? (Y/N) _

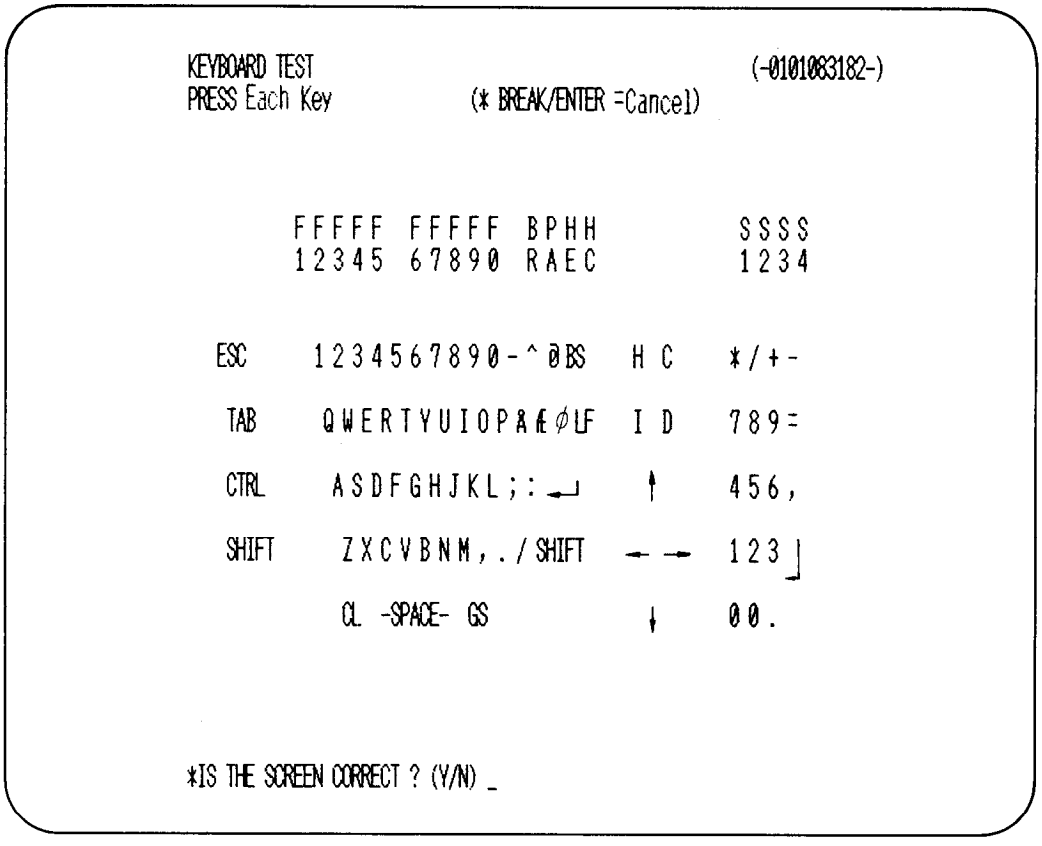
FRENCH


KEYBOARD TEST
(-0101083182-)
PRESS Each Key
(* BREAK/ENTER =Cancel)
FFFFF FFFFF BPHS
SSSS
12345 67890 RAEC
1234
ESC 1234567890-^\BS H C */+-
TAB QWERTYUIOP@°éLF I D 789=
CTRL ASDFGHJKL;: 456,
SHIFT ZXCVBNM,./SHIFT 123
CL -SPACE- GS 00.
*IS THE SCREEN CORRECT ? (Y/N) _

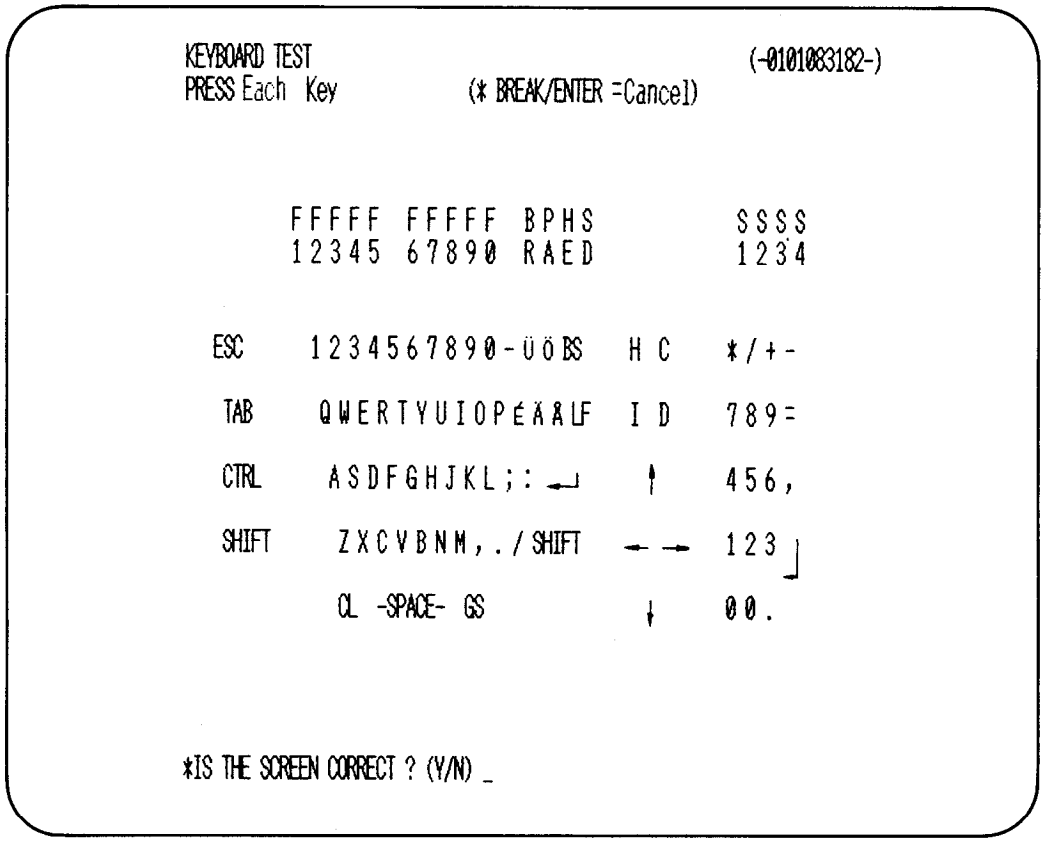
ITALIAN


KEYBOARD TEST
(-0101083182-)
PRESS Each Key
(* BREAK/ENTER =Cancel)
FFFFF FFFFF BPHS
12345 67890 RAED
SSSS
1234
ESC 1234567890-^ÑBS H C */+-
TAB QWERTYUIOP@¡¿LF I D 789=
CTRL ASDFGHJKL;: 456,
SHIFT ZXCVBNM,./SHIFT 123
CL -SPACE- GS 00.
*IS THE SCREEN CORRECT ? (Y/N) _

SPANISH


KEYBOARD TEST
(-0101083182-)
PRESS Each Key
(* BREAK/ENTER =Cancel)
FFFFF FFFFF BPHH SSSS
12345 67890 RAEC 1234
ESC 1234567890-^@BS H C */+-
TAB QWERTYUIOPÅ¨ØLF I D 789=
CTRL ASDFGHJKL;: 456,
SHIFT ZXCVBNM,./SHIFT 123
CL -SPACE- GS 00.
*IS THE SCREEN CORRECT ? (Y/N) _

DANISH


KEYBOARD TEST
(-0101083182-)
PRESS Each Key
(* BREAK/ENTER =Cancel)
FFFFF FFFFF BPHS
12345 67890 RAED
SSSS
1234
ESC 1234567890-ÜÖ BS H C */+-
TAB QWERTYUIOPÉÄÅLF I D 789=
CTRL ASDFGHJKL;: ↵ 456,
SHIFT ZXCVBNM,./SHIFT ← → 123
CL -SPACE- GS 00.
*IS THE SCREEN CORRECT ? (Y/N) _

SWEDISH

When an invalid key code is accepted, the following message is displayed.

```
DIAGNOSTIC CODE 0035 aa
```

"aa" indicates the invalid key code. When the type of the keyboard is not set properly, pressing some keys may result in the same message. In this case, press the reset button and perform keyboard setting. The following message is displayed under the previous message.

```
* Continue ? (Y/N)
```

Make sure that the keyboard and the main unit are connected properly. Then, enter "Y" key and press ENTER. The screen is cleared and the keyboard test screen is displayed again. Press any key. If the same message indicating the invalid code is displayed again, press the BREAK and ENTER keys.

```
Cancel Command Complete
```

The test is cancelled with the above message. Then the menu is displayed again. Press all keys if screen is displayed as shown previously, enter "Y" and press ENTER and menu is displayed. Otherwise, enter "N" and press ENTER.

If the keyboard test is to be done again, enter "Y" and press ENTER. Otherwise, enter "N" and press ENTER to proceed with the subsequent test specified in the menu. If no test is specified, menu is displayed.

4. Display Test

4.1 Display attribute test

Checks that characters are properly displayed according to the attribute.

Normal characters (020H to 0FFH).
Intensified characters (020H to 0FFH).
Inversed characters (020H to 0FFH).
Blink characters (020H to 0FFH).

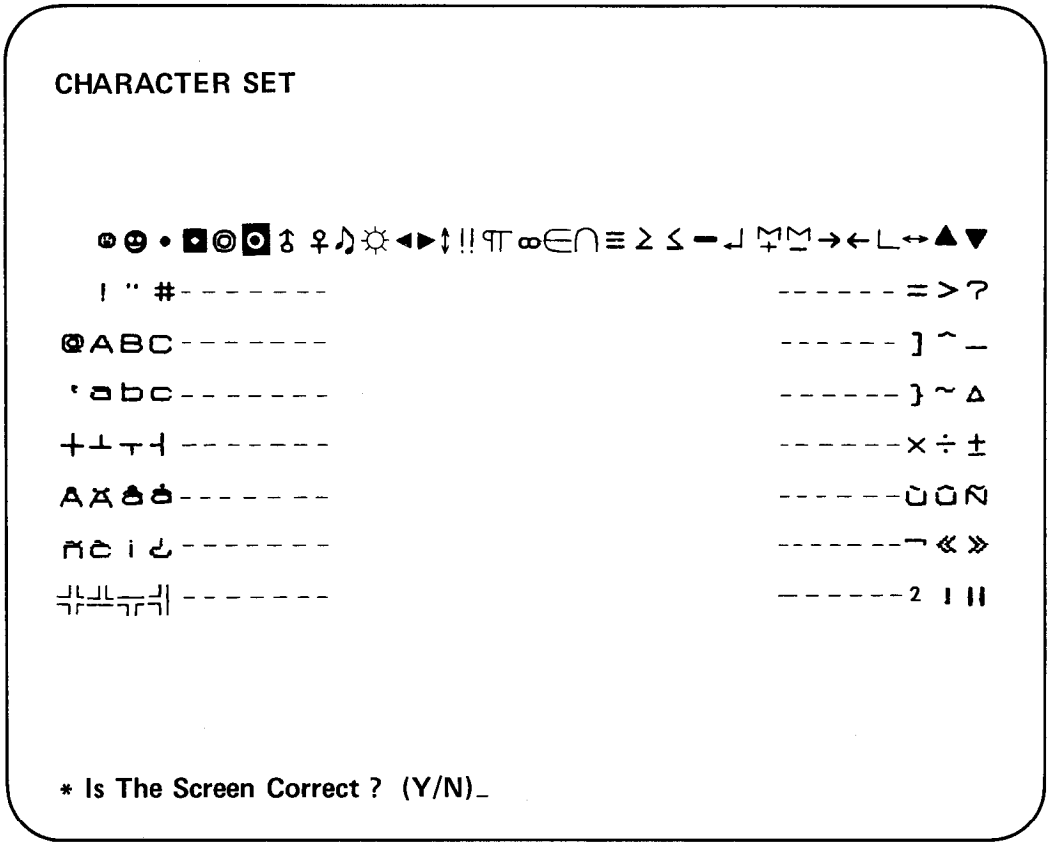
If characters are displayed according to the specified attribute, enter Y and press ENTER to proceed with the next subsection 4.2. Otherwise, enter N and press ENTER. In the latter case, the following message is displayed.

```
DIAGNOSTIC CODE 0040 10
* Continue ? (Y/N)
```

When the following display tests (from 4.2 on) are to be performed subsequently, enter Y and press ENTER; otherwise, enter N and press ENTER to proceed with the next test specified in the menu or return to the menu. In addition to Y and N keys, the BREAK key can be entered. When the BREAK key is pressed, the test is cancelled and the following message is displayed; afterwards, the menu is redisplayed.

```
Cancel Command Complete
```

4.2 All character display



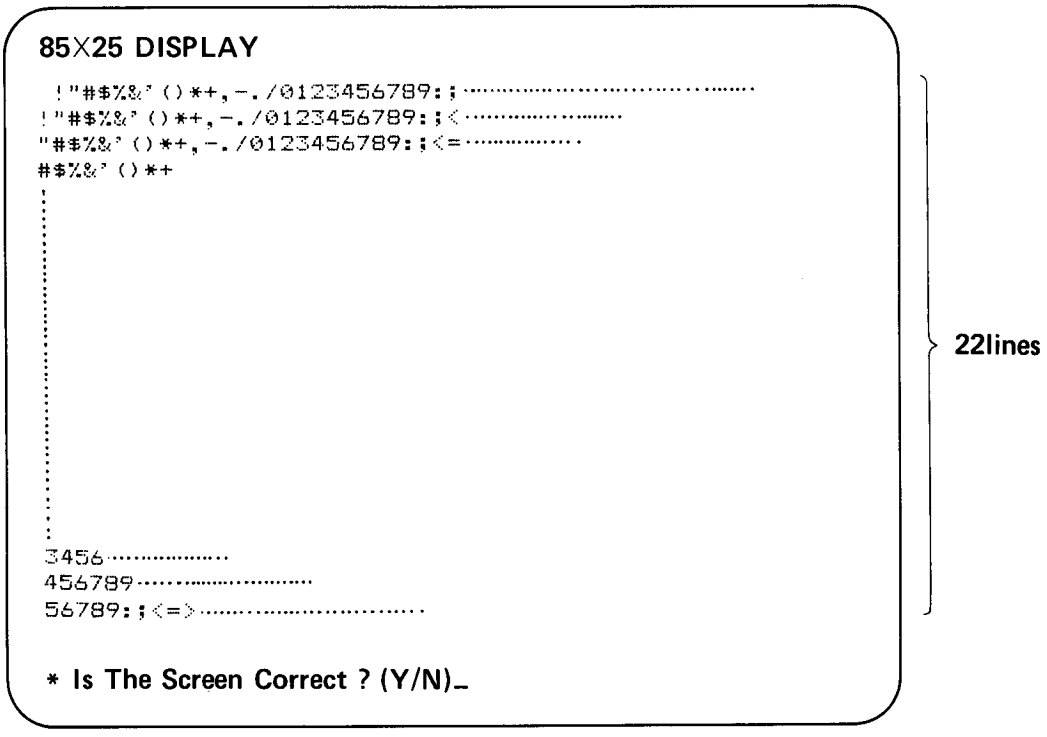
Tests that the entire character set is displayed properly. If the entire character set is displayed properly, enter Y and press ENTER; otherwise, enter N and press ENTER. In the latter case, the following message is displayed.

```
DIAGNOSTIC CODE 0040 11
* Continue ? (Y/N)
```

When the following display tests (from 4.3 on) are to be performed subsequently, enter Y and press ENTER. Otherwise, enter N and press ENTER to proceed with the next test specified in the menu or to return to the menu. If the BREAK key is pressed, the test is cancelled and the following message is displayed; afterwards, the menu is redisplayed.

```
Cancel Command Complete
```

4.3 Entire screen (80 × 25) display



If 22 lines (80 characters per line) are displayed properly, enter Y and press ENTER; otherwise, enter N and press ENTER. In the latter case, the following message is displayed.

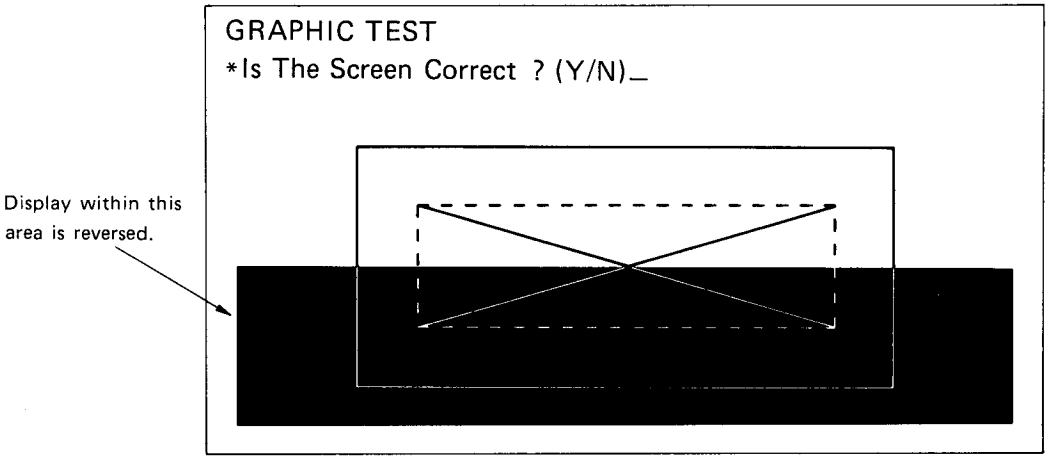
```
DIAGNOSTIC CODE 0040 12
* Continue ? (Y/N)
```

When the following display tests (from 4.4 on) are to be performed, enter Y and press ENTER. Otherwise, enter N and press ENTER to proceed with the next test specified in the menu or to return to the menu. If the BREAK key is pressed, the test is cancelled and the following message is displayed; afterwards, the menu is redisplayed.

```
Cancel Command Complete
```

4.4 Graphic display

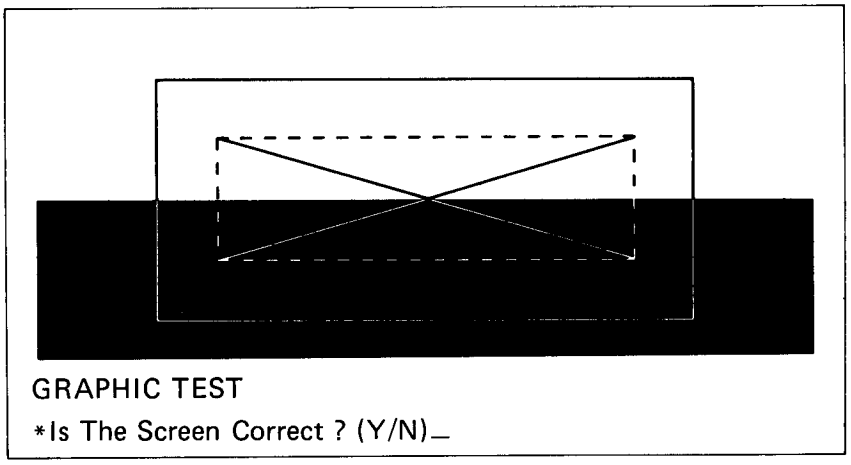
The upper 6 lines are set to be in characrter mode and the lower 19 lines are set to be in graphic mode. Characters and graphic are displayed simultaneously as shown below.



If the screen is as shown above, enter Y and press ENTER; otherwise, enter N and press ENTER. In the latter case, the screen is cleared and the following message is displayed.

```
DIAGNOSTIC CODE 0040      14
* Continue ? (Y/N)__
```

When the following display tests are to be performed, enter Y and press ENTER. Otherwise, enter N and press ENTER to proceed with the next test specified in the menu or to return to the menu.



In the former case, the screen is cleared and charcters and graphic are displayed simultaneously as shown below.
If the screen is as shown above, enter Y and press ENTER; otherwise, enter N and press ENTER. In the latter case, the screen is cleared and the following message is displayed.

```
DIAGNOSTIC CODE 0040 14 * Continue ? (Y/N)
```

When the following display test (from 4.5 on) are to be performed, enter Y and press ENTER. Otherwise, enter N and press ENTER to proceed with the next test specified in the menu or to return to the menu.

If the BREAK key is pressed, the test is cancelled and the following message is displayed; afterwards, the menu is redisplayed.

```
Cancel Command Complete
```

4.5 Enlarged character display

```
Zoom Test
```

The characters above are enlarged up to 16 times as large as the initial size. When the maximum characters are displayed, the initial size characters are displayed after about 1 second later as follows:

```
Zoom test
* Is The Screen Correct ? (Y/N)
```

When enlarged character are displayed, enter Y and press ENTER; otherwise, enter N and press ENTER. In the latter case, the following message is displayed.

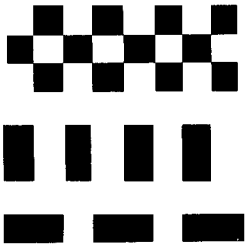
```
DIAGNOSTIC CODE 0040     16
* Continue ? (Y/N)
```

If the following display tests (from 4.6 on) are to be performed, enter Y and press ENTER. Otherwise, enter N and press ENTER to proceed with the next test specified in the menu or return to the menu.
If the BREAK is pressed, the test is cancelled and the following message is displayed; afterwards, the menu is redisplayed.

```
Cancel Command Complete
```

4.6 Enlarged graphic pattern display

The graphic pattern below is displayed.



The 8 × 8 dot pattern is enlarged up to 16 times as large as the original size. About 1 second later since the largest graphic pattern is displayed, the following message is displayed.

```
* Is The Screen correct ? (Y/N)
```

If the graphic pattern is displayed properly, enter Y and press ENTER. Otherwise, enter N and press ENTER. In the latter case, the following message is displayed.

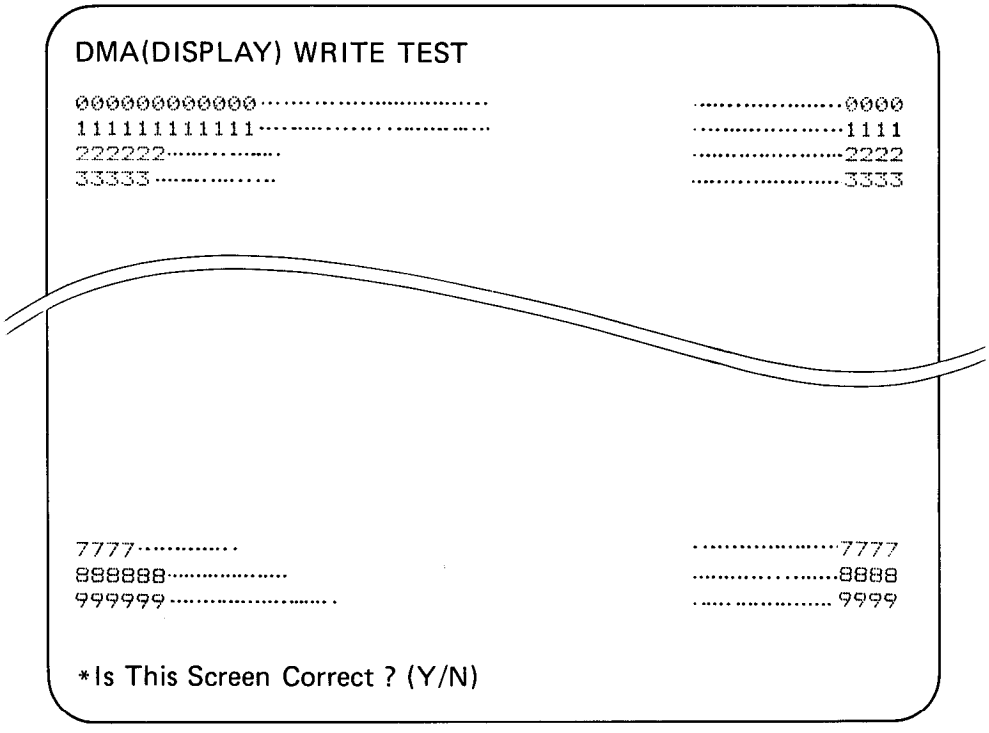
```
DIAGNOSTIC CODE 0040     18
* Continue ? (Y/N)
```

If the following display tests (from 4.7 on) are to be performed, enter Y and press ENTER. Otherwise, enter N and press ENTER to proceed with the next test specified in the menu or return to the menu. If the BREAK key is pressed, the test is cancelled and the following message is displayed; afterwards, the menu is redisplayed.

```
Cancel Command Complete
```

4.7 Displaying and reading character data by means of direct memory access (DMA)

The following character data is displayed by means of DMA.



If numbers from 0 to 9 are displayed twice (20 lines for total; each number is displayed repeatedly for each line), enter Y and press ENTER. Otherwise, enter N and press ENTER. In the latter case, the following message is displayed.

```
DIAGNOSTIC CODE 0040    20
* Continue ? (Y/N)
```

If the following read test in which DMA is used is to be performed, enter Y and press ENTER. Otherwise, enter N and press ENTER to proceed with the next test specified in the menu or return to the menu. If the BREAK key is pressed, the test is cancelled and the menu is redisplayed.
Next, character data is displayed without using DMA.

```
DMA(DISPLAY) READ TEST
0000000000000000000000000000000000000000000000000000000000000000
1111111111111111111111111111111111111111111111111111111111111111
2222222222222222222222222222222222222222222222222222222222222222
3333333333333333333333333333333333333333333333333333333333333333
4444444444444444444444444444444444444444444444444444444444444444
5555555555555555555555555555555555555555555555555555555555555555
6666666666666666666666666666666666666666666666666666666666666666
7777777777777777777777777777777777777777777777777777777777777777
8888888888888888888888888888888888888888888888888888888888888888
9999999999999999999999999999999999999999999999999999999999999999
0000000000000000000000000000000000000000000000000000000000000000
1111111111111111111111111111111111111111111111111111111111111111
2222222222222222222222222222222222222222222222222222222222222222
3333333333333333333333333333333333333333333333333333333333333333
4444444444444444444444444444444444444444444444444444444444444444
5555555555555555555555555555555555555555555555555555555555555555
6666666666666666666666666666666666666666666666666666666666666666
7777777777777777777777777777777777777777777777777777777777777777
8888888888888888888888888888888888888888888888888888888888888888
9999999999999999999999999999999999999999999999999999999999999999
*Is The Screen Correct ? (Y/N)_
```

The screen is the same as that for the preceding test which displays character data on the screen by means of DMA. If the characters are properly displayed, enter Y and press ENTER; otherwise, enter N and press ENTER. In the latter case, the following message is displayed.

```
DIAGNOSTIC CODE 0040     12
* Continue ? (Y/N)
```

If the next display test (4.8) is to be performed, enter Y and press ENTER.

Otherwise, enter N and press ENTER to proceed with the next test specified in the menu or return to the menu. If Y and ENTER keys are pressed in response to the message above, the data displayed on the screen is read by means of DMA and is compared with the original data. If an inconsistency occurs, the following message is displayed.

```
DIAGNOSTIC CODE 0040     22
* Continue ? (Y/N)
```

If the following test (4.8) is to be performed, enter Y and press ENTER. Otherwise, enter N and press ENTER to proceed with the next test or return to the menu. If the BREAK key is pressed, the menu is redisplayed.

4.8 Random data display

The following message is displayed. The screen is still filled with the character data.

```
DISPLAY RANDOM DATA
```

Following this message, the defined character set is displayed. Each character is displayed repeatedly for 3 lines (80×3 = 240 characters). Undefined codes are not displayed.

Upon completion of random display of the entire character set, 3-line display mode is restarted. This random and 3-line display is performed repeatedly. To end this test, press the BREAK. The display operation is cancelled and the following message is displayed.

```
* Continue ? (Y/N)
```

If the test 4.8 is to be performed again, enter Y and press ENTER. Otherwise, enter N and press ENTER to proceed with the next test specified in the menu or return to the menu. If the BREAK key is pressed, the menu is redisplayed.

5. Flexible Disk Test

The flexible disk test is performed by writing data to it. Prepare at least one flexible disk. Initially, the following message is displayed.

```
FLOPPY TEST                                    (-0101083182-)
***** WARNING *****
DATA WILL BE DESTROYED

Insert SCRATCH FLOPPY In Drive A And Press ENTER when Ready
_
```

Insert a floopy disk in drive A (the data on the flexible disk can be destroyed) and push the button. When the drive is ready, press ENTER key. If flexible disk test is not performed, press "P" instead of the ENTER key. When the ENTER key is pressed, the disk is formatted and the track number of the track being currently accessed is displayed as follows:

```
Current Track 0 1__
```

All tracks are formatted and data is written and read for all tracks. When an error is detected, the following message is displayed. This message is used commonly for all flexible disk tests.

```
   DIAGNOSTIC CODE 01aa bb
or DIAGNOSTIC CODE 02aa bb
or DIAGNOSTIC CODE 03aa bb
```

"aa" and "bb" indicate the condition for error detection.
Following this message, the condition message is displayed.
There are following types of condition messages. See messages in Section 8 for details.

FDD (Drive X) TIME OUT
FDD (Drive X) EQUIPMENT CHECK
FDD (Drive X) BAD ADDRESS MARK
FDD (Drive X) REC NOT FOUND
FDD (Drive X) BAD CRC (ID)
FDD (Drive X) BAD CRC (DATA)
FDD (Drive X) NO CYLINDER
FDD (Drive X) BAD CYLINDER
FDD (Drive X) WRITE PROTECT
FDD (Drive X) NOT READY

FDD (Drive X) WRITE PROTECT

FDD (Drive X) NOT READY

The following message is displayed for the 2 messages above.

```
Insert SCRATCH FLOPPY In Drive X And Press ENTER When Ready
```

This message indicates that a write protect tab is attached to the flexible disk or the disk drive is not ready. Make sure that the disk drive is ready for write operation and press ENTER. In this case, P cannot be entered. If an inconsistency occurs with write data and read data, the following message is displayed.

```
DATA COMPARE ERROR OCCURED
* Continue ? (Y/N)__
```

If subsequent tracks are to be tested, enter Y and press ENTER. Otherwise, enter N and press ENTER. Upon completion of test for drive A, perform the same test for drive B.

```
Insert SCRATCH FLOPPY In Drive B and Press ENTER When Ready
```

Insert the flexible disk whose data can be discarded in drive B and push the button. When the drive is ready, press ENTER. If test is not performed for disk drive B, enter P instead of the ENTER key. Test for drive B can be done in the same manner as that for drive A. Upon completion of drive B test, copy test for drives A and B is started.

```
Insert SCRATCH FLOPPY In All Drives And Press ENTER When Ready
```

Insert flexible disks whose data can be discarded in drives A and B and push the button. When both drives are ready, press ENTER. If test is not performed for drives A and B, enter P instead of the ENTER key.
Proceed with the next random test. Data on disk is copied from drive A to B.

```
COPY TEST. A → B
```

When an error is detected, a message is displayed as is the case for drive A test. When copy is completed, the following message is displayed.

```
Continue ? (Y/N)
```

Enter Y and press ENTER to copy data from drive B to A; enter N and press ENTER to start the random test. In the former case, the following message is displayed and the copy test is started.

```
COPY TEST. B → A
```

Upon completion of copying from drive B to A, the following random test is started.

```
FDD RANDOM ACCESS TEST
Insert SCRATCH FLOPPY In All Drives And Press ENTER When Ready
```

Insert flexible disks whose data can be discarded in drives A and B, and push the button. When both drives are ready, press ENTER. If this random test is not performed, enter P instead of the ENTER key.

In this case, the flexible disk test is terminated; afterwards, the next test specified in the menu is started and the menu is redisplayed. If an error is detected during this test, the processing is continued. To terminate the test, press the BREAK key. The number of errors detected is displayed as follows:

```
Drive A Error Count = aa
Drive B Error Count = bb
* Continue ? (Y/N)
```

The symbols "aa" and "bb" indicate the numbers of errors detected.
To terminate the test, enter N and press ENTER. The next test specified in the menu is started or the menu is redisplayed.

If Y is entered and the ENTER key is pressed, the random test is performed. During flexible disk test, if the BREAK key is pressed when the keyboard is in a wait state, the test is cancelled and the menu is redisplayed.

6. Printer test

When the printer test is selected, the following will be displayed, asking you to select the size of paper to be used for the test.

```
PRINTER TEST (0101090982-)
Select LIST SIZE
1:   80 Characters/Line
2:  136 Characters/Line
SIZE (1 or 2) =
```

Press 1 to select a paper size of 80 characters per line and 2 to select a paper size of 136 characters per line. ENTER is not necessary.

(1) Reset

Printer reset is performed. This takes approx. 1 sec. The following message is displayed to show that the printer is ready.

```
Press ENTER When Printer Is Ready
```

(2) Test procedure

CR (carriage return), LF (line feed), VT (vertical tab), FF (form feed), Shift In, Shift Out, character and bit image printing as well as continuous character printing are all performed. Continuous printing will continue until BREAK is input.
During the tests described above, the current test item is displayed as follows as each test is performed.

```
CR3     (Carriage return)
LF 3    (Line Feed)
VT 3    (Vertical Tabulation)
FF      (Form Feed)
Shift In
Shift Out
Shift In & Shift Out
Character
Bit Image
Bit Image
* Is The List Correct?
```

(3) Error messages

During print execution, if an error, or a condition in which printing is not possible, is detected, one of the following messages will be displayed.

```
PRINTER OFF LINE
```

The printer is off line.

PRINTER POWER OFF

Power is not being supplied to the printer.

PRINTER NOT READY

The printer is not in the ready state.

PRINTER PAPER END

There is no paper set in the printer. In the above cases, the following message will be displayed.

Press ENTER When Printer Is Ready

This indicates that you should input ENTER after you have put the printer in the ready state by correcting the condition indicated in the error message.
At this point, input BREAK to cancel the test and perform the next test as specified by a command or the menu.
When the source of the error is a hardware malfunction, one of the following messages will be displayed.

PRINTER HARDWARE ERROR

This indicates a malfunction in the printer.

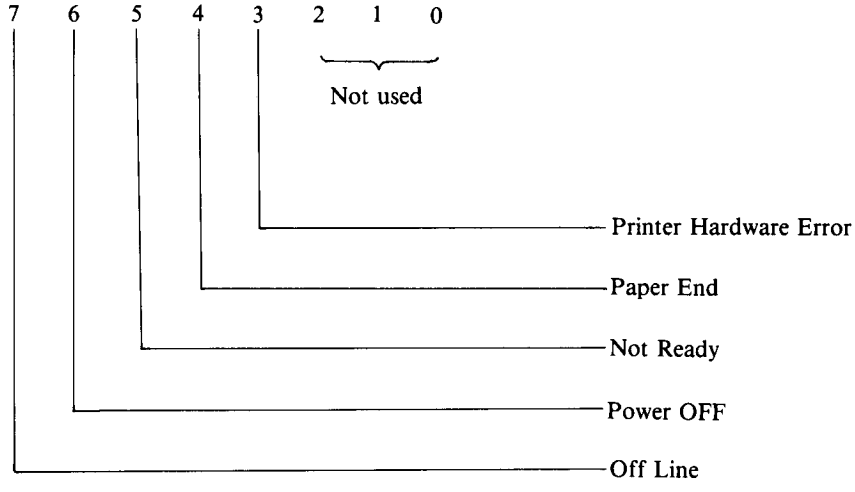
PRINTER TIME OUT

The printer cannot print even after waiting the fixed time. When either of the above errors occur, the following message will be displayed.

DIAGNOSTIC CODE 0050 aa

aa is a two-digit hex code indicating the status of the printer at the time the error occurs.

The values of each bit of aa denote the following.



Then, the following message will be displayed.

```
* Continue? (Y/N)
```

If you input Y ENTER, processing will continue.
Input N ENTER to execute the next test as specified by the menu or a command.
Before each of the printer tests is executed, the contents of the test will be displayed.
When the following message is displayed,

```
* Is The List Correct?
```

Input Y ENTER if the list is correct, and N ENTER if it is not. Press BREAK to return to the menu display.
If you input Y ENTER, continuous printing will be performed.
If you input N ENTER, the following message will be displayed.

```
* Continue? (Y/N)
```

Input Y ENTER to perform continuous printing and N ENTER to end the test.
The following message is displayed when the BREAK key is pressed during continuous printing.

```
* Continue? (Y/N)
```

Press the N key and ENTER to proceed with the subsequent test specified in the menu or to return to the menu.

If the Y key and ENTER are pressed, character codes from 020H ((32)D) to 07EH ((126)D) are printed continuously until the BREAK key is pressed. The following message is displayed when the BREAK key is pressed.

```
* Continue? (Y/N)
```

Press the Y key and ENTER to restart the printer test from the beginning.
Press the N key and ENTER to proceed with the next test specified in the menu or to return to the menu.

The results of test execution using an MX-80 TYPE III are shown below.

```
CR 1 CR 2 CR 3

LF 1
LF 2

LF 3



VT 1
VT 2

VT 3


Form Feed
```

Shift In

Shift Out

Shift In & Shift OUT

```
 !"#$%&'()*+,-./
0123456789:;<=>?
@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_
`abcdefghijklmno
pqrstuvwxyz{|}~
```

```
EEEEEEE PPPPPP    SSSSS    OOOOO  N      N
E       P     P S      S O      O NN     N
E       P     P S        O      O N N    N
EEEEEE  PPPPPP    SSSSS  O      O N   N  N
E       P              S O      O N    N N
E       P       S      S O      O N     NN
EEEEEEE P         SSSSS    OOOOO  N      N
```

```
EEEEEEE PPPPPP    SSSSS    OOOOO  N      N
E       P     P S      S O      O NN     N
E       P     P S        O      O N N    N
EEEEEE  PPPPPP    SSSSS  O      O N   N  N
E       P              S O      O N    N N
E       P       S      S O      O N     NN
EEEEEEE P         SSSSS    OOOOO  N      N
```

```
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
N
```

BREAK key was pressed to stop printing.

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwx
```

7. CMOS RAM Test

This is a test for write/read and battery back-up of the CMOS RAM.
Since data will be written to CMOS RAM in this test, the following message is displayed to warn you that the data in the CMOS RAM will be lost.

```
CMOS TEST              (-01010927829-)
***** WARNING *****
DATA WILL BE DESTROYED
Press The ENTER Key
```

If you wish to execute the test, press the ENTER key, if you do not wish to execute the test, press the BREAK key to return to the menu display.

(1) Write/read test for the CMOS RAM

In this test, the CMOS RAM is enabled and data FFH is written to all addresses. Then, the data is read to check if FFH has been correctly written into all addresses. If all the addresses contain FFH, data 0 is then written and read for all addresses. The following message appears if the data read is not the same as the data written.

```
DIAGNOSTIC CODE 0060 aa
```

aa is a 2-digit hex code in which only those bits in which there is a discrepancy between the data read and the data written appear as 1s.

Example

aa = 20H = 0010 0000B

This shows that the data read in bit 5 does not match the data written.
Also, the following message will be displayed to confirm the error.

```
CMOS WRITE/READ ERROR
Press The ENTER Key
```

At this time, if you press the ENTER key, the next test as specified by the menu or by a command will be executed. Press the BREAK key to return to the menu display. Only input of the above-mentioned keys will be accepted.
If the CMOS RAM is found to be in proper state, a test of the battery back-up will be performed.

(2) CMOS RAM battery back-up test

In this test, the following message will be displayed first.

```
Turn OFF The Dip Switch Bit 5
```

Set DIP SW 5 located at the back of the QX-10 to the OFF position. The program will loop until this DIP SW is turned OFF. The following message is displayed when DIP SW 5 is turned OFF.

```
Turn OFF The Power Switch And Turn ON After 5 Minutes
```

Turn the power OFF, according to the message.
To cancel this test, return the DIP SW which you had just set to the ON position and press the BREAK key to return to the menu display. Pressing any other keys at this time will cause misoperation.
Turn the power ON again after waiting for 5 minutes, and the menu display will be skipped and the following will be displayed directly.

```
CMOS TEST
Turn ON The Dip Switch Bit 5
```

When this is displayed, return DIP SW 5 to the ON position. The CMOS RAM will be enabled and a check will be performed to ascertain whether data 5AH still remains in all addresses. If a value other than 5AH is encountered, the following message will be displayed to show the back-up failure.

```
DIAGNOSTIC 0065 aa
CMOS (Battery Back-up) FAULT
```

aa is a 2-digit hex code in which the bits that differ from data 5AH appear as 1s.
If the CMOS RAM was properly backed-up, the following message is displayed.

```
CMOS (Battery Back-up) NORMAL
```

The following message will be displayed whether an error was detected or not to disable the CMOS RAM and confirm the battery backup test.

```
Press The ENTER Key
```

Press the ENTER or BREAK key to return to the menu.

8. Message list

8.1 DIAGNOSTIC CODE aaa bb

aaaa	Meaning	bb	Remarks
0000	Test following power on has been normally completed.	None	
0001	Abnormal CPU operation	None	Test stopped.
0002	Resident RAM W/R error	None	Test stopped.
0010	Main memory W/R error	Hexadecimal number whose ''1'' bits indicate defective RAM chips in main memory.	
		bb = 50: W/R error in all banks	Test stopped.
0030	Keyboard interrupt error	Error caused by interrupt code	
		bb = 88: Interrupt time out	
0035	Keyboard data error	Error key code	
		bb = EE Input not possible for some key	
0040	Display error	bb = 10: Attribute error	
		bb = 11: Display error for the entire character set	
		bb = 12: Display error for the eitire screen	
		bb = 14: Graphic/character display error	
		bb = 16: Character zoom error	
		bb = 18: Graphic zoom error	
		bb = 20: DMA write error	
		bb = 22: DMA read error	
0050	Printer error	Error condition	See Section 6.
0060	CMOS RAM W/R error	Hexadecimal number whose ''1'' bits indicate defective RAM chips in main memory.	
0065	CMOS RAM battery backup error	Hexadecimal number whose ''1'' bits indicate defective RAM chips in main memory.	
01aa	Flexible disk drive test error	bb = command, aa = error condition	Explained below.
02aa	Flexible disk drive time out	bb = command, aa = error condition	Explained below.
03aa	Flexible disk drive hardware trouble	bb = command, aa = error condition	Explained below.

8.2. Other printer test error message

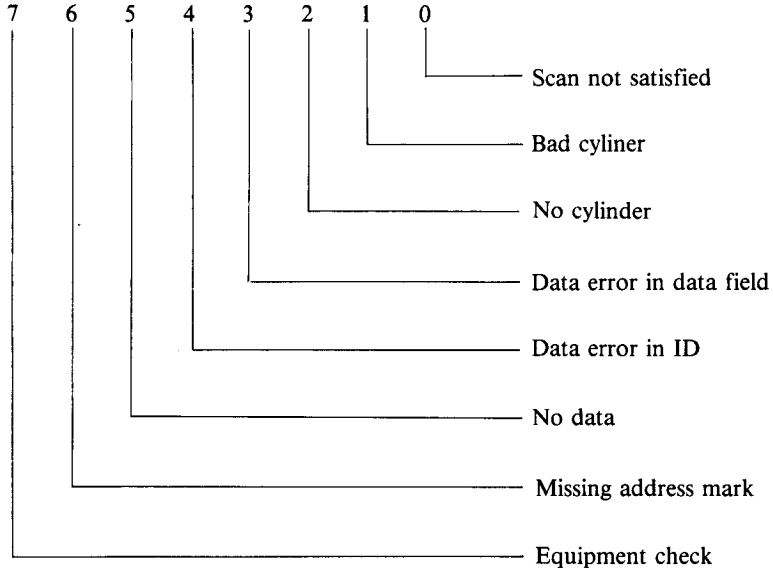
PRINTER TIME OUT

No response was received from the printer within a certain period of time.

8.3 Flexible disk drive test error messames

DIAGNOSTIC CODE 01aa bb DIAGNOSTIC CODE 02aa bb DIAGNOSTIC CODE 03aa bb

aa indictes one of the error conditions as shown below.



bb indicates the command which was issued when the error occurred.

bb = 04 Sense device status
07 Recalibrate
08 Sense interrupt status
0F Seek
45 Write
46 Read
4A Read ID
4D Write ID

In the following error messages, x indicates the drive in which the error was detected.

FDD (Drive x) TIME OUT

No response was received from the flexible disk drive within a certain period of time.

FDD (Drive x) EQUIPMENT CHECK

An error was detected in drive x; or, the track 0 signal was not detected within a certain period of time when recalibration was performed.

FDD (Drive x) BAD ADDRESS MARK

The flexible disk was not initialized or the address mark was not detected.

FDD (Drive x) REC NOT FOUND

The object sector was not found or the format of the sector ID is incorrect.

FDD (Drive x) BAD CRC (ID)

A CRC error was detected when the object sector information was read.

FDD (Drive x) BAD CRC (DATA)

A CRC error was detected when data in the object sector was read.

FDD (Drive x) NO CYLINDER

The object cylinder was not found or was not properly initialized.

FDD (Drive x) BAD CYLINER

The object cylinder is defective or was not properly initialized.

FDD (Drive x) WRITE PROTECT

Data writes to the object drive are not possible.

FDD (Drive x) NOT READY

The flexible disk drive was not ready.

Appendix H-CP/M Messages

Messages come from several different sources. CP/M displays error messages when there are errors in calls to the Basic Disk Operating System (BDOS). CP/M also displays messages when there are errors in command lines. Each utility supplied with CP/M has its own set of messages. The following lists CP/M messages and utility messages. One might see messages other than those listed here if one is running an application program. Check the application program's documentation for explanations of those messages.

Message	Meaning
?	This message has four possible meanings: 1) DDT does not understand the assembly language instruction. 2) The file cannot be opened. 3) A checksum error occurred in a HEX file. 4) The assembler/disassembler was overlayed.
ABORTED	You stopped a PIP operation by pressing a key.
ASM Error Messages	D Data error: data statement element cannot be placed in specified data area. E Expression error: expression cannot be evaluated during assembly. L Label error: label cannot appear in this context (might be duplicate label). N Not implemented: unimplemented features, such as macros, are trapped. O Overflow: expression is too complex to evaluate. P Phase error: label value changes on two passes through assembly. R Register error: the value specified as a register is incompatible with the code. S Syntax error: improperly formed expression. U Underlined label: label used does not exist. V Value error: improperly formed operand encountered in an expression.
BAD DELIMITER	Check command line for typing errors.
Bad Load	CCP error message, or SAVE error message.
Bdos Err On d:	Basic Disk Operating System Error on the designated drive: CP/M replaces d: with the drive specification of the drive where the error occurred. This message is followed by one of the four phrases in the situations described below.

Message	Meaning
Bdos Err On d: Bad Sector	This message appears when CP/M finds no disk in the drive, when the disk is improperly formatted, when the drive latch is open, or when power to the drive is off. Check for one of these situations and try again. This could also indicate a hardware problem or a worn or improperly formatted disk. Press CTRL-C to terminate the program and return to CP/M, or press the return key to ignore the error.
Bdos Err On d: File R/O	You tried to erase, rename, or set file attributes on a Read-Only file. The file should first be set to Ready-Write (RW) with the command: "STAT filespec $R/W."
Bdos Err On d: R/O	Drive has been assigned Read Only status with a STAT command, or the disk in the drive has been changed without being initialized with a CTRL-C. CP/M terminates the current program as soon as you press any key.
Bdos Err on d: Select	CP/M received a command line specifying a nonexistent drive. CP/M terminates the current program as soon as you press any key. Press return key or CTRL-C to recover.
Break "x" at c	"x" is one of the symbols described below and c is the command letter being executed when the error occurred. # Search failure. ED cannot find the string specified in an F, S, or N command. ? Unrecognized command letter c. ED does not recognize the indicated command letter, or an E, H, Q, or O command is not alone on its command line. O The file specified in an R command cannot be found. > Buffer full. ED cannot put any more characters in the memory buffer, or the string specified in an F, N, or S command is too long. E Command aborted. A keystroke at the console aborted command execution. F Disk or directory full. This error is followed by either the disk or directory full message. Refer to the recovery procedures listed under these messages.

Message	Meaning
CANNOT CLOSE DESTINATION FILE-{filespec}	An output file cannot be closed. You should take appropriate action after checking to see if the correct disk is in the drive and that the disk is not write protected.
Cannot close, R/O CANNOT CLOSE FILES	CP/M cannot write to the file. This usually occurs because the disk is write-protected. An output file cannot be closed. This is a fatal error that terminates ASM execution. Check to see that the disk is in the drive, and that the disk is not write-protected. The disk file written by a W command cannot be closed. This is a fatal error that terminates DDT execution. Check if the correct disk is in the drive and that the disk is not write-protected. This error can occur during SUBMIT file processing. Check if the correct system disk is in the A drive and that the disk is not write-protected. The SUBMIT job can be restarted after rebooting CP/M.
CANNOT READ	PIP cannot read the specified source. Reader may not be implemented.
CANNOT WRITE	The destination specified in the PIP command is illegal. You probably specified an input device as a destination.
Checksum error	A hex record checksum error was encountered. The hex record that produced the error must be corrected, probably by recreating the hex file.
CHECKSUM ERROR LOAD ADDRESS hhhh ERROR ADDRESS hhhh BYTES READ: hhhh:	File contains incorrect data. Regenerate hex file from the source.
Command Buffer Overflow	The SUBMIT buffer allows up to 2048 characters in the input file.
Command too long	A command in the SUBMIT file cannot exceed 125 characters.

Message	Meaning
CORRECT ERROR, TYPE RETURN OR CTRL-Z	A hex record checksum was encountered during the transfer of a hex file. The hex file with the checksum error should be corrected, probably by recreating the hex file.
DESTINATION IS R/O, DELETE (Y/N)?	The destination file specified in a PIP command already exists and it is Read Only. If you type Y, the destination file is deleted before the file copy is done.
Directory full	There is not enough directory space for file being written to the destination disk. You can use the OX filespec command to erase any unnecessary files on the disk without leaving the editor. There is not enough directory space to write the $$$.SUB file used for processing SUBMITs. Erase some files or select a new disk and retry.
Disk full	There is not enough disk space for the output file. This error can occur on the W, E, H, or X commands. If it occurs with X command, you can repeat the command prefixing the filename with a different drive.
DISK READ ERROR-{filespec}	The input disk file specified in a PIP command cannot be read properly. This is usually the result of an unexpected end-of-file. Correct the problem in your file.
DISK WRITE ERROR-{filespec}	A disk write operation cannot be successfully performed during a W command, probably due to a full disk. You should either erase some unnecessary files or get another disk with more space. A disk write operation cannot be successfully performed during a PIP command, probably due to a full disk. You should either erase some unnecessary files or get another disk with more space and execute PIP again. The SUBMIT program cannot write the $$$.SUB file to the disk. Erase some files, or select a new disk and try again.
ERROR: BAD PARAMETER	You entered an illegal parameter in a PIP command. Retype the entry correctly.

Message	Meaning
ERROR: CANNOT OPEN SOURCE, LOAD ADDRESS hhhh	Displayed if LOAD cannot find the specified file or if no filename is specified.
ERROR: CANNOT CLOSE FILE, LOAD ADDRESS hhhh	Caused by an error code returned by a BDOS function call. Disk may be write protected.
ERROR: CANNOT OPEN SOURCE, LOAD ADDRESS hhhh	Cannot find source file. Check disk directory.
ERROR: DISK READ, LOAD ADDRESS hhhh	Caused by an error code returned by a BDOS function call.
ERROR: DISK WRITE, LOAD ADDRESS hhhh	Destination Disk is full.
ERROR: INVERTED LOAD ADDRESS, LOAD ADDRESS hhhh	The address of a record was too far from the address of the previously-processed record. This is an internal limitation of LOAD, but it can be circumvented. Use DDT to read the hexfile into memory, then use a SAVE command to store the memory image file on disk.
ERROR: NO MORE DIRECTORY SPACE, LOAD ADDRESS hhhh	Disk directory is full.
Error on line nnn message	The SUBMIT program displays its messages in the format shown above, where nnn represents the line number of the SUBMIT file. Refer to the message following the line number.
FILE ERROR	Disk or directory is full, and ED cannot write anything more on the disk. This is a fatal error, so make sure there is enough space on the disk to hold a second copy of the file before invoking ED.
FILE EXISTS	You have asked CP/M to create or rename a file using a file specification that is already assigned to another file. Either delete the existing file or use another file specification. The new name specified is the name of a file that already exist. You cannot rename a file with the name

Message	Meaning
	of an existing file. If you want to replace an existing file with a newer version of the same file, either rename or erase the existing file, or use the PIP utility.
File exists, erase it	The destination filename already exists when you are placing the destination file on a different disk than the source. It should be erased or another disk selected to receive the output file.
FILE IS READ/ONLY	The file specified in the command to invoke ED has the Read Only attribute. ED can read the file so that the user can examine it, but ED cannot change a Read Only file.
File Not Found	CP/M cannot find the specified file. Check that you have entered the correct drive specification or that you have the correct disk in the drive. ED cannot find the specified file. Check that you have entered the correct drive specification or that you have the correct disk in the drive. STAT cannot find the specified file. The message might appear if you omit the drive specification. Check to see if the correct disk is in the drive.
FILE NOT FOUND-{filespec}	An input file that you have specified does not exist.
Filename required	You typed the ED command without a filename. Reenter the ED command followed by the name of the file you want to edit or create.
hhhh?? = dd	The ?? indicates DDT does not know how to represent the hexadecimal value dd encountered at address hhhh in 8080 assembly language. dd is not an 8080 machine instruction opcode.
Insufficient memory	There is not enough memory to load the file specified in an R or E command.
Invalid Assignment	You specified an invalid drive or file assignment,

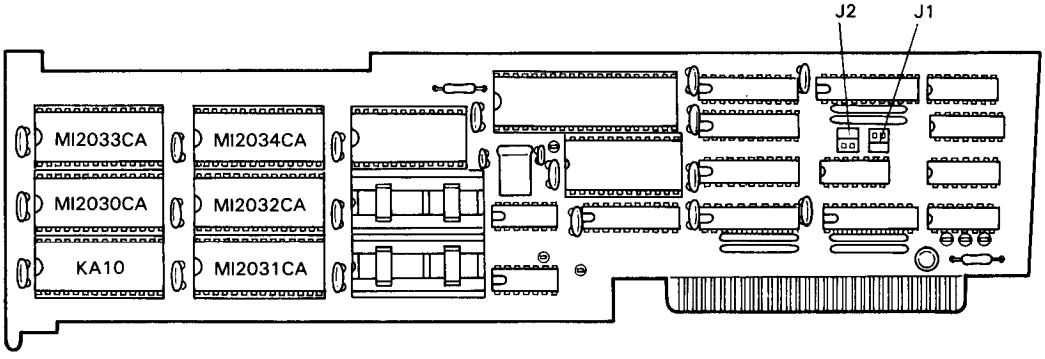
Message	Meaning
	or misspelled a device name. This error message might be followed by a list of the valid file assignments that can follow a filename. If an invalid drive assignment was attempted the message "Use: d: = RO" is displayed, showing the proper syntax for drive assignments.
Invalid control character	The only valid control characters in the SUBMIT files of type SUB are ^A through ^Z. Note that in a SUBMIT file the control character is represented by typing the circumflex, ^, not by pressing the control key.
INVALID DIGIT-{filespec}	An invalid hex digit has been encountered while reading a hex file. The hex file with the invalid hex digit should be corrected, probably by recreating the hex file.
Invalid Disk Assignment	Might appear if you follow the drive specification with anything except = R/O.
INVALID DISK SELECT	CP/M received a command line specifying a nonexistent drive, or the disk in the drive is improperly formatted. CP/M terminates the current program as soom as you press any key.
INVALID DRIVE NAME (Use A, B, C, or D)	SYSGEN recognizes only drives A, B, C and D as valid destinations for system generation.
Invalid File Indicator	Appears if you do not specify RO, RW, DIR, or SYS.
INVALID FORMAT	The format of your PIP command is illegal. See the description of the PIP command.
INVALID HEX DIGIT LOAD ADDRESS hhhh ERROR ADDRESS hhhh BYTES READ: hhhh	File contains incorrect hex digit.
INVALID MEMORY SIZE	Specify a value less than 64K or your computer's actual memory size.
INVALID SEPARATOR	You have placed an invalid character for a separator between two input filenames.

Message	Meaning
INVALID USER NUMBER	You have specified a user number greater than 15. User numbers are in the range 0 to 15.
n?	You specified a number greater than fifteen for a user area number. For example, if you type USER ⏎, the screen displays 18?.
NO DIRECTORY SPACE	The disk directory is full. Erase some files to make room for PRN and HEX files. The directory can usually hold only 64 filenames.
NO DIRECTORY SPACE-{filespec}	There is not enough directory space for the output file. You should either erase some unnecessary files or get another disk with more directory space and execute PIP again.
NO FILE-{filespec}	CP/M cannot find the specified file, or no files exist. The indicated source or include file cannot be found on the indicated drive. The file specified in an R or E command cannot be found on the disk.
NO INPUT FILE PRESENT ON DISK	The file you requested does not exist.
No memory	There is not enough (buffer?) memory available for loading the program specified.
NO SOURCE FILE ON DISK	SYSGEN cannot find CP/M either in CPMxx.com form or on the system tracks of the source disk.
NO SOURCE FILE PRESENT	The assembler cannot find the file you specified. Either you mistyped the filespecification in you command line, or the file is not type ASM.
NO SPACE	Too many files are already on the disk, or no room is left on the disk to save the information.
No SUB file present	For SUBMIT to operate properly, you must create a file with filetype of SUB. The SUB file contains usual CP/M commands. Use one command per line.

Message	Meaning
NOT A CHARACTER SOURCE	The source specified in your PIP commands is illegal. You have probably specified an output device as a source.
NOT DELETED	PIP did not delete the file, which may have had the R/O attribute.
NOT FOUND	PIP cannot find the specified file.
OUTPUT FILE WRITE ERROR	You specified a write-protected diskette as the destination for the PRN and HEX files, or the diskette has no space left. Correct the program before assembling your program.
Parameter error	Within the SUBMIT file of type sub, valid parameters are $0 through $9.
PARAMETER ERROR, TYPE RETURN TO IGNORE	If you press return, SYSGEN proceeds without processing the invalid parameter.
QUIT NOT FOUND	The string argument to a Q parameter was not found in you input file.
Read error	An error occurred when reading the file specified in the type command. Check the disk and try again. The STAT filespec command can diagnose trouble.
READER STOPPING	Reader operation interrupted.
Record Too Long	PIP cannot process a record longer than 128 bytes.
START NOT FOUND	The string argument to an S parameter cannot be found in the source file.
SOURCE FILE INCOMPLETE	SYSGEN cannot use your CP/M source file.
SOURCE FILE NAME ERROR	When you assemble a file, you cannot use the wildcard characters * and ? in the filename. Only one file can be assembled at a time.
SOURCE FILE READ ERROR	The assembler cannot understand the information in the file containing the assembly language program

Message	Meaning
	Portions of another file might have been written over your assembly language file, or information was not properly saved on the diskette. Use the TYPE command to locate the error. Assembly language files contain the letters, symbols, and numbers that appear on your keyboard. If your screen displays unrecognizable output or behaves strangely, you have found where computer instructions have crept into your file.
SYNCHRONIZATION ERROR	The MOVCPM utility is being used with the wrong CP/M system.
"SYSTEM" FILE NOT ACCESSIBLE	You tried to access a file set to SYS with the STAT command.
TOO MANY FILES	There is not enough memory for STAT to sort the files specified, or more than 512 files were specified.
UNEXPECTED END OF HEX FILE-{filespec}	An end-of-file was encountered prior to a termination hex record. The hex file without a termination record should be corrected, probably by recreating the hex file.
Unrecognized Destination	Check command line for valid destination.
Use: STAT d:=RO	An invalid STAT drive command was given. The only valid drive assignment in STAT is STAT d:=RO.
VERIFY ERROR: -{filespec}	When copying with the V option, PIP found a difference when rereading the data just written and comparing it to the data in its memory buffer. Usually this indicates a failure of either the destination disk or drive.
XSUB ACTIVE	XSUB has been invoked.
XSUB ALREADY PRESENT	XSUB is already active in memory.
Your input?	If CP/M cannot find the command you specified, it returns the command name you entered followed by a question mark. Check that you have typed the command line correctly, or that the command you requested exists as a .COM file on the default or specified disk.

Appendix I - MultiFonts Character Generator ROM Card



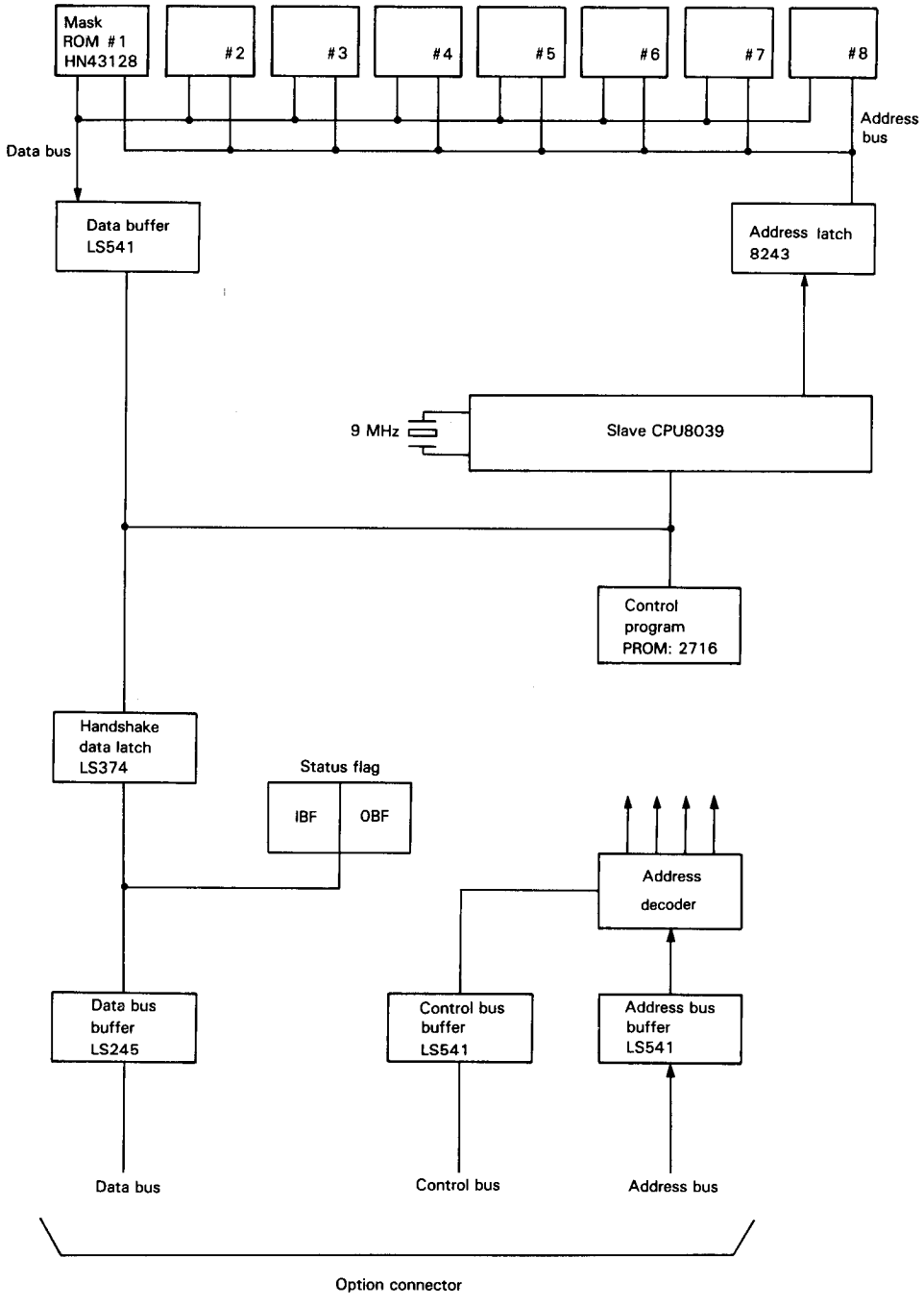
This card is a character generator consisting of six 128K-bit mask ROMs which generate fonts consisting of 14 × 17 dots. The card is mounted in the option slots of the QX-10.

Characters featured by this card is supported by Epson's MultiFonts CP/M. Also, the multiple fonts in the Ql0MF include information necessary for proportional spacing.

The character generator ROM cards are controlled by the 8-bit 8039 slave CPU, with the control program stored on PROM 2716. Each of the mask ROMs includes muliple fonts of 512 characters.

Three flags (IBF, OBF, and ERR) are provided for data communication with the main system, and handshake protocol is used for exchanges of font code and pattern.

Block diagram

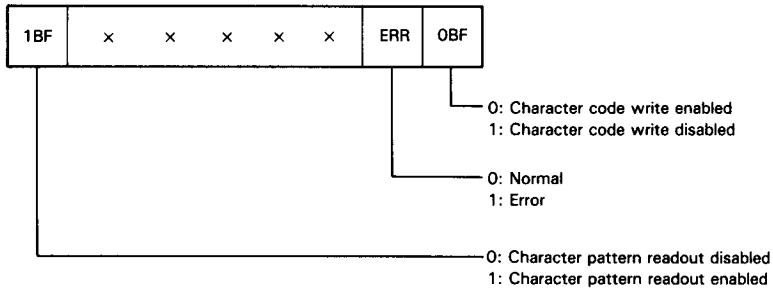


Procedures for using the character generators

Ports with which this option card is provided include status ports and data ports.

(1) Status port (F9H, FBH or FDH as set by the jumper)

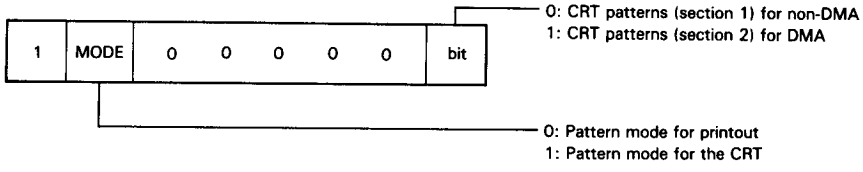
i The following statuses can be read by reading this port.



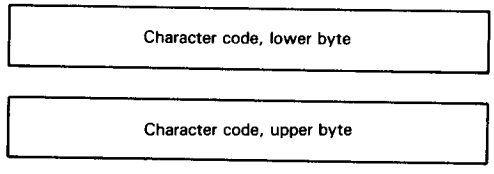
ii Writing data to this port (the contents do not matter) causes a hardware interrupt to be placed on interrupt line INT(L). Since this interrupt signal line is assigned to a different interrupt address for each option slot, it is possible to determine from this interrupt which slot the card is mounted in. This interrupt can be cleared by reading the status port.

(2) Data port (F8H, FAH, or FCH, as set by the jumper)

i Data written to this port consists of the following three bytes.



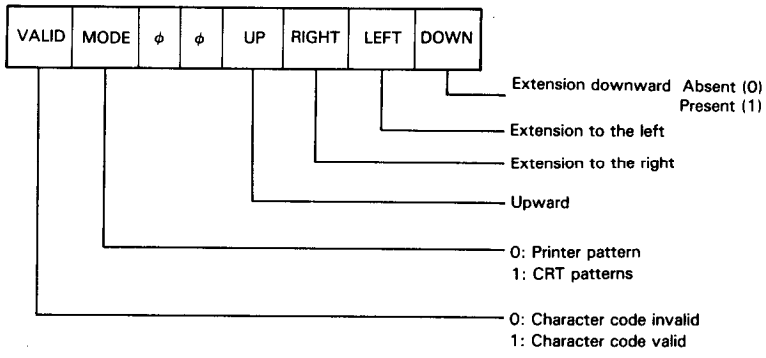
- Command byte: Specifies whether the pattern read from the character generator is to be sent to the CRT or the printer.



- Character code bytes: The command byte is sent first, followed in sequence by the lower and upper character code bytes. However, the character codes must be in the range from 0000H to 0DFFH; any values outside this range will result in an error.

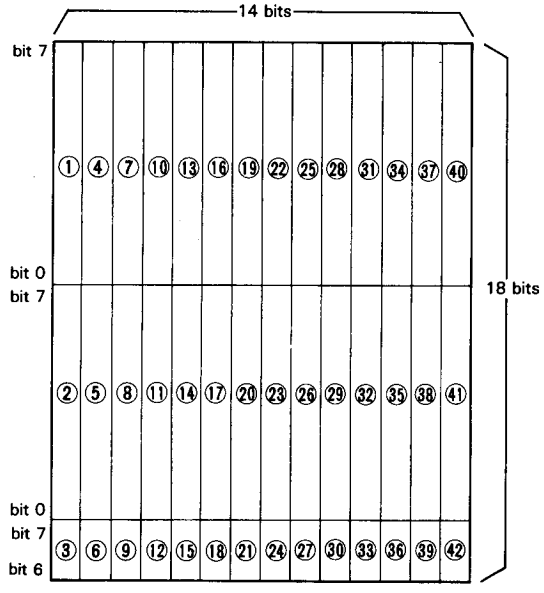
  Bit OBF of the status port must be monitored as these three bytes are being written into the option card, and each byte written only when the bit becomes 0. Further, an interrupt is applied to line INT(L) when these three bytes have been read into the option card for preparation to read out the character pattern. (This interrupt can be cleared by reading the status port.)

ii Character patterns are read out from the data port.

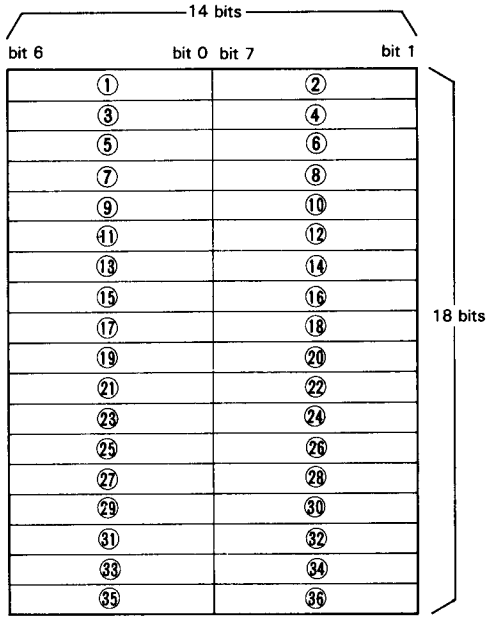


- Status byte: This byte contains the status information concerning the character pattern, and must be read out ahead of the character pattern.
- Character pattern: The pattern information differs according to the CRT or printer as shown below.

Pattern for printer



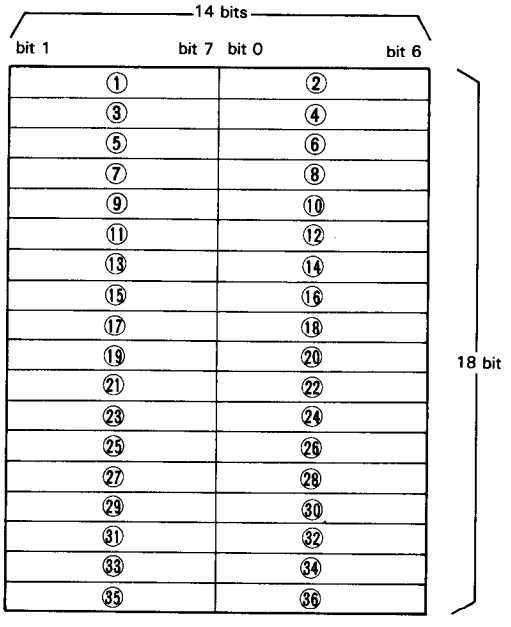
Pattern for CRT (1)



The IBF bit of the status port must be monitored as these patterns are read out, with each byte picked up as IBF becomes 1.

Note:
These patterns are used in the non-DMA mode when bit 0 of the command byte is 0.

Pattern for CRT (2)



This pattern is used in the DMA mode when bit 0 of the command byte is 1. Here, the bit pattern is reversed from that of the first instance.

Appendix J - International Character Sets

The QX-10 provides international character sets for the following eight countries:

United States	England
Germany	France
Italy	Spain
Denmark	Sweden

The characters displayed or printed for the above countries are as follows.

Country / Hex. code	U.S.A.	France	Germany	England	Denmark	Sweden	Italy	Spain
23 (A3)	#	#	#	£	#	#	#	Pt
24 (A4)	$	$	$	$	$	¤	$	$
40 (C0)	@	à	§	@	@	É	@	@
5B (DB)	[	°	Ä	[	Æ	Ä	°	¡
5C (DC)	\	ç	Ö	\	Ø	Ö	\	Ñ
5D (DD)	]	§	Ü	]	Å	Å	é	¿
5E (DE)	^	^	^	^	^	Ü	^	^
60 (E0)	`	`	`	`	`	é	ù	`
7B (FB)	{	é	ä	{	æ	ä	à	¨
7C (FC)	¦	ù	ö	¦	ø	ö	ò	ñ
7D (FD)	}	è	ü	}	å	å	è	}
7E (FE)	~	¨	ß	~	~	ü	ì	~

NOTE: Numbers in parentheses are hexadecimal codes.

NOTES:

1) *Numbers in parentheses are apply to the non-MFBASIC mode only.*
2) *In the WIDTH 80 or WIDTH 40 mode of MFBASIC, certain characters are blank when option style 16 (OCR B font) is selected.*
3) *Depending on the international character set selected, certain characters are blank when option style 15 (Old Germany) is selected.*

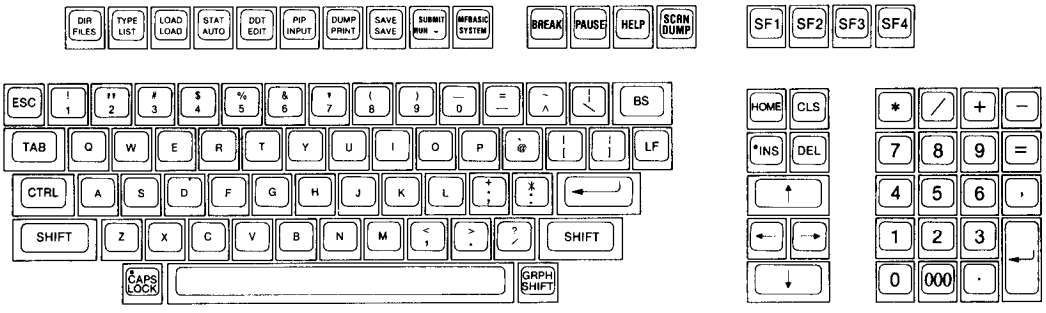
Country Hex. code (Dec code)	U.S.A.	France	Germany	England	Denmark	Sweden	Italy	Spain
A0A3 (160-163)	#	#	#	£	#	#	#	
A0A4 (160-164)	$	$	$	$	$	¤	$	$
A0C0 (160-192)	@		§	@	@		@	@
A0DB (160-219)	[			[				
A0DC (160-220)	\			\			\	
A0DD (160-221)	]	§		]				
A0DE (160-222)	^	^	^	^	^		^	^
A0E0 (160-224)	`	`	`	`	`			`
A0FB (160-251)	{			{				
A0FC (160-252)								
A0FD (160-253)	}			}				}
A0FE (160-254)								
A1A3 (161-163)	#	#	#	£	#	#	#	Pt
A1A4 (161-164)	$	$	$	$	$	¤	$	$
A1C0 (161-192)	@	à	§	@	@	É	@	@
A1DB (161-219)	[	°	Ä	[	Æ	Ä	°	¡
A1DC (161-220)	\	Ç	Ö	\	Ø	Ö	\	Ñ
A1DD (161-221)	]	§	Ü	]	Å	Å	é	¿
A1DE (161-222)	^	^	^	^	^	Ü	^	^
A1E0 (161-224)	`	`	`	`	`	é	ù	`
A1FB (161-251)	{	é	ä	{	æ	ä	à	¨
A1FC (161-252)	¦	ù	ö	¦	ø	ö	ò	ñ
A1FD (161-253)	}	è	ü	}	å	å	è	}
A1FE (161-254)	~	¨	ß	~	~	ü	ì	~
A2A3 (162-163)	#	#	#	£	#	#	#	
A2A4 (162-164)	$	$	$	$	$	¤	$	$
A2C0 (162-192)	@	à	§	@	@	É	@	@
A2DB (162-219)	[	°	Ä	[	Æ	Ä	°	¡
A2DC (162-220)	\	Ç	Ö	\	Ø	Ö	\	Ñ
A2DD (162-221)	]	§	Ü	]	Å	Å	é	¿
A2DE (162-222)	^	^	^	^	^	Ü	^	^
A2E0 (162-224)	`	`	`	`	`	é	ù	`
A2FB (162-251)	{	é	ä	{	æ	ä	à	¨
A2FC (162-252)	¦	ù	ö	¦	ø	ö	ò	ñ
A2FD (162-253)	}	è	ü	}	å	å	è	}
A2FE (162-254)	~	¨	ß	~	~	ü	ì	~
A3A3 (163-163)	#	#	#	£	#	#	#	Pt
A3A4 (163-164)	$	$	$	$	$	¤	$	$
A3C0 (163-192)	@	à	§	@	@	É	@	@
A3DB (163-219)	[	°	Ä	[	Æ	Ä	°	¡
A3DC (163-220)	\	Ç	Ö	\	Ø	Ö	\	Ñ
A3DD (163-221)	]	§	Ü	]	Å	Å	é	¿
A3DE (163-222)	^	^	^	^	^	Ü	^	^
A3E0 (163-224)	`	`	`	`	`	é	ù	`
A3FB (163-251)	{	é	ä	{	æ	ä	à	¨
A3FC (163-252)	¦	ù	ö	¦	ø	ö	ò	ñ
A3FD (163-253)	}	è	ü	}	å	å	è	}
A3FE (163-254)	~	¨	ß	~	~	ü	ì	~

Country Hex. code (Dec code)	U.S.A.	France	Germany	England	Denmark	Sweden	Italy	Spain
A4A3 (164-163)	#	#	#	#	#	#	#	Pt
A4A4 (164-164)	$	$	$	$	$	¤	$	$
A4C0 (164-192)	@	à	§	@	@	É	@	@
A4DB (164-219)	[	°	Ä	[	Æ	Ä	°	¡
A4DC (164-220)	\	ç	Ö	\	Ø	Ö	\	Ñ
A4DD (164-221)	]	§	Ü	]	Å	Å	é	¿
A4DE (164-222)	^	^	^	^	^	Ü	^	^
A4E0 (164-224)	`	`	`	`	`	é	ù	`
A4FB (164-251)	{	é	ä	{	æ	ä	à	¨
A4FC (164-252)	|	ù	ö	|	ø	ö	ò	ñ
A4FD (164-253)	}	è	ü	}	å	å	è	}
A4FE (164-254)	~	¨	ß	~	~	ü	ì	~
A5A3 (165-163)	#	#	#	£	#	#	#	Pt
A5A4 (165-164)	$	$	$	$	$	¤	$	$
A5C0 (165-192)	@	à	§	@	@	É	@	@
A5C0 (165-219)	[	°	Ä	[	Æ	Ä	°	¡
A5DC (165-220)	\	Ç	Ö	\	Ø	Ö	\	Ñ
A5DD (165-221)	]	§	Ü	]	Å	Å	é	¿
A5DE (165-222)	^	^	^	^	^	Ü	^	^
A5E0 (165-224)	`	`	`	`	`	é	ù	`
A5FB (165-251)	{	é	ä	{	æ	ä	à	¨
A5FC (165-252)	|	ù	ö	|	ø	ö	ò	ñ
A5FD (165-253)	}	è	ü	}	å	å	è	}
A5FE (165-254)	~	¨	ß	~	~	ü	ì	~
A6A3 (166-163)	#	#	#	£	#	#	#	Pt
A6A4 (166-164)	$	$	$	$	$	¤	$	$
A6C0 (166-192)	@	à	§	@	@	É	@	@
A6DB (166-219)	[	°	Ä	[	Æ	Ä	°	¡
A6DC (166-220)	\	Ç	Ö	\	Ø	Ö	\	Ñ
A6DD (166-221)	]	§	Ü	]	Å	Å	é	¿
A6DE (166-222)	^	^	^	^	^	Ü	^	^
A6E0 (166-224)	`	`	`	`	`	é	ù	`
A6FB (166-251)	{	é	ä	{	æ	ä	à	¨
A6FC (166-252)	|	ù	ö	|	ø	ö	ò	ñ
A6FD (166-253)	}	è	ü	}	å	å	è	}
A6FE (166-254)	~	¨	ß	~	~	ü	ì	~
A7A3 (167-163)	#	#	#	£	#	#	#	Pt
A7A4 (167-164)	$	$	$	$	$	¤	$	$
A7C0 (167-192)	@	à	§	@	@	É	@	@
A7DB (167-219)	[	°	Ä	[	Æ	Ä	°	¡
A7DC (167-220)	\	Ç	Ö	\	Ø	Ö	\	Ñ
A7DD (167-221)	]	§	Ü	]	Å	Å	é	¿
A7DE (167-222)	^	^	^	^	^	Ü	^	^
A7E0 (167-224)	`	`	`	`	`	é	ù	`
A7FB (167-251)	{	é	ä	{	æ	ä	à	¨
A7FC (167-252)	|	ù	ö	|	ø	ö	ò	ñ
A7FD (167-253)	}	è	ü	}	å	å	è	}
A7FE (167-254)	~	¨	ß	~	~	ü	ì	~

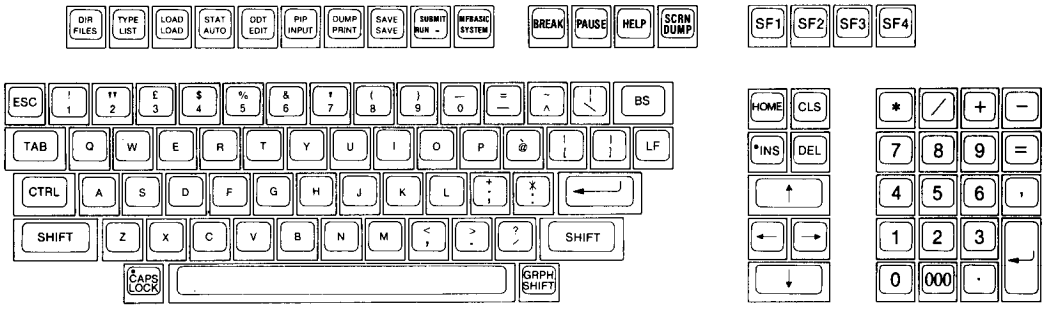
Country Hex. code (Dec code)	U.S.A.	France	Germany	England	Denmark	Sweden	Italy	Spain
A8A3 (168-163)	#	#	#	£	#	#	#	Pt
A8A4 (168-164)	$	$	$	$	$	¤	$	$
A8C0 (168-192)	@	à	§	@	@	É	@	@
A8DB (168-219)	[	°	Ä	[	Æ	Ä	°	¡
A8DC (168-220)	\	Ç	Ö	\	Ø	Ö	\	Ñ
A8DD (168-221)	]	§	Ü	]	Å	Å	é	¿
A8DE (168-222)	^	^	^	^	^	Ü	^	^
A8E0 (168-224)	`	`	`	`	`	é	ù	`
A8FB (168-251)	{	é	ä	{	æ	ä	à	¨
A8FC (168-252)	|	ù	ö	|	ø	ö	ò	ñ
A8FD (168-253)	}	è	ü	}	å	å	è	}
A8FE (168-254)	~	¨	ß	~	~	ü	ì	~
A9A3 (169-163)	#	#	#	£	#	#	#	Pt
A9A4 (169-164)	$	$	$	$	$	¤	$	$
A9C0 (169-192)	@	à	§	@	@	É	@	@
A9DB (169-219)	[	°	Ä	[	Æ	Ä	°	¡
A9DC (169-220)	\	Ç	Ö	\	Ø	Ö	\	Ñ
A9DD (169-221)	]	§	Ü	]	Å	Å	é	¿
A9DE (169-222)	^	^	^	^	^	Ü	^	^
A9E0 (169-224)	`	`	`	`	`	é	ù	`
A9FB (169-251)	{	é	ä	{	æ	ä	à	¨
A9FC (169-252)	|	ù	ö	|	ø	ö	ò	ñ
A9FD (169-253)	}	è	ü	}	å	å	è	}
A9FE (169-254)	~	¨	ß	~	~	ü	ì	~
AAA3 (170-163)	#	#	#	£	#	#	#	Pt
AAA4 (170-164)	$	$	$	$	$	¤	$	$
AAC0 (170-192)	@	à	§	@	@	É	@	@
AADB (170-219)	[	°	Ä	[	Æ	Ä	°	¡
AADC (170-220)	\	Ç	Ö	\	Ø	Ö	\	Ñ
AADD (170-221)	]	§	Ü	]	Å	Å	é	¿
AADE (170-222)	^	^	^	^	^	Ü	^	^
AAE0 (170-224)	`	`	`	`	`	é	ù	`
AAFB (170-251)	{	é	ä	{	æ	ä	à	¨
AAFC (170-252)	|	ù	ö	|	ø	ö	ò	ñ
AAFD (170-253)	}	è	ü	}	å	å	è	}
AAFE (170-254)	~	¨	ß	~	~	ü	ì	~
ABA3 (171-163)	#	#	#	£	#	#	#	Pt
ABA4 (171-164)	$	$	$	$	$	¤	$	$
ABC0 (171-192)	@	à	§	@	@	É	@	@
ABDB (171-219)	[	°	Ä	[	Æ	Ä	°	¡
ABDC (171-220)	\	Ç	Ö	\	Ø	Ö	\	Ñ
ABDD (171-221)	]	§	Ü	]	Å	Å	é	¿
ABDE (171-222)	^	^	^	^	^	Ü	^	^
ABE0 (171-224)	`	`	`	`	`	é	ù	`
ABFB (171-251)	{	é	ä	{	æ	ä	à	¨
ABFC (171-252)	|	ù	ö	|	ø	ö	ò	ñ
ABFD (171-253)	}	è	ü	}	å	å	è	}
ABFE (171-254)	~	¨	ß	~	~	ü	ì	~

Country Hex. code (Dec code)	U.S.A.	France	Germany	England	Denmark	Sweden	Italy	Spain
ACA3 (172-163)								
ACA4 (172-164)								
ACC0 (172-192)								
ACDB (172-219)								
ACDC (172-220)								
ACDD (172-221)								
ACDE (172-222)								
ACE0 (172-224)								
ACFB (172-251)								
ACFC (172-252)								
ACFD (172-253)								
ACFE (172-254)								
ADA3 (173-163)								
ADA4 (173-164)								
ADC0 (173-192)								
ADDB (173-219)								
ADDC (173-220)								
ADDD (173-221)								
ADDE (173-222)								
ADE0 (173-224)								
ADFB (173-251)								
ADFC (173-252)								
ADFD (173-253)								
ADFE (173-254)								
AEA3 (174-163)								
AEA4 (174-164)								
AEC0 (174-192)								
AEDB (174-219)								
AEDC (174-220)								
AEDD (174-221)								
AEDE (174-222)								
AEE0 (174-224)								
AEFB (174-251)								
AEFC (174-252)								
AEFD (174-253)								
AEFE (174-254)								
AFA3 (175-163)								
AFA4 (175-164)								
AFC0 (175-192)								
AFDB (175-219)								
AFDC (175-220)								
AFDD (175-221)								
AFDE (175-222)								
AFE0 (175-224)								
AFFB (175-251)								
AFFC (175-252)								
AFFD (175-253)								
AFFE (175-254)								

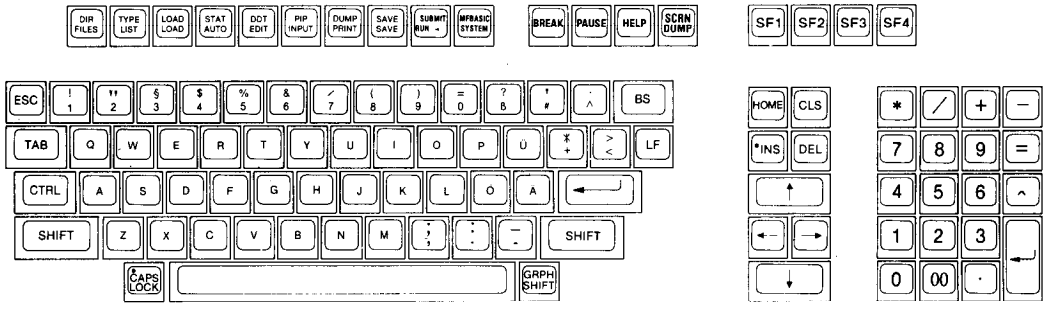
Appendix K - Keyboard arrangements



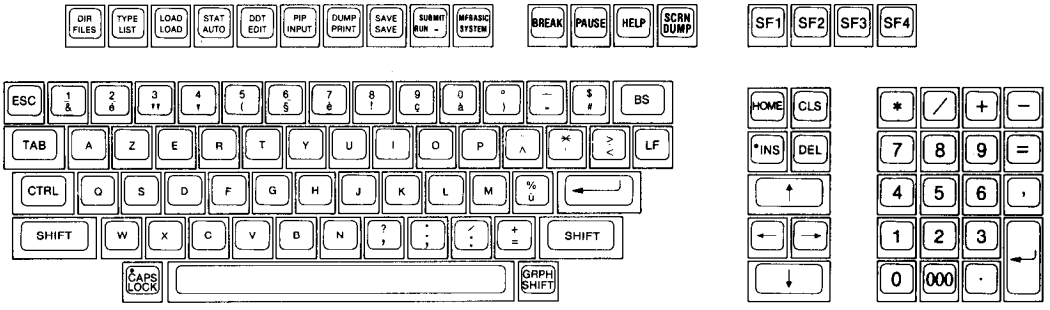
USASCII Keyboard



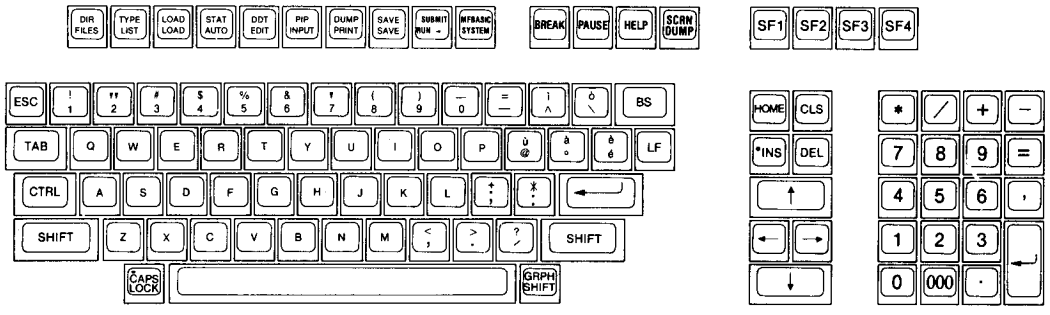
English Keyboard



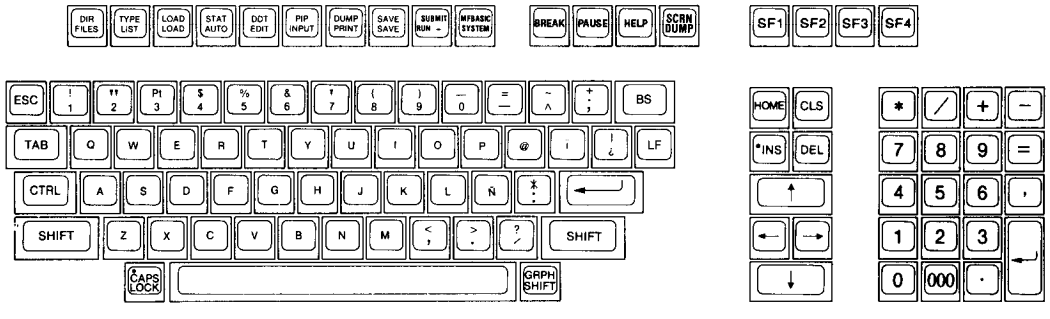
German Keyboard



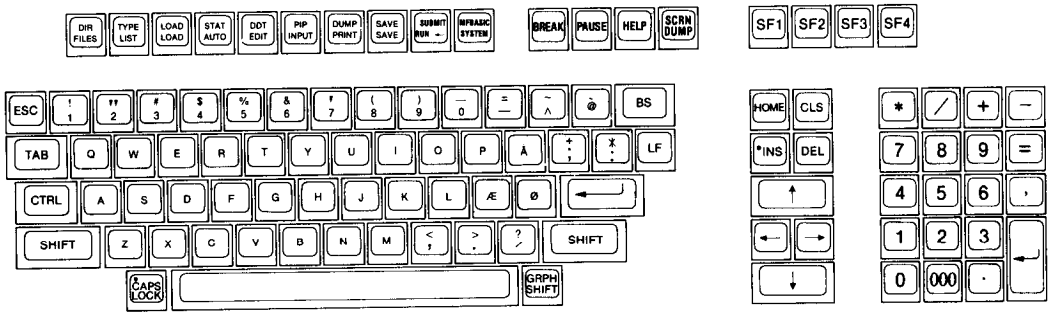
French Keyboard



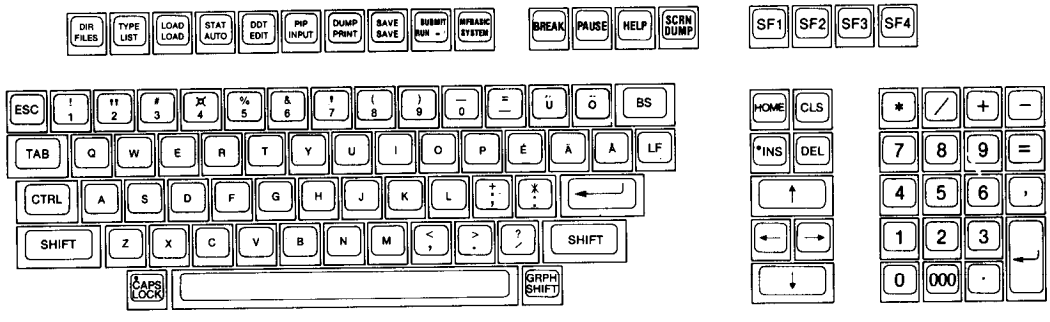
Italian Keyboard



Spanish Keyboard



Danish Keyboard



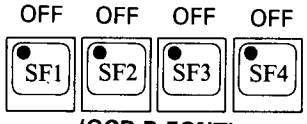
Swedish Keyboard

Appendix L - Multiple Fonts Style Selection

Characters printed or displayed are as shown at right when the style selection keys are set as shown at left.

Style Selection

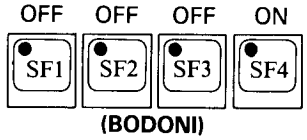
0:



(OCR B-FONT)

```
 ! " # $ % & ' ( ) * + , - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o
p q r s t u v w x y z { | }
```

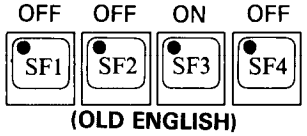
1:



(BODONI)

```
 ! " # $ % & ' ( ) * + , - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o
p q r s t u v w x y z { | } ~ Δ
```

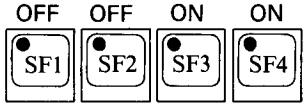
2:



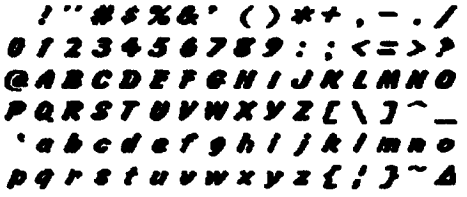
(OLD ENGLISH)

```
 ! " # $ % & ' ( ) * + , - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o
p q r s t u v w x y z { | } ~ Δ
```

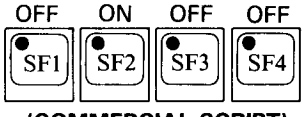
3:



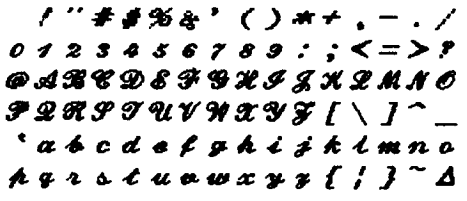
(FLASH BOLD)



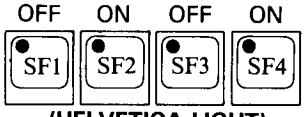
4:



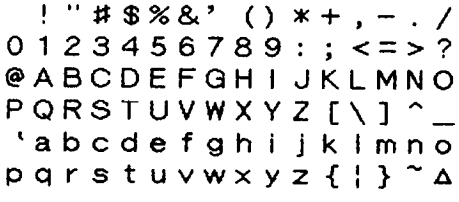
(COMMERCIAL SCRIPT)



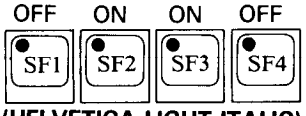
5:



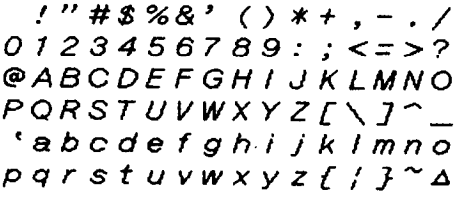
(HELVETICA LIGHT)



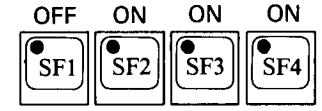
6:



(HELVETICA LIGHT ITALIC)



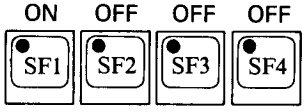
7:



(HELVETICA MEDIUM ITALIC)

```
 !"#$%&' ()*+,-./
0123456789:;<=>?
@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_
`abcdefghijklmno
pqrstuvwxyz{|}~Δ
```

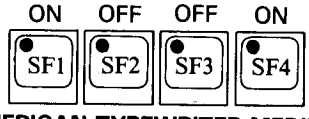
8:



(BROADWAY)

```
 !"#$%&' ()*+,-./
0123456789:;<=>?
@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_
`abcdefghijklmno
pqrstuvwxyz{|}~Δ
```

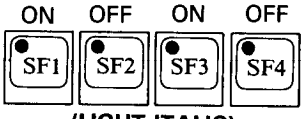
9:



(AMERICAN TYPEWRITER MEDIUM)

```
 !"#$%&' ()*+,-./
0123456789:;<=>?
@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_
`abcdefghijklmno
pqrstuvwxyz{|}~Δ
```

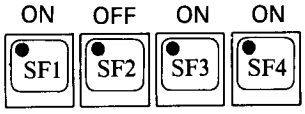
A:



(LIGHT ITALIC)

```
 !"#$%&' ()*+,-./
0123456789:;<=>?
@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_
`abcdefghijklmno
pqrstuvwxyz{|}~Δ
```

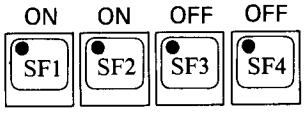
B:



(HELVETICA MEDIUM)

```
 ! " # $ % & ' ( ) * + , - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o
p q r s t u v w x y z { | } ~ Δ
```

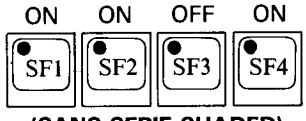
C:



(BODONI ITALIC)

```
 ! " # $ % & ' ( ) * + , - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o
p q r s t u v w x y z { | } ~ Δ
```

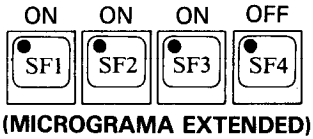
D:



(SANS SERIF SHADED)

```
 ! " # $ % & ' ( ) * + , - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o
p q r s t u v w x y z { | } ~ Δ
```

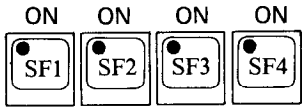
E:



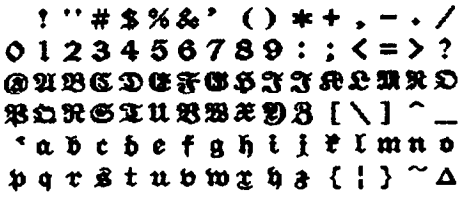
(MICROGRAMA EXTENDED)

```
 ! " # $ % & ' ( ) * + , - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o
p q r s t u v w x y z { | } ~ Δ
```

F:



(OLD GERMANY)



Appendix M - Character Code Tables

1. USASCII in Non-MFBASIC Mode

	Hex. No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	[0]	[16]	SPACE [32]	0 [48]	@ [64]	P [80]	` [96]	p [112]	+ [128]	O [144]	SPACE [160]	O [176]	@ [192]	P [208]	` [224]	p [240]
1	0001	[1]	[17]	! [33]	1 [49]	A [65]	Q [81]	a [97]	q [113]	⊥ [129]	♠ [145]	! [161]	1 [177]	A [193]	Q [209]	a [225]	q [241]
2	0010	[2]	[18]	" [34]	2 [50]	B [66]	R [82]	b [98]	r [114]	⊤ [130]	♥ [146]	" [162]	2 [178]	B [194]	R [210]	b [226]	r [242]
3	0011	[3]	[19]	# [35]	3 [51]	C [67]	S [83]	c [99]	s [115]	┤ [131]	♦ [147]	# [163]	3 [179]	C [195]	S [211]	c [227]	s [243]
4	0100	[4]	[20]	$ [36]	4 [52]	D [68]	T [84]	d [100]	t [116]	├ [132]	♣ [148]	$ [164]	4 [180]	D [196]	T [212]	d [228]	t [244]
5	0101	EL [5]	[21]	% [37]	5 [53]	E [69]	U [85]	e [101]	u [117]	− [133]	♪ [149]	% [165]	5 [181]	E [197]	U [213]	e [229]	u [245]
6	0110	[6]	[22]	& [38]	6 [54]	F [70]	V [86]	f [102]	v [118]	│ [134]	┌ [150]	& [166]	6 [182]	F [198]	V [214]	f [230]	v [246]
7	0111	BEL [7]	[23]	' [39]	7 [55]	G [71]	W [87]	g [103]	w [119]	┌ [135]	┼ [151]	' [167]	7 [183]	G [199]	W [215]	g [231]	w [247]
8	1000	BS [8]	[24]	([40]	8 [56]	H [72]	X [88]	h [104]	x [120]	┐ [136]	▀ [152]	([168]	8 [184]	H [200]	X [216]	h [232]	x [248]
9	1001	TAB [9]	[25]	) [41]	9 [57]	I [73]	Y [89]	i [105]	y [121]	└ [137]	▄ [153]	) [169]	9 [185]	I [201]	Y [217]	i [233]	y [249]
A	1010	LF [10]	ES [26]	* [42]	: [58]	J [74]	Z [90]	j [106]	z [122]	┘ [138]	▌ [154]	* [170]	: [186]	J [202]	Z [218]	j [234]	z [250]
B	1011	HOME [11]	ESC [27]	+ [43]	; [59]	K [75]	[[91]	k [107]	{ [123]	▐ [139]	↑ [155]	+ [171]	; [187]	K [203]	[[219]	k [235]	{ [251]
C	1110	CLS [12]	→ [28]	, [44]	< [60]	L [76]	\ [92]	l [108]	¦ [124]	■ [140]	↓ [156]	, [172]	< [188]	L [204]	\ [220]	l [236]	¦ [252]
D	1101	← [13]	▔ [29]	− [45]	= [61]	M [77]	] [93]	m [109]	} [125]	▬ [141]	x [157]	− [173]	= [189]	M [205]	] [221]	m [237]	} [253]
E	1110	[14]	▏ [30]	. [46]	> [62]	N [78]	^ [94]	n [110]	~ [126]	▮ [142]	÷ [158]	. [174]	> [190]	N [206]	^ [222]	n [238]	~ [254]
F	1111	[15]	▕ [31]	/ [47]	? [63]	O [79]	_ [95]	o [111]	Δ [127]	● [143]	± [159]	/ [175]	? [191]	O [207]	_ [223]	o [239]	Δ [255]

USASCII in Non-MFBASIC Mode

2. USASCII in MFBASIC Mode

Hex. No.	Binary No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	0	16	SPACE 32	0 48	@ 64	P 80	` 96	p 112	┼ 128	○ 144						
1	0001	1	17	! 33	1 49	A 65	Q 81	a 97	q 113	┴ 129	♠ 145						
2	0010	2	18	" 34	2 50	B 66	R 82	b 98	r 114	┬ 130	♥ 146						
3	0011	BREAK 3	PAUSE 19	# 35	3 51	C 67	S 83	c 99	s 115	┤ 131	♦ 147						
4	0100	4	20	$ 36	4 52	D 68	T 84	d 100	t 116	├ 132	♣ 148						
5	0101	CL 5	21	% 37	5 53	E 69	U 85	e 101	u 117	─ 133	♪ 149						
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	│ 134	Ç 150						
7	0111	BEL 7	23	' 39	7 55	G 71	W 87	g 103	w 119	┌ 135	ü 151						
8	1000	BS 8	24	(40	8 56	H 72	X 88	h 104	x 120	┐ 136	é 152						
9	1001	TAB 9	25	) 41	9 57	I 73	Y 89	i 105	y 121	└ 137	ä 153						
A	1010	LF 10	ES 26	* 42	: 58	J 74	Z 90	j 106	z 122	┘ 138	à 154						
B	1011	HOME 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	▒ 139	å 155						
C	1110	CLS 12	→ 28	, 44	< 60	L 76	\ 92	l 108	¦ 124	▓ 140	ç 156						
D	1101	↵ 13	← 29	- 45	= 61	M 77	] 93	m 109	} 125	▬ 141	ñ 157						
E	1110	14	↑ 30	. 46	> 62	N 78	^ 94	n 110	~ 126	▌ 142	÷ 158						
F	1111	15	↓ 31	/ 47	? 63	O 79	_ 95	o 111	△ 127	● 143	± 159						

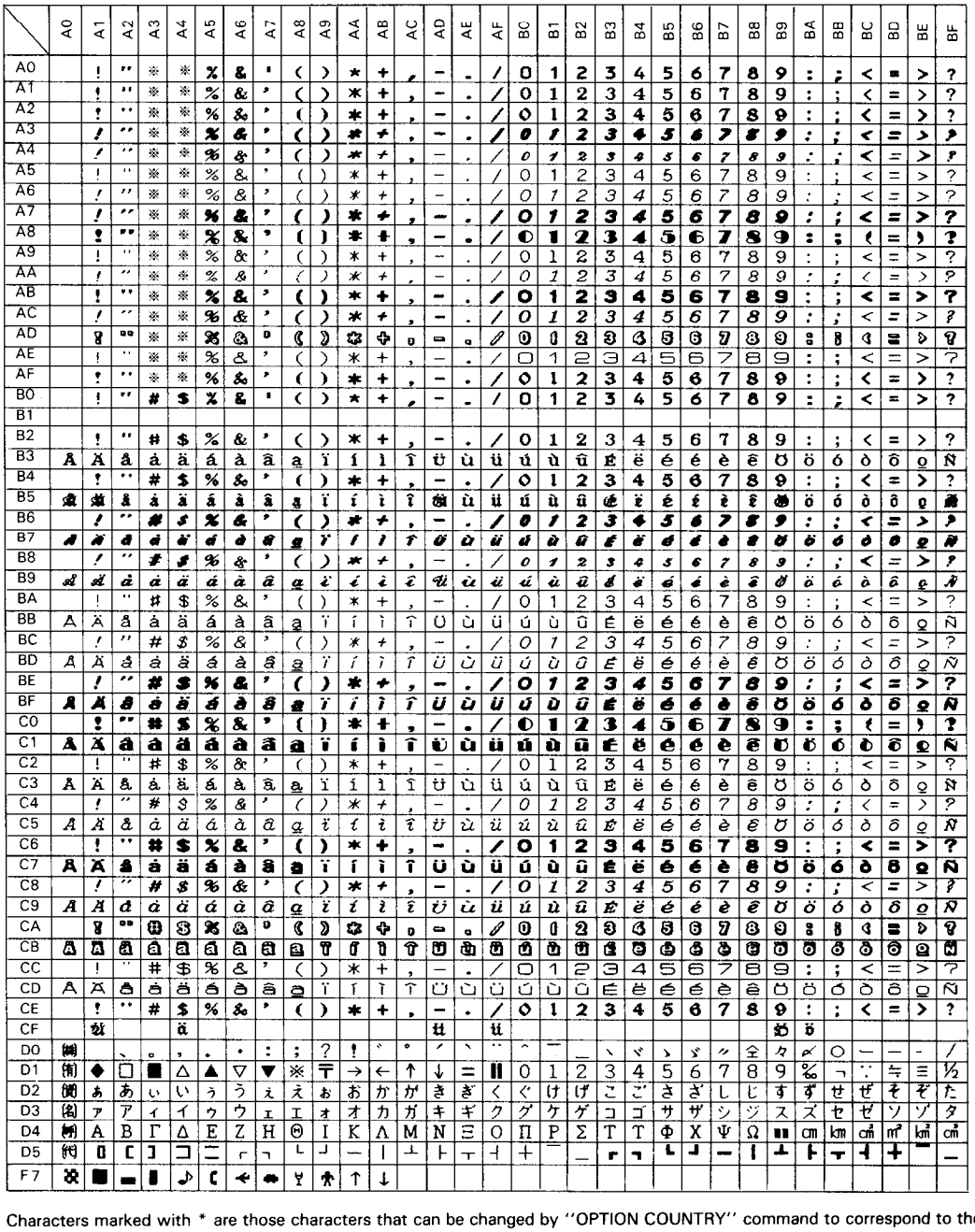
Graphic symbols
Multiple fonts
User-defined characters

USASCII in MFBASIC Mode

NOTES:

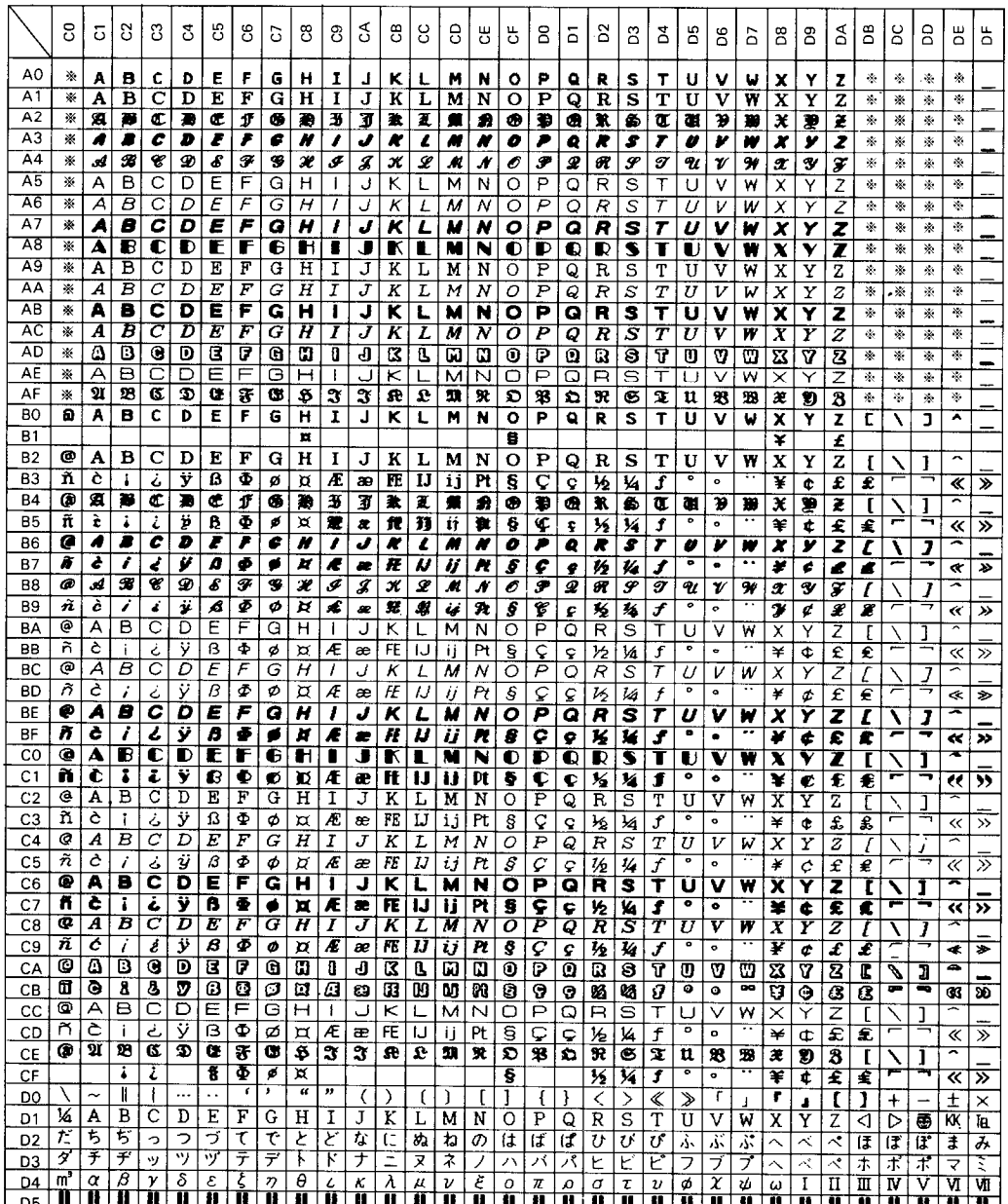
1. *$(0)_D$ through $(31)_D$ are control characters.*
2. *$(32)_D$ through $(127)_D$ are ASCII characters.*
3 *$(128)_D$ through $(159)_D$ are graphic symbols.*
4. *$(160)_D$ through $(255)_D$ are multiple font characters.*

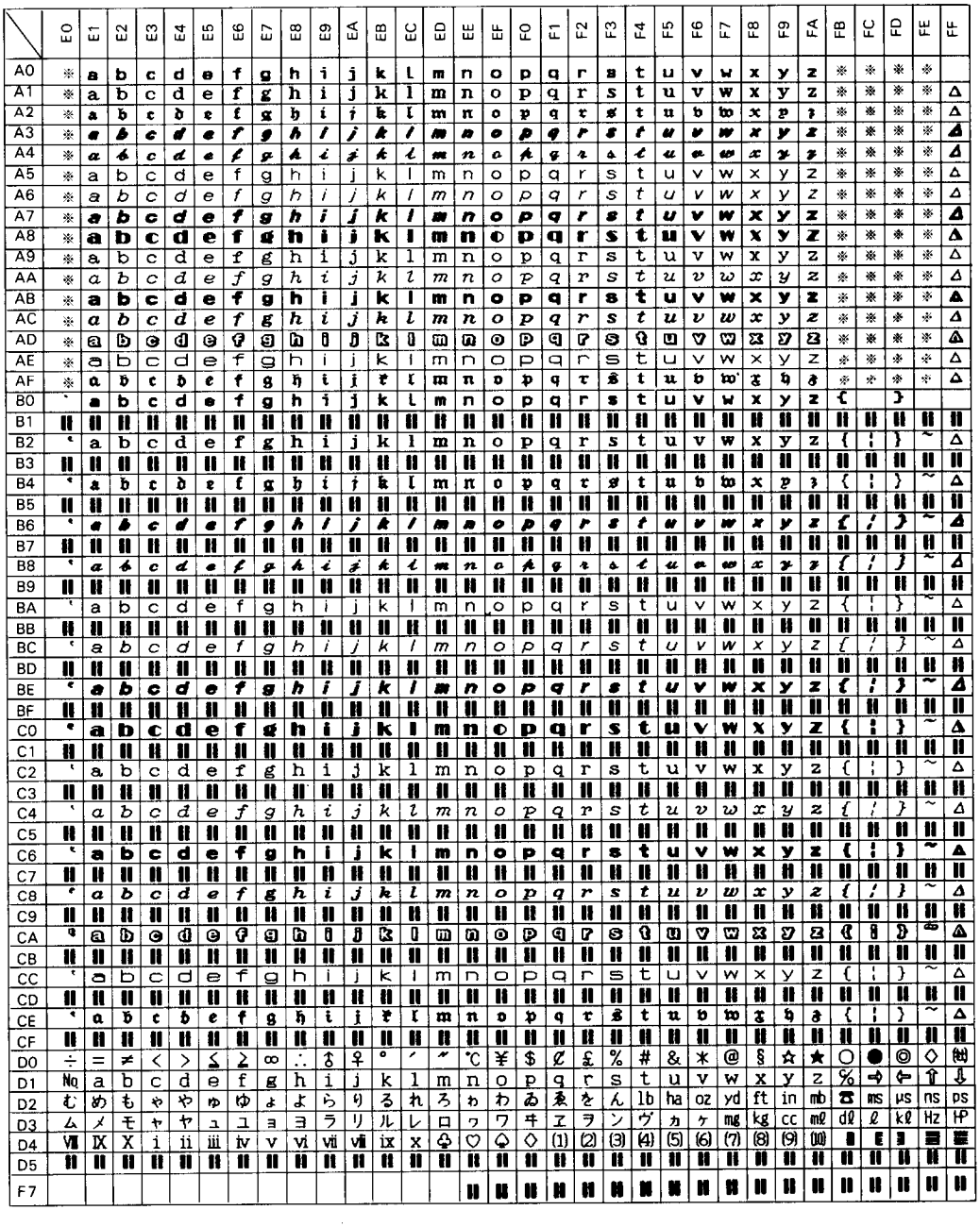
3. Multiple Fonts Character Set



Characters marked with * are those characters that can be changed by "OPTION COUNTRY" command to correspond to the specific country's language requirements.

"▮▮"is generated for codes other than those listed in these tables.





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