Personal Computer

MZ-700

OWNER'S MANUAL

SHARP

IMPORTANT

The wires in this mains lead are coloured in accordance with the following code:

BLUE: **Neutral**
BROWN: **Live**

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug proceed as follows,
The wire which is coloured **BLUE** must be connected to the terminal which is marked with the letter **N** or coloured black.
The wire which is coloured **BROWN** must be connected to the terminal which is marked with the letter **L** or coloured red.

This apparatus complies with requirements of EEC directive 76/889/EEC.

Das Gerät stimmt mit den Bedingungen der EG-Richtlinien 76/889/EWG überein.

Cet appareil répond aux spécifications de la directive CCE 76/889/CCE.

Dit apparaat voldoet aan de vereisten van EEG-reglementen 76/889/EEG.

Apparatet opfylder kravene i EF direktivet 76/889/EF.

Quest'apparecchio è stato prodotto in conformità alle direttive CEE 76/889/CEE.

Personal Computer

MZ-700

Owner's Manual

NOTICE

This manual has been written for the MZ-700 series personal computers and the BASIC interpreter which is provided with the MZ-700.

(1) All system software for the MZ-700 series computers is supported in software packs (cassette tape, etc.) in file form. The contents of all system software and the material presented in this manual are subject to change without prior notice for the purpose of product improvement and other reasons, and care should be taken to confirm that the file version number of the system software used matches that specified in this manual.

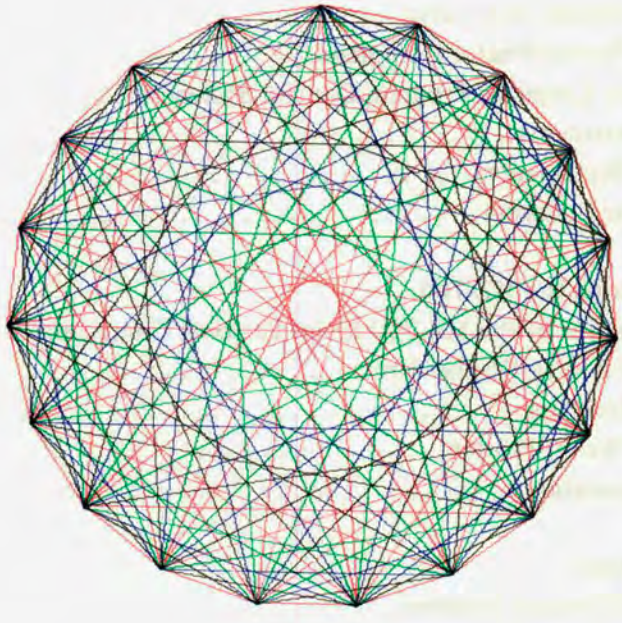
(2) All system software for the Sharp MZ-700 series personal computer has been developed by the Sharp Corporation, and all rights to such software are reserved. Reproduction of the system software or the contents of this book is prohibited.

(3) This computer and the contents of this manual have been fully checked for completeness and correctness prior to shipment; however, if you should encounter any problems during operation or have any questions which cannot be resolved by reading this manual, please do not hesitate to contact your Sharp dealer for assistance.
Not withstanding the foregoing, note that the Sharp Corporation and its representatives will not assume responsibility for any losses or damages incurred as a result of operation or use of this equipment.

Preface

Congratulations on your purchase of a Sharp MZ-700 series personal computer. Before using your computer, please read and make sure you understand the operating procedures which are described in this manual. The features and general operating procedures are described in Chapters 1 and 3, so please read those chapters first.

All software for the MZ-700 series computers is distributed on cassette tape.
The cassette tape included with the computer contains BASIC 1Z-013B, a high level BASIC interpreter which enables programming in the BASIC language and makes it possible to utilize the full capabilities of the MZ-700. The BASIC 1Z-013B interpreter and procedures for its use are fully described in this manual.



THIS FIGURE DRAWN USING THE COLOR PLOTTER-PRINTER

MZ-700 OWNER'S MANUAL

CONTENTS

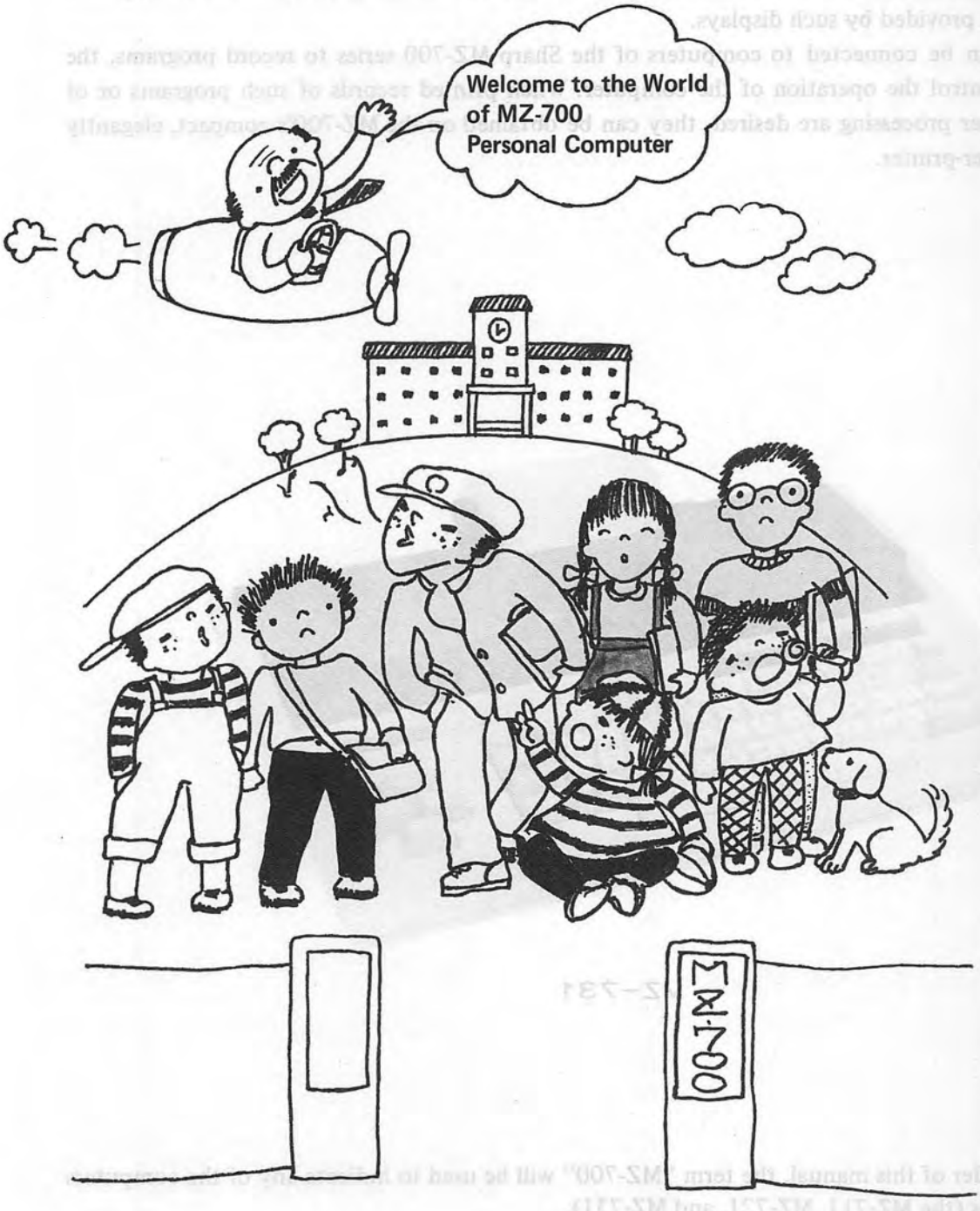
APPENDICES

INDEX

[BASIC COMMANDS] ( ) is abbreviated format

Chapter 1

THE WORLD OF MZ-700 SERIES PERSONAL COMPUTER



1.1 Features of the MZ-700 Series

In the space of just a few decades, the computer has undergone a dramatic transformation, changing from an intricate, enormously expensive monster weighing several dozen tons into a compact, inexpensive device which can be used by almost anyone. Whereas access to computers used to be limited to a few privileged individuals with special training, the inexpensive, user-friendly machines now available make the world of computing open to people in all different walks of life. The Sharp MZ-700 series computers are representative of such machines.

People use words and expressions to convey meanings.

Computers of the Sharp MZ-700 series, however, convey meaning through an ordinary television set or special printer. Any TV set can be used, either color or black-and-white; or, you may invest in one of the special display screens available if you want greater resolution and sharpness; you will be surprised at the beauty which is provided by such displays.

A tape recorder can be connected to computers of the Sharp MZ-700 series to record programs, the instructions which control the operation of the computer. When printed records of such programs or of the results of computer processing are desired, they can be obtained on the MZ-700's compact, elegantly designed 4-color plotter-printer.

MZ-731

Note: In the remainder of this manual, the term "MZ-700" will be used to indicate any of the computers of the MZ-700 series (the MZ-711, MZ-721, and MZ-731).

MZ-721

MZ-711

1. 2 Using this Manual

Before starting to study programming, why not try playing with the MZ-700 a bit? We're sure you want to do that anyway, rather than waiting until after you have read this book. **First, read "Operating the MZ-700" in Chapter 3 (you need read only those parts which apply to the model which you are using). Connect the MZ-700 to a television, read the explanation of procedures for using the keyboard, and learn which characters are output when each key is pressed.**

If you are using the MZ-700 for the first time, read Chapters 1 and 2, in that order. At first, you may find it difficult to grasp the meanings of the various commands and statements of the BASIC programming language; however, even if you don't understand the explanations, be sure to key in the examples as they are encountered. As you do so, you will gradually develop a concept of what BASIC is all about.

You may skip over those portions of Chapter 2 which start with 2. 8 "Machine Language Program Control Statements"; however, these sections will prove useful when you have completely mastered programming in BASIC, or wish to become more familiar with the computer's internal operation.

If you have used the MZ-80K, you will find that the commands and statements of BASIC for the MZ-700 are used in the same manner as those of the SP-5025 family, so that the MZ-700 can be used in almost exactly the same manner as the MZ-80K. The major difference between the two is in the color statements (applicable to both the television screen and the color plotter-printer) which have been added; however, you should find it easy to become familiar with these by reading sections 2. 6 "Color display statement" and 2. 7 "Color Plotter-printer Commands." Having done this, you will quickly be captivated by the power of expanded BASIC.

This manual also includes a discussion of "Operating the MZ-700" (Chapter 3), a reference section entitled "Hardware" (Chapter 4), a discussion of the "Monitor Commands and Subroutines" (Chapter 5), and appendices of other information.

Now go ahead and learn everything you can about the MZ-700. We hope that you will find this manual helpful.

1.3 An Introduction to the World of Computers

1.3.1 What is BASIC?

People use language to communicate with each other, and specially designed languages are also used for communication with computers. BASIC is one such language.

Beginner's All-purpose Symbolic Instruction Code

Just as human beings use languages such as English, French, German, and Japanese for communication, there are also many different languages which are used for communication with computers. Among these are BASIC, FORTRAN, COBOL, and PASCAL. Of these, BASIC is the computer language whose structure is closest to that of the languages used by humans, and therefore is the easiest for humans to understand.

1.3.2 Loading BASIC into the MZ-700

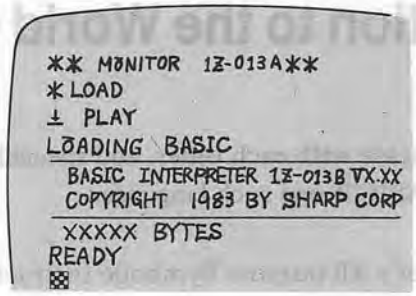
The BASIC language must be loaded into the MZ-700 before it can be used to do any work. A cassette tape containing this language has been included in the case containing the MZ-700. Now let's teach the language to the computer; procedures for doing this are described below. (The explanation assumes that you are using an MZ-731; however, the procedures are basically the same for all computers of the MZ-700 series.)

(1) Connect the display as described on page 106.
(2) Turn on the power switch located on the back of the computer.
(3) The following characters are displayed on the screen and a square, blinking pattern appears. This pattern is referred to as the cursor.

```
**  MONITOR 1Z-013A **
*
  └── Cursor
```

(4) Set the cassette tape containing the BASIC language in the computer's data recorder.
(5) Type in the word [L][O][A][D]※1 and press the [CR]※2 key. After doing this, the message ↓ PLAY appears on the screen.
(6) Press the data recorder's [PLAY] button; the cassette tape starts moving and loading of the BASIC language begins.
(7) After loading has been completed, the message READY is displayed and the cursor starts to blink again.

Notes:
※1 [L][O][A][D] . . . This is the instruction for loading programs or data from cassette tape.
※2 [CR] . . . . . This is referred to as the carriage return key, and is mainly used to indicate completion of entry of an instruction.



This completes loading of the BASIC program. You can talk to the computer using BASIC, and the computer will respond.

1.3.3 Try Executing a Program

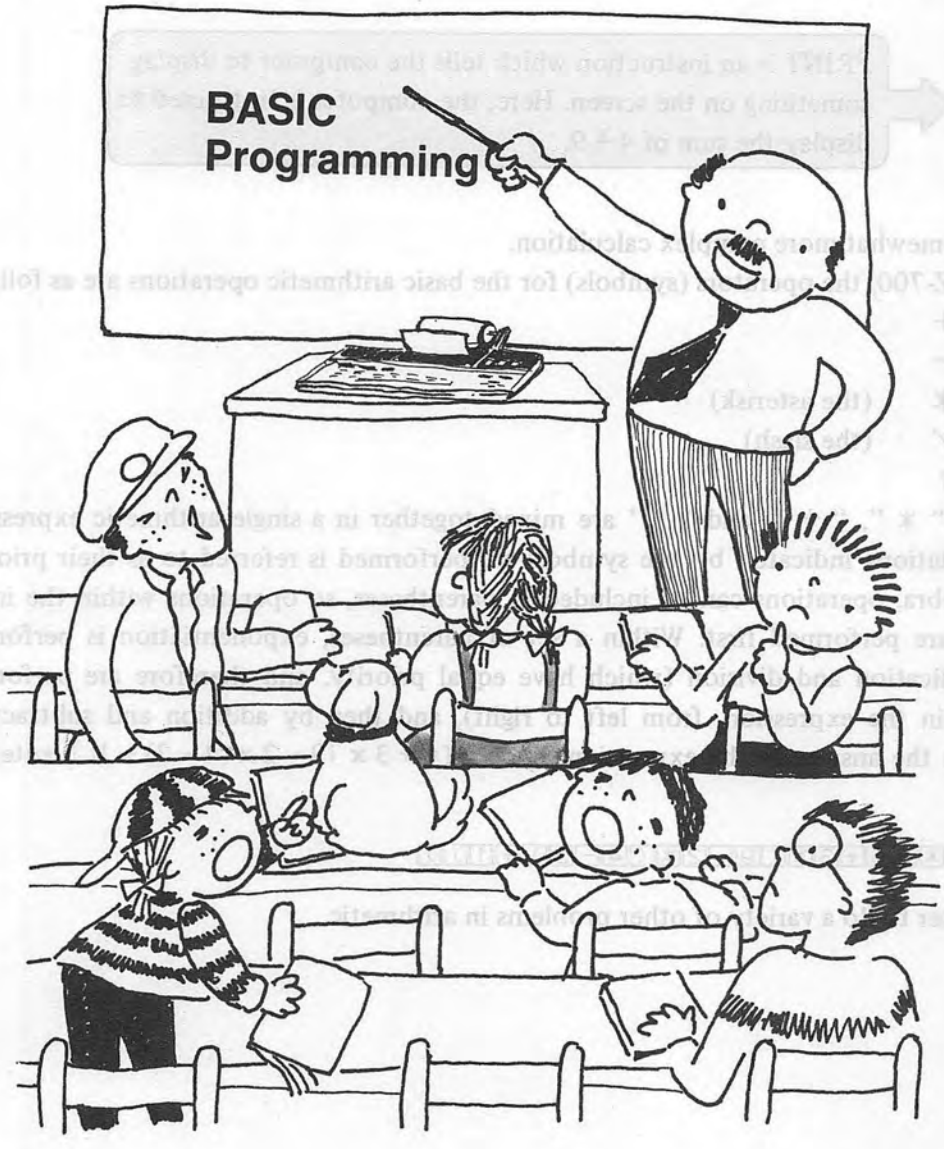
Loading BASIC into the computer doesn't cause it to do anything; first, it must be given instructions in BASIC as to what it is to do. Although we will not explain the instructions of BASIC until later, let's go ahead and try executing a BASIC program right now.

Remove the cassette tape from the recorder and turn it over so that the "B" side is up. A sample program is recorded on this side of the cassette tape. Using the following procedures, load this program into the computer and execute it.

(1) After turning the tape over and reloading it into the recorder, press the REWIND button to rewind it. Next, type in [L][O][A][D] and press the [CR] key; when the message ± PLAY is displayed, press the [PLAY] button on the data recorder. This begins loading of the sample program.
(2) When loading is completed, the cassette tape stops, READY is displayed on the screen, and the cursor starts to blink again.
(3) Now that the program has been loaded into the computer's memory, try executing it. This is done by typing in [R][U][N] and pressing the [CR] key.
(4) Now let's take a peek at the program. Hold down the [SHIFT] key and press the [BREAK] key. This stops program execution and displays the words BREAK and READY, then the cursor starts to blink again.
(5) Type in [L][I][S][T] and press the [CR] key. This lists the lines of the program on the screen one after another. (Output of the list can be temporarily stopped at any time by pressing the space bar.)
(6) If you wish to resume program execution, type in [R][U][N] again and hit the [CR] key.
(7) If you want to run a different program, set the cassette tape containing that program in the recorder, LOAD the program, then RUN it. The previous program is automatically erased from memory when the new one is loaded, so the computer contains only the BASIC language and the last program loaded.

Chapter 2

BASIC



2. 1 Introduction to Programming in BASIC

2.1.1 Direct Mode

Now that you have made some key entries on the MZ-700, you have reached the point where you are ready to start learning how to program. Before you start, however, try using the MZ-700 as you would an ordinary pocket calculator. (This is called operating the MZ-700 in the "direct mode".) Key in the following, just as you would on a pocket calculator.

4 + 9 = CR

As you can see, the computer doesn't do anything when it is presented with a problem in this form; your computer and an ordinary calculator are completely different in this respect, and instructions must be entered in a form which can be understood by the computer (i.e, in the form prescribed by the BASIC language). Now try typing in the following.

PRINT 4 + 9 CR

If you have done this correctly, the number "13" will be displayed and the screen will appear as shown below.

```
READY
PRINT 4+9
 13
READY
```

PRINT is an instruction which tells the computer to display something on the screen. Here, the computer is instructed to display the sum of 4 + 9.

Now let's try doing a somewhat more complex calculation.

With BASIC for the MZ-700, the operators (symbols) for the basic arithmetic operations are as follows.

Addition:	+	
Subtraction:	−	
Multiplication:	*	(the asterisk)
Division:	/	(the slash)
Exponentiation:	↑	

When symbols such a " * ", " + ", and " ↑ " are mixed together in a single arithmetic expression, the order in which calculations indicated by the symbols are performed is referred to as their priority. Just as with ordinary algebra, operations can be included in parentheses, so operations within the innermost set of parentheses are performed first. Within a set of parentheses, exponentiation is performed first, followed by multiplication and division (which have equal priority, and therefore are performed as they are encountered in the expression, from left to right), and then by addition and subtraction.

For example, to obtain the answer to the expression $3 \times 6 \times [6 + 3 \times \{9 - 2 \times (4 - 2) + 1\}]$, enter the following.

PRINT 3 * 6 * (6 + 3 * (9 − 2 * (4 − 2) + 1))

Now try using the computer to do a variety of other problems in arithmetic.

[EXERCISE]

1. $\frac{6+4}{6-4}$

2. $3\times\left|5+9\times(9-2)-\frac{6}{4-2}\right|+5$

3. $(3+4)\times(5+6)$

4. $\frac{10+20}{6}\times(2+3)$

5. $\frac{10+20}{6\times(2+3)}$

[ANSWER]

```
PRINT  (6+4)/(6-4)
 5
PRINT  3*(5+9*(9-2)-6/(4-2)) +5
 200
PRINT  (3+4)*(5+6)
 77
PRINT  (10+20) /6*(2+3)
 25
PRINT  (10+20) /(6*(2+3))
 1
```

After going through the exercises, try typing in [?][5][*][8] and pressing the [CR] key; the answer "40" is displayed. The reason for this is that BASIC interprets **the question mark in the same manner as the instruction PRINT**. Remember this as a convenient, abbreviated form of the PRINT instruction.

Now try entering the following. (The quotation marks are entered by holding down [SHIFT] and pressing the [2] key.)

[P][R][I][N][T]["][4][+][9][=]["][CR]

As you can see, the characters within quotation marks are displayed on the screen, but the answer is not. Now try entering the following.

[P][R][I][N][T]["][A][B][C][D][E][F][G]["][CR]

This causes ABCDEFG to be displayed on the screen.

In other words, using the PRINT instruction together with quotation marks tells the MZ-700 to display characters on the screen exactly as they are specified between quotation marks. The characters within any set of quotation marks are referred to as a **"character string" or "string"**.

Now go on to enter the following.

[P][R][I][N][T]["][4][+][9][=]["][;][4][+][9][CR]

This causes the following to be displayed on the screen.

4+9=␣13..... (The "␣" symbol indicates a space. Actually, nothing is displayed on the TV screen in the position indicated by this symbol.)

In other words, the instruction above tells the computer to display both the character string "4 + 9 =" and the result of the arithmetic expression "4 + 9 =". Now try entering the following.

[P][R][I][N][T]["][4][+][9][=]["][,][4][+][9][CR]

After typing in this entry, the following should be displayed on the screen.

4+9=␣␣␣␣␣␣␣13

The reason the screen appears different this time is because the PRINT instruction displays items of information (character strings or the results of arithmetic expressions) differently depending on whether they are separated from each other by semicolons or commas.

Semicolon (;) ..... Instructs the computer to display items immediately adjacent to each other.

Comma (,) ..... Instructs the computer to display the item at the position which is 10 spaces (columns) from the beginning of the display line.

If you have the MZ-731 (or a separate plotter-printer), now try appending the characters 「/P」 to the end of the word PRINT.

PRINT/P"4+9=";4+9CR

This time nothing appears on the display screen, but the same result is printed out on the plotter-printer. In other words, the 「/P」 symbols switch output from the display to the plotter-printer.

This completes our explanation of procedures for using the MZ-700 as you would a pocket calculator.

Note: PRINT "5 + 8 ="; 5 + 8 displays 5 + 8 = 13, while PRINT " 5 - 8 ="; 5 - 8 displays 5 - 8 = -3. The reason for this is that one space is always reserved for a symbol indicating whether the result is positive or negative, but the symbol is only displayed in that space when the result is negative.

2.1.2 Programming

Let's try making a simple program. However, first let's make sure that the area in the computer's memory which is used for storing programs is completely empty. Do this by typing in NEW and pressing the CR key. (This instruction will be explained in more detail later; see page 32.)

Type in the following program exactly as shown.

```
10 A=3CR ..... Assigns the value 3 to A.
20 B=6CR ..... Assigns the value 6 to B.
30 C=A+BCR ..... Assigns the result of A + B to C.
40 ? CCR ..... Displays the value assigned to C.
50 ENDCR ..... Instruction indicating the end of the program.
```

The numbers 10, 20, 30, and so forth at the left end of each line are referred to as program line numbers, or simply line numbers; these numbers indicate the order in which instructions are to be executed by the computer. Instructions on the lowest numbered line are executed first, followed by those on the next lowest numbered line, and so forth. Line numbers must be integers in the range from 1 to 65535.

The line numbers 1, 2, 3, and so forth could have been used in this program instead of 10, 20, 30. However, it is common practice to assign line numbers in increments of 10 to provide room for later insertion of other lines.

Now let's check whether the lines have been correctly entered. Type in LIST and press the CR key; this causes a list of the program lines to be displayed. Notice that the question mark entered at the beginning of line 40 has been converted to PRINT, the full form of the command for displaying data on the display screen.

Now let's try executing the program.

[R][U][N][CR]

Enter RUN and press the [CR] key; the result is displayed on line 9 of the screen.

Now we will explain procedures for making changes in programs. First, let's change the instruction on line 20 from B = 6 to B = 8. Type in LIST 20 and press the [CR] key; this displays just line 20 of the program on the screen. Next, use the cursor control keys (the keys at the right side of the keyboard which are marked with arrows) to move the cursor to the number "6", then press the [8] key and the [CR] key in succession to make the change. **Note that the change is not completed until the [CR] key is pressed.**

Now type in LIST and press the [CR] key again to confirm that the change has been made.

Next, let's change line 30 of the program to C = 30 * A + B.

Using the cursor control keys, move the cursor so that it is positioned on top of the "A" in line 30, then press the [INST] key three times in succession. This moves "A + B" three spaces to the right.

```
C=␣␣␣A+B
   ↑
   └Cursor position
```

Now type in [3][0][*] and press the [CR] key to complete the insertion. LIST the program to confirm that the change has been made correctly.

Now change line 30 again so that it reads "C = 30 * A" instead of "C = 30 * A + B". Do this by moving the cursor to the position immediately to the right of B and pressing the [DEL] key two times; this deletes "+B". Press the [CR] key to complete the change.

Now LIST the program and confirm that it appears as shown below.

```
10 A=3
20 B=8
30 C=30*A
40 PRINT C
50 END
```

To delete an entire line from a program, simply enter the line number of that line and press the [CR] key; delete line 20 in this manner, then LIST the program to confirm that the line has been deleted.

We could insert the instruction "?A" between lines 30 and 40, by typing in 35␣?A and pressing the [CR] key. Try this, then LIST the program to confirm that the line has been added. Now delete line 35 by entering 35 and pressing the [CR] key.

The process of changing or inserting lines in a program in this manner is referred to as **editing**, and the program which results from this process is referred to as the **BASIC text**. Each line of the program can include a maximum of 255 characters, including the line number, but the maximum length is reduced by four characters if the question mark is used to represent the PRINT instruction.

At this point, the program contained in the computer's memory should be as follows.

```
10 A=3
30 C=30*A
40 PRINT C
50 END
```

Now we will use this program to explain the procedures for recording programs on cassette tape. Prepare a blank cassette tape (one on which nothing has been recorded) and set it in the data recorder,

then type in the following from the keyboard.

SAVE "CALCULATION" ♩

Here, "CALCULATION" is the name which is to be recorded on the cassette tape to identify the program. Any name may be assigned, but the name connot be longer than 16 characters.

Note: The ♩ symbol in the example above represents the [CR] key.

When the [CR] key is pressed, "⭳ RECORD. PLAY" is displayed on the screen. Pressing the [RECORD] button on the data recorder at this time records the program on cassette tape.

The name which is assigned to the program is referred to as its **file name.** Specification of a file name is not absolutely necessary, but from the point of view of file management it is a good idea to assign one. Of course, the file name is recorded on the tape together with the program.

When recording is completed, READY is displayed to indicate that the computer is finished. Now press the STOP button on the data recorder and rewind the tape.

The program is still present in the computer's memory after recording is completed, so type in NEW ♩ to delete it (enter LIST ♩ to confirm that the program has been deleted). Now let's try using the LOAD instruction to load the program back into memory from the cassette tape as described on page 14.

When a cassette tape contains many programs, that which is to be loaded can be identified by specifying the program's file name together with the LOAD instruction as follows.

LOAD "CALCULATION" ♩

Specifying the file name in this manner tells the computer to ignore all programs on the tape other than that with the specified name. If the file name is not specified (if only LOAD♩ is entered), the computer loads the first program encountered.

Note: When using cassette recorder other than the data recorder built into the MZ-731, and MZ-721 read the instructions on page 109 before attempting to record or load programs.

The LIST command shown above can be used in a variety of different ways. For example, during editing LIST 20 ♩ can be used to display just line 20 of a program. The entire program can be listed by entering LIST ♩ . Other uses of the instruction are as follows.

[L][I][S][T] [-][3][0][CR]	Lists all lines of the program to line 30.
[L][I][S][T] [3][0][-][CR]	Lists all lines from line 30 to the end of the program.
[L][I][S][T] [3][0][-][5][0][CR]	Lists all lines from line 30 to line 50.
[L][I][S][T] [3][0][CR]	Lists line 30.

When editing programs by listing individual lines with the LIST instruction, press the [CLR] key (the [INST] key) together with the [SHIFT] key when the screen becomes distractingly crowded. This clears the entire screen and moves the cursor to its upper left corner. (This does not affect the program in memory). Afterwards, enter LIST < line number > ♩ again to list the line which is to be edited.

2. 2 An Outline of BASIC

2.2.1 Constants

A constant is a number or string of characters which is written into a program, and which is used by that program as it is executed. Types of constants include numeric constants, string (character) constants, and system constants. These are explained below.

Numeric constants

A numeric constant is a number which has a maximum of 8 significant digits. The exponent of such constants must be in the range from 10^{-38} to 10^{38} (the maximum range is 1.548437E–38 to 1.7014118E +38).

(Examples:)

−123. 4
Ø. 789
3748. Ø
3. 7E+12 ..... 3.7×10^{12}
7. 65E−9 ..... 7.65×10^{-9} } E indicates the exponent.
14. 8E9 ..... 14.8×10^{9}

Hexadecimal numbers: Numbers can be specified in hexadecimal format only for direct memory addressing with the LIMIT, POKE, PEEK, and USR instructions (see pages 92 and 93), and are represented as four digits preceded by a dollar sign ($).

(Examples:)

LIMIT $BFFF
USR ($CØØØ, X$) ..... X$ represents a string variable.

String constants

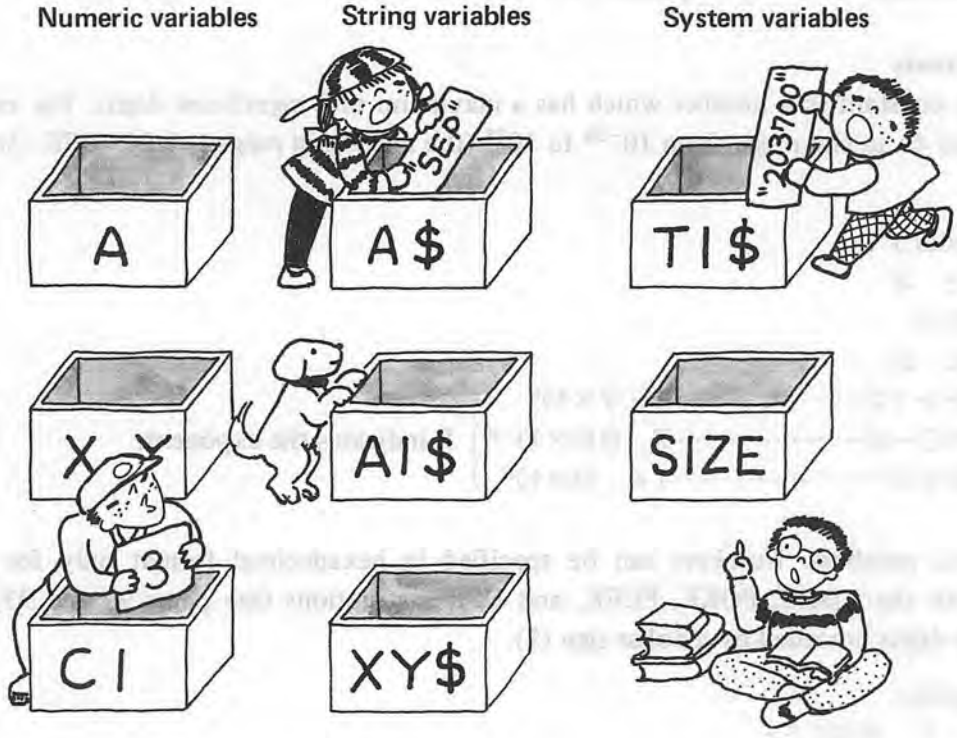
String constants are letters and symbols between quotation marks which are included in programs to allow titles or messages to be output to the display screen or printer. The characters "4+9" appearing on page 17 are a character constant, and not a numeric constant. With BASIC, a string constant may consist of a maximum of 255 characters. (Not including quotation marks which cannot be included in a string constant.)

(Examples:)

"ABCDEFG"
"12345678910"
DATA ABCDEFG..... Quotation marks are not needed when string constants are specified in a DATA statement; however, they may be used if desired.

2.2.2 Variables

The word "variable" has a different meaning with BASIC than it does when used with regard to algebraic expressions. To put it in very simple terms, the variables of BASIC are "boxes" in memory for the storage of numbers and characters (character strings). The types of variables used in BASIC include numeric variables, string variables, and system variables.



Numeric variables

Only numeric data can be stored in numeric variables.

Names must be assigned to these variables in accordance with the following rules.

i) A variable name may consist of any number of characters, but only the first two characters are actually used by the BASIC interpreter to identify the variable. Further, the first character of the variable name must be a letter (A to Z), either letters or numerals may be used for subsequent characters.

ii) It is not possible to use the names of BASIC commands and statements as variable names.

Correct variable names: ABC, XY, ABCD, A12345
(ABC and ABCD are regarded as the same variable.)

Incorrect variable names: PRINT ..... (PRINT is a BASIC statement)
C@ ..... (Variable names may not include special characters.)

(Example:)

```
10 A=5 ..... Stores 5 in variable A.
20 PRINT A ..... Displays the value stored in variable A.
```

String variables

String variables are variables which are used for storing character strings. Names assigned to string variables must conform to the same rules as those assigned to numeric variables; however a dollar sign ($) is appended to the end of string variable names to differentiate them from other types of variables.

String variables may be used to store a maximum of 255 characters. Such variables are blank until string data is assigned to them.

The only operator which can be used in expressions including more than one string variable is the "+" sign.

(Example:)

```
10 A$="ABCD" ..... Substitutes the character string ABCD into string variable A$.
20 B$="XYZ" ..... Substitutes the character string XYZ into string variable B$.
30 C$=A$+B$ ..... Substitutes the sum of string variables A$ and B$ (ABCDXYZ)
                  into string variable C$.
40 PRINT C$ ..... Displays the contents of string variable C$.
```

System Variables

System variables contain values which are automatically changed by the BASIC interpreter. The system variables are size (the variable which indicates the amount of BASIC free area) and TI$ (a 6-digit variable which contains the value of the system's 24-hour clock).

(Examples:)

```
10 TI$="013500" ... This statement assigns the value corresponding to 1:35:00 A.M.
                    to system variable TI$ and sets the system clock to that time.
20 PRINT TI$ ..... Executing this statement displays the current time of the system
                   clock (24-hour time).
```

Display format:

```
132819 ..... Indicates that the time is 13:28:19.
```

```
PRINT SIZE ↵ ..... This displays the current amount of free space in the computer's
                   memory (in other words, the amount of space which is available
                   for additional program lines). The value indicated by this variable
                   is reduced each time a program line is entered.
```

2.2.3 Arrays

Arrays can be thought of as shelves within the computer's memory which contain rows of boxes, each of which represents a variable. The boxes on these shelves are arranged in an orderly sequence, and are identified by means of numbers; these numbers are referred to as subscripts, because they are subscripted to the name which identifies the entire group of boxes.

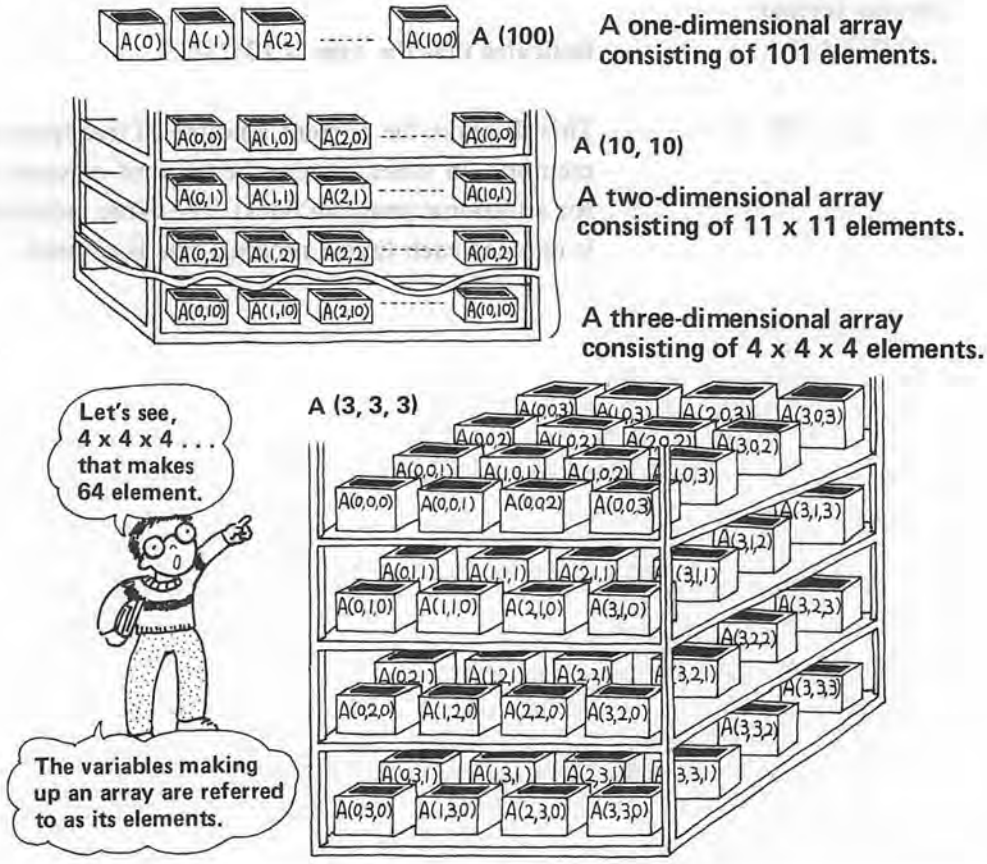
Such shelves of boxes are set up simply by executing an instruction which declares that they exist; this is referred to as making an array declaration. The array declaration specifies the number of boxes which are to be included in each set of shelves (i.e., the size of the shelves) and the manner in which they are to be arranged.

The boxes in each unit of shelves may be arranged in sequences which have any number of dimensions. Thus, a one-dimensional array can be thought of as a single shelf which holds, one row of boxes; a two-dimensional array can be thought of as a stack of shelves, each of which holds one row of boxes; and so forth. These boxes, or variables, are referred to as the array's elements.

The number of subscripts used to identify each of the array elements of a corresponds to the number of dimensions in that array. For example, each of the elements in a one-dimensional array is identified by a single subscript which indicates the box's position in the row; each of the elements in a two dimensional array is identified by two subscripts, one which identifies the box's row, and one which indicates the box's position within that row; and so forth. The numbers which are used as the subscripts start with zero, and have a maximum value which is determined by the size of each of the array's dimensions (i.e., the number of boxes in each row, etc.).

The maximum size of an array is limited by the amount of free space which is available in the computer's memory (i.e., by the size of the program, the number of items of data which are to be stored in the array, and so forth). The syntax of BASIC places no restrictions on the number of dimensions which can be used for any array, but in practice the number of dimensions is limited by the amount of free memory space which is available for storage of array variables.

An array must be declared before values can be stored in any of its elements.



(Example 1)

```
10 DIM A(5)
```
Declares 1-dimensional numeric array A with 6 elements.

```
20 DIM X$(8)
```
Declares 1-dimensional string array X$ with 9 elements.

```
10 DIM A(5), X$(8)
```
Performs the same function as lines 10 and 20 above.

(Example 2)

```
10 DIM B(5, 5)
```
Declares 2-dimensional numeric array B with 6 x 6 elements.

```
20 DIM Y$(5, 8)
```
Declares 2-dimensional string array Y$ with 6 x 9 elements.

```
10 DIM B(5, 5), Y$(5, 8), A(5), X$(8)
```
Declares two numeric arrays and two string arrays.

(Example 3)

```
10 DIM C(3, 3, 3)
```
Declares 3-dimensional array C with 4 x 4 x 4 elements.

Note: Different names must be used for each array which is declared; for example, the instruction DIM A(5), A(6) is not a legal array declaration.

Try executing the program shown below and check the results which are obtained.

```
10 DIM A(2), B$(2)
20 A(0)=26
30 A(1)=9
40 A(2)=-100
50 B$(0)="ABC"
60 B$(1)="XYZ"
70 B$(2)="MZ-700"
80 PRINT A(1)
90 PRINT B$(2)
100 PRINT A(2)
110 PRINT B$(0)+B$(1)
120 PRINT A(0)
```

Note: Individual variables within an array, such as A(5) and X$(8), are referred to as an array's elements. Numeric constants, numeric variables, and numeric arrays are collectively referred to as numeric expressions, and string constants, string variables, and string arrays are collectively referred to as string expressions.

2.2.4 BASIC Operations

In BASIC, arithmetic operations take a slightly different form than is the case with ordinary arithmetic. The various arithmetic operators used in BASIC are shown in the table below. The priority of these operators when they are used together within a single expression (the sequence in which the different arithmetic operations are performed) is as indicated by the numbers in the left column of the table; **however, operators within parentheses always have the highest priority.**

Arithmetic operations

	Operator	Operation	Format
1	↑	Exponentiation	X ↑ Y (Indicates X^Y; i.e., X to the Yth power.)
2	–	Negation	– X
3	＊, ／	Multiplication, division	X ＊ Y (X times Y), X/Y ($\frac{X}{Y}$; i.e., X divided by Y)
4	+, –	Plus, minus	X + Y (X plus Y), X – Y (X minus Y)

(Example 1)

```
10 A=3*8/4
```
·····When a series of operators with the same priority are used in an arithmetic expression, calculations are carried out from left to right; thus, the result of the expression at left is 6.

(Example 2)

```
10 A=60-6*8+2
```
·····Result is 14.

```
20 B= (60-6) *8+2
```
·····Result is 434.

(Example 3)

```
10 A=2↑3
```
····· Assigns 2 to the 3rd power to A; result is 8.

String operations

String operations are used to create new strings of character data by concatenating (linking) two or more shorter strings. The only operator which can be used in string operations is the "+" sign.

(Example)

```
PRINT "ABC"+"DEF"↵
```
⟶ Displays the character string "ABCDEF".

2.2.5 Initial settings

Initial settings made when BASIC 1Z–013B is started are as described below.

■ **Keyboard**

1) Operation mode: Normal (alphanumeric)
2) Definable function keys

F1	: ····· "RUN" +CHR$ (13)	SHIFT + F1	: ····· "CHR$ ("
F2	: ····· "LIST"	SHIFT + F2	: ····· "DEF KEY ("
F3	: ····· "AUTO"	SHIFT + F3	: ····· "CONT"
F4	: ····· "RENUM"	SHIFT + F4	: ····· "SAVE"
F5	: ····· "COLOR"	SHIFT + F5	: ····· "LOAD"

Note A carriage return code is included in the definition of function key F1 .

■ **Built-in clock**

The initial value set to system variable TI$ is "000000".

■ **Music function**

1) Musical performance tempo: 4 (moderato, approximately medium speed)
2) Note duration: 5 (quarter note ♩)

■ **Control keys and control characters**

The control keys are keys which perform special functions when pressed together with the CTRL key. Functions of these keys and their corresponding ASCII codes are as shown in the table below.

[Control codes]

CTRL +	ASCII code (decimal)	Function
E	5	Selects the lowercase letter input mode for alphanumeric characters.
F	6	Selects the uppercase letter input mode for alphanumeric characters.
M	13	Carriage return (CR).
P	16	Same as the DEL key.
Q	17	Moves the cursor down one line (↓).
R	18	Moves the cursor up one line (↑).
S	19	Moves the cursor one column (character) to the right (→).
T	20	Moves the cursor one column (character) to the left (←).
U	21	Moves the cursor to the home position (HOME).
V	22	Clears the screen to the background color (CLR).
W	23	Places the computer in the graphic character input mode (GRAPH).
X	24	Inserts one space (INST).
Y	25	Places the computer in the alphanumeric input mode.

■ **Other**

The lower limit of the BASIC text area is set to address $FEFF; this is the same as LIMIT MAX is executed).

For initial printer settings, see the discussion of the printer.

2. 3 Frequently Used BASIC Commands and Statements

2.3.1 Program file input/output instructions

2. 3. 1. 1 **LOAD** ..... (abbreviated format: **LO.**)

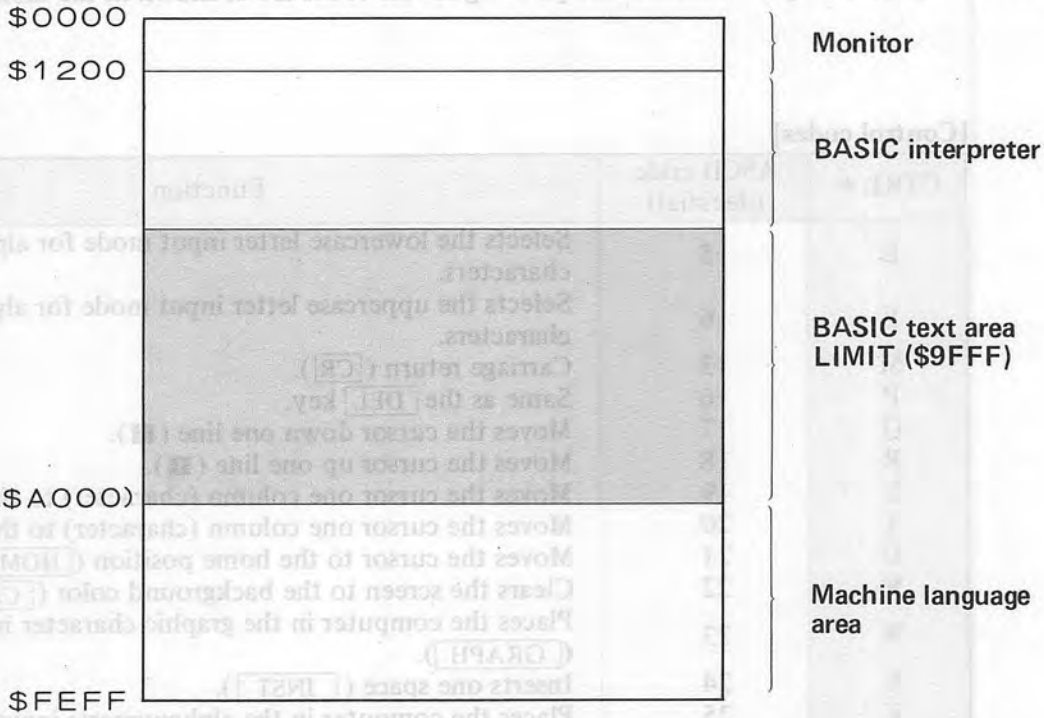
Format **LOAD** or **LOAD** " filename"

Function This command loads the specified BASIC text file or a machine language file to be linked with a BASIC program from cassette tape.

(See pages 14 and 20.)

Only BASIC text files and machine language programs can be loaded with this command. When the file to be loaded is a BASIC text file, the current program is cleared from the BASIC text area when the new program is loaded.

Note When loading a machine language routine to be linked with a BASIC program, the LIMIT statement must be executed to reserve a machine language progam area in memory. Further, the applicable machine language program file is executed as soon as loading is completed if the loading address is inside that area. (In this case, the BASIC text is not erased.)
The LOAD command can be used within a program to load a machine language program file.



Note: The lower limit of the BASIC text area shifts according to the size the program text loaded.

2. 3. 1. 2 SAVE ..... (abbreviated format: SA.)

Format — **SAVE** or **SAVE** "filename"

Function — This command assigns a file name to the BASIC program in the computer's memory and saves it on cassette tape.

Note — This command saves only the BASIC program text (i.e., the program text displayed by executing the LIST command); it does not save any machine language program in the machine language area.

The file name specified is recorded on tape together with the BASIC text file; specify any name desired using up to 16 characters. If no file name is specified, the program is recorded without a file name; however note that this can make file management difficult if more than one program is recorded on a single tape.

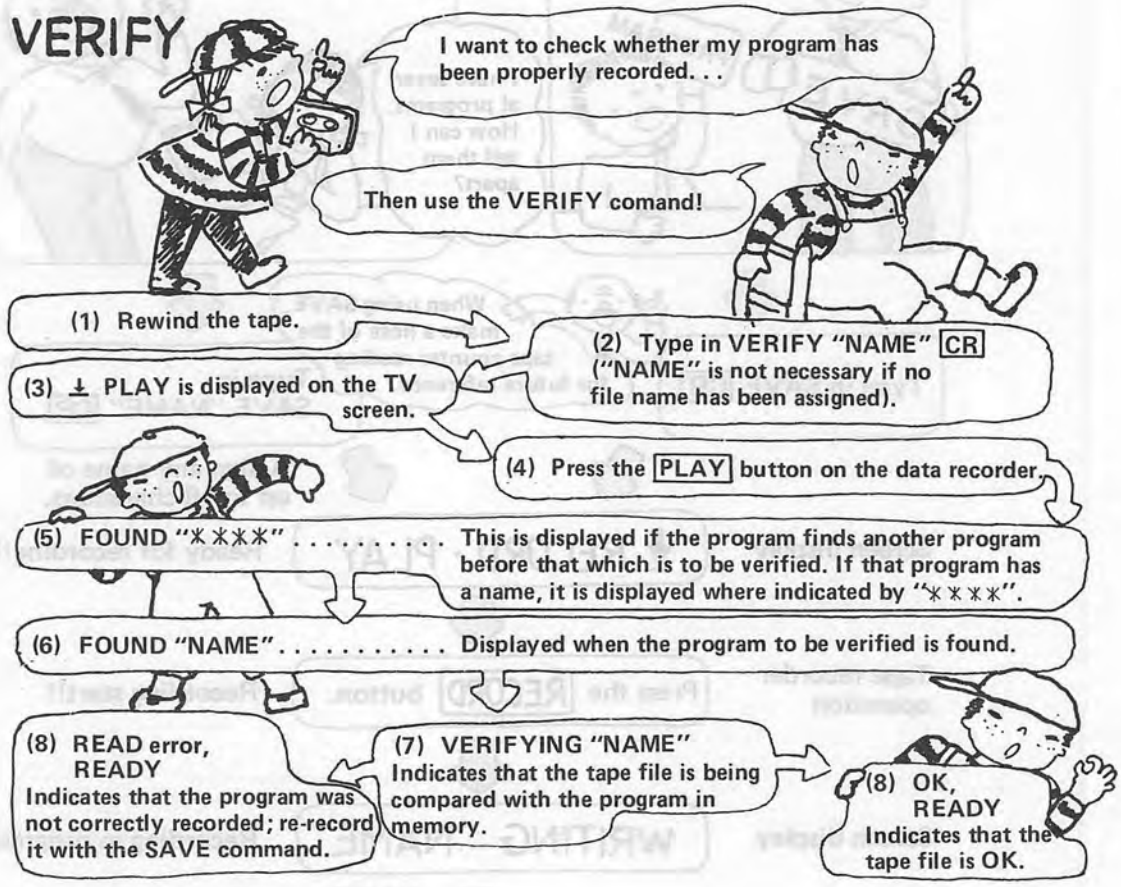
2. 3. 1. 3 VERIFY ..... (abbreviated format: V.)

Format

VERIFY or **VERIFY** "filename"

Function

This command is used to confirm that programs have been properly recorded on tape by the SAVE command. This is done by playing the tape and comparing the program read with the program contained in memory. If both programs are the same, **"OK"** is displayed; if they are different, "READ error" is displayed. In the latter case, save the program again.



2.3.2 Text editing commands

2. 3. 2. 1 AUTO ..... (abbreviated format: A.)

Format AUTO or AUTO Ls, n

Ls ····· Starting line number

n ····· Line number increment

Function This command automatically generates program line numbers during entry of BASIC program statements.

Example (Example 1)

```
AUTO↵
10·····↵
20·····↵
30·····↵
```

(Example 2)

```
AUTO 300, 5↵
300·····↵
305·····↵
310·····↵
```

Automatically generates program line numbers with an increment of 5, starting with line 300.

(Example 3)

```
AUTO 100↵
100·····↵
110·····↵
120·····↵
```

Generates program line numbers with an increment of 10, starting with line 100.

(Example 4)

```
AUTO, 20↵
10·····↵
30·····↵
50·····↵
```

Generates program line numbers with an increment of 20, starting with line 10.

Note: The AUTO command is terminated by pressing [SHIFT] and [BREAK].

2. 3. 2. 2 DELETE ..... (abbreviated format: D.)

Format

DELETE Ls—Le ····· Deletes program lines from Ls to Le.

DELETE —Le ····· Deletes all program lines from the beginning of the program to line Le.

DELETE Ls— ····· Deletes all program lines from line Ls to the end of the program.

DELETE Ls ····· Deletes line Ls.

Example (Example 1)

```
DELETE 150—350↵
```

····· Deletes all program lines from 150 to 350.

(Example 2)

```
DELETE —100↵
```

····· Deletes all program lines up to line 100.

(Example 3)

```
DELETE 400—↵
```

····· Deletes all program lines from 400 to the end of the program.

2. 3. 2. 3 LIST ..... (abbreviated format: L.)

Format

```
LIST
LIST Ls-Le
LIST Ls-
LIST -Le
```

Ls indicates the starting line number and Le indicates the ending line number.

Function

This command lists all or part of the program lines contained in the BASIC text area on the display screen.

```
LIST ↵ ..... Lists the entire program.
LIST -30↵ ..... Lists all lines of the program to line 30.
LIST 30-↵ ..... Lists all lines of the program from line 30 to the end.
LIST 30-50↵ ..... Lists all lines of the program from line 30 to line 50.
LIST 30↵ ..... Lists line 30 of the program.
```

Output of the program list to the display screen can be temporarily interrupted by pressing the space bar; listing is then resumed when the space bar is released. To terminate list output, press the BREAK key together with the SHIFT key.

2. 3. 2. 4 LIST/P ..... (abbreviated format: L./P)

Format

LIST/P <Ls-Le>

Ls ..... Starting line number

Le ..... Ending line number

Function

This command lists all or part of the program in the BASIC text area on the printer. The range of program lines to be listed is specified in the same manner as with the LIST command described above.

Note: The angle brackets < . . . > in the above indicate that the enclosed item is optional.

2. 3. 2. 5 MERGE ..... (abbreviated format: ME.)

Format

MERGE or **MERGE** "filename"

Function

The MERGE command is used to read a program from cassette tape. When a program is read using this command, it is appended to the program in memory. If "filename" is omitted, the computer reads the first file encountered on the cassette tape.

If any line numbers in the program read are the same as those of the program in memory, corresponding lines of the program in memory are replaced with lines of the program read.

2. 3. 2. 6 NEW

Format

NEW

Function

The NEW command erases the BASIC text area and clears all variables. Execute this command when you wish to clear the program in memory prior to entering another program. This command does not erase the machine language area reserved by the LIMIT statement.

Since the BASIC text area is automatically cleared by the LOAD command, it is not necessary to execute this command before loading a BASIC program from cassette tape.

2. 3. 2. 7 RENUM ..... (abbreviated format: REN.)

Format

```
RENUM
RENUM Ln
RENUM Ln, Lo, n
```

Ln .... New line number
Lo .... Old line number
n ..... Increment

Function

This command renumbers the lines of a BASIC program. When this command is executed, line numbers referenced in branch statements such as GOTO, GOSUB, ON ~ GOTO, and ON ~ GOSUB are also reassigned.

`RENUM` ..... Renumbers the lines of the current program in memory so that they start with 10 and are incremented in units of 10.

`RENUM 100` ..... Renumbers the lines of the current program in memory so that they start with 100 and incremented in units of 10.

`RENUM 100, 50, 20` ..... Renumbers lines of the current program in memory starting with line number 50; line number 50 is renumbered to 100, and subsequent line numbers are incremented in units of 20.

Example

The example below shows the result of executing RENUM 100, 50, 20 for a sample program.

(Before renumbering)

```
50 A=1
60 A=A+1
70 PRINT A
100 GOTO 60
```

→

(After renumbering)

```
100 A=1
120 A=A+1
140 PRINT A
160 GOTO 120
```

Note

When specifying the new and old line numbers, the new line number specified must be larger than the old line number. Note that an error will result if execution of this command results in generation of a line number which is greater than 65535.

2.3.3 Control commands

2. 3. 3. 1 **RUN** ..... (abbreviated format: **R.**)

Format — **RUN** or **RUN** Ls

Ls .... Starting line number

Function — This command executes the current program in the BASIC text area.

If the program is to be executed starting with the first program line, just enter RUN and press the [CR] key. If execution is to begin with a line other than that the lowest line number, type in RUN Ls (where Ls is the line number at which execution is to start) and press the [CR] key.

When this command is executed, the BASIC interpreter clears all variables and arrays before passing control to the BASIC program.

2. 3. 3. 2 **CONT** ..... (abbreviated format: **C.**)

Format — **CONT**

Function — The CONT command is used to resume execution of a program which has been interrupted by pressing [SHIFT] + [BREAK] or by a STOP statement in the program. This command can also be used to continue execution of a program which has been interrupted by an END statement; however, in this case care must be taken to ensure that lines following the END statement are not the lines of a subroutine. Examples of situations in which the CONT command can and cannot be used are shown in the table below.

Program continuation possible	Program continuation not possible
• Program execution stopped by pressing [SHIFT] + [BREAK].	• Before a RUN command has been executed.
• Program execution stopped by a STOP command.	• "READY" displayed due to an error occurring during program execution.
• Program execution stopped by pressing [SHIFT] + [BREAK] while the program was a waiting input for an INPUT statement.	• Cassette tape operation interrupted by pressing [SHIFT] + [BREAK].
	• Program execution stopped during execution of a MUSIC statement.
	• Program execution stopped and "READY" displayed after execution of an END statement.

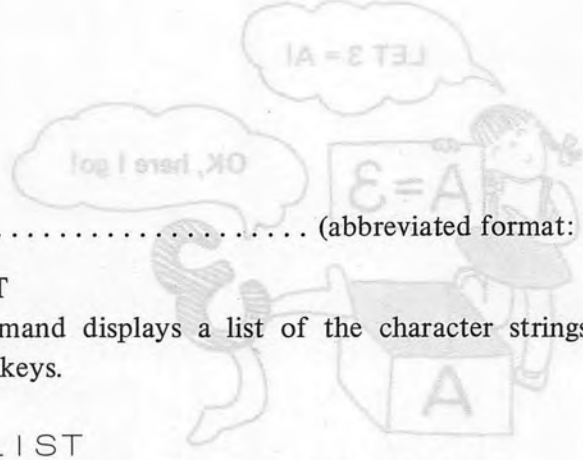
2. 3. 3. 3 BYE ..... (abbreviated format: B.)

Format

BYE

Function

This command returns control of the computer from BASIC interpreter 1Z-013B to the monitor program in RAM. (The monitor commands are explained starting on page 99.)



2. 3. 3. 4 KEY LIST ..... (abbreviated format: K. L.)

Format

KEY LIST

Function

This command displays a list of the character strings assigned to the definable functions keys.

```
KEY LIST
DEF KEY (1) = "RUN" +CHR$ (13)
DEF KEY (2) = "LIST"
DEF KEY (3) = "AUTO"
DEF KEY (4) = "RENUM"
DEF KEY (5) = "COLOR"
DEF KEY (6) = "CHR$ ("
DEF KEY (7) = "DEF KEY ("
DEF KEY (8) = "CONT"
DEF KEY (9) = "SAVE"
DEF KEY (10) = "LOAD"
READY
■
```

2.3.4 Assignment statement

LET

Format

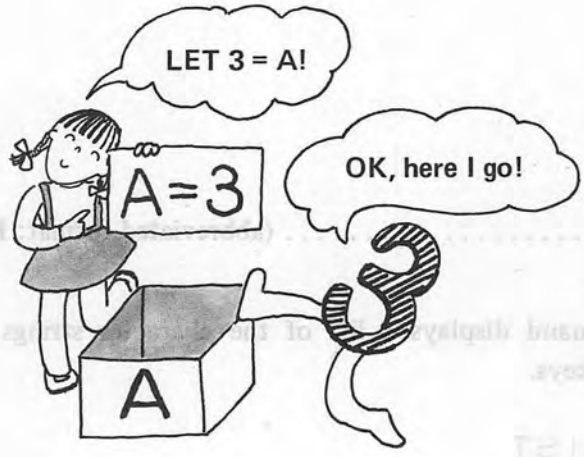
LET v = e or v = e

v . . . Numeric variable or array element, or string variable or array element.

e . . . Numeric expression (consisting of one or more constants, variables, or array elements) or string expression (consisting of one or more constants, variables, or array elements).

Function

This statement assigns the value (numeric or string) specified by e to the variable or array element specified by v. As shown in the examples below, LET may be omitted.



Example

```
10 A=10                    10 LET A=10
20 B=20                    20 LET B=20
30 A=A+B                   30 LET A=A+B
40 PRINT A                 40 PRINT A
50 END                     50 END

RUN↵
30
```

.....The two programs above produce exactly the same result.

The following are examples of incorrect use of the LET statement.

```
20 A$=A+B
```
.....Invalid because different types of variables (string and numeric) are specified on either sides of the "=" sign.

```
20 LOG(LK)=LK+1
```
.....Invalid because the left side of the statement is not an numeric variable or array element.

2.3.5 Input/output statements

Input/output statements are the means by which data is submitted to the computer for processing, and by which the results of processing are output to the TV screen or printer.

2. 3. 5. 1 PRINT

Format

PRINT / ? [variable / constant / expression] < ; / , > [variable / constant / expression] .....

Function

This statement outputs the values of variables, constants, character strings, or expressions to the display screen. Values are displayed starting at the cursor's current location on the screen. (To move the cursor down one line on the screen, execute the PRINT statement without specifying any variables, constants, or expressions.)

To simplify key input when entering this statement, a question mark (?) may be typed instead of the word PRINT.

Numeric data is displayed by this statement in one of two formats: real number format or exponential format.

Real number format

Numeric values in the range from 1×10^{-8} to 1×10^{8} are displayed in real number format.

```
-1.9999
63598757
Ø.ØØØØØØØ1 ..... ..... 1 x 10^-8
99999999
```

Exponential format

Numbers which cannot be displayed in real number format are displayed in exponential format.

```
-.31415E+9 ..... -0.31415 x 10^9
.513ØØ6E-2Ø ..... 0.513606 x 10^-20
```

A plus (+) or minus (–) sign is always displayed ahead of the exponent (the number following "E") of a number displayed in exponential format.

Some special methods of using the PRINT statement are shown below.

PRINT "[C]" Clears the entire screen and moves the cursor to the home position (the upper left corner of the screen).

PRINT "[H]" Moves the cursor to the home position without clearing the screen.

PRINT "[→]" Moves the cursor one column to the right.

PRINT "[←]" Moves the cursor one column to the left.

PRINT "[↑]" Moves the cursor up one line.

PRINT "[↓]" Moves the cursor down one line.

PRINT "[C][↓][↓][↓][↓][↓]A" ····· Clears the screen, then displays the character "A" at the beginning of the sixth line from the top.

Note: The vertical bars {...} in the format description indicate that any one of the enclosed items may be selected.

To enter the special characters for cursor control, press the [GRAPH] key; this places BASIC in the graphic character input mode and changes the form of the cursor to "⊞". Next, enter the characters as follows.

[C]····· Press the [CLR] key.
[H]····· Press the [HOME] key.
[→]····· Press the [→] key.
[←]····· Press the [←] key.
[↑]····· Press the [↑] key.
[↓]····· Press the [↓] key.

After entering a special character, press the [ALPHA] key to return from the graphic character input mode to the alphanumeric input mode.

2. 3. 5. 2 PRINT USING ..... (abbreviated format: ?USI.)

Format **PRINT USING** "format string" ; variable ⟨ { ; / , } variable . . . ⟩

Function This statement displays data on the screen in a specific format. The format specification consists of a character or string of characters in quotation marks, and is specified immediately after the word USING as follows.

(1) Format specification strings for numeric values

(a) #

The number sign is used to specify the maximum number of digits to be displayed. If the number of digits in the number displayed is smaller than the number of # signs specified in "format string", numbers are right-justified in the field defined by that string.

(Example:)

```
10 A = 123
20 PRINT USING "####" ; A
RUN ♪
 123
```

(b) .

A period may be included in a format string consisting of # signs to specify the position in which the decimal point is to be displayed. The number of # signs to the right of the decimal point specifies the number of decimal places to be displayed.

(Example:)

```
10 A = 12.345 : B = 6.789
20 PRINT USING "###.##" ; A
30 PRINT USING "###.##" ; B
RUN ♪
␣12.34
␣␣6.79
```

(c) ,

Commas may also be included in "format string" to indicate positions in which commas are to be displayed. Numbers are right-justified in the same manner as when # signs are used alone.

(Example:)

```
10 A = 6345123 : B = 987324
20 PRINT USING "#, ###, ###" ; A
30 PRINT USING "#, ###, ###" ; B
RUN ♪
6,345,123
␣␣987,324
```

(d) + and –

A plus (+) or minus (–) sign may be included at the end of "format string" to specify that the sign of the number is to be displayed in that position instead of a space. For instance, PRINT USING "####+" will cause the sign to be displayed immediately after the number. (PRINT USING "####–" causes a minus sign to be displayed following the number if the number is negative; if the number is positive, only a space is displayed in that position.) Further, a plus sign may be specified at the beginning of a format string to indicate that the number's sign is to be displayed in that position regardless of whether it is positive or negative.

(Examples)

```
PRINT USING "####+" ; –13
␣␣13–
PRINT USING "+####" ; 25
␣␣+25
```

(Note:)

Although a minus sign will be displayed if one is specified at the beginning of the format string, it will have no relationship to the sign of the number.

(e) ＊＊

Specifying a pair of asterisks at the beginning of the format string indicates that asterisks are to be displayed in the positions of leading zeros.

(Example:)

```
10 A = 1234
20 PRINT USING " ＊＊####" ; A
RUN ♪
＊＊1234
```

(f) ￡￡

Specifying a pair of pound signs at the beginning of the format string indicates that a pound sign is to be displayed in the position immediately to the left of the number.

(Example:)

```
10 A = 123
20 PRINT USING "￡￡####" ; A
RUN ♪
␣␣￡123
```

(g) $$

Specifying a pair of dollar signs at the beginning of the format string indicates that a dollar sign is to be displayed in the position immediately to the left of the number.

(h) ↑↑↑↑

Four exponential operators may be included at the end of a format string to control display of numbers in exponential format.

(Example:)

```
10 A = 51123
20 PRINT USING "##.### ↑↑↑↑" ; A
RUN ♪
␣5.112E+04
```

In this case, the first number sign is reserved for display of the sign of the number.

(i) Extended list of operands

A list of variables may be specified following a single PRINT USING statement by separating them from each others with commas or semicolons. When this is done, the format specified in "format string" is used for display of all resulting values.

(Example:)

```
10 A = 5.3 : B = 6.9 : C = 7.123
20 PRINT USING "##.###" ; A, B, C
RUN ♪
␣5.300␣6.900␣7.123
```

(2) Format specification for string values

(a) !

When the values being displayed are character strings, specifying an exclamation mark in "format string" causes just the first character of the string specified to be displayed.

(Example:)

```
10 A$ = "CDE"
20 PRINT USING "!" ; A$
RUN ♪
C
```

(b) & ␣␣␣␣ &

Specifying "& ␣␣␣␣ &" in the format string causes the first 2 + n characters of specified string expressions to be displayed (where n is the number of spaces between the two ampersands). If fewer than 2 + n characters are specified in a string expression, characters displayed are left-justified in the field defined by "& ␣␣␣␣ &".

(Examples:)

```
10 A$ = "ABCDEFGH"
20 PRINT USING "& ␣␣␣␣ &" ; A$
RUN ♪
ABCDEF
10 A$ = "XY"
20 PRINT USING "& ␣␣␣␣ &" ; A$
RUN ♪
XY
```

(3) String constant output function

When any character other than those described above is included in the format string of a PRINT USING statement, that character is displayed together with the value specified following the semicolon.

(Example:)

```
10 A = 123
20 PRINT USING "DATA####" ; A
RUN ♪
DATA␣123
```

(4) Separation of USING

Usually, PRINT and USING are specified adjacent to each other; however, it is possible to use them separately within the same statement.

(Example:)

```
10 A = −12 : B = 14 : C = 12
20 PRINT A; B; USING "####" ; C
   Normal PRINT function    USING function
RUN ♪
−12␣14␣␣12
```

2. 3. 5. 3 INPUT ..... (abbreviated format: I.)

Format

INPUT { numeric variable / string variable / array element } ... or **INPUT** "character string" ; { numeric variable / string variable / array element } ...

```
INPUT A                    INPUT"DATA A=";A
INPUT B$                   INPUT"YES OR NO";B$
INPUT X(5)                 INPUT"KEY IN";X(5)
```

Function

INPUT is one of the statements which is used for entering values for assignment to variables during program execution. Program execution pauses when an INPUT statement is encountered to allow values to be typed in from the keyboard. After input has been completed, the values are substituted into specified variables by pressing the CR key, then program execution resumes.

(Example:)

```
10 INPUT A, B
20 C=A+B
30 PRINT C
40 END
```

When the program above is executed, a question mark is displayed and the cursor blinks to indicate that the computer is waiting for data input; enter any arbitrary number, then press the CR key. This assigns the value entered to variable A.
After doing this, the question mark will be displayed again. The reason for this is that two variables (A and B) are specified in the INPUT statement on line 10, but only one value has been entered (that which is substituted into variable A). Enter another arbitrary number and press the CR key again; this substitutes the second value entered into variable B and causes execution to go on to the next line of the program. In the example above, subsequent lines add the values of A and B, substitute the result into C, then display the contents of C.
Since the variables used in this example are numeric variables, the computer will display the message ILLEGAL DATA ERROR if an attempt is made to enter any characters other than numerics. The question mark is then redisplayed to prompt the user to reenter a legal value (a value whose type is the same as that of the variable or array element into which it is to be substituted). Be sure to enter data whose type matches that of the variable(s) specified in the INPUT statement.
During program execution, it may be difficult to remember what data is to be entered when the question mark is displayed; therefore, prompt strings are usually included in INPUT statements for display on the screen as a reminder. This is done as shown in the program example below.

```
10 INPUT"A=";A
20 INPUT"B=";B
30 PRINT"A+B=";A+B
40 PRINT"A-B=";A-B
50 PRINT"A*B=";A*B
60 PRINT"A/B=";A/B
70 END
```

Try running the program shown above. Inclusion of character strings in the PRINT and INPUT statements provides a clear indication of the program's operation. Practical computer programs consist of combinations of sequences similar to the one shown here. By combining commands, statements, and sequences in different manners, you will soon find that there are many different methods of achieving a desired result.

2. 3. 5. 4 GET

Format

GET v

v . . . . . Numeric variable or array element, or string variable or array element.

Function

When this statement is encountered during program execution, the BASIC interpreter checks whether any key on the keyboard is being pressed and, if so, assigns the corresponding value to the variable specified in v. Whereas the INPUT statement prompts for entry of data and waits until that data has been entered before resuming execution, the GET statement continues execution regardless of whether any key is being pressed.

Although data is substituted into variable v by the GET statement if any keys are pressed when the statement is executed, the variable will be left empty (0 for a numeric variable or null for a string variable) if no keys are pressed.

With numeric variables, this statement allows a single digit (from 0 to 9) to be entered; with string variables, it allows a single character to be entered.

This statement can be extremely useful when you want to enter data without pressing the [CR] key, as is often the case with game programs.

(Example:)

```
10 PRINT "NEXT GO? (Y OR N) "
20 GET A$
30 IF A$="Y" THEN 50
40 GOTO 20
50 PRINT "PROGRAM END"
60 END
```

30 ····· In the example above, execution jumps from line 30 to line 50 if the value of variable A$ is "Y".

40 ····· Line 40 unconditionally transfers execution to line 20.

This program displays the prompt "NEXT GO? (Y OR N)" and waits for input. When the Y key is pressed, execution moves to line 50 and the program ends. Until that time, however, execution loops repeatedly between lines 20 and 40. Now delete lines 30 and 40 and try executing the program again. As you can see, execution is completed immediately regardless of whether any keys have been pressed.

Note: When GET statements are executed in succession, a routine should be included between them to ensure that each is completed before going on to the next. The reason for this is that key chatter (vibration of the contacts of the key switches) may result in two GET statements being executed simultaneously.

2. 3. 5. 5 READ ~ DATA ..... (abbreviated format: REA. ~ DA.)

Format

READ { numeric variable / string variable / array element } < , { numeric variable / string variable / array element } , ... >

⋮

DATA { numeric constant / string constant } , < { numeric constant / string constant } , ... >

Function

Like the INPUT and GET statements, the READ statement is used to submit data to the computer for processing. However, unlike the INPUT and GET statements, data is not entered from the keyboard, but is stored in the program itself in DATA statements. More specifically, the function of the READ statement is to read successive items of data into variables from a list of values which follows a DATA statement. When doing this, there must be a one-to-one correspondence between the variables of the READ statements and the data items specified in the DATA statements.

Example

(Example 1)

```
10 READ A, B, C, D
20 PRINT A;B;C;D
30 END
40 DATA 10, 100, 50, 60
RUN ♪
```

```
 10  100  50  60
```

..... In this example, values specified in the DATA statement are read into variables A, B, C, and D by the READ statement, then the values of those variable are displayed.

(Example 2)

```
10 READ X$, A1, Z$
20 PRINT X$;A1;Z$
30 END
40 DATA A, 1, C
```

..... As shown by the example below, string data included in DATA statements does not need to be enclosed in quotation marks.

```
RUN ♪
A 1C
```

..... The READ statement in this example picks successive data items from the list specified in the DATA statement, then substitutes each item into the corresponding variable in the list following the READ statement.

(Example 3)

```
10 DIM A(2)
20 READ A(0), A(1), A(2)
30 PRINT A(0); A(1); A(2)
40 END
50 DATA 3,4,5
RUN ↵
 3  4  5
```

.....The READ statement in this program substitutes the numeric values following the DATA statement into array elements A(0), A(1), and A(2), then the PRINT statement on line 30 displays the values of those array elements.

(Example 4)

```
10 READ A
20 READ B
30 DATA X
```

..... The example above is incorrect because (1) a numeric variable is specified by the READ statement on line 10, but the value specified following the DATA statement is a string value, and (2) there is no data which can be read by the READ statement on line 20.

2. 3. 5. 6 RESTORE ..... (abbreviated format: . . . RES.)

Format **RESTORE** or **RESTORE** Ln

Function When READ statements are executed, a pointer managed by the BASIC interpreter is incremented to keep track of the next item of data to be read from DATA statements. The RESTORE statement resets this pointer to (1) the beginning of the first DATA statement in the program or (2) the beginning of the DATA statement on a specified line.

Example

```
10 DATA 1, 2, 3
20 DATA "AA", "BB"
30 READ X, Y
40 READ Z, V$
.....
100 RESTORE
110 READ A, B, C, D$, E$
.....
200 READ I, J
210 RESTORE
220 READ M, N
230 RESTORE 260
240 READ O, P
250 DATA 1, 2, 3, 4
260 DATA -1, -2, -3, -4
```

An error will result if the number specified in Ln is the number of non-existent line.

```
10 X=33*RND(1)
20 FOR A=1 TO 5
30 READ M$
40 PRINT TAB(0);"◆";TAB(X);M$;
50 PRINT TAB(37);"◆"
60 NEXT A
70 Y=10*RND(1)
80 FOR A=1 TO Y
90 PRINT TAB(0);"◆";
100 PRINT TAB(37);"◆":NEXT
110 RESTORE:GOTO 10
120 DATA"  ◢◎◣", "●▩▩▩●"
130 DATA"  ▩▩▩", "●▩▩▩●"
140 DATA"  ◥■◤"
```

This function creates random numbers (see page 72).

Note: See page 62 for the TAB function and page 47 for the FOR . . . NEXT statement.

2.3.6 Loop and branch instructions

2. 3. 6. 1 **FOR ~ NEXT** ..... (abbreviated format: **F. ~ N.**)

Format

FOR cv = iv TO fv < STEP sv >

.....

NEXT < cv >

cv .... Control variable; a numeric variable or array element.

iv .... Initial value; a numeric expression.

fv .... Final value; a numeric expression.

sv .... Increment, or step value; a numeric expression (if omitted, 1 is assumed).

Function

This statement repeats the instructions between FOR and NEXT a certain number of times.

```
10 A=0
20 FOR N=0 TO 10 STEP 2
30 A=A+1
40 PRINT "N=";N,
50 PRINT "A=";A
60 NEXT N
```

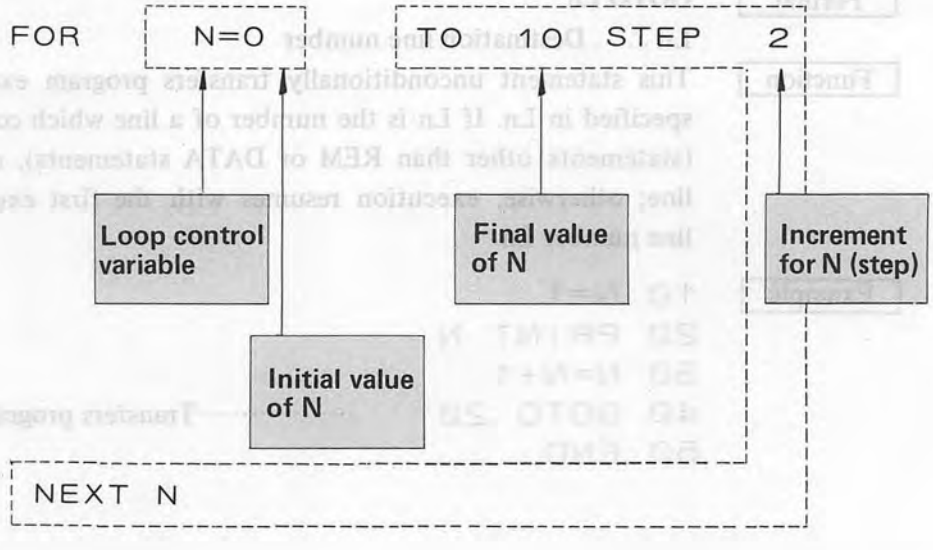
(1) In the program above, 0 is assigned to N as the initial value.

(2) Next, lines 20 through 50 are executed and the values of variables A and N displayed.

(3) In line 60, the value of N is increased by 2, after which the BASIC interpreter checks to see whether N is greater than 10, the final value. If not, lines following line 20 are repeated.

When the value of N exceeds 10, execution leaves the loop and subsequent instructions (on lines following line 60) are executed. The program above repeats the loop 6 times.

If < STEP sv > is omitted from the statement specification, the value of N is increased by 1 each time the loop is repeated. In the case of the program above, omitting < STEP sv > in this manner would result in 11 repetitions of the loop.



FOR . . . NEXT loops may be nested within other FOR . . . NEXT loops. When doing this, inner loops must be completely included within outer ones. Further, separate control variables must be used for each loop.

Example

```
10 FOR X=1 TO 9
20 FOR Y=1 TO 9
30 PRINT X*Y;
40 NEXT Y
50 PRINT
60 NEXT X
70 END
```

Inner loop

Outer loop

```
FOR A=1 TO 3
FOR B=1 TO 5
FOR C=1 TO 7
.....
NEXT C
NEXT B
NEXT A
```

NEXT C, B, A

When loops C, B, and A all end at the same point as in the example above, one NEXT statement may be used to indicate the end of all the loops.

Incorrect example:

```
→FOR J=1 TO 10
 →FOR J=K TO K+5
 NEXT J
```

× Different control variables must be used in each loop.

```
→FOR I=1 TO 10
 →FOR J=K TO K+5
 NEXT I
NEXT J
```

× Loops may not cross one another.

Note

The syntax of BASIC does not limit the number of levels to which loops may be nested; however, space is required to store return addresses for each level, so the number of levels is limited by the amount of available free space.
The **CLR** statement (see page 59) cannot be used within a FOR . . . NEXT loop.

2. 3. 6. 2 GOTO ..... (abbreviated format: . . . G.)

Format

GOTO Ln
Ln . . . . Destination line number

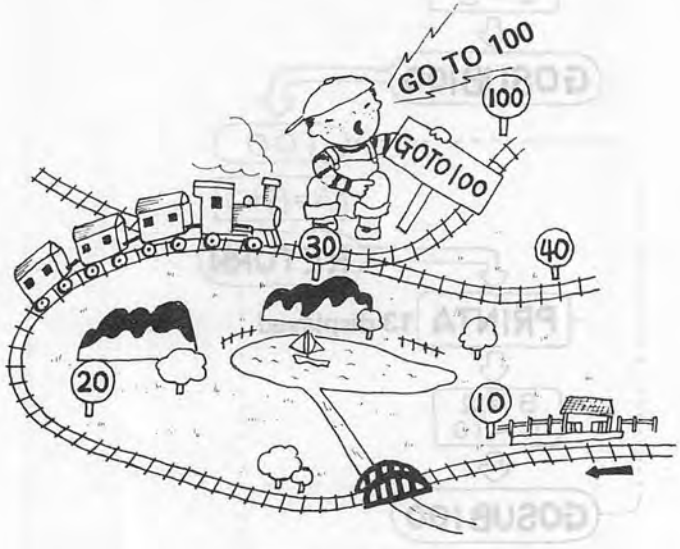
Function

This statement unconditionally transfers program execution to the line number specified in Ln. If Ln is the number of a line which contains executable statements (statements other than REM or DATA statements), execution resumes with that line; otherwise, execution resumes with the first executable statement following line number Ln.

Example

```
10 N=1
20 PRINT N
30 N=N+1
40 GOTO 20        .....Transfers program execution to line 20.
50 END
```

Since execution of the program shown above will continue indefinitely, stop it by pressing the [SHIFT] and [BREAK] keys together (this may be done at any time to stop execution of a BASIC program). To resume execution, execute the CONT ↵ command.



[Note] The line number specified in a GOTO statement may not be that of a line included within a FOR . . . NEXT loop.

2. 3. 6. 3 GOSUB ~ RETURN ..... (abbreviated format: GOS. ~ RET.)

[Format]
```
GOSUB Ln
  :
RETURN
```
Ln . . . Destination line number

[Function] The GOSUB statement unconditionally transfers program execution to a BASIC subroutine beginning at the line number specified in Ln; after execution of the subroutine has been completed, **execution is returned to the statement following GOSUB** when a RETURN statement is executed.

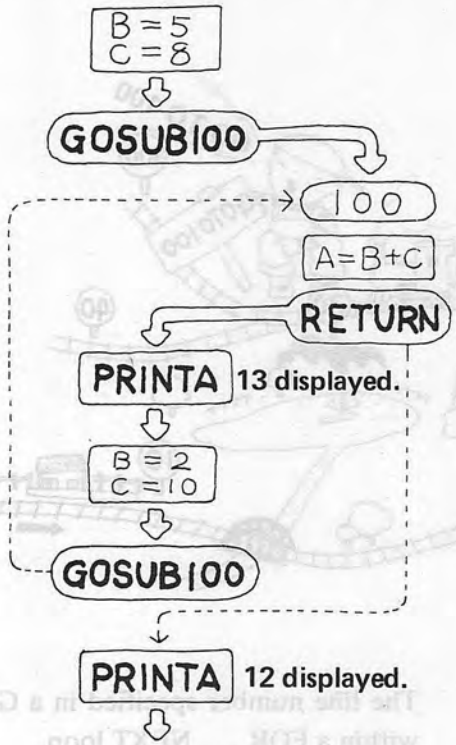
GOSUB ~ RETURN statements are frequently used when the same processing is required at several different points in a program. In such cases, a subroutine which performs this processing is included at some point in the program, and execution is branched to this subroutine at appropriate points by means of the GOSUB statement. After the required processing has been completed, execution is returned to the main routine by the RETURN statement.

[Example]
```
100 X=10
110 GOSUB 200
120 PRINT X
130 END
200 X=X*2
210 RETURN
```

Note

The syntax of BASIC imposes no limit on the extent to which subroutines can be nested (that is, on the number of levels of subroutine calls which can be made from other subroutines); however, in practice a limitation is imposed by the amount of free space in memory which is available for storing return addresses.

```
10 B=5
20 C=8
30 GOSUB 100
40 PRINT A
50 B=2
60 C=10
70 GOSUB 100
80 PRINT A
90 END
100 A=B+C
110 RETURN
```



2. 3. 6. 4 IF ~ THEN ..... (abbreviated format: ... IF ~ TH.)

Format

IF e **THEN** Ln

IF e **THEN statement**

e: A relational expression or logical expression

Ln: Destination line number

Function

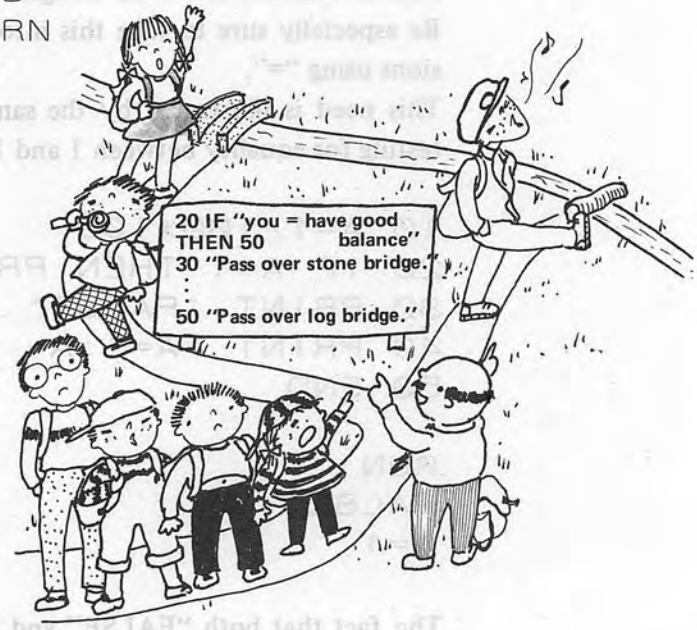
IF ... THEN statements are used to control branching of program execution according to the result of a logical or relational expression. When the result of such an expression is true, statements following THEN are executed. If a line number is specified following THEN, program execution jumps to that line of the program if the result of the expression is true.

If the result of the logical or relational expression is false, execution continues with the program line following that containing the IF ... THEN statement.

IF	Condition	THEN	Statement or line number

Example

```
IF……THEN 100
IF……THEN GOTO or IF……GOTO
IF……THEN PRINT or IF……THEN ?
IF……THEN A=5*7 assignment
IF……THEN I=10:J=50
IF……THEN INPUT
IF……THEN READ
IF……THEN GOSUB
IF……THEN RETURN
IF……THEN STOP
IF……THEN END
```



Examples of logical and relational expressions

	Operator	Sample application	Explanation
Relational expressions	=	IF A=X THEN…	If the value of numeric variable A equals the value of X, execute the statements following THEN.
		IF A$="XYZ" THEN…	If the contents of string variable A$ equal "XYZ", execute the statements following THEN.
	>	IF A>X THEN…	If the value of variable A is greater than X, execute the statements following THEN.
	<	IF A<X THEN…	If the value of variable A is less then X, execute the statements following THEN.
	<> or ><	IF A<>X THEN…	If the value of variable A is not equal to X, execute the statements following THEN.
	>= or =>	IF A>=X THEN…	If the value of variable A is greater than or equal to X, execute the statements following THEN.
	<= or =<	IF A<=X THEN…	If the value of variable A is less than or equal to X, execute the statements following THEN.
Logical expressions	*	IF(A>X)*(B>Y) THEN…	If the value of variable A is greater than X and the value of variable B is greater than Y, execute the statements following THEN.
	+	IF(A>X)+(B>Y) THEN…	If the value of variable A is greater than X or the value of variable B is greater than Y, execute the statements following THEN.

Note

Precautions on comparison of numeric values with BASIC 1Z-013B, numeric values are internally represented in binary floating point representation; since such values must be converted to other forms for processing or external display (such as in decimal format with the PRINT statement), a certain amount of conversion error can occur.

For example, when an arithmetic expression is evaluated whose mathematical result is an integer, an integer value may not be returned upon completion of the operation if values other than integers are handled while calculations are being made. Be especially sure to take this into consideration when evaluating relational expressions using "=".

This need is illustrated by the sample program below, which returns FALSE after testing for equality between 1 and 1/100 ✕ 100.

```
10 A=1/100*100
20 IF A=1 THEN PRINT "TRUE":GOTO 40
30 PRINT "FALSE"
40 PRINT "A=";A
50 END

RUN
FALSE
A=1
```

The fact that both "FALSE" and " A = 1" are displayed as the result of this program showns that external representation of numbers may differ from the number's internal representation.

Therefore, a better method of checking for equality in the program example above is as follows.

```
20 IF ABS(A-1)<.1E-8 THEN PRINT "TRUE":
   GOTO 40
```

2. 3. 6. 5 IF ~ GOTO ..... (abbreviated format: **IF ~ G.**)

Format **IF** e **GOTO** Lr

e: Relational expression or logical expression

Lr: Destination line number

Function This statement sequence evaluates the condition defined by relational or logical expression e, then branches to the line number specified in Lr if the condition is satisfied. As with the IF . . . THEN sequence, IF ~ GOTO is used for conditional branching; when the specified condition is satisfied, program execution jumps to the line number specified in Lr. If the condition is not satisfied, execution continues with the next line of the program. (Any statements following IF ~ GOTO on the same program line will be ignored.)

Example

```
10 G=0:N=0
20 INPUT "GRADE=";X
30 IF X=999 GOTO 100
40 T=T+X:N=N+1
50 GOTO 20
100 PRINT "----------"
110 PRINT "TOTAL:";T
120 PRINT "NO. PEOPLE:";N
130 PRINT "AVERAGE:";T/N
140 END
```

2. 3. 6. 6 IF ~ GOSUB ..... (abbreviated format: **IF ~ GOS.**)

Format **IF** e **GOSUB** Lr

e: Relational expression or logical expression

Lr: Destination line number

Function This statement evaluates the condition defined by relational or logical expression e, then, if the condition is satisfied, branches to the subroutine beginning on the line number specified in Lr. Upon completion of the subroutine, execution returns to the first executable statement following the calling IF ~ GOSUB statement; therefore, if multiple statements are included on the line with the IF ~ GOSUB statement, execution returns to the first statement following IF ~ GOSUB.

Example

```
10 INPUT "  X=  ";X
20 IF X<0 GOSUB 100:PRINT"X<0"
30 IF X=0 GOSUB 200:PRINT"X=0"
40 IF X>0 GOSUB 300:PRINT"X>0"
50 PRINT "----------------------"
60 GOTO 10
100 PRINT " * PROGRAM LINE 100 ":RETURN
200 PRINT " * PROGRAM LINE 200 ":RETURN
300 PRINT " * PROGRAM LINE 300 ":RETURN
```

2. 3. 6. 7 ON~GOTO ..... (abbreviated format: ON~G.)

Format

ON e **GOTO** Lr_1 <, Lr_2 , Lr_3, ... , Lri >

e . . . Numeric variable, array element, or expression

Lri . List of destination line numbers

Function

This statement branches execution to one of the line numbers following GOTO, depending on the value of e.

The value of e indicates which of the line numbers following GOTO is to be used for making the branch; in other words, if e is 1, execution branches to the first line number in the list; if e is 2, execution branches to the second line number in the list; and so forth. For example:

```
100 ON A GOTO 200, 300, 400, 500
```

Destination when

A is 1 → 200

A is 2 → 300

A is 3 → 400

A is 4 → 500

Example

```
10 INPUT "NUMBER" ; A
20 ON A GOTO 50, 60, 70
50 PRINT "XXX" : GOTO 10
60 PRINT "YYY" : GOTO 10
70 PRINT "ZZZ" : GOTO 10
RUN
NUMBER ? 1
XXX
NUMBER ? 2
YYY
NUMBER ? ■
```

If a decimal number such as 1 . 2 is specified, the decimal portion is truncated before evaluating the statement.

Note

When the value of e in an ON~GOTO statement is greater than the number of line numbers specified following GOTO, execution continues with the next line of the program.

This also applies if the value of e is less than 1 or negative.

Further, if the value of e is a non-integer, the decimal portion is truncated to obtain an integer value before the statement is evaluated.

2. 3. 6. 8 ON~GOSUB ..... (abbreviated format: **ON~GOS.**)

Format

ON e **GOSUB** $Lr_1 <, Lr_2, Lr_3, \ldots\ldots, Lri >$

e . . . Numeric variable, array element, or expression

Lri . Destination line numbers

Function

This statement branches execution to the subroutine beginning on one of the line numbers following GOSUB, depending on the value of e. Operation of this statement is basically the same as with the ON~GOTO statement, but all branches are made to subroutines. Upon return from the subroutine, execution resumes with the first executable statement following the ON~GOSUB statement which made the call.

Example

Let's try using the ON~GOSUB statement in a scheduling program. The most important point to note in the following program is that, a subroutine call is made at line 180, even though line 180 itself is part of a subroutine (from line 170 to 190) which is called by line 90. Subroutines can be nested to many levels in this manner.

```
10 A$=" ENGL " :B$=" MATH " :C$=" FREN "
20 D$=" SCI " :E$=" MUS " :F$=" GYM "
30 G$=" HIST " :H$=" ART " :I$=" GEOG "
40 J$=" BUS " :K$=" H RM " :PRINT"■"
50 INPUT"WHAT DAY?";X$
60 FOR Z=1 TO 7:Y$=MID$("SUNMONTUEWEDTHU
FRISAT",1+3*(Z-1),3):IF Y$=X$ THEN X=Z
70 NEXT Z
80 FOR Y=0 TO 4:PRINT TAB(5+6*Y);Y+1;
90 NEXT Y:PRINT
100 ON X GOSUB 180,120,130,140,150,160,170
110 PRINT:GOTO 50
120 PRINT"MON ";A$;B$;D$;G$;K$:RETURN
130 PRINT"TUE ";B$;E$;H$;H$;D$:RETURN
140 PRINT"WED ";C$;C$;I$;A$;F$:RETURN
150 PRINT"THU ";B$;D$;F$;G$;E$:RETURN
160 PRINT"FRI ";A$;D$;I$;C$;C$:RETURN
170 PRINT"SAT ";B$;G$;D$;K$:RETURN
180 FOR Y=1 TO 6
190 ON Y GOSUB 120,130,140,150,160,170
200 PRINT:NEXT Y
210 RETURN
```

2.3.7 Definition statements

2. 3. 7. 1 DIM

Format

DIM a_1 $(i_1)<, a_2$ (i_2), ... ai (im)>
DIM b_1 $(i_1, j_1)<, b_2$ (i_2, j_2), ... bi (in, jn)>

ai ..... 1-dimensional array name (list)
bi ..... 2-dimensional array name (table)
im, in, jn ..... Dimensions

Function

This statement is used to declare (define) arrays with from one to four dimensions and to reserve space in memory for the number of dimensions declared (DIM: dimension). Up to two characters can be specified as the array name, and subscripts of any value may be specified to define the size of dimensions; however, the number of dimensions which can be used is limited in practice by the amount of free memory available.

Example

(Examples:)

```
10 DIM A(100)
20 FOR J=0 TO 100
30 READ A(J)
40 NEXT J
50 DATA 5, 30, 12, .....
```

(Examples:)

```
10 DIM A$(1), B$(1), C$(1)
20 FOR J=0 TO 1 : READ A$(J), B$(J)
30 C$(J)=A$(J)+"  "+B$(J)
40 PRINT A$(J), B$(J), C$(J)
50 NEXT J
60 END
70 DATA YOUNG, GIRL, WHITE, ROSE
```

Note

Execution of the DIM statement sets the values of all elements of declared arrays to 0 (for numeric arrays) or null (for string arrays). Therefore, this statement should be executed before values are assigned to arrays.

Different names must be used for each array which is declared; for example, the instruction DIM A(5), A(6) is not a legal array declaration.

All array declarations are nullified by execution of a CLR statement (see page 59) and a NEW statement (see page 32).

2. 3. 7. 2 DEF FN

Format

DEF FN f (x) = e

f . . . Name assigned to the function being defined (one uppercase letter from A to Z)
x . . . Argument (variable name)
e . . . Numeric expression (constant, variable, array element, or function) or previously defined user function

Function

The DEF FN statement is used to define user function **FN** f (x). Such functions consist of combinations of functions which are intrinsic to BASIC.

Example

```
DEF FNA(X)=2*X↑2+3*X+1 ····· Defines 2X² + 3X + 1 as FNA (X).
DEF FNE(V)=1/2*M*V↑2 ····· Defines 1/2MV² as FNE (V).
10 DEF FNB(X)=TAN(X-PAI(1)/6)
20 DEF FND(X)=FNB(X)/C+X ·· Defines function FNB using the function defined on line 10.
```

(Incorrect definitions)

```
10 DEF FNK(X)=SIN(X/3+PAI(1)/4), FNL(X)=EXP(-X↑2/K)
```

. . . . Only one user function can be defined by a single DEF FN statement.

Find the kinetic energy of a mass of 5.5 when it is imparted with initial accelerations of 3.5, 3.5 x 2, and 3.5 x 3.

```
10 DEF FNE(V)=1/2*M*V↑2
20 M=5.5:V=3.5
30 PRINT FNE(V),FNE(V*2),FNE(V*3)
40 END
```

Note

All user function definitions are cleared when the CLR statement and the NEW statement is executed.

2. 3. 7. 3 DEF KEY

Format

DEF KEY (k) = S$

k . . . . . Definable function key number (1 to 10)

S$ . . . . . Character string (up to 15 characters).

Function

Character strings can be assigned to any of the ten function keys to allow strings to be entered at any time just by pressing a single key. This statement is used to define such strings and assign them to the definable function keys. Function key numbers 1 to 5 are entered just by pressing the corresponding key at the top left corner of the keyboard; keys 6 to 10 are entered by pressing the SHIFT key together with the corresponding key. The function key number (1 to 10) is specified in k, and the string or command which is to be assigned to the key is specified exactly as it is to be entered in S$. Execution of the DEF KEY statement cancels the previous definition of the definable function key.

No other statement can be specified after a DEF KEY statement on the same line.

(Example:)

```
10 DEF KEY(1)="INPUT" ····· Defines key F1 as INPUT
20 DEF KEY(2)="RUN"+CHR$(13)··· Defines F2 as RUN ♪
```

Note: CHR$ (13) indicates the ASCII code for CR, and specifying it together with the string assigned to a definable function key has the same effect as pressing the CR key. (See the description of the CHR$ function on page 78 and the ASCII code table on page 154.)

2.3.8 Remark statement and control commands

2. 3. 8. 1 REM

Format **REM r**

r . . . . Programmer's remark

Function REM is a non-executable statement which is specified in a program line to cause the BASIC interpreter to ignore the remainder of that line. Since REM statements are non-executable, they may be included at any point in the program without affecting the results of execution. REM statements are generally used to make a program easier to read, or to add explanatory notes to a program.

Multiple statement program lines

When more than one statement is included on a single program line, each statement must be separated from the one preceding it by a colon (:). Operation of the BASIC interpreter is generally the same in such cases as when the same statements are specified on different lines. For example, the two programs below produce exactly the same result.

```
10 A=5
20 B=8
30 C=A*B
40 PRINT C
```

```
10 A=5:B=8:C=A*B:PRINT C
```

Note: Also note that program operation may differ when multiple statement lines are used as shown below.

```
10 INPUT A
20 B=0
30 IF 99<A THEN B=1
40 PRINT B
50 END
```

This program displays 1 if the value entered at line 10 is greater than or equal to 100, and 0 if the value entered is less than 100.

```
10 INPUT A:B=0:IF 99<A THEN B=1:PRINT B
20 END
```

This program displays 1 if the value entered is greater than or equal to 100, but nothing at all if the value entered is less than 100. The reason for this is that statements following THEN on line 10 are not executed if the IF condition is not satisfied.

2. 3. 8. 2 STOP ..... (abbreviated format: S.)

Format

STOP

Function

Temporarily stops program execution, displays BREAK and READY, then waits for entry of executable commands in the direct mode.

The STOP statement is used to temporarily interrupt program execution, and may be inserted at as many points and locations in the program as required. Since execution of the program is only interrupted temporarily, the PRINT statement can be used in the direct mode to check the values stored in variables, after which execution can be resumed by entering CONT ♪ .

Example

```
10 READ A, B
20 X=A*B
30 STOP
40 Y=A/B
50 PRINT X, Y
60 DATA 15, 5
70 END
RUN
BREAK IN 30
```

Note

Unlike the END statement, no files are closed by the STOP statement. (See page 68 concerning procedures for opening and closing of files.)

2. 3. 8. 3 END ..... (abbreviated format: E.)

Format

END

Function

The END statement terminates program execution and returns the BASIC interpreter to the command mode for input of direct mode commands. When this statement is executed, READY is displayed to indicate that the BASIC interpreter is ready. After the END statement has been executed, execution cannot be resumed by executing the CONT command even if there are executable statements on program lines following the END statement.

Note

All open files are closed when the END statement is executed. (See page 68 concerning procedures for opening and closing files.)

Differences between the STOP and END statements

	Screen display	Files	Resumption of execution
STOP	BREAK IN ×××× READY	Open files are not closed.	Can be resumed by executing CONT.
END	READY	Open files are closed	Cannot be resumed.

2. 3. 8. 4 CLR

Format

CLR

Function

The CLR command clears all variables and cancels all array definitions. All numeric variables are cleared to 0, and null strings (" ") are placed in all string variables; arrays are eliminated entirely by nullifying all previously executed DIM statements. Therefore, DIM statements must be executed to redefine the dimensions of required arrays before they can be used again.

The CLR command also cancels all function definitions made with the DEF FN statement; therefore, it is also necessary to reexecute DEF FN statements to redefine such functions before they can be used again.

Note — CLR statements cannot be included in a FOR~NEXT loop or BASIC subroutine.

2. 3. 8. 5 TI$

Format — **TI$** "hh mm ss"

Function — TI$ is the name of the system string variable which contains the time of the computer's built-in clock.

This built-in variable is automatically incremented once each second, and the six character string contained in this variable indicates the hour, minute, and second, with two characters used for each. For example, if the string contained in TI$ is "092035", the time is 9:20:35 A. M.

Variable TI$ is automatically set to 00:00:00 when BASIC is loaded into the computer. To set the current time of day, use the string assignment statement. For example, the clock can be set to 7:00:00 P. M. by executing the following.

TI$ = "190000"

The clock is set to 7:00:00 and then restarted automatically when the CR key is pressed.

The digits specified for the hour must be in the range from 00 to 23, and those specified for the minute and second must each be in the range from 00 to 59.

Example — The following program displays the current local time in various cities of the world.

```
10 PRINT "■"
20 DIM C$(10), D(10), E(10), T$(10)
30 FOR I=1 TO 10:READ C$(I), D(I):NEXT I
40 PRINT"ENTER NEW YORK TIME (HOUR, MINUT
E, SECOND)"
50 INPUT B$:TI$=B$:PRINT"■"
60 PRINT"■":T$(1)=TI$
70 FOR I=1 TO 10
80 E(I)=VAL(LEFT$(T$(1), 2))+D(I)
90 IF E(I)=24 THEN E(I)=0
100 IF E(I)<0 THEN E(I)=24+E(I)
110 T$(I)=STR$(E(I))+RIGHT$(T$(1), 4)
120 IF LEN(T$(I))=5 THEN T$(I)="0"+T$(I)
130 PRINT C$(I);TAB(15);LEFT$(T$(I), 2);
140 PRINT":";MID$(T$(I), 3, 2);":";RIGHT$(
T$(I), 2);
150 NEXT I:GOTO 60
160 DATA NEW YORK, 0, MOSCOW, 8, RIO DE JANE
IRO, 2
170 DATA SYDNEY, 15, HONOLULU, -5, LONDON, 5,
CAIRO, 7
180 DATA TOKYO, 14, SAN FRANCISCO, -3, PARIS
, 6
```

Note

The TI$ variable cannot be specified in an INPUT statement. Further, after the time changes from 23:59:59 to 00:00:00, the time "00:00:01" is not displayed.

2. 3. 8. 6 CURSOR ..... (abbreviated format: CU.)

Format

CURSOR x, y

x . . . X coordinate (0 to 39)

y . . . Y coordinate (0 to 24)

Function

This command is used to move the cursor to a specified position on the TV (display) screen, and can be used together with the PRINT and INPUT statements to display characters in any desired location.

In the system of screen coordinates used, the columns of the screen are numbered from left to right, starting with 0 on the left side and ending with 39 on the right side; lines of the screen are numbered from top to bottom, with 0 indicating the top line of the screen and 24 indicating the bottom line. Thus, the cursor can be moved to any desired position in the range from (0, 0), which indicates the top left corner of the screen, to (39, 24) indicates the bottom right corner.

Example

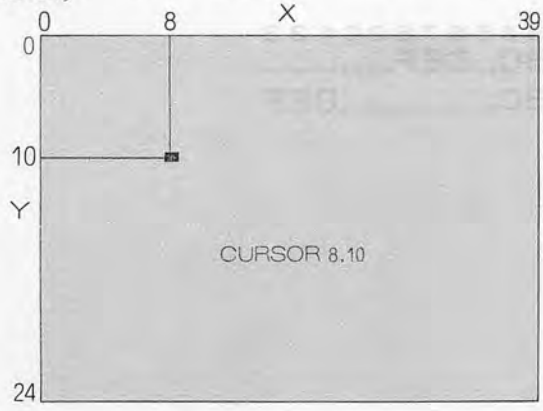
The following program moves an asterisk (*) about on the screen as the cursor keys are pressed.

```
10 X=0:Y=0
15 PRINT"■"
20 CURSOR X,Y:PRINT"*";
30 GET A$:IF A$="" THEN 30
40 CURSOR X,Y:PRINT" ";
50 IF A$="■" THEN Y=Y-1 :REM "UP    "
60 IF A$="■" THEN Y=Y+1 :REM "DOWN  "
70 IF A$="■" THEN X=X-1 :REM "LEFT  "
80 IF A$="■" THEN X=X+1 :REM "RIGHT "
90 IF X<0    THEN X=0
100 IF Y<0   THEN Y=0
110 IF X>38  THEN X=38
120 IF Y>24  THEN Y=24
150 GOTO 20
```

Note

If the value specified for either X or Y is other than an integer, it is converted to an integer by truncating the decimal portion before the cursor is moved.

Other methods of moving the cursor which are used together with the PRINT statement include the TAB and SPC functions. (See page 62 for a description of the SPC function.)



2. 3. 8. 7 TAB

Format TAB (x)

x . . . A numeric expression

Function The TAB function is used together with the PRINT statement to move the cursor to the character position which is x + 1 positions from the left side of the screen. (This is referred to as space tabulation.)

Example

```
PRINT TAB(5);"XYZ";TAB(10);"ABC"
0 1 2 3 4 5 6 7 8 9 0 1 2   <- Not actually displayed.
␣␣␣␣␣XYZ␣␣ABC
```

Note Tabulation can only be used to move the cursor to the right; therefore, **nothing happens** if this function is used together with the PRINT statement when the cursor is already to the right of the character position specified in (x).

(Example:)

```
PRINT TAB(5);"XYZ";TAB(5);"ABC"
0 1 2 3 4 5 6 7 8 9 0
␣␣␣␣␣XYZABC
```

2. 3. 8. 8 SPC

Format SPC (n)

n . . . A numeric expression

Function Use together with the PRINT statement, this function outputs a string of n spaces and thus moves the cursor n character positions to the right of its current position.

Example

(Example 1)

```
PRINT SPC(5);"ABC"
0 1 2 3 4 5 6 7
␣␣␣␣␣ABC
```

(Example 2)

The following example illustrates the difference between the TAB and SPC functions.

```
10 ? TAB(2);"ABC";TAB(6);"DEF"
20 ? SPC(2);"ABC";SPC(6);"DEF"
0 1 2 3 4 5 6 7 8 9 0 1 2 3
␣␣ABC␣DEF␣␣␣␣␣
␣␣ABC␣␣␣␣␣␣DEF
```

2. 3. 8. 9 SET, RESET

These statements are used to turn dots on or off at a specified position on the screen.

Format	Function	Range of X, Y coordinates
SET X, Y <, C> X ... Numeric expression specifying the X coordinate. Y ... Numeric expression specifying the Y coordinate. C ... Color code (0 to 7).	Turns on the dots at the screen coordinates specified by X and Y. (SET)	$0 \leqq X \leqq 79$ $0 \leqq Y \leqq 49$
RESET X, Y X ... Numeric expression specifying the X coordinate. Y ... Numeric expression specifying the Y coordinate.	Turns off the dots at the screen coordinates specified by X and Y. (RESET)	$0 \leqq X \leqq 79$ $0 \leqq Y \leqq 49$

When a color code is specified, the color of the dots displayed by the SET statement is as follows.

(0) ..... Black
(1) ..... Blue
(2) ..... Red
(3) ..... Purple
(4) ..... Green
(5) ..... Light blue
(6) ..... Yellow
(7) ..... White

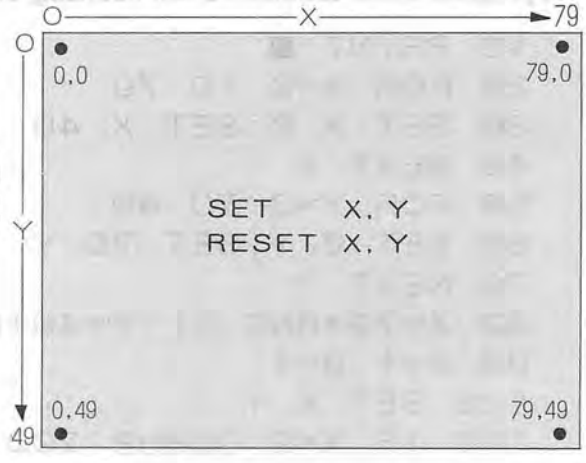
Since four dots are turned on simultaneously by the SET statement, changing the color of any one dot in that four dot group also causes the color of the other dots to change.

The SET and RESET statements can be use to produce a wide variety of interesting effects; some examples are introduced below.

1. Turning on one dot on the screen.

```
10 PRINT"■"
20 X=79:Y=49
30 SET X,Y,2
40 RESET X,Y
50 GOTO 30
```

Turns dots on.
Turns dots off.



2. Coloring the entire screen white.

```
10 PRINT"■"
20 FOR X=0 TO 79
30 FOR Y=0 TO 49
40 SET X,Y,7
50 NEXT Y,X
60 GOTO 10
```

3. Drawing a rectangle around the edge of the screen.

```
10 PRINT"■"
20 FOR X=0 TO 79
30 SET X, 0
40 SET X, 49
50 NEXT X
60 FOR Y=0 TO 49
70 SET 0, Y
80 SET 79, Y
90 NEXT Y
100 GOTO 100
```

4. A program which simulates the ripples produced by throwing a pebble into a pond.

```
10 X=40:Y=25
20 DEF FNY(Z)=SQR(R*R-Z*Z)
30 PRINT"■":SET X, Y
40 R=R+5
50 FOR Z=0 TO R
60 T=FNY(Z)
70 SET X+Z, Y+T
80 SET X+Z, Y-T
90 SET X-Z, Y+T
100 SET X-Z, Y-T
110 NEXT Z
120 IF R<>25 THEN 40
130 GOTO 130
```

5. A program which simulates a ball bouncing off four walls.

```
10 PRINT"■"
20 FOR X=0 TO 79
30 SET X, 0:SET X, 49
40 NEXT X
50 FOR Y=0 TO 49
60 SET 0, Y:SET 79, Y
70 NEXT Y
80 X=79*RND(1):Y=49*RND(1)
90 A=1:B=1
100 SET X, Y
110 IF X<2 GOSUB 200
120 IF X>78 GOSUB 200
130 IF Y<2 GOSUB 250
140 IF Y>48 GOSUB 250
150 RESET X, Y
160 X=X+A:Y=Y+B:GOTO 100
200 A=-A:MUSIC"+A0": RETURN
250 B=-B:MUSIC"A0": RETURN
```

Note — As to JOY command, refer to the instruction manual of Joy Stick.

2.3.9 Music control statements

This section discusses the MUSIC and TEMPO statements which are used to control performance of music by the computer. As its name implies, the TEMPO statement specifies the speed with which music is performed. The notes (including half notes and upper and lower octaves) and duration of notes produced are controlled by the MUSIC statement.

Tempo:	Specified with TEMPO as a numeric variable or constant with a value from 1 (slow) to 7 (fast).
Melody:	Specified with MUSIC as a string variable consisting of a collection of notes.
Note specification:	octave | # (sharp) | note name | duration

2. 3. 9. 1 MUSIC ..... (abbreviated format: MU.)

Format

MUSIC X$

X$ . . . String data

Automatically performs music.

Discussion

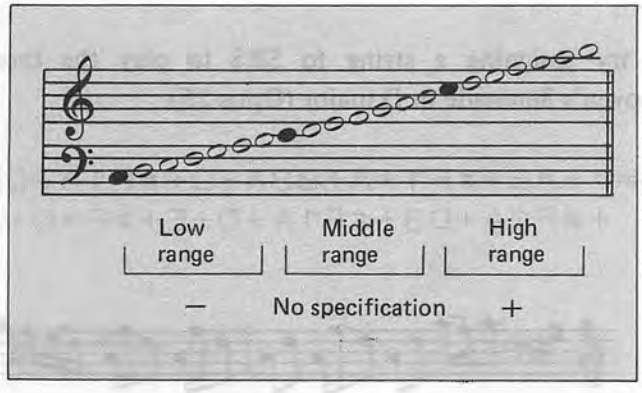
This statement outputs the melody or sound effects specified by the character string or string variable of its argument to the speaker. The speed with which this melody is played is that which is specified with the TEMPO statement (see page 67).

The format for specification of each note is as follows:
< octave specification > < # (sharp) > note name < duration >

The plus or minus signs are used to specify the octave. If neither is specified, the middle range is assumed.

The three ranges of sounds which can be output by the computer are as shown in the figure below. For example, the C notes ("do" on the 8-note C scale) indicated by the black dots below are differentiated from each other by the octave specification.

Low C ..... –C
Middle C..... C
High C ..... +C

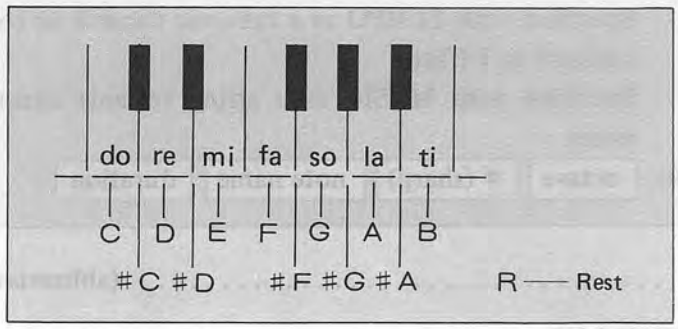


Note specification

The symbols used to specify notes within each range are as follows:

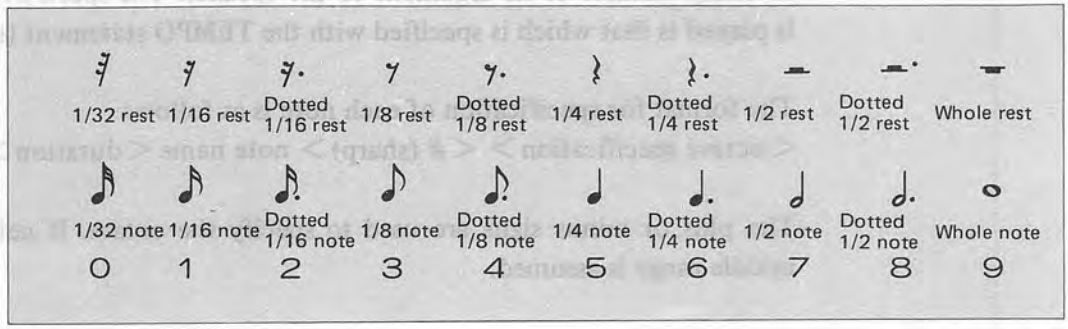
CDEFGAB # R

The relationship between the 8-note scale (do, re, mi, fa, so, la, ti, do) and these symbols are as shown below. The sharp symbol (#) is used to specify half notes. Silent intervals are specified with "R".



Duration specification

The duration specification determines the length of the specified note. The durations from 1/32 to whole are specified as numbers from 0 to 9. (When R is specified, this determines the length of the silent interval.)



When sucessive notes have the same duration, the duration specification can be omitted for the second and following notes. If no duration is specified for the first note, 1/4 notes are assumed.

Sound volume

The volume of sound produced cannot be controlled by the program, but can be adjusted with the computer's external volume control.

Example

Let's try assigning a string to SR$ to play the theme from the beginning of Beethoven's Serenade in D major (Opus 25).

```
SR$="+A3+#F1+A+B3A+D+#F1A+D3A+D
    +#F1A+D3+#F1A+D+E+#F+G+A3R"
```

2. 3. 9. 2 TEMPO ..... (abbreviated format: TEM.)

Format

TEMPO x

x . . . Numeric expression (1 to 7)

Function

This statement sets the tempo with which music is played by the MUSIC statement. If this statement is not executed, TEMPO 4 is assumed for execution of MUSIC statements.

```
3Ø TEMPO 1   Slowest tempo .... (Lento, adagio)
3Ø TEMPO 4   Medium tempo .... (Moderato);
                                four times as fast as TEMPO 1.
3Ø TEMPO 7   Fastest tempo ..... (Motto allegro, presto);
                                seven times as fast as TEMPO 1.
```

Example

```
1Ø REM  Chopin's mazourka
2Ø MM$="A3":M1$="A5+#C3+D+E+#F+G+#FØ+G+#
   F4+E3+D+#CB"
3Ø M2$="A3+D2RØ+D1+E2+D+#C3B+#C7+#C3"
4Ø M3$="A3+#C2RØ+#C1+D2+#CB3A+D7+D3"
5Ø TEMPO 3
6Ø MUSIC MM$, M1$, M2$, M1$, M3$, M1$, M2$, M1
   $, M3$
7Ø END
```

2.3.10 Data file input/output commands

Although the SAVE and LOAD commands can be used to write or read program text, other commands are used to record or read the various types of data which is handled by programs. These commands are described below.

	Format	Function
WOPEN (abbreviated **W.**)	WOPEN < file name >	Opens a data file on cassette tape prior to writing data to it. This command also assigns a name to the data file.
PRINT/T (abbreviated **?/T**)	PRINT/T d_1 <, d_2, d_3 , . . . dn > dn . . . . Numeric data or string data	Writes data to cassette tape in the same format as it would be displayed by the PRINT statement.
ROPEN (abbreviated **RO.**)	ROPEN < file name >	Searches for the data file on cassette tape with the specified name and opens that file to prepare for reading data from it.
INPUT/T (abbreviated **I./T**)	INPUT/T v_1 <, v_2, v_3 , . . . vn > vn . . . . Numeric data or string data	Used to input data from a cassette file and pass it to the program (in a manner similar to that in which the INPUT statement is used to input data from the keyboard).
CLOSE (abbreviated **CLO.**)	CLOSE	Statement which closes cassette data files after writing or reading has been completed.

Unlike the LOAD and SAVE commands, no messages are displayed by execution of the WOPEN and ROPEN statements.
If display of a message is desired, use the PRINT statement to define one in the program.

Note: When an ordinary cassette recorder is used, it may not be possible to record data files even if no problems are encountered in storing or reading programs with the SAVE and LOAD commands.

(Example 1)
The following program writes the numbers from 1 to 99 on cassette tape.

```
10 WOPEN "DATA"
20 FOR X=1 TO 99
30 PRINT/T X
40 NEXT X
50 CLOSE
60 END
```

(Example 2)
The following program reads data from the data file prepared in Example 1 above. Before executing this program, be sure to rewind the cassette tape.

```
10 ROPEN "DATA"
20 FOR X=1 TO 99
30 INPUT/T A
40 PRINT A
50 NEXT X
60 CLOSE
70 END
```

(Example 3)

The following program creates a data file consisting of string data.

```
10 DIM N$(5)
20 N$(1)="BACH"
30 N$(2)="MOZART"
40 N$(3)="BEETHOVEN"
50 N$(4)="CHOPIN"
60 N$(5)="BRAHMS"
70 WOPEN"GREAT MUSICIAN"
80 FOR J=1 TO 5
90 PRINT/T N$(J)
100 NEXT J
110 CLOSE
120 END
```

(Example 4)

The following program reads string data from the file created in Example 3. Before executing this program, be sure to rewind the cassette tape.

```
200 DIM M$(5)
210 ROPEN "GREAT MUSICIAN"
220 FOR K=1 TO 5
230 INPUT/T M$(K)
240 PRINT M$(K)
250 NEXT K
260 CLOSE
270 END
```

It is also possible to create data files which include both numeric and string data. However, since an error will occur if the type of data read does not match the type of variable specified in the INPUT/T statement, it is generally best to limit files to one type of data or the other.

Note: It is possible to omit the file name when opening a sequential file with the WOPEN statement. However, this is likely to result in errors if many files are included on the same tape; therefore, it is recommended that you make a habit of assigning file names to sequential data files.

The following program records student grades in English, French, science, and mathemetics to a sequential data cassette file.

```
10 INPUT"ENTER NO. OF STUDENTS";N
20 DIM N$(N),K(N),E(N)
30 DIM R(N),S(N)
40 A$="GRADE IS"
50 FOR X=1 TO N
60 PRINT:PRINT "STUDENT NO. ";X
70 INPUT"ENTER STUDENT NAME: ";N$(X)
80 PRINT "ENG ";A$;:INPUT K(X)
90 PRINT "FREN";A$;:INPUT E(X)
100 PRINT "SCI ";A$;:INPUT R(X)
110 PRINT "MATH";A$;:INPUT S(X)
120 NEXT X
130 WOPEN"GRADES"      <- Opens data file "GRADES" for output on cassette tape.
140 PRINT/T N          <- Writes the number of students in the class to the file.
150 FOR X=1 TO N
160 PRINT/T N$(X),K(X),E(X),R(X),S(X)   <- Writes grades to the file.
170 NEXT X
180 CLOSE              <- Closes the cassette file.
190 END
```

The following program reads the grade data written to the cassette file by the program shown above, then calculates displays the grade average for each student and class averages for each of the various subjects.

```
10 ROPEN"GRADES"       <- Opens cassette file "GRADES" for input.
20 INPUT/T N           <- Reads the number of people in the class.
30 DIM N$(N),K(N),E(N)
40 DIM R(N),S(N)
50 FOR X=1 TO N
60 INPUT/T N$(X),K(X)  <- Reads student names and the grades for English.
70 INPUT/T E(X),R(X),S(X)   <- Reads the grades for French, science and mathematics.
80 NEXT X
90 CLOSE               <- Closes the file.
100 PRINT TAB(10);"ENG ";
110 PRINT TAB(15);"FREN";
120 PRINT TAB(20);"SCI ";
130 PRINT TAB(25);"MATH"
140 FOR X=1 TO N
150 PRINT N$(X);TAB(10);K(X);
160 PRINT TAB(15);E(X);
170 PRINT TAB(20);R(X);
180 PRINT TAB(25);S(X);
190 PRINT TAB(30);(K(X)+E(X)+R(X)+S(X))/4
200 K(0)=K(0)+K(X):E(0)=E(0)+E(X)
210 R(0)=R(0)+R(X):S(0)=S(0)+S(X)
220 NEXT X
230 PRINT TAB(10);K(0)/N;TAB(15);E(0)/N;
240 PRINT TAB(20);R(0)/N;TAB(25);S(0)/N
250 END
```

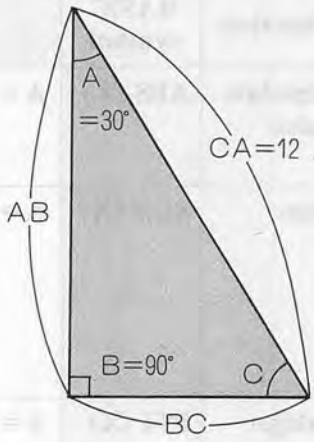
2.4 Built-in Function

Function	BASIC symbol	Example	Description
Absolute value	ABS (X)	A = ABS (X)	Assigns the absolute value of variable | X | to vairable A. Example: A = ABS (2. 9) →A = 2. 9 A = ABS (−5. 5) →A = 5. 5
Sign	SGN (X)	A = SGN (X)	Assigns the numeric sign of variable X to variable A. If the value of X is negative, −1 is assigned to A; if X is 0, 0 is assigned to A; and if X is positive, 1 is assigned to A. A = { 1 (X > 0); 0 (X = 0); −1 (X < 0) Example: 1 is assigned to variable A when A = SGN (0.4) is executed.
Integer conversion	INT (X)	A = INT (X)	Assigns the greatest integer value to A which is less than or equal to the value of variable X. Examples: A = INT (3. 87) →A = 3 A = INT (0. 6) →A = 0 A = INT (−3. 87) →A = −4
Trigonometric functions	SIN (X)	A = SIN (X) A=SIN(30＊PAI(1/180)	Assigns the sine of X (where X is in radians) to variable A. If the value of X is in degrees, it must be converted to radians before this function is used to obtain the sine. Since 1 degree equals π/180 radians, the value in radians is obtained by multiplying the number of degrees by PAI(1)/180. For example, 30° = 30＊PAI(1)/180 radians. The same applies to the COS, TAN, and ATN functions.
	COS (X)	A = COS (X) A=COS (200＊PAI(1)/180)	Assigns the cosine of X (where X is in radians) to variable A.
	TAN (X)	A = TAN (X) A=TAN(Y＊PAI(1)/180)	Assigns the tangent of X (where X is in radians) to variable A.
	ATN (X)	A = ATN (X) A=180/PAI(1)＊ATN(X)	Assigns the arctangent in radians of X ($\tan^{-1}X$) to variable A. The value returned will be in the range from −PI/2 to PI/2.
Square root	SQR (X)	A = SQR (X)	Calculates the square root of X and assigns the result to variable A. X must be a positive number or 0.
Exponentiation	EXP (X)	A = EXP (X)	Calculates the value of e^x and assigns the result to variable A.
Common logarithm	LOG (X)	A = LOG (X)	Calculates the common logarithm of X ($\log_{10}X$) and assigns the result to variable A.
Natural logarithm	LN (X)	A = LN (X)	Calculates the natural logarithm of X ($\log_e X$) and assigns the result to variable A.
Ratio of circumference to diameter	PAI (X)	A = PAI (X)	Assigns the value to variable A which is X times the value of PI.
Radians	RAD (X)	A = RAD (X)	Converts the value of X (where X is in degrees) to radians and assigns the result to variable A.

Examples of use of the built-in funcions

(Example 1)

Let's try solving the various elements of a triangle with a BASIC program.



Angle A of the triangle shown in the figure at right is 30°, angle B is a right angle, and side CA has a length of 12. The following program finds all angles of the triangle, the length of its sides, and its total area.

```
10 A=30:B=90:CA=12
20 AB=CA*COS (A*PAI(1)/180)
30 BC=CA*SIN (A*PAI(1)/180)
40 S=AB*BC/2
50 C=180-A-B
60 PRINT "AB=";AB, "BC=";BC, "CA=";CA
70 PRINT "AREAS=";S
80 PRINT "A=";A, "B=";B, "C=";C
90 END
```

(Example 2)

Now let's change line 50 of the program to use ATN, the function for finding the arctangent of a number, to fine angle C from sides AB and BC.

```
10 A=30:B=90:CA=12
20 AB=CA*COS (A*PAI(1)/180)
30 BC=CA*SIN (A*PAI(1)/180)
40 S=AB*BC/2
50 C=ATN (AB/BC)*180/PAI(1)
60 PRINT "AB=";AB, "BC=";BC, "CA=";CA
70 PRINT "AREAS=";S
80 PRINT "A=";A, "B=";B, "C=";C
90 END
```

RND function

Format

RND (X)

X . . Numeric expression

Function

The RND function returns a pseudo-random number in the range from 0.00000001 to 0.99999999.

When X is greater than 0, the random number returned is the one which follows that previously generated by the BASIC interpreter in a given pseudo-random number series.

When $X \leqq 0$, the BASIC Interpreter's pseudo-random number generator is reinitialized to start a new series, and the pseudo-random number returned is the first one in that series. Reinitialization of the pseudo-random number series in this manner can be used to allow simulations based on random numbers to be reproduced.

The RND function is often used in game programs to produce unpredicatable numbers, as in games of chance. Let's try using the RND function to investigate the percentage of times each of the six sides of a die comes up by simulating the action of throwing it a given number of times.
Since the sides of each die are numbered from 1 to 6, we must multiply the value returned by the RND function by 6.

```
0<RND (1) <1  ---×6--->  0<6*RND (1) <6
```

Then we must use the INT function to convert the value obtained to an integer.

```
INT (6*RND (1) ) →0、1、2、3、4、5
```

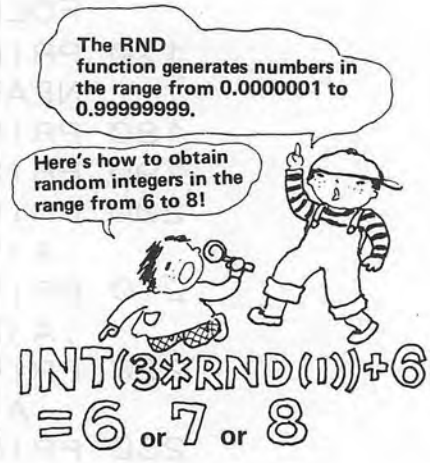
The result will be an integer between 0 and 5; now 1 is added to obtain the numbers which correspond to the number of dots on each of the 6 sides of a die.

```
INT (6*RND (1) ) +1 →1、2、3、4、5、6
```

This sequence is performed a specified number of times for each die thrown. Now let's incorporate the sequence into a program and check the results.

Example

```
10 PRINT "ENTER NO. OF
   TIMES DIE THROWN";
20 INPUT N
30 FOR J=1 TO N
40 R=INT (6*RND (1) ) +1
50 IF R=1 THEN N1=N1+1
60 IF R=2 THEN N2=N2+1
70 IF R=3 THEN N3=N3+1
80 IF R=4 THEN N4=N4+1
90 IF R=5 THEN N5=N5+1
100 IF R=6 THEN N6=N6+1
110 NEXT J
120 P1=N1/N : P2=N2/N : P3=N3/N
130 P4=N4/N : P5=N5/N : P6=N6/N
140 PRINT P1, P2, P3, P4, P5, P6
150 END
```



How about it? If the die is thrown enough times, the percentage of the time each number appears should be about the same. Mathematically speaking, each number should occur an average of once in six throws, or about 16.7% of the time. This mathematical ideal is approached more closely as the number of throws is increased.

Example

Now let's try using the RND function in a program which tests your ability to solve for the area of a triangle of random size. Here, the RND function is used to determine the length of each of the three sides of the triangle, then you compute the area of the triangle yourself and submit your answer to the computer for checking.

```
10 DIM A(3), L$(4)
20 FOR J=1 TO 4
30 READ L$(J) :NEXT J
40 FOR J=1 TO 3
50 A(J)=INT(20*RND(1))+1
60 NEXT J
70 IF A(1)>=A(2)+A(3) GOTO 40
80 IF A(2)>=A(1)+A(3) GOTO 40
90 IF A(3)>=A(1)+A(2) GOTO 40
100 W=(A(1)+A(2)+A(3))/2
110 T=W :FOR J=1 TO 3
120 T=T*(W-A(J)) :NEXT J
130 SS=SQR(T) :S=INT(SS)
140 IF SS-S>0.5 THEN S=S+1
150 PRINT "■■■■■"
160 PRINT "    SOLVE FOR THE AREA OF THE
    FOLLOWING TRIANGLE"
170 PRINT "    ROUND YOUR ANSWER TO THE
    NEAREST WHOLE NUMBER"
180 PRINT
190 PRINT TAB(8);"A"
200 PRINT TAB(8);"◪◹"      ;TAB(15);L$(1)
    ;A(1)
210 PRINT TAB(7);"◪  ◹"    ;TAB(15);L$(2)
    ;A(2)
220 PRINT TAB(6);"◪    ◹"  ;TAB(15);L$(3)
    ;A(3)
230 PRINT TAB(5);"◪      ◹"
240 PRINT TAB(3);"B◪        ◹C"
250 PRINT TAB(4);"□□□□□□□□□□"
260 PRINT "■■■"
270 PRINT TAB(3);L$(4);
280 INPUT Y
290 IF Y=S  THEN PRINT "      OK!!":GOTO
    40
300 IF Y<S  THEN PRINT "  TOO SMALL!"
    :GOTO  320
310 PRINT "  TOO LARGE!"
320 PRINT "■■";
330 PRINT TAB(24);SPC(25):PRINT "■";
340 GOTO 270
350 DATA LENGTH SIDE AB=,LENGTH SIDE BC=
360 DATA LENGTH SIDE CA=,AREAS OF TRIAN
    GLE ABC IS
```

Note

Note than specifying a value for X which is less than or equal to 0 will always result in the same number for a given value of X. The reason for this is that specifying 0 or a negative number reinitializes the pseudo-random number generator to the beginning of the random number series.

2. 5 String Function

2.5.1 LEN

Format

LEN (X$)

X$ . . . String expression

Function

This funcion returns **the number of characters** included in the string expression represented by X$. This value includes spaces which are not displayed on the screen and any control characters in the string, as well as letters, numerals, and symbols.

Example

(Example 1)

```
10 A$="ABCDEFG"
20 PRINT LEN(A$)

RUN
7
```

(Example 2) The following program uses the LEN funcition to draw squares on the screen.

```
10 ?"■":?"ENTER 3OR MORE ASTERISKS"
20 INPUT A$
30 FOR I=1 TO LEN(A$)-2
40 PRINT TAB(2);"*";SPC(LEN(A$)-2);"*"
50 NEXT I
60 PRINT TAB(2);A$:GOTO 20
```

(Example 3) The LEN function can also be used to produce a "parade" of characters as shown below.

```
10 S$="SHARP BASIC"
20 FOR I=1 TO LEN(S$)
30 ? RIGHT$(S$, I)
40 NEXT I
50 END
RUN
C
IC
SIC
 ⋮
SHARP BASIC
```

(Example 4)

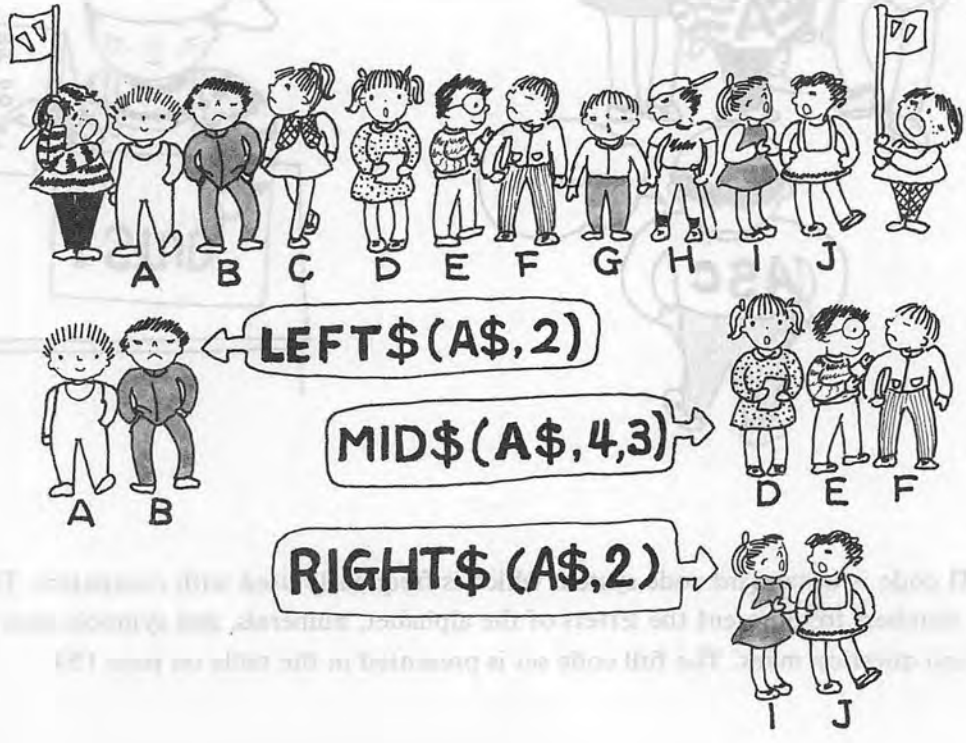
```
PRINT LEN(STR$(PAI(1))) ↵
 9
```

PAI (1), the function which returns the value of the ratio of the circumference of a circle to its diameter, contains the 8-digit constant 3.1415927 (approximately the value of PI). When the length of the character string produced by converting this constant with the STR$ function is evaluated with the LEN function, a total string length of 9 is returned.

2.5.2 LEFT$, MID$, and RIGHT$

The LEFT$, MID$, and RIGHT$ functions are used to extract character strings from the left end, right end, or middle of a character expression.

Format X$: String expression m and n: Numeric expressions	Function	Example (when A$ = "ABCDEFG")	Remarks
LEFT$ (X$, n)	Returns the character string consisting of the n characters making up the left of string expression X$.	B$= LEFT$ (A$, 2) B$←[AB]CDEFG Substitutes 2 characters from the left end of string variable A$ into string varible B$. Thus, B$ = "AB".	$0 \leqq n \leqq 255$
MID$ (X$, m, n)	Returns the character string consisting of the n characters making up the n characters starting with the mth character in string expression X$.	B$=MID$ (A$, 3, 3) B$← AB[CDE]FG Substitutes the 3 characters starting at the 3rd character in string variable A$ into string variable B$.	$1 \leqq m \leqq 255$ $0 \leqq n \leqq 255$
RIGHT$ (X$, n)	Returns the character string consisting of the n characters making up the right end of string expression X$.	B$ = RIGHT$ (A$, 2) B$← ABCDE[FG] Substitutes 2 characters from the right end of string variable A$ into string varible B$. Thus, B$ = "FG".	$0 \leqq n \leqq 255$



2.5.3 ASC and CHR$

Format	Function	Example
ASC (x$) x$: String expression	Returns the ASCII code for the first character in string expression x$.	X=ASC (" A ") Substitutes 65 (the ASCII code for the letter A) into variable X. Y=ASC (" SHARP ") Substitutes 83 (the ASCII code for S, the first letter in the string "SHARP") into variable X.
CHR$ (x) x: Numeric expression	Returns the letter whose ASCII code corresponds to the value of numeric expression X. (No character is returned if the value specified for x is less then 33; therefore, PRINT " " or PRINT SPC (1) should be used to obtain spaces, rather than CHR$ (32)).	A$=CHR$ (65) Assigns A, the letter corresponding to ASCII code 65, to string variable A$. This function can be used to display characters which cannot be entered from the keyboard as follows. PRINT CHR$ (107) ♪ This displays the graphic character ⊠.

Note: ASCII code is a standard code system which is frequently used with computers. This code uses 8 bit numbers to represent the letters of the alphabet, numerals, and symbols such as the dollar sign and question mark. The full code set is presented in the table on page 154.

2.5.4 VAL and STR$

Format	Function	Example
STR$ (x) x: Numeric expression	Returns a string of ASCII characters representing the value of numeric expression X.	A$=STR$ (−12) Substitutes the character string "−12" into string variable A$. B$=STR$ (70 * 33) Substitutes the character string " 2310 " into string variable B$. C$=STR$ (1200000 * 5000) Substitutes the character string "6E + 09" into string variable C$. Note: Positive numeric values are displayed with a leading space to indicate that the plus sign (+) has been omitted. However, this space is not included in the character sting returned by the STR$ function.
VAL (x$) x$: String expression	Converts an ASCII character representation of a numeric value into a numeric value. This is the complement of the STR$ function.	A=VAL ("123") Converts the character string " 123 " into the number 123 and assigns it to numeric variable A.

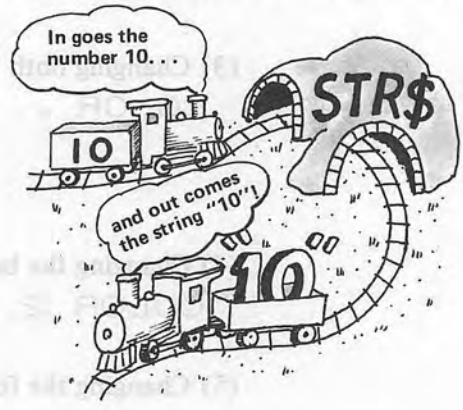
The following sample program illustrates use of some of the functions discussed above to display numeric values in tabular format (with the decimal points aligned).

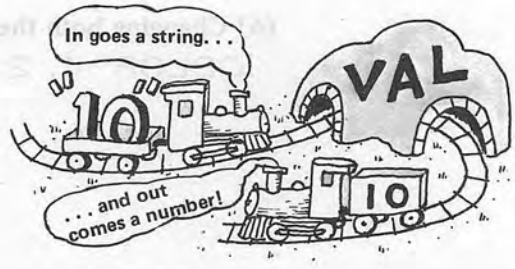
```
 1.23456
 12.3456
 10
 1
 1234
```

If the values read from DATA statements were displayed using only the PRINT statement, the result would appear as shown below.

```
10 FOR X=1 TO 5
20 READ A
30 L=5-LEN(STR$(INT(A)))
40 PRINT TAB(L);A
50 NEXT:END
60 DATA 1.23456,12.3456
70 DATA 123.456,1234.56
80 DATA 12345.6
```

```
  1.23456
 12.3456
123.456
1234.56
12345.6
```





2. 6 Color display statement

One of the greatest features of the MZ-700 is that it allows characters and graphics to be displayed using any of up to 8 colors.

2.6.1 COLOR ..... (Abbreviated format: COL.)

Format

COLOR x, y, c <, b >

x . . . . X coordinate (0 to 39)

y . . . . Y coordinate (0 to 24)

c . . . . Character color specification (0 to 7).

b . . . . Background color specification (0 to 7).

Function

This statement is used to set the foreground and background colors for the character at a specific position on the screen. Any of up to 8 different colors can be specified for the character foreground (c) or background (b) as shown in the table below.

Color No.	Color
0	Black
1	Blue
2	Red
3	Purple
4	Green
5	Light blue
6	Yellow
7	White

Example

(1) Changing the background color of the entire screen

```
COLOR , , , 2
```

. . . . . (Changes the background color used for display of characters to red.)

(2) Changing the foreground color of the entire screen (the color used for display of all characters)

```
COLOR , , 3
```

. . . . . (Changes the color used for display of all characters to purple.)

(3) Changing both the background and foreground colors for the entire screen

```
COLOR , , 1, Ø
```

. . . . . (Changes the color used for display of all characters to blue and changes the background used for display of characters to black.)

(4) Changing the background color at a specific screen location

```
COLOR 2, 2, , 4
```

. . . . . (Changes the background color at coordinates 2, 2 to green.)

(5) Changing the foreground color at a specific screen location

```
COLOR 3, 2, 7
```

. . . . . (Changes the foreground color at coordinates 3, 2 to white.)

(6) Changing both the foreground and background color at a specific screen location

```
COLOR 4, 2, 4, 2
```

. . . . . (Changes the foreground color at coordinates 4, 2 to green and changes the background color at that location to red.)

2.6.2 Adding color specifications to the PRINT statement

Format

{PRINT / ?} [f , b] {variable / constant / expression} <{ ; / , } {variable / constant / expression} { ; / , } .....>

or

{PRINT / ?} [f , b] USING "format string" ; variable <{ ; / , } variable ....>

f . . . . Foreground (character color) specification (a number from 0 to 7)

b . . . . Background color specification (a number from 0 to 7)

Function

Adding the color specifications to the PRINT and PRINT USING statements described on pages 37 and 38 makes it possible to display characters in a variety of colors. In the format above, f indicates the character foreground color, and b indicates the character background color. If only the foreground color is specified, the current background color is used for display of characters; this is done by specifying the foreground color, followed by a comma.

If only the background color is specified, the current foreground color is used for display of characters; in this case, a comma must precede the background color specification.

Example

(Example 1)

```
PRINT (6, 5) "ABCDE"
```
. . . . Displays the letters "ABCDE" in yellow against a background of light blue.

```
PRINT (, 4) "FGHIJ"
```
. . . . Displays the letters "FGHIJ" in yellow against a background of green.

```
PRINT (7, ) "VWXYZ"
```
. . . . Displays the letter "VWXYZ" in green against a background of white.

(Example 2) Let's try adding color to the automobile race program shown on page 46.

```
10 PRINT (, 1) "■"
20 Q=INT (5*RND (1)) +2 : X=33*RND (1)
30 FOR A=1 TO 5
40 READ M$
50 PRINT TAB (0) ; "◆" ; TAB (X) ;
60 PRINT (Q, 1) M$ ;
70 PRINT (7, 1) TAB (37) ; "◆"
80 NEXT A
90 Y=10*RND (1)
100 FOR A=1 TO Y
110 PRINT TAB (0) ; "◆" ;
120 PRINT TAB (37) ; "◆" : NEXT
130 RESTORE : GOTO 20
140 DATA "  ◢◆◣  ", "●▩▩▩▩●"
150 DATA "  ▩▩▩▩  ", "●▩▩▩▩●"
160 DATA "  ◥■◤  "
```

With ordinary PRINT statements (those without color specifications), the foreground and background colors used for character display are those which have been specified with the latest COLOR statement.

2. 7 Color Plotter-Printer Commands

The color plotter-printer commands described below can be used with the MZ-731 or, when the MZ1P01 color-plotter printer is connected, with the MZ-711, or MZ-721. The color plotter-printer can be used in either of two modes: The text mode (for printout of program lists, results of calculations, or other character data), or the graphic mode (for drawing figures and graphs).

Further, any of four colors (black, blue, green, or red) can be used for printout of characters and graphics. This capability is particularly useful when using the printer in the graphic mode.

2.7.1 General information about the color plotter-printer

(1) The color plotter-printer operates in either of two modes: **The text mode** (for printout of the results of calculations, program lists, and other character data) and **the graphic mode** (used for drawing figures and graphs). The printer will only operate in one mode at a time. (Graphic printer commands are ignored while the printer is in the text mode, and vice versa.)

(2) Printer parameters are reset when the printer is switched from the graphics mode to the text mode. (In other words, the pens' X and Y coordinate settings are reinitialized.)

(3) The printer runs on power supplied from the main unit of the MZ-700, and is not equipped with a separate power switch.

(4) The following switches are used to control operation of the printer.

a. Feed switch ..... Advances the paper.

b. Reset switch ..... Resets (reinitializes) the printer.

c. Pen change switch ..... Used when replacing the printer's pens.

(5) There are four pen colors: Black, blue, green, and red.

(6) When the printer is used in the text mode, any of three different sizes of characters can be printed. The largest size permits a maximum of 26 characters to be printed on one line, medium size permits a maximum of 40 characters to be printed on one line, and the smallest size allows up to 80 characters to be printed on one line.

Characters which can be printed when using the printer in the text mode are as shown below. No other letters, symbols, or graphic characters can be output while the printer is in this mode.

In most cases, hexadecimal ASCII codes will be printed in a different color if an attempt is made to print graphic characters with the PRINT/-P statement or LIST/P command.

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGH
IJKLMNOPQRSTUVWXYZ[¥]↑← e`~ tgh bxdrpcq
azwsui ÖkfV üßjn Üm'}^o|ÄöÜ y{ ¯π□ →▯▯
▯▯▯▯£↓_ !"#$%&'()*+,-./0123456789:;<=>?@A
BCDEFGHIJKLMNOPQRSTUVWXYZ[¥]↑← e`~ tgh
bxdrpcqazwsui Ökfv üßjn Üm'}^o|ÄöÜ y{ ¯
π□ →▯▯▯▯▯▯£↓_ !"#$%&'()*+,-./0123456789:
;<=>
```

2.7.2 Initial Printer Settings

The initial printer settings made when the BASIC interpreter 1Z-013B is started up are as follows.

(1) Pen color: Black

(2) Pen position: Left side of the carriage. (top line of 1 page.)

(3) Mode: Text mode

(4) Print size: 40 characters/line ..... (standard size)
66 lines/page

2.7.3 Mode Specification Commands

These commands are used to place the printer in the text mode for printout of letters and numerics. This is the mode which is effective when the power is turned on; the initial character size is 40 characters/line.

(1) **MODE TN** ..... (abbreviated format: **M. TN**)

This command returns the printer to the text mode from the graphic mode and sets the character size to 40 characters/line.

(2) **MODE TL** ..... (abbreviated format: **M. TL**)

This command returns the printer to the text mode from the graphic mode and sets the character size to 26 characters/line.

(3) **MODE TS** ..... (abbreviated format: **M. TS**)

This command returns the printer to the **text mode** from the graphic mode and sets the character size to 80 characters/line.

```
*** CHARACTER MODE ***
```

80 character mode

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

40 character mode

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

26 character mode

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

(4) **MODE GR** ..... (abreviated format: **M. GR**)

The MODE GR command is used to switch the printer from the text mode to **the graphics mode** for printout of charts and graphs. When switching to this mode, it is necessary for the BASIC program being executed to make a note of the character size being used immediately before the mode change is made. The reason for this is in order to return to the text mode when the BREAK key is pressed or a STOP command is encountered.

Note: Executing MODE command, every state returns to initial state excluding pen color and print size.

2.7.4 Pen color selection commands

PCOLOR n { n : 0 black; n : 1 blue; n : 2 green; n : 3 red } ..... (abbreviated format: **PC.**)

This command specifies the color to be used for printout of characters or graphics. n is a number from 0 to 3, with 0 corresponding to black, 1 to blue, 2 to green, and 3 to red.

In text mode, executing PCOLOR in text mode every state is on initial state excluding pen color.

To keep current state execute PRINT/P CHR$(29) ..... next color.

This command can be entered in either the text mode or graphics mode.

2.7.5 Text mode commands

2.7.5.1 TEST ..... (abbreviated format: TE.)

Format **TEST**

Format This command causes the printer to print squares in each of the four different colors to check the color specification, quantity of pen ink, and so forth. (Only usable in the text mode.)

0 (Black) 1 (Blue) 2 (Green) 3 (Red) ..... Value of n in PCOLOR n

2.7.5.2 SKIP

Format **SKIP** n

n. . . A number in the range from −20 to 20

Function This command is used to feed the paper. Paper is fed n lines in the forward direction when the value for n is positive; if the value specified for n is negative, the paper is fed n lines in the reverse direction. Note that PRINTER MODE ERROR will occur if this command is executed while the printer is in the graphics mode.

2.7.5.3 PAGE

Format **PAGE** n

n. . . An integer in the range $1 \leqq n \leqq 72$

Function This command specifies the number of lines per page. (Executable only in the text mode.)

2.7.5.4 LIST/P ..... (abbreviated format: **L./P**)

Format **LIST/P** or **LIST/P** <LS–Le>

Ls ..... Starting line number

Le ..... Ending line number

Function This command lists all or part of the program lines in memory on the printer. See the explanation of the LIST command on page 32 for an explanation of procedures for specifying the range of lines to be printed. Note that, when graphic characters are included in the program list, most of them will be printed in a different color as hexadecimal ASCII codes. See page 154 for the printer ASCII codes.
This command can only be executed in the text mode.

2.7.5.5 PRINT/P ..... (abbreviated format: **? /P**)

Format **PRINT/P** $< I_1,\ d_1,\ I_2,\ d_2 \ldots\ldots$ In, dn >

In ..... Output list (numeric or string expressions)

dn ..... Delimiter

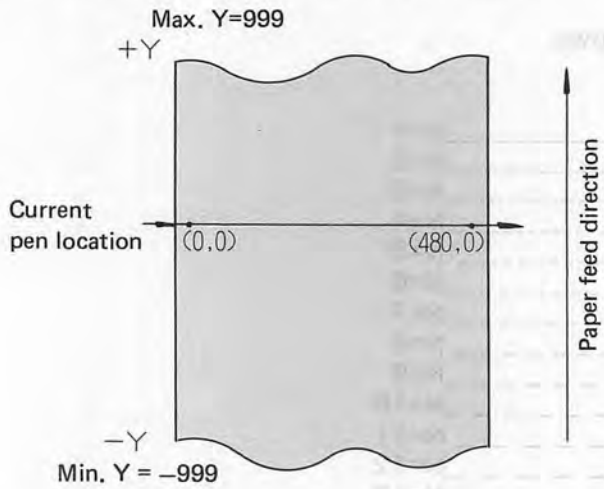
Function This command outputs the data in the output list to the printer. For details on using this command, see the description of the PRINT command on page 37. See pages 82 for printout of graphic characters.

2.7.5.6. PRINT/P USING ..... (abbreviated format: **? /P USI.**)

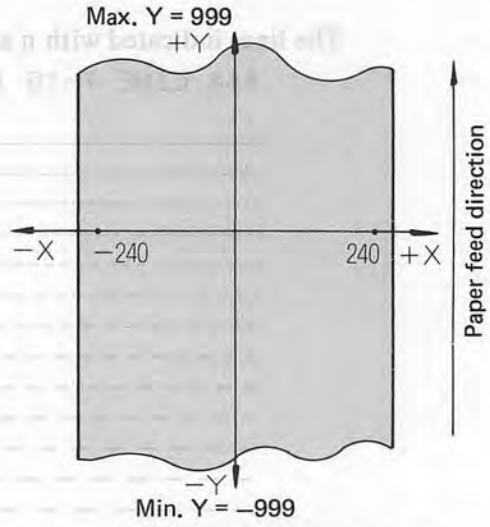
Except that output is directed to the printer, this is the same as the PRINT USING statement described on page 38.

2.7.6 Graphic mode statements

The graphic mode statements become effective after the **MODE GR** statement has been executed. When this statement is executed, the current pen location is set to the origin (X = 0, Y = 0). However, the origin can be set to any location. Be careful not to specify a location which is out of the print area, as this may damage the pen or cause other problems.



X–Y coordinates after MODE GR has been executed. The allowable range of X is 0 to 480 and the allowable range of Y is −999 to 999.



X–Y coordinates after the origin has been moved to the center of paper. (MOVE 240, −240: HSET)

Note: See page 88 for the HSET statement.

2.7.6.1 LINE

Format

LINE x_1, y_1 <, x_2, y_2, . . . , xi, yi> or

LINE %n, x_1, y_1 <, x_2, y_2, . . . , xi, yi>

n . . . . . Integer from 1 to 16

xi . . . . . Number indicating the X coordinate (xi = −480 to 480; the limit varies depending on the current pen location.)

yi . . . . . Number indicating the Y coordinate (yi = −999 to 999)

Function

This statement draws a line from the current pen location to location (x_1, y_1), then draws a line from (x_1, y_1) to (x_2, y_2), and so on. n specifies the type of line drawn as shown below.

n = 1: solid line

n = 2 to 16: dotted line

If % is omitted, the previous value of n is assumed. The initial value of n is 1 (solid line).

Example

(Example 1) The following program draws a square with a side length of 240 units.

```
10 MODE GR          ..... Switches to the graphic mode.
20 LINE 240, 0      ..... Draws a line from the origin to the center
                          of paper.
30 LINE 240, -240
40 LINE 0, -240
50 LINE 0, 0        ..... Draws a line to the origin.
60 MODE TN          ..... Returns to the text mode.
```

(Example 2) The following program draws the same square as the example above.

```
10 MODE GR
20 LINE 240, 0, 240, -240, 0, -240, 0, 0
30 MODE TN
```

(Example 3) The following program draws a rectangle with a side length of 240 units.

```
10 MODE GR
20 SQ=INT(120*SQR(3))
30 LINE %2,240,0,120,-SQ,0,0
40 MODE TN
```

The lines indicated with n are as follows.

```
*** LINE 1-16 ***
```

N=1
N=2
N=3
N=4
N=5
N=6
N=7
N=8
N=9
N=10
N=11
N=12
N=13
N=14
N=15
N=16

2.7.6.2 RLINE ..... (abbreviated format: **RL.**)

Format

RLINE $x_1, y_1 <, x_2, y_2, \ldots xi, yi \ldots >$

RLINE $\%n, x_1, y_1, <, x_2, y_2, \ldots, xi, yi \ldots >$

n ..... Integer from 1 to 16

xi ..... Number indicating the X coordinate (–480 to 480)

yi ..... Number indicating the Y coordinate (–999 to 999)

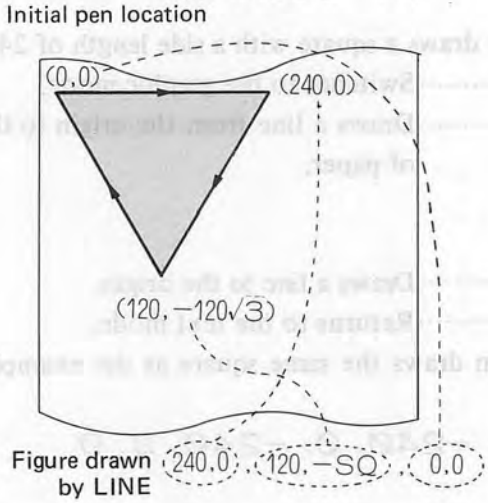
Function

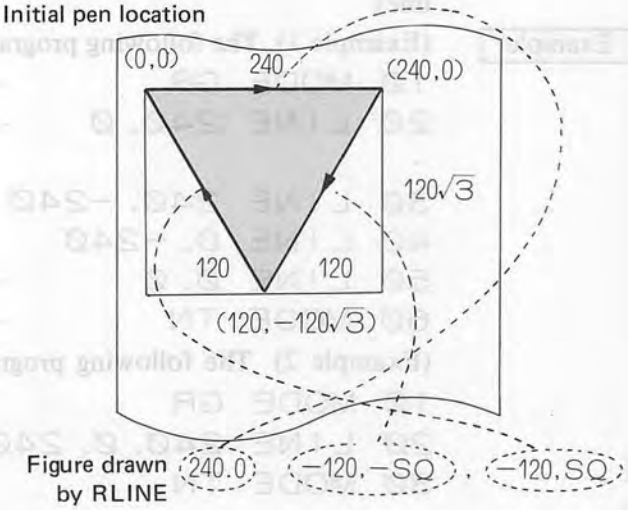
This statement draws a line from the current pen location to the location indicated by **relative coordinates** x_1, y_1, then draws a line from that point to the location indicated by relative coordinates x_2, y_2, and so on. n is the same as for the LINE statement.

Example

This program draws the same rectangle as example 3 above.

```
10 MODE GR
20 SQ=INT(120*SQR(3))
30 RLINE %1,240,0,-120,-SQ,-120,SQ
40 MODE TN
```





2.7.6.3 MOVE

Format — **MOVE** x, y

x . . . . . Integer indicating the X coordinate (–480 to 480)

y . . . . . Integer indicating the Y coordinate (–999 to 999)

Function — This statement **lifts the pen** and moves it to the specified location (x, y).

Example — The following program draws a cross with a side length of 480 units.

```
10 MODE GR
20 LINE 480, 0
30 MOVE 240, 240 ·····Lifts the pen at (480, 0) and moves it to
                      240, 240).
40 LINE 240, -240
50 MODE TN
```

Be sure to advance the paper before executing this program.

2.7.6.4 RMOVE . . . . . (abbreviated formed: **RM.**)

Format — **RMOVE** x, y

x . . . . . Integer indicating relative X coordinate (–480 to 480)

y . . . . . Integer indicating relative Y coordinate (–999 to 999)

Function — This statement lifts the pen and moves it to the location indicated by **relative coordinates** (Δ x, Δ y)

Example — The following program draws the same cross as the example for the MOVE statement.

```
10 MODE GR
20 LINE 480, 0
30 RMOVE -240, 240 ·····Lifts the pen at (480, 0), then moves it
                        -240 units in the X direction and 240
                        units in the Y direction.
40 LINE 240, -240
50 MODE TN
```

Be sure to advance the paper before executing this program.

2.7.6.5 PHOME . . . . . (abbreviated format: **PH.**)

Format — **PHOME**

Function — This statement returns the pen to the origin.

Example — The following example draws the same cross in red as the example for the MOVE statement.

```
10 MODE GR
20 LINE 480, 0 :MOVE 240, 240
30 LINE 240, -240
40 PHOME ·····Returns the pen to the origin.
50 PCOLOR 3
60 LINE 0, 240, 480, 240, 480, -240, 0, -240, 0,
   0
70 MODE TN
```

2.7.6.6 HSET ..... (abbreviated format: **H.**)

Format **HSET**

Function This statement sets the current pen location as the new origin. With this feature, the origin can be set to the location which is most appropriate for drawing figures. A MOVE statement is frequently executed before executing this command.

Example

```
10 MODE GR
20 MOVE 240, -240
30 HSET ·····Sets the new origin.
40 FOR I=1 TO 360 STEP 30
50 LINE 240*COS (PAI(1)*I/180),240*SIN (PAI(1)*I/180)
60 PHOME
70 NEXT
80 MODE TN
```

2.7.6.7 GPRINT ..... (abbreviated format: **GP.**)

Format **GPRINT** [n, @] , x$

GPRINT x$

n ..... Integer indicating the character size (0 ~ 63)

@ ..... Integer indicating the direction in which lines of characters are printed. (@ = 0 ~ 3)

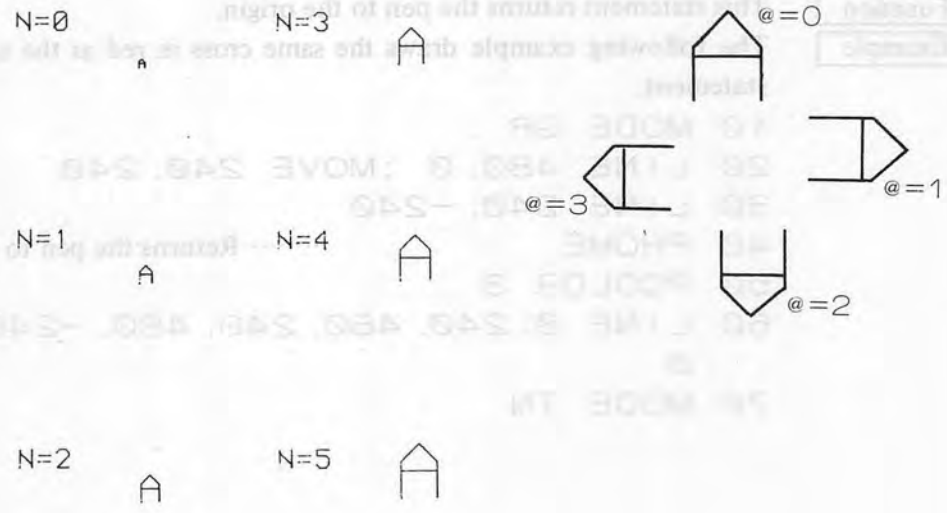
x$ ..... Character

Function This statement prints the specified character using the specified size and direction. 80 characters can be printed on each line when n = 0; 40 characters can be printed on each line when n = 1; and 26 characters can be printed on each line when n = 2. When n and @ are omitted, the previous settings are assumed. Their initial values are n = 1 and @ = 0.

Example

```
10 MODE GR
20 GPRINT "A" ·····Prints "A" in the graphic mode.
30 GPRINT (2, 2) , "A" ···Prints an upside down "A" in the 26
                          characters/line mode.
```

The following figures show various examples of printout.



2.7.6.8 AXIS ..... (abbreviated format: AX.)

Format

AXIS x, p, r

x ..... Integer specifying the axis drawn (0 or 1)

p ..... Integer specifying the scale pitch (–999 to 999)

r ..... Integer specifying the number of repetitions (1 to 255)

Function

This statement draws the X-axis when x = 0 and the Y-axis when x = 1. The number of scale marks specified in r are drawn with a pitch of p.

Example

The following example draws the X and Y axes with scale marks from –240 to 240 at 10 unit intervals.

```
10 MODE GR
20 MOVE 240, 5
30 GPRINT [1, 0], "A"
40 MOVE 240, 0
50 AXIS 0, -10, 48
60 MOVE 240, -500
70 GPRINT [1, 0], "B"
80 MOVE 0, -240
90 GPRINT [1, 0], "C"
100 MOVE 0, -240
110 AXIS 1, 10, 48
120 MOVE 470, -240
130 GPRINT [1, 0], "D"
140 MODE TN
```

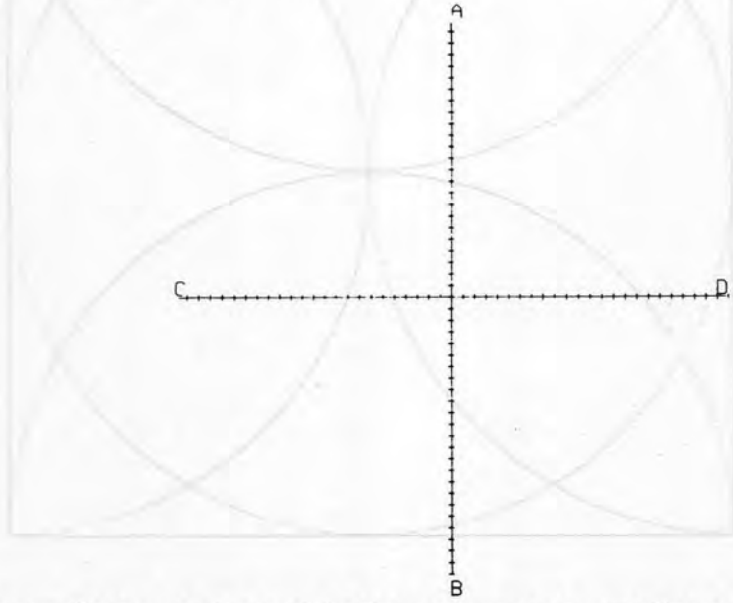
Switches the printer to the graphic mode.

Lifts the pen and moves it to position A (240, 0).

Draws the Y-axis from position A to position B with scale marks included at 10-unit interval.

Lifts the pen and moves it to position C (0, –240).

Draws the X-axis from position C to position D with scale marks included at 10-unit intervals.



The coordinates can be used in the same manner as ordinary Cartesian coordinates after setting the point of intersection of the X and Y axes as the new origin. (X = –240 to 240, Y = –240 to 240)

2.7.6.9 CIRCLE ..... (abbreviated format: CI.)

Format

CIRCLE x, y, r, s, e, d

x, y ..... Location of the center (–999 to 999)
r ..... Radius (0 to 999)
s ..... Starting angle (in degree)
e ..... Ending angle (in degree)
d ..... Step angle (in degree)

Function

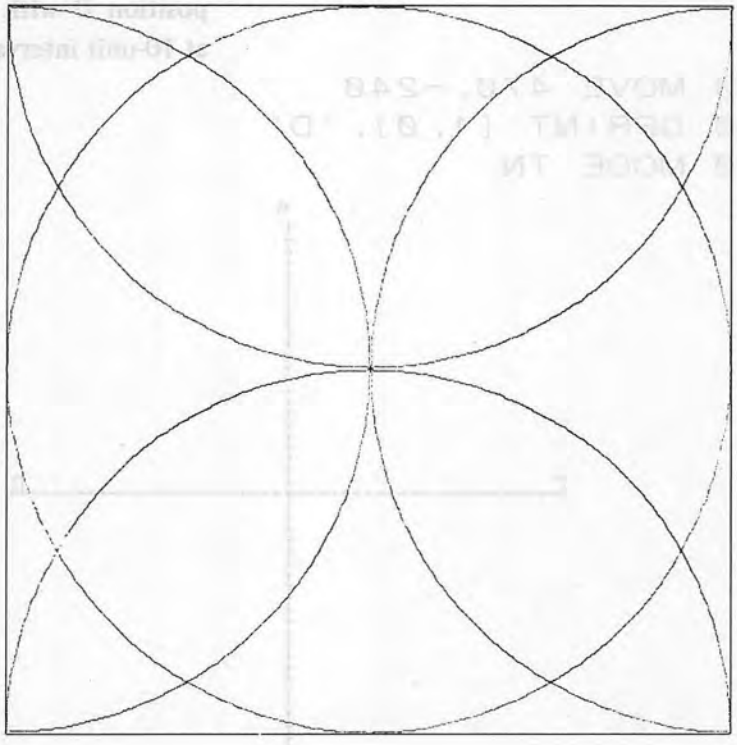
This statement draws a circle or arc with a radius of r and a step of d at location (x, y), starting at angle S and ending at angle e. A complete circle is drawn when s = 0, e = 360 and d = 0.2.

Actually this statement draws a polygon; therefore, d must be as small as possible in order to draw a smooth figure.

s must be smaller than e. When d = 0, lines connecting the center and the starting point and the center and the ending point are drawn.

Example

```
10 MODE GR
20 LINE 480, 0, 480, -480, 0, -480, 0, 0
30 MOVE 240, -240
40 HSET
50 CIRCLE 0, 0, 240, 0, 360, 0.2
60 CIRCLE 240, 0, 240, 90, 270, 0.2
70 CIRCLE 0, 240, 240, 180, 360, 0.2
80 CIRCLE -240, 0, 240, 270, 450, 0.2
90 CIRCLE 0, -240, 240, 0, 180, 0.2
100 MODE TN
```



2. 8 Machine Language Program Control Statements

Several machine language program control statements are suported by the MZ-700 BASIC interpreter. With these statements, machine language programs can be linked with a BASIC program.

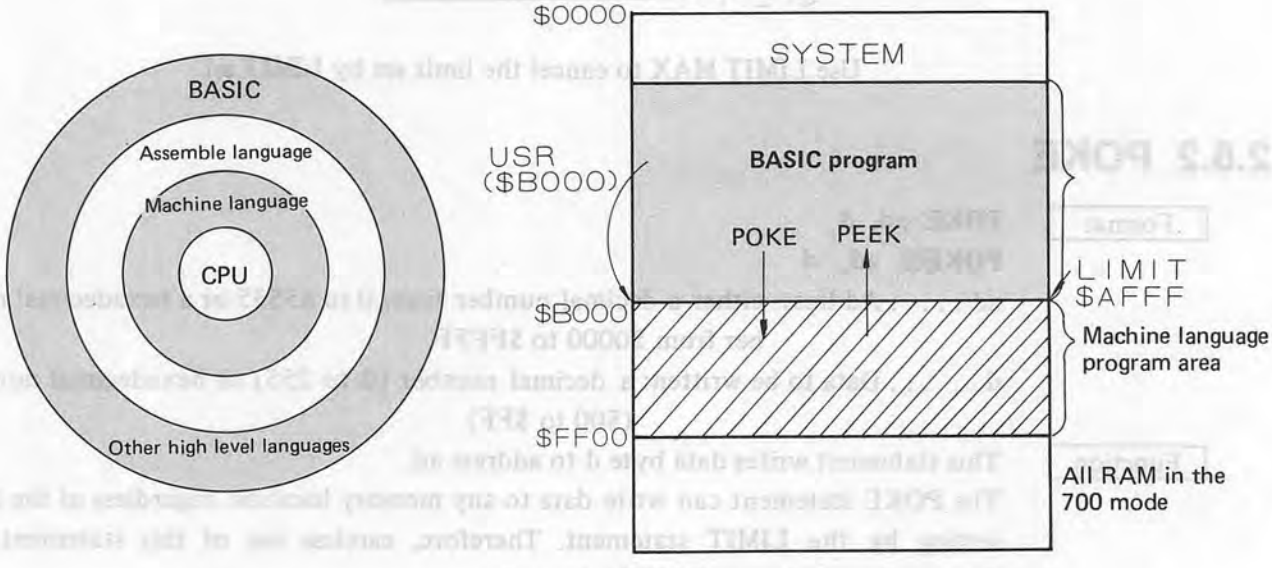
Computer programming languages form a hierarchical structure as shown below. High level languages such as BASIC automatically performs work required when lower level languages such as assembly language are used. Although high level languages are convenient and easy to use, they cannot control the CPU directly.

The lowest level language (machine language) directly controls the CPU and provides high processing speed, but considerable skill is required for coding long programs.

Machine language program control statements enable sophisticated programming techiques which make it possible to utilize the advantages of both BASIC and machine language.

Machine language programs can be generated and loaded into the machine language program area (reserved with the BASIC LIMIT statement) using the monitor or assembler and loader. Such machine language programs can be called by BASIC programs with the USR ( ) function. Machine language programs can also be loaded into memory using a BASIC program which uses the POKE statement to write each step in machine code. The resultant machine language program can then be called by BASIC programs with the USR ( ) function.

The memory map at bottom right outlines the concept of data access with POKE and PEEK, and of calling machine language programs with USR ( ).



2.8.1 LIMIT ..... (Abbreviated format: LIM.)

Format

LIMIT ad

ad . . . . . Address; either a decimal number from 0 to 65279 or a 4-digit hexadecimal number from $0000 to $FEFF.

Function

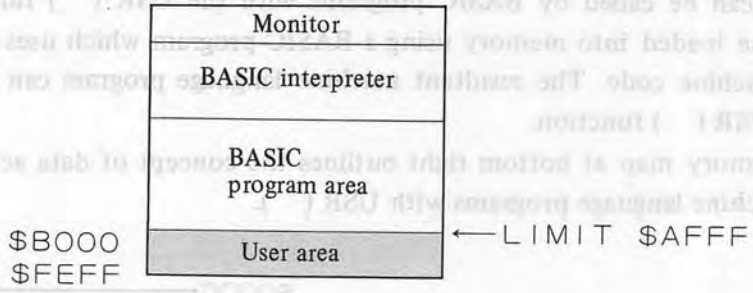
This statement limits the memory area which can be used by the BASIC interpreter. ad indicates the upper limit of the BASIC area, and the area from the following address (ad + 1) to $FEFF (65279) can be used for machine language programs or special data.

Example

```
LIMIT $AFFF
```

Limits the BASIC program area to $AFFF.

Note The area from $FF00 to $FFFF is used by the monitor as a work area, so it cannot be used as the user area. The LIMIT statement must be used at the beginning of a BASIC program.



Use LIMIT MAX to cancel the limit set by LIMIT ad.

2.8.2 POKE

Format

POKE ad, d

POKE@ ad, d

ad . . . . . Address: either a decimal number from 0 to 65535 or a hexadecimal number from $0000 to $FFFF.

d . . . . . Data to be written: a decimal number (0 to 255) or hexadecimal number ($00 to $FF)

Function

This statement writes data byte d to address ad.

The POKE statement can write data to any memory location, regardless of the limit setting by the LIMIT statement. Therefore, careless use of this statement can destroy the monitor or BASIC interpreter.

The POKE@ format is used to write data to an address in the user RAM area following 53248 ($D000). (See page 125.)

Example

```
POKE $DØØØ, $5F
POKE 53248, 95
```

The two statements above perform the same funcition.

Note A POKE statement specifying an address after $D000 writes data into the video RAM area.

2.8.3 PEEK

Format

PEEK (ad)
PEEK@ (ad)
ad . . . . Address in decimal or hexadecimal notation (0 to 65535 or $0000 to $FFFF)

Function

This function returns the contents of the specified address as a decimal number from 0 to 255. Use the PEEK@ format to PEEK a user RAM area following 53248 ($D000).

Example

The following program displays data stored in the area from 40960 ($A000) to 40975 ($A00F).

```
10 FOR AD= 40960 TO 40975
20 ? PEEK (AD)
30 NEXT AD
```

2.8.4 USR ..... (Abbreviated format: U.)

Format

USR (ad)
USR (ad, x$)
ad . . . . . Address (decimal or 4-digit hexadecimal)
x$ . . . . . String data

Function

This is a special function which transfers control to a machine language program which starts at the specified address. As with CALL ad, so control is returned to the statement following the USR function if the machine language program includes a return instruction (RET or RET␣cc).
When x$ is specified, the starting address of the memory area containing x$ is loaded into the DE register, then the length of x$ is loaded into the B register before the machine language program is called. This makes it possible for a BASIC program to pass string data to a machine language program.

2.8.5 Preparing machine language programs

A machine language program which fills the entire display screen with the characters supported by the MZ-700 is presented in this section as an example.

The following BASIC program loads such a machine program into memory and calls it.

```
10 LIMIT $BFFF ..... Limits the BASIC area to $BFFF.
20 GOSUB 50
30 USR($C000) ..... Calls the machine language program.
40 END
50 FOR I =49152 TO 49181
60 READ M ..... Reads data for the machine language program from DATA
70 POKE I,M statements and writes it into the machine language area.
80 NEXT I
90 RETURN
100 DATA 197:REM        PUSH BC ..... Beginning of data for the machine language program.
110 DATA 213:REM        PUSH DE
120 DATA 229:REM        PUSH HL
130 DATA 22,0:REM       LD D,0
140 DATA 33,0,208:REM   LD HL,D000H
150 DATA 1,232,3:REM    LD BC,1000
160 DATA 243:REM        DI
170 DATA 211,227:REM    OUT (E3H),A ..... Switches the memory block to video RAM. (See page
180 DATA 114:REM    STO:LD (HL),D ..... 155).
190 DATA 35:REM         INC HL ..... Sets a display code to video RAM.
200 DATA 20:REM         INC D
210 DATA 11:REM         DEC BC
220 DATA 120:REM        LD A,B
230 DATA 177:REM        OR C
240 DATA 194,14,192:REM JP NZ,STO
250 DATA 211,225:REM    OUT (E1H),A ..... Switches the memory block to RAM. (See page 127.)
260 DATA 251:REM        EI
270 DATA 225:REM        POP HL
280 DATA 209:REM        POP DE
290 DATA 193:REM        POP BC
300 DATA 201:REM        RET ..... Returns to the BASIC program.
```

If the machine language program has been generated with the monitor and saved on cassette tape under the file name DISPLAYCODE, use the following program to call the machine language program.

```
11Ø LIMIT $BFFF
11Ø LOAD "DISPLAYCODE"
12Ø USR ($CØØØ)
```

2. 9 I/O Statements

All external devices (including floppy disk drives) are connected to the MZ-700 through an optional interface board. The optional universal interface board makes it possible for the user to connect external devices such as an X-Y plotter, paper tape punch, and music synthesizer to the MZ-700.
A port address selection switch is provided on the universal interface card to allow any port address from 0 to 239 (00H to EFH) can be assigned to any devices. Addresses 240 to 255 are reserved for optional peripheral devices supplied by Sharp.

The INP and OUT statements allow the user to transfer data from/to external devices through the optional universal I/O card. The format of these statements is as follows.

INP #P, D . . . . . Reads 8-bit data from port P, converts it into a decimal number and assigns it to variable D.

OUT #P, D . . . . . Converts a decimal number in variable D to binary format and outputs it to port D.

These statements greatly extend the range of applications of the MZ-700 series computers.

2. 10 Other Statements

2.10.1 ON ERROR GOTO ..... (Abbreviated format: ON ERR. G.)

Format

ON ERROR GOTO Lr

Lr . . . . Destination line number (entry point of an error processing routine)

Function

This statements causes execution to branch to line number Lr if an error occurs. The IF ERN and IF ERL statement can be used in a trap routine starting at that line to control subsequent processing according to the type of error and the line number in which it occurred. Including a RESUME statement at the end of the error processing routine makes it possible to return execution to the line at which the error occurred. Executing an ON ERROR GOTO statement cancels the error trap line number definied by the previous ON ERROR GOTO statement. The error trap line number definition is also cancelled by executing a CLR statement.

2.10.2 IF ERN

Format

IF relational expression using **ERN** THEN Lr
IF relational expression using **ERN** THEN statement
IF relational expression using **ERN** GOTO Lr

Lr . . . . Destination line number

Function

This statement branches execution to the error processing (trap) routine starting at line Lr or executes the statement following THEN when the result of <relational expression using ERN> is true.

ERN is a special function which returns a number corresponding to the type of error occurring. See page 159 for the error numbers.

Example

The following shows an error processing routine beginning on line 1000 which causes execution to branch to line 1200 if the error number is 5.

```
10 ON ERROR GOTO 1000·····Declares the line number of the
                          error processing routine.
.....
1000 IF ERN=5 THEN 1200·····Branches to 1200 if a string
.....                        overflow error has occurred.
```

2.10.3 IF ERL

Format

IF relational expression using **ERL** THEN Lr
IF relational expression using **ERL** THEN statement
IF relational expression using **ERL** GOTO Lr
Lr . . . . Destination line number

Function

This statement branches execution to the routine starting at line Lr or executes the statement following THEN when the result of <relational expression using ERL> is true.
ERL is a special function which returns the line number at which an error occurred.

Example

The following statement causes execution to branch to line 1300 if an error has occurred on line 250.

```
1010 IF ERL = 250 THEN 1300
```

The following statement returns control to line 520 in the main routine if the error number is 43 and the error line number is other then 450.

```
1020 IF (ERN = 43) * (ERL < > 450) THEN RESUME 520
```

2.10.4 RESUME ..... (Abbreviated format: RESU.)

Format

RESUME <NEXT>
RESUME Lr
Lr . . . . Line number or 0

Function

This statement returns control to the main routine from an error processing routine.

Discussion

The system holds the number of the line on which the error occurred in memory and returns program execution to that line or to another specified line after the error is corrected.
The RESUME statement may be used in any of the following four forms:

```
RESUME ..... Returns to the error line.
RESUME NEXT ..... Returns to the line following the error line.
RESUME Lr ..... Returns to line Lr.
RESUME 0 ..... Returns to the beginning of the main routine.
```

If the RESUME is encountered when no error has occurred, error 21 (RESUME ERROR) occurs.
If the RESUME cannot be executed, error 20 (CAN'T RESUME ERROR) occurs.

2.10.5 SIZE

Format

PRINT SIZE

Function

This is a special function which returns the number of bytes in memory which can be used for storage of BASIC programs.
For example, PRINT SIZE displays the number of free bytes of memory area.

2.10.6 PLOT ON ..... (Abbreviated format: PL. ON)

Format — PLOT ON

Function — This statement makes it possible to use the color plotter-printer as a display unit. Thus, the MZ-700 can be used without an external display screen.
This statement is effective only when the color plotter-printer is installed and the MODE TN statement has been previously executed.

Example
```
PLOT ON
```

Note — A period " . " is printed to represent any characters which are not stored in the color plotter-printer's character generator (see page 156). The [INST], [DEL] and " ← " keys are disabled by executing this statement. [CTRL] + [G] can be used to change the pen.

2.10.7 PLOT OFF ..... (Abbreviated format: PL. OFF)

Format — PLOT OFF

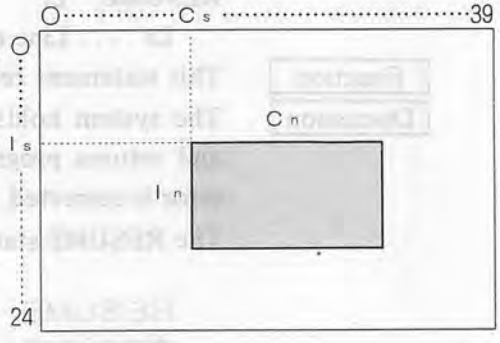
Function — This statement cancels PLOT ON made of plotter-printer operation.

Example
```
PLOT OFF
```

2.10.8 CONSOLE ..... (Abbreviated format: CONS.)

Format — CONSOLE <Is, In< ,Cs, Cn >>

Is : Starting line of the scroll area
In : Number of lines within the scroll area
Cs : Starting column of the scroll area
Cn : Number of columns in the scroll area



Example
```
CONSOLE Ø, 25, Ø, 4Ø
CONSOLE 5, 15
CONSOLE Ø, 25, 5, 3Ø
CONSOLE Ø, 1Ø, Ø, 1Ø
CONSOLE
```

Function — This statement specifies the size of the scroll area; i. e., the area which is cleared by PRINT " ■ ".
The first example specifies the entire screen as the scroll area. The second specifies the area between lines 5 and 15 as the scroll area. The third specifies the area between columns 5 and 30 as the scroll area. The fourth specifies the 10 x 10 positions at the upper left corner of the screen as the scroll area.
This statement is useful for excluding the left and/or right edges of the image from the display area. When they are hidden behind the edges of the screen.
The last example does not specify the scroll area. When the scroll area is not specified, it is possible to scroll the screen up or down.
However, this makes it harder to perform screen editing because the values of Cn and In become smaller.

2.11 Monitor Function

The IOCS section of the BASIC Interpreter includes a monitor program to make it easy to enter machine language programs. This monitor program uses the area from FF00H to FFFFH as a stack area.

This monitor program includes the screen editor similar to that of BASIC which makes it possible to change the contents of any address within the 64K RAM area as described below.

2.11.1 Editing format

: address = data data data

: (colon) ... Indicates that the line following can be edited.

address ... Indicates the starting address of the memory area whose contents can be changed. (4 hexadecimal digits)

= ... Separates data from the address.

data ... 2-digit hexadecimal number or a semicolon " ; " plus the character which is written in the specified address. A blank is used to separate adjacent data items.

2.11.2 Printer switching command ..... (P command)

Format ✳ P

This command switches data output with the D or F command between the printer and display. If the printer is not connected to the computer, the message "ERR? " is displayed and the monitor stands by for input of another command. Check the printer connection or execute the P command again to switch the output device to the display.

2.11.3 Dump command ..... (D command)

Format ✳ D <start address < ␣ end address >>

This command dumps the contents of memory from the starting address to the end address. If the end address is omitted, the contents of the 128-byte block starting at the specified address are dumped. If both addresses are omitted, it dumps the contents of the 128-byte block following memory block previously dumped. The format in which data is dumped is as follows.

: HHHH=HH␣HH␣HH HH HH HH HH HH /ABCDE. G.

↑ Starting adress — 8 bytes (Hexadecimal code) — 8 bytes (Characters)

The contents of any location can be changed by moving the cursor to the corresponding byte, entering the new data, and pressing the CR key.

Note Control codes are displayed as a period (.) in the character data field. Pressing the BREAK key stops dump output, and pressing the SHIFT and BREAK keys simultaneously returns the monitor to the command input mode.

2.11.4 Memory set command ..... (M command)

Format ＊ M [starting address]

This command is used to change the contents of memory. If the starting address is omitted, the address currently indicated by the program counter is assumed. Press the SHIFT and BREAK keys together to terminate this command.

When this command is entered, the starting address of the memory block and its contents are dispalyed in the editing format described previously and the cursor is moved to the data to be changed. Enter the new data and press the CR key; the following address and its contents are then displayed.

2.11.5 Fin command ..... (F command)

Format ＊ F [starting adress] ␣ [end adress] ␣ [data] ␣ [data] ␣ .....

This command searches for the specified data string in the memory area from the starting address to the end address. When found, the address of the string and its contents are dumped to the screen. This command is terminated by simultaneously pressing the SHIFT and BREAK keys.

2.11.6 Subroutine call ..... (G command)

Format ＊ G [call address]

This command calls the subroutine starting at the specified address. The stack pointer is located at FFEEH.

2.11.7 Transfer command ..... (T command)

Format ＊ T [starting address] ␣ [end address] ␣ [destination adress]

This address transfers the contents of memory between the starting address and the end address to the memory area starting at the destination address.

2.11.8 Save command ..... (S command)

Format ＊ S[starting address] ␣ [end adress] ␣ [execution adress] : [file name]

This command saves the contents of the memory between the starting address and the end address to cassette tape under the specified file name.

2.11.9 Load command ..... (L command)

Format ＊L <load address><: file name>

This command loads the specified file into memory, starting at the load address. If the load address is omitted, the execution address contained in the file is assumed as the load address. If the file name is omitted, the first file encountered on the tape is loaded. The message "ERR?" is displayed if a check sum error is detected or the BREAK key is pressed during execution, then the monitor returns to the command wait state input mode. The command input mode wait state is entered when execution is wait state is entered when execution is completed.

2.11.10 Verify command ..... (V command)

Format ＊V <file name>

This command reads the specified file from cassette tape and compares it with the contents of memory. This makes it possible to confirm that a program has been properly recorded with the SAVE command. If any difference is found between data read from the tape and that contained in memory, the message "Err ? " is displayed.

2.11.11 Return command ..... (R command)

Format ＊R

This command returns control to the system program which called the monitor program and restores the SP (stack pointer) and HL register to the values which they contained when the monitor program was called. Execution resumes with the command following BYE is executed.

This command cannot return control if the monitor has been called by a system program whose stack pointer is between FF00H to FFFFH, or if the stack pointer does not contain a return address. In such cases, use the G command to call the warm start entry point.

2.11.9 Load command ..... (L command)

Format * L < load address > < : file name >

This command loads the specified file into memory, starting at the load address. If the load address is omitted, the execution address contained in the file is assumed as the load address. If the file name is omitted, the first file encountered on the tape is loaded. The message "ERR?" is displayed if a check sum error is detected or the BREAK key is pressed during execution, then the monitor returns to the command wait state input mode. The command input mode wait state is entered when execution is wait state is entered when execution is completed.

2.11.10 Verify command ..... (V command)

Format * V < file name >

This command reads the specified file from cassette tape and compares it with the contents of memory. This makes it possible to confirm that a program has been properly recorded with the SAVE command. If any difference is found between data read from the tape and that contained in memory, the message "Er ? " is displayed.

2.11.11 Return command ..... (R command)

Format * R

This command returns control to the system program which called the monitor program and restores the SP (stack pointer) and HL register to the values which they contained when the monitor program was called. Execution resumes with the command following BYE is executed.

This command cannot return control if the monitor has been called by a system program whose stack pointer is between FF00H to FFFFH, or if the stack pointer does not contain a return address. In such cases, use the G command to call the warm start entry point.

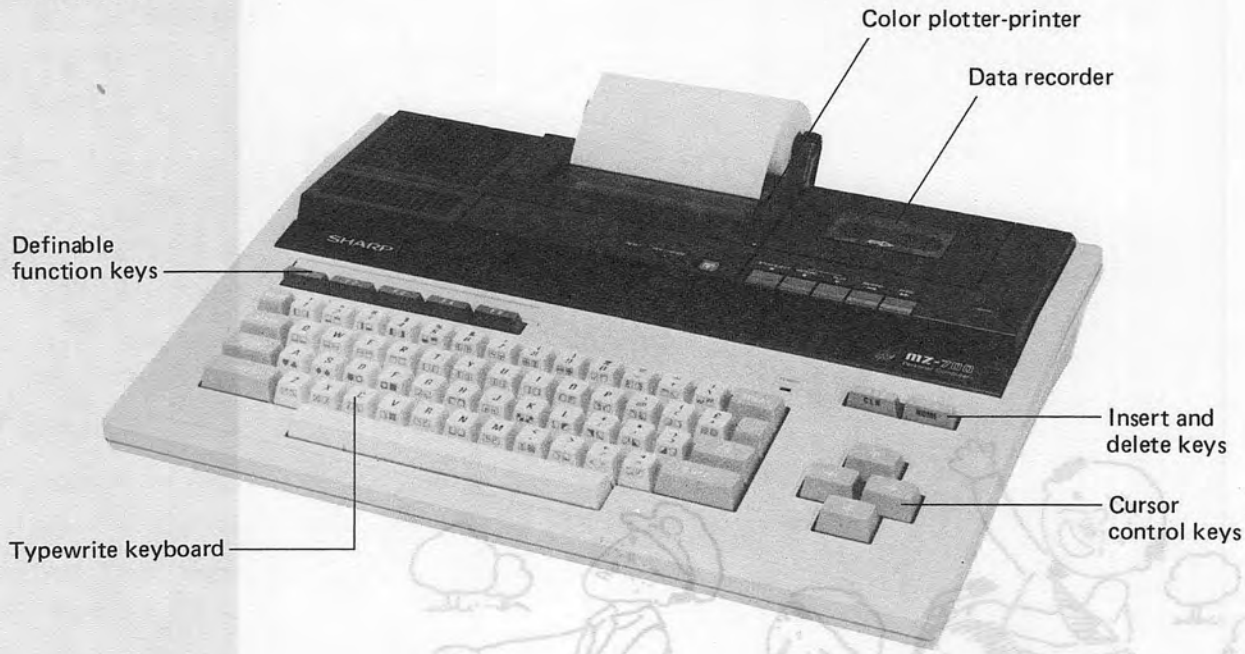
Chapter 3

Operating the MZ-700

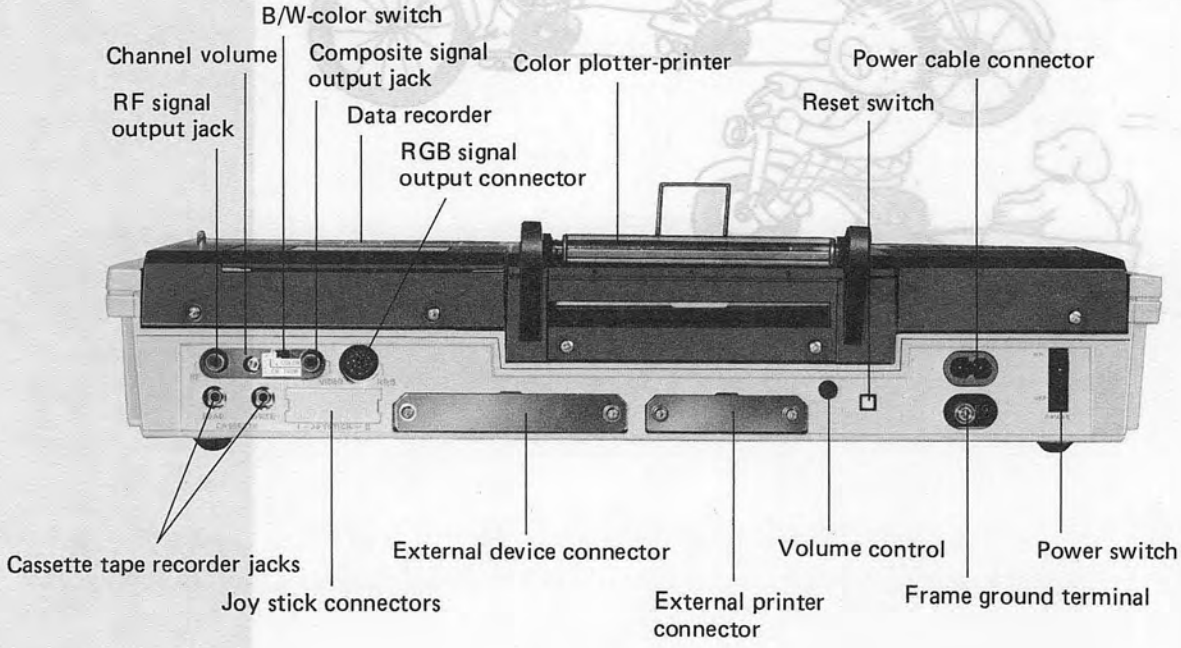
3. 1 Appearance of the MZ-700 Series Personal Computers

3.1.1 MZ-731

■ **Front view**

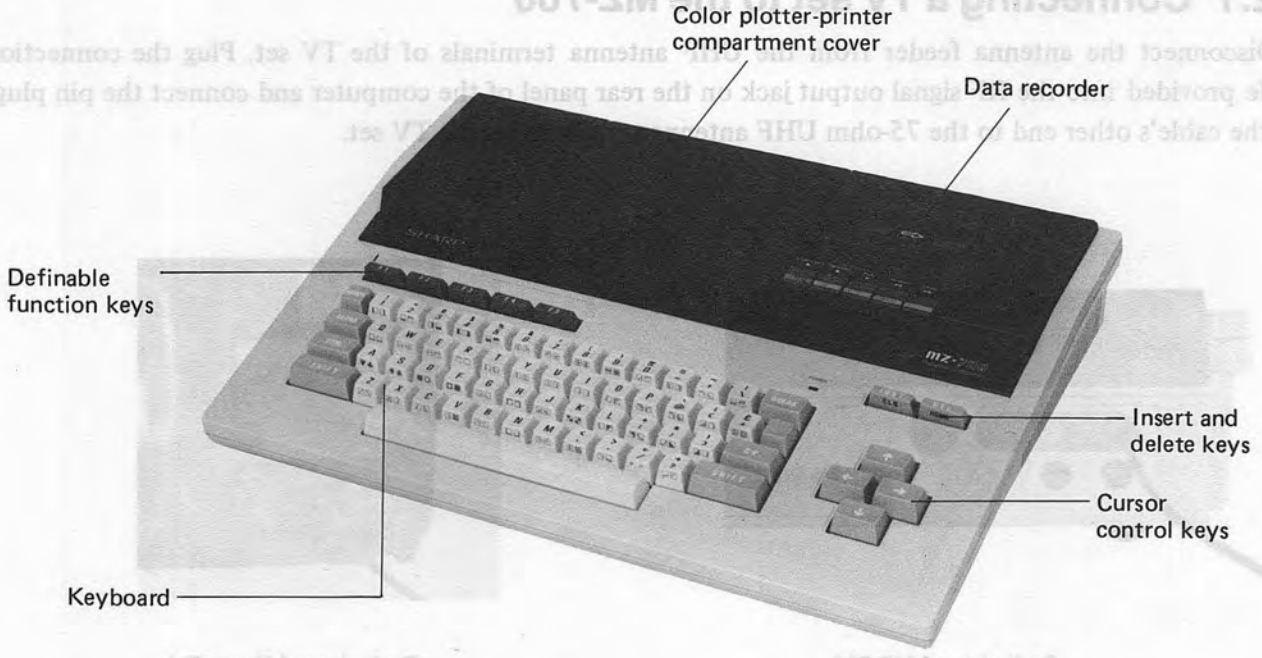


■ **Rear view**



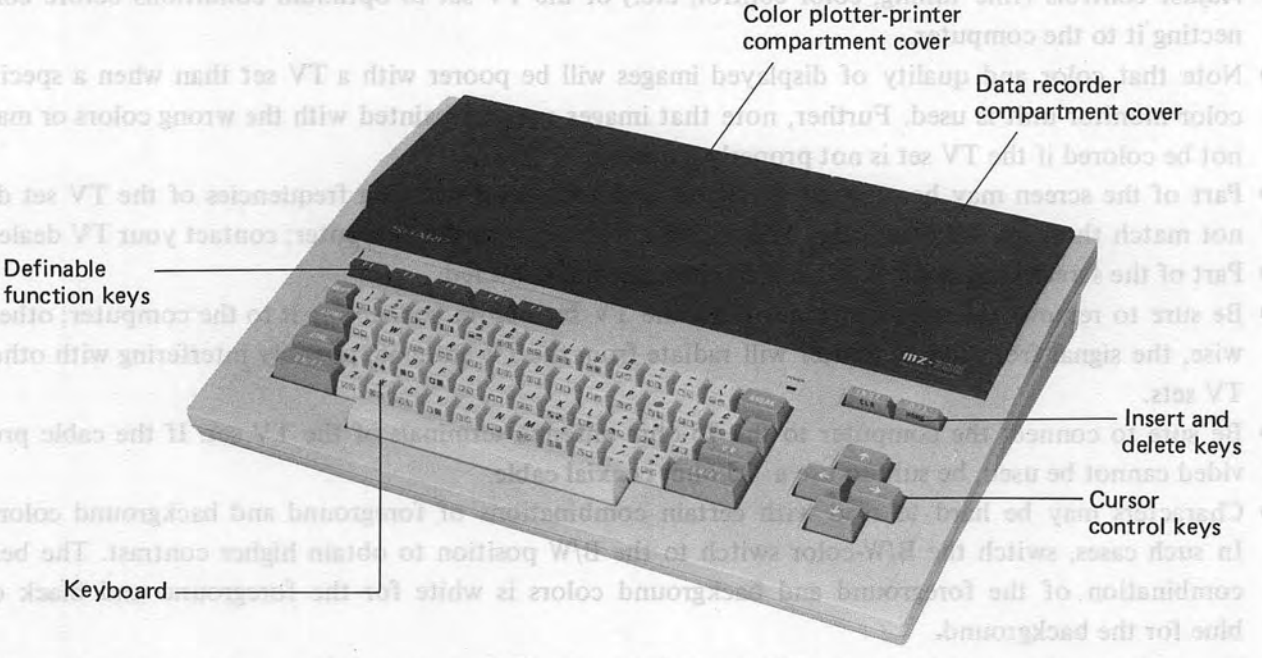
3.1.2 MZ-721

- **Front view**



3.1.3 MZ-711

- **Front view**



3. 2 Connection to Display Unit

Be sure to turn off both the computer and display unit before connecting them.

3.2.1 Connecting a TV set to the MZ-700

Disconnect the antenna feeder from the UHF antenna terminals of the TV set. Plug the connection cable provided into the RF signal output jack on the rear panel of the computer and connect the pin plugs on the cable's other end to the 75-ohm UHF antenna terminals on the TV set.

Back view of MZ-700

Back view of Home TV

Set the channel selection switch to the 36 ± 3 ch position, depending on which is not used in your area.

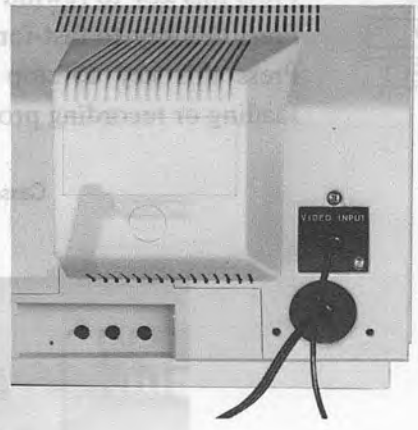
Note the following when using an ordinary TV set as a display unit.

- Adjust controls (fine tuning, color control, etc.) of the TV set to optimum conditions before connecting it to the computer.
- Note that color and quality of displayed images will be poorer with a TV set than when a special color monitor unit is used. Further, note that images may be painted with the wrong colors or may not be colored if the TV set is not properly adjusted.
- Part of the screen may be omitted if vertical and horizontal scanning frequencies of the TV set do not match those of the computer. This is not a problem with the computer; contact your TV dealer.
- Part of the screen may not be visible if the image is not centered.
- Be sure to remove the antenna feeder from the TV set before connecting it to the computer; otherwise, the signal from the computer will radiate from the TV antenna, possibly interfering with other TV sets.
- Be sure to connect the computer to the 75-ohm antenna terminals of the TV set. If the cable provided cannot be used, be sure to use a **75-ohm coaxial cable**.
- Characters may be hard to read with certain combinations of foreground and background colors. In such cases, switch the B/W-color switch to the B/W position to obtain higher contrast. The best combination of the foreground and background colors is white for the foreground and black or blue for the background.
- No audio signal is included in the RF signal fed to the TV set, so sound cannot be output from the speaker of the TV set.

3.2.2 Connecting the MZ-1D04 12-inch green display to the computer

Use the cable included with the MZ-1D04 green display to connect it to the computer. Plug the cable into the composite signal jack on the computer's rear panel, then set the B/W-COLOR switch to the B/W position.

Rear panel of the MZ-700 series computer

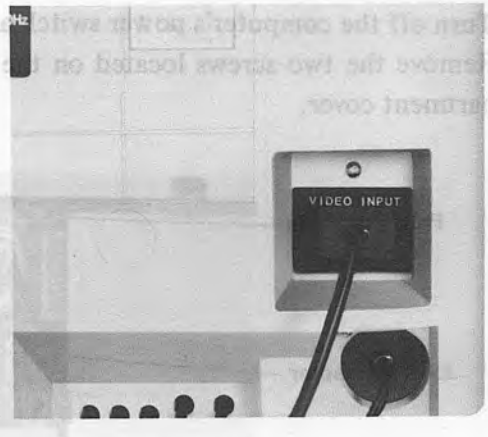


Rear panel of the MZ-1D04

3.2.3 Connecting the MZ-1D05 14-inch color display to the computer

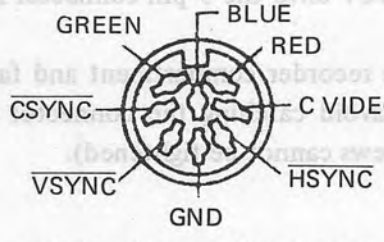
Use the cable included with the MZ-1D05 color display to connect it to the computer. Plug the cable's DIN connector into the RGB signal output connector on the MZ-700.

Rear panel of the MZ-700 series computer



Rear panel of the MZ-1D05

Pin assignments of the RGB signal output connector of the MZ-700 are as shown below.



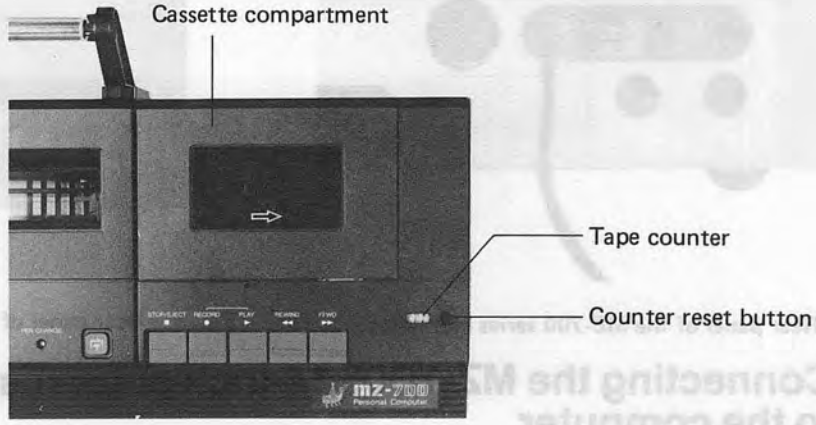
RGB signal output DIN connector
(viewed from the rear side)

3. 3 Data Recorder

■ **Data recorder built into the MZ-731 and MZ-721**

The built-in data recorder can be operated in the same manner as an ordinary cassette tape recorder.

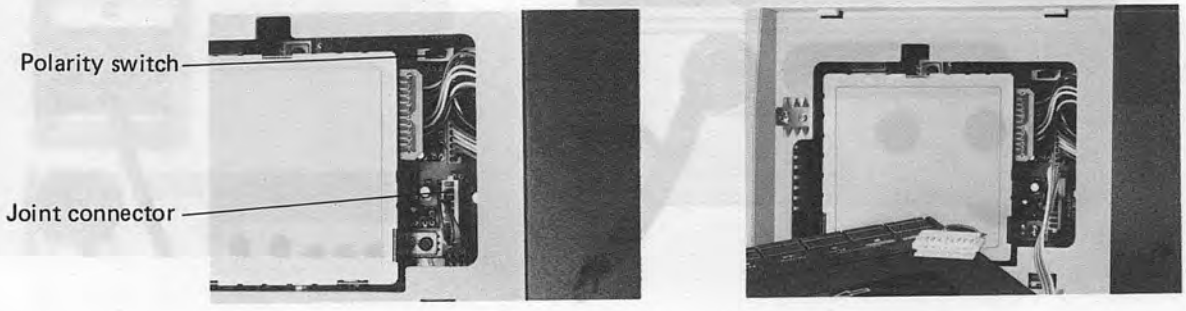
RECORD	Press this key to record programs and data.
PLAY	Press this key to load programs and data.
REWIND	Press this key to rewind the tape.
FFWD	Press this key to fast-forward the tape.
STOP/EJECT	Press this key to stop the tape, to release other keys when the tape stops after loading or recording programs or data, or to eject the tape.



■ **MZ-1T01**

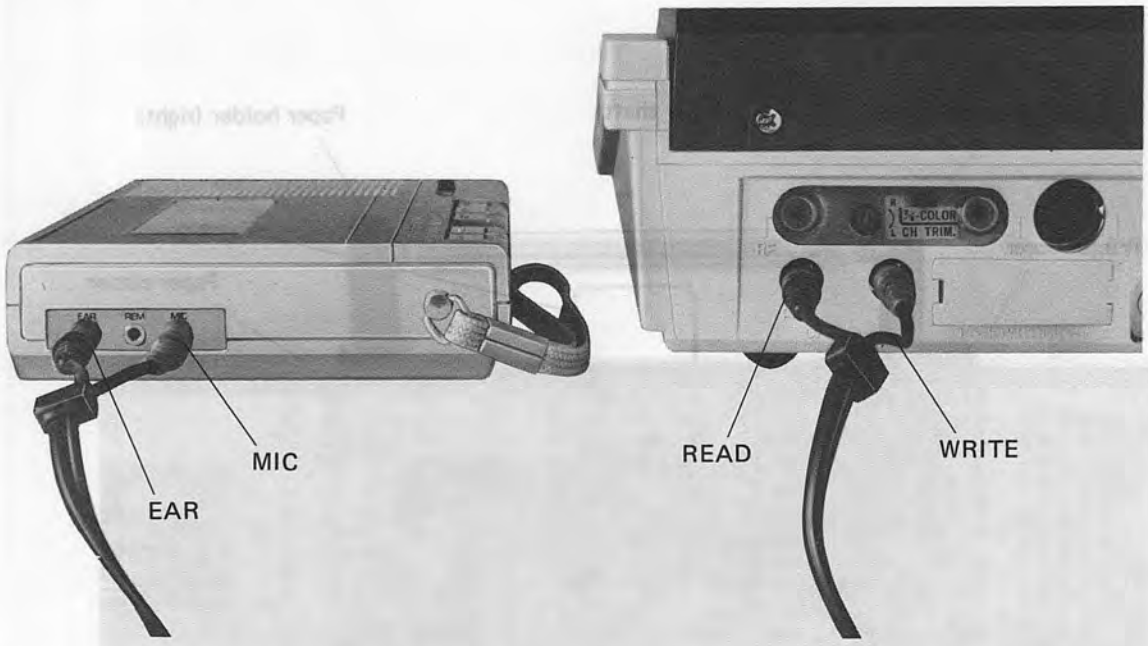
The MZ-1T01 data recorder unit can be installed in the MZ-711 (MZ-710). Installation procedures are as follows.

1. Turn off the computer's power switch and unplug the power cable from the AC outlet.
2. Remove the two screws located on the left side of the rear panel to remove the data recorder compartment cover.



3. Remove the joint connector cover.
4. Plug the connector of the MZ-1T01 onto the 9-pin connector located at the left rear of the recorder compartment of the MZ-711.
5. Position the data recorder in the recorder compartment and fasten it in place with the two screws. When doing this, be careful to avoid catching the connector cable between the data recorder and the computer, (otherwise, the screws cannot be tightened).

■ **Ordinary cassette tape recorder**



Using commercially available audio cables with 3.5 mm mini-plugs, connect the WRITE jack of the computer to the MIC jack of the cassette tape recorder and connect the computer's READ jack to the EXT SP or EAR jack of the cassette tape recorder.

Take note of the following when using an **ordinary cassette tape recorder.**

(1) The message "⊥ RECORD. PLAY" does not appear when a SAVE command is entered. Be sure to press the RECORD key on the recorder before entering this command. Press the STOP key to stop the recorder after the message "READY" is displayed. Without depressing the STOP key, the recorder is not stopped.

(2) The message "⊥ PLAY" does not appear when a LOAD command is entered. Be sure to start playing the tape after entering the command. The message "READY" is displayed when loading is completed.

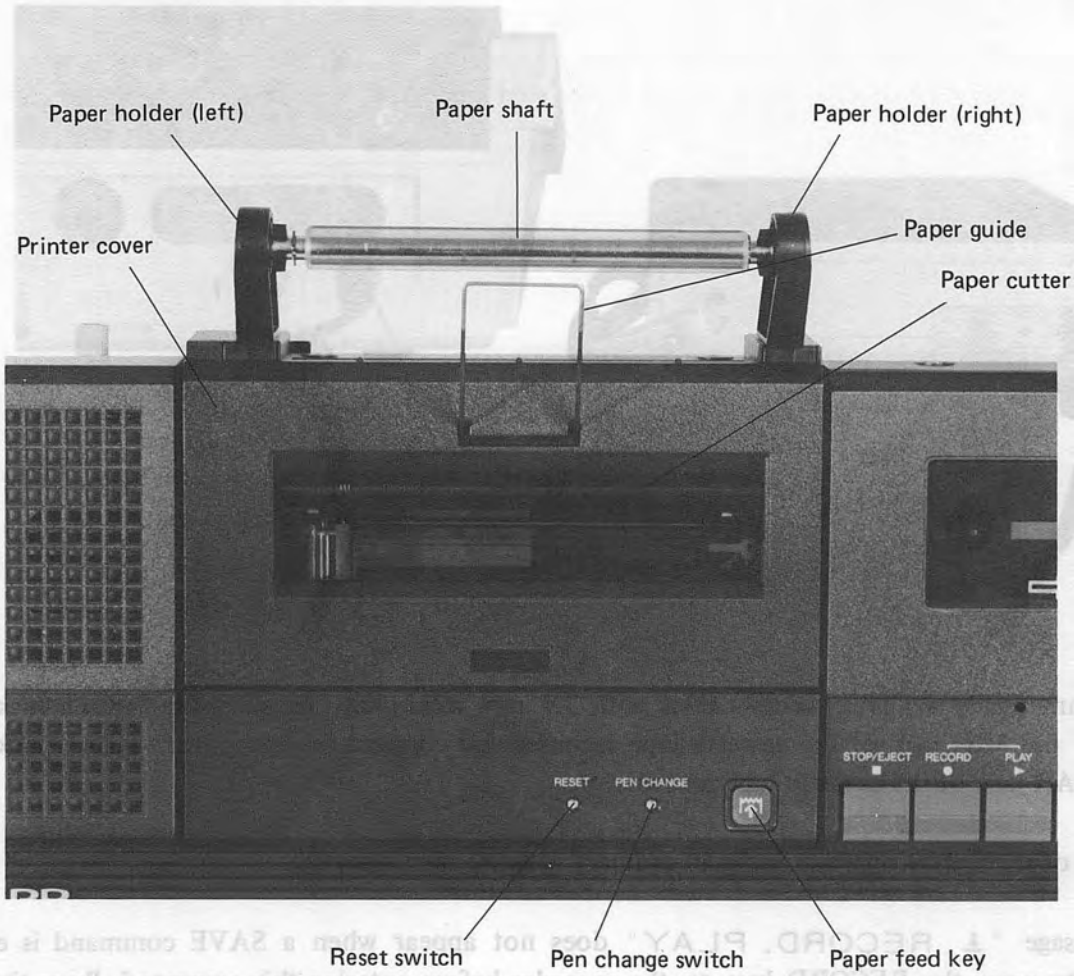
(3) The level and tone controls of the cassette tape reocrder must be adjusted to appropriate levels. Some cassette recorders (e.g. those with the automatic level control) may not be usable. In such cases, please purchase the MZ-1T01.

(4) The polarity of the head can make it impossible to load programs provided with the computer. Try switching the head polarity if programs cannot be loaded.

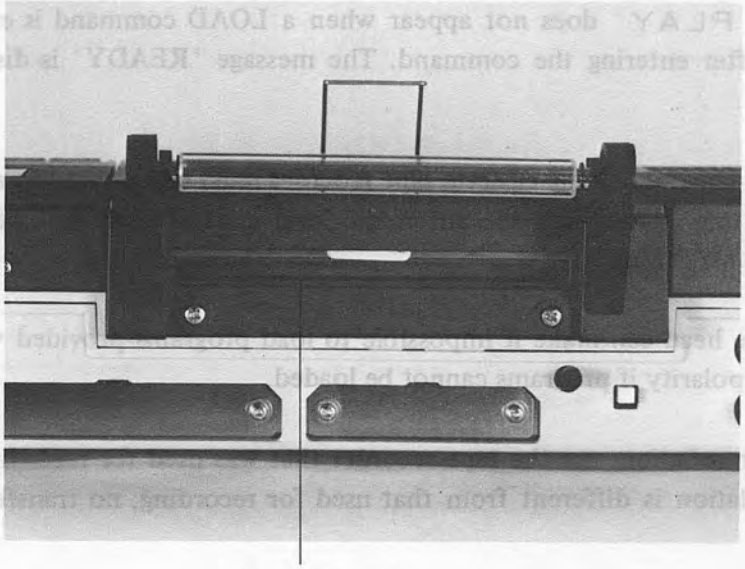
(5) For any transfer or collation, use the tape recorder that was used for recording. If the tape recorder for transfer or collation is different from that used for recording, no transfer nor collation may be possible.

(6) Data written using an ordinary cassette recorder may not be readable with the data recorder. Therefore, use of the **MZ-1T01** is recommended.

3. 4 Color Plotter-Printer



Plotter-printer (viewed from the top)



Plotter-printer (viewed from the rear side)

■ **Loading roll paper**

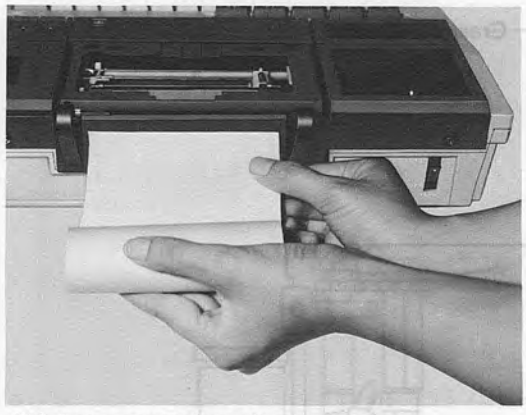
1. Remove the printer cover.
2. Cut the end of roll paper straight across and insert the end into the paper inlet. (Be careful to avoid folding or wrinkling the end of the paper when doing this.)
3. Turn on MZ-731's power switch and press the ⊡ (paper feed) key to feed paper until the top of paper is 3 to 5 cm above the outlet.
4. Insert the paper shaft into the roll and mount it to the paper holders.
5. Set the printer cover so that the end of paper comes out through the paper cutter.

- To remove the roll from the printer for replacement, cut straight across the paper at the paper inlet and press the paper feed key.

■ Roll paper for the MZ-700 series computers is available at any Sharp dealer. Do not use paper other than that specified.

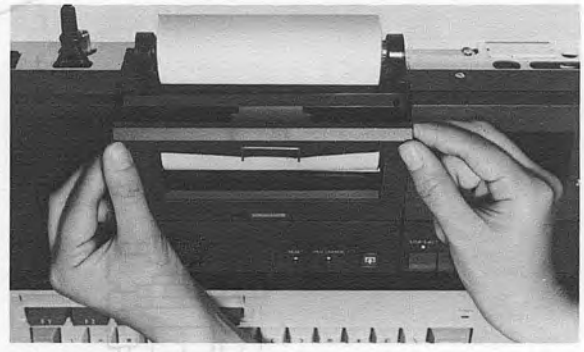
The length of the paper is 23 to 25 meters, and the maximum roll diameter which can be loaded is 50 mm. Paper will not feed properly if a roll with a greater diameter is used, resulting in poor print quality.

Procedures for loading roll paper



(A) Insert paper into the paper inlet.

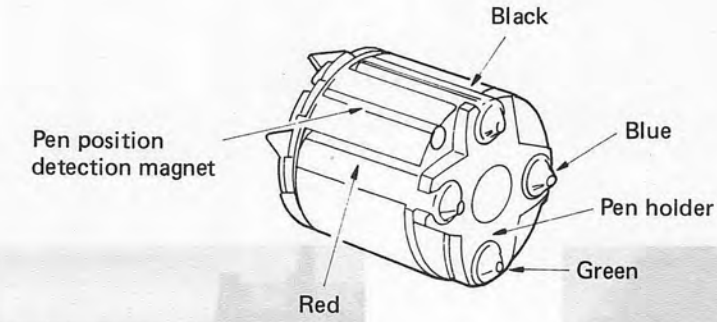
(B) Press the paper feed key to feed paper.

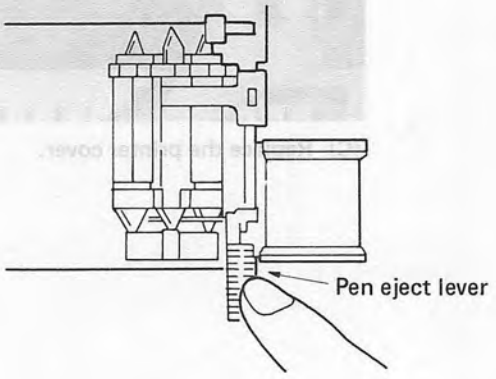


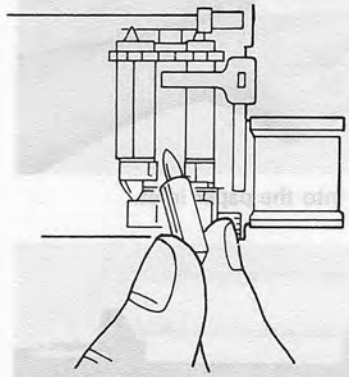
(C) Replace the printer cover.

■ **Installing/replacing pens**

1. Remove the printer cover and press the PEN CHANGE switch with a ball pen or the like; this causes the pen holder to move to the right side of the printer for pen replacement.
2. Depress the pen eject lever to eject the pen which is at the top of the holder. When doing this, rest your finger lightly on top of the pen while pushing the eject lever to prevent it from falling inside the printer.
3. Insert a new pen.
4. Press the PEN CHANGE switch again to bring another pen to the top of the holder.
5. Replace all four pens (black, blue, green and red) in the same manner. When finished, press the RESET switch to ready the printer for printing with the black pen.
   Execute the BASIC TEST command to confirm that all colors are printed correctly.







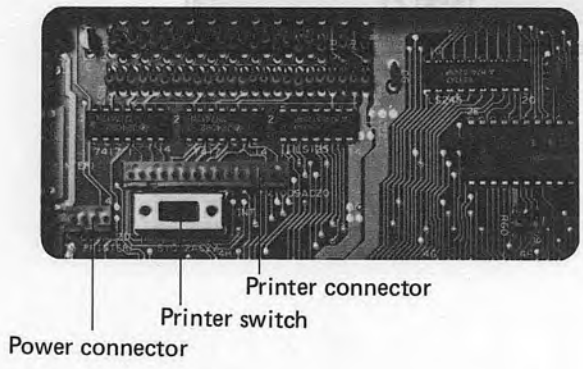
■ Replacements for the printer pens (ballpoint pens) can be purchased at the dealer where the printer was purchased.

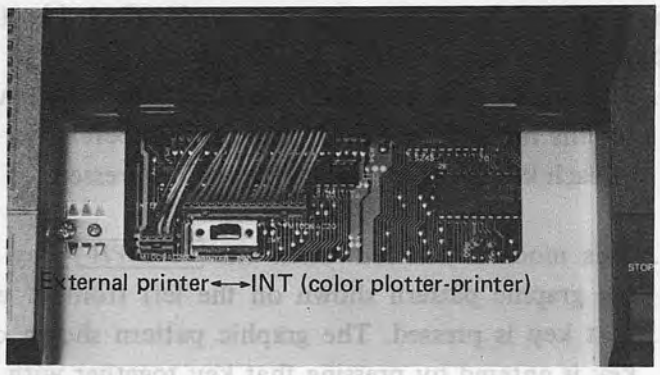
- EA-850B (black; 4 pens)
- EA-850C (black, blue, green, red; 4 pens, 1 of each color)

■ **MZ-1P01**

Installation of the MZ-1P01 color plotter printer (for models other than the MZ-731)

1. Turn off the computer's power switch and unplug the power cable.
2. Remove the two screws located at the center of the rear panel to remove the printer compartment cover.
3. Confirm that the printer switch on the printed circuit board is set to the INT position.
4. Plug the printer connector into the matching connector on the printed circuit board, then position the printer in the printer compartment and fasten it in place with the two screws. When doing this, be careful to avoid catching the connector cable between the data recorder and the computer (otherwise, the screws cannot be tightened).





Connection of color plotter-printer to the MZ-700

■ **Connecting an external printer (MZ-80P5(K))**

The MZ-80P5(K) printer for the MZ-80K series computers can be connected to the MZ-700's external printer connector (see page 104) without any special interface card. Use an optional connection cable for making the connection.

When using an external printer, the printer switch on the printed circuit board must be set to the external printer position. Therefore, the color plotter-printer and the external printer cannot be used simultaneously.

Note that if a program including color plotter-printer control statements is run with an external printer, meaningless characters (control codes for the plotter-printer) will be printed.

3.5 Key Operation

3.5.1 Typewriter keyboard

Except for the special control keys, several characters are assigned to each key on the keyboard. The character entered when a key is pressed depends on the input mode selected by the special keys.

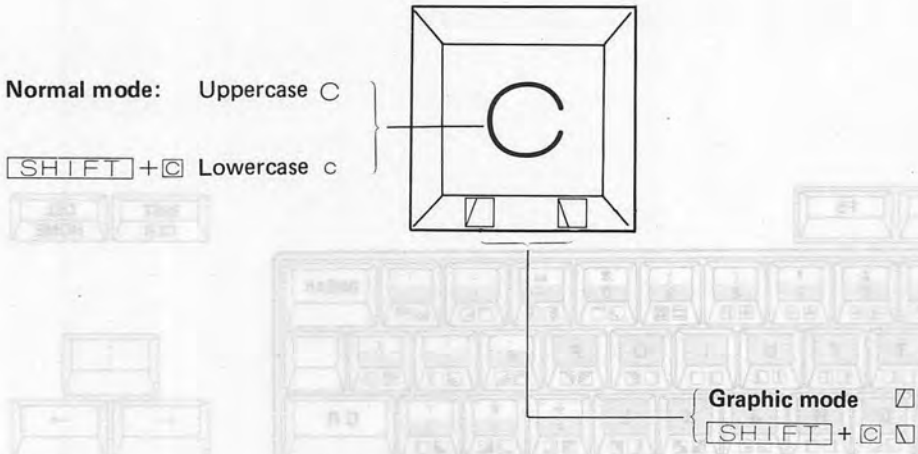
The input modes are as follows.

(1) Normal mode . . . . . This mode is automatically entered when the BASIC interpreter is loaded. In this mode, the ASCII character (uppercase or lowercase) shown on top of each key is entered when that key is pressed.

(2) Graphic mode . . . . . This mode is entered when the GRAPH key is pressed. In this mode, the graphic pattern shown on the left front of each key is entered when that key is pressed. The graphic pattern shown on the right front of each key is entered by pressing that key together with the shift key. Pressing the ALPHA key returns input to the normal mode.

Pressing the space bar enters a space regardless of the input mode.

For example characters entered by the C key in different input modes are as follows.



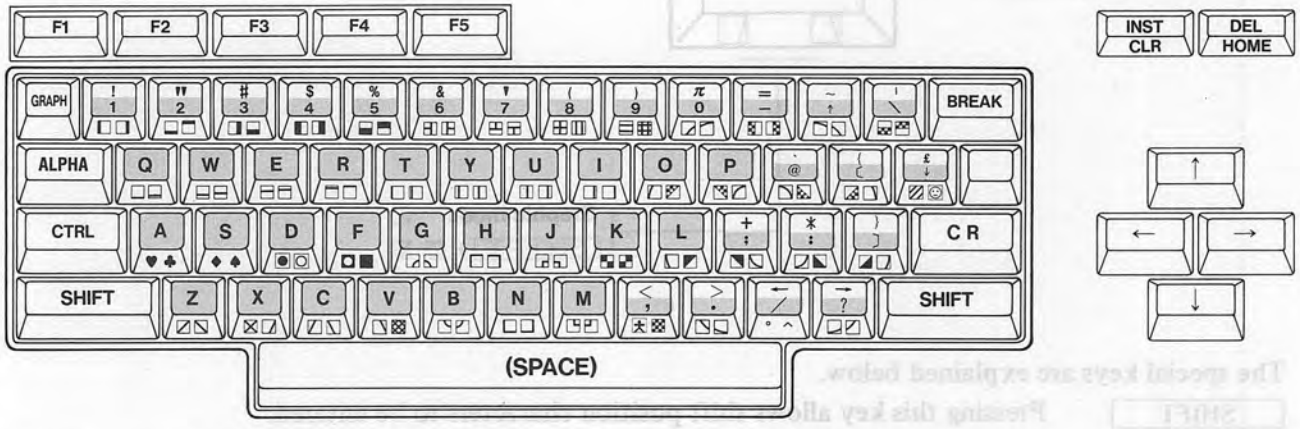
The special keys are explained below.

SHIFT	Pressing this key allows shift position characters to be entered. For alphabetic keys, the shift position characters are lowercase letters; for keys other than alphabetic keys, the shift position characters are those shown on the upper side of the key tops. In the GRAPH mode, the graphic pattern shown on the right front of each key is entered.
C R	Pressing this key enters a CR (carriage return) code, terminating the line and moving the cursor to the beginning of the next line.
BREAK	Pressing this key enters a BREAK code. Pressing it together with the SHIFT key stops execution of a program or operation of the data recorder.
GRAPH	Pressing this key changes the input mode from normal to graphic for input of the graphic patterns shown on the left front of keys.
ALPHA	**Pressing this key changes the input mode from graphic to normal.**

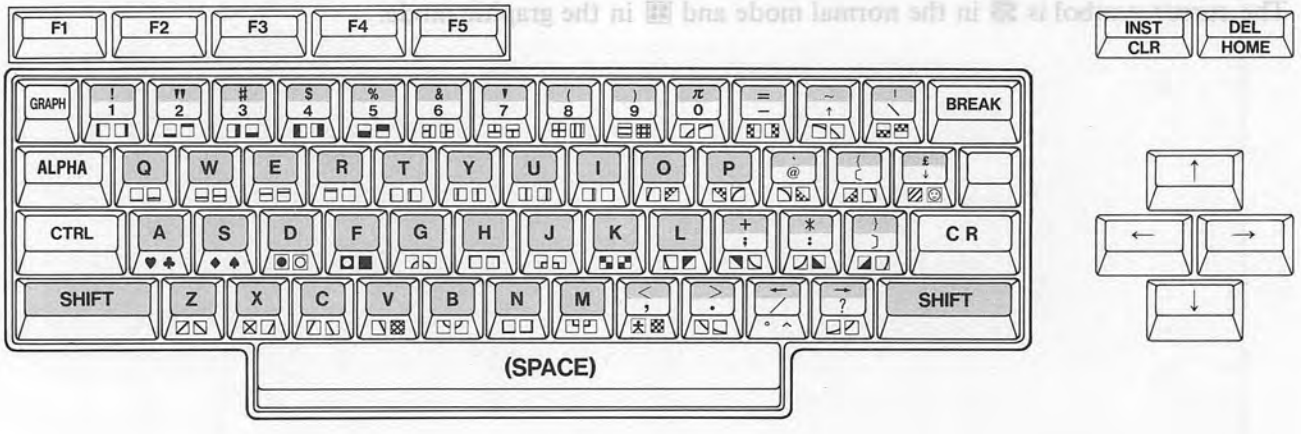
The cursor symbol is ▩ in the normal mode and ▦ in the graphic mode.

(1) Normal mode (alphanumeric mode)

Character entered by each key in the normal mode are as indicated by the screened areas in the figure below.



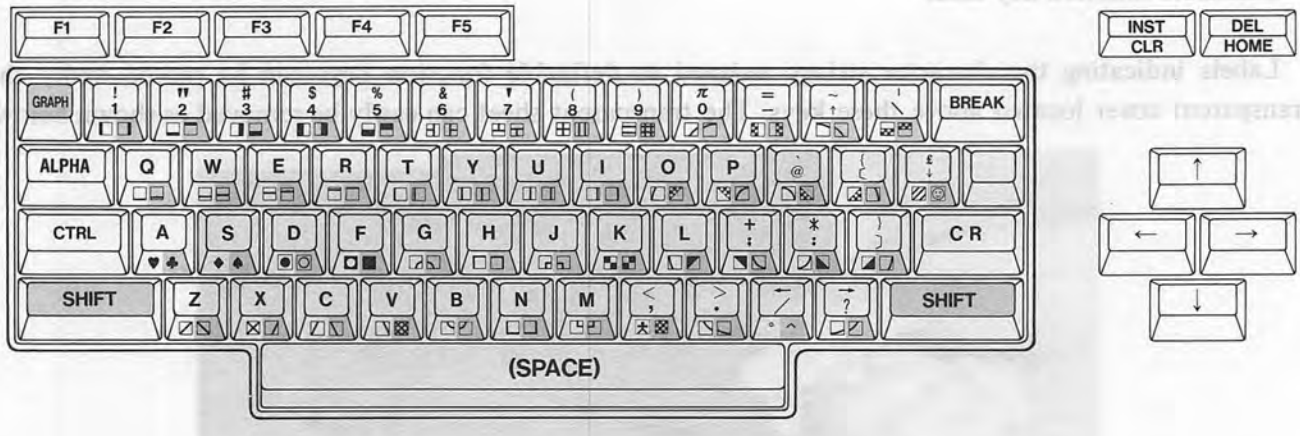
When with the [SHIFT] key is pressed together with other keys, lowercase letters (or other symbols indicated by the screen areas in the figure below) are entered.



(2) Graphic mode

Pressing the GRAPH key places the computer in the graphic input mode. Characters entered by each key in the graphic mode are as indicated by the screened areas in the figure below. In this mode, pressing any of the cursor control keys, the INST/CLR key or the DEL/HOME key enters the symbols ■, ■, ■, ■, ■, or ■, respectively.

When with the SHIFT key is pressed together with other keys, symbols indicated by the screen areas in the figure below are entered.



The cursor symbol is ■ in the graphic mode. To return the mode to normal, press the ALPHA key.

3.5.2 Definable function keys

Definable function keys

The five blue keys marked F1 to F5 above the typewriter keyboard are referred to as definable function keys.

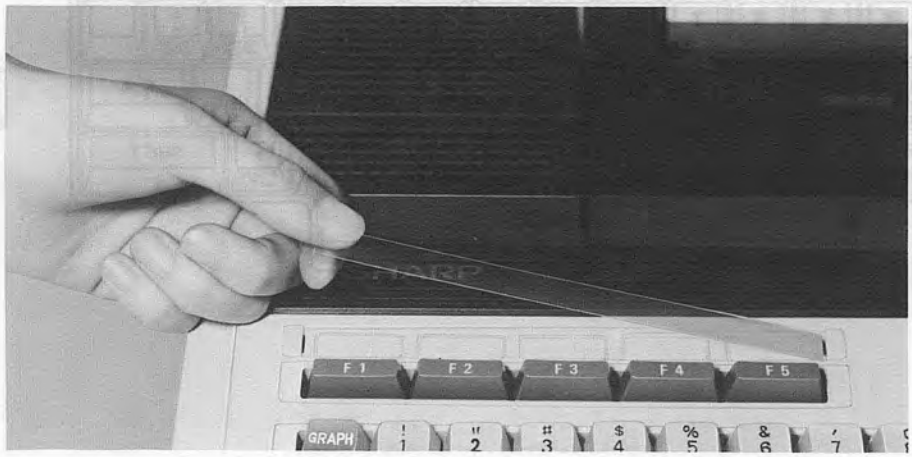
Certain character strings are automatically assigned to these keys as follows when the BASIC interpreter is activated.

F1: "RUN" + CHR$ (13)
F2: "LIST"
F3: "AUTO"
F4: "RENUM"
F5: "COLOR"
SHIFT + F1: "CHR$ ("
SHIFT + F2: "DEF KEY ("
SHIFT + F3: "CONT"
SHIFT + F4: "SAVE"
SHIFT + F5: "LOAD"

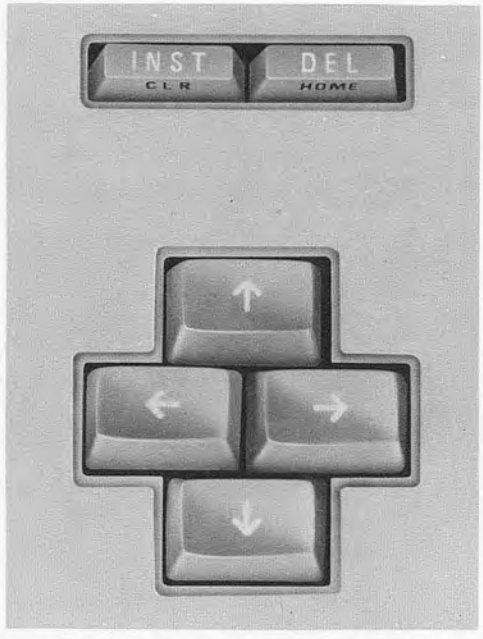
When one of these keys is pressed, the character string assigned to that key is entered; thus, statements which are frequently used can be entered just by pressing one key. The character string assigned to any of the definable function keys can be changed by the DEF KEY statement. (See page 57, DEF KEY statement.)

■ **Definable function key label**

Labels indicating the character strings assigned to definable function keys can be placed under the transparent cover located above these keys. The transparent sheet can easily be removed as shown below.



3.5.3 Cursor control keys and insert and delete keys



Cursor control keys and insert and delete keys

The cursor control keys are the four yellow keys at the right of the keyboard which are marked with arrows.

Pressing these keys moves the cursor one position in the direction indicated by the arrow. These keys are used when editing programs.

The [INST CLR] and [DEL HOME] key have the following functions.

[INST CLR]
Inserts a space at the position of the cursor and shifts all following characters one position to the right. INST: insert.

[DEL HOME]
Erases the character to the left of the cursor and shifts all following characters one position to the left. DEL: delete.

[SHIFT] + [INST CLR]
Clears the entire screen and returns the cursor to the screen's upper left corner. Pressing this key does not affect the program in memory. CLR: clear.

[SHIFT] + [DEL HOME]
Returns the cursor to the upper left corner of the screen (does not affect any characters displayed).

See pages 18 and 19.

3.5.3 Cursor control keys and insert and delete keys

Cursor control keys and insert and delete keys

The cursor control keys are the four yellow keys at the right of the keyboard which are marked with arrows.

Pressing these keys moves the cursor one position in the direction indicated by the arrow. These keys are used when editing programs.

The INST CLR and DEL HOME key have the following functions.

INST
CLR

Inserts a space at the position of the cursor and shifts all following characters one position to the right. INST: insert.

DEL
HOME

Erases the character to the left of the cursor and shifts all following characters one position to the left. DEL: delete.

SHIFT + INST CLR

Clears the entire screen and returns the cursor to the screen's upper left corner. Pressing this key does not affect the program in memory. CLR: clear.

SHIFT + DEL HOME

Returns the cursor to the upper left corner of the screen (does not affect any characters displayed).

See pages 18 and 19.

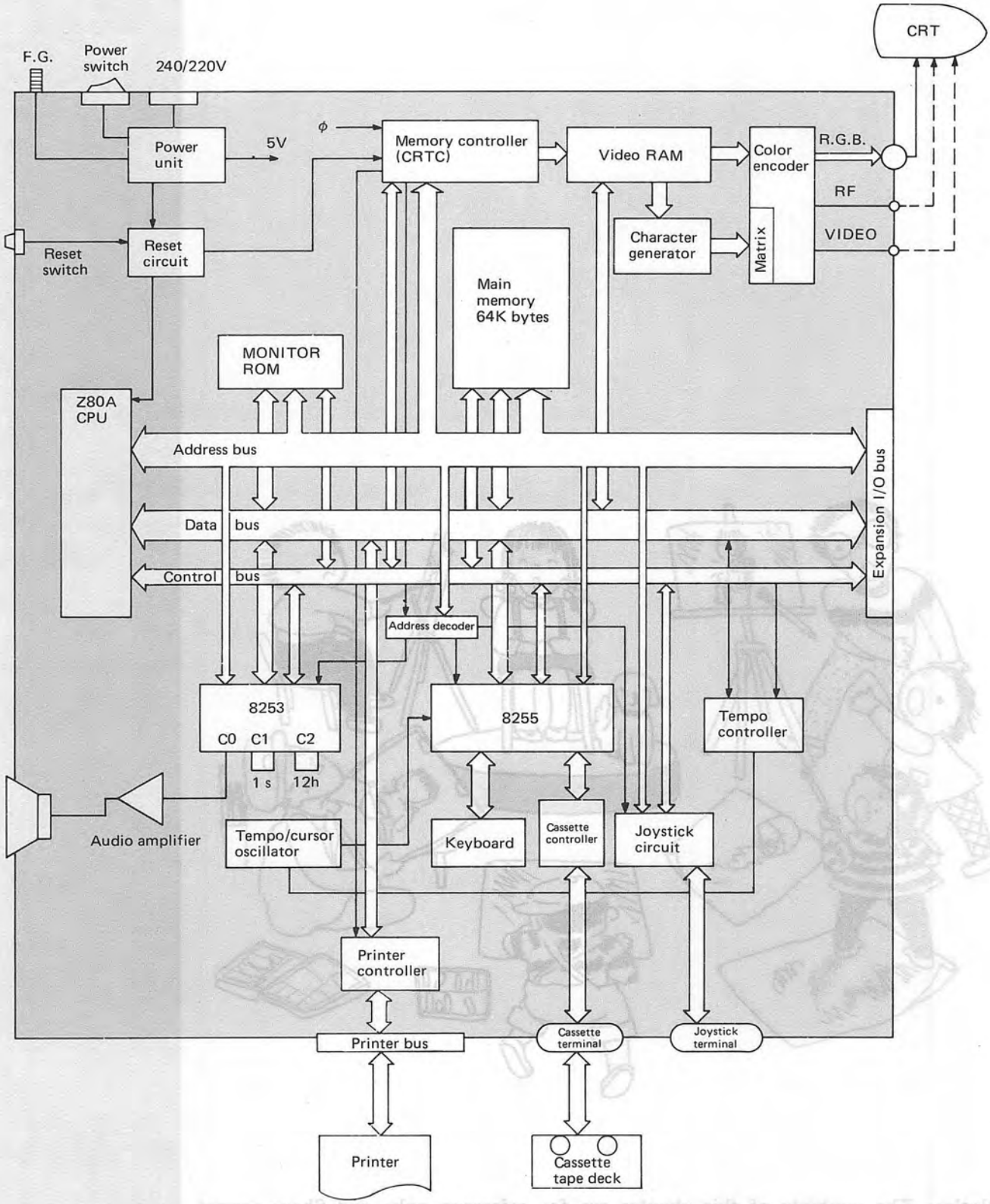
Chapter 4

Hardware

Notice: The contents of this chapter are for reference only, and Sharp cannot assume responsibility for answering any questions about its contents.

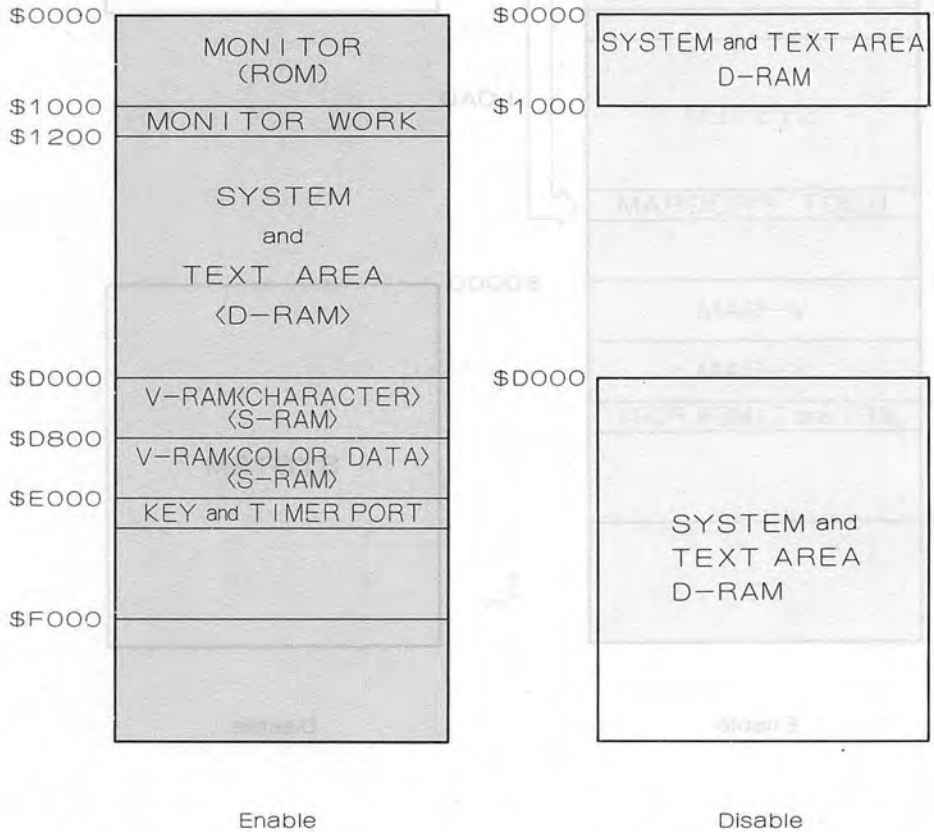
4. 1 MZ-700 System Diagram

The figure below shows the system configuration of the MZ-700 series computers.



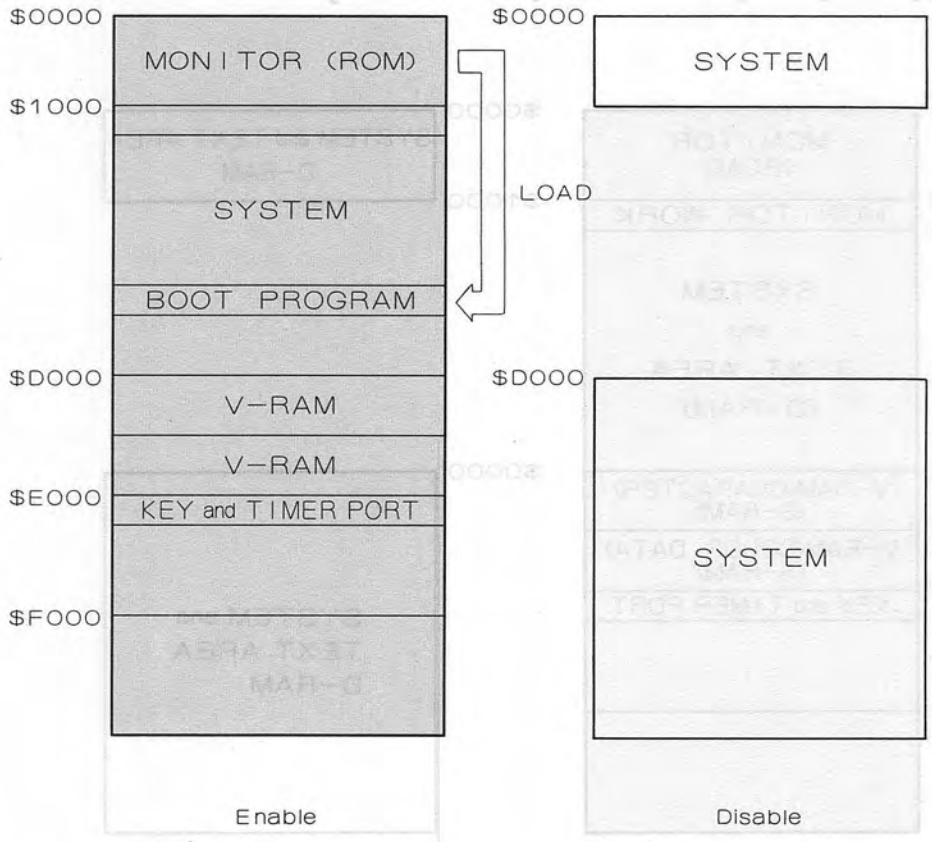
4. 2 Memory configuration

4.2.1 Memory map at power-on (80k mode)



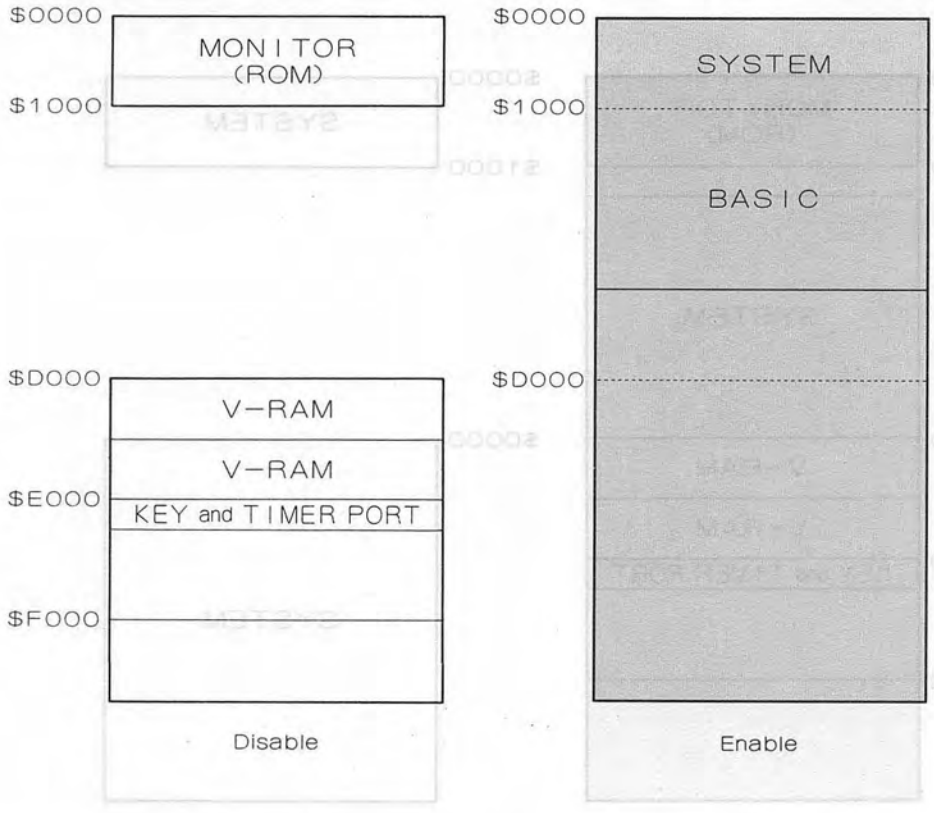
- The memory map is as shown above immediately after the power has been turned on. (The contents of the V-RAM area from $D000 to $DFFF are not the same as those of MZ-80K.)
- The entry point of the monitor ROM is the same as that of the MZ-80K.

4.2.2 Memory map while loading system program (BASIC)



- When the monitor LOAD command is entered, the bootstrap loader is loaded into the system RAM area from ROM and control is transferred to that program.
- BOOT COMMAND : L

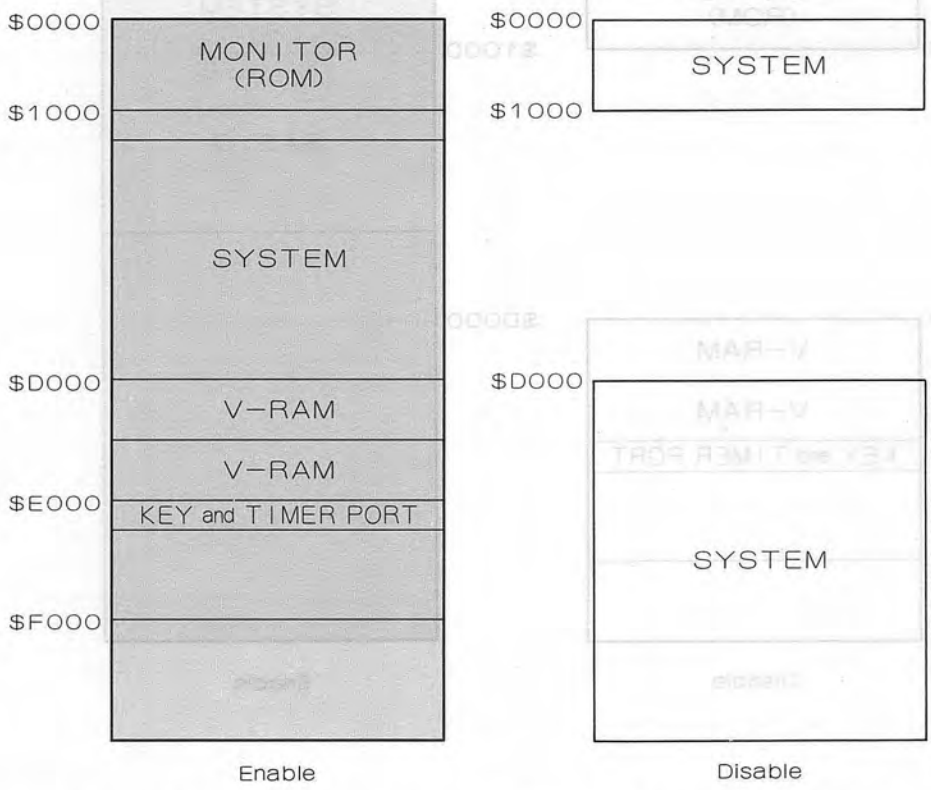
4.2.3 Memory map after the BASIC interpreter has been loaded (MZ-700 mode)



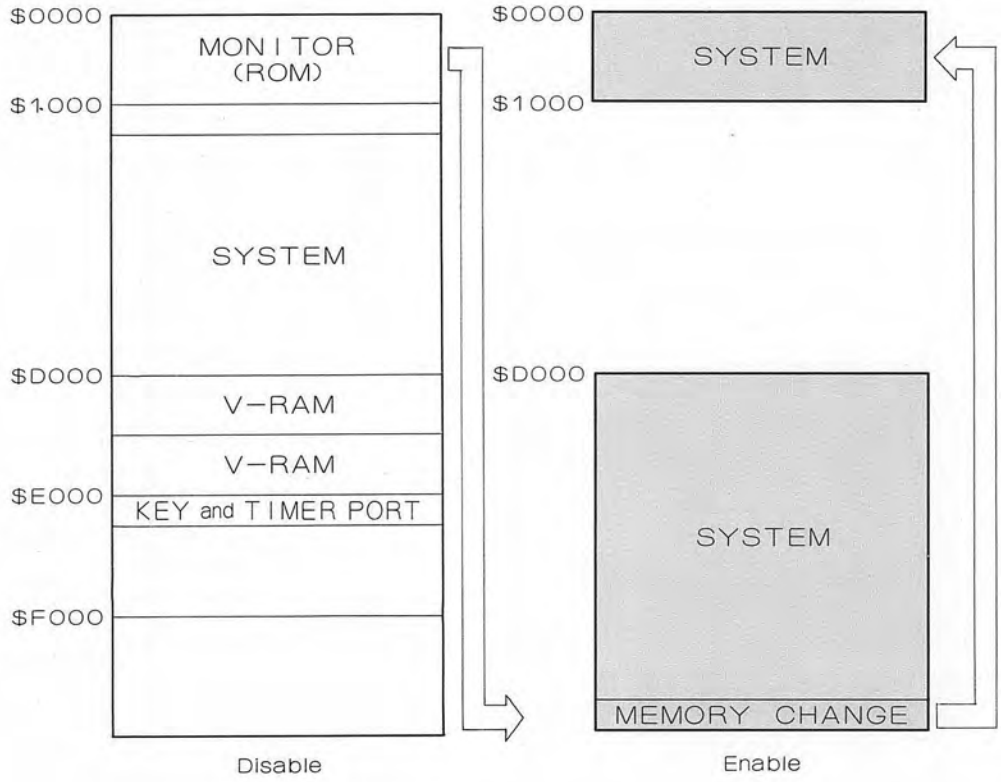
- The memory map is as shown above after the BASIC interpreter has been loaded.
- Bank switching is performed to access V-RAM or the KEY and TIMER PORT area.

4.2.4 Memory map after manual reset

The memory map is as shown below after the reset switch on the rear panel has been pressed.



After pressing the reset switch together with the CTRL key, the memory map is as shown below.



- When the reset switch is pressed together with the CTRL key, addresses $0000 to $0FFF and from $D000 to $FFFF are assigned to RAM.
- When the # command is entered after the reset switch has been pressed, the computer operates in the same manner as after the reset switch has been pressed together with the CTRL key.

4.2.5 Bank switching

a) Memory blocks can be selected by outputting data to I/O ports as shown below.

SWITCHING

I/O PORT	$0000~$0FFF	$D000~$FFFF
$ E0	SYSTEM AREA (D-RAM)	
$ E1		SYSTEM AREA (D-RAM)
$ E2	MONITOR (ROM)	
$ E3		V-RAM, KEY, TIMER
$ E4	MONITOR (ROM)	V-RAM, KEY, TIMER
$ E5		Inhibit
$ E6		Return to the front of condition, where being inhibitted by $ E5.

Note: Outputting data to I/O port $E4 performs the same function as pressing the reset switch.

b) Examples:

OUT ($E0), A

Assigns addresses $0000 to $0FFF to RAM, but does not change execution address. The contents of variable A do not affect the result.

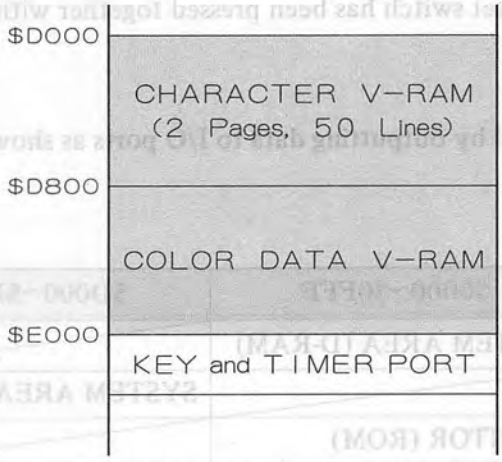
OUT ($E4), A

Initializes memory to the state immediately after the power has been turned on.

Note: Since the program counter is not moved by the OUT statement, care must be taken when switching memory blocks if the program counter is located in the area from $0000 to $0FFF or from $D000 to$FFFF.

4.2.6 Memory map when V-RAM is accessed

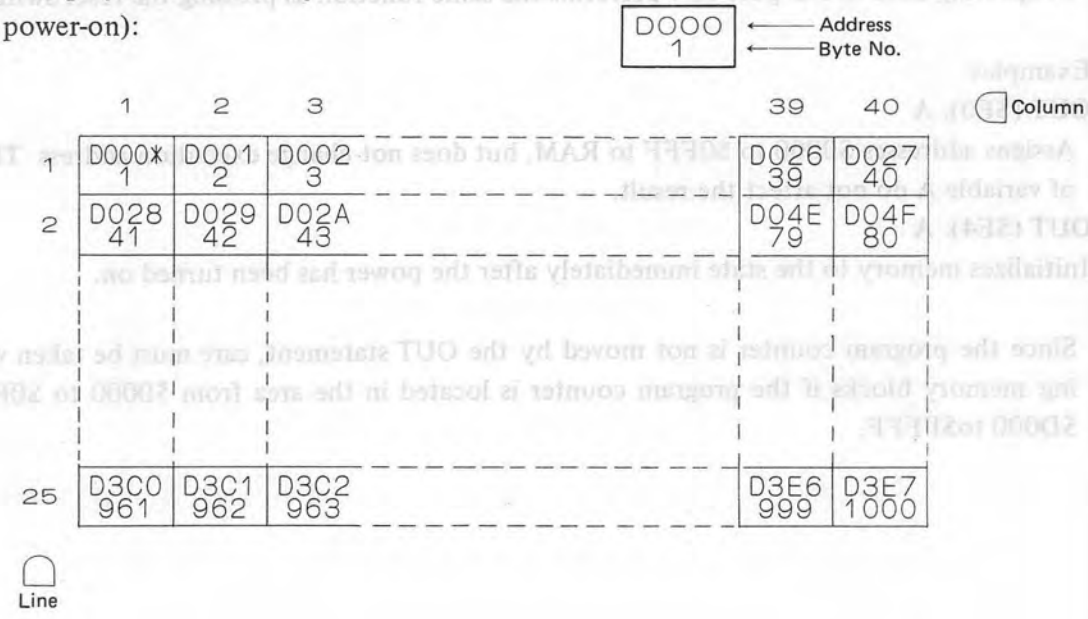
i) V-RAM (Video RAM) memory map



ii) Correspondence between V-RAM address and location on the screen.

The MZ-700 has a 2K byte V-RAM area, but only 1K byte of that area can be displayed on the screen at one time. The area displayed can be changed by scrolling the screen.

a) Area displayed immediately after reset (or power-on):



b) Area displayed after the screen has been scrolled up one line from the end of V-RAM:

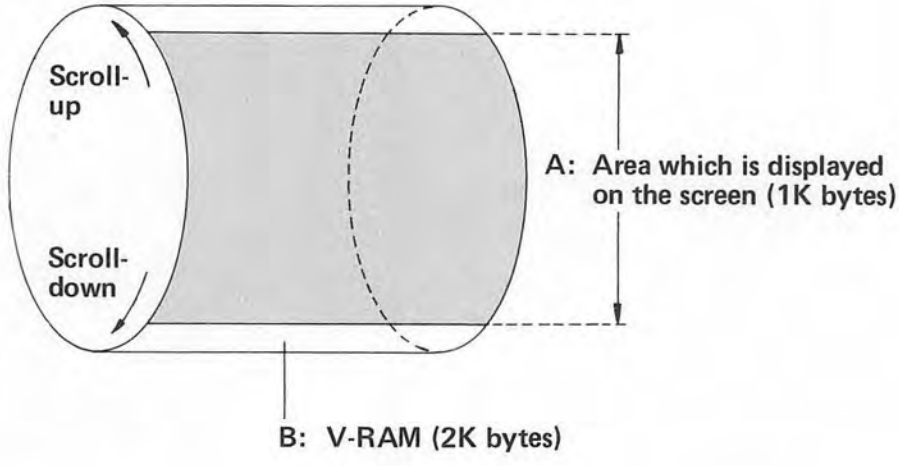
	1	2	3		39	40
1	D000 1041	D001 1042	D002 1043		D026 1079	D027 1080
2	D028 1081	D029 1082	D02A 1083		D04E 1119	D04F 1120
24	D398 1961	D399 1962	D39A 1963		D3BE 1999	D3BF 2000
25	D3C0 1	D3C1 2	D3C2 3		D3E6 39	D3E7 40

Note: The line consisting of bytes 1 to 40 is wrapped around to that consisting of bytes 1961 to 2000 as shown above.

iii) Scroll-up and scroll-down

a) The screen is scrolled up by pressing the SHIFT and ↑ keys together, and is scrolled down by pressing the SHIFT and ↓ keys together.

b) Scroll-up and scroll-down



- During scrolling, the area which is displayed on the screen moves through the 2K byte V-RAM area as shown above.
- The end of the V-RAM area is warpped around to the beginning of V-RAM as shown above.
- The cursor does not move on the screen during scrolling.

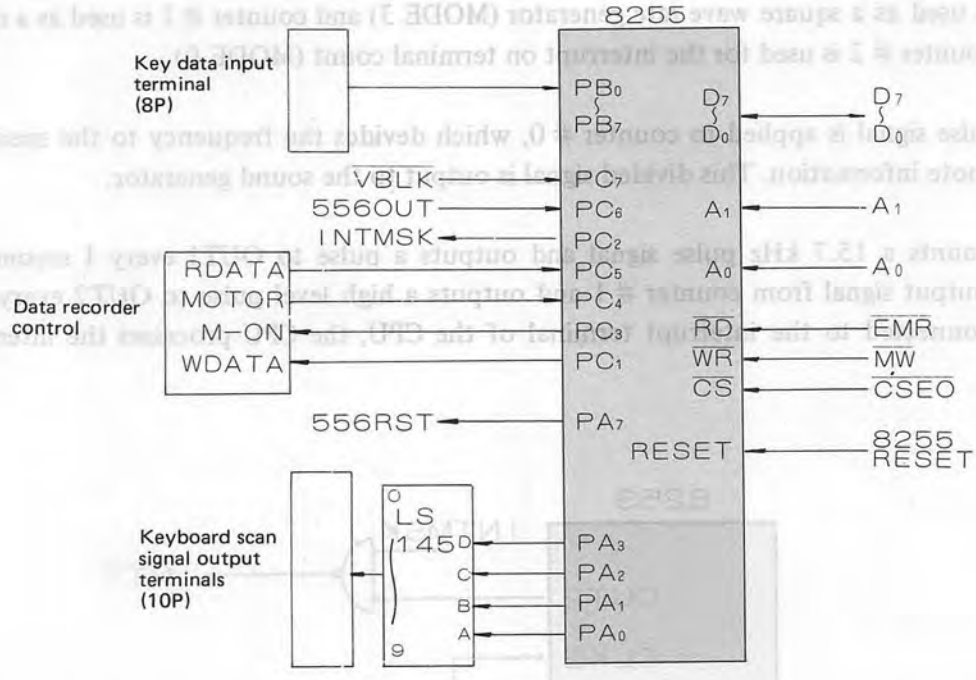
4. 3 Memory Mapped I/O ($E000-$E008)

Addresses $E000 to $E008 are assigned to the 8255 programmable peripheral interface, 8253 programmable interval timer and other I/O control ICs so that various I/O devices (including music functions using counter #0 of the 8253) can be accessed in the same manner as memory. The memory mapped I/O chart is shown below.

CPU memory address	Controller	Operation
$E000 $E001 $E002 $E003	8255	P_A: Output P_B: Input P_C: Input and output control by bit setting Mode control
$E004 $E005 $E006 $E007	8253	C_0: Mode 3 (square wave rate generator) C_1: Mode 2 (rate generator) C_2: Mode 0 (terminal counter) Mode control
$E008	LS367, etc.	Tempo, joystick and HBLNK input

4.3.1 Signal system of the 8255

The 8255 outputs keyboard scan signals, input key data, and controls the cassette tape deck and cursor blink timing.



Port	Terminal	I/O	Active state	Description of control	Name of signal
PA ($E000)	PA_0	OUT	H	Keyboard scan signals	
	PA_1		H		
	PA_2		H		
	PA_3		H		
	PA_7		L	Resets the cursor blink timer.	556 RST
PB ($E001)	PB_0	IN	L	Key scanning data input signals	
	PB_1		L		
	PB_2		L		
	PB_3		L		
	PB_4		L		
	PB_5		L		
	PB_6		L		
	PB_7		L		
PC* ($E002)	PC_1	OUT	–	Cassette tape write data	WDATA
	PC_2	OUT	L	Inhibits clock interrupts.	INTMSK
	PC_3	OUT	⎍	Motor drive signal	M–ON
	PC_4	IN	H	Indicates that the motor is on.	MOTOR
	PC_5	IN	–	Cassette tape read data	RDATA
	PC_6	IN	–	Cursor blink timer input signal	556 OUT
	PC_7	IN	–	Vertical blanking signal	$\overline{\text{VBLK}}$

* Each output data bit can be independently set or reset.

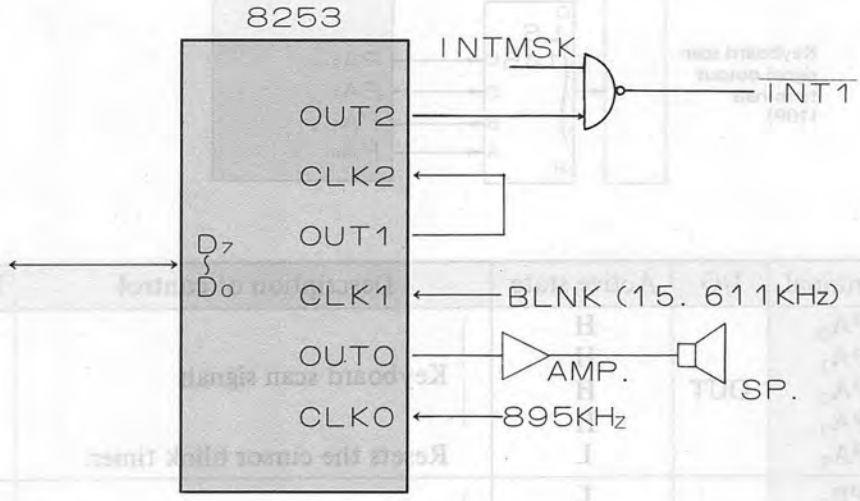
4.3.2 Signal system of the 8253

The 8253 includes three counters # 0, # 1 and # 2. Counter # 0 is used for sound generation, and counter # 1 and # 2 are used for the built-in clock.

Counter # 0 is used as a square wave rate generator (MODE 3) and counter # 1 is used as a rate generator (MODE 2). Counter # 2 is used for the interrupt on terminal count (MODE 0).

A 895 kHz pulse signal is applied to counter # 0, which devides the frequency to the specified value according to the note information. This divided signal is output to the sound generator.

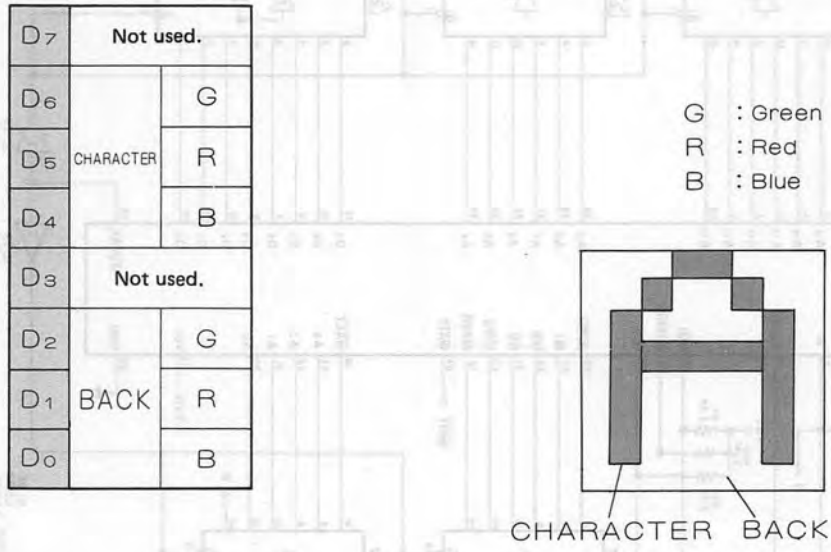
Counter # 1 counts a 15.7 kHz pulse signal and outputs a pulse to OUT1 every 1 second. Counter # 2 counts the output signal from counter # 1 and outputs a high level pulse to OUT2 every 12 hours. Since OUT2 is connected to the interrupt terminal of the CPU, the CPU processes the interrupt every 12 hours.



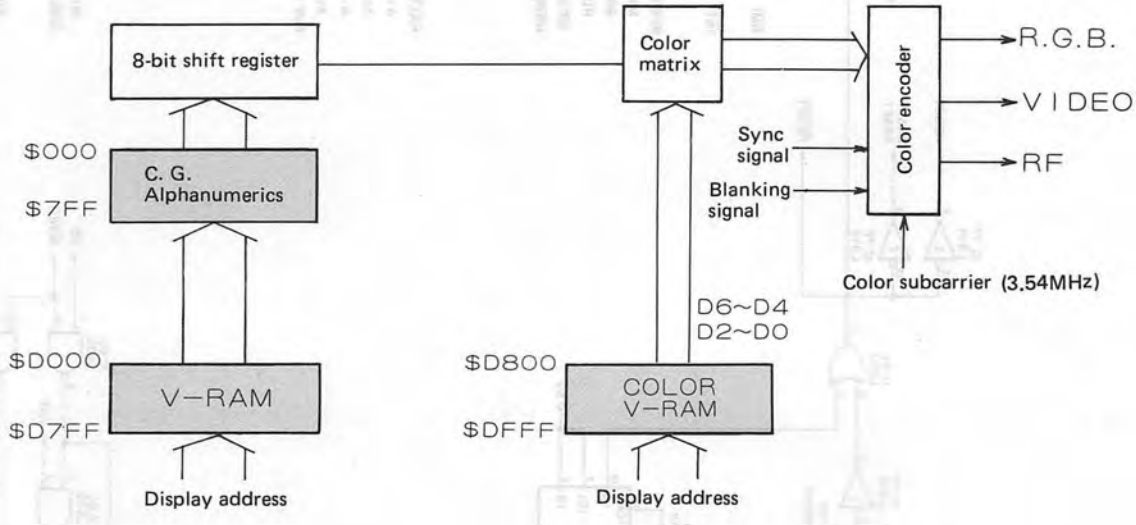
4. 4 Signal System of Color V-RAM

Color information of the MZ-700 is controlled in character units; that is, a 1-byte color information table is assigned to each character displayed on the screen.

A color information table is shown in the figure below.



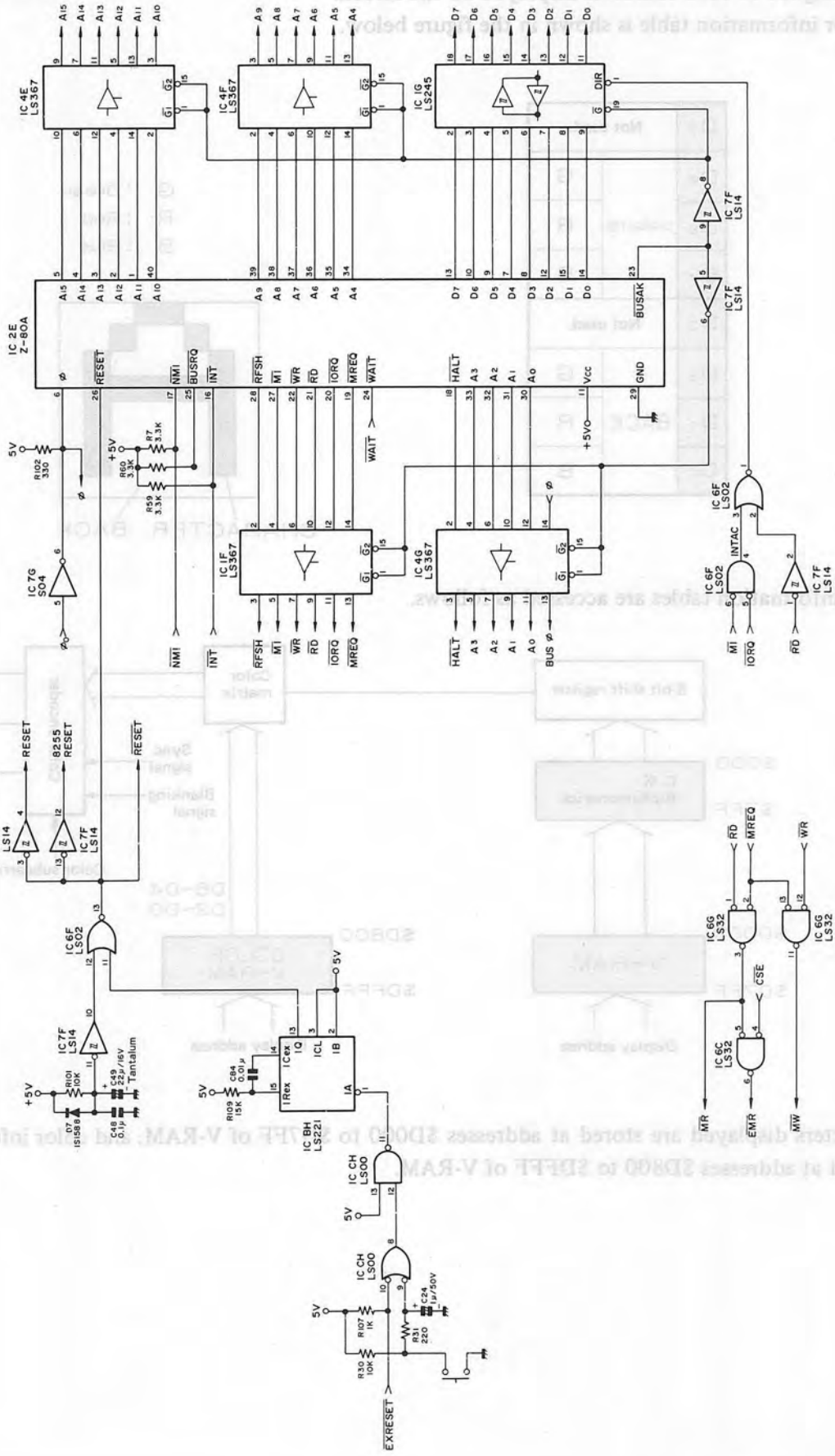
Color information tables are accessed as follows.

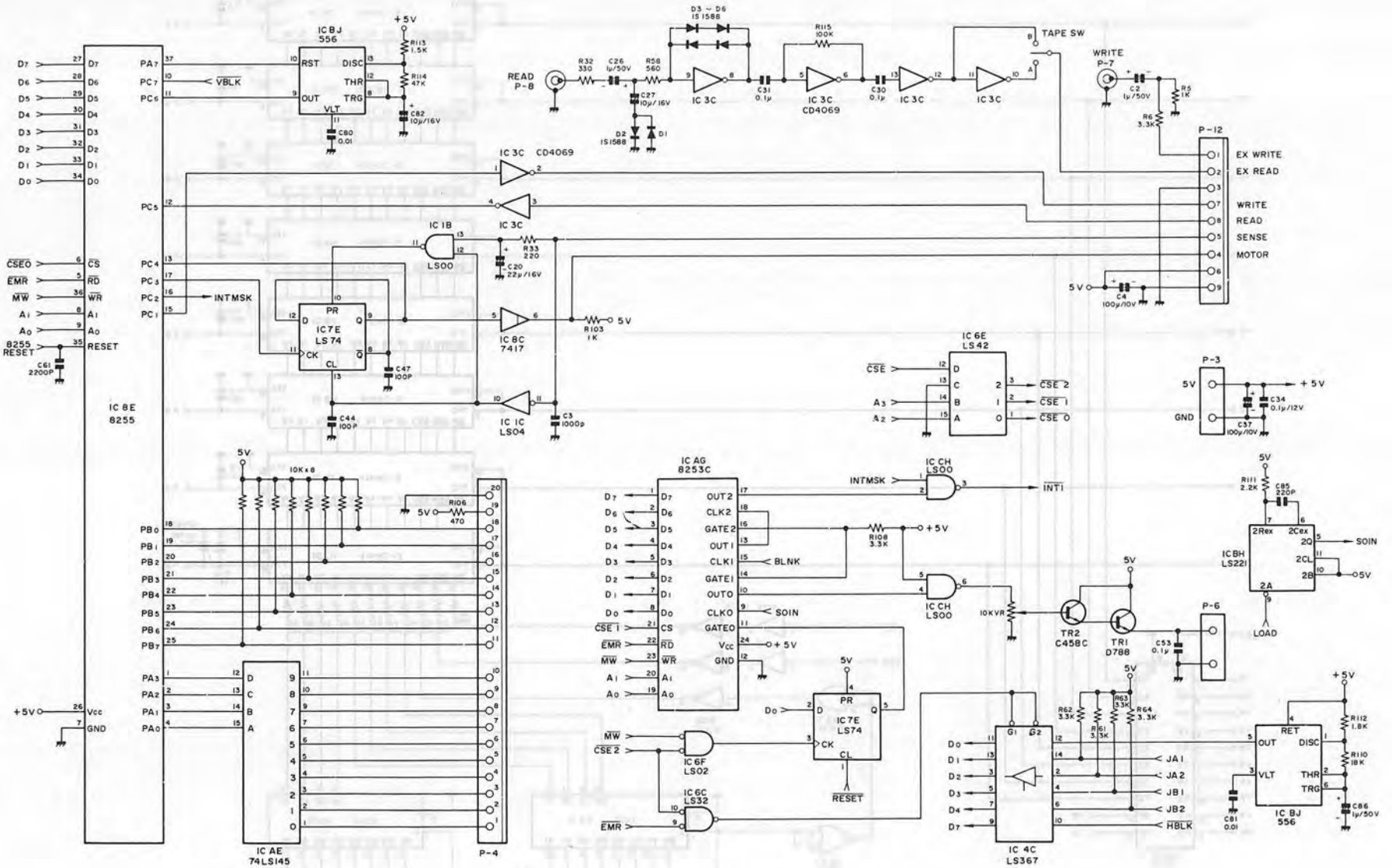


Characters displayed are stored at addresses $D000 to $D7FF of V-RAM, and color information tables are stored at addresses $D800 to $DFFF of V-RAM.

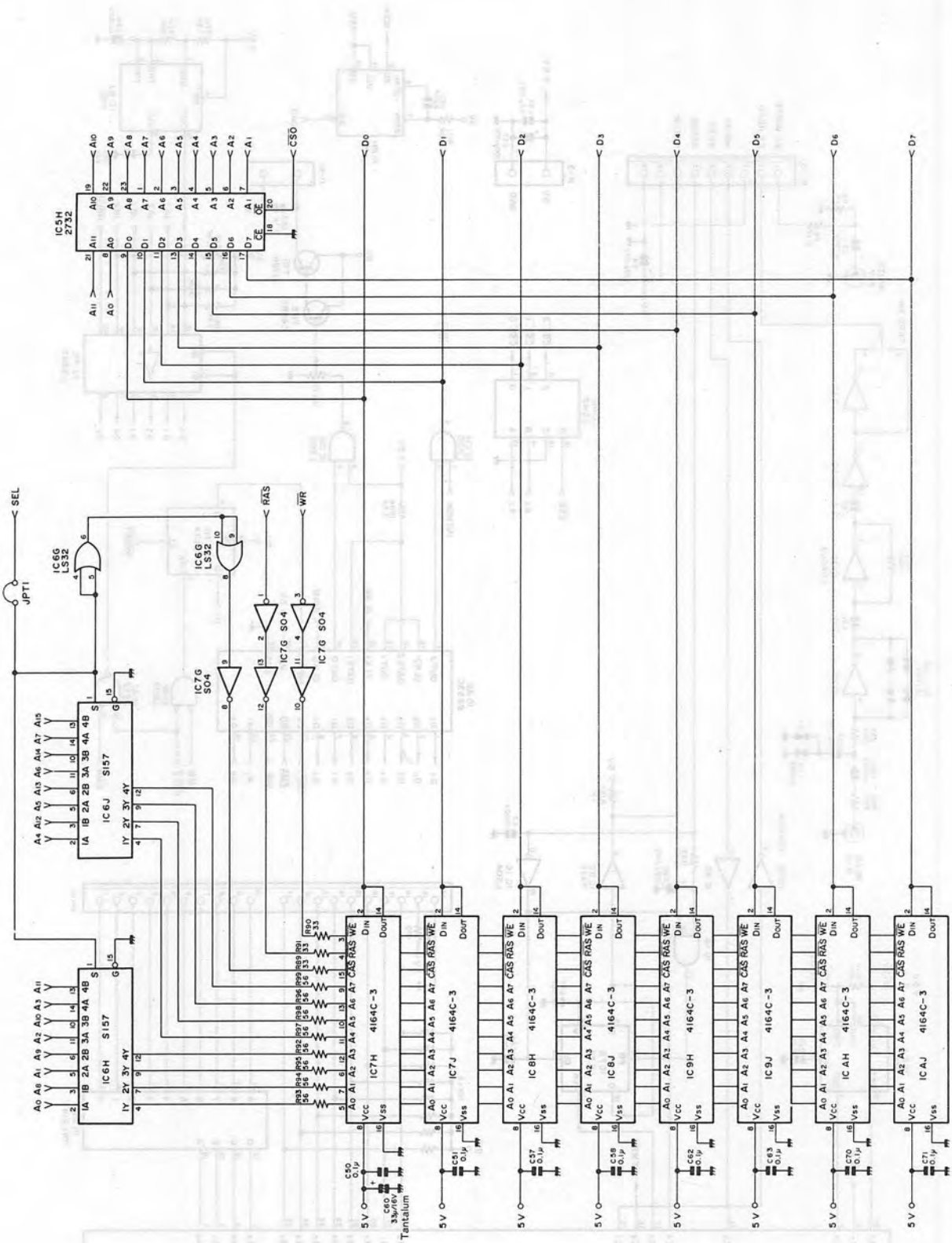
4. 5 MZ-700 Circuit Diagrams

[CPU board circuit (1)]

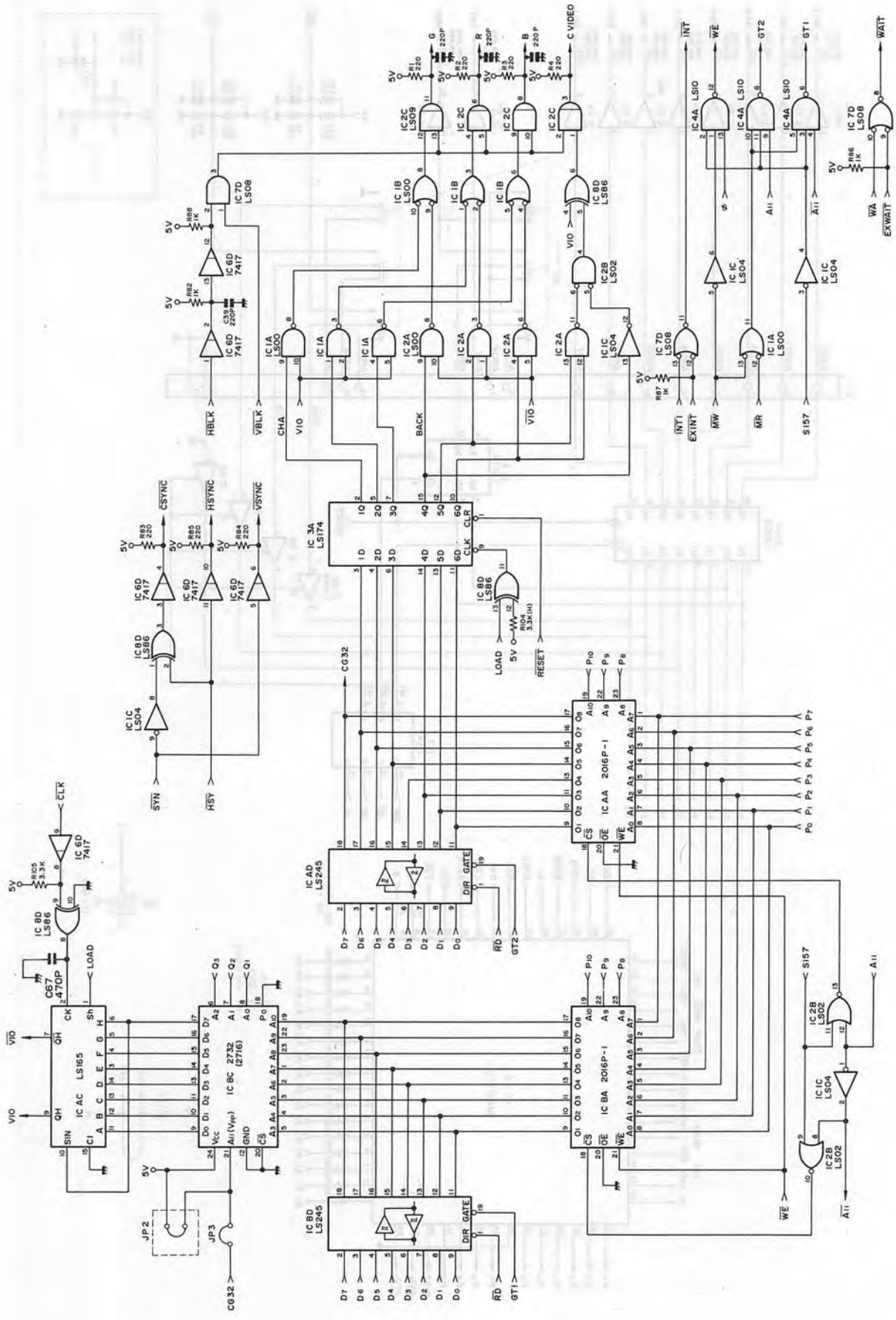



IC 8E
8255
IC BJ
556
IC 7E
LS74
IC 1B
LS00
IC 8C
7417
IC IC
LS04
IC 3C
CD4069
IC 6E
LS42
IC AG
8253C
IC CH
LS00
IC BH
LS221
IC 6F
LS02
IC 6C
LS32
IC 4C
LS367
IC AE
74LS145
P-3
P-4
P-6
P-7
P-12
TAPE SW
READ
P-8
WRITE
EX WRITE
EX READ
WRITE
READ
SENSE
MOTOR
INTMSK
VBLK
SOIN
BLNK
INTI
LOAD
RESET
HBLK
TR2
C458C
TR1
D788
+5V
5V
GND

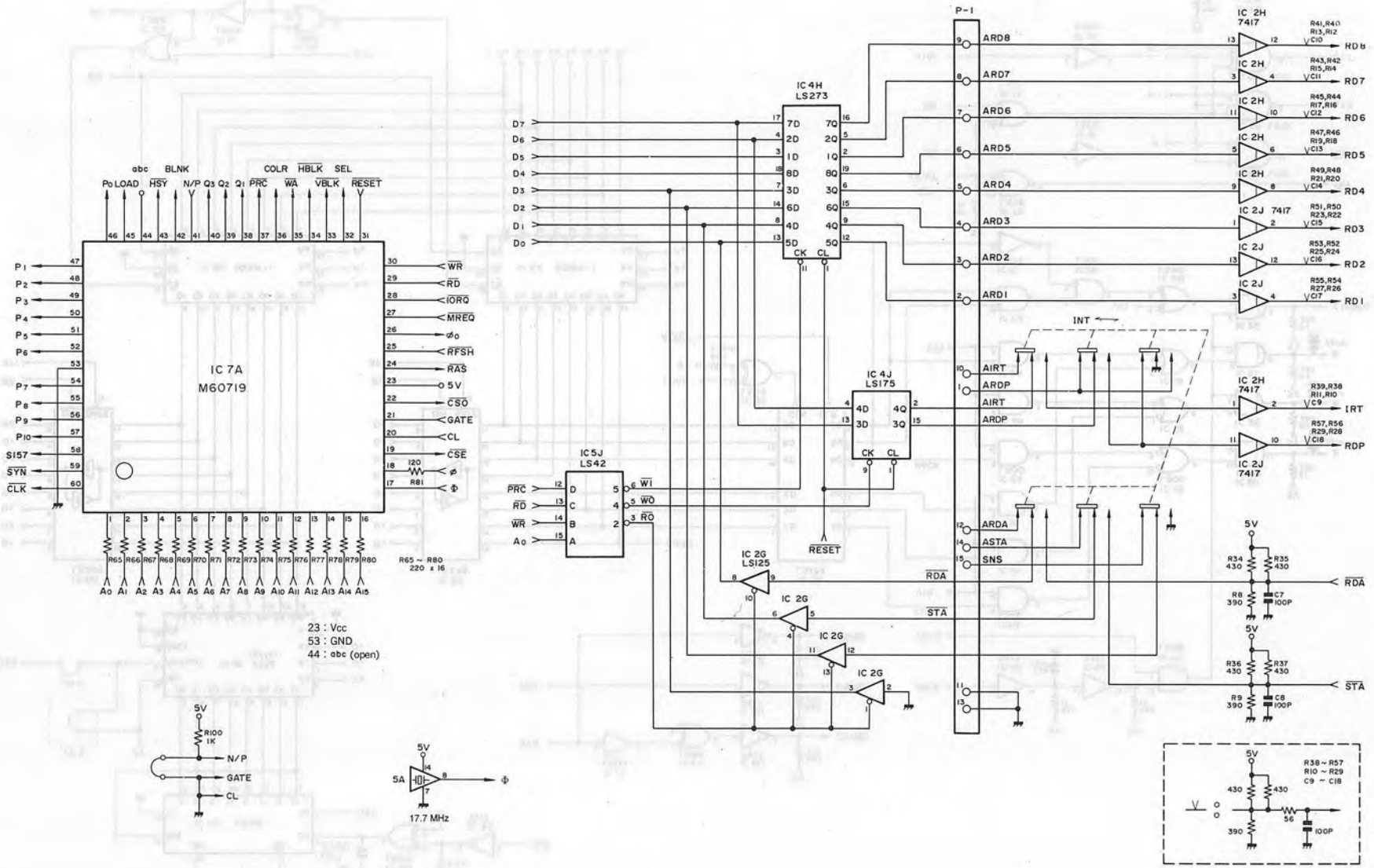
[CPU board circuit (3)]

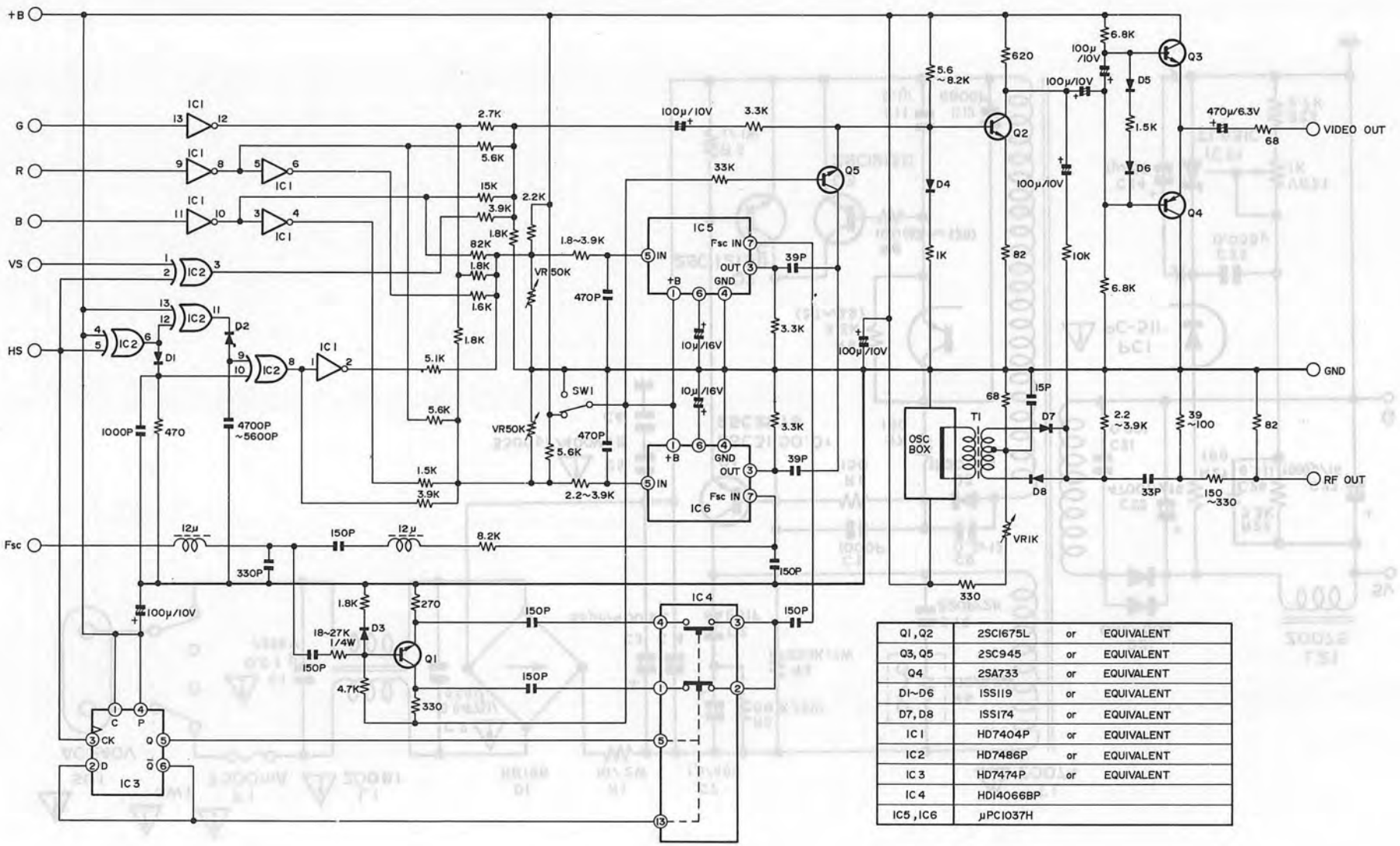


[CPU board circuit (4)]

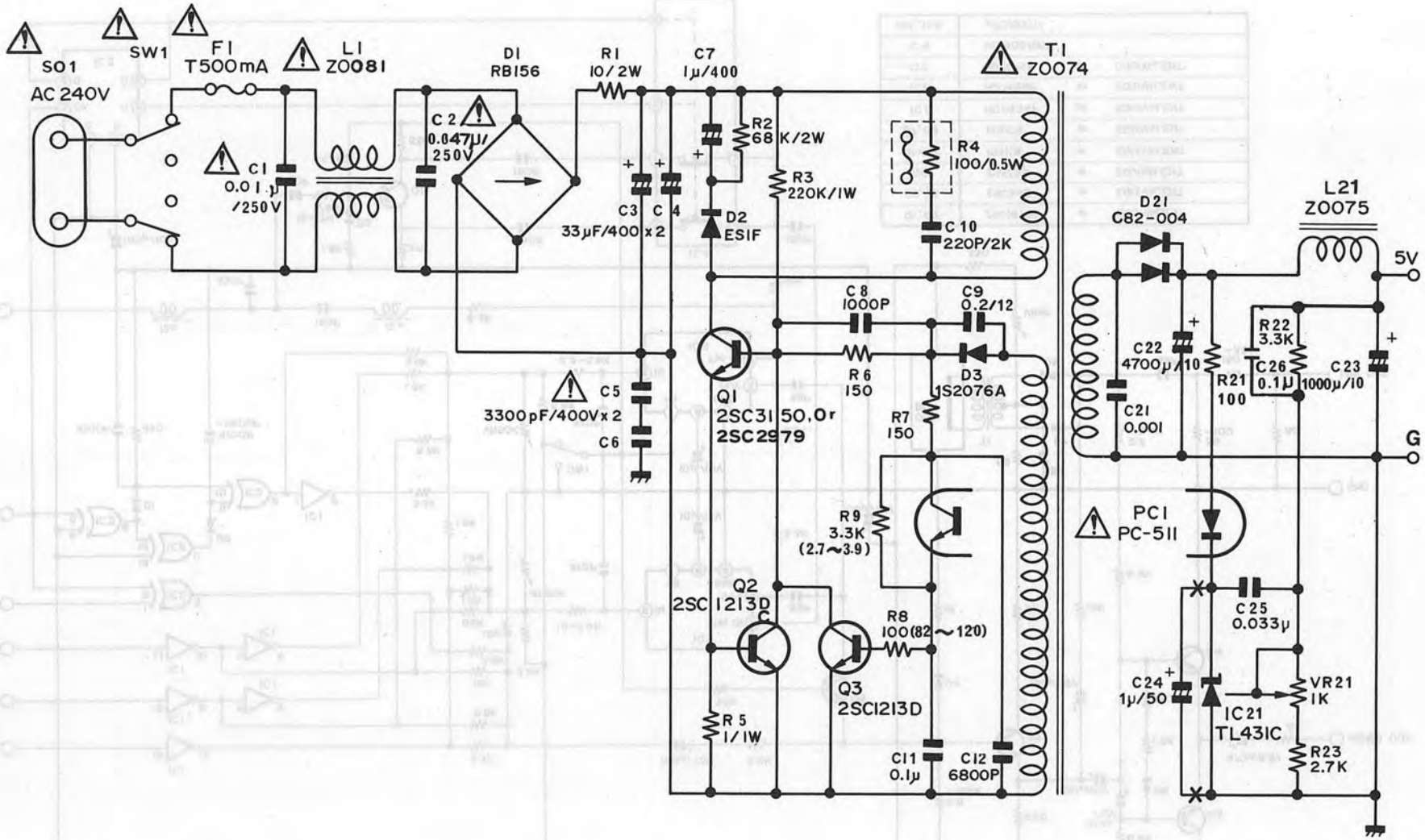


[CPU board circuit (5)]





Q1, Q2	2SC1675L	or	EQUIVALENT
Q3, Q5	2SC945	or	EQUIVALENT
Q4	2SA733	or	EQUIVALENT
D1~D6	1SS119	or	EQUIVALENT
D7, D8	1SS174	or	EQUIVALENT
IC1	HD7404P	or	EQUIVALENT
IC2	HD7486P	or	EQUIVALENT
IC3	HD7474P	or	EQUIVALENT
IC4	HD14066BP		
IC5, IC6	μPC1037H		


SO1
AC 240V
SW1
F1
T500mA
L1
Z0081
C1
0.01μ
/250V
C2
0.047μ/
250V
D1
RB156
R1
10/2W
C7
1μ/400
C3
C4
33μF/400x2
R2
68K/2W
R3
220K/1W
D2
ESIF
T1
Z0074
R4
100/0.5W
C10
220P/2K
C5
3300pF/400Vx2
C6
C8
1000P
C9
0.2/12
R6
150
D3
1S2076A
Q1
2SC3150,Or
2SC2979
R7
150
R9
3.3K
(2.7~3.9)
Q2
2SC1213D
R8
100(82~120)
Q3
2SC1213D
R5
1/1W
C11
0.1μ
C12
6800P
D21
C82-004
L21
Z0075
5V
G
C22
4700μ/10
C21
0.001
R21
100
R22
3.3K
C26
0.1μ
C23
1000μ/10
PC1
PC-511
C25
0.033μ
C24
1μ/50
IC21
TL431C
VR21
1K
R23
2.7K

[CPU board terminal configuration]

P-1

mark	1	ARDP
	2	ARD1
	3	ARD2
	4	ARD3
	5	ARD4
	6	ARD5
	7	ARD6
	8	ARD7
	9	ARD8
	10	AIRT
	11	GND
	12	ARDA
	13	GND
	14	ASTA
	15	ALPS

P-5

mark	1	+ 5 V
	2	+ 5 V
	3	GND
	4	GND

P-10

mark	1	RDP	2	GND
	3	RD1	4	GND
	5	RD2	6	GND
	7	RD3	8	GND
	9	RD4	10	GND
	11	RD5	12	GND
	13	RD6	14	GND
	15	RD7	16	GND
	17	RD8	18	GND
	19	IRT	20	GND
	21	$\overline{RDA}$	22	GND
	23	$\overline{STA}$	24	GND
	25	FG	26	FG

P-11

49	A15	$\overline{NM1}$	50
47	A14	$\overline{EXINT}$	48
45	A13	GND	46
43	A12	$\overline{MREQ}$	44
41	A11	GND	42
39	A10	$\overline{IORQ}$	40
37	A9	GND	38
35	A8	$\overline{RD}$	36
33	A7	GND	34
31	A6	$\overline{WR}$	32
29	A5	$\overline{EXWAIT}$	30
27	A4	$\overline{M1}$	28
25	A3	GND	26
23	A2	$\overline{HALT}$	24
21	A1	$\overline{EXRESET}$	22
19	A0	RESET	20
17	BUS Ø	GND	18
15	D7	GND	16
13	D6	GND	14
11	D5	GND	12
9	D4	GND	10
7	D3	GND	8
5	D2	GND	6
3	D1	GND	4
mark 1	D0	GND	2

P-13

1	5V	
2	$\overline{VBLK}$	
3	JA1	
4	JA2	
5	GND	

P-14

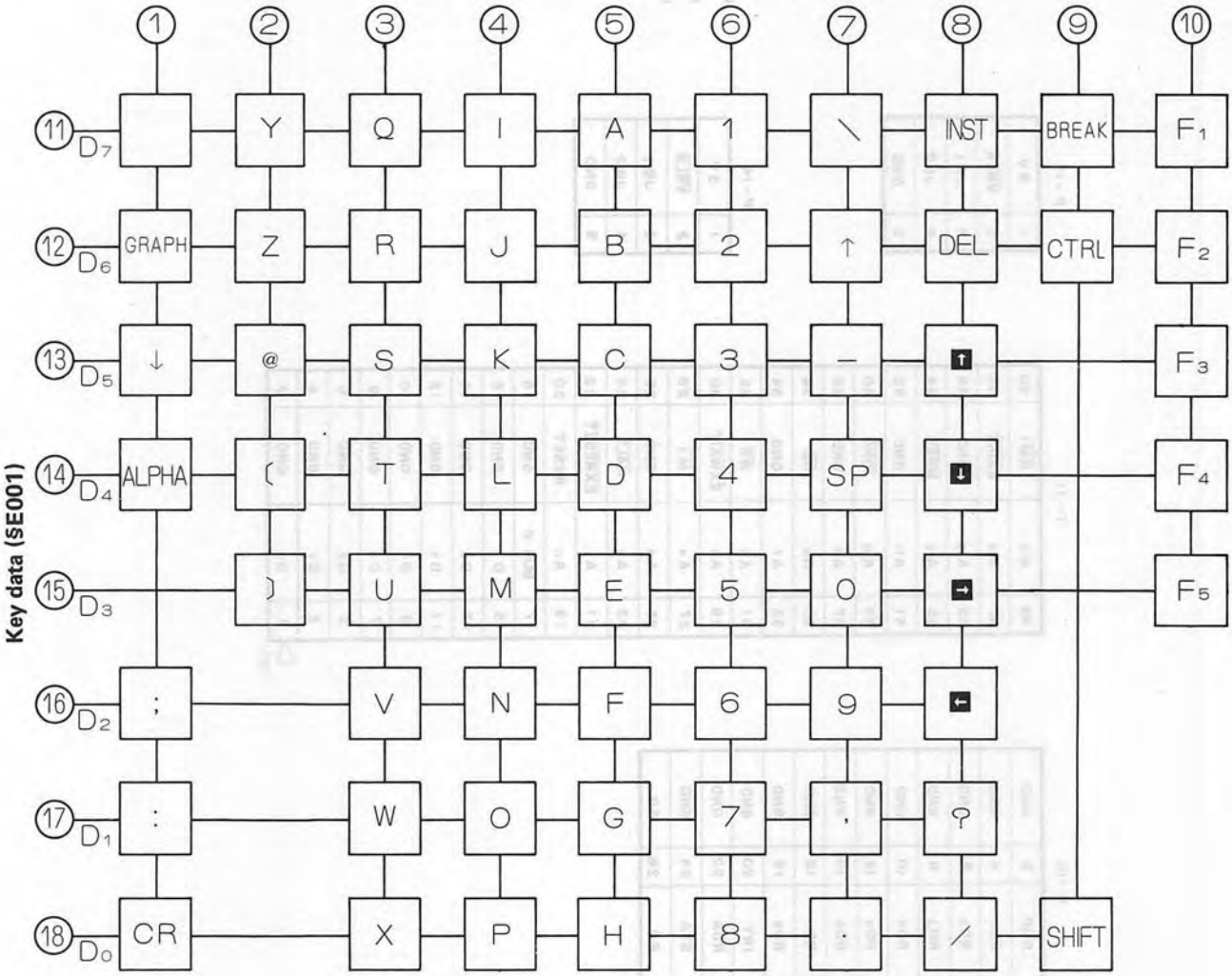
1	5V	
2	$\overline{VBLK}$	
3	JB1	
4	JB2	
5	GND	

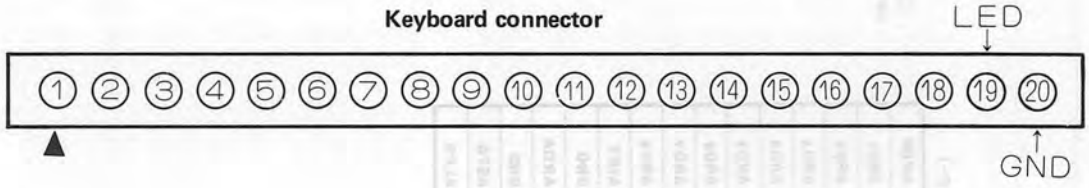
P-9

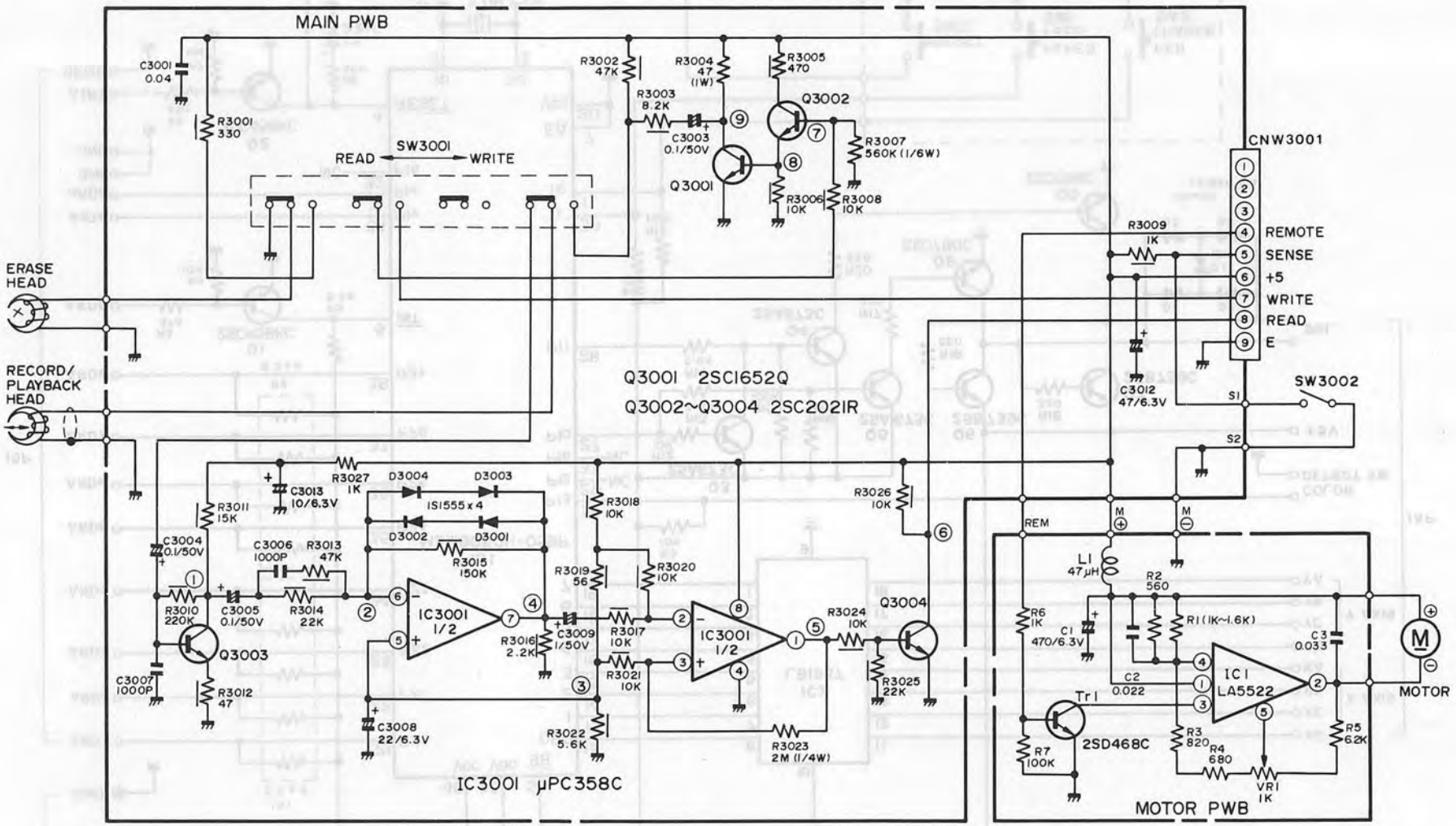
1	○	GND
2	○	$\overline{C\ SYNC}$
3	○	C VIDEO
4	○	$\overline{H\ SYNC}$
5	○	$\overline{V\ SYNC}$
6	○	GND
7	○	+5V
8	○	G
9	○	B
10	○	R
11	○	COLR
12	○	GND

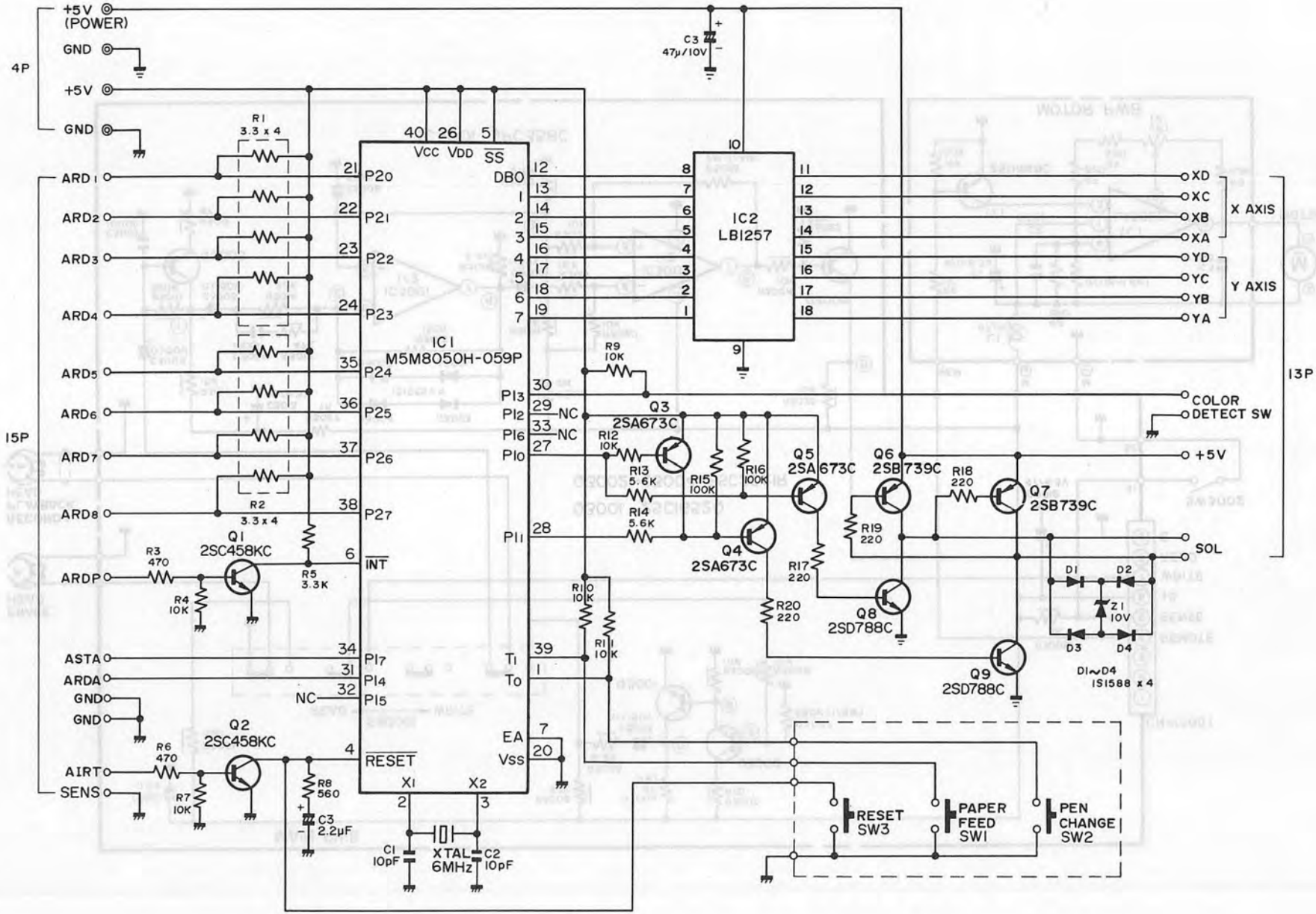
[Keyboard matrix circuit]

8255 outputs keyboard scan signals from port PA to the keyboard and reads key data from port PB. The figure below snows the key matrix.






MAIN PWB
C3001 0.04
R3001 330
SW3001
READ
WRITE
R3002 47K
R3004 47 (1W)
R3005 470
R3003 8.2K
C3003 0.1/50V
Q3002
Q3001
R3007 560K (1/6W)
R3006 10K
R3008 10K
CNW3001
R3009 1K
REMOTE
SENSE
+5
WRITE
READ
E
ERASE HEAD
RECORD/ PLAYBACK HEAD
C3012 47/6.3V
SW3002
S1
S2
Q3001 2SC1652Q
Q3002~Q3004 2SC2021R
R3027 1K
C3013 10/6.3V
D3004
D3003
1S1555 x 4
D3002
D3001
R3015 150K
R3011 15K
R3026 10K
C3004 0.1/50V
C3006 1000P
R3013 47K
R3018 10K
R3019 56
R3020 10K
R3010 220K
C3005 0.1/50V
R3014 22K
IC3001 1/2
R3016 2.2K
C3009 1/50V
R3017 10K
R3021 10K
IC3001 1/2
R3024 10K
Q3004
Q3003
C3007 1000P
R3012 47
R3025 22K
C3008 22/6.3V
R3022 5.6K
R3023 2M (1/4W)
IC3001 μPC358C
REM
M
M
L1 47μH
R2 560
R6 1K
C1 470/6.3V
R1 (1K~1.6K)
C3 0.033
C2 0.022
IC1 LA5522
MOTOR
Tr1
2SD468C
R3 820
R4 680
R5 6.2K
R7 100K
VR1 1K
MOTOR PWB


+5V (POWER)
GND
4P
+5V
GND
15P
ARD1
ARD2
ARD3
ARD4
ARD5
ARD6
ARD7
ARD8
ARDP
ASTA
ARDA
GND
GND
AIRT
SENS
R1 3.3 x 4
R2 3.3 x 4
R3 470
R4 10K
R5 3.3K
R6 470
R7 10K
R8 560
C3 2.2µF
Q1 2SC458KC
Q2 2SC458KC
IC1 M5M8050H-059P
40 Vcc
26 Vdd
5 SS
P20
P21
P22
P23
P24
P25
P26
P27
INT
P17
P14
P15
RESET
X1
X2
DB0
NC
NC
P13
P12
P16
P10
P11
Ti
To
EA
Vss
C1 10pF
XTAL 6MHz
C2 10pF
C3 47µ/10V
IC2 LB1257
R9 10K
R10 10K
R11 10K
R12 10K
R13 5.6K
R14 5.6K
R15 100K
R16 100K
R17 220
R18 220
R19 220
R20 220
Q3 2SA673C
Q4 2SA673C
Q5 2SA673C
Q6 2SB739C
Q7 2SB739C
Q8 2SD788C
Q9 2SD788C
D1
D2
D3
D4
Z1 10V
D1~D4 1S1588 x 4
XD
XC
XB
XA
YD
YC
YB
YA
X AXIS
Y AXIS
13P
COLOR DETECT SW
+5V
SOL
RESET SW3
PAPER FEED SW1
PEN CHANGE SW2

Chapter 5

Monitor Commands and Subroutines

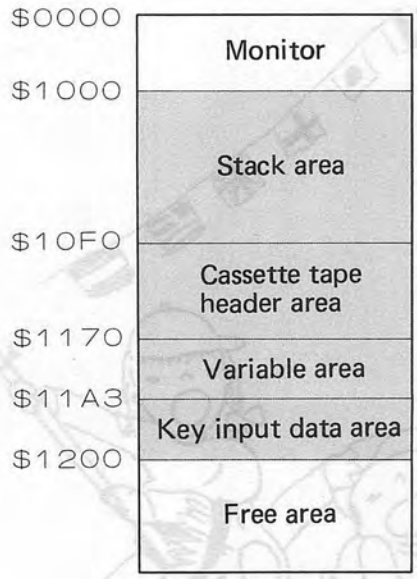
5. 1 Monitor Commands

The monitor program starts immediately after the power is turned on and awaits input of a monitor command. The monitor commands are listed below. In this chapter, [CR] indicates that the carriage return key is to be pressed.

L command ..... Loads cassette tape files into memory.
P command ..... Outputs the specified character string to the printer. (Print)
M command ..... Changes the contents of memory. (Memory correction)
J command ..... Transfers control to the specified address. (Jump)
S command ..... Saves the contents of the specified memory block to cassette tape. (Save)
V command ..... Compares the contents of cassette tape with the contents of memory.
command ..... Transfers control to the RAM area.
B command ..... Makes the bell sound every time a key is pressed. Executing this command again stops the bell.

■ **Configuration of the monitor work area**

The configuration of the monitor work area from $1000 to $11FF is shown below.



Note: The ROM monitor described in this chapter is not the same as the monitor function of the BASIC interpreter.

5. 2 Functions and Use of Monitor Commands

This section describes the functions and use of the eight monitor commands.

- Commands are executed when the [CR] key is pressed. Characters must be entered in the correct order. If illegal characters (such as spaces) are included in a command string, the monitor rejects the command.
- All numeric data must be entered in hexadecimal form at, and all data is displayed in hexadecimal form at. Therefore, 1-byte data is represented with two hexadecimal digits and 2-byte data is represented with a four hexadecimal digits. For example, the decimal number 21 is displayed as 15 and the decimal number 10 must be typed in as 0A. The upper digit "0" cannot be omitted.
- If the number of characters typed as an operand exceeds the specified number, excess characters are discarded.
- Each command can access any location of memory. Therefore, the monitor program may be changed if the commands are used carelessly. **Since this can result in loss of control over the system, be careful to avoid changing the contents of the monitor program.**

5.2.1 L command

Format L

Function This command loads the first machine language file encountered on the cassette tape into memory. After the L command is entered, the display changes as follows.

```
*L
↓ PLAY
```

Press the [PLAY] key of the data recorder. When a machine language program is found, the message "LOADING program-name" is displayed. For example, the following message is displayed during loading of the BASIC interpreter.

```
LOADING BASIC
```

5.2.2 P command (P : Printer)

Function

This command is used as follows to control the plotter printer:

```
*PABC↵
```

Prints the letters "ABC".

```
*P&T↵
```

Prints the test pattern.

```
*P&S↵
```

Sets the line width (character size) to 80 characters/line.

```
*P&L↵
```

Sets the line width (character size) to 40 characters/line.

```
*P&G↵
```

Switches the printer to the graphic mode.

```
*P&C↵
```

Changes the pen color.

5.2.3 M command (M : Memory modification)

Format

M h h h h

h h h h . . . . . starting address

Function

This command is used to change the contents of memory a byte at a time, starting at the specified address.

```
*MCØØØ↵
CØØØ  ØØ  FF
CØØ1  ØØ  FF
CØØ2  ØØ  FF
CØØ3  ØØ  FF
CØØ4  ØØ  [SHIFT]+[BREAK]
*MCØ1Ø↵
CØ1Ø  ØØ  88
CØ11  ØØ  88
CØ12  ØØ  88
CØ13  ØØ  88
CØ14  ØØ    [SHIFT]+[BREAK]
*
```

To terminate the M command, simultaneously press the [SHIFT] and [BREAK] keys.

5.2.4 J command (J : Jump)

Format

J h h h h

h h h h . . . . . destination address

Function

This command transfers control to the specified address; i.e., it sets the specified address in the program counter.

```
*J1200↵                    ..... Jumps to address $1200.
```

5.2.5 S command (S : Save)

Format

S h h h h h' h' h' h' h'' h'' h'' h''

h h h h ..... starting address

h' h' h' h' .... end address

h'' h'' h'' h'' ... execution address

Function

Upon execution, this command prompts for entry of a file name, then saves the contents of memory from h h h h to h' h' h' h' on cassette tape under the specified file name. Assume that a machine language program in the area from $6000 to $60A3 whose execution address is at $6050 is to be saved under file name "MFILE"; the command is then entered as follows.

```
*S6000 60A3 6050↵
FILENAME? MFILE↵
↓ RECORD · PLAY
```

Confirm that a blank cassette tape is loaded in the data recorder and press the RECORD key.

If the write protect tab of the cassette tape is removed, the RECORD key cannot be pressed. Replace it with another cassette.

This command can only be used to save machine language programs.

```
WRITING MFILE
OK!
■
```

Note: To abort recording, hold down both the SHIFT and BREAK keys until the prompt " * " appeas.

5.2.6 V command (V : Verify)

Format V

Function Compares a machine language cassette file saved using the S command with the original program in memory.

```
*V↵
↧ PLAY
OK
```

Press the PLAY key to read the cassette tape file when the prompt "↧ PLAY" is displayed. The message "OK" is displayed when the contents of the cassette file matches that of the original program; otherwise, the message "CHECK SUM ER." is displayed.

It is recommended to that this command be executed immediately after recording a program with the S command.

5.2.7 # command

Format #

Function After pressing the RESET switch, executing this command produces the same effect as simultaneoulsy pressing the RESET switch and the CTRL key.

*# ↵

5.2.8 B command (B : Bell)

Format B

Function *B ↵

Executing this command once causes the bell to ring each time a key is pressed. Executing it again disables the bell.

5. 3 Monitor Subroutines

The following subroutines are provided for **Monitor 1Z-013A**. Each subroutine name symbolically represents the function of the corresponding subroutine. These subroutines can be called from user programs.

Registers saved are those whose contents are restored when control is returned to the calling program. The contents of other registers are changed by execution of the subroutine.

Name and entry point (hex.)	Function	Register saved
CALL LETNL (0006)	Moves the cursor to the beginning of the next line.	Other than AF
CALL PRINTS (000C)	Displays a space at the cursor position.	Other than AF
CALL PRINTS (0012)	Displays the character corresponding to the ASCII code stored in ACC at the cursor position. See Appendix A. 1 for the ASCII codes. No character is displayed when code 0D (carriage return) or 11 to 16 (the cursor control codes) is entered, but the corresponding function is performed (a carriage return for 0D and cursor movement for 11 to 16).	Other than AF
CALL MSG (0015)	Displays a message, starting at the position of the cursor. The starting address of the area in which the message is stored must be set in the DE register before calling this subroutine, and the message must end with a carriage return code (0D). The carriage return is not executed. The cursor is moved if any cursor control codes (11 to 16) are included in the message.	All registers
CALL BELL (003E)	Briefly sounds high A (about 880 Hz).	Other AF
CALL MELDY (0030)	Plays music according to music data stored in the memory area starting at the address indicated in the DE register. The music data must be in the same format as that for the MUSIC statement of the BASIC, and must end with 0D or C8. When play is completed, control is returned to the calling program with the C flag set to 0; when play is interrupted with the [BREAK] key, control is returned with the C flag set to 1.	Other than AF
CALL XTEMP (0041)	Sets the musical tempo according to the tempo data stored in the accumulator (ACC). ACC ← 01 Slowest speed ACC ← 04 Middle speed ACC ← 07 Highest speed Note that the data in the accumulator is not the ASCII code corresponding to 1 to 7 but the binary code.	All registers
CALL MSTA (0044)	Generates a continuous sound of the specified frequency. The frequency is given by the following equation. freq. = 895 kHz/nn'. Here, nn' is a 2-byte number stored in addresses 11A1 and 11A2 (n in 11A2 and n' in 11A1).	BC and DE

Name and entry point (hex.)	Function	Register saved
CALL MSTP (0047)	Stops the sound generated with the CALL MSTA subroutine.	Other than AF
CALL TIMST (0033)	Sets and starts the built-in clock. Registers must be set as follows before this routine is called. ACC ← 0 (AM), ACC ← 1 (PM) DE ← 4-digit hexadecimal number representing the time in seconds.	Other than AF
CALL TIMRD (003B)	Reads the built-in clock and returns the time as follows. ACC ← 0 (AM), ACC ← 1 (PM) DE ← 4-digit hexadecimal number representing the time in seconds.	Other than AF and DE
CALL BRKEY (001E)	Checks whether the [SHIFT] and [BREAK] keys are both being pressed. The Z flag is set when they are being pressed simultaneoulsy; otherwise, it is reset.	Other than AF
CALL GETL (0003)	Reads one line of data from the keyboard and stores it in the memory area starting at the address indicated in the DE register. This routine stops reading data when the RETURN key is pressed, then appends a carriage return code (0D) to the end of the data read. A maximum of 80 characters (including the carriage return code) can be entered in one line. Characters keyed in are echoed back to the display, and cursor control codes can be included in the line. When the [SHIFT] and [BREAK] keys are pressed simultaneously, BREAK code is stored in the address indicated in the DE register and a carriage return code is stored in the subsequent address.	All registers
CALL GETKY (001B)	Reads a character code (ASCII) from the keyboard. If no key is pressed, control is returned to the calling program with 00 set in ACC. No provision is made to avoid data read errors due to key chatter, and characters entered are not echoed back to the display. When any of the special keys (such as [DEL] or [CR]) are pressed, this subroutine returns a code to ACC which is different from the corresponding ASCII code as shown below. Here, display codes are used to address characters stored in the cahracter generator, and are different from the ASCII codes.	Other than AF

Special key read with GETKY

Special key	Code set in ACC	Display code
DEL	60	C7
INST	61	C8
ALPHA	62	C9
BREAK	64	CB
CR	66	CD
↓	11	C1
↑	12	C2
→	13	C3
←	14	C4
[HOME]	15	C5
[CLR]	16	C6

<table>
<tr><th>Name and entry point (hex.)</th><th>Function</th><th>Register saved</th></tr>
<tr><td>CALL ASC
(03DA)</td><td>Sets the ASCII character corresponding to the hexadecimal number represented by the lower 4 bits of data in ACC.</td><td>Other than AF</td></tr>
<tr><td>CALL HEX
(03F9)</td><td>Converts the 8 data bits stored in ACC into a hexadecimal number (assuming that the data is an ASCII character), then sets the hexadecimal number in the lower 4 bits of ACC.
The C flag is set to 0 when a hexadecimal number is set in ACC; otherwise, it is set to 1.</td><td>Other than AF</td></tr>
<tr><td>CALL HLHEX
(0410)</td><td>Converts a string of 4 ASCII characters into a hexadecimal number and sets it in the HL register. The call and return conditions are as follows.
DE ← Starting adress of the memory area which contains the ASCII character string
(e.g., "3" "1" "A" "5")
↑ DE
CALL HLHEX
CF = 0 HL ← hexadecimal number (e.g., HL = 31A5H)
CF = 1 The contents of HL are not assured.</td><td>Other than AF and HL</td></tr>
<tr><td>CALL 2HEX
(041F)</td><td>Converts a string of 2 ASCII characters into a hexadecimal number and sets it in ACC. The call and return conditions are as follows.
DE ← Starting adress of the memory area which contains the ASCII character string. (e.g., "3" "A")
↑ DE
CALL 2HEX
CF = 0 ACC ← hexadecimal number (e.g., ACC = 3AH)
CF = 1 The contents of the ACC are not assured.</td><td>Other than AF and DE</td></tr>
<tr><td>CALL ??KEY
(09B3)</td><td>Blinks the cursor to prompt for key input. When a key is pressed, the corresponding display code is set in ACC and control is returned to the calling program.</td><td>Other than AF</td></tr>
<tr><td>CALL ?ADCN
(0BB9)</td><td>Converts ASCII codes into display codes. The call and return conditions are as follows.
ACC ← ASCII code
CALL ? ADCN
ACC ← Display code</td><td>Other than AF</td></tr>
<tr><td>CALL ?DACN
(0BCE)</td><td>Converts display codes into ASCII codes. The call and return conditions are as follows.
ACC ← Display code
CALL ? DACN
ACC ← ASCII code</td><td>Other than AF</td></tr>
<tr><td>CALL ?BLNK
(0DA6)</td><td>Detects the vertical blanking period. Control is returned to the calling program when the vertical blanking period is entered.</td><td>All registers</td></tr>
<tr><td>CALL ?DPCT
(0DDC)</td><td>Controls display as follows.
<table>
<tr><th>ACC</th><th>Control</th><th>ACC</th><th>Control</th></tr>
<tr><td>C0H</td><td>Scrolling</td><td>C6H</td><td>Same as the CLR key.</td></tr>
<tr><td>C1H</td><td>Same as the ↓ key.</td><td>C7H</td><td>Same as the DEL key.</td></tr>
<tr><td>C2H</td><td>Same as the ↑ key.</td><td>C8H</td><td>Same as the INST key.</td></tr>
<tr><td>C3H</td><td>Same as the → key.</td><td>C9H</td><td>Same as the ALPHA key.</td></tr>
<tr><td>C4H</td><td>Same as the ← key.</td><td>CDH</td><td>Same as the CR key.</td></tr>
<tr><td>C5H</td><td>Same as the HOME key.</td><td></td><td></td></tr>
</table></td><td>All registers</td></tr>
<tr><td>CALL ?PONT
(0FB1)</td><td>Sets the current cursor location in the HL register. The return conditions are as follows.
CALL ? PONT
HL ← Cursor location (binary)</td><td>Other than AF and HL</td></tr>
</table>

Name and entry point (hex.)	Function	Register saved
CALL ASC (05DA)	Sets the ASCII character corresponding to the hexadecimal number represented by the lower 4 bits of data in ACC.	Other than AF
CALL HEX (05F9)	Converts the 8 data bits stored in ACC into a hexadecimal number (assuming that the data is an ASCII character), then sets the hexadecimal number in the lower 4 bits of ACC. The C flag is set to 0 when a hexadecimal number is set in ACC; otherwise, it is set to 1.	Other than AF
CALL HLHEX (0610)	Converts a string of 4 ASCII characters into a hexadecimal number and sets it in the HL register. The call and return conditions are as follows. DE ← Starting adress of the memory area which contains the ASCII character string (e.g., '3' '1' 'A' '5') CALL HLHEX ⌊_ DE CF = 0 HL ← hexadecimal number (e.g., HL = 31A5H) CF = 1 The contents of HL are not assured.	Other than AF and HL
CALL 2HEX (614F)	Converts a string of 2 ASCII characters into a hexadecimal number and sets it in ACC. The call and return conditions are as follows. DE ← Starting adress of the memory area which contains the ASCII character string. (e.g., '3' 'A') CALL 2HEX ⌊_ DE CF = 0 ACC ← hexadecimal number (e.g., ACC = 3AH) CF = 1 The contents of the ACC are not assured.	Other than AF and DE
CALL ?KEY (0983)	Blinks the cursor to prompt for key input. When a key is pressed, the corresponding display code is set in ACC and control is returned to the calling program.	Other than AF
CALL ?ADCN (0B89)	Converts ASCII codes into display codes. The call and return conditions are as follows. ACC ← ASCII code CALL ? ADCN ACC ← Display code	Other than AF
CALL ?DACN (0BCE)	Converts display codes into ASCII codes. The call and return conditions are as follows. ACC ← Display code CALL ? DACN ACC ← ASCII code	Other than AF
CALL ?BLNK (0DA6)	Detects the vertical blanking period. Control is returned to the calling program when the vertical blanking period is entered.	All registers
CALL ?DPCT (0D0C)	Controls display as follows. Scrolling Same as the ↑ key. Same as the ↓ key. Same as the ← key. Same as the → key. Same as the HOME key. Same as the CLR key. Same as the DEL key. Same as the INST key. Same as the ALPHA key. Same as the CR key.	All registers
CALL ?PONT (0F81)	Sets the current cursor location in the HL register. The return conditions are as follows. CALL ? PONT HL ← Cursor location (binary)	Other than AF and HL

APPENDICES

A. 1 Code Tables

■ **ASCII code table**

MSD is an abbreviation for most significant digit, and represents the upper 4 bits of each code; LSD is an abbreviation for least significant digit, and represents the lower 4 bits of each code. Codes 11H to 16H are cursor control codes. For example, executing CALL PRNT (a monitor subroutine) with 15H set in ACC returns the cursor to the home position. ("■" is not displayed.)

LSD \ MSD	0 0000	1 0001	2 0010	3 0011	4 0100	5 0101	6 0110	7 0111	8 1000	9 1001	A 1010	B 1011	C 1100	D 1101	E 1110	F 1111
0 0000			SP	0	@	P			}	_	q	n	|			
1 0001		↓	!	1	A	Q					a				♠	●
2 0010		↑	"	2	B	R				e	z	Ü				
3 0011		→	#	3	C	S				`	w	m				♥
4 0100		←	$	4	D	T				~	s					
5 0101		■	%	5	E	U					u					
6 0110		C	&	6	F	V				t	i		→			
7 0111			'	7	G	W				g		o				○
8 1000			(	8	H	X				h	ö		■			♣
9 1001			)	9	I	Y				k	Ä					
A 1010			*	:	J	Z				b	f	ö				◆
B 1011			+	;	K			°		x	v	ä				£
C 1100			,	<	L					d			○			↓
D 1101	CR		—	=	M					r	ü	y				
E 1110			.	>	N	↑				p	ß					
F 1111			/	?	O	←				c	j					π

■ **Display code table**

The display codes are used to address character patterns stored in the character generator. These codes must be transferred to video-RAM to display characters.

Monitor subroutines PRNT (0012H) and MSG (0015H) convert ASCII codes into display codes and transfer them to the V-RAM location indicated for the cursor.

Codes C1H to C6H are for controlling the cursor.

LSD \ MSD	0 0000	1 0001	2 0010	3 0011	4 0100	5 0101	6 0110	7 0111	8 1000	9 1001	A 1010	B 1011	C 1100	D 1101	E 1110	F 1111
0 0000	SP	P	0		}	↑	π		|	p			±			SP
1 0001	A	Q	1		♠	<	!		a	q			↓			
2 0010	B	R	2			[	"		b	r			↑			
3 0011	C	S	3		■	♥	#		c	s			→			
4 0100	D	T	4		◆	]	$		d	t	`		←			
5 0101	E	U	5		←	@	%		e	u	~		H			
6 0110	F	V	6		♣		&		f	v			C			
7 0111	G	W	7		●	>	'		g	w						
8 1000	H	X	8		○	↓	(		h	x			H			
9 1001	I	Y	9		?	\	)		i	y			I			
A 1010	J	Z	—		■	→	+		j	z	ß		±			
B 1011	K	£	=			✱			k	ä	ü		±	°		
C 1100	L		;						l	ö	{		±			
D 1101	M		/						m	Ü			¥			
E 1110	N		.						n	Ä	^		●			
F 1111	O		,		:				o	Ö	_		☺			

The character patterns on the former page are contained in the 2K bytes which make up the first half of CG-ROM. Character patterns for the second half of CG-ROM are shown on the latter page. However, character patterns in the second 2K bytes of the CG-ROM are not supported by BASIC, and cannot be entered directly from the keyboard. Although they can be displayed using the POKE statement as shown in the example below, they cannot be output to any printer (either the built-in printer or an external printer).

< Examples >

(1) The following program example displays character patterns from the second half of CG-ROM on the CRT screen.

```
10 COLOR, , 7, 0
20 PRINT"■";
30 FOR J=55296 TO 56296 ——→ 55296 = $D800
40 POKE J, 240 ——————————→ Specifies the second 2K-byte
50 NEXT J                   half of CG-ROM. 240 = $F0
60 A=53248 : I=0 : H=0 ———→ 53248 = $D000
70 POKE A, I
80 A=A+2
90 I=I+1 : IF I=256 THEN GOTO 120
100 H=H+1 : IF H=20 THEN A=A+40 : H=0
110 GOTO 70
120 GOTO 120
```

(2) The example below illustrates using machine language to display character patterns from the second half of CG-ROM on the CRT screen.

```
LD HL, D000H          DISP :XOR A
CALL DISP                   LD B, 00H
LD HL, D208H          DISP2:LD (HL), A
CALL DISP                   INC HL
LD A, F1H                   INC A
LD HL, DA08H                DEC B
LD DE, DA09H                JP NZ, DISP2
LD BC, 00FFH                RET
LD (HL), A
LDIR
END
```

■ **MZ-700 Display code table (second 2K-byte half)**

LSD \ MSD	0 0000	1 0001	2 0010	3 0011	4 0100	5 0101	6 0110	7 0111	8 1000	9 1001	A 1010	B 1011	C 1100	D 1101	E 1110	F 1111
0	0000																
1	0001																
2	0010																
3	0011																
4	0100																
5	0101																
6	0110																
7	0111																
8	1000																
9	1001																
A	1010																
B	1011																
C	1100																
D	1101																
E	1110																
F	1111																

■ **ASCII code table for color plotter-printer**

Graphic characters other than those shown above cannot be printed, but the corresponding hexadecimal code is printed in a different pen color.

MSD / LSD	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0			SP	0	@	P			}		q	n				
1		↓	▽	1	A	Q					a					
2		↑	"	2	B	R				e	Z	ü				
3		→	#	3	C	S				`	w	m				
4		←	$	4	D	T				~	s					
5		H	%	5	E	U					u					
6		C	&	6	F	V				t	¦		→			
7			'	7	G	W				g		o		▭		
8			(	8	H	X				h	ö	¦				
9			)	9	I	Y					k	ä				
A			*	▫	J	Z				b	f	ö				
B			+	;	K	[		▫	^	x	v	ä				£
C			,	<	L	\				d						↓
D			−	=	M	]				r	ü	y				
E			.	>	N	↑				p	ß	{				
F			/	?	O	←				c	j		▭			π

A. 2 MZ-700 Series Computer Specifications

A.2.1 MZ-700

CPU:	SHARP LH0080A (Z80A)
Clock:	3.5 MHz
Memory:	ROM 4K bytes (ROM)
	2K bytes (character generator)
	RAM 64K bytes (program area)
	4K bytes (video RAM)
Video output:	PAL system
	RGB signal
	Composite signal (B/W)
	RF signal (UHF 36 ± 3 CH, B/W)
Screen size:	40 characters x 25 lines
	8 x 8 dot character matrix
Colors:	8 colors for characters
	8 colors for background
Music function:	Built in (500 mW max. output)
Clock:	Built in (24 hour clock, no backup)
Keys:	69 keys
	ASCII standard
	Definable function keys, cursor control keys
Editing function:	Screen editor
	(cursor control, home, clear, insert, and delete)
Temperature:	Operating; 0 ~ 35°C
	Storage; −20 ~ 60°C
Humidity:	Operating; 85% or less
	Storage; 85% or less
Dimensions:	MZ-731; 400 (W) x 305 (D) x 102 (H) mm
	MZ-721; 440 (W) x 305 (D) x 86 (H) mm
	MZ-711; 440 (W) x 305 (D) x 86 (H) mm
Weight:	MZ-731; 4.6 kg
	MZ-721; 4.0 kg
	MZ-711; 3.6 kg
Accessories:	Cassette tape (BASIC (side A) Application programs (side B))
	Owners manual, function labels, power cable, TV connection cable
	Attachments for the color plotter-printer are listed later.

A.2.2 CPU board specifications

CPU:	LH0080A (Z80A)	1
PPI:	8255	1
PIT:	8253	1
Memory controller (CRTC):	M60719	1
ROM:	Monitor 4K byte ROM	1
	Character generator 2K byte ROM	1
RAM:	64K bits D-RAM	8
	2K byte S-RAM	2
I/O bus:	Expansion I/O bus	1
	Printer I/O bus	2 (Cannot be used at the same time)
	Cassette READ/WRITE terminals	2
	Joystick terminal	2

A.2.3 Color plotter-printer specifications

Printing system:	4 selectable colors using ball point pens
Colors:	1. Black, 2. Blue, 3. Green, 4. Red
Printing speed:	Average 10 characters/second when printing with the smallest size characters.
Line width:	80 columns, 40 columns, or 26 columns (selected by software)
Number of characters:	115 (including ASCII characters)
Resolution:	0.2 mm
Accessories:	Roll paper (1), Ball pens (black, blue, green red) Paper holders (left and right) Roll shaft (1), Paper guide (1)

A.2.4 Data recorder specifications

Type:	IEC standard compact cassette mechanism
Recording/ playback system:	2 track, 1 channel monophonic
Rated speed:	4.8 cm/s ±3.5%
Type of control switches:	Piano type
Control switches:	PLAY, FF, REW, STOP/EJECT, and REC keys and counter reset button
Data transfer method:	Sharp PWM method
Data transfer rate:	1200 bps (typ.)
Tape:	Ordinary audio cassette tape

A.2.5 Power supply specifications

(Supplies power to the color plotter-printer and data recorder, as well as to the main unit.)

Input:	240/220 V ±10%, 50/60 Hz, 20 W
Output:	5 V

A. 3 BASIC Error Message List

The BASIC interpreter displays an error message in one of the following formats when an error occurs during operation.

1. < error type > error (Direct mode error)
2. < error type > error in line number (Run mode error)

Error messages in format 1 are issued when an error is detected during execution of a direct command or entry of a program. Error messages in format 2 are issued when an error is detected during program execution.

Error messages which may be displayed are shown below.

SYNTAX

Error No.	Message displayed	Description
1	Syntax error	Syntax error
2	Over flow error	Numeric data used is out of the specified range, or an overflow occurred.
3	Illegal data error	Illegal constant or variable was used.
5	String length error	String length exceeded 255 characters.
6	Memory capacity error	Memory capacity is insufficient.
7	Array def. error	An attempt was made to redefine an array to a size greater than that defined previously.
8	Linelength error	The length of a line was too long.
10	GOSUB nesting error	The number of levels of GOSUB nesting exceeded the limit determined by the usable memory space.
11	FOR~NEXT error	The number of levels of FOR~NEXT loops exceeded the limit determined by the usable memory area.
12	DEF FN nesting error	The number of levels of DEF FN nesting exceeded the limit.
13	NEXT error	NEXT was used without a corresponding FOR.
14	RETURN error	RETURN was used without a corresponding GOSUB.
15	Un def. function error	An undefined function was called.
16	Un def. line num. error	An unused line number was referenced.
17	Can't continue	CONT command cannot be executed.
18	Memory protection	An attempt was made to write data to the BASIC control area.
19	Instruction error	Direct mode commands and statements are mixed together.
20	Can't RESUME error	RESUME cannot be executed.
21	RESUME error	An attempt was made to execute RESUME when no error had occurred.
24	READ error	READ was used without a corresponding DATA statement.
43	Already open error	An OPEN statement was issued to a file which was already open.
63	Out of file error	Out of file during file read.
65	Printer is not ready	Printer is not connected.
68	Printer mode error	Color plotter-printer mode error.
70	Check sum error	Check sum error (during tape read).

A. 4 Z80A Instruction Set

A summary of the Z80A instructions are given below for reference.

Mnemonic	Symbolic operation	Op-code
8-bit load group		
LD r, r'	r←r'	01 r r'
LD r, n	r←n	00 r 110
		← n →
LD r, (HL)	r←(HL)	01 r 110
LD r, (IX+d)	r←(IX+d)	11 011 101
		01 r 110
		← d →
LD r, (IY+d)	r←(IY+d)	11 111 101
		01 r 110
		← d →
LD (HL), r	(HL)←r	01 110 r
LD (IX+d), r	(IX+d)←r	11 011 101
		01 110 r
		← d →
LD (IY+d), r	(IY+d)←r	11 111 101
		01 110 r
		← d →
LD (HL), n	(HL)←n	00 110 110
		← n →
LD (IX+d), n	(IX+d)←n	11 011 101
		00 110 110
		← d →
		← n →
LD (IY+d), n	(IY+d)←n	11 111 101
		00 110 110
		← d →
		← n →
LD A, (BC)	A←(BC)	00 001 010
LD A, (DE)	A←(DE)	00 011 010
LD A, (nn)	A←(nn)	00 111 010
		← n →
		← n →
LD (BC), A	(BC)←A	00 000 010
LD (DE), A	(DE)←A	00 010 010
LD (nn), A	(nn)←A	00 110 010
		← n →
		← n →
LD A, I	A←I	11 101 101
		01 010 111
LD A, R	A←R	11 101 101
		01 011 111
LD I, A	I←A	11 101 101
		01 000 111
LD R, A	R←A	11 101 101
		01 001 111
16-bit load group		
LD dd, nn	dd←nn	00 dd0 001
		← n →
		← n →
LD IX, nn	IX←nn	11 011 101
		00 100 001
		← n →
		← n →
LD IY, nn	IY←nn	11 111 101
		00 100 001
		← n →
		← n →
LD HL, (nn)	H←(nn+1)	00 101 010
	L←(nn)	← n →
		← n →
LD dd, (nn)	dd_H←(nn+1)	11 101 101
	dd_L←(nn)	01 dd1 011
		← n →
		← n →
LD IX, (nn)	IX_H←(nn+1)	11 011 101
	IX_L←(nn)	00 101 010
		← n →
		← n →
LD IY, (nn)	IY_H←(nn+1)	11 111 101
	IY_L←(nn)	00 101 010
		← n →
		← n →
LD (nn), HL	(nn+1)←H	00 100 010
	(nn)←L	← n →
		← n →
LD (nn), dd	(nn+1)←dd_H	11 101 101
	(nn)←dd_L	01 dd0 011
		← n →
		← n →
LD (nn), IX	(nn+1)←IX_H	11 011 101
	(nn)←IX_L	00 100 010
		← n →
		← n →
LD (nn), IY	(nn+1)←IY_H	11 111 101
	(nn)←IY_L	00 100 010
		← n →
		← n →
LD SP, HL	SP←HL	11 111 001
LD SP, IX	SP←IX	11 011 101
		11 111 001
LD SP, IY	SP←IY	11 111 101
		11 111 001
PUSH qq	(SP−2)←qq_L	11 qq0 101
	(SP−1)←qq_H	
PUSH IX	(SP−2)←IX_L	11 011 101
	(SP−1)←IX_H	11 100 101
PUSH IY	(SP−2)←IY_L	11 111 101
	(SP−1)←IY_H	11 100 101
POP qq	qq_H←(SP+1)	11 qq0 001
	qq_L←(SP)	
POP IX	IX_H←(SP+1)	11 011 101
	IX_L←(SP)	11 100 001
POP IY	IY_H←(SP+1)	11 111 101
	IY_L←(SP)	11 100 001
Exchange group and block transfer and search group		
EX DE, HL	DE↔HL	11 101 011
EX AF, AF'	AF↔AF'	00 001 000
EXX	(BC)↔(BC')	11 011 001
	(DE)↔(DE')	
	(HL)↔(HL')	
EX (SP), HL	H↔(SP+1)	11 100 011
	L↔(SP)	
EX (SP), IX	IX_H↔(SP+1)	11 011 101
	IX_L↔(SP)	11 100 011
EX (SP), IY	IY_H↔(SP+1)	11 111 101
	IY_L↔(SP)	11 100 011

Mnemonic	Symbolic operation	Op-code
LDI	(DE)←(HL)	11 101 101
	DE←DE+1	10 100 000
	HL←HL+1	
	BC←BC−1	
LDIR	(DE)←(HL)	11 101 101
	DE←DE+1	10 110 000
	HL←HL+1	
	BC←BC−1	
	Repeat until BC=0	
LDD	(DE)←(HL)	11 101 101
	DE←DE−1	10 101 000
	HL←HL−1	
	BC←BC−1	
LDDR	(DE)←(HL)	11 101 101
	DE←DE−1	10 111 000
	HL←HL−1	
	BC←BC−1	
	Repeat until BC=0	
CPI	A−(HL)	11 101 101
	HL←HL+1	10 100 001
	BC←BC−1	
CPIR	A−(HL)	11 101 101
	HL←HL+1	10 110 001
	BC←BC−1	
	Repeat until A=(HL) or BC=0	
CPD	A−(HL)	11 101 101
	HL←HL−1	10 101 001
	BC←BC−1	
CPDR	A−(HL)	11 101 001
	HL←HL−1	10 111 001
	BC←BC−1	
	Repeat until A=(HL) or BC=0	

8-bit arithmetic and logical group

ADD A, r	A←A+r	10 [000] r
AD A, n	A←A+n	11 [000] 110
		← n →
ADD A, (HL)	A←A+(HL)	10 [000] 110
ADD A, (IX+d)	A←A, (IX+d)	11 011 101
		10 [000] 110
		← d →
ADD A, (IY+d)	A←A+(IY+d)	11 111 101
		10 [000] 110
		← d →
ADC A, s	A←A+s+CY	[001]
SUB s	A←A−s	[010]
SBC A, s	A←A−s−CY	[011]
AND s	A=A∧s	[100]
OR s	A←AVs	[110]
XOR s	A←A⊕s	[101]
CP s	A−s	[111]
INC r	r←r+1	00 r [100]
INC (HL)	(HL)←(HL)+1	00 110 [100]
INC (IX+d)	(IX+d)	11 011 101
	←(IX+d)+1	00 110 [100]
		← d →
INC (IY+d)	(IY+d)	11 111 101
	←(IY+d)+1	00 110 [100]

Mnemonic	Symbolic operation	Op-code
		← d →
DEC m	m←m−1	[101]

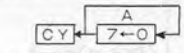
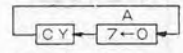
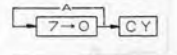
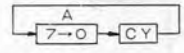
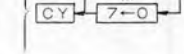
General purpose arithmetic and control group

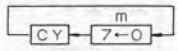
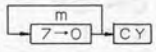
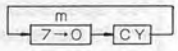
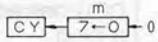
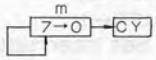
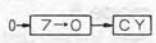
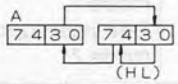
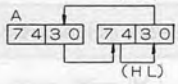
DAA	Decimal adjustment upon contents of A after add or subtract	00 100 111
CPL	$A \leftarrow \overline{A}$	00 101 111
NEG	$A \leftarrow \overline{A}+1$	11 101 101
		01 000 100
CCF	$CY \leftarrow \overline{CY}$	00 111 111
SCF	CY←1	00 110 111
NOP	No operation, but PC is incremented.	00 000 000
HALT	CPU halted	01 110 110
DI	IFF←0	11 110 011
EI	IFF←1	11 111 011
IM0	Set interrupt mode 0	11 101 101
		01 000 110
IM1	Set interrupt mode 1	11 101 101
		01 010 110
IM2	Set interrupt mode 2	11 101 101
		01 011 110

16-bit arithmetic group

ADD HL, ss	HL←HL+ss	00 ss1 001
ADC HL, ss	HL←HL+ss+CY	11 101 101
		01 ss1 010
SBC HL, ss	HL←HL−ss−CY	11 101 101
		01 ss0 010
ADD IX, pp	IX←IX+pp	11 011 101
		00 pp1 001
ADD IY, rr	IY←IY+rr	11 111 101
		00 rr1 001
INC ss	ss←ss+1	00 ss0 011
INC IX	IX←IX+1	11 011 101
		00 100 011
INC IY	IY←IY+1	11 111 101
		00 100 011
DEC ss	ss←ss−1	00 ss1 011
DEC IX	IX←IX−1	11 011 101
		00 101 011
DEC IY	IY←IY−1	11 111 101
		00 101 011

Rotate and shift group

RLCA		00 000 111
RLA		00 010 111
RRCA		00 001 111
RRA		00 011 111
RLC r		11 001 011
		00 [000] r
RLC (HL)		11 001 011
		00 [000] 110

Mnemonic	Symbolic operation	Op-code
RLC (IX+d)		11 011 101 11 001 011 ← d → 00 000 110
RLC (IY+d)		11 111 011 11 001 011 ← d → 00 000 110
RL m		010
RRC m		001
RR m		011
SLA m		100
SRA m		101
SRL m		111
RLD		11 101 101 01 101 111
RRD		11 101 101 01 100 111

Bit set, reset and test group

Mnemonic	Symbolic operation	Op-code
BIT b, r	$Z \leftarrow \overline{rb}$	11 001 011 01 b r
BIT b, (HL)	$Z \leftarrow \overline{(HL)b}$	11 011 011 01 b 110
BIT b, (IX+d)	$Z \leftarrow \overline{(IX+d)b}$	11 011 101 11 001 011 ← d → 01 b 110
BIT b, (IY+d)	$Z \leftarrow \overline{(IY+d)b}$	11 111 101 11 001 011 ← d → 01 b 110
SET b, r	rb←1	11 001 011 11 b r
SET b, (HL)	(HL)b←1	11 001 011 11 b 110
SET b, (IX+d)	(IX+d)b←1	11 001 101 11 001 011 ← d → 11 b 110
SET b, (IY+d)	(IY+d)b←1	11 111 101 11 001 011 ← d → 11 b 110
RES b, m	mb←0	10

Mnemonic	Symbolic operation	Op-code
Jump group		
JP nn	PC←nn	11 000 011 ← n → ← n →
JP cc, nn	If condition cc is true, PC←nn; otherwise, continue	11 cc 010 ← n → ← n →
JR e	PC←PC+e	00 011 000 ← e-2 →
JR C, e	If C=0, continue. If C=1, PC←PC+e	00 111 000 ← e-2 →
JR Z, e	If Z=0, continue. If C=1, PC←PC+e	00 101 000 ← e-2 →
JR NC, e	If C=1, continue. If C=0, PC←PC+e	00 110 000 ← e-2 →
JR NZ, e	If Z=1, continue. If Z=0, PC←PC+e	00 100 000 ← e-2 →
JP (HL)	PC←HL	11 101 001
JP (IX)	PC←IX	11 011 101 11 101 001
JP (IY)	PC←IY	11 111 101 11 101 001
DJNZ e	B←B−1 If B=0, continue; otherwise, PC←PC+e	00 010 000 ← e-2 →
Call and return group		
CALL nn	$(SP-1) \leftarrow PC_H$ $(SP-2) \leftarrow PC_L$ PC←nn	11 001 101 ← n → ← n →
CALL cc, nn	If condition cc is false, continue; otherwise same as CALL nn.	11 cc 100 ← n → ← n →
RET	$PC_L \leftarrow (SP)$ $PC_H \leftarrow (SP+1)$	11 001 001
RET cc	If condition cc is false, continue; otherwise same as RET.	11 cc 000
RETI	Return from interrupt	11 101 101 01 001 101
RETN	Return from $\overline{NMI}$.	11 101 101 01 000 101
RST p	$(SP-1) \leftarrow PC_H$ $(SP-2) \leftarrow PC_L$ $PC_H \leftarrow 0$ $PC_L \leftarrow p$	11 t 111

Mnemonic	Symbolic operation	Op-code
Input and output group		
IN A, (n)	A←(n)	11 011 011 ← n →
IN r, (C)	r←(C)	11 101 101 01 r 000
INI	(HL)←(C) B←B−1 HL←HL+1	11 101 101 10 100 010
INIR	(HL)←(C) B←B−1 HL←HL+1 Repeat until B=0	11 101 101 10 110 010
IND	(HL)←(C) B←B−1 HL←HL−1	11 101 101 10 101 010
INDR	(HL)←(C) B←B−1 HL←HL−1 Repeat until B=0	11 101 101 10 111 010
OUT (n), A	(n)←A	11 010 011 ← n →
OUT (C), r	(C)←r	11 101 101 01 r 001
OUTI	(C)←(HL) B←B−1 HL←HL+1	11 101 101 10 100 011
OTIR	(C)←(HL) B←B−1 HL←HL+1 Repeat until B=0	11 101 101 10 110 011
OUTD	(C)←(HL) B←B−1 HL←HL−1	11 101 101 10 101 011
OTDR	(C)←(HL) B←B−1 HL←HL−1 Repeat until B=0	11 101 101 10 111 011

(Note) The meanings of symbols used in the above table are as follows.

r, r'	Register
000	B
001	C
010	D
011	E
100	H
101	L
111	A

dd, ss	Register pair
00	B C
01	D E
10	H L
11	S P

qq	Register pair
00	B C
01	D E
10	H L
11	A F

pp	Register pair
00	B C
01	D E
10	I X
11	S P

rr	Register pair
00	B C
01	D E
10	I Y
11	S P

b	Bit set
000	0
001	1
010	2
011	3
100	4
101	5
110	6
111	7

cc	Condition	
000	N Z	non zero
001	Z	zero
010	N C	non carry
011	C	carry
100	P O	parity odd
101	P E	parity even
110	P	sign positive
111	M	sign negative

t	p
000	00H
001	08H
010	10H
011	18H
100	20H
101	28H
110	30H
111	38H

∧ : AND operation
∨ : OR operation
⊕ : Exclusive OR operation

s: r, n, (HL), (IX + d), (IY + d)
CY: Carry flip-flop
(register pair)$_H$: Upper 8 bits of register pair

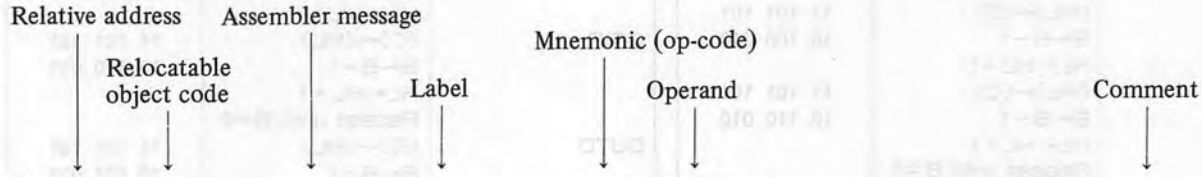
m : r, (HL), (IX + d), (IY + d)
m$_b$: Bit b or location m
(register pair)$_L$: Lower 8 bits of register pair

For op-codes ADC, SUB, SBC, AND, OR, XOR and CP, the bits in ☐ replace ☐ in the ADD set.
For op-code DEC, ☐ replaces ☐ in the INC set.
Similar operations apply to op-codes of the rotate and shift group and bit set, reset and test group.

A. 5 Monitor Program Assembly List

An assembly listing of the MONITOR 1Z-013A is provided on the following pages.

This assembly list was produced with the Z80 assembler contained in the floppy DOS. The meanings of symbols in the list are as follows.




```
20 02A7 13              INC     DE
21 02A8 13              INC     DE
22 02A9 13              INC     DE
23 02AA C9              RET
24 02AB                 ;
25 02AB                 ;
26 02AB                 ;
27 02AB                 ;ORG 02ABH ; MLDST
28 02AB                 ;
29 02AB                 ;    MELODY START & STOP
30 02AB                 ;
31 02AB                 MLDST:  ENT
32 02AB 2AA111                  LD      HL,(RATIO)
33 02AE 7C                      LD      A,H
34 02AF B7                      OR      A
35 02B0 280C                    JR      Z,MLDSP
36 02B2 D5                      PUSH    DE
37 02B3 EB                      EX      DE,HL
38 02B4 2104E0                  LD      HL,CONTO
39 02B7 73                      LD      (HL),E
40 02B8 72                      LD      (HL),D
41 02B9 3E01                    LD      A,1
42 02BB D1                      POP     DE
43 02BC 1806                    JR      MLDS1
44 02BE                 ;
45 02BE                 MLDSP:  ENT
46 02BE 3E36                    LD      A,36H           ; MODE SET (8253 C0)
47 02C0 3207E0                  LD      (CONTF),A       ; E007H
48 02C3 AF                      XOR     A
49 02C4 3208E0          MLDS1:  LD      (SUNDG),A       ; E008H
50 02C7 C9                      RET                     ; TEHRO RESET
```

Since the starting address of Monitor 1Z-013A is set to $0000, relocatable addresses and object codes in the assembly list can be assumed as absolute addresses and object code, respectively.

This assembly list is provided for reference, only and the Sharp Corporation can assume no responsibility for answering any question about it.

Note that this monitor differs from the monitor program included in the BASIC interpreter.

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 01          04.07.83

01 0000                 ;
02 0000                 ;
03 0000                 ;   MONITOR PROGRAM 1Z-013A
04 0000                 ;
05 0000                 ;          (MZ-700) FOR PAL
06 0000                 ;
07 0000                 ;          REV. 83.4.7
08 0000                 ;
09 0000                 ;
10 0000                 MONIT:  ENT
11 0000 C34A00                  JP      START           ; MONITOR ON
12 0003                 GETL:   ENT
13 0003 C3E607                  JP      ?GETL           ; GET LINE (END'CR')
14 0006                 LETNL:  ENT
15 0006 C30E09                  JP      ?LTNL           ; NEW LINE
16 0009                 NL:     ENT
17 0009 C31809                  JP      ?NL             ;
18 000C                 PRNTS:  ENT
19 000C C32009                  JP      ?PRTS           ; PRINT SPACE
20 000F                 PRNTT:  ENT
21 000F C32409                  JP      ?PRTT           ; PRINT TAB
22 0012                 PRNT:   ENT
23 0012 C33509                  JP      ?PRNT           ; 1 CHARACTER PRINT
24 0015                 MSG:    ENT
25 0015 C39308                  JP      ?MSG            ; 1 LINE PRINT (END'0DH'
)
26 0018                 MSGX:   ENT
27 0018 C3A108                  JP      ?MSGX           ; RST 3
28 001B                 GETKY:  ENT
29 001B C3BD08                  JP      ?GET            ; GET KEY
30 001E                 BRKEY:  ENT
31 001E C3320A                  JP      ?BRK            ; GET BREAK
32 0021                 WRINF:  ENT
33 0021 C33604                  JP      ?WRI            ; WRITE INFORMATION
34 0024                 WRDAT:  ENT
35 0024 C37504                  JP      ?WRD            ; WRITE DATA
36 0027                 RDINF:  ENT
37 0027 C3D804                  JP      ?RDI            ; READ INFORMATION
38 002A                 RDDAT:  ENT
39 002A C3F804                  JP      ?RDD            ; READ DATA
40 002D                 VERFY:  ENT
41 002D C38805                  JP      ?VRFY           ; VERIFING CMT
42 0030                 MELDY:  ENT
43 0030 C3C701                  JP      ?MLDY           ; RST 6
44 0033                 TIMST:  ENT
45 0033 C30803                  JP      ?TMST           ; TIME SET
46 0036 00                      NOP
47 0037 00                      NOP
48 0038 C33810                  JP      1038H           ; INTERRUPT ROUTINE
49 003B                 TIMRD:  ENT
50 003B C35803                  JP      ?TMRD           ; TIME READ
51 003E                 BELL:   ENT
52 003E C37705                  JP      ?BEL            ; BELL ON
53 0041                 XTEMP:  ENT
54 0041 C3E502                  JP      ?TEMP           ; TEMPO SET (1-7)
55 0044                 MSTA:   ENT
56 0044 C3AB02                  JP      MLDST           ; MELODY START
57 0047                 MSTP:   ENT
58 0047 C3BE02                  JP      MLDSP           ; MELODY STOP
59 004A                 ;
60 004A                 ;
```

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 02          04.07.83

01 004A                 ;
02 004A                 START:  ENT
03 004A 31F010                  LD      SP,SP           ; STACK SET (10F0H)
04 004D ED56                    IM      1               ; IM 1 SET
05 004F CD3E07                  CALL    ?MODE           ; 8255,8253 MODE SET
06 0052 CD320A                  CALL    ?BRK            ; CTRL ?
07 0055 3019                    JR      NC,STO
08 0057 FE20                    CP      20H             ; KEY IS CTRL KEY
09 0059 2015                    JR      NZ,STO
10 005B                 CMYO:   ENT
11 005B D3E1                    OUT     (E1H),A         ; D000H-FFFFH IS DRAM
12 005D 11F0FF                  LD      DE,FFF0H        ; TRANS. ADR.
13 0060 216B00                  LD      HL,$MCP         ; MEMORY CHANG PROGRAM
14 0063 010500                  LD      BC,05           ; BYTE SIZE
15 0066 EDB0                    LDIR
16 0068 C3F0FF                  JP      FFF0H           ; JUMP $FFF0
17 006B                 ;
18 006B                 $MCP:   ENT                     ; 0000H-0FFFH IS DRAM
19 006B D3E0                    DEFW    E0D3H           ; OUT (E0H),A
20 006D C300                    DEFW    00C3H           ; JP 0000H
21 006F 00                      DEFB    00H
22 0070                 ;
23 0070                 STO:    ENT
24 0070 06FF                    LD      B,FFH           ; BUFFER CLEAR
25 0072 21F110                  LD      HL,NAME         ; 10F1H-11F0H CLEAR
26 0075 CDD80F                  CALL    ?CLER
27 0078 3E16                    LD      A,16H           ; LASTER CLR.
28 007A CD1200                  CALL    PRNT
29 007D 3E71                    LD      A,71H           ; BACK:BLUE CHA.:WRITE
30 007F 2100D8                  LD      HL,D800H        ; COLOR ADDRESS
31 0082 CDD509                  CALL    #CLR8
32 0085 218D03                  LD      HL,TIMIN        ; INTERRUPT JUMP ROUTINE
33 0088 3EC3                    LD      A,C3H           ;
34 008A 323810                  LD      (1038H),A
35 008D 223910                  LD      (1039H),HL
36 0090 3E04                    LD      A,04            ; NORMAL TEMPO
37 0092 329E11                  LD      (TEMPW),A
38 0095 CDBE02                  CALL    MLDSP           ; MELODY STOP
39 0098 CD0900                  CALL    NL
40 009B 11E706                  LD      DE,MSG?3        ; ** MONITOR 1Z-013A **
41 009E DF                      RST     3               ; CALL MGX
42 009F CD7705                  CALL    ?BEL
43 00A2                 SS:     ENT
44 00A2 3E01                    LD      A,01H
45 00A4 329D11                  LD      (SWRK),A        ; KEY IN SILENT
46 00A7 2100E8                  LD      HL,E800H        ; USR ROM ?
47 00AA 77                      LD      (HL),A          ; ROM CHECK
48 00AB 1855                    JR      FD2
49 00AD                 ST1:    ENT
50 00AD CD0900                  CALL    NL
51 00B0 3E2A                    LD      A,2AH           ; '*' PRINT
52 00B2 CD1200                  CALL    PRNT
53 00B5 11A311                  LD      DE,BUFER        ; GET LINE WORK (11A3H)
54 00B8 CD0300                  CALL    GETL
55 00BB 1A                      LD      A,(DE)
56 00BC 13                      INC     DE
57 00BD FE0D                    CP      0DH
58 00BF 28EC                    JR      Z,ST1
59 00C1 FE4A                    CP      'J'             ; JUMP
60 00C3 282E                    JR      Z,GOTO
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 03          04.07.83

01 00C5 FE4C                    CP      'L'             ; LOAD PROGRAM
02 00C7 2848                    JR      Z,LOAD
03 00C9 FE46                    CP      'F'             ; FLOPPY ACCESS
04 00CB 2832                    JR      Z,FD
05 00CD FE42                    CP      'B'             ; KEY IN BELL
06 00CF 2826                    JR      Z,SG
07 00D1 FE23                    CP      '#'             ; CHANG MEMORY
08 00D3 2886                    JR      Z,CMYO
09 00D5 FE50                    CP      'P'             ; PRINTER TEST
10 00D7 287C                    JR      Z,PTEST
11 00D9 FE4D                    CP      'M'             ; MEMORY CORRECTION
12 00DB CAA807                  JP      Z,MCOR
13 00DE FE53                    CP      'S'             ; SAVED DATA
14 00E0 CA5E0F                  JP      Z,SAVE
15 00E3 FE56                    CP      'V'             ; VERIFYING DATA
16 00E5 CAC80F                  JP      Z,VRFY
17 00E8 FE44                    CP      'D'             ; DUMP DATA
18 00EA CA290D                  JP      Z,DUMP
19 00ED                 ;
20 00ED                 ;
21 00ED                         DEFS    +4
22 00F1                 ;
23 00F1 18C8                    JR      ST2             ; NOT COMMAND
24 00F3                 ;
25 00F3                 ;   JUMP COMMAND
26 00F3                 ;
27 00F3 CD3D01          GOTO:   CALL    HEXIY
28 00F6 E9                      JP      (HL)
29 00F7                 ;
30 00F7                 ;   KEY SOUND ON OFF
31 00F7                 ;
32 00F7 3A9D11          SG:     LD      A,(SWRK)        ; DO = SOUND WORK
33 00FA 1F                      RRA
34 00FB 3F                      CCF                     ; CHENGE MODE
35 00FC 17                      RLA
36 00FD 18A5                    JR      SS+2
37 00FF                 ;
38 00FF                 ;   FLOPPY
39 00FF                 ;
40 00FF 2100F0          FD:     LD      HL,F000H        ; FLOPPY I/O CHECK
41 0102 7E              FD2:    LD      A,(HL)
42 0103 B7                      OR      A
43 0104 20A7                    JR      NZ,ST1
44 0106 E9              FD1:    JP      (HL)
45 0107                 ;
46 0107                 ;
47 0107                 ;   ERROR (LOADING)
48 0107                 ;
49 0107                 ?ER:    ENT                     ;
50 0107 FE02                    CP      02H             ; A=02H : BREAK IN
51 0109 28A2                    JR      Z,ST1           ;
52 010B 114701                  LD      DE,MSGE1        ; CHECK SUM ERROR
53 010E DF                      RST     3               ; CALL MSGX
54 010F 189C                    JR      ST1
55 0111                 ;
56 0111                 ;
57 0111                 ;   LOAD COMMAND
58 0111                 ;
59 0111 CDD804          LOAD:   CALL    ?RDI
60 0114 38F1                    JR      C,?ER
```

```
   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 04          04.07.83

01 0116 CD0900          LOAO:   CALL    NL
02 0119 11A009                  LD      DE,MSG?2        ; LOADING
03 011C DF                      RST     3               ; CALL MSGX
04 011D 11F110                  LD      DE,NAME         ; FILE NAME
05 0120 DF                      RST     3               ; CALL MSGX
06 0121 CDF804                  CALL    ?RDD
07 0124 38E1                    JR      C,?ER
08 0126 2A0611                  LD      HL,(EXADR)      ; EXECUTE ADDRESS
09 0129 7C                      LD      A,H
10 012A FE12                    CP      12H             ; EXECUTE CHECK
11 012C 38E1                    JR      C,LOAD-2
12 012E E9                      JP      (HL)
13 012F                 ;
14 012F                 ;
15 012F                 ;
16 012F                 ;     GETLINE AND BREAK IN CHECK
17 012F                 ;
18 012F                 ;    EXIT BREAK IN THEN JUMP (ST1)
19 012F                 ;       ACC=TOP OF LINE DATA
20 012F                 ;
21 012F                 BGETL:  ENT
22 012F E3                      EX      (SP),HL
23 0130 C1                      POP     BC              ; STACK LOAD
24 0131 11A311                  LD      DE,BUFER        ; MONITOR GETLINE BUFF
25 0134 CD0300                  CALL    GETL
26 0137 1A                      LD      A,(DE)
27 0138 FE1B                    CP      1BH             ; BREAK CODE
28 013A 28D3                    JR      Z,LOAD-2        ; JP Z,ST1
29 013C E9                      JP      (HL)
30 013D                 ;
31 013D                 ;   ASCII TO HEX CONVERT
32 013D                 ;     INPUT (DE)=ASCII
33 013D                 ;     CY=1 THEN JUMP (ST1)
34 013D                 ;
35 013D                 HEXIY:  ENT
36 013D FDE3                    EX      (SP),IY
37 013F F1                      POP     AF
38 0140 CD1004                  CALL    HLHEX
39 0143 38CA                    JR      C,LOAD-2        ; JP C,ST1
40 0145 FDE9                    JP      (IY)
41 0147                 ;
42 0147                 ;
43 0147                 ;
44 0147                 MSGE1:  ENT
45 0147 43484543                DEFM    'CHECK SUM ER.'
46 014B 4B205355
47 014F 4D204552
48 0153 2E
49 0154 0D                      DEFB    0DH
50 0155                 ;
51 0155                 ;
52 0155                 ;   PLOTTER PRINTER TEST COMMAND
53 0155                 ;           (DPG23)
54 0155                 ;       &=CONTROL COMMANDS GROUP
55 0155                 ;          C=PEN CHENGE
56 0155                 ;          G=GRAPH MODE
57 0155                 ;          S=80 CHA. IN 1 LINE
58 0155                 ;          L=40 CHA. IN 1 LINE
59 0155                 ;          T=PLOTTER TEST
60 0155                 ;    IN  (DE)=PRINT DATA
```

```
0155                    ;
0155                    PTEST:  ENT
0155 1A                         LD      A,(DE)
0156 FE26                       CP      '&'
0158 2016                       JR      NZ,PTST1
015A 13                 PTST0:  INC     DE
015B 1A                         LD      A,(DE)
015C FE4C                       CP      'L'             ; 80 IN 1 LINE
015E 2816                       JR      Z,.LPT
0160 FE53                       CP      'S'             ; 80 IN 1LINE
0162 2817                       JR      Z,..LPT
0164 FE43                       CP      'C'             ; PEN CHENGE
0166 2823                       JR      Z,PEN
0168 FE47                       CP      'G'             ; GRAPH MODE
016A 2818                       JR      Z,PLOT
016C FE54                       CP      'T'             ; TEST
016E 2810                       JR      Z,PTRN
0170                    ;
0170 CDA501             PTST1:  CALL    PMSG            ; PLOT MESSAGE
0173 C3AD00                     JP      ST1
0176                    ;
0176 117004             .LPT:   LD      DE,LLPT         ; 01-09-09-0B-0D
0179 18F5                       JR      PTST1
017B                    ;
017B 11D503             ..LPT:  LD      DE,SLPT         ; 01-09-09-09-0D
017E 18F0                       JR      PTST1
0180                    ;
0180 3E04               PTRN:   LD      A,04H           ; TEST PATTERN
0182 1802                       JR      PLOT+2
0184                    ;
0184 3E02               PLOT:   LD      A,02H           ; GRAPH CODE
0186 CD8F01                     CALL    LPRNT
0189 18CF                       JR      PTST0
018B                    ;
018B 3E1D               PEN:    LD      A,1DH           ; 1 CHENGE CODE (TEXT MO
DE)
018D 18F7                       JR      PLOT+2
018F                    ;
018F                    ;
018F                    ;   1CHA. PRINT TO $LPT
018F                    ;
018F                    ;       IN: ACC PRINT DATA
018F                    ;
018F                    ;
018F 0E00               LPRNT:  LD      C,0             ; RDA TEST
0191 47                         LD      B,A             ; PRINT DATA STORE
0192 CDB601                     CALL    RDA
0195 78                         LD      A,B
0196 D3FF                       OUT     (FFH),A         ; DATA OUT
0198 3E80                       LD      A,80H           ; RDP HIGH
019A D3FE                       OUT     (FEH),A
019C 0E01                       LD      C,01H           ; RDA TEST
019E CDB601                     CALL    RDA
01A1 AF                         XOR     A               ; RDP LOW
01A2 D3FE                       OUT     (FEH),A
01A4 C9                         RET
01A5                    ;
01A5                    ;   $LPT  MSG.
01A5                    ;     IN: DE DATA LOW ADR.
01A5                    ;       ODH  MSG. END
01A5                    ;
```



```
01A5 D5                 PMSG:   PUSH    DE
01A6 C5                         PUSH    BC
01A7 F5                         PUSH    AF
01A8 1A                 PMSG1:  LD      A,(DE)          ; ACC=DATA
01A9 CD8F01                     CALL    LPRNT
01AC 1A                         LD      A,(DE)
01AD 13                         INC     DE
01AE FE0D                       CP      0DH             ; END ?
01B0 20F6                       JR      NZ,PMSG1
01B2 F1                         POP     AF
01B3 C1                         POP     BC
01B4 D1                         POP     DE
01B5 C9                         RET
01B6                    ;
01B6                    ;   RDA CHECK
01B6                    ;
01B6                    ;       BRKEY IN TO MONITOR RETURN
01B6                    ;     IN: C RDA CODE
01B6                    ;
01B6 DBFE               RDA:    IN      A,(FE)
01B8 E60D                       AND     0DH
01BA B9                         CP      C
01BB C8                         RET     Z
01BC CD1E00                     CALL    BRKEY
01BF 20F5                       JR      NZ,RDA
01C1 31F010                     LD      SP,SP
01C4 C3AD00                     JP      ST1
01C7                    ;
01C7                    ;
01C7                    ;ORG 01C7H
01C7                    ;
01C7                    ;   MELODY
01C7                    ;
01C7                    ;    DE=DATA LOW ADR.
01C7                    ;   EXIT  CF=1 BREAK
01C7                    ;         CF=0 OK
01C7                    ;
01C7                    ?MLDY:  ENT
01C7 C5                         PUSH    BC
01C8 D5                         PUSH    DE
01C9 E5                         PUSH    HL
01CA 3E02                       LD      A,02H
01CC 32A011                     LD      (OCTV),A
01CF 0601                       LD      B,01
01D1 1A                 MLD1:   LD      A,(DE)
01D2 FE0D                       CP      0DH             ; CR
01D4 283B                       JR      Z,MLD4
01D6 FEC8                       CP      0C8H            ; END MARK
01D8 2837                       JR      Z,MLD4
01DA FECF                       CP      0CFH            ; UNDER OCTAVE
01DC 2827                       JR      Z,MLD2
01DE FE2D                       CP      2DH             ; '-'
01E0 2823                       JR      Z,MLD2
01E2 FE2B                       CP      2BH             ; '+'
01E4 2827                       JR      Z,MLD3
01E6 FED7                       CP      0D7H            ; UPPER OCTAVE
01E8 2823                       JR      Z,MLD3
01EA FE23                       CP      23H             ; "#" HANON
01EC 216C02                     LD      HL,MTBL
01EF 2004                       JR      NZ,+6
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 07          04.07.83

01 01F1 218402              LD      HL,M#TBL
02 01F4 13                  INC     DE
03 01F5 CD1C02              CALL    ONPU            ; ONTYO SET
04 01F8 38D7                JR      C,MLD1
05 01FA CDC802              CALL    RYTHM           ;
06 01FD 3815                JR      C,MLD5
07 01FF CDAB02              CALL    MLDST           ; MELODY START
08 0202 41                  LD      B,C
09 0203 18CC                JR      MLD1
10 0205 3E03        MLD2:   LD      A,+3
11 0207 32A011              LD      (OCTV),A
12 020A 13                  INC     DE
13 020B 18C4                JR      MLD1
14 020D 3E01        MLD3:   LD      A,1
15 020F 18F6                JR      MLD2+2
16 0211 CDC802      MLD4:   CALL    RYTHM
17 0214 F5          MLD5:   PUSH    AF
18 0215 CDBE02              CALL    MLDSP
19 0218 F1                  POP     AF
20 0219 C39B06              JP      RET3
21 021C             ;
22 021C             ;   ONPU TO RATIO CONV
23 021C             ;
24 021C             ;   EXIT (RATIO)=RATIO VALUE
25 021C             ;         C=ONTYO*TEMPO
26 021C             ;
27 021C             ONPU:   ENT
28 021C C5                  PUSH    BC
29 021D 0608                LD      B,8
30 021F 1A          ONP1:   LD      A,(DE)
31 0220 BE                  CP      (HL)
32 0221 2809                JR      Z,ONP2
33 0223 23                  INC     HL
34 0224 23                  INC     HL
35 0225 23                  INC     HL
36 0226 10F8                DJNZ    -6
37 0228 37                  SCF
38 0229 13                  INC     DE
39 022A C1                  POP     BC
40 022B C9                  RET
41 022C 23          ONP2:   INC     HL
42 022D D5                  PUSH    DE
43 022E 5E                  LD      E,(HL)
44 022F 23                  INC     HL
45 0230 56                  LD      D,(HL)
46 0231 EB                  EX      DE,HL
47 0232 7C                  LD      A,H
48 0233 B7                  OR      A
49 0234 2809                JR      Z,+11
50 0236 3AA011              LD      A,(OCTV)        ; 11A0H OCTAVE WORK
51 0239 3D                  DEC     A
52 023A 2803                JR      Z,+5
53 023C 29                  ADD     HL,HL
54 023D 18FA                JR      -4
55 023F 22A111              LD      (RATIO),HL      ; 11A1H ONPU RATIO
56 0242 21A011              LD      HL,OCTV
57 0245 3602                LD      (HL),2
58 0247 2B                  DEC     HL
59 0248 D1                  POP     DE
60 0249 13                  INC     DE
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 08          04.07.83

01 024A 1A                  LD      A,(DE)
02 024B 47                  LD      B,A
03 024C E6F0                AND     F0H             ; ONTYO ?
04 024E FE30                CP      30H
05 0250 2803                JR      Z,+5
06 0252 7E                  LD      A,(HL)          ; HL=ONTYO
07 0253 1805                JR      +7
08 0255 13                  INC     DE
09 0256 78                  LD      A,B
10 0257 E60F                AND     0FH
11 0259 77                  LD      (HL),A          ; HL=ONTYO
12 025A 219C02              LD      HL,OPTBL
13 025D 85                  ADD     A,L
14 025E 6F                  LD      L,A
15 025F 4E                  LD      C,(HL)
16 0260 3A9E11              LD      A,(TEMPW)
17 0263 47                  LD      B,A
18 0264 AF                  XOR     A
19 0265 81          ONP3:   ADD     A,C
20 0266 10FD                DJNZ    -1
21 0268 C1                  POP     BC
22 0269 4F                  LD      C,A
23 026A AF                  XOR     A
24 026B C9                  RET
25 026C             ;
26 026C             ;
27 026C             MTBL:   ENT
28 026C 43                  DEFB    43H             ; C
29 026D 4608                DEFW    0846H
30 026F 44                  DEFB    44H             ; D
31 0270 5F07                DEFW    075FH
32 0272 45                  DEFB    45H             ; E
33 0273 9106                DEFW    0691H
34 0275 46                  DEFB    46H             ; F
35 0276 3306                DEFW    0633H
36 0278 47                  DEFB    47H             ; G
37 0279 8605                DEFW    0586H
38 027B 41                  DEFB    41H             ; A
39 027C EC04                DEFW    04ECH
40 027E 42                  DEFB    42H             ; B
41 027F 6404                DEFW    0464H
42 0281 52                  DEFB    52H             ; R
43 0282 0000                DEFW    0
44 0284             M#TBL:  ENT
45 0284 43                  DEFB    43H             ; #C
46 0285 CF07                DEFW    07CFH
47 0287 44                  DEFB    44H             ; #D
48 0288 F506                DEFW    06F5H
49 028A 45                  DEFB    45H             ; #E
50 028B 3306                DEFW    0633H
51 028D 46                  DEFB    46H             ; #F
52 028E DA05                DEFW    05DAH
53 0290 47                  DEFB    47H             ; #G
54 0291 3705                DEFW    0537H
55 0293 41                  DEFB    41H             ; #A
56 0294 A504                DEFW    04A5H
57 0296 42                  DEFB    42H             ; #B
58 0297 2304                DEFW    0423H
59 0299 52                  DEFB    52H             ; #R
60 029A
```

```
01 029A 0000                    DEFW   0
02 029C                 OPTBL:  ENT
03 029C 01                      DEFB   1
04 029D 02                      DEFB   2
05 029E 03                      DEFB   3
06 029F 04                      DEFB   4
07 02A0 06                      DEFB   6
08 02A1 08                      DEFB   8
09 02A2 0C                      DEFB   0CH
10 02A3 10                      DEFB   10H
11 02A4 18                      DEFB   18H
12 02A5 20                      DEFB   20H
13 02A6                 ;
14 02A6                 ;
15 02A6                 ;
16 02A6                 ;       INCREMENT DE REG.
17 02A6                 ;
18 02A6                 .4DE:   ENT
19 02A6 13                      INC    DE
20 02A7 13                      INC    DE
21 02A8 13                      INC    DE
22 02A9 13                      INC    DE
23 02AA C9                      RET
24 02AB                 ;
25 02AB                 ;
26 02AB                 ;
27 02AB                 ;ORG 02ABH ; MLDST
28 02AB                 ;
29 02AB                 ;   MELODY START & STOP
30 02AB                 ;
31 02AB                 MLDST:  ENT
32 02AB 2AA111                  LD     HL,(RATIO)
33 02AE 7C                      LD     A,H
34 02AF B7                      OR     A
35 02B0 280C                    JR     Z,MLDSP
36 02B2 D5                      PUSH   DE
37 02B3 EB                      EX     DE,HL
38 02B4 2104E0                  LD     HL,CONTO
39 02B7 73                      LD     (HL),E
40 02B8 72                      LD     (HL),D
41 02B9 3E01                    LD     A,1
42 02BB D1                      POP    DE
43 02BC 1806                    JR     MLDS1
44 02BE                 ;
45 02BE                 MLDSP:  ENT
46 02BE 3E36                    LD     A,36H           ; MODE SET (8253 C0)
47 02C0 3207E0                  LD     (CONTF),A       ; E007H
48 02C3 AF                      XOR    A
49 02C4 3208E0          MLDS1:  LD     (SUNDG),A       ; E008H
50 02C7 C9                      RET                    ; TEHRO RESET
51 02C8                 ;
52 02C8                 ;   RHYTHM
53 02C8                 ;
54 02C8                 ;     B=COUNT DATA
55 02C8                 ;        IN
56 02C8                 ;    EXIT CF=1 BREAK
57 02C8                 ;         CF=0 OK
58 02C8                 ;
59 02C8                 RYTHM:  ENT
60 02C8 2100E0                  LD     HL,KEYPA        ; E000H
```



```
01 02CB 36F8                    LD     (HL),F8H
02 02CD 23                      INC    HL
03 02CE 7E                      LD     A,(HL)
04 02CF E681                    AND    81H             ; BREAK IN CHECK
05 02D1 2002                    JR     NZ,+4
06 02D3 37                      SCF
07 02D4 C9                      RET
08 02D5 3A08E0                  LD     A,(TEMP)        ; E008H
09 02D8 0F                      RRCA                   ; TEMPO OUT
10 02D9 38FA                    JR     C,-4
11 02DB 3A08E0                  LD     A,(TEMP)
12 02DE 0F                      RRCA
13 02DF 30FA                    JR     NC,-4
14 02E1 10F2                    DJNZ   -12
15 02E3 AF                      XOR    A
16 02E4 C9                      RET
17 02E5                 ;
18 02E5                 ;
19 02E5                 ;   TEMPO SET
20 02E5                 ;
21 02E5                 ;     ACC=VALUE (1-7)
22 02E5                 ;
23 02E5                 ?TEMP:  ENT
24 02E5 F5                      PUSH   AF
25 02E6 C5                      PUSH   BC
26 02E7 E60F                    AND    0FH
27 02E9 47                      LD     B,A
28 02EA 3E08                    LD     A,8
29 02EC 90                      SUB    B
30 02ED 329E11                  LD     (TEMPW),A
31 02F0 C1                      POP    BC
32 02F1 F1                      POP    AF
33 02F2 C9                      RET
34 02F3                 ;
35 02F3                 ;         CRT MANAGMENT
36 02F3                 ;
37 02F3                 ;     EXIT  HL:DSPXY H=Y,L=X
38 02F3                 ;           DE:MANG ADR. (ON DSPXY)
39 02F3                 ;           A :MANG DATA
40 02F3                 ;           CY:MANG=1
41 02F3                 ;
42 02F3                 .MANG:  ENT
43 02F3 217311                  LD     HL,MANG         ; CRT MANG. POINTER
44 02F6 3A7211                  LD     A,(1172H)       ; DSPXY+1
45 02F9 85                      ADD    A,L
46 02FA 6F                      LD     L,A
47 02FB 7E                      LD     A,(HL)
48 02FC 23                      INC    HL
49 02FD CB16                    RL     (HL)
50 02FF B6                      OR     (HL)
51 0300 CB1E                    RR     (HL)
52 0302 0F                      RRCA
53 0303 EB                      EX     DE,HL
54 0304 2A7111                  LD     HL,(DSPXY)
55 0307 C9                      RET
56 0308                 ;
57 0308                 ;
58 0308                 ;
59 0308                 ;ORG 0308H
60 0308                 ;
```

```
                        ;   TIME SET
                        ;
                        ;      ACC=0 : AM
                        ;         =1 : PM
                        ;      DE=SEC: BINARY
                        ;
                        ?TMST:  ENT
0308 F3                         DI
0309 C5                         PUSH    BC
030A D5                         PUSH    DE
030B E5                         PUSH    HL
030C 329B11                     LD      (AMPM),A        ; AMPM DATA
030F 3EF0                       LD      A,F0H
0311 329C11                     LD      (TIMFG),A       ; TIME FLAG
0314 21C0A8                     LD      HL,A8C0H        ; 12H
0317 AF                         XOR     A
0318 ED52                       SBC     HL,DE           ; COUNT DATA = 12H-IN DA
TA
031A E5                         PUSH    HL
031B 00                         NOP
031C EB                         EX      DE,HL
031D 2107E0                     LD      HL,CONTF        ; E007H
0320 3674                       LD      (HL),74H
0322 36B0                       LD      (HL),B0H
0324 2B                         DEC     HL              ; CONT2
0325 73                         LD      (HL),E
0326 72                         LD      (HL),D
0327 2B                         DEC     HL              ; CONT1
0328 360A                       LD      (HL),0AH
032A 3600                       LD      (HL),0
032C 23                         INC     HL
032D 23                         INC     HL              ; CONTF
032E 3680                       LD      (HL),80H
0330 2B                         DEC     HL              ; CONT2
0331 4E                 ?TMS1:  LD      C,(HL)
0332 7E                         LD      A,(HL)
0333 BA                         CP      D
0334 20FB                       JR      NZ,?TMS1
0336 79                         LD      A,C
0337 BB                         CP      E
0338 20F7                       JR      NZ,?TMS1
033A 2B                         DEC     HL
033B 00                         NOP
033C 00                         NOP
033D 00                         NOP
033E 36FB                       LD      (HL),FBH        ; 1SEC
0340 363C                       LD      (HL),3CH
0342 23                         INC     HL
0343 D1                         POP     DE
0344 4E                 ?TMS2:  LD      C,(HL)
0345 7E                         LD      A,(HL)
0346 BA                         CP      D
0347 20FB                       JR      NZ,?TMS2
0349 79                         LD      A,C
034A BB                         CP      E
034B 20F7                       JR      NZ,?TMS2
034D E1                         POP     HL
034E D1                         POP     DE
034F C1                         POP     BC
0350 FB                         EI
0351 C9                         RET
```



```
                        ;
                        ;
                        ;   BELL DATA
                        ;
                        ?BELD:  ENT
0352 D7                         DEFB    D7H
0353 4130                       DEFM    'A0'
0355 0D                         DEFB    0DH
0356                    ;
0356                    ;
0356                    ;
0356                            DEFS    +2
                        ;ORG 0358H
0358                    ;
0358                    ;   TIME READ
0358                    ;
0358                    ;     EXIT  ACC=0 :AM
0358                    ;             =1 :PM
0358                    ;           DE=SEC. BINARY
0358                    ;
0358                    ?TMRD:  ENT
0358 E5                         PUSH    HL
0359 2107E0                     LD      HL,CONTF
035C 3680                       LD      (HL),80H
035E 2B                         DEC     HL              ; CONT2
035F F3                         DI
0360 5E                         LD      E,(HL)
0361 56                         LD      D,(HL)
0362 FB                         EI
0363 7B                         LD      A,E
0364 B2                         OR      D
0365 280E                       JR      Z,?TMR1
0367 AF                         XOR     A
0368 21C0A8                     LD      HL,A8C0H
036B ED52                       SBC     HL,DE
036D 3810                       JR      C,?TMR2
036F EB                         EX      DE,HL
0370 3A9B11                     LD      A,(AMPM)
0373 E1                         POP     HL
0374 C9                         RET
0375 11C0A8             ?TMR1:  LD      DE,A8C0H        ; 12H
0378 3A9B11                     LD      A,(AMPM)
037B EE01                       XOR     1
037D E1                         POP     HL
037E C9                         RET
037F F3                 ?TMR2:  DI
0380 2106E0                     LD      HL,CONT2
0383 7E                         LD      A,(HL)
0384 2F                         CPL
0385 5F                         LD      E,A
0386 7E                         LD      A,(HL)
0387 2F                         CPL
0388 57                         LD      D,A
0389 FB                         EI
038A 13                         INC     DE
038B 18EB                       JR      ?TMR1+3
038D                    ;
038D                    ;   TIME INTERRUPT
038D                    ;
038D                    TIMIN:  ENT
```

```
03BD F5                 PUSH    AF
03BE C5                 PUSH    BC
03BF D5                 PUSH    DE
0390 E5                 PUSH    HL
0391 219B11             LD      HL,AMPM
0394 7E                 LD      A,(HL)
0395 EE01               XOR     1
0397 77                 LD      (HL),A
0398 2107E0             LD      HL,CONTF
039B 3680               LD      (HL),80H
039D 2B                 DEC     HL              ; CONT2
039E E5                 PUSH    HL
039F 5E                 LD      E,(HL)
03A0 56                 LD      D,(HL)
03A1 21C0A8             LD      HL,A8C0H
03A4 19                 ADD     HL,DE
03A5 2B                 DEC     HL
03A6 2B                 DEC     HL
03A7 EB                 EX      DE,HL
03A8 E1                 POP     HL
03A9 73                 LD      (HL),E
03AA 72                 LD      (HL),D
03AB E1                 POP     HL
03AC D1                 POP     DE
03AD C1                 POP     BC
03AE F1                 POP     AF
03AF FB                 EI
03B0 C9                 RET
03B1                ;
03B1                ;       SPACE PRINT AND DISP ACC
03B1                ;
03B1                ;         INPUT:HL=DISP. ADR.
03B1                ;
03B1                SPHEX:  ENT
03B1 CD2009             CALL    ?PRTS           ; SP.PRINT
03B4 7E                 LD      A,(HL)
03B5 CDC303             CALL    PRTHX           ; DSP OF ACC (ASCII)
03B8 7E                 LD      A,(HL)
03B9 C9                 RET
03BA                ;
03BA                ;
03BA                ;
03BA                ;ORG 03BAH
03BA                ;
03BA                ;  (ASCII PRINT) FOR HL
03BA                ;
03BA                PRTHL:  ENT
03BA 7C                 LD      A,H
03BB CDC303             CALL    PRTHX
03BE 7D                 LD      A,L
03BF 1802               JR      PRTHX
03C1                ;       DEFS    +2
03C1                ;ORG 03C3H;PRTHX
03C3                ;
03C3                ;  (ASCII PRINT) FOR ACC
03C3                ;
03C3                PRTHX:  ENT
03C3 F5                 PUSH    AF
03C4 0F                 RRCA
```



```
03C5 0F                 RRCA
03C6 0F                 RRCA
03C7 0F                 RRCA
03C8 CDDA03             CALL    ASC
03CB CD1200             CALL    PRNT
03CE F1                 POP     AF
03CF CDDA03             CALL    ASC
03D2 C31200             JP      PRNT
03D5                ;
03D5                ;
03D5                ;
03D5                ;
03D5                ;    80 CHA. 1 LINE CODE (DATA)
03D5                ;
03D5                SLPT:   ENT
03D5 01                 DEFB    01H             ; TEXT MODE
03D6 09                 DEFB    09H
03D7 09                 DEFB    09H
03D8 09                 DEFB    09H
03D9 0D                 DEFB    0DH
03DA                ;
03DA                ;ORG 03DAH;ASC
03DA                ;
03DA                ;  HEXADECIMAL TO ASCII
03DA                ;    IN : ACC (D3-D0)=HEXADECIMAL
03DA                ;   EXIT: ACC = ASCII
03DA                ;
03DA                ASC:    ENT
03DA E60F               AND     0FH
03DC FE0A               CP      0AH
03DE 3802               JR      C,NOADD
03E0 C607               ADD     A,7
03E2                NOADD:  ENT
03E2 C630               ADD     A,30H
03E4 C9                 RET
03E5                ;
03E5                ;  ASCII TO HEXADECIMAL
03E5                ;  IN  : ACC = ASCII
03E5                ; EXIT : ACC = HEXADECIMAL
03E5                ;        CY  = 1 ERROR
03E5                ;
03E5                HEXJ:   ENT
03E5 D630               SUB     30H
03E7 D8                 RET     C
03E8 FE0A               CP      0AH
03EA 3F                 CCF
03EB D0                 RET     NC
03EC D607               SUB     7
03EE FE10               CP      10H
03F0 3F                 CCF
03F1 D8                 RET     C
03F2 FE0A               CP      0AH
03F4 C9                 RET
03F5                ;
03F5                ;
03F5                    DEFS    +4
03F9                ;ORG 03F9H;HEX
03F9                HEX:    ENT
03F9 18EA               JR      HEXJ
03FB                ;
```

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 15          04.07.83

01 03FB                 ;       PRASS PLAY MESSAGE
02 03FB                 ;
03 03FB                 MSG#1:  ENT
04 03FB 7F20                    DEFW    207FH
05 03FD                 MSG#2:  ENT
06 03FD 504C4159                DEFM    'PLAY'
07 0401 0D                      DEFB    0DH
08 0402                 MSG#3:  ENT
09 0402 7F20                    DEFW    207FH
10 0404 5245434F                DEFM    'RECORD.'       ; PRESS RECORD
11 0408 52442E
12 040B 0D                      DEFB    0DH
13 040C                 ;
14 040C                 ;
15 040C                         DEFS    +4
16 0410                 ;ORG 0410H;HLHEX
17 0410                 ;
18 0410                 ;
19 0410                 ;  4 ASCII TO (HL)
20 0410                 ;
21 0410                 ;  IN  DE=DATA LOW ADR.
22 0410                 ;  EXIT  CF=0 : OK
23 0410                 ;           =1 : OUT
24 0410                 ;
25 0410                 HLHEX:  ENT
26 0410 D5                      PUSH    DE
27 0411 CD1F04                  CALL    2HEX
28 0414 3807                    JR      C,+9
29 0416 67                      LD      H,A
30 0417 CD1F04                  CALL    2HEX
31 041A 3801                    JR      C,+3
32 041C 6F                      LD      L,A
33 041D D1              HL1:    POP     DE
34 041E C9                      RET
35 041F                 ;
36 041F                 ;ORG 041FH;2HEX
37 041F                 ;
38 041F                 ;
39 041F                 ;   2 ASCII TO (ACC)
40 041F                 ;
41 041F                 ;   IN  DE=DATA  LOW ADR.
42 041F                 ;
43 041F                 ;   EXIT  CF=0 : OK
44 041F                 ;           =1 : OUT
45 041F                 ;
46 041F                 2HEX:   ENT
47 041F C5                      PUSH    BC
48 0420 1A                      LD      A,(DE)
49 0421 13                      INC     DE
50 0422 CDF903                  CALL    HEX
51 0425 380D                    JR      C,+15
52 0427 0F                      RRCA
53 0428 0F                      RRCA
54 0429 0F                      RRCA
55 042A 0F                      RRCA
56 042B 4F                      LD      C,A
57 042C 1A                      LD      A,(DE)
58 042D 13                      INC     DE
59 042E CDF903                  CALL    HEX
60 0431 3801                    JR      C,+3
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 16          04.07.83

01 0433 B1                      OR      C
02 0434 C1              2HE1:   POP     BC
03 0435 C9                      RET
04 0436                 ;
05 0436                 ;
06 0436                 ;   WRITE INFORMATION
07 0436                 ;
08 0436                 ?WRI:   ENT
09 0436 F3                      DI
10 0437 D5                      PUSH    DE
11 0438 C5                      PUSH    BC
12 0439 E5                      PUSH    HL
13 043A 16D7                    LD      D,0D7H          ; 'W'
14 043C 1ECC                    LD      E,0CCH          ; 'L'
15 043E 21F010                  LD      HL,IBUFE        ; 10F0H
16 0441 018000                  LD      BC,80H          ; WRITE BYTE SIZE
17 0444 CD1A07          WRI1:   CALL    CKSUM           ; CHECK SUM
18 0447 CD9F06                  CALL    MOTOR           ; MOTOR ON
19 044A 3818                    JR      C,WRI3
20 044C 7B                      LD      A,E
21 044D FECC                    CP      0CCH            ; 'L'
22 044F 200D                    JR      NZ,WRI2
23 0451 CD0900                  CALL    NL
24 0454 D5                      PUSH    DE
25 0455 116704                  LD      DE,MSG#7        ; WRITING
26 0458 DF                      RST     3               ; CALL MSGX
27 0459 11F110                  LD      DE,NAME         ; FILE NAME
28 045C DF                      RST     3               ; CALL MSGX
29 045D D1                      POP     DE
30 045E CD7A07          WRI2:   CALL    GAP
31 0461 CD8A04                  CALL    WTAPE
32 0464 C35405          WRI3:   JP      RET2
33 0467                 ;
34 0467                 MSG#7:  ENT
35 0467 57524954                DEFM    'WRITING '
36 046B 494E4720
37 046F 0D                      DEFB    0DH
38 0470                 ;
39 0470                 ;
40 0470                 ;
41 0470                 ;     40 CHA. IN 1 LINE CODE (DATA)
42 0470                 ;
43 0470                 LLPT:   ENT
44 0470 01                      DEFB    01H             ; TEXT MODE
45 0471 09                      DEFB    09H
46 0472 09                      DEFB    09H
47 0473 0B                      DEFB    0BH
48 0474 0D                      DEFB    0DH
49 0475                 ;
50 0475                 ;ORG 0475H
51 0475                 ;
52 0475                 ;
53 0475                 ;   WRITE DATA
54 0475                 ;
55 0475                 ;    EXIT CF=0 : OK
56 0475                 ;           =1 : BREAK
57 0475                 ;
58 0475                 ?WRD:   ENT
59 0475 F3                      DI
60 0476 D5                      PUSH    DE
```

```
0477 C5                 PUSH    BC
0478 E5                 PUSH    HL
0479 16D7               LD      D,D7H           ; 'W'
047B 1E53               LD      E,53H           ; 'S'
047D ED4B0211           LD      BC,(SIZE)       ; WRITE DATA BYTE SIZE
0481 2A0411             LD      HL,(DTADR)      ; WRITE DATA ADDRESS
0484 78                 LD      A,B
0485 B1                 OR      C
0486 284A               JR      Z,RET1
0488 18BA               JR      WRI1
048A            ;
048A            ;
048A            ;   TAPE WRITE
048A            ;
048A            ;     BC=BYTE SIZE
048A            ;     HL=DATA LOW ADR.
048A            ;
048A            ;    EXIT  CF=0 : OK
048A            ;             =1 : BREAK
048A            ;
048A D5         WTAPE:  PUSH    DE
048B C5                 PUSH    BC
048C E5                 PUSH    HL
048D 1602               LD      D,2
048F 3EF8               LD      A,F8H
0491 3200E0             LD      (KEYPA),A       ; E000H
0494 7E         WTAP1:  LD      A,(HL)
0495 CD6707             CALL    WBYTE           ; 1 BYTE WRITE
0498 3A01E0             LD      A,(KEYPB)       ; E001H
049B E681               AND     81H             ; SHIFT & BREAK
049D C2A504             JP      NZ,WTAP2
04A0 3E02               LD      A,02H           ; BREAK IN CODE
04A2 37                 SCF
04A3 182D               JR      WTAP3
04A5 23         WTAP2:  INC     HL
04A6 0B                 DEC     BC
04A7 78                 LD      A,B
04A8 B1                 OR      C
04A9 C29404             JP      NZ,WTAP1
04AC 2A9711             LD      HL,(SUMDT)      ; SUM DATA SET
04AF 7C                 LD      A,H
04B0 CD6707             CALL    WBYTE
04B3 7D                 LD      A,L
04B4 CD6707             CALL    WBYTE
04B7 CD1A0A             CALL    LONG
04BA 15                 DEC     D
04BB C2C204             JP      NZ,+7
04BE B7                 OR      A
04BF C3D204             JP      WTAP3
04C2 0600               LD      B,0
04C4 CD010A             CALL    SHORT
04C7 05                 DEC     B
04C8 C2C404             JP      NZ,-4
04CB E1                 POP     HL
04CC C1                 POP     BC
04CD C5                 PUSH    BC
04CE E5                 PUSH    HL
04CF C39404             JP      WTAP1
04D2            WTAP3:
04D2 E1         RET1:   POP     HL
```



```
04D3 C1                 POP     BC
04D4 D1                 POP     DE
04D5 C9                 RET
04D6            ;
04D6            ;
04D6            ;
04D6            ;
04D6            ;
04D8                    ORG     04D8H
04D8            ;
04D8            ;
04D8            ;   READ INFORMATION (FROM $CMT)
04D8            ;
04D8            ;    EXIT ACC=0 : OK CF=0
04D8            ;            =1 : ER CF=1
04D8            ;            =2 : BREAK CF=1
04D8            ;
04D8            ?RDI:   ENT
04D8 F3                 DI
04D9 D5                 PUSH    DE
04DA C5                 PUSH    BC
04DB E5                 PUSH    HL
04DC 16D2               LD      D,D2H           ; 'R'
04DE 1ECC               LD      E,CCH           ; 'L'
04E0 018000             LD      BC,80H
04E3 21F010             LD      HL,IBUFE
04E6            RD1:    ENT
04E6 CD9F06             CALL    MOTOR
04E9 DA7205             JP      C,RTP6
04EC CD5B06             CALL    TMARK
04EF DA7205             JP      C,RTP6
04F2 CD0E05             CALL    RTAPE
04F5 C35405             JP      RTP4
04F8            ;
04F8            ;
04F8            ;
04F8            ;ORG 04F8H
04F8            ;
04F8            ;
04F8            ;   READ DATA (FROM $CMT)
04F8            ;
04F8            ;      EXIT SAME UP
04F8            ;
04F8            ?RDD:   ENT
04F8 F3                 DI
04F9 D5                 PUSH    DE
04FA C5                 PUSH    BC
04FB E5                 PUSH    HL
04FC 16D2               LD      D,D2H           ; 'R'
04FE 1E53               LD      E,53H           ; 'S'
0500 ED4B0211           LD      BC,(SIZE)
0504 2A0411             LD      HL,(DTADR)
0507 78                 LD      A,B
0508 B1                 OR      C
0509 CA5405             JP      Z,RTP4
050C 18D8               JR      RD1
050E            ;
050E            ;
050E            ;   READ TAPE
050E            ;
```

```
   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 19          04.07.83

01 050E                    ;     IN  BC=SIZE
02 050E                    ;           DE=LOAD ADR.
03 050E                    ;
04 050E                    ;     EXIT  ACC=0 : OK CF=0
05 050E                    ;               =1 : ER   =1
06 050E                    ;               =2 : BREAK=1
07 050E                    ;
08 050E                    RTAPE:  ENT
09 050E D5                         PUSH   DE
10 050F C5                         PUSH   BC
11 0510 E5                         PUSH   HL
12 0511 2602                       LD     H,2             ; TWICE WRITE
13 0513                    RTP1:   ENT
14 0513 0101E0                     LD     BC,KEYPB
15 0516 1102E0                     LD     DE,CSTR
16 0519                    RTP2:   ENT
17 0519 CD0106                     CALL   EDGE            ; 1→0 EDGE DETECT
18 051C 3854                       JR     C,RTP6
19 051E CD4A0A                     CALL   DLY3            ; CALL DLY2*3
20 0521 1A                         LD     A,(DE)          ; DATA (1BIT) READ
21 0522 E620                       AND    20H
22 0524 CA1905                     JP     Z,RTP2
23 0527 54                         LD     D,H
24 0528 210000                     LD     HL,0
25 052B 229711                     LD     (SUMDT),HL
26 052E E1                         POP    HL              ;
27 052F C1                         POP    BC
28 0530 C5                         PUSH   BC
29 0531 E5                         PUSH   HL
30 0532                    RTP3:   ENT
31 0532 CD2406                     CALL   RBYTE           ; 1BYTE READ
32 0535 383B                       JR     C,RTP6
33 0537 77                         LD     (HL),A
34 0538 23                         INC    HL
35 0539 0B                         DEC    BC
36 053A 78                         LD     A,B
37 053B B1                         OR     C
38 053C 20F4                       JR     NZ,RTP3
39 053E 2A9711                     LD     HL,(SUMDT)      ; CHECK SUM
40 0541 CD2406                     CALL   RBYTE           ; CHECK SUM DATA
41 0544 382C                       JR     C,RTP6
42 0546 5F                         LD     E,A
43 0547 CD2406                     CALL   RBYTE           ; CHECK SUM DATA
44 054A 3826                       JR     C,RTP6
45 054C BD                         CP     L
46 054D 2016                       JR     NZ,RTP5
47 054F 7B                         LD     A,E
48 0550 BC                         CP     H
49 0551 2012                       JR     NZ,RTP5
50 0553                    RTP8:   ENT
51 0553 AF                         XOR    A
52 0554                    RTP4:   ENT
53 0554                    RET2:   ENT
54 0554 E1                         POP    HL
55 0555 C1                         POP    BC
56 0556 D1                         POP    DE
57 0557 CD0007                     CALL   MSTOP
58 055A F5                         PUSH   AF
59 055B 3A9C11                     LD     A,(TIMFG)       ; INT. CHECK
60 055E FEF0                       CP     F0H
```

```
   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 20          04.07.83

01 0560 2001                       JR     NZ,+3
02 0562 FB                         EI
03 0563 F1                         POP    AF
04 0564 C9                         RET
05 0565                    ;
06 0565                    RTP5:   ENT
07 0565 15                         DEC    D
08 0566 2806                       JR     Z,RTP7
09 0568 62                         LD     H,D
10 0569 CDE20F                     CALL   GAPCK
11 056C 18A5                       JR     RTP1
12 056E                    RTP7:   ENT
13 056E 3E01                       LD     A,1
14 0570 1802                       JR     RTP9
15 0572                    RTP6:   ENT
16 0572 3E02                       LD     A,2
17 0574                    RTP9:   ENT
18 0574 37                         SCF
19 0575 18DD                       JR     RTP4
20 0577                    ;
21 0577                    ;
22 0577                    ;    BELL
23 0577                    ;
24 0577                    ?BEL:   ENT
25 0577 D5                         PUSH   DE
26 0578 115203                     LD     DE,?BELD
27 057B F7                         RST    6               ; CALL MELDY
28 057C D1                         POP    DE
29 057D C9                         RET
30 057E                    ;
31 057E                    ;     FLASING AND KEYIN
32 057E                    ;        EXIT:ACC INPUT KEY DATA(DSP.CODE)
33 057E                    ;             H=F0H THEN NO KEYIN(Z FLG.)
34 057E                    ;
35 057E                    FLKEY:  ENT
36 057E CDFF09                     CALL   ?FLAS
37 0581 CDCA08                     CALL   ?KEY
38 0584 FEF0                       CP     F0H
39 0586 C9                         RET
40 0587                    ;
41 0587                    ;
42 0587                    ;
43 0587                    ;
44 0587                    ;
45 0587                            DEFS   +1
46 0588                    ;ORG 0588H
47 0588                    ;
48 0588                    ;
49 0588                    ;    VERIFY (FROM $CMT)-
50 0588                    ;
51 0588                    ;     EXIT ACC =0 : OK CF=0
52 0588                    ;              =1 : ER CF=1
53 0588                    ;              =2 : BREAK CF=1
54 0588                    ;
55 0588                    ?VRFY:  ENT
56 0588 F3                         DI
57 0589 D5                         PUSH   DE
58 058A C5                         PUSH   BC
59 058B E5                         PUSH   HL
60 058C ED4B0211                   LD     BC,(SIZE)
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 21          04.07.83

0590 2A0411             LD      HL,(DTADR)
0593 16D2               LD      D,D2H           ; 'R'
0595 1E53               LD      E,53H           ; 'S'
0597 78                 LD      A,B
0598 B1                 OR      C
0599 28B9               JR      Z,RTP4
059B CD1A07             CALL    CKSUM
059E CD9F06             CALL    MOTOR
05A1 38CF               JR      C,RTP6
05A3 CD5B06             CALL    TMARK           ; TAPE MARK DETECT
05A6 38CA               JR      C,RTP6
05A8 CDAD05             CALL    TVRFY
05AB 18A7               JR      RTP4
                ;
                ;
                ;   DATA VERIFY
                ;
                ;     BC=SIZE
                ;     HL=DATA LOW ADR
                ;     CSMDT=CHECK SUM
                ;    EXIT ACC=0 : OK CF=0
                ;           =1 : ER   =1
                ;           =2 : BREAK=1
                ;
                ;
05AD            TVRFY:  ENT
05AD D5                 PUSH    DE
05AE C5                 PUSH    BC
05AF E5                 PUSH    HL
05B0 2602               LD      H,2
05B2            TVF1:   ENT
05B2 0101E0             LD      BC,KEYPB
05B5 1102E0             LD      DE,CSTR
05B8            TVF2:   ENT
05B8 CD0106             CALL    EDGE
05BB DA7205             JP      C,RTP6
05BE CD4A0A             CALL    DLY3            ; CALL DLY2*3
05C1 1A                 LD      A,(DE)
05C2 E620               AND     20H
05C4 CAB805             JP      Z,TVF2
05C7 54                 LD      D,H
05C8 E1                 POP     HL
05C9 C1                 POP     BC
05CA C5                 PUSH    BC
05CB E5                 PUSH    HL
05CC            TVF3:   ENT
05CC CD2406             CALL    RBYTE
05CF 38A1               JR      C,RTP6
05D1 BE                 CP      (HL)
05D2 209A               JR      NZ,RTP7
05D4 23                 INC     HL
05D5 0B                 DEC     BC
05D6 78                 LD      A,B
05D7 B1                 OR      C
05D8 20F2               JR      NZ,TVF3
05DA 2A9911             LD      HL,(CSMDT)
05DD CD2406             CALL    RBYTE
05E0 BC                 CP      H
05E1 208B               JR      NZ,RTP7
05E3 CD2406             CALL    RBYTE
```

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 22          04.07.83

05E6 BD                 CP      L
05E7 2085               JR      NZ,RTP7
05E9 15                 DEC     D
05EA CA5305             JP      Z,RTP8
05ED 62                 LD      H,D
05EE 18C2               JR      TVF1
05F0            ;
05F0            ;   FLASHING DATA LOAD
05F0            ;
05F0            ?LOAD:  ENT
05F0 F5                 PUSH    AF
05F1 3A8E11             LD      A,(FLASH)
05F4 CDB10F             CALL    ?PONT
05F7 77                 LD      (HL),A
05F8 F1                 POP     AF
05F9 C9                 RET
05FA            ;
05FA            ;
05FA            ;   NEW LINE AND PRINT HL REG.(ASCII)
05FA            ;
05FA            NLPHL:  ENT
05FA CD0900             CALL    NL
05FD CDBA03             CALL    PRTHL
0600 C9                 RET
0601            ;
0601            ;
0601            ;ORG 0601H;EDGE
0601            ;
0601            ;
0601            ;   EDGE      (TAPE DATA EDGE DETECT)
0601            ;
0601            ;   BC=KEYPB ($E001)
0601            ;   DE=CSTR  ($E002)
0601            ;   EXIT CF=0 OK :    CF=1 BREAK
0601            ;
0601            EDGE:   ENT
0601 3EF8               LD      A,F8H           ; BREAK KEY IN
0603 3200E0             LD      (KEYPA),A
0606 00                 NOP
0607            EDG1:   ENT
0607 0A                 LD      A,(BC)
0608 E681               AND     81H             ; SHIFT & BREAK
060A 2002               JR      NZ,+4
060C 37                 SCF
060D C9                 RET
060E 1A                 LD      A,(DE)
060F E620               AND     20H
0611 20F4               JR      NZ,EDG1         ; CSTR D5 = 0
0613            EDG2:   ENT
0613 0A                 LD      A,(BC)          ; 8
0614 E681               AND     81H             ; 9
0616 2002               JR      NZ,+4           ; 10/14
0618 37                 SCF
0619 C9                 RET
061A 1A                 LD      A,(DE)          ; 8
061B E620               AND     20H             ; 9
061D 28F4               JR      Z,EDG2          ; CSTR D5 = 1  :10/14
061F C9                 RET                     ; 11
0620            ;
0620            ;
```

```
** Z80 ASSEMBLER SB-7201 <1Z-013A> PAGE 23          04.07.83

0620                    DEFS   +4
0624                ;ORG 0624H;RBYTE
0624                ;
0624                ;
0624                ;   1 BYTE READ
0624                ;
0624                ;     EXIT  SUMDT=STORE
0624                ;      CF=1 : BREAK
0624                ;
0624                ;      CF=0 : DATA=ACC
0624                ;
0624                RBYTE:  ENT
0624 C5                     PUSH   BC
0625 D5                     PUSH   DE
0626 E5                     PUSH   HL
0627 210008                 LD     HL,0800H
062A 0101E0                 LD     BC,KEYPB        ; KEY DATA $E001
062D 1102E0                 LD     DE,CSTR         ; $TAPE DATA $E002
0630                RBY1:   ENT
0630 CD0106                 CALL   EDGE            ; 41 OR 101
0633 DA5406                 JP     C,RBY3          ; 13
0636 CD4A0A                 CALL   DLY3            ; 20+18*63+33
0639 1A                     LD     A,(DE)          ; DATA READ :8
063A E620                   AND    20H
063C CA4906                 JP     Z,RBY2
063F E5                     PUSH   HL
0640 2A9711                 LD     HL,(SUMDT)
0643 23                     INC    HL
0644 229711                 LD     (SUMDT),HL
0647 E1                     POP    HL
0648 37                     SCF
0649                RBY2:   ENT
0649 7D                     LD     A,L
064A 17                     RLA
064B 6F                     LD     L,A
064C 25                     DEC    H
064D C23006                 JP     NZ,RBY1
0650 CD0106                 CALL   EDGE
0653 7D                     LD     A,L
0654                RBY3:   ENT
0654 E1                     POP    HL
0655 D1                     POP    DE
0656 C1                     POP    BC
0657 C9                     RET
0658                ;
0658                ;
0658                ;   TAPE MARK DETECT
0658                ;
0658                ;     E=@L@ :INFORMATION
0658                ;       =@S@ :DATA
0658                ;    EXIT CF=0 :OK
0658                ;           =1 :BREAK
0658                ;
0658                        DEFS   +3
065B                ;
065B                TMARK:  ENT
065B                ;
065B                ;ORG 065BH
065B                ;
065B CDE20F                 CALL   GAPCK
```

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** Z80 ASSEMBLER SB-7201 <1Z-013A> PAGE 24          04.07.83

065E C5                     PUSH   BC              ; ORG 065EH
065F D5                     PUSH   DE
0660 E5                     PUSH   HL
0661 212828                 LD     HL,2828H
0664 7B                     LD     A,E
0665 FECC                   CP     CCH             ; 'L'
0667 2B03                   JR     Z,+5
0669 211414                 LD     HL,1414H
066C 229511                 LD     (TMCNT),HL
066F 0101E0                 LD     BC,KEYPB
0672 1102E0                 LD     DE,CSTR
0675                TM1:    ENT
0675 2A9511                 LD     HL,(TMCNT)
0678                TM2:    ENT
0678 CD0106                 CALL   EDGE
067B 381E                   JR     C,TM4
067D CD4A0A                 CALL   DLY3            ; CALL DLY2*3
0680 1A                     LD     A,(DE)
0681 E620                   AND    20H
0683 28F0                   JR     Z,TM1
0685 25                     DEC    H
0686 20F0                   JR     NZ,TM2
0688                TM3:    ENT
0688 CD0106                 CALL   EDGE
068B 380E                   JR     C,TM4
068D CD4A0A                 CALL   DLY3            ; CALL DLY2*3
0690 1A                     LD     A,(DE)
0691 E620                   AND    20H
0693 20E0                   JR     NZ,TM1
0695 2D                     DEC    L
0696 20F0                   JR     NZ,TM3
0698 CD0106                 CALL   EDGE
069B                RET3:   ENT
069B                TM4:    ENT
069B E1                     POP    HL
069C D1                     POP    DE
069D C1                     POP    BC
069E C9                     RET
069F                ;
069F                ;
069F                ;   MOTOR ON
069F                ;
069F                ;     IN  D=@W@ :WRITE
069F                ;         =@R@ :READ
069F                ;    EXIT CF=0 :OK
069F                ;           =1 :BREAK
069F                MOTOR:  ENT
069F C5                     PUSH   BC
06A0 D5                     PUSH   DE
06A1 E5                     PUSH   HL
06A2 060A                   LD     B,10
06A4                MOT1:   ENT
06A4 3A02E0                 LD     A,(CSTR)
06A7 E610                   AND    10H
06A9 280E                   JR     Z,MOT4
06AB                MOT2:   ENT
06AB 06FF                   LD     B,FFH           ; 2 SEC DELAY
06AD CD9609                 CALL   DLY12           ; 7 MSEC DELAY
06B0 1802                   JR     +4              ;MOTOR ENTRY ADJUST
06B2 18EB                   JR     MOTOR           ; ORG 06B2H
```

```
06B4 10F7                       DJNZ    -7
06B6 AF                         XOR     A
06B7                    MOT7:   ENT
06B7 18E2                       JR      RET3
06B9                    MOT4:   ENT
06B9 3E06                       LD      A,06H
06BB 2103E0                     LD      HL,CSTPT
06BE 77                         LD      (HL),A
06BF 3C                         INC     A
06C0 77                         LD      (HL),A
06C1 10E1                       DJNZ    MOT1
06C3 CD0900                     CALL    NL
06C6 7A                         LD      A,D
06C7 FED7                       CP      D7H             ; 'W'
06C9 2805                       JR      Z,MOT8
06CB 11FB03                     LD      DE,MSG#1        ; PLAY MARK
06CE 1807                       JR      MOT9
06D0                    MOT8:   ENT
06D0 110204                     LD      DE,MSG#3        ; "RECORD."
06D3 DF                         RST     3               ; CALL MSGX
06D4 11FD03                     LD      DE,MSG#2        ; "PLAY"
06D7                    MOT9:   ENT
06D7 DF                         RST     3               ; CALL MSGX
06D8                    MOT5:   ENT
06D8 3A02E0                     LD      A,(CSTR)
06DB E610                       AND     10H
06DD 20CC                       JR      NZ,MOT2
06DF CD320A                     CALL    ?BRK
06E2 20F4                       JR      NZ,MOT5
06E4 37                         SCF
06E5 18D0                       JR      MOT7
06E7                    ;
06E7                    ;       INITIAL MESSAGE
06E7                    ;
06E7                    MSG?3:  ENT
06E7 2A2A2020                   DEFM    '**  MONITOR 1Z-013A  **'
06EB 4D4F4E49
06EF 544F5220
06F3 315A2D30
06F7 31334120
06FB 202A2A
06FE 0D                         DEFB    0DH
06FF                    ;
06FF                    ;
06FF                            DEFS    +1
0700                    ;
0700                    ;
0700                    ;ORG 0700H;MSTOP
0700                    ;
0700                    ;
0700                    ;  MOTOR STOP
0700                    ;
0700                    MSTOP:  ENT
0700 F5                         PUSH    AF
0701 C5                         PUSH    BC
0702 D5                         PUSH    DE
0703 060A                       LD      B,10
0705                    MST1:   ENT
0705 3A02E0                     LD      A,(CSTR)
0708 E610                       AND     10H
```



```
070A 280B                       JR      Z,MST3
070C                    MST2:   ENT
070C 3E06                       LD      A,06H
070E 3203E0                     LD      (CSTPT),A
0711 3C                         INC     A
0712 3203E0                     LD      (CSTPT),A
0715 10EE                       DJNZ    MST1
0717                    MST3:   ENT
0717 C3E60E                     JP      ?RSTR1
071A                    ;
071A                    ;
071A                    ;
071A                    ;   CHECK SUM
071A                    ;
071A                    ;     IN    BC=SIZE
071A                    ;           HL=DATA ADR.
071A                    ;     EXIT SUMDT=STORE
071A                    ;           CSMDT=STORE
071A                    ;
071A                    CKSUM:  ENT
071A C5                         PUSH    BC
071B D5                         PUSH    DE
071C E5                         PUSH    HL
071D 110000                     LD      DE,0
0720                    CKS1:   ENT
0720 78                         LD      A,B
0721 B1                         OR      C
0722 200B                       JR      NZ,CKS2
0724 EB                         EX      DE,HL
0725 229711                     LD      (SUMDT),HL
0728 229911                     LD      (CSMDT),HL
072B E1                         POP     HL
072C D1                         POP     DE
072D C1                         POP     BC
072E C9                         RET
072F                    CKS2:   ENT
072F 7E                         LD      A,(HL)
0730 C5                         PUSH    BC
0731 0608                       LD      B,+8
0733                    CKS3:   ENT
0733 07                         RLCA
0734 3001                       JR      NC,+3
0736 13                         INC     DE
0737 10FA                       DJNZ    CKS3
0739 C1                         POP     BC
073A 23                         INC     HL
073B 0B                         DEC     BC
073C 18E2                       JR      CKS1
073E                    ;
073E                    ;   MODE SET OF KEYPORT
073E                    ;
073E                    ?MODE:  ENT
073E 2103E0                     LD      HL,KEYPF
0741 368A                       LD      (HL),8AH        ; 10001010
0743 3607                       LD      (HL),07H        ; PC3=1
0745 3605                       LD      (HL),05H        ; PC2=1
0747                    VGOFF:  ENT
0747                    ;
0747 C9                         RET
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 27          04.07.83

01 0748                    ;
02 0748                    ;
03 0748                          DEFS   +17
04 0759                    ;
05 0759                    ;ORG 0759H;DLY1
06 0759                    ;
07 0759                    ;   107 MICRO SEC DELY
08 0759                    ;
09 0759                    DLY1:   ENT
10 0759 3E15                       LD     A,15H          ; 18*21+20
11 075B 3D                         DEC    A
12 075C C25B07                     JP     NZ,-1
13 075F C9                         RET
14 0760                    ;
15 0760                    ;ORG 0760H;DLY2
16 0760                    ;
17 0760                    DLY2:   ENT
18 0760 3E13                       LD     A,13H          ; 18*19+20
19 0762 3D                         DEC    A
20 0763 C26207                     JP     NZ,-1
21 0766 C9                         RET
22 0767                    ;
23 0767                    ;
24 0767                    ;
25 0767                    ;
26 0767                    ;
27 0767                    ;  1 BYTE WRITE
28 0767                    ;
29 0767                    WBYTE:  ENT
30 0767 C5                         PUSH   BC
31 0768 0608                       LD     B,+8
32 076A CD1A0A                     CALL   LONG
33 076D                    WBY1:   ENT
34 076D 07                         RLCA
35 076E DC1A0A                     CALL   C,LONG
36 0771 D4010A                     CALL   NC,SHORT
37 0774 05                         DEC    B
38 0775 C26D07                     JP     NZ,WBY1
39 0778 C1                         POP    BC
40 0779 C9                         RET
41 077A                    ;
42 077A                    ;
43 077A                    ;   GAP + TAPEMARK
44 077A                    ;
45 077A                    ;    E=@L@ LONG GAP
46 077A                    ;     =@S@ SHORT GAP
47 077A                    ;
48 077A                    GAP:    ENT
49 077A C5                         PUSH   BC
50 077B D5                         PUSH   DE
51 077C 7B                         LD     A,E
52 077D 01F055                     LD     BC,55F0H
53 0780 112828                     LD     DE,2828H
54 0783 FECC                       CP     CCH            ; 'L'
55 0785 CA8E07                     JP     Z,GAP1
56 0788 01F82A                     LD     BC,2AF8H
57 078B 111414                     LD     DE,1414H
58 078E                    GAP1:   ENT
59 078E CD010A                     CALL   SHORT
60 0791 0B                         DEC    BC
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 28          04.07.83

01 0792 78                         LD     A,B
02 0793 B1                         OR     C
03 0794 20FB                       JR     NZ,-6
04 0796                    GAP2:   ENT
05 0796 CD1A0A                     CALL   LONG
06 0799 15                         DEC    D
07 079A 20FA                       JR     NZ,-4
08 079C                    GAP3:   ENT
09 079C CD010A                     CALL   SHORT
10 079F 1D                         DEC    E
11 07A0 20FA                       JR     NZ,-4
12 07A2 CD1A0A                     CALL   LONG
13 07A5 D1                         POP    DE
14 07A6 C1                         POP    BC
15 07A7 C9                         RET
16 07A8                    ;
17 07A8                    ;    MEMORY CORRECTION
18 07A8                    ;       COMMAND 'M'
19 07A8                    ;
20 07A8                    MCOR:   ENT
21 07A8 CD3D01                     CALL   HEXIY          ; CRRECTION ADR.
22 07AB                    MCR1:   ENT
23 07AB CDFA05                     CALL   NLPHL          ; COR. ADR. PRINT
24 07AE CDB103                     CALL   SPHEX          ; ACC ⇔ ASCII DISP.
25 07B1 CD2009                     CALL   ?PRTS          ; SPACE PRINT
26 07B4 CD2F01                     CALL   BGETL          ; GET DATA & CHECK DATA
27 07B7 CD1004                     CALL   HLHEX          ; HL←ASCII(DE)
28 07BA 381B                       JR     C,MCR3
29 07BC CDA602                     CALL   .4DE           ; (INC DE)*4
30 07BF 13                         INC    DE
31 07C0 CD1F04                     CALL   2HEX           ; DATA CHECK
32 07C3 38E6                       JR     C,MCR1
33 07C5 BE                         CP     (HL)
34 07C6 20E3                       JR     NZ,MCR1
35 07C8 13                         INC    DE
36 07C9 1A                         LD     A,(DE)
37 07CA FE0D                       CP     0DH            ; NOT CORRECTION ?
38 07CC 2806                       JR     Z,MCR2
39 07CE CD1F04                     CALL   2HEX           ; ACC←HL(ASCII)
40 07D1 38D8                       JR     C,MCR1
41 07D3 77                         LD     (HL),A         ; DATA CORRECT
42 07D4                    MCR2:   ENT
43 07D4 23                         INC    HL
44 07D5 18D4                       JR     MCR1
45 07D7                    ;
46 07D7 60                 MCR3:   LD     H,B            ; MEMORY ADR.
47 07D8 69                         LD     L,C
48 07D9 18D0                       JR     MCR1
49 07DB                    ;
50 07DB                    ;
51 07DB                    ;
52 07DB                    ;
53 07DB                    ;
54 07E6                          ORG    07E6H
55 07E6                    ;
56 07E6                    ;
57 07E6                    ;
58 07E6                    ;   GET 1 LINE STATEMENT  *
59 07E6                    ;
60 07E6                    ;      DE = DATA STORE LOW ADR.
```

```
0007E6                  ;           (END =CR )
0007E6                  ;
0007E6                  ;
0007E6                  ?GETL:  ENT
0007E6 F5                       PUSH    AF
0007E7 C5                       PUSH    BC
0007E8 E5                       PUSH    HL
0007E9 D5                       PUSH    DE
0007EA                  GETL1:  ENT
0007EA CDB309                   CALL    ??KEY           ; ENTRY KEY
0007ED                  AUTO3:  ENT
0007ED F5                       PUSH    AF              ; IN KEY DATA SAVE
0007EE 47                       LD      B,A
0007EF 3A9D11                   LD      A,(SWRK)        ; BELL WORK
0007F2 0F                       RRCA
0007F3 D47705                   CALL    NC,?BEL         ; ENTRY BELL
0007F6 78                       LD      A,B
0007F7 217011                   LD      HL,KANAF        ; KANA & GRAPH FLAG
0007FA E6F0                     AND     F0H
0007FC FEC0                     CP      C0H
0007FE D1                       POP     DE              ; Ereg=FLAGreg
0007FF 78                       LD      A,B
000800 2016                     JR      NZ,GETL2
000802 FECD                     CP      CDH             ; CR
000804 2855                     JR      Z,GETL3
000806 FECB                     CP      CBH             ; BREAK
000808 CA2208                   JP      Z,GETLC
00080B FECF                     CP      CFH             ; NIKO MARK WH.
00080D 2809                     JR      Z,GETL2
00080F FEC7                     CP      C7H             ; CRT EDITION
000811 300A                     JR      NC,GETL5
000813 CB1B                     RR      E               ; CY ?
000815 78                       LD      A,B
000816 3005                     JR      NC,GETL5
000818                  GETL2:  ENT
000818 CDB50D                   CALL    ?DSP
00081B 18CD                     JR      GETL1
00081D                  GETL5:  ENT
00081D CDDC0D                   CALL    ?DPCT           ; CRT CONTROL
000820 18C8                     JR      GETL1
000822                  ;
000822                  ;     BREAK IN
000822                  ;
000822 E1               GETLC:  POP     HL
000823 E5                       PUSH    HL
000824 361B                     LD      (HL),1BH        ; BREAK CODE
000826 23                       INC     HL
000827 360D                     LD      (HL),0DH
000829 1853                     JR      GETLR
00082B                  ;  GETLA
00082B                  ;
00082B 0F               GETLA:  RRCA                    ; CY<D7
00082C 3037                     JR      NC,GETL6
00082E 1833                     JR      GETLB
000830                  ;
000830                  ;
000830                  ;
000830                  ;    DELAY 7M SEC AND SWEP
000830                  ;
000830 CD9609           DSWEP:  CALL    DLY12
```



```
000833 CD500A                   CALL    ?SWEP
000836 C9                       RET
000837                  ;
000837                  ;
000837                          DEFS    36
00085B                  ;
00085B                  ;
00085B                  ;
00085B                  ; ORG 085BH;GETL3
00085B                  ;
00085B CDF302           GETL3:  CALL    .MANG           ; CR
00085E 0628                     LD      B,40            ; 1LINE
000860 30C9                     JR      NC,GETLA
000862 25                       DEC     H               ; BEFORE LINE
000863 0650             GETLB:  LD      B,80            ; 2 LINE
000865 2E00             GETL6:  LD      L,0
000867 CDB40F                   CALL    ?PNT1
00086A D1                       POP     DE              ; STORE TOP ADR.
00086B D5                       PUSH    DE
00086C 7E               GETLZ:  LD      A,(HL)
00086D CDCE0B                   CALL    ?DACN
000870 12                       LD      (DE),A
000871 23                       INC     HL
000872 13                       INC     DE
000873 10F7                     DJNZ    GETLZ
000875 EB                       EX      DE,HL
000876 360D             GETLU:  LD      (HL),0DH
000878 2B                       DEC     HL
000879 7E                       LD      A,(HL)
00087A FE20                     CP      20H             ; SPACE THEN CR
00087C                  ;
00087C                  ;
00087C                  ;   CR AND NEW LINE
00087C                  ;
00087C 28F8                     JR      Z,GETLU
00087E                  ;
00087E                  ;   NEW LINE RETURN
00087E                  ;
00087E CD0E09           GETLR:  CALL    ?LTNL
000881 D1                       POP     DE
000882 E1                       POP     HL
000883 C1                       POP     BC
000884 F1                       POP     AF
000885 C9                       RET
000886                  ;
000886                  ;
000886                  ;
000886                          DEFS    +13
000893                  ;ORG 0893H
000893                  ;
000893                  ;   MESSAGE PRINT
000893                  ;
000893                  ;    DE PRINT DATA LOW ADR.
000893                  ;       END=CR
000893                  ;
000893                  ?MSG:   ENT
000893 F5                       PUSH    AF
000894 C5                       PUSH    BC
000895 D5                       PUSH    DE
000896 1A               MSG1:   LD      A,(DE)
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 31          04.07.83

01 0897 FE0D                    CP      0DH             ; CR
02 0899 280C                    JR      Z,MSGX2
03 089B CD3509                  CALL    ?PRNT
04 089E 13                      INC     DE
05 089F 18F5                    JR      MSG1
06 08A1                 ;
07 08A1                 ;
08 08A1                 ;ORG 08A1H
09 08A1                 ;
10 08A1                 ;  ALL PRINT MESSAGE
11 08A1                 ;
12 08A1                 ?MSGX:  ENT
13 08A1 F5                      PUSH    AF
14 08A2 C5                      PUSH    BC
15 08A3 D5                      PUSH    DE
16 08A4 1A              MSGX1:  LD      A,(DE)
17 08A5 FE0D                    CP      0DH
18 08A7 CAE60E          MSGX2:  JP      Z,?RSTR1
19 08AA CDB90B                  CALL    ?ADCN
20 08AD CD6C09                  CALL    PRNT3
21 08B0 13                      INC     DE
22 08B1 18F1                    JR      MSGX1
23 08B3                 ;
24 08B3                 ;   TOP OF KEYTBLS
25 08B3                 ;
26 08B3 112A0C          ?KYSM:  LD      DE,KTBLS
27 08B6 1842                    JR      ?KY5
28 08B8                 ;
29 08B8                 ;   BREAK CODE IN
30 08B8                 ;
31 08B8 3ECB            #BRK:   LD      A,CBH           ; BREAK CODE
32 08BA B7                      OR      A
33 08BB 1819                    JR      ?KY1
34 08BD                 ;
35 08BD                 ;
36 08BD                 ;ORG 08BDH
37 08BD                 ;
38 08BD                 ;   GETKEY
39 08BD                 ;
40 08BD                 ;       NOT ECHO BACK
41 08BD                 ;
42 08BD                 ;     EXIT:ACC=ASCII CODE
43 08BD                 ;
44 08BD                 ?GET:   ENT
45 08BD CDCA08                  CALL    ?KEY            ; KEY IN (DISPLAY CODE)
46 08C0 D6F0                    SUB     F0H             ; NOT KEYIN CODE
47 08C2 C8                      RET     Z
48 08C3 C6F0                    ADD     A,F0H
49 08C5 C3CE0B                  JP      ?DACN           ; DIAPLAY TO ASCII CODE
50 08C8                 ;
51 08C8                 ;
52 08C8                         DEFS    +2
53 08CA                 ;
54 08CA                 ;
55 08CA                 ;
56 08CA                 ;
57 08CA                 ;ORG 08CAH;?KEY
58 08CA                 ;
59 08CA                 ;   1KEY INPUT
60 08CA                 ;  IN      B = KEY MODE(SHIFT,CTRL,BREAK)
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 32          04.07.83

01 08CA                 ;          C = KEY DATA (COLUMN & ROW)
02 08CA                 ;  EXIT    ACC=DISPLAY CODE
03 08CA                 ;          IF NO KEY   ACC=F0H
04 08CA                 ;        IF CY=1 THEN ATTRIBUTE ON
05 08CA                 ;                (SMALL,HIRAKANA)
06 08CA                 ;
07 08CA                 ?KEY:   ENT
08 08CA C5                      PUSH    BC
09 08CB D5                      PUSH    DE
10 08CC E5                      PUSH    HL
11 08CD CD3008                  CALL    DSWEP           ; DELAY AND KEY SWEP
12 08D0 78                      LD      A,B
13 08D1 07                      RLCA
14 08D2 3806                    JR      C,?KY2
15 08D4 3EF0                    LD      A,F0H
16 08D6                 ?KY1:   ENT
17 08D6 E1                      POP     HL
18 08D7 D1                      POP     DE
19 08D8 C1                      POP     BC
20 08D9 C9                      RET
21 08DA                 ;
22 08DA                 ?KY2:   ENT
23 08DA 11EA0B                  LD      DE,KTBL         ; NORMAL KEY TABLE
24 08DD 78                      LD      A,B
25 08DE FE88                    CP      88H             ; BREAK IN
26 08E0 28D6                    JR      Z,#BRK
27 08E2 2600                    LD      H,0             ; HL=ROW & COLUMN
28 08E4 69                      LD      L,C
29 08E5 CB6F                    BIT     5,A             ; CTRL CHECK
30 08E7 200E                    JR      NZ,?KY5-3
31 08E9 3A7011                  LD      A,(KANAF)       ; 0=NR.,1=GRAPH
32 08EC 0F                      RRCA
33 08ED DAFE08                  JP      C,?KYGRP        ; GRAPH MODE
34 08F0 78                      LD      A,B             ; CTRL KEY CHECK
35 08F1 17                      RLA
36 08F2 17                      RLA
37 08F3 38BE                    JR      C,?KYSM
38 08F5 1803                    JR      ?KY5
39 08F7 11AA0C                  LD      DE,KTBLC        ; CONTROL KEY TABLE
40 08FA                 ?KY5:   ENT
41 08FA 19                      ADD     HL,DE           ; TABLE
42 08FB                 ?KY55:  ENT
43 08FB 7E                      LD      A,(HL)
44 08FC 18D8                    JR      ?KY1
45 08FE                 ?KYGRP: ENT
46 08FE CB70                    BIT     6,B
47 0900 2807                    JR      Z,?KYGRS
48 0902 11E90C                  LD      DE,KTBLG
49 0905 19                      ADD     HL,DE
50 0906 37                      SCF
51 0907 18F2                    JR      ?KY55
52 0909                 ;
53 0909 116A0C          ?KYGRS: LD      DE,KTBLGS
54 090C 18EC                    JR      ?KY5
55 090E                 ;
56 090E                 ;
57 090E                 ;
58 090E                 ;
59 090E                 ;
60 090E                 ;ORG 090EH
```

```
0910                    ;
0910                    ;   NEWLINE
0910                    ;
0910                    ?LTNL:  ENT
0910 AF                         XOR     A
0911 329411                     LD      (DPRNT),A       ; ROW POINTER
0914 3ECD                       LD      A,CDH           ; CR
0916 1843                       JR      PRNT5
0918                            DEFS    +2
0918                    ;ORG 0918H
0918                    ;
0918                    ?NL:    ENT
0918 3A9411                     LD      A,(DPRNT)
091B B7                         OR      A
091C C8                         RET     Z
091D 18EF                       JR      ?LTNL
091F                            DEFS    +1
0920                    ;ORG 0920H
0920                    ;
0920                    ;   PRINT SPACE
0920                    ;
0920                    ?PRTS:  ENT
0920 3E20                       LD      A,20H
0922 1811                       JR      ?PRNT
0924                    ;
0924                    ;   PRINT TAB
0924                    ;
0924                    ?PRTT:  ENT
0924 CD0C00                     CALL    PRNTS
0927 3A9411                     LD      A,(DPRNT)
092A B7                         OR      A
092B C8                         RET     Z
092C D60A                       SUB     +10
092E 38F4                       JR      C,-10
0930 20FA                       JR      NZ,-4
0932                            DEFS    +3
0935                    ;ORG 0935H
0935                    ;
0935                    ;   PRINT
0935                    ;
0935                    ;       IN ACC = PRINT DATA (ASCII)
0935                    ;
0935                    ?PRNT:  ENT
0935 FE0D                       CP      0DH             ; CR
0937 28D5                       JR      Z,?LTNL
0939 C5                         PUSH    BC
093A 4F                         LD      C,A
093B 47                         LD      B,A
093C CD4609                     CALL    ?PRT
093F 78                         LD      A,B
0940 C1                         POP     BC
0941 C9                         RET
0942                    ;
0942                    ;
0942                    MSGOK:  ENT
0942 4F4B21                     DEFM    'OK!'
0945 0D                         DEFB    0DH
0946                    ;ORG 0946H
0946                    ;
0946                    ;  PRINT ROUTINE
```



```
0946                    ;       1 CHA.
0946                    ;   INPUT:C=ASCII DATA (?DSP+?DPCT)
0946                    ;
0946                    ?PRT:   ENT
0946 79                         LD      A,C
0947 CDB90B                     CALL    ?ADCN           ; ASCII TO DSPLAY
094A 4F                         LD      C,A
094B FEF0                       CP      F0H
094D C8                         RET     Z               ; ZERO=ILLEGAL DATA
094E E6F0                       AND     F0H             ; MSD CHECK
0950 FEC0                       CP      C0H
0952 79                         LD      A,C
0953 2017                       JR      NZ,PRNT3
0955 FEC7                       CP      C7H
0957 3013                       JR      NC,PRNT3        ; CRT EDITOR
0959                    PRNT5:  ENT
0959 CDDC0D                     CALL    ?DPCT
095C FEC3                       CP      C3H
095E 280F                       JR      Z,PRNT4
0960 FEC5                       CP      C5H             ; HOME
0962 2803                       JR      Z,PRNT2
0964 FEC6                       CP      C6H             ; CLR
0966 C0                         RET     NZ
0967 AF                 PRNT2:  XOR     A
0968 329411                     LD      (DPRNT),A
096B C9                         RET
096C                    PRNT3:  ENT
096C CDB50D                     CALL    ?DSP
096F 3A9411             PRNT4:  LD      A,(DPRNT)       ; TAB POINT+1
0972 3C                         INC     A
0973 FE50                       CP      +80
0975 38F1                       JR      C,PRNT2+1
0977 D650                       SUB     +80
0979 18ED                       JR      PRNT2+1
097B                    ;
097B                    ;
097B                    ;
097B                    ;
097B                    ;
097B                    ;   FLASSING BYPASS 1
097B                    ;
097B                    FLAS1:  ENT
097B 3A8E11                     LD      A,(FLASH)
097E 186F                       JR      FLAS2
0980                    ;
0980                    ;   BREAK SUBROUTINE BYPASS 1
0980                    ;
0980                    ;       CTRL OR NOT KEY
0980                    ;
0980                    ?BRK2:  ENT
0980 CB6F                       BIT     5,A             ; NOT OR CTRL
0982 2802                       JR      Z,?BRK3         ; CTRL
0984 B7                         OR      A               ; NOTKEY A=7FH
0985 C9                         RET
0986                    ;
0986 3E20               ?BRK3:  LD      A,20H           ; CTRL D5=1
0988 B7                         OR      A               ; ZERO FLG. CLR
0989 37                         SCF
098A C9                         RET
098B                    ;
```

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 35          04.07.83

01 098B                 MSGSV:  ENT
02 098B 46494C45                DEFM   'FILENAME? '
03 098F 4E414D45
04 0993 3F20
05 0995 0D                      DEFB   0DH
06 0996                 ;
07 0996                 ;   DLY 7  MSEC
08 0996                 ;
09 0996                 DLY12:  ENT
10 0996 C5                      PUSH   BC
11 0997 0615                    LD     B,15H
12 0999 CD4A0A                  CALL   DLY3
13 099C 10FB                    DJNZ   -3
14 099E C1                      POP    BC
15 099F C9                      RET
16 09A0                 ;
17 09A0                 ;
18 09A0                 ;
19 09A0                 ;   LOADING MESSAGE
20 09A0                 ;
21 09A0                 MSG?2:  ENT
22 09A0 4C4F4144                DEFM   'LOADING '
23 09A4 494E4720
24 09A8 0D                      DEFB   0DH
25 09A9                 ;
26 09A9                 ;
27 09A9                 ;
28 09A9                 ;   DELAY FOR LONG PULSE
29 09A9                 ;
30 09A9                 DLY4:   ENT
31 09A9 3E59                    LD     A,59H           ; 18*89+20
32 09AB 3D                      DEC    A
33 09AC C2AB09                  JP     NZ,-1
34 09AF C9                      RET
35 09B0                 ;
36 09B0                 ;
37 09B0                         DEFS   +3
38 09B3                 ;
39 09B3                 ;
40 09B3                 ;ORG 09B3H;??KEY
41 09B3                 ;
42 09B3                 ;   KEY BOAD SEARCH
43 09B3                 ;     & DISPLAY CODE CONV.
44 09B3                 ;
45 09B3                 ;     EXIT A = DISPLAY CODE
46 09B3                 ;          CY= GRAPH MODE
47 09B3                 ;     WITH CURSOR DISPLAY
48 09B3                 ;
49 09B3                 ??KEY:  ENT
50 09B3 E5                      PUSH   HL
51 09B4 CD920B                  CALL   ?SAVE
52 09B7                 KSL1:   ENT
53 09B7 CD7E05                  CALL   FLKEY           ; KEY
54 09BA 20FB                    JR     NZ,KSL1         ; KEY IN THEN JUMP
55 09BC                 KSL2:   ENT
56 09BC CD7E05                  CALL   FLKEY
57 09BF 28FB                    JR     Z,KSL2          ; NOT KEY IN THEN JUMP
58 09C1 67                      LD     H,A
59 09C2 CD9609                  CALL   DLY12           ; DELAY CHATTER
60 09C5 CDCA0B                  CALL   ?KEY
```

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 36          04.07.83

01 09C8 F5                      PUSH   AF
02 09C9 BC                      CP     H               ; CHATER CHECK
03 09CA E1                      POP    HL
04 09CB 20EF                    JR     NZ,KSL2
05 09CD E5                      PUSH   HL
06 09CE F1                      POP    AF              ; IN KEY DATA
07 09CF CDF005                  CALL   ?LOAD           ; FLSHING DATA LOAD
08 09D2 E1                      POP    HL
09 09D3 C9                      RET
10 09D4                 ;
11 09D4                 ;
12 09D4                 ;   CLEAR 2
13 09D4                 ;
14 09D4                 #CLR0B: ENT                    ; CY FLG.
15 09D4 AF                      XOR    A
16 09D5                 #CLR8:  ENT
17 09D5 010008                  LD     BC,0800H
18 09D8                 CLEAR:  ENT                    ; BC = CLR BYTE SIZE
19 09D8 D5                      PUSH   DE              ; A = CLR DATA
20 09D9 57                      LD     D,A
21 09DA                 CLEAR1: ENT
22 09DA 72                      LD     (HL),D
23 09DB 23                      INC    HL
24 09DC 0B                      DEC    BC
25 09DD 78                      LD     A,B
26 09DE B1                      OR     C
27 09DF 20F9                    JR     NZ,CLEAR1
28 09E1 D1                      POP    DE
29 09E2 C9                      RET
30 09E3                 ;
31 09E3                 ;
32 09E3                 ;
33 09E3                 ;
34 09E3                 ;   FLASHING 2
35 09E3                 ;
36 09E3                 ?FLS:   ENT
37 09E3 F5                      PUSH   AF
38 09E4 E5                      PUSH   HL
39 09E5 3A02E0                  LD     A,(KEYPC)
40 09E8 07                      RLCA
41 09E9 07                      RLCA
42 09EA 388F                    JR     C,FLAS1
43 09EC 3A9211                  LD     A,(FLSDT)
44 09EF                 FLAS2:  ENT
45 09EF CDB10F                  CALL   ?PONT           ; DISPLAY POSITION
46 09F2 77                      LD     (HL),A
47 09F3                 FLAS3:  ENT
48 09F3 E1                      POP    HL
49 09F4 F1                      POP    AF
50 09F5 C9                      RET
51 09F6                 ;
52 09F6                 ;
53 09F6                 ;
54 09F6                         DEFS   +9
55 09FF                 ;
56 09FF                 ;
57 09FF                 ;ORG 09FF ; ?FLAS
58 09FF                 ;
59 09FF                 ?FLAS:  ENT
60 09FF 18E2                    JR     ?FLS
```

```
0A01                    ;
0A01                    ;
0A01                    ;
0A01                    ;  SHORT AND LONG PULSE FOR 1 BIT WRITE
0A01                    ;
0A01                    SHORT:  ENT
0A01 F5                         PUSH    AF              ; 12
0A02 3E03                       LD      A,03H           ; 9
0A04 3203E0                     LD      (CSTPT),A       ; $E003 PC3=1:16
0A07 CD5907                     CALL    DLY1            ; 20+18*21+20
0A0A CD5907                     CALL    DLY1            ; 20+18*21+20
0A0D 3E02                       LD      A,02H           ; 9
0A0F 3203E0                     LD      (CSTPT),A       ; $E003 PC3=0:16
0A12 CD5907                     CALL    DLY1            ; 20+18*21+20
0A15 CD5907                     CALL    DLY1            ; 20+18*21+20
0A18 F1                         POP     AF              ; 11
0A19 C9                         RET                     ; 11
0A1A                    ;
0A1A                    ;
0A1A                    LONG:   ENT
0A1A F5                         PUSH    AF              ; 11
0A1B 3E03                       LD      A,03H           ; 9
0A1D 3203E0                     LD      (CSTPT),A       ; 16
0A20 CDA909                     CALL    DLY4            ; 20+18*89+20
0A23 3E02                       LD      A,02H           ; 9
0A25 3203E0                     LD      (CSTPT),A       ; 16
0A28 CDA909                     CALL    DLY4            ; 20+18*89+20
0A2B F1                         POP     AF              ; 11
0A2C C9                         RET                     ; 11
0A2D                    ;
0A2D                    ;
0A2D                            DEFS    +5
0A32                    ;
0A32                    ;
0A32                    ;ORG 0A32H
0A32                    ;
0A32                    ;   BREAK KEY CHECK
0A32                    ;     AND SHIFT,CTNL KEY CHECK
0A32                    ;
0A32                    ;     EXIT BREAK ON : ZERO=1
0A32                    ;                OFF: ZERO=0
0A32                    ;          NO KEY   : CY  =0
0A32                    ;          KEY IN   : CY  =1
0A32                    ;           A D6=1  : SHIFT ON
0A32                    ;               =0  :       OFF
0A32                    ;             D5=1  : CTRL ON
0A32                    ;               =0  :       OFF
0A32                    ;             D4=1  : SFT+CNT ON
0A32                    ;               =0            OFF
0A32                    ;
0A32                    ?BRK:   ENT
0A32 3EF8                       LD      A,F8H           ; LINE 8SWEEP
0A34 3200E0                     LD      (KEYPA),A
0A37 00                         NOP
0A38 3A01E0                     LD      A,(KEYPB)
0A3B B7                         OR      A
0A3C 1F                         RRA
0A3D DA8009                     JP      C,?BRK2         ; SHIFT ?
0A40 17                         RLA
0A41 17                         RLA
```



```
0A42 3004                       JR      NC,?BRK1        ; BREAK ?
0A44 3E40                       LD      A,40H           ; SHIFT D6=1
0A46 37                         SCF
0A47 C9                         RET
0A48                    ;
0A48                    ;
0A48 AF                 ?BRK1:  XOR     A               ; SHIFT ?
0A49 C9                         RET
0A4A                    ;
0A4A                    ;
0A4A                    ;   320 U SEC DELAY
0A4A                    ;
0A4A                    DLY3:   ENT
0A4A 3E3F                       LD      A,3FH           ; 18*63+33
0A4C C36207                     JP      0762H           ; JP DLY2+2
0A4F                    ;
0A4F                    ;
0A4F                            DEFS    +1
0A50                    ;
0A50                    ;
0A50                    ;
0A50                    ;ORG 0A50H ; ?SWEP
0A50                    ;
0A50                    ;
0A50                    ;   KEY BOAD SWEEP
0A50                    ;
0A50                    ;   EXIT B,D7=0  NO DATA
0A50                    ;             =1  DATA
0A50                    ;          D6=0   SHIFT OFF
0A50                    ;             =1  SHIFT ON
0A50                    ;          D5=0   CTRL OFF
0A50                    ;             =1  CTRL ON
0A50                    ;          D4=0   SHIFT+CTRL OFF
0A50                    ;             =1  SHIFT+CTRL ON
0A50                    ;           C    = ROW & COLOUMN
0A50                    ;                7 6 5 4 3 2 1 0
0A50                    ;                * * ↑ ↑ ↑ ← ← ←
0A50                    ;
0A50                    ?SWEP:  ENT
0A50 D5                         PUSH    DE
0A51 E5                         PUSH    HL
0A52 AF                         XOR     A
0A53 06F8                       LD      B,F8H
0A55 57                         LD      D,A
0A56 CD320A                     CALL    ?BRK
0A59 2004                       JR      NZ,SWEP6
0A5B 1688                       LD      D,88H           ; BREAK ON
0A5D 1814                       JR      SWEP9
0A5F                    SWEP6:  ENT
0A5F 3005                       JR      NC,SWEP0
0A61 57                         LD      D,A
0A62 1802                       JR      SWEP0
0A64                    SWEP01: ENT
0A64 CBFA                       SET     7,D
0A66                    SWEP0:  ENT
0A66 05                         DEC     B
0A67 78                         LD      A,B
0A68 3200E0                     LD      (KEYPA),A
0A6B FEEF                       CP      EFH             ; MAP SWEEP END ?
0A6D 2008                       JR      NZ,SWEP3
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 39          04.07.83

0A6F FEF8                   CP      F8H             ; BREAK KEY ROW
0A71 28F3                   JR      Z,SWEP0
0A73                SWEP9:  ENT
0A73 42                     LD      B,D
0A74 E1                     POP     HL
0A75 D1                     POP     DE
0A76 C9                     RET
0A77                ;
0A77                SWEP3:  ENT
0A77 3A01E0                 LD      A,(KEYPB)
0A7A 2F                     CPL
0A7B B7                     OR      A
0A7C 28E8                   JR      Z,SWEP0
0A7E 5F                     LD      E,A
0A7F                SWEP2:  ENT
0A7F 2608                   LD      H,8
0A81 78                     LD      A,B
0A82 E60F                   AND     0FH
0A84 07                     RLCA
0A85 07                     RLCA
0A86 07                     RLCA
0A87 4F                     LD      C,A
0A88 7B                     LD      A,E
0A89 25                     DEC     H
0A8A 0F                     RRCA
0A8B 30FC                   JR      NC,-2
0A8D 7C                     LD      A,H
0A8E 81                     ADD     A,C
0A8F 4F                     LD      C,A
0A90 18D2                   JR      SWEP01
0A92                ;
0A92                ;
0A92                ;   ASCII TO DISPLAY CODE TABL  ;
0A92                ;
0A92                ATBL:
0A92                ;  00 - 0F  ;
0A92 F0                     DEFB    F0H             ; ↑@
0A93 F0                     DEFB    F0H             ; ↑A
0A94 F0                     DEFB    F0H             ; ↑B
0A95 F3                     DEFB    F3H             ; ↑C
0A96 F0                     DEFB    F0H             ; ↑D
0A97 F5                     DEFB    F5H             ; ↑E
0A98 F0                     DEFB    F0H             ; ↑F
0A99 F0                     DEFB    F0H             ; ↑G
0A9A F0                     DEFB    F0H             ; ↑H
0A9B F0                     DEFB    F0H             ; ↑I
0A9C F0                     DEFB    F0H             ; ↑J
0A9D F0                     DEFB    F0H             ; ↑K
0A9E F0                     DEFB    F0H             ; ↑L
0A9F F0                     DEFB    F0H             ; ↑M
0AA0 F0                     DEFB    F0H             ; ↑N
0AA1 F0                     DEFB    F0H             ; ↑O
0AA2                ;  10 - 1F
0AA2 F0                     DEFB    F0H             ; ↑P
0AA3 C1                     DEFB    C1H             ; ↑Q CUR. DOWN
0AA4 C2                     DEFB    C2H             ; ↑R CUR. UP
0AA5 C3                     DEFB    C3H             ; ↑S CUR. RIGHT
0AA6 C4                     DEFB    C4H             ; ↑T CUR. LEFT
0AA7 C5                     DEFB    C5H             ; ↑U HOME
0AA8 C6                     DEFB    C6H             ; ↑V CLEAR
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 40          04.07.83

0AA9 F0                     DEFB    F0H             ; ↑W
0AAA F0                     DEFB    F0H             ; ↑X
0AAB F0                     DEFB    F0H             ; ↑Y
0AAC F0                     DEFB    F0H             ; ↑Z SEP.
0AAD F0                     DEFB    F0H             ; ↑[
0AAE F0                     DEFB    F0H             ; ↑\
0AAF F0                     DEFB    F0H             ; ↑]
0AB0 F0                     DEFB    F0H             ; ↑^
0AB1 F0                     DEFB    F0H             ; ↑-
0AB2                ;  20 - 2F  ;
0AB2 00                     DEFB    00H             ; SPACE
0AB3 61                     DEFB    61H             ; !
0AB4 62                     DEFB    62H             ; "
0AB5 63                     DEFB    63H             ; #
0AB6 64                     DEFB    64H             ; $
0AB7 65                     DEFB    65H             ; %
0AB8 66                     DEFB    66H             ; &
0AB9 67                     DEFB    67H             ; ´
0ABA 68                     DEFB    68H             ; (
0ABB 69                     DEFB    69H             ; )
0ABC 6B                     DEFB    6BH             ; *
0ABD 6A                     DEFB    6AH             ; +
0ABE 2F                     DEFB    2FH             ; ,
0ABF 2A                     DEFB    2AH             ; -
0AC0 2E                     DEFB    2EH             ; .
0AC1 2D                     DEFB    2DH
0AC2                ;  30 -3F  ;
0AC2 20                     DEFB    20H             ; 0
0AC3 21                     DEFB    21H             ; 1
0AC4 22                     DEFB    22H             ; 2
0AC5 23                     DEFB    23H             ; 3
0AC6 24                     DEFB    24H             ; 4
0AC7 25                     DEFB    25H             ; 5
0AC8 26                     DEFB    26H             ; 6
0AC9 27                     DEFB    27H             ; 7
0ACA 28                     DEFB    28H             ; 8
0ACB 29                     DEFB    29H             ; 9
0ACC 4F                     DEFB    4FH             ; :
0ACD 2C                     DEFB    2CH             ; ;
0ACE 51                     DEFB    51H             ; <
0ACF 2B                     DEFB    2BH             ; =
0AD0 57                     DEFB    57H             ; >
0AD1 49                     DEFB    49H             ; ?
0AD2                ;  40 - 4F  ;
0AD2 55                     DEFB    55H             ; @
0AD3 01                     DEFB    01H             ; A
0AD4 02                     DEFB    02H             ; B
0AD5 03                     DEFB    03H             ; C
0AD6 04                     DEFB    04H             ; D
0AD7 05                     DEFB    05H             ; E
0AD8 06                     DEFB    06H             ; F
0AD9 07                     DEFB    07H             ; G
0ADA 08                     DEFB    08H             ; H
0ADB 09                     DEFB    09H             ; I
0ADC 0A                     DEFB    0AH             ; J
0ADD 0B                     DEFB    0BH             ; K
0ADE 0C                     DEFB    0CH             ; L
0ADF 0D                     DEFB    0DH             ; M
0AE0 0E                     DEFB    0EH             ; U
0AE1 0F                     DEFB    0FH             ; O
```

```
0AE2                    ;  50 - 5F  ;
0AE2 10                         DEFB    10H             ; P
0AE3 11                         DEFB    11H             ; Q
0AE4 12                         DEFB    12H             ; R
0AE5 13                         DEFB    13H             ; S
0AE6 14                         DEFB    14H             ; T
0AE7 15                         DEFB    15H             ; U
0AE8 16                         DEFB    16H             ; V
0AE9 17                         DEFB    17H             ; W
0AEA 18                         DEFB    18H             ; X
0AEB 19                         DEFB    19H             ; Y
0AEC 1A                         DEFB    1AH             ; Z
0AED 52                         DEFB    52H             ; [
0AEE 59                         DEFB    59H             ; \
0AEF 54                         DEFB    54H             ; ]
0AF0 50                         DEFB    50H             ; ^
0AF1 45                         DEFB    45H             ; _
0AF2                    ;  60 - 6F  ;
0AF2 C7                         DEFB    C7H             ; UFO
0AF3 C8                         DEFB    C8H
0AF4 C9                         DEFB    C9H
0AF5 CA                         DEFB    CAH
0AF6 CB                         DEFB    CBH
0AF7 CC                         DEFB    CCH
0AF8 CD                         DEFB    CDH
0AF9 CE                         DEFB    CEH
0AFA CF                         DEFB    CFH
0AFB DF                         DEFB    DFH
0AFC E7                         DEFB    E7H
0AFD E8                         DEFB    E8H
0AFE E5                         DEFB    E5H
0AFF E9                         DEFB    E9H
0B00 EC                         DEFB    ECH
0B01 ED                         DEFB    EDH
0B02                    ;  70 - 7F  ;
0B02 D0                         DEFB    D0H
0B03 D1                         DEFB    D1H
0B04 D2                         DEFB    D2H
0B05 D3                         DEFB    D3H
0B06 D4                         DEFB    D4H
0B07 D5                         DEFB    D5H
0B08 D6                         DEFB    D6H
0B09 D7                         DEFB    D7H
0B0A D8                         DEFB    D8H
0B0B D9                         DEFB    D9H
0B0C DA                         DEFB    DAH
0B0D DB                         DEFB    DBH
0B0E DC                         DEFB    DCH
0B0F DD                         DEFB    DDH
0B10 DE                         DEFB    DEH
0B11 C0                         DEFB    C0H
0B12                    ;  80 - 8F  ;
0B12 80                         DEFB    80H             ; )
0B13 BD                         DEFB    BDH             ;
0B14 9D                         DEFB    9DH
0B15 B1                         DEFB    B1H
0B16 B5                         DEFB    B5H
0B17 B9                         DEFB    B9H
0B18 B4                         DEFB    B4H             ;
0B19 9E                         DEFB    9EH             ;
```



```
0B1A B2                         DEFB    B2H             ;
0B1B B6                         DEFB    B6H             ;
0B1C BA                         DEFB    BAH             ;
0B1D BE                         DEFB    BEH             ;
0B1E 9F                         DEFB    9FH             ;
0B1F B3                         DEFB    B3H             ;
0B20 B7                         DEFB    B7H             ;
0B21 BB                         DEFB    BBH             ;
0B22                    ;  90 - 9F  ;
0B22 BF                         DEFB    BFH             ; ~
0B23 A3                         DEFB    A3H             ;
0B24 85                         DEFB    85H             ;
0B25 A4                         DEFB    A4H             ; `
0B26 A5                         DEFB    A5H             ; ~
0B27 A6                         DEFB    A6H             ;
0B28 94                         DEFB    94H             ;
0B29 87                         DEFB    87H             ;
0B2A 88                         DEFB    88H             ;
0B2B 9C                         DEFB    9CH             ;
0B2C 82                         DEFB    82H             ;
0B2D 98                         DEFB    98H             ;
0B2E 84                         DEFB    84H             ;
0B2F 92                         DEFB    92H             ;
0B30 90                         DEFB    90H             ;
0B31 83                         DEFB    83H             ;
0B32                    ;  A0 - AF  ;
0B32 91                         DEFB    91H             ;
0B33 81                         DEFB    81H             ;
0B34 9A                         DEFB    9AH             ;
0B35 97                         DEFB    97H             ;
0B36 93                         DEFB    93H             ;
0B37 95                         DEFB    95H             ;
0B38 89                         DEFB    89H             ;
0B39 A1                         DEFB    A1H             ;
0B3A AF                         DEFB    AFH             ;
0B3B 8B                         DEFB    8BH             ;
0B3C 86                         DEFB    86H             ;
0B3D 96                         DEFB    96H             ;
0B3E A2                         DEFB    A2H             ;
0B3F AB                         DEFB    ABH             ;
0B40 AA                         DEFB    AAH             ;
0B41 8A                         DEFB    8AH             ;
0B42                    ;  B0 - BF  ;
0B42 8E                         DEFB    8EH             ;
0B43 B0                         DEFB    B0H             ;
0B44 AD                         DEFB    ADH             ;
0B45 8D                         DEFB    8DH             ;
0B46 A7                         DEFB    A7H             ;
0B47 A8                         DEFB    A8H             ;
0B48 A9                         DEFB    A9H             ;
0B49 8F                         DEFB    8FH             ;
0B4A 8C                         DEFB    8CH             ;
0B4B AE                         DEFB    AEH             ;
0B4C AC                         DEFB    ACH             ;
0B4D 9B                         DEFB    9BH             ;
0B4E A0                         DEFB    A0H             ;
0B4F 99                         DEFB    99H             ;
0B50 BC                         DEFB    BCH             ; (
0B51 B8                         DEFB    B8H
0B52                    ;  C0 - CF  ;
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 43          04.07.83

01 0B52 40                      DEFB   40H              ; @
02 0B53 3B                      DEFB   3BH
03 0B54 3A                      DEFB   3AH
04 0B55 70                      DEFB   70H
05 0B56 3C                      DEFB   3CH
06 0B57 71                      DEFB   71H
07 0B58 5A                      DEFB   5AH
08 0B59 3D                      DEFB   3DH
09 0B5A 43                      DEFB   43H
10 0B5B 56                      DEFB   56H
11 0B5C 3F                      DEFB   3FH
12 0B5D 1E                      DEFB   1EH
13 0B5E 4A                      DEFB   4AH
14 0B5F 1C                      DEFB   1CH
15 0B60 5D                      DEFB   5DH
16 0B61 3E                      DEFB   3EH
17 0B62                 ;  D0 - DF  ;
18 0B62 5C                      DEFB   5CH
19 0B63 1F                      DEFB   1FH
20 0B64 5F                      DEFB   5FH
21 0B65 5E                      DEFB   5EH
22 0B66 37                      DEFB   37H
23 0B67 7B                      DEFB   7BH
24 0B68 7F                      DEFB   7FH
25 0B69 36                      DEFB   36H
26 0B6A 7A                      DEFB   7AH
27 0B6B 7E                      DEFB   7EH
28 0B6C 33                      DEFB   33H
29 0B6D 4B                      DEFB   4BH
30 0B6E 4C                      DEFB   4CH
31 0B6F 1D                      DEFB   1DH
32 0B70 6C                      DEFB   6CH
33 0B71 5B                      DEFB   5BH
34 0B72                 ;  E0 - EF  ;
35 0B72 78                      DEFB   78H
36 0B73 41                      DEFB   41H
37 0B74 35                      DEFB   35H
38 0B75 34                      DEFB   34H
39 0B76 74                      DEFB   74H
40 0B77 30                      DEFB   30H
41 0B78 38                      DEFB   38H
42 0B79 75                      DEFB   75H
43 0B7A 39                      DEFB   39H
44 0B7B 4D                      DEFB   4DH
45 0B7C 6F                      DEFB   6FH
46 0B7D 6E                      DEFB   6EH
47 0B7E 32                      DEFB   32H
48 0B7F 77                      DEFB   77H
49 0B80 76                      DEFB   76H
50 0B81 72                      DEFB   72H
51 0B82                 ;  F0 - FF  ;
52 0B82 73                      DEFB   73H
53 0B83 47                      DEFB   47H
54 0B84 7C                      DEFB   7CH
55 0B85 53                      DEFB   53H
56 0B86 31                      DEFB   31H
57 0B87 4E                      DEFB   4EH
58 0B88 6D                      DEFB   6DH
59 0B89 48                      DEFB   48H
60 0B8A 46                      DEFB   46H
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 44          04.07.83

01 0B8B 7D                      DEFB   7DH
02 0B8C 44                      DEFB   44H
03 0B8D 1B                      DEFB   1BH
04 0B8E 58                      DEFB   58H
05 0B8F 79                      DEFB   79H
06 0B90 42                      DEFB   42H
07 0B91 60                      DEFB   60H
08 0B92                 ;
09 0B92                 ;
10 0B92                 ;   FLASHING DATA SAVE
11 0B92                 ;
12 0B92                 ?SAVE:  ENT
13 0B92 219211                  LD     HL,FLSDT
14 0B95 36EF                    LD     (HL),EFH          ; NOMAL CURSOR
15 0B97 3A7011                  LD     A,(KANAF)
16 0B9A 0F                      RRCA
17 0B9B 3803                    JR     C,SV0-2           ; GRAPH MODE
18 0B9D 0F                      RRCA
19 0B9E 3002                    JR     NC,SV0            ; NORMAL MODE
20 0BA0 36FF                    LD     (HL),FFH          ; GRAPH CURSOR
21 0BA2                 SV0:    ENT
22 0BA2 7E                      LD     A,(HL)
23 0BA3 F5                      PUSH   AF
24 0BA4 CDB10F                  CALL   ?PONT             ; FLASING POSITION
25 0BA7 7E                      LD     A,(HL)
26 0BA8 328E11                  LD     (FLASH),A
27 0BAB F1                      POP    AF
28 0BAC 77                      LD     (HL),A
29 0BAD AF                      XOR    A
30 0BAE 2100E0                  LD     HL,KEYPA
31 0BB1 77                      LD     (HL),A
32 0BB2 2F                      CPL
33 0BB3 77                      LD     (HL),A
34 0BB4 C9                      RET
35 0BB5                 SV1:    ENT
36 0BB5 3643                    LD     (HL),43H          ; KANA CURSOR
37 0BB7 18E9                    JR     SV0
38 0BB9                 ;
39 0BB9                 ;ORG 0BB9H;?ADCN
40 0BB9                 ;
41 0BB9                 ;
42 0BB9                 ;   ASCII TO DISPLAY CODE CONVERTE
43 0BB9                 ;
44 0BB9                 ;       IN    ACC:ASCII
45 0BB9                 ;       EXIT  ACC:DISPLAY CODE
46 0BB9                 ;
47 0BB9                 ?ADCN:  ENT
48 0BB9 C5                      PUSH   BC
49 0BBA E5                      PUSH   HL
50 0BBB 21920A                  LD     HL,ATBL
51 0BBE 4F                      LD     C,A
52 0BBF 0600                    LD     B,0
53 0BC1 09                      ADD    HL,BC
54 0BC2 7E                      LD     A,(HL)
55 0BC3 181B                    JR     DACN3
56 0BC5                 ;
57 0BC5 56312E30        VRNS:   DEFM   "V1.0A"           ; VERSION MANAGEMENT
58 0BC9 41
59 0BCA 0D                      DEFB   0DH
60 0BCB                         DEFS   +3
```

```
0BCE                    ;
0BCE                    ;
0BCE                    ;ORG OBCEH;?DACN
0BCE                    ;
0BCE                    ;    DISPLAY CODE TO ASCII CONV.  ;
0BCE                    ;
0BCE                    ;      IN   ACC = DISPLAY CODE
0BCE                    ;      EXIT ACC = ASCII
0BCE                    ;
0BCE                    ?DACN:  ENT
0BCE C5                         PUSH    BC
0BCF E5                         PUSH    HL
0BD0 D5                         PUSH    DE
0BD1 21920A                     LD      HL,ATBL
0BD4 54                         LD      D,H
0BD5 5D                         LD      E,L
0BD6 010001                     LD      BC,0100H
0BD9 EDB1                       CPIR
0BDB 2806                       JR      Z,DACN1
0BDD 3EF0                       LD      A,F0H
0BDF                    DACN2:  ENT
0BDF D1                         POP     DE
0BE0                    DACN3:  ENT
0BE0 E1                         POP     HL
0BE1 C1                         POP     BC
0BE2 C9                         RET
0BE3                    ;
0BE3                    DACN1:  ENT
0BE3 B7                         OR      A
0BE4 2B                         DEC     HL
0BE5 ED52                       SBC     HL,DE
0BE7 7D                         LD      A,L
0BE8 18F5                       JR      DACN2
0BEA                    ;
0BEA                    ;
0BEA                    ;
0BEA                    ;    KEY MATRIX TO DISPLAY CODE TABL
0BEA                    ;
0BEA                    KTBL:   ENT
0BEA                    ;S0    00 - 07  ;
0BEA BF                         DEFB    BFH             ; SPARE
0BEB CA                         DEFB    CAH             ; GRAPH
0BEC 58                         DEFB    58H             ; ↓
0BED C9                         DEFB    C9H             ; ALPHA
0BEE F0                         DEFB    F0H             ; NO
0BEF 2C                         DEFB    2CH             ; ;
0BF0 4F                         DEFB    4FH             ; :
0BF1 CD                         DEFB    CDH             ; CR
0BF2                    ;S1    08 - 0F  ;
0BF2 19                         DEFB    19H             ; Y
0BF3 1A                         DEFB    1AH             ; Z
0BF4 55                         DEFB    55H             ; @
0BF5 52                         DEFB    52H             ; [
0BF6 54                         DEFB    54H             ; ]
0BF7 F0                         DEFB    F0H             ; NULL
0BF8 F0                         DEFB    F0H             ; NULL
0BF9 F0                         DEFB    F0H             ; NULL
0BFA                    ;S2    0 - 17  ;
0BFA 11                         DEFB    11H             ; Q
0BFB 12                         DEFB    12H             ; R
```



```
0BFC 13                         DEFB    13H             ; S
0BFD 14                         DEFB    14H             ; T
0BFE 15                         DEFB    15H             ; U
0BFF 16                         DEFB    16H             ; V
0C00 17                         DEFB    17H             ; W
0C01 18                         DEFB    18H             ; X
0C02                    ;S3    18 - 1F  ;
0C02 09                         DEFB    09H             ; I
0C03 0A                         DEFB    0AH             ; J
0C04 0B                         DEFB    0BH             ; K
0C05 0C                         DEFB    0CH             ; L
0C06 0D                         DEFB    0DH             ; M
0C07 0E                         DEFB    0EH             ; N
0C08 0F                         DEFB    0FH             ; O
0C09 10                         DEFB    10H             ; P
0C0A                    ;S4    20 - 27  ;
0C0A 01                         DEFB    01H             ; A
0C0B 02                         DEFB    02H             ; B
0C0C 03                         DEFB    03H             ; C
0C0D 04                         DEFB    04H             ; D
0C0E 05                         DEFB    05H             ; E
0C0F 06                         DEFB    06H             ; F
0C10 07                         DEFB    07H             ; G
0C11 08                         DEFB    08H             ; H
0C12                    ;S5    28 - 2F  ;
0C12 21                         DEFB    21H             ; 1
0C13 22                         DEFB    22H             ; 2
0C14 23                         DEFB    23H             ; 3
0C15 24                         DEFB    24H             ; 4
0C16 25                         DEFB    25H             ; 5
0C17 26                         DEFB    26H             ; 6
0C18 27                         DEFB    27H             ; 7
0C19 28                         DEFB    28H             ; 8
0C1A                    ;S6    30 - 37  ;
0C1A 59                         DEFB    59H             ; \
0C1B 50                         DEFB    50H             ; ↑
0C1C 2A                         DEFB    2AH             ; -
0C1D 00                         DEFB    00H             ; SPACE
0C1E 20                         DEFB    20H             ; 0
0C1F 29                         DEFB    29H             ; 9
0C20 2F                         DEFB    2FH             ; ,
0C21 2E                         DEFB    2EH             ; .
0C22                    ;S7    38 - 3F  ;
0C22 C8                         DEFB    C8H             ; INST.
0C23 C7                         DEFB    C7H             ; DEL.
0C24 C2                         DEFB    C2H             ; CURSOR UP
0C25 C1                         DEFB    C1H             ; CURSOR DOWN
0C26 C3                         DEFB    C3H             ; CURSOR RIGHT
0C27 C4                         DEFB    C4H             ; CURSOR LEFT
0C28 49                         DEFB    49H             ; ?
0C29 2D                         DEFB    2DH             ; /
0C2A                    ;
0C2A                    ;    KTBL SHIFT ON
0C2A                    ;
0C2A                    KTBLS:  ENT
0C2A                    ;S0    00-07
0C2A BF                         DEFB    BFH             ; SPARE
0C2B CA                         DEFB    CAH             ; GRAPH
0C2C 1B                         DEFB    1BH             ; POND
0C2D C9                         DEFB    C9H             ; ALPHA
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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 47          04.07.83

01 0C2E F0                      DEFB    F0H             ; NO
02 0C2F 6A                      DEFB    6AH             ; +
03 0C30 6B                      DEFB    6BH             ; *
04 0C31 CD                      DEFB    CDH             ; CR
05 0C32                 ;S1     08-0F
06 0C32 99                      DEFB    99H             ; y
07 0C33 9A                      DEFB    9AH             ; z
08 0C34 A4                      DEFB    A4H             ; ^
09 0C35 BC                      DEFB    BCH             ; (
10 0C36 40                      DEFB    40H             ; )
11 0C37 F0                      DEFB    F0H             ; NULL
12 0C38 F0                      DEFB    F0H             ; NULL
13 0C39 F0                      DEFB    F0H             ; NULL
14 0C3A                 ;S2     10-17
15 0C3A 91                      DEFB    91H             ; q
16 0C3B 92                      DEFB    92H             ; r
17 0C3C 93                      DEFB    93H             ; s
18 0C3D 94                      DEFB    94H             ; t
19 0C3E 95                      DEFB    95H             ; u
20 0C3F 96                      DEFB    96H             ; v
21 0C40 97                      DEFB    97H             ; w
22 0C41 98                      DEFB    98H             ; x
23 0C42                 ;S3     18-1F
24 0C42 89                      DEFB    89H             ; i
25 0C43 8A                      DEFB    8AH             ; j
26 0C44 8B                      DEFB    8BH             ; k
27 0C45 8C                      DEFB    8CH             ; l
28 0C46 8D                      DEFB    8DH             ; m
29 0C47 8E                      DEFB    8EH             ; n
30 0C48 8F                      DEFB    8FH             ; o
31 0C49 90                      DEFB    90H             ; p
32 0C4A                 ;S4     20-27
33 0C4A 81                      DEFB    81H             ; a
34 0C4B 82                      DEFB    82H             ; b
35 0C4C 83                      DEFB    83H             ; c
36 0C4D 84                      DEFB    84H             ; d
37 0C4E 85                      DEFB    85H             ; e
38 0C4F 86                      DEFB    86H             ; f
39 0C50 87                      DEFB    87H             ; g
40 0C51 88                      DEFB    88H             ; h
41 0C52                 ;S5     28-2F
42 0C52 61                      DEFB    61H             ; !
43 0C53 62                      DEFB    62H             ; "
44 0C54 63                      DEFB    63H             ; #
45 0C55 64                      DEFB    64H             ; $
46 0C56 65                      DEFB    65H             ; %
47 0C57 66                      DEFB    66H             ; &
48 0C58 67                      DEFB    67H             ; '
49 0C59 68                      DEFB    68H             ; (
50 0C5A                 ;S6     30-37
51 0C5A 80                      DEFB    80H             ; \
52 0C5B A5                      DEFB    A5H             ; POND MARK
53 0C5C 2B                      DEFB    2BH             ; YEN
54 0C5D 00                      DEFB    00H             ; SPACE
55 0C5E 60                      DEFB    60H             ; π
56 0C5F 69                      DEFB    69H             ; )
57 0C60 51                      DEFB    51H             ; <
58 0C61 57                      DEFB    57H             ; >
59 0C62                 ;S7      38-3F
60 0C62 C6                      DEFB    C6H             ; CLR
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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 48          04.07.83

01 0C63 C5                      DEFB    C5H             ; HOME
02 0C64 C2                      DEFB    C2H             ; CURSOR UP
03 0C65 C1                      DEFB    C1H             ; CURSOR DOWN
04 0C66 C3                      DEFB    C3H             ; CURSOR RIGHT
05 0C67 C4                      DEFB    C4H             ; CURSOR LEFT
06 0C68 5A                      DEFB    5AH             ; ⇨
07 0C69 45                      DEFB    45H             ; ⇦
08 0C6A                 ;
09 0C6A                 ;   GRAPHIC
10 0C6A                 ;
11 0C6A                 KTBLGS: ENT
12 0C6A                 ;S0     00-07
13 0C6A BF                      DEFB    BFH             ; SPARE
14 0C6B F0                      DEFB    F0H             ; GRAPH BUT NULL
15 0C6C E5                      DEFB    E5H             ; #↓
16 0C6D C9                      DEFB    C9H             ; ALPHA
17 0C6E F0                      DEFB    F0H             ; NO
18 0C6F 42                      DEFB    42H             ; #;
19 0C70 B6                      DEFB    B6H             ; #:
20 0C71 CD                      DEFB    CDH             ; CR
21 0C72                 ;S1     08-0F
22 0C72 75                      DEFB    75H             ; #Y
23 0C73 76                      DEFB    76H             ; #Z
24 0C74 B2                      DEFB    B2H             ; #@
25 0C75 D8                      DEFB    D8H             ; #[
26 0C76 4E                      DEFB    4EH             ; #]
27 0C77 F0                      DEFB    F0H             ; #NULL←
28 0C78 F0                      DEFB    F0H             ; #NULL
29 0C79 F0                      DEFB    F0H             ; #NULL
30 0C7A                 ;S2     10-17
31 0C7A 3C                      DEFB    3CH             ; #Q
32 0C7B 30                      DEFB    30H             ; #R
33 0C7C 44                      DEFB    44H             ; #S
34 0C7D 71                      DEFB    71H             ; #T
35 0C7E 79                      DEFB    79H             ; #U
36 0C7F DA                      DEFB    DAH             ; #V
37 0C80 38                      DEFB    38H             ; #W
38 0C81 6D                      DEFB    6DH             ; #X
39 0C82                 ;S3     18-1F
40 0C82 7D                      DEFB    7DH             ; #I
41 0C83 5C                      DEFB    5CH             ; #J
42 0C84 5B                      DEFB    5BH             ; #K
43 0C85 B4                      DEFB    B4H             ; #L
44 0C86 1C                      DEFB    1CH             ; #M
45 0C87 32                      DEFB    32H             ; #N
46 0C88 B0                      DEFB    B0H             ; #O
47 0C89 D6                      DEFB    D6H             ; #P
48 0C8A                 ;S4     20-27
49 0C8A 53                      DEFB    53H             ; #A
50 0C8B 6F                      DEFB    6FH             ; #B
51 0C8C DE                      DEFB    DEH             ; #C
52 0C8D 47                      DEFB    47H             ; #D
53 0C8E 34                      DEFB    34H             ; #E
54 0C8F 4A                      DEFB    4AH             ; #F
55 0C90 4B                      DEFB    4BH             ; #G
56 0C91 72                      DEFB    72H             ; #H
57 0C92                 ;S5     28-2F
58 0C92 37                      DEFB    37H             ; #1
59 0C93 3E                      DEFB    3EH             ; #2
60 0C94 7F                      DEFB    7FH             ; #3
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```
0C95 7B                 DEFB   7BH          ; #4
0C96 3A                 DEFB   3AH          ; #5
0C97 5E                 DEFB   5EH          ; #6
0C98 1F                 DEFB   1FH          ; #7
0C99 BD                 DEFB   BDH          ; #8
0C9A                ;S6   30-3F
0C9A D4                 DEFB   D4H          ; #YEN
0C9B 9E                 DEFB   9EH          ; #+
0C9C D2                 DEFB   D2H          ; #-
0C9D 00                 DEFB   00H          ; SPACE
0C9E 9C                 DEFB   9CH          ; #0
0C9F A1                 DEFB   A1H          ; #9
0CA0 CA                 DEFB   CAH          ; #,
0CA1 B8                 DEFB   B8H          ; #.
0CA2                ;S7   38-3F
0CA2 C8                 DEFB   C8H          ; INST
0CA3 C7                 DEFB   C7H          ; DEL.
0CA4 C2                 DEFB   C2H          ; CURSOR UP
0CA5 C1                 DEFB   C1H          ; CURSOR DOWN
0CA6 C3                 DEFB   C3H          ; CURSOR RIGHT
0CA7 C4                 DEFB   C4H          ; CURSOR LEFT
0CA8 BA                 DEFB   BAH          ; #?
0CA9 DB                 DEFB   DBH          ; #/
0CAA                ;
0CAA                ;   CONTROL CODE
0CAA                ;
0CAA                KTBLC:  ENT
0CAA                ;S0   00-07N
0CAA F0                 DEFB   F0H          ;
0CAB F0                 DEFB   F0H
0CAC F0                 DEFB   F0H          ; ↑
0CAD F0                 DEFB   F0H
0CAE F0                 DEFB   F0H
0CAF F0                 DEFB   F0H
0CB0 F0                 DEFB   F0H
0CB1 F0                 DEFB   F0H
0CB2                ;S1   08-0F
0CB2 F0                 DEFB   F0H          ; ↑Y  E3
0CB3 5A                 DEFB   5AH          ; ↑Z  E4 (CHECKER)
0CB4 F0                 DEFB   F0H          ; ↑@
0CB5 F0                 DEFB   F0H          ; ↑[  E5
0CB6 F0                 DEFB   F0H          ; ↑]  E7
0CB7 F0                 DEFB   F0H
0CB8 F0                 DEFB   F0H
0CB9 F0                 DEFB   F0H
0CBA                ;S2   10-17
0CBA C1                 DEFB   C1H          ; ↑@
0CBB C2                 DEFB   C2H          ; ↑R
0CBC C3                 DEFB   C3H          ; ↑S
0CBD C4                 DEFB   C4H          ; ↑T
0CBE C5                 DEFB   C5H          ; ↑U
0CBF C6                 DEFB   C6H          ; ↑V
0CC0 F0                 DEFB   F0H          ; ↑W  E1
0CC1 F0                 DEFB   F0H          ; ↑X  E2
0CC2                ;S3   18-1F
0CC2 F0                 DEFB   F0H          ; ↑I  F9
0CC3 F0                 DEFB   F0H          ; ↑J  FA
0CC4 F0                 DEFB   F0H          ; ↑K  FB
0CC5 F0                 DEFB   F0H          ; ↑L  FC
0CC6 F0                 DEFB   F0H          ; ↑M  FD
```



```
0CC7 F0                 DEFB   F0H          ; ↑N  FE
0CC8 F0                 DEFB   F0H          ; ↑O  FF
0CC9 F0                 DEFB   F0H          ; ↑P  E0
0CCA                ;S4   20-27
0CCA F0                 DEFB   F0H          ; ↑A  F1
0CCB F0                 DEFB   F0H          ; ↑B  F2
0CCC F0                 DEFB   F0H          ; ↑C  F3
0CCD F0                 DEFB   F0H          ; ↑D  F4
0CCE F0                 DEFB   F0H          ; ↑E  F5
0CCF F0                 DEFB   F0H          ; ↑F  F6
0CD0 F0                 DEFB   F0H          ; ↑G  F7
0CD1 F0                 DEFB   F0H          ; ↑H  F8
0CD2                ;S5   28-2F
0CD2 F0                 DEFB   F0H
0CD3 F0                 DEFB   F0H
0CD4 F0                 DEFB   F0H
0CD5 F0                 DEFB   F0H
0CD6 F0                 DEFB   F0H
0CD7 F0                 DEFB   F0H
0CD8 F0                 DEFB   F0H
0CD9 F0                 DEFB   F0H
0CDA                ;S6   30-37
0CDA F0                 DEFB   F0H          ; ↑YEN E6
0CDB F0                 DEFB   F0H
0CDC F0                 DEFB   F0H
0CDD F0                 DEFB   F0H
0CDE F0                 DEFB   F0H
0CDF F0                 DEFB   F0H          ; ↑, EF
0CE0 F0                 DEFB   F0H
0CE1                ;S7   38-3F
0CE1 F0                 DEFB   F0H
0CE2 F0                 DEFB   F0H
0CE3 F0                 DEFB   F0H
0CE4 F0                 DEFB   F0H
0CE5 F0                 DEFB   F0H
0CE6 F0                 DEFB   F0H
0CE7 F0                 DEFB   F0H
0CE8 F0                 DEFB   F0H          ; ↑/ EE
0CE9                ;
0CE9                ;   KANA
0CE9                ;
0CE9                KTBLG:  ENT
0CE9                ;S0   00-07
0CE9 BF                 DEFB   BFH          ; SPARE
0CEA F0                 DEFB   F0H          ; GRAPH BUT NULL
0CEB CF                 DEFB   CFH          ; NIKO WH.
0CEC C9                 DEFB   C9H          ; ALPHA
0CED F0                 DEFB   F0H          ; NO
0CEE B5                 DEFB   B5H          ; MO
0CEF 4D                 DEFB   4DH          ; DAKU TEN
0CF0 CD                 DEFB   CDH          ; CR
0CF1                ;S1   08-0F
0CF1 35                 DEFB   35H          ; HA
0CF2 77                 DEFB   77H          ; TA
0CF3 D7                 DEFB   D7H          ; WA
0CF4 B3                 DEFB   B3H          ; YO
0CF5 B7                 DEFB   B7H          ; HANDAKU
0CF6 F0                 DEFB   F0H
0CF7 F0                 DEFB   F0H
0CF8 F0                 DEFB   F0H
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 51          04.07.83

0CF9                    ;S2      10-17
0CF9 7C                          DEFB   7CH             ; KA
0CFA 70                          DEFB   70H             ; KE
0CFB 41                          DEFB   41H             ; SHI
0CFC 31                          DEFB   31H             ; KO
0CFD 39                          DEFB   39H             ; HI
0CFE A6                          DEFB   A6H             ; TE
0CFF 78                          DEFB   78H             ; KI
0D00 DD                          DEFB   DDH             ; CHI
0D01                    ;S3      18-1F
0D01 3D                          DEFB   3DH             ; FU
0D02 5D                          DEFB   5DH             ; MI
0D03 6C                          DEFB   6CH             ; MU
0D04 56                          DEFB   56H             ; ME
0D05 1D                          DEFB   1DH             ; RHI
0D06 33                          DEFB   33H             ; RA
0D07 D5                          DEFB   D5H             ; HE
0D08 B1                          DEFB   B1H             ; HO
0D09                    ;S4      20-27
0D09 46                          DEFB   46H             ; SA
0D0A 6E                          DEFB   6EH             ; TO
0D0B D9                          DEFB   D9H             ; THU
0D0C 48                          DEFB   48H             ; SU
0D0D 74                          DEFB   74H             ; KU
0D0E 43                          DEFB   43H             ; SE
0D0F 4C                          DEFB   4CH             ; SO
0D10 73                          DEFB   73H             ; MA
0D11                    ;S5      28-2F
0D11 3F                          DEFB   3FH             ; A
0D12 36                          DEFB   36H             ; I
0D13 7E                          DEFB   7EH             ; U
0D14 3B                          DEFB   3BH             ; E
0D15 7A                          DEFB   7AH             ; O
0D16 1E                          DEFB   1EH             ; NA
0D17 5F                          DEFB   5FH             ; NI
0D18 A2                          DEFB   A2H             ; NU
0D19                    ;S6      30-37
0D19 D3                          DEFB   D3H             ; YO
0D1A 9F                          DEFB   9FH             ; YU
0D1B D1                          DEFB   D1H             ; YA
0D1C 00                          DEFB   00H             ; SPACE
0D1D 9D                          DEFB   9DH             ; NO
0D1E A3                          DEFB   A3H             ; NE
0D1F D0                          DEFB   D0H             ; RU
0D20 B9                          DEFB   B9H             ; RE
0D21                    ;S7      38-3F
0D21 C6                          DEFB   C6H             ; ?CLR @
0D22 C5                          DEFB   C5H             ; ?HOME ▯
0D23 C2                          DEFB   C2H             ; ?CURSOR UP
0D24 C1                          DEFB   C1H             ; ?CURSOR DOWN
0D25 C3                          DEFB   C3H             ; ?CURSOR RIGHT
0D26 C4                          DEFB   C4H             ; ?CURSOR LEFT
0D27 BB                          DEFB   BBH             ; DASH
0D28 BE                          DEFB   BEH             ; RO
0D29                    ;
0D29                    ;      MEMORY DUMP
0D29                    ;         COMMAND 'D'
0D29                    ;
0D29                    DUMP:    ENT
0D29 CD3D01                      CALL   HEXIY           ; START ADR.
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 52          04.07.83

0D2C CDA602                      CALL   .4DE
0D2F E5                          PUSH   HL
0D30 CD1004                      CALL   HLHEX           ; END ADR.
0D33 D1                          POP    DE
0D34 3852                        JR     C,DUM1          ; DATA ER. THEN
0D36 EB                          EX     DE,HL
0D37 0608               DUM3:    LD     B,08H           ; DISP 8BYTES
0D39 0E17                        LD     C,23            ; CHA. PRINT BIAS
0D3B CDFA05                      CALL   NLPHL           ; NEWLINE PRINT
0D3E CDB103             DUM2:    CALL   SPHEX           ; SP. PRT.+ACC PRT.
0D41 23                          INC    HL
0D42 F5                          PUSH   AF
0D43 3A7111                      LD     A,(DSPXY)       ; DISPLAY POINT
0D46 81                          ADD    A,C
0D47 327111                      LD     (DSPXY),A       ; X AXIS.=X+Creg
0D4A F1                          POP    AF
0D4B FE20                        CP     20H
0D4D 3002                        JR     NC,+4
0D4F 3E2E                        LD     A,2EH           ; '.'
0D51 CDB90B                      CALL   ?ADCN           ; ASCII TO DSPLAY CODE
0D54 CD6C09                      CALL   PRNT3
0D57 3A7111                      LD     A,(DSPXY)
0D5A 0C                          INC    C
0D5B 91                          SUB    C               ; ASCII DSP POSITION
0D5C 327111                      LD     (DSPXY),A
0D5F 0D                          DEC    C
0D60 0D                          DEC    C
0D61 0D                          DEC    C
0D62 E5                          PUSH   HL
0D63 ED52                        SBC    HL,DE
0D65 E1                          POP    HL
0D66 281D                        JR     Z,DUM1-3
0D68 3EF8                        LD     A,F8H
0D6A 3200E0                      LD     (KEYPA),A
0D6D 00                          NOP
0D6E 3A01E0                      LD     A,(KEYPB)
0D71 FEFE                        CP     FEH             ; SHIFT KEY ?
0D73 2003                        JR     NZ,+5
0D75 CDA60D                      CALL   ?BLNK           ; 64MSEC DELAY
0D78 10C4                        DJNZ   DUM2
0D7A CDCA08                      CALL   ?KEY            ; STOP DISP
0D7D B7                          OR     A
0D7E 28FA                        JR     Z,-4            ; SPACE KEY THEN STOP
0D80 CD320A                      CALL   ?BRK            ; BREAK IN ?
0D83 20B2                        JR     NZ,DUM3
0D85 C3AD00                      JP     ST1             ; COMMAND IN !
0D88 21A000             DUM1:    LD     HL,160          ; 20*8 BYTE
0D8B 19                          ADD    HL,DE
0D8C 18A8                        JR     DUM3-1
0D8E                    ;
0D8E                    ;
0D8E                    ;
0D8E                    ;
0D8E                             DEFS   +24
0DA6                    ;
0DA6                    ;
0DA6                    ;
0DA6                    ;ORG 0DA6H;?BLNK
0DA6                    ;
0DA6                    ;
```

```
0ODA6                   ;   V-BLANK CHECK  ;
0ODA6                   ;
0ODA6                   ?BLNK:  ENT
0ODA6 F5                        PUSH    AF
0ODA7 3A02E0                    LD      A,(KEYPC)       ; V-BLNK
0ODAA 07                        RLCA
0ODAB 30FA                      JR      NC,-4
0ODAD 3A02E0                    LD      A,(KEYPC)
0ODB0 07                        RLCA
0ODB1 38FA                      JR      C,-4
0ODB3 F1                        POP     AF
0ODB4 C9                        RET
0ODB5                   ;
0ODB5                   ;ORG 0DB5H;?DSP
0ODB5                   ;
0ODB5                   ;
0ODB5                   ;  DISPLAY ON POINTER  ;
0ODB5                   ;
0ODB5                   ;    ACC = DISPLAY CODE
0ODB5                   ;    EXCEPT F0H
0ODB5                   ;
0ODB5                   ?DSP:   ENT
0ODB5 F5                        PUSH    AF
0ODB6 C5                        PUSH    BC
0ODB7 D5                        PUSH    DE
0ODB8 E5                        PUSH    HL
0ODB9                   DSP01:  ENT
0ODB9 CDB10F                    CALL    ?PONT           ; DSPLAY POSITION
0ODBC 77                        LD      (HL),A
0ODBD 2A7111                    LD      HL,(DSPXY)
0ODC0 7D                        LD      A,L
0ODC1 FE27                      CP      +39
0ODC3 200B                      JR      NZ,DSP04
0ODC5 CDF302                    CALL    .MANG
0ODC8 3806                      JR      C,DSP04
0ODCA EB                        EX      DE,HL
0ODCB 3601                      LD      (HL),+1         ; LOGICAL 1ST COLUMN
0ODCD 23                        INC     HL
0ODCE 3600                      LD      (HL),0          ; LOGICAL 2ND COLUMN
0ODD0                   DSP04:  ENT
0ODD0 3EC3                      LD      A,C3H           ; CURSL
0ODD2 180C                      JR      ?DPCT+4
0ODD4                   ;
0ODD4                   ;
0ODD4                   ;
0ODD4                   ;
0ODD4                   ;   GRAPHIC STATUS CHECK
0ODD4                   ;
0ODD4 3A7011            GRSTAS: LD      A,(KANAF)
0ODD7 FE01                      CP      01H
0ODD9 3ECA                      LD      A,0AH
0ODDB C9                        RET
0ODDC                   ;
0ODDC                   ;
0ODDC                   ;
0ODDC                   ;
0ODDC                   ;
0ODDC                   ;
0ODDC                   ;ORG 0DDCH;?DPCT
```



```
0ODDC                   ;
0ODDC                   ;
0ODDC                   ;   DISPLAY CONTROL   ;
0ODDC                   ;
0ODDC                   ;     ACC = CONTROL CODE
0ODDC                   ;
0ODDC                   ?DPCT:  ENT
0ODDC F5                        PUSH    AF
0ODDD C5                        PUSH    BC
0ODDE D5                        PUSH    DE
0ODDF E5                        PUSH    HL
0ODE0 47                        LD      B,A
0ODE1 E6F0                      AND     F0H
0ODE3 FEC0                      CP      C0H
0ODE5 201B                      JR      NZ,CURS5
0ODE7 A8                        XOR     B
0ODE8 07                        RLCA
0ODE9 4F                        LD      C,A
0ODEA 0600                      LD      B,+0
0ODEC 21AA0E                    LD      HL,CTBL         ; PAGE MODE1
0ODEF 09                        ADD     HL,BC
0ODF0 5E                        LD      E,(HL)
0ODF1 23                        INC     HL
0ODF2 56                        LD      D,(HL)
0ODF3 2A7111                    LD      HL,(DSPXY)
0ODF6 EB                        EX      DE,HL
0ODF7 E9                        JP      (HL)
0ODF8                   ;
0ODF8                   ;
0ODF8                   ;
0ODF8                   CURSD:  ENT
0ODF8 EB                        EX      DE,HL           ; LD HL,(DSPXY)
0ODF9 7C                        LD      A,H
0ODFA FE18                      CP      +24
0ODFC 2825                      JR      Z,CURS4
0ODFE 24                        INC     H
0ODFF                   CURS1:  ENT
0ODFF
0ODFF
0ODFF
0ODFF                   CURS3:  ENT
0ODFF 227111                    LD      (DSPXY),HL
0E02 C3E50E             CURS5:  JP      ?RSTR
0E05                    ;
0E05                    CURSU:  ENT
0E05 EB                         EX      DE,HL           ; LD HL,(DSPXY)
0E06 7C                         LD      A,H
0E07 B7                         OR      A
0E08 28F8                       JR      Z,CURS5
0E0A 25                         DEC     H
0E0B                    CURSU1: ENT
0E0B 18F2                       JR      CURS3
0E0D                    CURSR:  ENT
0E0D EB                         EX      DE,HL           ; LD HL,(DSPXY)
0E0E 7D                         LD      A,L
0E0F FE27                       CP      +39
0E11 3003                       JR      NC,CURS2
0E13 2C                         INC     L
0E14 18E9                       JR      CURS3
0E16                    CURS2:  ENT
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 55          04.07.83

01 0E16 2E00                    LD      L,+0
02 0E18 24                      INC     H
03 0E19 7C                      LD      A,H
04 0E1A FE19                    CP      +25
05 0E1C 38E1                    JR      C,CURS1
06 0E1E 2618                    LD      H,+24
07 0E20 227111                  LD      (DSPXY),HL
08 0E23                 CURS4:  ENT
09 0E23 1848                    JR      SCROL
10 0E25                 ;
11 0E25                 CURSL:  ENT
12 0E25 EB                      EX      DE,HL           ; LD HL,(DSPXY)
13 0E26 7D                      LD      A,L
14 0E27 B7                      OR      A
15 0E28 2803                    JR      Z,+5
16 0E2A 2D                      DEC     L
17 0E2B 18D2                    JR      CURS3
18 0E2D 2E27                    LD      L,+39
19 0E2F 25                      DEC     H
20 0E30 F20B0E                  JP      P,CURSU1
21 0E33 2600                    LD      H,0
22 0E35 227111                  LD      (DSPXY),HL
23 0E38 18C8                    JR      CURS5
24 0E3A                 ;
25 0E3A                 CLRS:   ENT
26 0E3A 217311                  LD      HL,MANG
27 0E3D 061B                    LD      B,27
28 0E3F CDD80F                  CALL    ?CLER
29 0E42 2100D0                  LD      HL,D000H        ; SCRN TOP
30 0E45 CDD409                  CALL    #CLR08
31 0E48 3E71                    LD      A,71H           ; COLOR DATA
32 0E4A CDD509                  CALL    #CLR8           ; D800H-DFFFH CLR.
33 0E4D                 HOME:   ENT
34 0E4D 210000                  LD      HL,0            ; DSPXY:0 X=0,Y=0
35 0E50 18AD                    JR      CURS3
36 0E52                 ;
37 0E52                         DEFS    +8
38 0E5A                 ;
39 0E5A                 ;       CR
40 0E5A                 ;
41 0E5A                 CR:     ENT
42 0E5A CDF302                  CALL    .MANG
43 0E5D 0F                      RRCA
44 0E5E 30B6                    JR      NC,CURS2
45 0E60 2E00                    LD      L,0
46 0E62 24                      INC     H
47 0E63 FE18                    CP      +24
48 0E65 2803                    JR      Z,CR1
49 0E67 24                      INC     H
50 0E68 1895                    JR      CURS1
51 0E6A                 CR1:    ENT
52 0E6A 227111                  LD      (DSPXY),HL
53 0E6D                 ;
54 0E6D                 ;   SCROL
55 0E6D                 ;
56 0E6D                 SCROL:  ENT
57 0E6D 01C003                  LD      BC,03C0H
58 0E70 1100D0                  LD      DE,SCRN         ; TOP OF $CRT ADR.
59 0E73 2128D0                  LD      HL,SCRN+40      ; 1 COLUMN
60 0E76 C5                      PUSH    BC              ; 1000 STORE
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 56          04.07.83

01 0E77 EDB0                    LDIR
02 0E79 C1                      POP     BC
03 0E7A D5                      PUSH    DE
04 0E7B 1100D8                  LD      DE,SCRN+800H    ; COLOR RAM SCROLL
05 0E7E 2128D8                  LD      HL,SCRN+828H    ; SCROLL TOP + 40
06 0E81 EDB0                    LDIR
07 0E83 0628                    LD      B,40            ; ONE LINE
08 0E85 EB                      EX      DE,HL
09 0E86 3E71                    LD      A,71H           ; COLOR RAM INITIAL DATA
10 0E88 CDDD0F                  CALL    ?DINT
11 0E8B E1                      POP     HL
12 0E8C 0628                    LD      B,40
13 0E8E CDD80F                  CALL    ?CLER           ; LAST LINE CLEAR
14 0E91 011A00                  LD      BC,26           ; ROW NUMBER +1
15 0E94 117311                  LD      DE,MANG         ; LOGICAL MANAGEMENT
16 0E97 217411                  LD      HL,MANG+1
17 0E9A EDB0                    LDIR
18 0E9C 3600                    LD      (HL),0
19 0E9E 3A7311                  LD      A,(MANG)
20 0EA1 B7                      OR      A
21 0EA2 2841                    JR      Z,?RSTR
22 0EA4 217211                  LD      HL,DSPXY+1
23 0EA7 35                      DEC     (HL)
24 0EA8 18C3                    JR      SCROL
25 0EAA                 ;
26 0EAA                 ;     CONTROL CODE TABLE
27 0EAA                 ;
28 0EAA                 CTBL:   ENT
29 0EAA 6D0E                    DEFW    SCROL           ; SCROLLING
30 0EAC F80D                    DEFW    CURSD           ; CURSOR
31 0EAE 050E                    DEFW    CURSU
32 0EB0 0D0E                    DEFW    CURSR
33 0EB2 250E                    DEFW    CURSL
34 0EB4 4D0E                    DEFW    HOME
35 0EB6 3A0E                    DEFW    CLRS
36 0EB8 F80E                    DEFW    DEL
37 0EBA 3B0F                    DEFW    INST
38 0EBC E10E                    DEFW    ALPHA
39 0EBE EE0E                    DEFW    KANA
40 0EC0 E50E                    DEFW    ?RSTR
41 0EC2 E50E                    DEFW    ?RSTR
42 0EC4 5A0E                    DEFW    CR
43 0EC6 E50E                    DEFW    ?RSTR
44 0EC8 E50E                    DEFW    ?RSTR
45 0ECA                 ;
46 0ECA                 ;
47 0ECA                 ;
48 0ECA                 ;     INST BYPASS
49 0ECA                 ;
50 0ECA CBDC            INST2:  SET     3,H             ; COLOR RAM
51 0ECC 7E                      LD      A,(HL)          ; FROM
52 0ECD 23                      INC     HL
53 0ECE 77                      LD      (HL),A          ; TO
54 0ECF 2B                      DEC     HL              ; ADR ADJ.
55 0ED0 CB9C                    RES     3,H
56 0ED2 EDA8                    LDD                     ; CHA. TRNS.
57 0ED4 79                      LD      A,C
58 0ED5 B0                      OR      B               ; BC=0 ?
59 0ED6 20F2                    JR      NZ,INST2
60 0ED8 EB                      EX      DE,HL
```

```
0ED9 3600                LD     (HL),0
0EDB CBDC                SET    3,H             ; COLOR RAM
0EDD 3671                LD     (HL),71H
0EDF 1804                JR     ?RSTR
0EE1                ;
0EE1                ;
0EE1                ;
0EE1                ;
0EE1                ;ORG 0EE1H;ALPHA
0EE1                ;
0EE1                ALPHA:  ENT
0EE1 AF                  XOR    A
0EE2                ALPH1:  ENT
0EE2 327011              LD     (KANAF),A
0EE5                ;
0EE5                ;
0EE5                ;  RESTORE  ;
0EE5                ;
0EE5                ?RSTR:  ENT
0EE5 E1                  POP    HL
0EE6                ?RSTR1: ENT
0EE6 D1                  POP    DE
0EE7 C1                  POP    BC
0EE8 F1                  POP    AF
0EE9 C9                  RET
0EEA                ;
0EEA                ;  MONITOR WORK AREA  ;
0EEA                ;
D000  P             SCRN:   EQU    D000H
E003  P             KANST:  EQU    E003H           ; KANA STATUS PORT
0EEA                ;
0EEA                ;
0EEA                ;
0EEA                         DEFS   +4
0EEE                ;ORG 0EEEH;KANA
0EEE                ;
0EEE                KANA:   ENT
0EEE CDD40D              CALL   GRSTAS
0EF1 CAB90D              JP     Z,DSP01         ; NOT GRAPH KEY THEN JUM
P
0EF4 3E01                LD     A,+1
0EF6 18EA                JR     ALPH1
0EF8                ;
0EF8                ;
0EF8                DEL:    ENT
0EF8 EB                  EX     DE,HL           ; LD HL,(DSPXY)
0EF9 7C                  LD     A,H             ; HOME ?
0EFA B5                  OR     L
0EFB 28E8                JR     Z,?RSTR
0EFD 7D                  LD     A,L
0EFE B7                  OR     A
0EFF 200D                JR     NZ,DEL1         ; LEFT SIDE ?
0F01 CDF302              CALL   .MANG
0F04 3808                JR     C,DEL1
0F06 CDB10F              CALL   ?PONT
0F09 2B                  DEC    HL
0F0A 3600                LD     (HL),+0
0F0C 1825                JR     INST-5          ; JP CURSL
0F0E                DEL1:   ENT
0F0E CDF302              CALL   .MANG
0F11 0F                  RRCA
```



```
0F12 5E28                LD     A,40
0F14 3001                JR     NC,+3
0F16 07                  RLCA                   ; ACC=80
0F17 95                  SUB    L
0F18 47                  LD     B,A             ; TRNS. BYTE
0F19 CDB10F              CALL   ?PONT
0F1C 7E             DEL2:   LD     A,(HL)          ; CHA. FROM ADR
0F1D 2B                  DEC    HL
0F1E 77                  LD     (HL),A          ; TO
0F1F 23                  INC    HL
0F20 CBDC                SET    3,H             ; COLOR RAM
0F22 7E                  LD     A,(HL)
0F23 2B                  DEC    HL
0F24 77                  LD     (HL),A
0F25 CB9C                RES    3,H             ; CHA.
0F27 23                  INC    HL
0F28 23                  INC    HL              ; NEXT
0F29 10F1                DJNZ   DEL2
0F2B 2B                  DEC    HL              ; ADR.ADJUST
0F2C 3600                LD     (HL),0
0F2E CBDC                SET    3,H
0F30 217100              LD     HL,71H          ; BLUE + WHITE
0F33 3EC4                LD     A,C4H           ; JP CURSL
0F35 C3E00D              JP     ?DPCT+4
0F38                ;
0F38                INST:   ENT
0F38 CDF302              CALL   .MANG
0F3B 0F                  RRCA
0F3C 2E27                LD     L,+39
0F3E 7D                  LD     A,L
0F3F 3001                JR     NC,+3
0F41 24                  INC    H
0F42 CDB40F              CALL   ?PNT1
0F45 E5                  PUSH   HL
0F46 2A7111              LD     HL,(DSPXY)
0F49 3002                JR     NC,+4
0F4B 3E4F                LD     A,+79
0F4D 95                  SUB    L
0F4E 0600                LD     B,0
0F50 4F                  LD     C,A
0F51 D1                  POP    DE
0F52 2891                JR     Z,?RSTR
0F54 1A                  LD     A,(DE)
0F55 B7                  OR     A
0F56 208D                JR     NZ,?RSTR
0F58 62                  LD     H,D             ; HL←DE
0F59 6B                  LD     L,E
0F5A 2B                  DEC    HL
0F5B C3CA0E              JP     INST2           ; JUMP NEXT (BYPASS)
0F5E                ;
0F5E                ;
0F5E                ;   PROGRAM SAVE
0F5E                ;
0F5E                ;      CMD. 'S'
0F5E                ;
0F5E                SAVE:   ENT
0F5E CD3D01              CALL   HEXIY           ; START ADR.
0F61 220411              LD     (DTADR),HL      ; DATA ADR. BUFFER
0F64 44                  LD     B,H
0F65 4D                  LD     C,L
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 59          04.07.83

0F66 CDA602                 CALL    .4DE
0F69 CD3D01                 CALL    HEXIY           ; END ADR.
0F6C ED42                   SBC     HL,BC           ; BYTE SIZE
0F6E 23                     INC     HL
0F6F 220211                 LD      (SIZE),HL       ; BYTE SIZE BUFFER
0F72 CDA602                 CALL    .4DE
0F75 CD3D01                 CALL    HEXIY           ; EXECUTE ADR.
0F78 220611                 LD      (EXADR),HL      ; BUFFER
0F7B CD0900                 CALL    NL
0F7E 118B09                 LD      DE,MSGSV        ; SAVED FILENAME
0F81 DF                     RST     3               ; CALL MSGX
0F82 CD2F01                 CALL    BGETL           ; FILENAME INPUT
0F85 CDA602                 CALL    .4DE
0F88 CDA602                 CALL    .4DE
0F8B 21F110                 LD      HL,NAME         ; NAME BUFFER
0F8E                SAV1:   ENT
0F8E 13                     INC     DE
0F8F 1A                     LD      A,(DE)
0F90 77                     LD      (HL),A          ; FILENAME TRANS.
0F91 23                     INC     HL
0F92 FE0D                   CP      0DH             ; END CODE
0F94 20F8                   JR      NZ,SAV1
0F96 3E01                   LD      A,01H           ; ATTRIBUE:OBJ.
0F98 32F010                 LD      (ATRB),A
0F9B CD3604                 CALL    ?WRI
0F9E DA0701                 JP      C,?ER           ; WRITE ERROR
0FA1 CD7504                 CALL    ?WRD            ; DATA
0FA4 DA0701                 JP      C,?ER
0FA7 CD0900                 CALL    NL
0FAA 114209                 LD      DE,MSGOK        ; OK MESSAGE
0FAD DF                     RST     3               ; CALL MSGX
0FAE C3AD00                 JP      ST1
0FB1                ;
0FB1                ;
0FB1                ;ORG 0FB1H;?PONT
0FB1                ;
0FB1                ;
0FB1                ;  COMPUTE POINT ADR .  ;
0FB1                ;
0FB1                ;    HL = SCREEN CORDINATE
0FB1                ;    EXIT
0FB1                ;    HL = POINT ADR. ON SCREEN
0FB1                ;
0FB1                ?PONT:  ENT
0FB1 2A7111                 LD      HL,(DSPXY)
0FB4                ;
0FB4                ;ORG 0FB4H;?PNT1
0FB4                ;
0FB4                ?PNT1:  ENT
0FB4 F5                     PUSH    AF
0FB5 C5                     PUSH    BC
0FB6 D5                     PUSH    DE
0FB7 E5                     PUSH    HL
0FB8 C1                     POP     BC
0FB9 112800                 LD      DE,0028H        ; 40
0FBC 21D8CF                 LD      HL,SCRN-40
0FBF                ?PNT2:  ENT
0FBF 19                     ADD     HL,DE
0FC0 05                     DEC     B
0FC1 F2BF0F                 JP      P,-2
```

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 60          04.07.83

0FC4 0600                   LD      B,+0
0FC6 09                     ADD     HL,BC
0FC7 D1                     POP     DE
0FC8 C1                     POP     BC
0FC9 F1                     POP     AF
0FCA C9                     RET
0FCB                ;
0FCB                ;   VERIFYING
0FCB                ;
0FCB                ;      COMMAND  'V'
0FCB                ;
0FCB                VRFY:   ENT
0FCB CD8805                 CALL    ?VRFY
0FCE DA0701                 JP      C,?ER
0FD1 114209                 LD      DE,MSGOK
0FD4 DF                     RST     3
0FD5 C3AD00                 JP      ST1
0FD8                ;
0FD8                ;
0FD8                ;
0FD8                ;ORG 0FD8H;?CLER
0FD8                ;
0FD8                ;
0FD8                ;  CLER  ;
0FD8                ;     B=SIZE
0FD8                ;     HL=LOW ADR.
0FD8                ;
0FD8                ?CLER:  ENT
0FD8 AF                     XOR     A
0FD9 1802                   JR      +4
0FDB                ?CLRFF: ENT
0FDB 3EFF                   LD      A,FFH
0FDD                ?DINT:  ENT
0FDD 77                     LD      (HL),A
0FDE 23                     INC     HL
0FDF 10FC                   DJNZ    -2
0FE1 C9                     RET
0FE2                ;
0FE2                ;
0FE2                ;   GAP CHECK
0FE2                ;
0FE2                GAPCK:  ENT
0FE2 C5                     PUSH    BC
0FE3 D5                     PUSH    DE
0FE4 E5                     PUSH    HL
0FE5 0101E0                 LD      BC,KEYPB
0FE8 1102E0                 LD      DE,CSTR
0FEB                GAPCK1: ENT
0FEB 2664                   LD      H,100
0FED                GAPCK2: ENT
0FED CD0106                 CALL    EDGE
0FF0 380B                   JR      C,GAPCK3
0FF2 CD4A0A                 CALL    DLY3            ; CALL DLY2*3
0FF5 1A                     LD      A,(DE)
0FF6 E620                   AND     20H
0FF8 20F1                   JR      NZ,GAPCK1
0FFA 25                     DEC     H
0FFB 20F0                   JR      NZ,GAPCK2
0FFD                GAPCK3: ENT
0FFD C39B06                 JP      RET3
```

```
01 1000                        SKP    H
```



```
01 1000                ;
02 1000                ;
03 1000                ;       MONITOR WORK AREA       ;
04 1000                ;           (MZ-700)            ;
05 1000                ;
06 1000                ;
07 1000                ;
08 10F0                        ORG     10F0H
09 10F0                SP:     ENT
10 10F0                IBUFE:  ENT                     ; TAPE BUFFER(128B)
11 10F0                ATRB:   ENT                     ; ATTRIBUTE
12 10F0                        DEFS    +1
13 10F1                NAME:   ENT                     ; FILE NAME
14 10F1                        DEFS    +17
15 1102                SIZE:   ENT                     ; BYTE SIZE
16 1102                        DEFS    +2
17 1104                DTADR:  ENT                     ; DATA ADR
18 1104                        DEFS    +2
19 1106                EXADR:  ENT                     ; EXECUTION ADR
20 1106                        DEFS    +2
21 1108                COMNT:  ENT                     ; COMMENT
22 1108                        DEFS    104
23 1170                KANAF:  ENT                     ; KANA FLAG
24 1170                        DEFS    +1
25 1171                DSPXY:  ENT                     ; DISPLAY CO-ORDINATES
26 1171                        DEFS    +2
27 1173                MANG:   ENT                     ; COLOUMN MANAGEMENT
28 1173                        DEFS    +27
29 118E                FLASH:  ENT                     ; FLASHING DATA
30 118E                        DEFS    +1
31 118F                FLPST:  ENT                     ; FLASSING POSITION
32 118F                        DEFS    +2
33 1191                FLSST:  ENT                     ; FLASING STATUS
34 1191                        DEFS    +1
35 1192                FLSDT:  ENT                     ; CURSOR DATA
36 1192                        DEFS    +1
37 1193                STRGF:  ENT                     ; STRING FLAG
38 1193                        DEFS    +1
39 1194                DPRNT:  ENT                     ; TAB COUNTER
40 1194                        DEFS    +1
41 1195                TMCNT:  ENT                     ; TAPE MARK COUNTER
42 1195                        DEFS    +2
43 1197                SUMDT:  ENT                     ; CHECK SUM DATA
44 1197                        DEFS    +2
45 1199                CSMDT:  ENT                     ; FOR COMPARE SUM DATA
46 1199                        DEFS    +2
47 119B                AMPM:   ENT                     ; AMPM DATA
48 119B                        DEFS    +1
49 119C                TIMFG:  ENT                     ; TIME FLAG
50 119C                        DEFS    +1
51 119D                SWRK:   ENT                     ; KEY SOUND FLAG
52 119D                        DEFS    +1
53 119E                TEMPW:  ENT                     ; TEMPO WORK
54 119E                        DEFS    +1
55 119F                ONTYO:  ENT                     ; ONTYO WORK
56 119F                        DEFS    +1
57 11A0                OCTV:   ENT                     ; OCTAVE WORK
58 11A0                        DEFS    +1
59 11A1                RATIO:  ENT                     ; ONPU RATIO
60 11A1                        DEFS    +2
```

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 63          04.07.83

01 11A3                   BUFER:  ENT                     ; GET LINE BUFFER
02 11A3                           DEFS    +81
03 11F4                   ;
04 11F4                   ;
05 11F4                   ;       EQU TABLE I/O PORT
06 11F4                   ;
07 11F4                   ;
08 E000  P                KEYPA:  EQU     E000H
09 E001  P                KEYPB:  EQU     E001H
10 E002  P                KEYPC:  EQU     E002H
11 E003  P                KEYPF:  EQU     E003H
12 E002  P                CSTR:   EQU     E002H
13 E003  P                CSTPT:  EQU     E003H
14 E004  P                CONT0:  EQU     E004H
15 E005  P                CONT1:  EQU     E005H
16 E006  P                CONT2:  EQU     E006H
17 E007  P                CONTF:  EQU     E007H
18 E008  P                SUNDG:  EQU     E008H
19 E008  P                TEMP:   EQU     E008H
20 11F4                   ;
21 11F4                           END
```

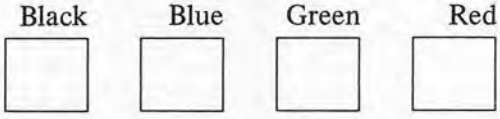
```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 64          04.07.83

#BRK    0888  #CLR0B  09D4  #CLR8   09D5  $MCP    006B  ..LPT   017B
.4DE    02A6  .LPT    0176  .MANG   02F3  2HE1    0434  2HEX    041F
??KEY   09B3  ?ADCN   0BB9  ?BEL    0577  ?BELD   0352  ?BLNK   0DA6
?BRK    0A32  ?BRK1   0A48  ?BRK2   0980  ?BRK3   0986  ?CLER   0FD8
?CLRFF  0FDB  ?DACN   0BCE  ?DINT   0FDD  ?DPCT   0DDC  ?DSP    0DB5
?ER     0107  ?FLAS   09FF  ?FLS    09E3  ?GET    08BD  ?GETL   07E6
?KEY    08CA  ?KY1    08D6  ?KY2    08DA  ?KY5    08FA  ?KY55   08FB
?KYGRP  08FE  ?KYGRS  0909  ?KYSM   08B3  ?LOAD   05F0  ?LTNL   090E
?MLDY   01C7  ?MODE   073E  ?MSG    0893  ?MSGX   08A1  ?NL     0918
?PNT1   0FB4  ?PNT2   0FBF  ?PONT   0FB1  ?PRNT   0935  ?PRT    0946
?PRTS   0920  ?PRTT   0924  ?RDD    04F8  ?RDI    04D8  ?RSTR   0EE5
?RSTR1  0EE6  ?SAVE   0B92  ?SWEP   0A50  ?TEMP   02E5  ?TMR1   0375
?TMR2   037F  ?TMRD   0358  ?TMS1   0331  ?TMS2   0344  ?TMST   0308
?VRFY   0588  ?WRD    0475  ?WRI    0436  ALPH1   0EE2  ALPHA   0EE1
AMPM    119B  ASC     03DA  ATBL    0A92  ATRB    10F0  AUTO3   07ED
BELL    003E  BGETL   012F  BRKEY   001E  BUFER   11A3  CKS1    0720
CKS2    072F  CKS3    0733  CKSUM   071A  CLEAR   09D8  CLEAR1  09DA
CLRS    0E3A  CMY0    005B  COMNT   1108  CONT0   E004  CONT1   E005
CONT2   E006  CONTF   E007  CR      0E5A  CR1     0E6A  CSMDT   1199
CSTPT   E003  CSTR    E002  CTBL    0EAA  CURS1   0DFF  CURS2   0E16
CURS3   0DFF  CURS4   0E23  CURS5   0E02  CURSD   0DF8  CURSL   0E25
CURSR   0E0D  CURSU   0E05  CURSU1  0E0B  DACN1   0BE3  DACN2   0BDF
DACN3   0BE0  DEL     0EF8  DEL1    0F0E  DEL2    0F1C  DLY1    0759
DLY12   0996  DLY2    0760  DLY3    0A4A  DLY4    09A9  DPRNT   1194
DSP01   0DB9  DSP04   0DD0  DSPXY   1171  DSWEP   0830  DTADR   1104
DUM1    0D88  DUM2    0D3E  DUM3    0D37  DUMP    0D29  EDG1    0607
EDG2    0613  EDGE    0601  EXADR   1106  FD      00FF  FD1     0106
FD2     0102  FLAS1   097B  FLAS2   09EF  FLAS3   09F3  FLASH   118E
FLKEY   057E  FLPST   118F  FLSDT   1192  FLSST   1191  GAP     077A
GAP1    078E  GAP2    0796  GAP3    079C  GAPCK   0FE2  GAPCK1  0FEB
GAPCK2  0FED  GAPCK3  0FFD  GETKY   001B  GETL    0003  GETL1   07EA
GETL2   0818  GETL3   085B  GETL5   081D  GETL6   0865  GETLA   082B
GETLB   0863  GETLC   0822  GETLR   087E  GETLU   0876  GETLZ   086C
GOTO    00F3  GRSTAS  0DD4  HEX     03F9  HEXIY   013D  HEXJ    03E5
HL1     041D  HLHEX   0410  HOME    0E4D  IBUFE   10F0  INST    0F38
INST2   0ECA  KANA    0EEE  KANAF   1170  KANST   E003  KEYPA   E000
KEYPB   E001  KEYPC   E002  KEYPF   E003  KSL1    09B7  KSL2    09BC
KTBL    0BEA  KTBLC   0CAA  KTBLG   0CE9  KTBLGS  0C6A  KTBLS   0C2A
LETNL   0006  LLPT    0470  LOAO    0116  LOAD    0111  LONG    0A1A
LPRNT   018F  M#TBL   0284  MANG    1173  MCOR    07A8  MCR1    07AB
MCR2    07D4  MCR3    07D7  MELDY   0030  MLD1    01D1  MLD2    0205
MLD3    020D  MLD4    0211  MLD5    0214  MLDS1   02C4  MLDSP   02BE
MLDST   02AB  MONIT   0000  MOT1    06A4  MOT2    06AB  MOT4    06B9
MOT5    06D8  MOT7    06B7  MOT8    06D0  MOT9    06D7  MOTOR   069F
MSG     0015  MSG#1   03FB  MSG#2   03FD  MSG#3   0402  MSG#7   0467
MSG1    0896  MSG?2   09A0  MSG?3   06E7  MSGE1   0147  MSGOK   0942
MSGSV   098B  MSGX    0018  MSGX1   08A4  MSGX2   08A7  MST1    0705
MST2    070C  MST3    0717  MSTA    0044  MSTOP   0700  MSTP    0047
MTBL    026C  NAME    10F1  NL      0009  NLPHL   05FA  NOADD   03E2
OCTV    11A0  ONP1    021F  ONP2    022C  ONP3    0265  ONPU    021C
ONTYO   119F  OPTBL   029C  PEN     018B  PLOT    0184  PMSG    01A5
PMSG1   01A8  PRNT    0012  PRNT2   0967  PRNT3   096C  PRNT4   096F
PRNT5   0959  PRNTS   000C  PRNTT   000F  PRTHL   03BA  PRTHX   03C3
PTEST   0155  PTRN    0180  PTSTO   015A  PTST1   0170  RATIO   11A1
RBY1    0630  RBY2    0649  RBY3    0654  RBYTE   0624  RD1     04E6
RDA     01B6  RDDAT   002A  RDINF   0027  RET1    04D2  RET2    0554
RET3    069B  RTAPE   050E  RTP1    0513  RTP2    0519  RTP3    0532
RTP4    0554  RTP5    0565  RTP6    0572  RTP7    056E  RTP8    0553
RTP9    0574  RYTHM   02C8  SAV1    0F8E  SAVE    0F5E  SCRN    D000
SCROL   0E6D  SG      00F7  SHORT   0A01  SIZE    1102  SLPT    03D5
```

SP	10F0	SPHEX	03B1	SS	00A2	ST0	0070	ST1	00AD
ST2	00BB	START	004A	STRGF	1193	SUMDT	1197	SUNDG	E008
SV0	0BA2	SV1	0BB5	SWEP0	0A66	SWEP01	0A64	SWEP2	0A7F
SWEP3	0A77	SWEP6	0A5F	SWEP9	0A73	SWRK	119D	TEMP	E008
TEMPW	119E	TIMFG	119C	TIMIN	038D	TIMRD	003B	TIMST	0033
TM1	0675	TM2	0678	TM3	0688	TM4	069B	TMARK	065B
TMCNT	1195	TVF1	05B2	TVF2	05B8	TVF3	05CC	TVRFY	05AD
VERFY	002D	VGOFF	0747	VRFY	0FCB	VRNS	0BC5	WBY1	076D
WBYTE	0767	WRDAT	0024	WRI1	0444	WRI2	045E	WRI3	0464
WRINF	0021	WTAP1	0494	WTAP2	04A5	WTAP3	04D2	WTAPE	048A
XTEMP	0041								

A. 6 Color Plotter-Printer Control Codes

A.6.1 Control codes used in the text mode

- Text code ($01)
  Sets the printer in the text mode.
- Graphic code ($02) ..... Same as the BASIC MODE GR statement.
  Sets the printer in the graphic mode.
- Line up ($03) ..... Same as the BASIC SKIP-1 statement.
  Moves the paper one line in the reverse direction. The line counter is decremented by 1.
- Pen test ($04) ..... Same as the BASIC TEST statement.
  Writes the following patterns to start ink flowing from the pens, then sets scale = 1 (40 chr/line), color = 0.



- Reduction scale ($09) + ($09) + ($09)
  Reduces the scale from 1 to 0 (80 chr/line).
- Reduction cancel ($09) + ($09) + ($0B)
  Enlarges the scale from 0 to 1. (40 chr/line).
- Line counter set ($09) + ($09) + $(ASCII)_2$ + $(ASCII)_1$ + $(ASCII)_0$ + ($0D)
  ..... Same as the BASIC PAGE statement.
  Specifies the number of lines per page as indicated by 3 bytes of ASCII code. The maximum number of lines per page is 255. Set to 66 when the power is turned on or the system is reset.
- Line feed ($0A) ..... Same as the BASIC SKIP 1 statement.
  Moves the paper one line in the forward direction. The line counter is incremented by 1.
- Magnify scale ($0B)
  Enlarges the scale from 1 to 2 (26 chr/line).
- Magnify cancel ($0C)
  Reduces the scale from 2 to 1.
- Carriage return ($0D)
  Moves the carriage to the left side of the print area.
- Back space ($0E)
  Moves the carriage one column to the left. This code is ignored when the carriage is at the left side of the print area.
- Form feed ($0F)
  Moves the paper to the beginning of the next page and resets the line counter to 0.
- Next color ($1D)
  Changes the pen to the next color.

A.6.2 Character scale

- The character scale is automatically set to 1 (40 chr/line) when the power is turned on. Afterwards, it can be changed by the control codes and commands.
- In the graphic mode, the scale can be changed in the range from 0 to 63.
- The scale is set to 1 when the mode is switched from graphic to text.

A.6.3 Graphic mode commands

A. 6. 3. 1 Command type

In the graphic mode, the printer can be controlled by outputting the following commands to the printer.

Words in parentheses are BASIC statements which have the same functions as the graphic mode commands.

Command name	Format	Function
LINE TYPE	Lp (p = 0 to 15)	Specifies the type of line (solid or dotted) and the dot pitch. p = 0 : solid line, p = 1 ~ 15 : dotted line 
ALL INITIALIZE	A	Sets the printer in the text mode.
HOME (PHOME)	H	Lifts the pen and returns it to the origin (home position).
INITIALIZE (HSET)	I	Sets the current pen location as the origin (x = 0, y = 0).
DRAW (LINE)	Dx, y, . . . xn, yn (−999 ≦ x, y ≦ 999)	Draws lines from the current pen location to coordinates (x_1, y_1), then to coordinates (x_2, y_2), and so forth.
RELATIVE DRAW (RLINE)	J△x, △y . . . △xn, △yn (−999 ≦ △x, △y ≦ 999)	Draws lines from the current pen location to relative coordinates $(\triangle x_1, \triangle y_1)$, then to relative coordinates $(\triangle x_2, \triangle y_2)$ and so forth.
MOVE (MOVE)	Mx, y (−999 ≦ x, y ≦ 999)	Lifts the pen and moves it to coordinates (x, y).
RELATIVE MOVE (RMOVE)	R△x, △y (−999 ≦ △x, △y ≦ 999)	Lifts the pen and moves it to relative coordinates (△x, △y).
COLOR CHANGE (PCOLOR)	Cn (n = 0 to 3)	Changes the pen color to n.
SCALE SET	Sn (n = 0 to 63)	Specifies the character scale.
ALPHA ROTATE	Qn (n = 0 to 3)	Specifies the direction in which characters are printed.
PRINT	$Pc_1 c_2 c_3$ . . . cn (n = ∞)	Prints characters.
AXIS (AXIS)	Xp, q, r (p = 0 or 1) (q = −999 to 999) (r = 1 to 255)	Draws an X axis when p = 1 and a Y axis when p = 0. q specifies the scale pitch and r specifies the number of scale marks to be drawn.

A. 6. 3. 2 Command format

There are 5 types of command formats as shown below.

1. Command character only (without parameters)
   "A", "H", "I"
2. Command character plus one parameter
   "L", "C", "S", "Q"
3. Command character plus pairs of parameters
   "D", "J", "M", "R"
   "," is used to separate parameters, and a CR code is used to end the parameter list.
4. Command plus character string
   "P"
   The character string is terminated with a CR code.
5. Command plus three parameters
   "X"
   "," is used to separate parameters.

A. 6. 3. 3 Parameter specification

1. Leading blanks are ignored.
2. Any number preceded by " -- " is treated as a negative number.
3. If the number of digits of a number exceeds 3, only the lower 3 digits are effective.
4. Each parameter is ended with "," or a CR code. If other than numbers are included in a parameter, subsequent characters are ignored until a comma or CR code is detected.

Example) D␣␣ −135. 21, ·····

Ignored.

A. 6. 3. 4 Abbreviated formats

1. Any command can be followed by a one-character command without entering a CR code.
   Ex) "HD100, 200" CR is effective and is the same as "H" CR "D100, 200" CR.
2. Any command can be followed by a command with one parameter by separating them with a comma ",".
   Ex) "L0, S1, Q0, C1, D100, 200" CR is effective.
3. A command with pairs of parameters must be terminated with a CR code.

4. 6. 3. 5 Data change due to mode switching

The following data changes when the printer is switched from the graphic mode to the text mode.

- X and Y coordinates
  Y is set to 0 and the origin is placed at the left side of the printable area.
- Direction of characters
  Q is set to 0.
- Character scale
  Character scale is set to 1.
- The line type setting is not affected.

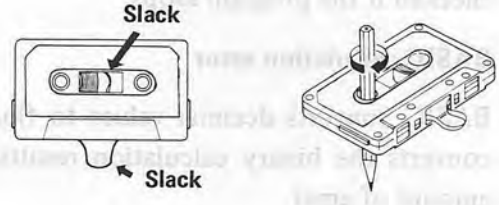
A. 7 Notes Concerning Operation

■ **Data recorder**

- Although the data recorder of the MZ-700 is highly reliable, the read/write head will wear out after prolonged use. Further, magnetic particles and dust will accumulate on the head, degrading read/write performance. Therefore, the head must be cleaned periodically or replaced when it becomes worn.
  1. To clean the head, open the cassette compartment, press the [PLAY] key, and wipe the head and pinch roller using a cotton swab. If they are very dirty, soak the cotton swab in alcohol.
  2. When the head becomes worn, contact your dealer. Do not attempt to replace it by yourself.

■ **Cassette tape**

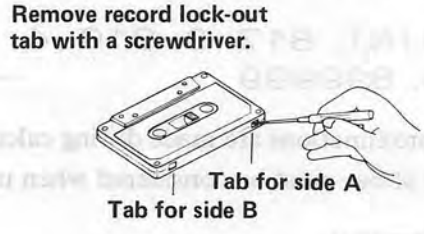
- **Any commercially available cassette tape can be used with the MZ-700. However, it is recommended that you use quality cassette tape produced by a reliable manufacturer.**
  - Use normal type tapes.
  - Avoid using C-120 type cassette tapes.
  - Use of C-60 or shorter cassette tapes is recommended.
  - Be sure to take up any the slack in the tape with a pencil or the like as shown at right before loading the cassette tape: otherwise, the tape may break or become wound round the pinch roller.



- **Protecting programs/data from accidental erasure**

The data recorder of the MZ-700 is equipped with a write protect function which operates in the same manner as with ordinary audio cassette tape decks.

To prevent data from being accidentally erased, remove the record lock-out tab from the cassette with a screwdriver or the like. This makes it impossible to press the [RECORD] key, preventing erasure of, valuable data.



■ **Other**

- See page 109 for commercially available cassette tape decks.

■ **Display unit**

When using a display unit other than one specified for the MZ-700, the screen size must be adjusted. See page 106.

■ **Color plotter-printer**

- Do not rotate the pen drum in the reverse direction when replacing pens.
- Be sure to remove the pens from the pen drum, replace their caps to them, and store them in the case to prevent them from drying out when the printer is not to be used for an extended period of time.
- It takes a certain amount of time for ink on the paper to dry. (The ink is water-soluble.)
- Do not rip off the paper when the printer cover is removed. Hold down the paper holder when ripping off the paper.
- Do not touch the internal mechanism when replacing the pens. Failure to observe this warning may result in damage to the printer.
- The color plotter printer generates sound for a moment when the power is turned on. This is not a problem.
- Letters printed in the 80 character line mode may be difficult to read. In this case, use the 40 character/line mode.
- In the graphic mode, lines printed repeatedly may become blurred. This is particularly liable to occur when a dotted line is printed repeatedly. Due to the characteristics of the ball pen, this is unavoidable.

■ **Notes concerning software**

- It takes about 3 minutes to load the BASIC interpreter.
- The reset switch on the rear panel is to used in the following cases. (See 3. 1. 1.)
  To stop execution of a BASIC program during normal execution or when the program enters an infinite loop. To return to the program, use the # command. However, the program or hardware should be checked if the program loops.

■ **BASIC calculation error**

- BASIC converts decimal values to floating point binary values before performing calculations, then converts the binary calculation results into decimal numbers for display. This can result in a certain amount of error.

  (Example:)

```
PRINT 817.3-810.4
 6.899999                    ..... Correct result is 6.9.
```

- Approximations are made during calculation of functions and exponentiation.
- The above must be considered when using IF statements.

  (Example:)

```
10 A=1/100*100
20 IF A=1 THEN PRINT"TRUE" :GOTO 40
30 PRINT "FALSE"
40 PRINT "A=";A
50 END
RUN
FALSE
A=1
```

Although the practical result of the equation in line 10 is 1, this program prints FALSE because of error due to conversion.

■ Notes concerning handling

- **Power switch**

  The power switch should be left untouched for at least 10 seconds after being turned on or off. This is necessary to ensure correct operation of the computer. Do not unplug the power cable when the power switch is on: otherwise, trouble may result.

- **Power cable**

  Avoid placing heavy objects such as desks on top of the power cable. This may damage the power cable, possibly resulting in a serious accident. Be sure to grasp the cable by the plug when unplugging it.

- **Power supply voltage**

  The power supply voltage is 240/220 VAC. The computer may not operate properly if the voltage is too high or too low. Contact your dealer for assistance if you experience this problem.

- **Ventilation**

  Many vents are provided in the cabinet to prevent overheating. Place the computer in a well ventilated place, and do not cover it with a cloth. Do not place any objects on the left side of the computer, since this is where the vents for the power supply unit are located.

- **Humidity and dust**

  Do not use the computer in a damp or dusty places.

- **Temperature**

  Do not place the computer near heaters or in places where it may be exposed to direct sunlight; failure to observe this precaution may result in damage to the computer's components.

- **Water and foreign substances**

  Water and other foreign substances (such as pins) entering the computer will damage it. Unplug the power cable immediately and contact your dealer for assistance if such an accident occurs.

- **Shock**

  Avoid subjecting the computer to shock; strong shocks will damage the computer permanently.

- **Trouble**

  Stop immediately operation and contact your dealer if you note any abnormality.

- **Prolonged disuse**

  Be sure to unplug the power cable if the computer is not to be used for a prolonged period of time.

- **Connection of peripheral devices**

  Use only parts and components designated by Sharp when connecting any peripheral devices, otherwise, the computer may be damaged.

- **Dirt**

  Wipe the cabinet with a soft cloth soaked in water or detergent when it becomes dirty. To avoid discoloration of the cabinet, do not use volatile fluids such as benzene.

- **Noise**

  It is recommended that a line filter be used when the computer is used in a place where high level noise signals may be present in the AC power. (A line filter can be obtained from your Sharp dealer). Move the signal cables as far as possible from the power cable and other electrical appliances.

- **RF interference**

  Interference with TV or radio reception may occur due to the RF signal generated by the computer if it is used near a TV or radio set. TV sets generate a strong magnetic field which may result in incorrect operation of the computer. If this occurs, move the TV set at least 2 to 3 meters away from the computer.

This apparatus complies with requirements of EEC directive 76/889/EEC.

Copying/Debugging of MZ-700 Basic Interpreter

A. Please follow the procedure below mentioned to copy the BASIC tape.

1) Power on MZ-700 (→ monitor state)
2) Partial memory should be modified by the use of monitor command M (memory correction) as follows:

```
*MCF00
CF00   FF → CD
CF01   00 → 27
CF02   FF → 00
CF03   00 → 38
CF04   FF → 03
CF05   00 → CD
CF06   FF → 2A
CF07   00 → 00
CF08   FF → DA
CF09   00 → FE
CF0A   FF → 00
CF0B   00 → C3
CF0C   FF → AD
CF0D   00 → 00
CF0E   FF → CD
CF0F   00 → 27
CF10   FF → 00
CF11   00 → 38
CF12   FF → F5
CF13   00 → C3
CF14   FF → CB
CF15   00 → 0F
```

[SHIFT] + [BREAK] to be keyed in.

NOTE: The content of memory from CF00 to CF15 may not always be as above mentioned.

3) The cassette to be read (copyed from) should be set to the tape recorder.
4) Key in the monitor command J (Jump) as follows:

```
* JCF00  [CR]
↓ PLAY
```

NOTE: If a button of the tape recorder is still pushed no play indication will appear.

5) Confirming the "↓PLAY" indication above mentioned, push [PLAY] button and load the content of BASIC tape. On this occasion, no indication like FILE NAME, etc. will be shown. When ERROR occured, please restart from the item 1) again.
6) Set a new cassette to which the BASIC should be written into the recorder and execute [REWIND].

7) Key in as follows:

＊ J1108 [CR]

8) The monitor will be cleared and the following indication will appear:

S-BASICEX SAVER xx ▫ xx ▪
HIT ANY KEY?

9) Push any key.

↓ Record Play
[STOP] button should be pushed beforehand.

10) Push [RECORD] button. The copy will start and the following indication will appear:

WRITING S-BASIC

On the occasion of MZ-711, item 9) should be effectuated after setting the external tape recorder in recording state.

11) After the sound "Pit Pit", the copy will be terminated.
12) The monitor state will be recovered by pushing the rear RESET SW.
13) Rewind the tape and push [STOP] button.
14) Key in as follows:

＊ JCF0E [CR]
↓ PLAY

15) Push [PLAY] button of the recorder and the "VERIFY" function will be executed. When successful verified, the indication of "OK!" will appear though no other indication like FILE NAME etc. will appear. When error occured, please restart from the item 4).
16) Please make sure to enable the write protection of the cassette by removing the nail.

B. The following procedure is requested to modify the content of BASIC interpreter.

a) Operate just as the case for copying mentioned in item 1) to 5).
b) Call up the address to be modified by using the monitor command M.
Ex. 8A in 1234H should be changed to 7A.

		Key in
＊M		1234
1234	8A	7A [CR]
1235	8A	[SHIFT] + [BREAK]
＊		

C. The operation from the item 6) onwards should be continued hereafter.

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