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

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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.

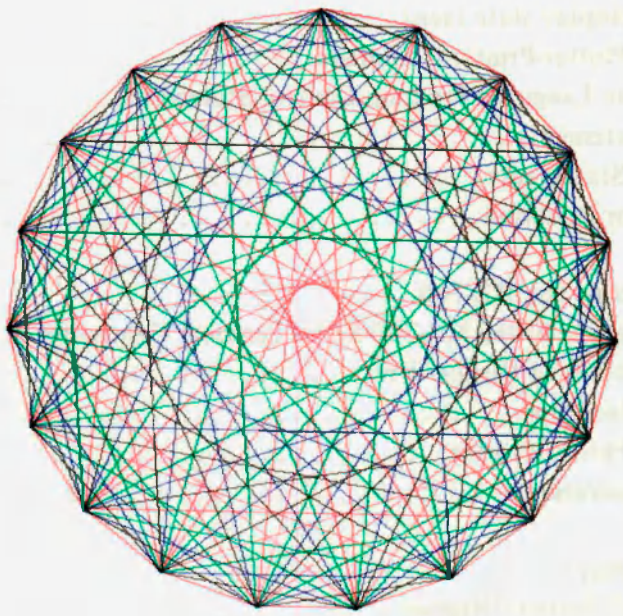
(2) All system software for the Sharp MZ-700 series personal computer has been developed by the Sharp Corporation, and all rights to such software are reserved. Reproduction of the system software or the contents of this book is prohibited.

(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

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APPENDICES

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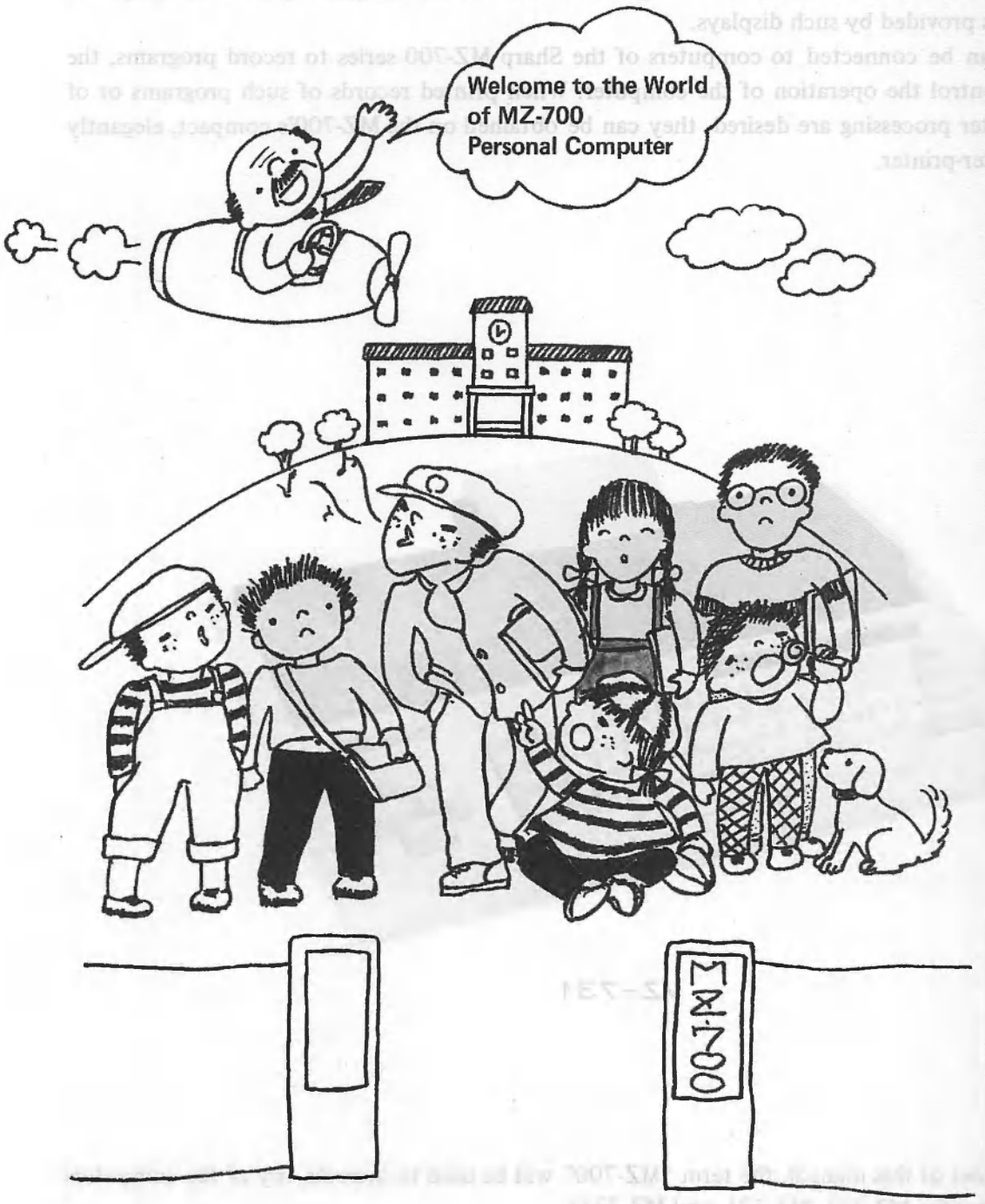
[BASIC COMMANDS] ( ) is abbreviated format

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

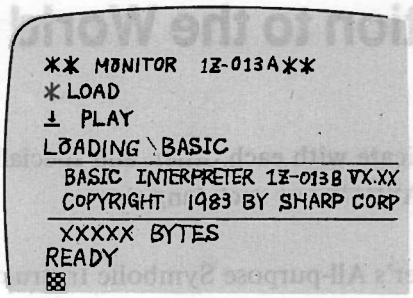
The BASIC language must be loaded into the MZ-700 before it can be used to do any work. A cassette tape containing this language has been included in the case containing the MZ-700. Now let's teach the language to the computer; procedures for doing this are described below. (The explanation assumes that 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.

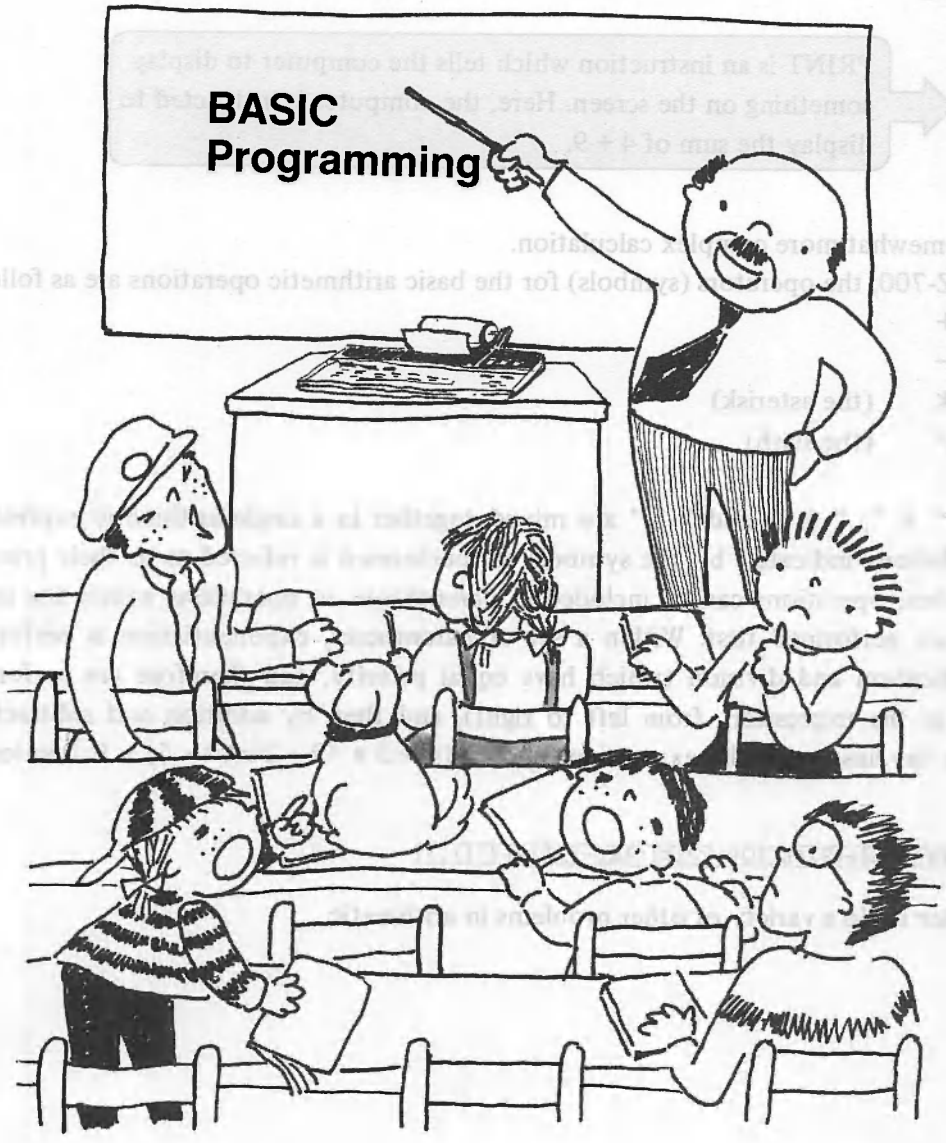
(5) Type in [L][I][S][T] and press the [CR] key. This lists the lines of the program on the screen one after another. (Output of the list can be temporarily stopped at any time by pressing the space bar.)

(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.)

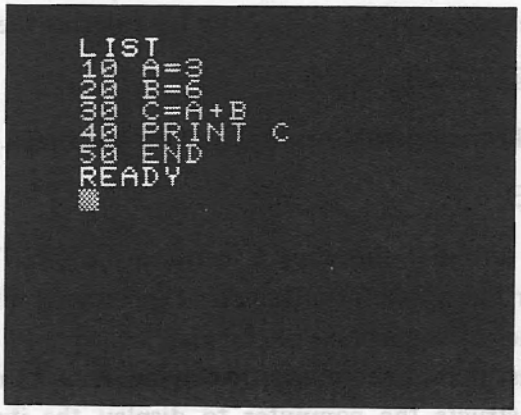
Type in the following program exactly as shown.

```
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.

RUN 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.

LIST -30 CR	Lists all lines of the program to line 30.
LIST 30- CR	Lists all lines from line 30 to the end of the program.
LIST 30-50 CR	Lists all lines from line 30 to line 50.
LIST 30 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

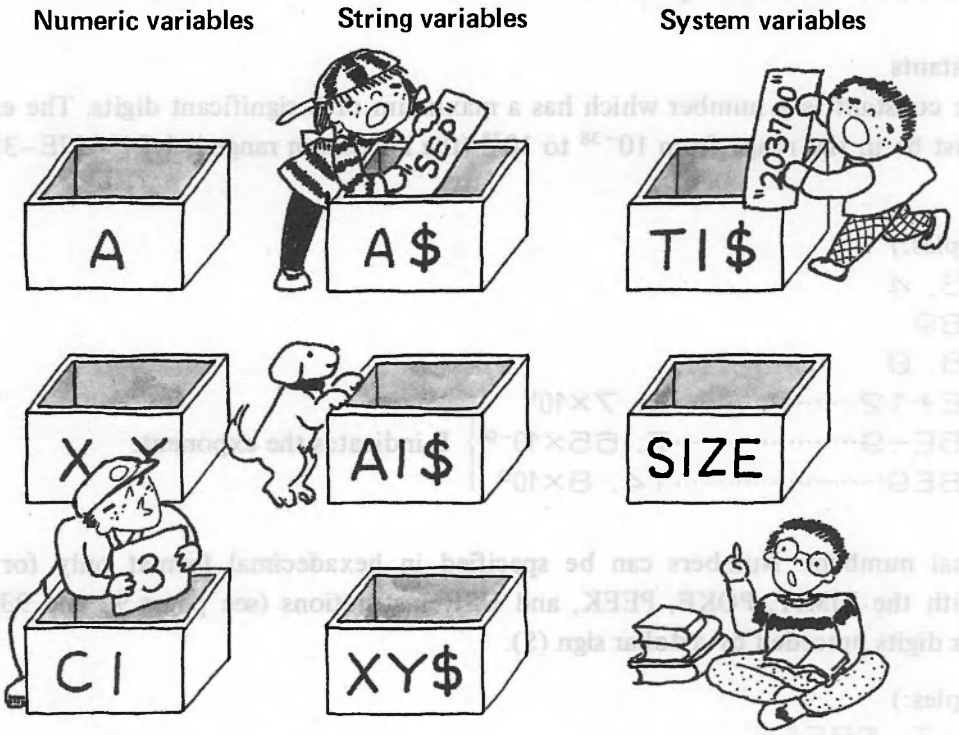
String constants are letters and symbols between quotation marks which are included in programs to allow titles or messages to be output to the display screen or printer. The characters "4+9" appearing on page 17 are a character constant, and not a numeric constant. With BASIC, a string constant may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

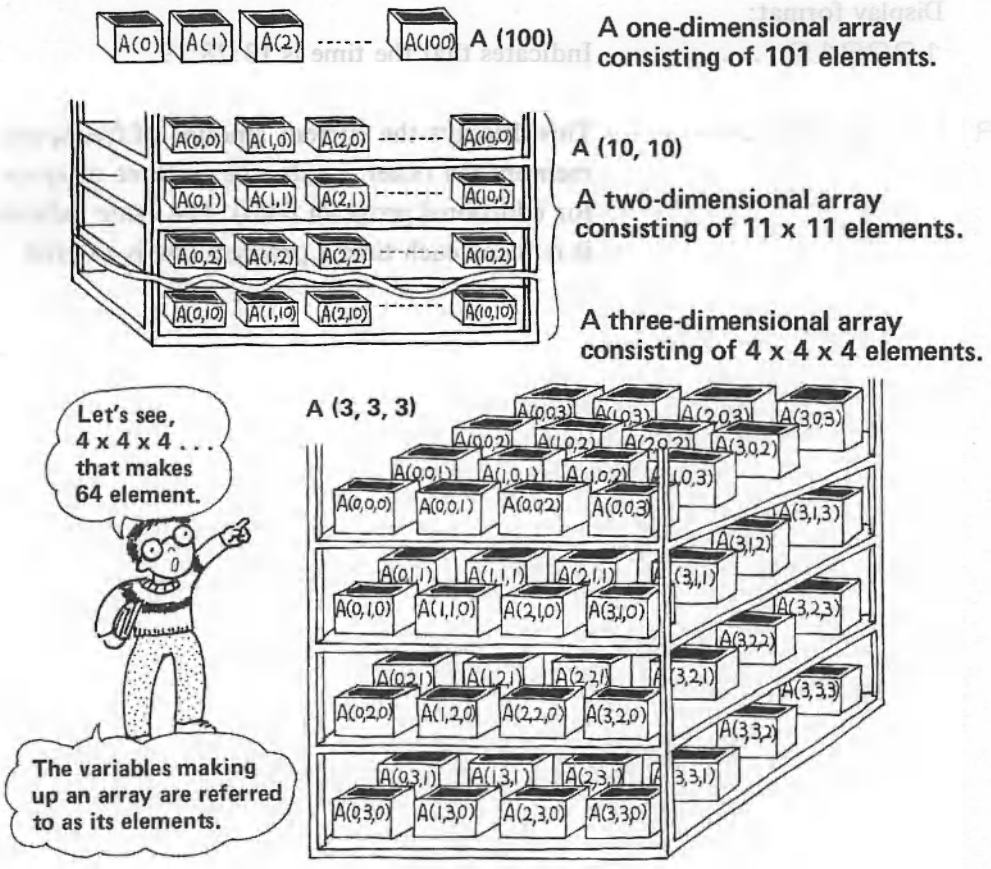
Such shelves of boxes are set up simply by executing an instruction which declares that they exist; this is referred to as making an array declaration. The array declaration specifies the number of boxes which are to be included in each set of shelves (i.e., the size of the shelves) and the manner in 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)·····
20 DIM X$(8)·····
```

Declares 1-dimensional numeric array A with 6 elements.
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)
```

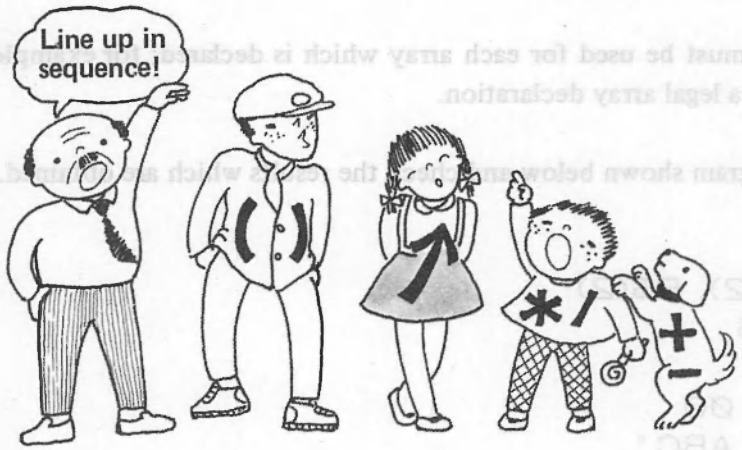
Note: Individual variables within an array, such as A(5) and X$(8), are referred to as an array's elements. Numeric constants, numeric variables, and numeric arrays are collectively referred to as numeric expressions, and string constants, string variables, and string arrays are collectively referred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

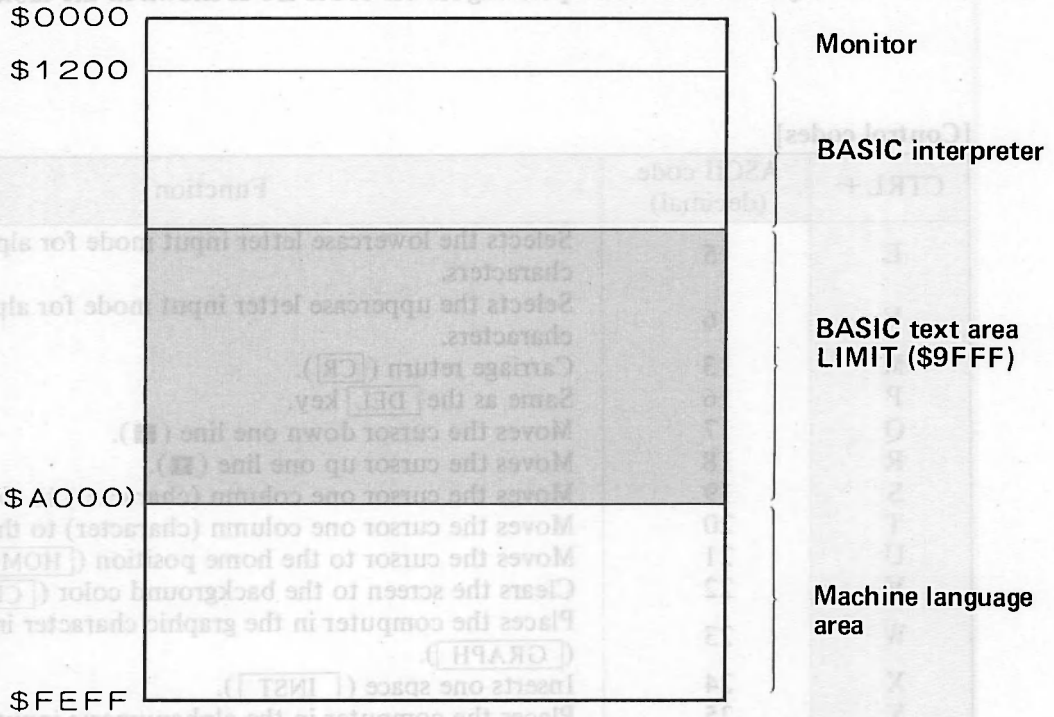
(See pages 14 and 20.)

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. 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.

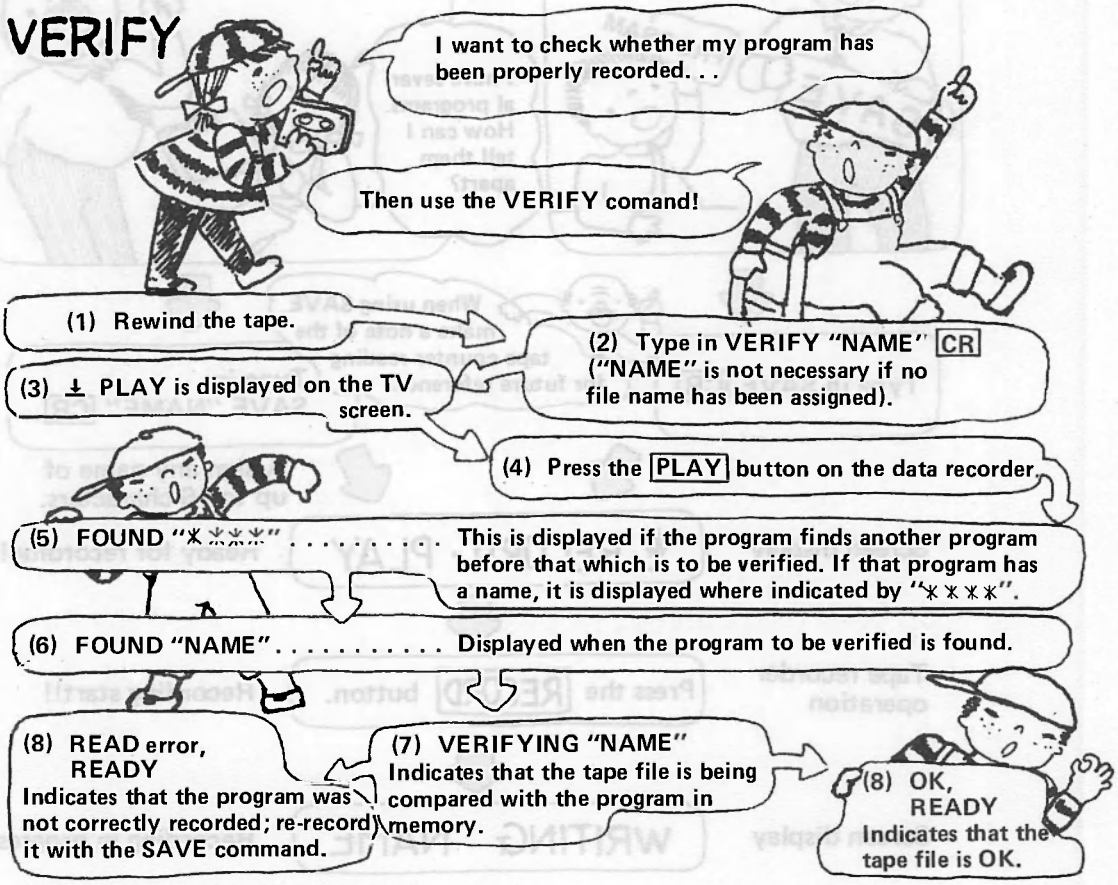
Note This command saves only the BASIC program text (i.e., the program text displayed by executing the LIST command); it does not save any machine language program in the machine language area.

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.

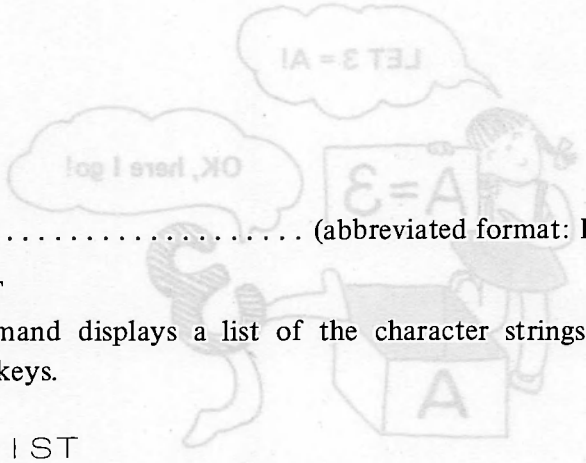
2. 3. 3. 3 BYE ..... (abbreviated format: B.)

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

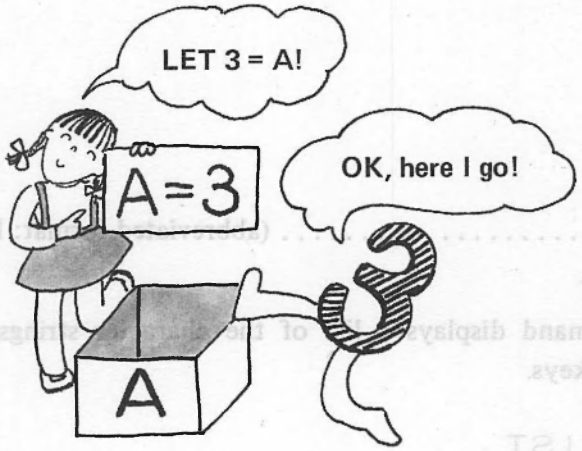
LET

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
 .513606E-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 "■■■■■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.

■ ····· Press the CLR key.
■ ····· 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
```

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

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
```

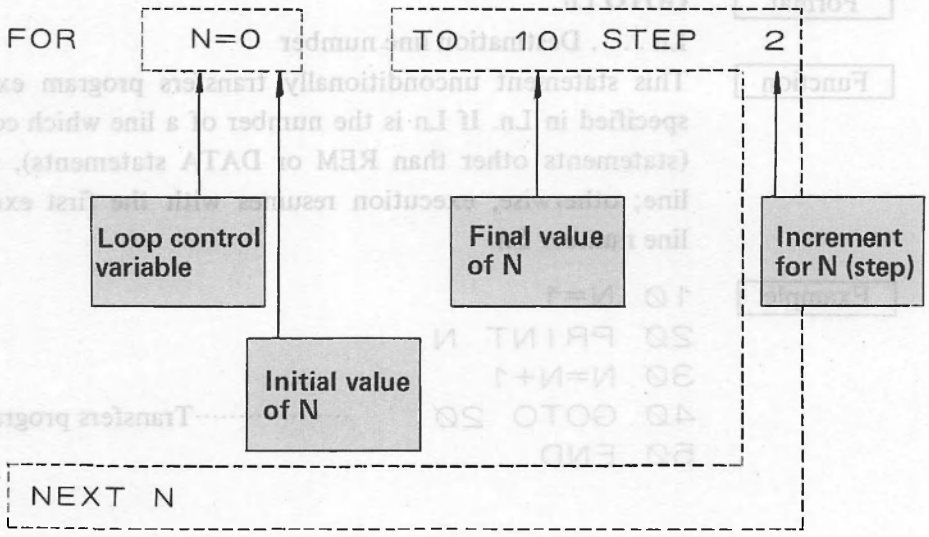
(1) In the program above, 0 is assigned to N as the initial value.

(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

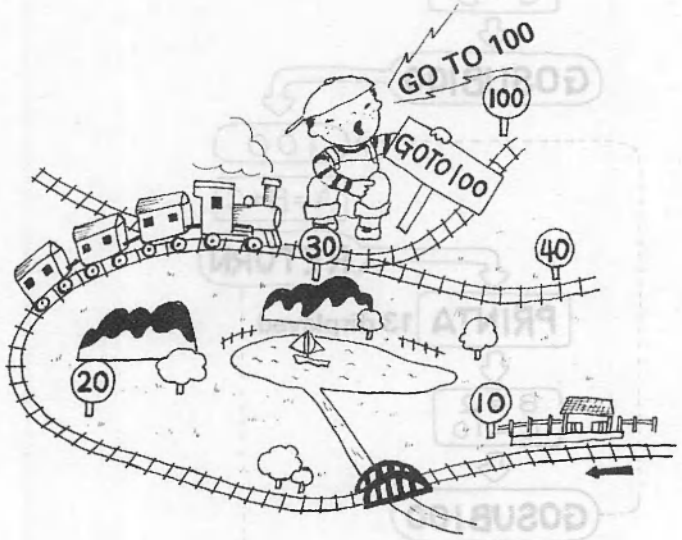
This statement unconditionally transfers program execution to the line number specified in Ln. If Ln is the number of a line which contains executable statements (statements other than REM or DATA statements), execution resumes with that line; otherwise, execution resumes with the first executable statement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

Example

```
10 N=1
20 PRINT N
30 N=N+1
40 GOTO 20
50 END
```

..... Transfers program execution to line 20.

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.

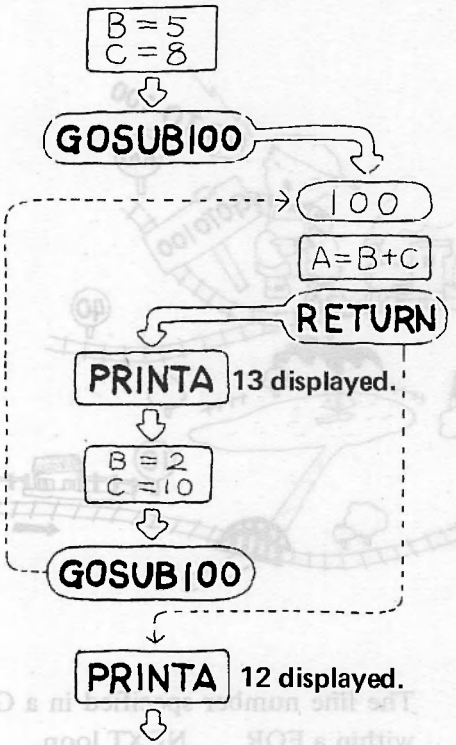
GOSUB ~ RETURN statements are frequently used when the same processing is required at several different points in a program. In such cases, a subroutine which performs this processing is included at some point in the program, and execution is branched to this subroutine at appropriate points by means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

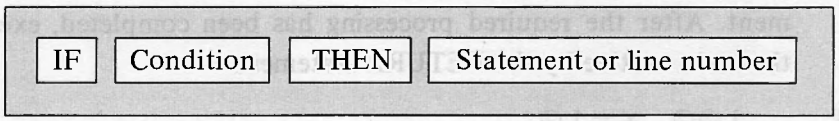
```
10  B=5
20  C=8
30  GOSUB 100
40  PRINT A
50  B=2
60  C=10
70  GOSUB 100
80  PRINT A
90  END
100 A=B+C
110 RETURN
```



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

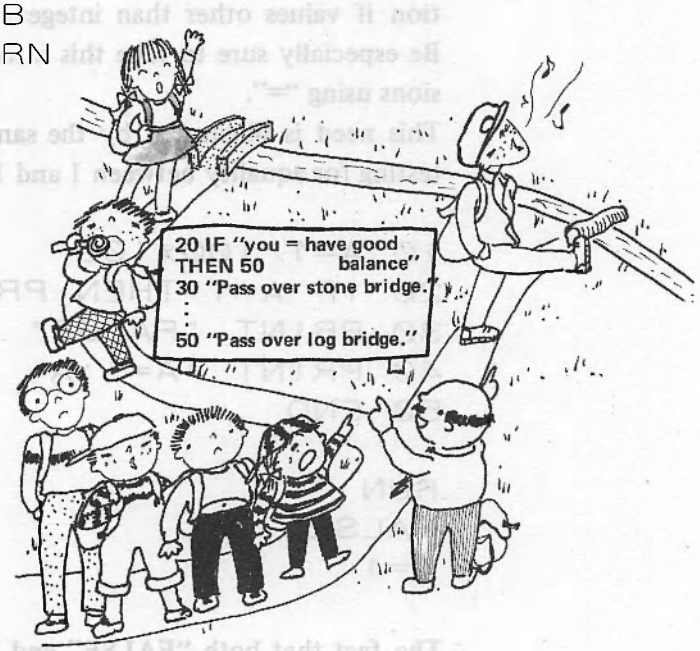
Format **IF** e **THEN** Ln
IF e **THEN statement**
e: A relational expression or logical expression
Ln: Destination line number

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.



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 4 → 500

A is 3 → 400

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, ..., 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.)

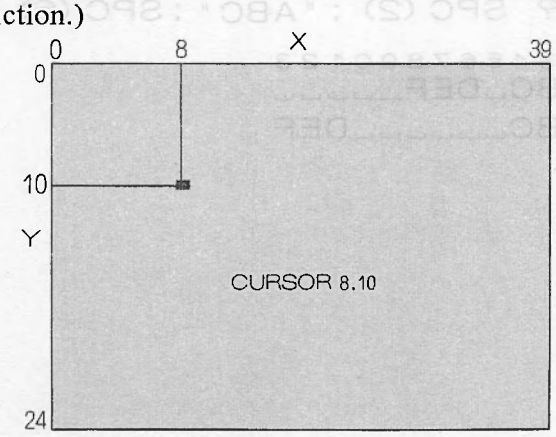
Format **CURSOR** x, y
x . . . X coordinate (0 to 39)
y . . . Y coordinate (0 to 24)

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

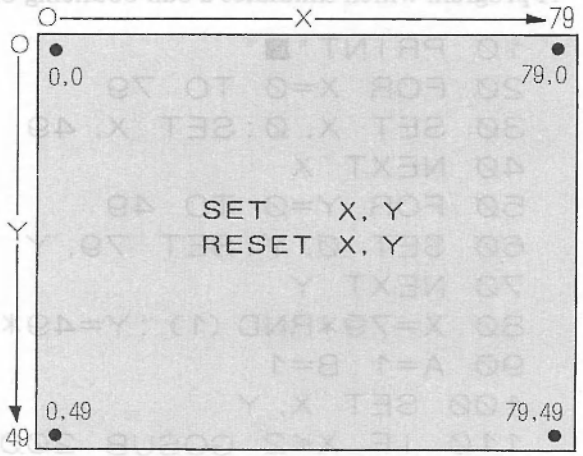
Since four dots are turned on simultaneously by the SET statement, changing the color of any one dot in that four dot group also causes the color of the other dots to change.

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).

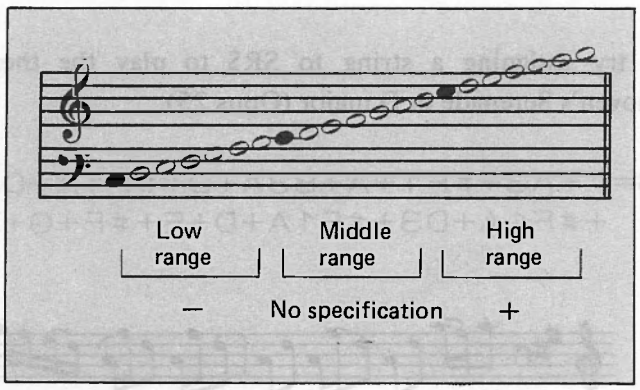
The format for specification of each note is as follows:

< 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

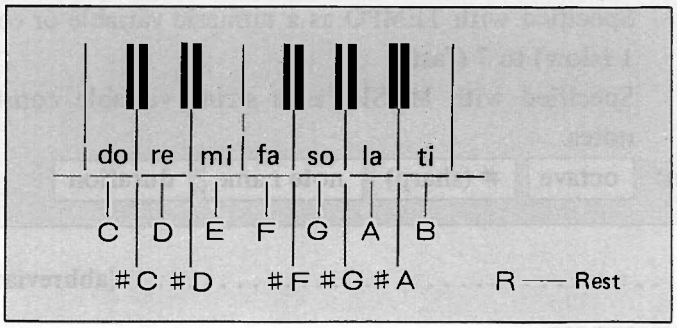


Note specification

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

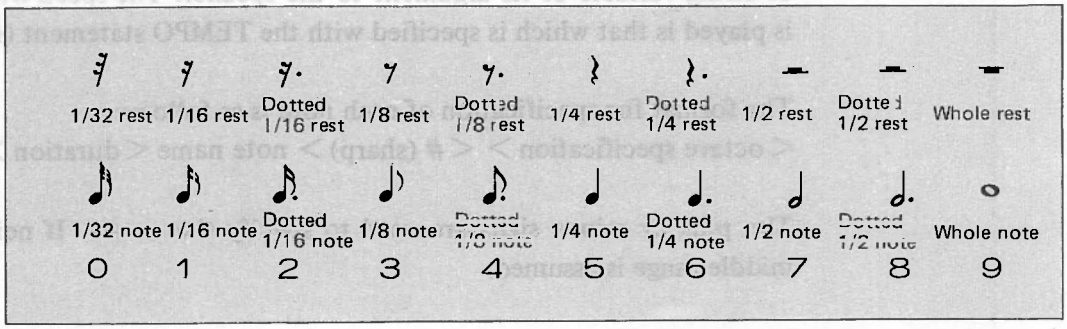
CDEFGAB # R

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.

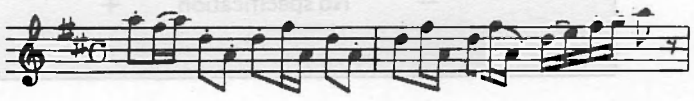
Sound volume

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.

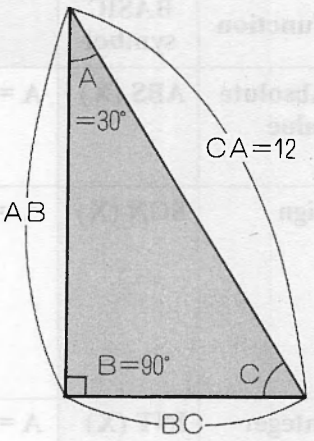
```
10 ROPEN"GRADES"       <- Opens cassette file "GRADES" for input.
20 INPUT/T N           <- Reads the number of people in the class.
30 DIM N$(N),K(N),E(N)
40 DIM R(N),S(N)
50 FOR X=1 TO N
60 INPUT/T N$(X),K(X)  <- Reads student names and the grades for English.
70 INPUT/T E(X),R(X),S(X)   <- Reads 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 $\leq$ 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.

$$0<\mathrm{RND}(1)<1 \xrightarrow{\times 6} 0<6*\mathrm{RND}(1)<6$$

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

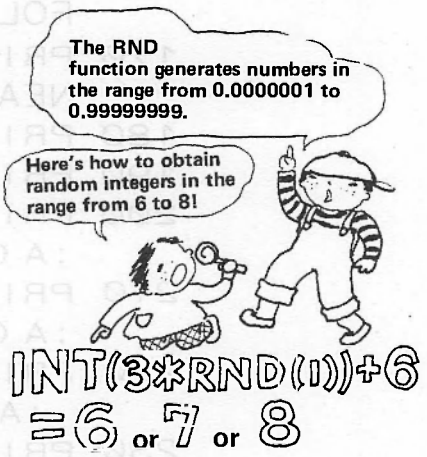
The result will be an integer between 0 and 5; now 1 is added to obtain the numbers which correspond to the number of dots on each of the 6 sides of a die.

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)

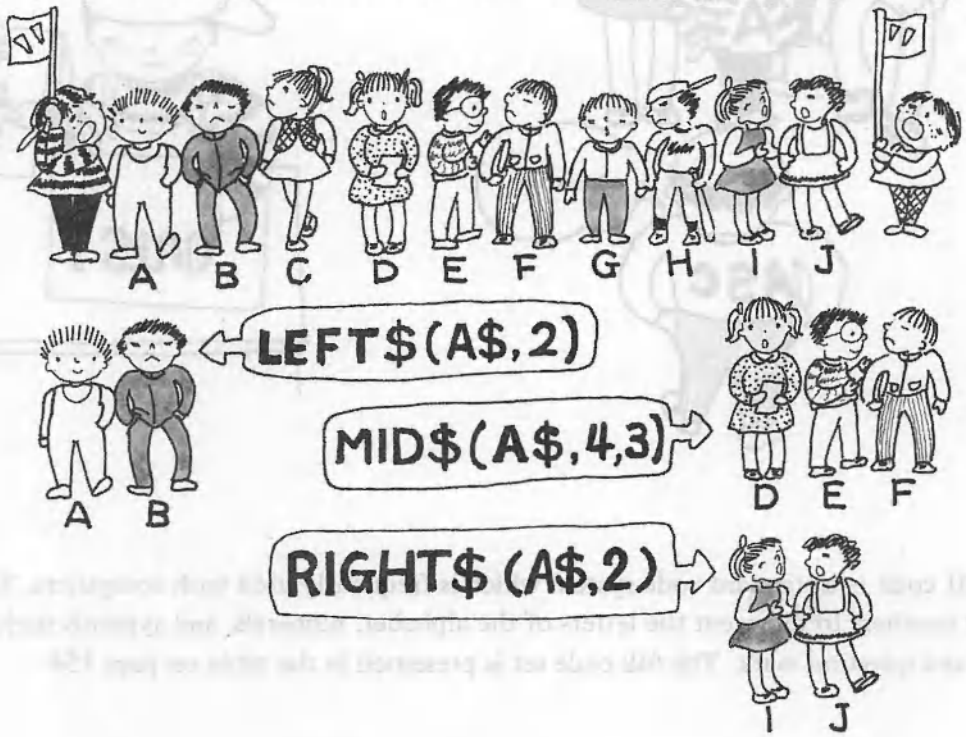
```
PRINT LEN(STR$(PAI(1))) ↵
 9
```

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.

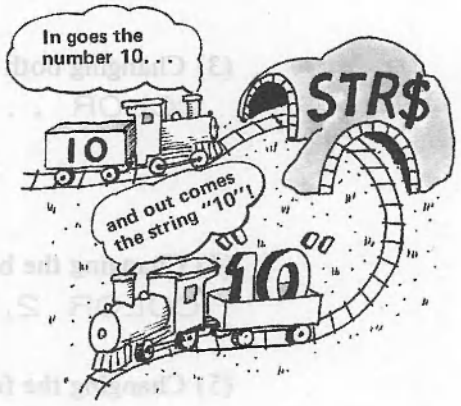
The following sample program illustrates use of some of the functions discussed above to display numeric values in tabular format (with the decimal points aligned).

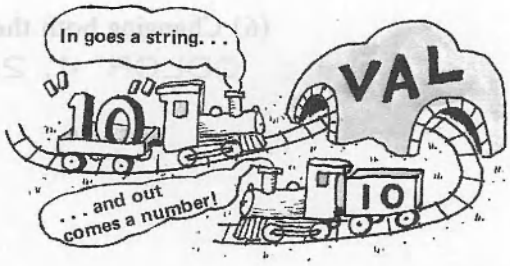
```
1.23456
12.3456
10
1
1234
```

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.

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGH
IJKLMNOPQRSTUVWXYZ[¥]↑← `abcdefghijklmno
pqrstuvwxyz{|}~ ｡｢｣､･ｦｧｨｩｪｫｬｭｮｯｰｱｲｳｴｵ
ｶｷｸｹｺｻｼｽｾｿﾀﾁﾂﾃﾄﾅﾆﾇﾈﾉﾊﾋﾌﾍﾎﾏﾐﾑﾒﾓﾔﾕﾖﾗ
ﾘﾙﾚﾛﾜﾝﾞﾟ■ !"#$%&'()*+,-./0123456789:;<=>?@A
BCDEFGHIJKLMNOPQRSTUVWXYZ[¥]↑← `abcdefgh
ijklmnopqrstuvwxyz{|}~ ｡｢｣､･ｦｧｨｩｪｫｬｭｮｯｰｱｲｳ
ｴｵｶｷｸｹｺｻｼｽｾｿﾀﾁﾂﾃﾄﾅﾆﾇﾈﾉﾊﾋﾌﾍﾎﾏﾐﾑﾒﾓﾔﾕﾖﾗﾘﾙ
ﾚﾛﾜﾝﾞﾟ■ !"#$%&'()*+,-./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.

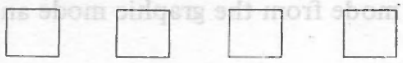
This command can be entered in either the text mode or graphics mode.

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

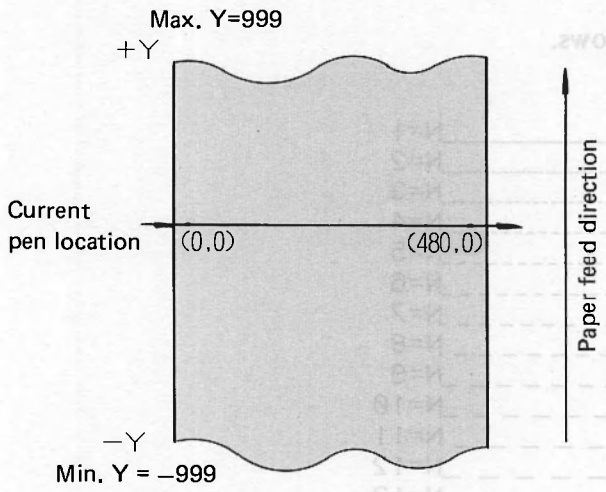
Function This command outputs the data in the output list to the printer. For details on using this command, see the description of the **PRINT** command on page 37. See pages 82 for printout of graphic characters.

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

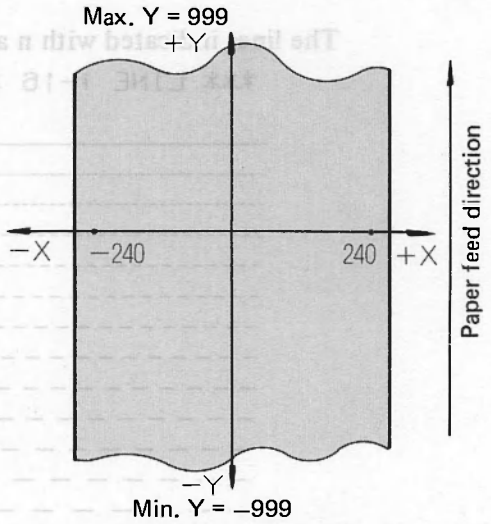
Except that output is directed to the printer, this is the same as the PRINT USING statement described on page 38.

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.

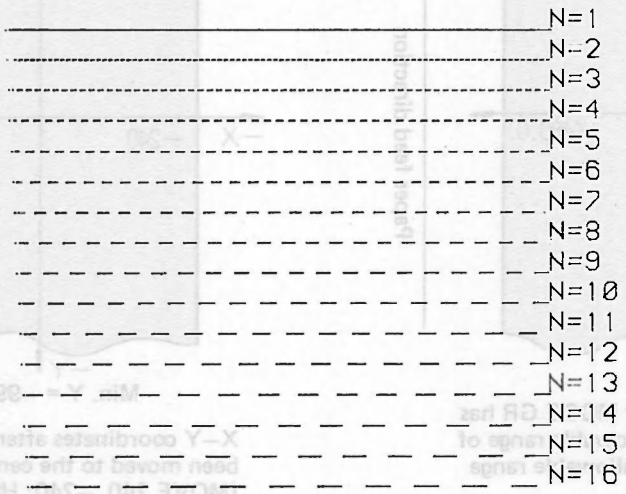
```
10 MODE GR
20 LINE 240, 0, 240, -240, 0, -240, 0, 0
30 MODE TN
```

(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 ***
```



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)

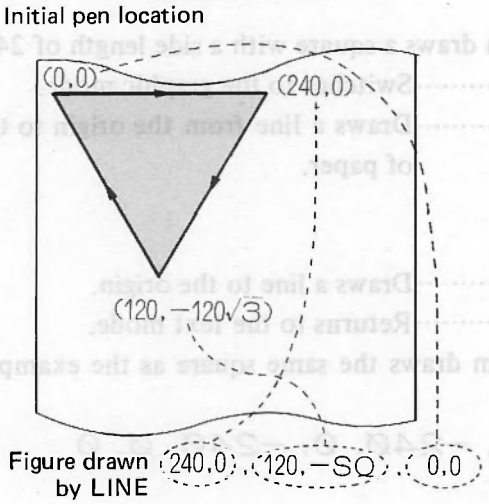
Function

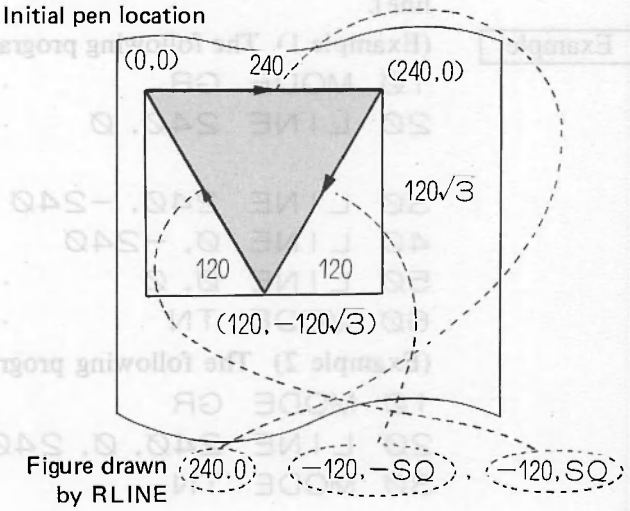
This statement draws a line from the current pen location to the location indicated by **relative coordinates** x_1, y_1, then draws a line from that point to the location indicated by relative coordinates x_2, y_2, and so on. n is the same as for the LINE statement.

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)

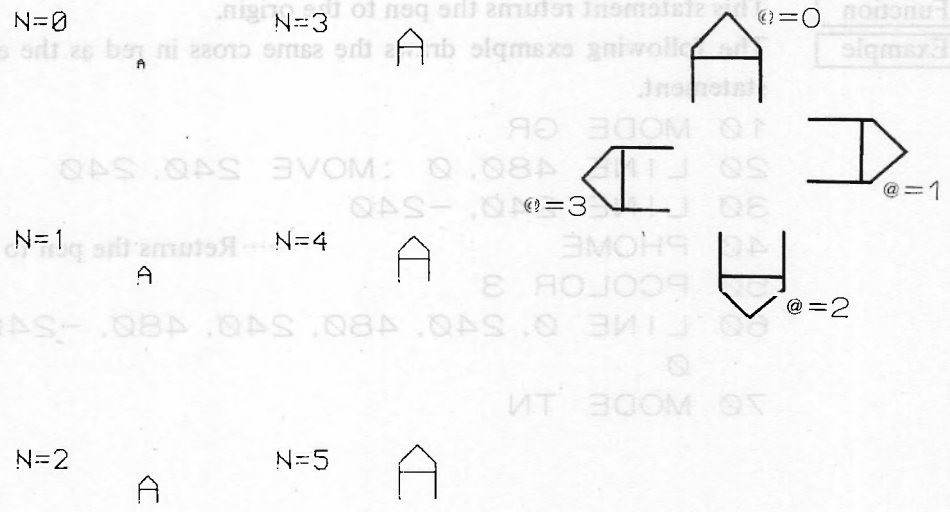
x$ ..... Character

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
```

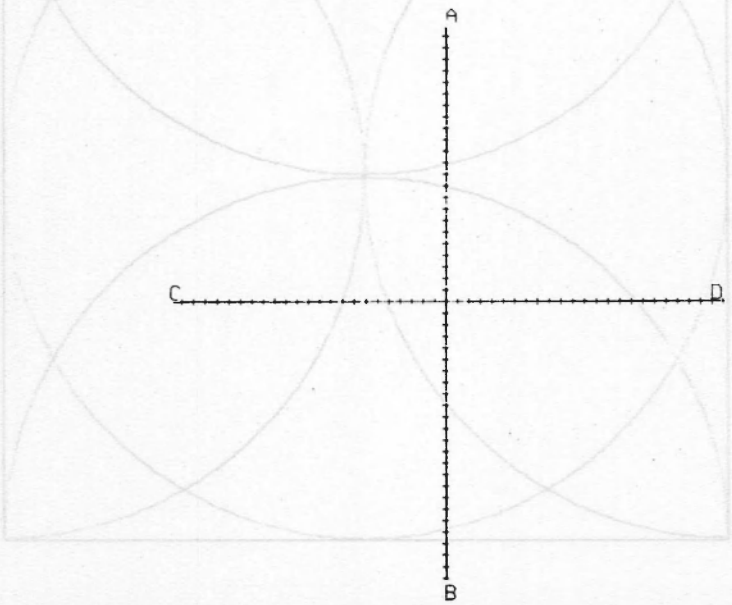
Switches the printer to the graphic mode.

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

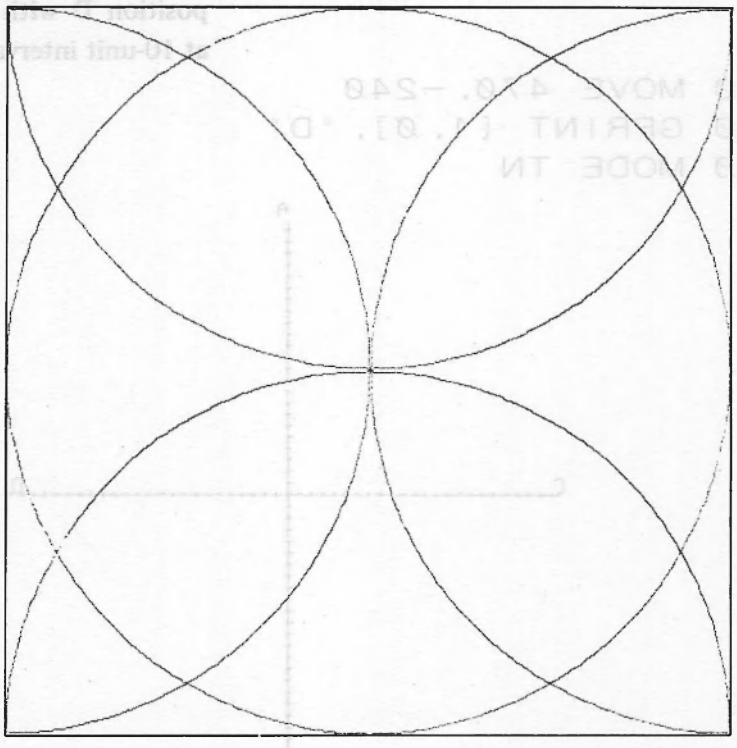
This statement draws a circle or arc with a radius of r and a step of d at location (x, y), starting at angle S and ending at angle e. A complete circle is drawn when s = 0, e = 360 and d = 0.2.

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.

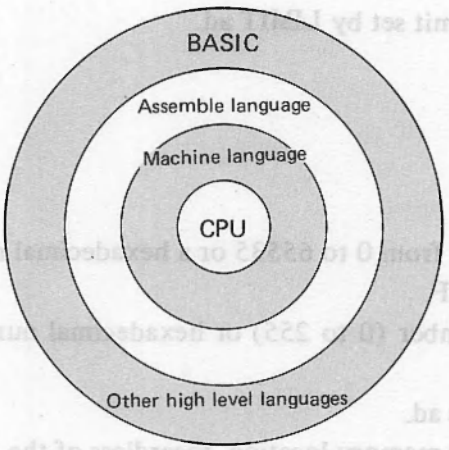
Computer programming languages form a hierarchical structure as shown below. High level languages such as BASIC automatically performs work required when lower level languages such as assembly language are used. Although high level languages are convenient and easy to use, they cannot control the CPU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

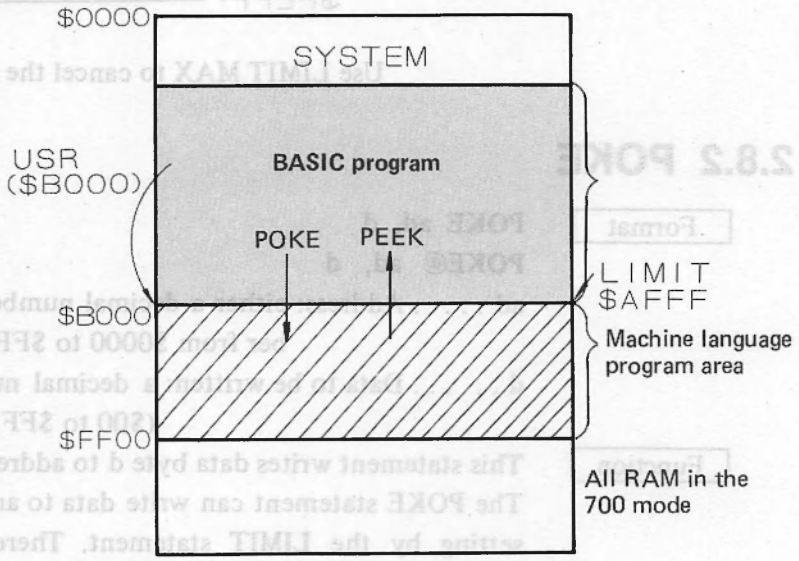
The lowest level language (machine language) directly controls the CPU and provides high processing speed, but considerable skill is required for coding long programs.

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

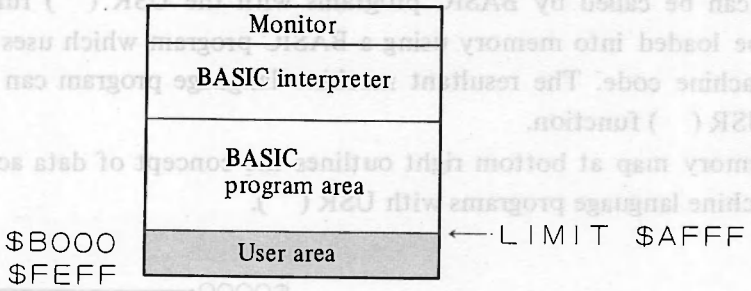
This statement limits the memory area which can be used by the BASIC interpreter. ad indicates the upper limit of the BASIC area, and the area from the following address (ad + 1) to $FEFF (65279) can be used for machine language programs or special data.

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.

```
110 LIMIT $BFFF
110 LOAD "DISPLAYCODE"
120 USR ($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 Ø ..... 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

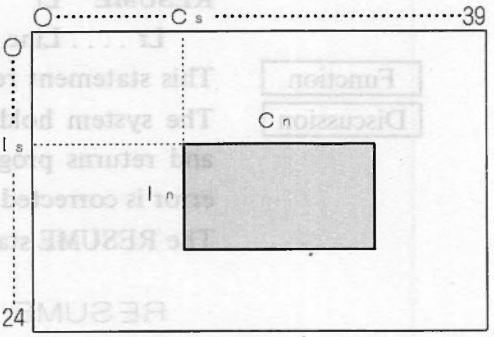
Function — This statement cancels PLOT ON made of plotter-printer operation.

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.

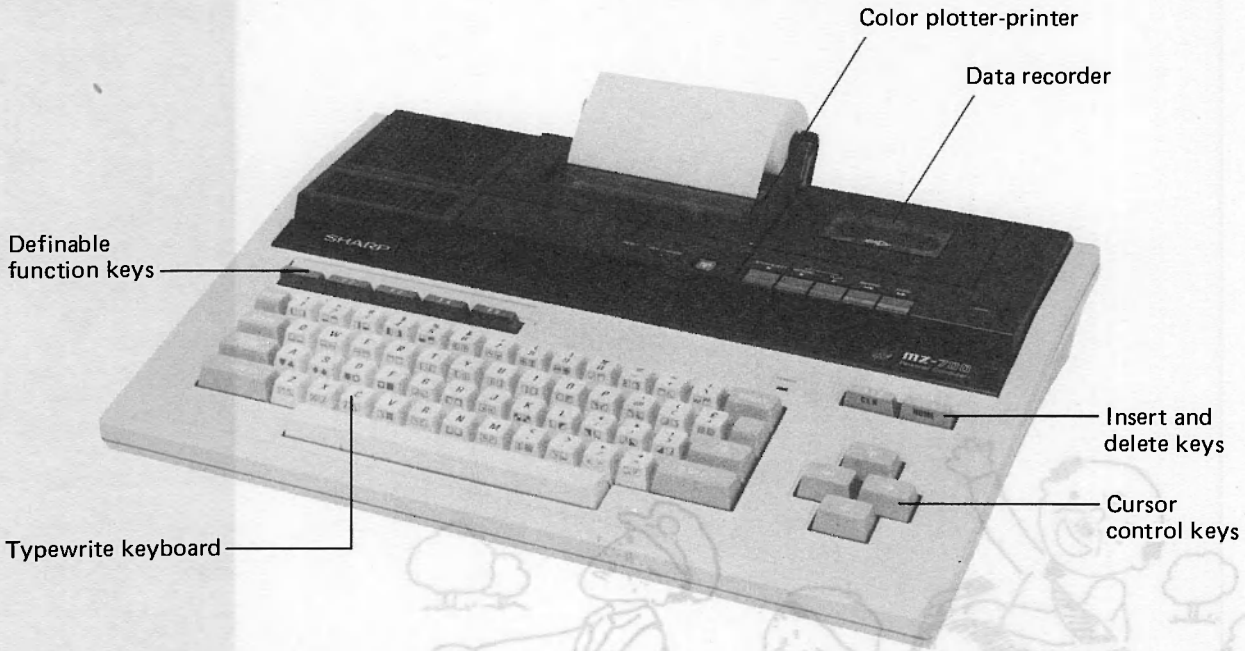
Chapter 3

Operating the MZ-700

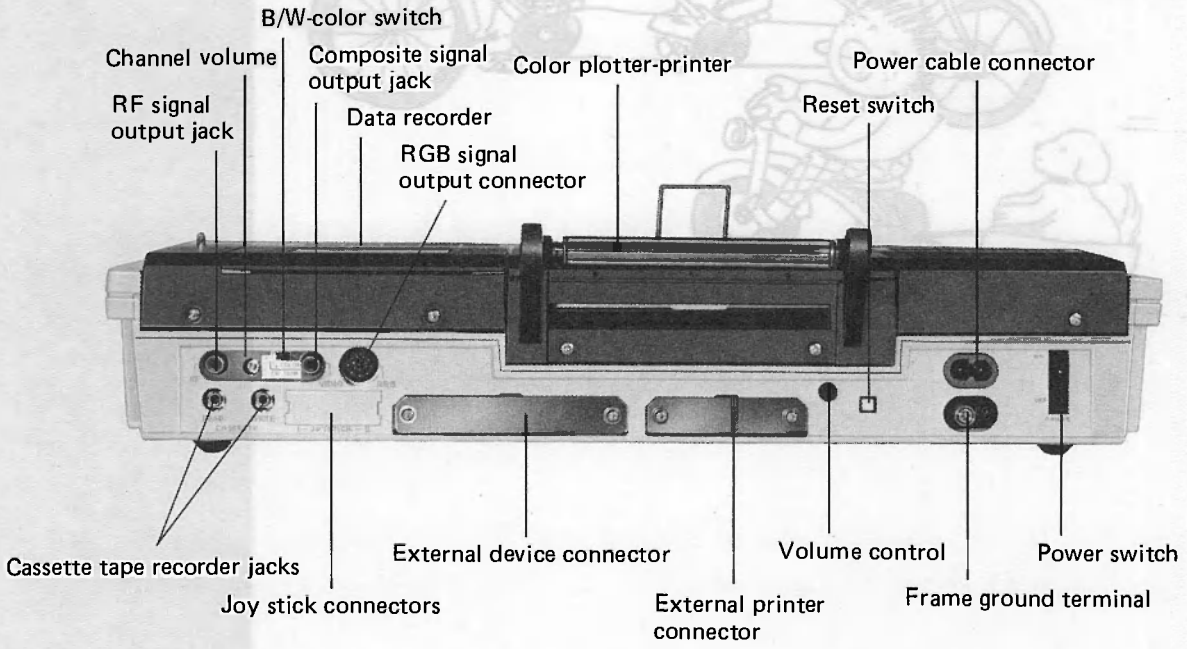
3. 1 Appearance of the MZ-700 Series Personal Computers

3.1.1 MZ-731

■ **Front view**

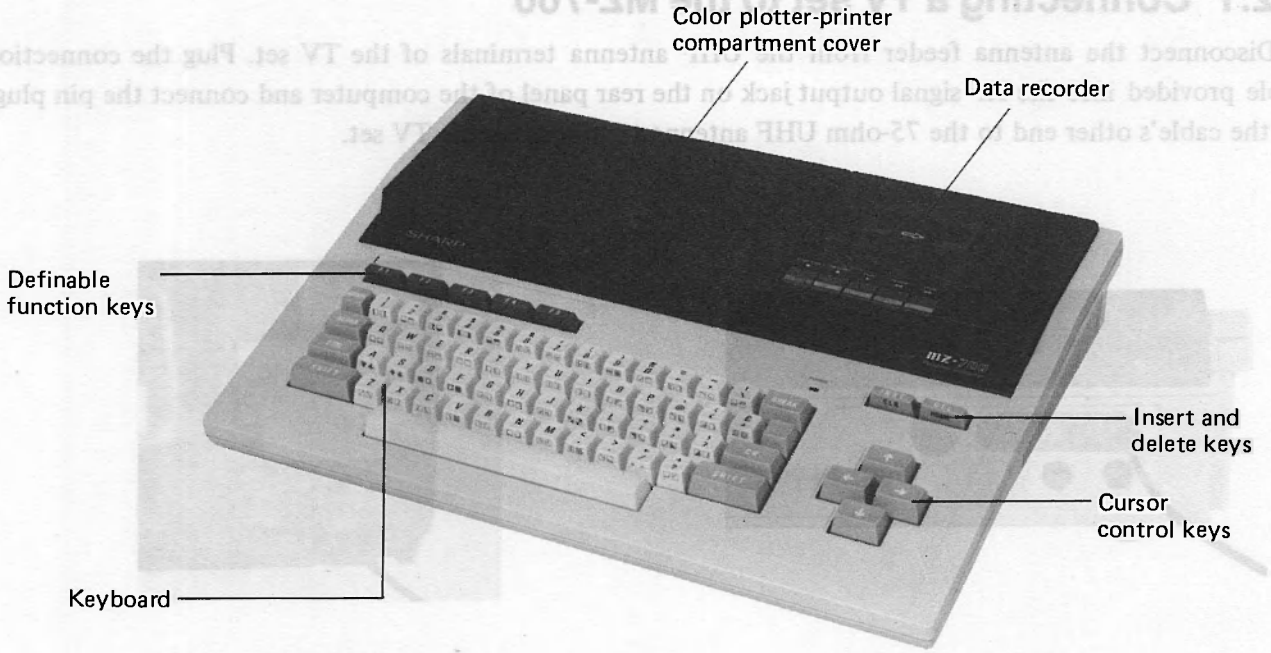


■ **Rear view**



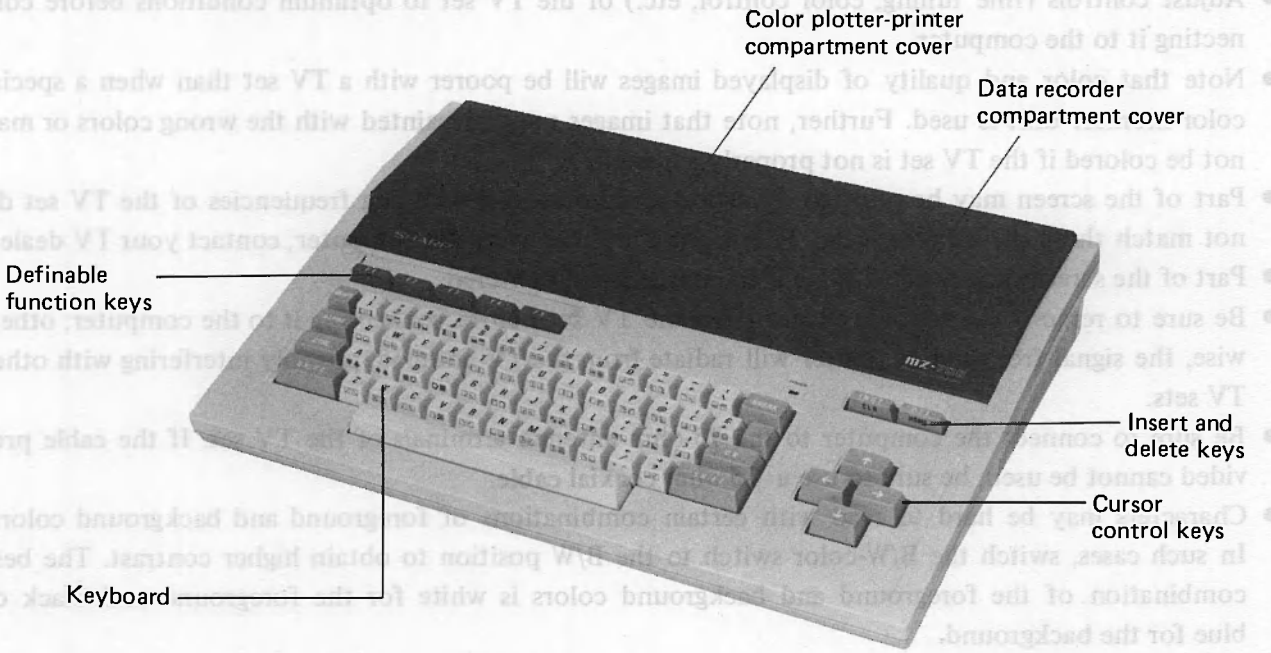
3.1.2 MZ-721

- **Front view**



3.1.3 MZ-711

- **Front view**

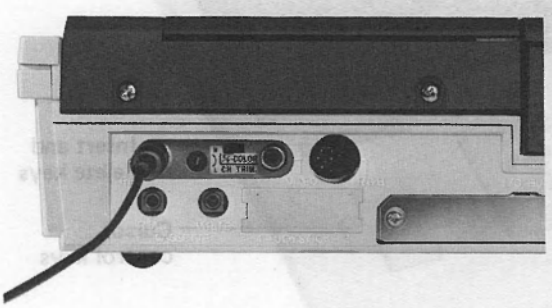


3. 2 Connection to Display Unit

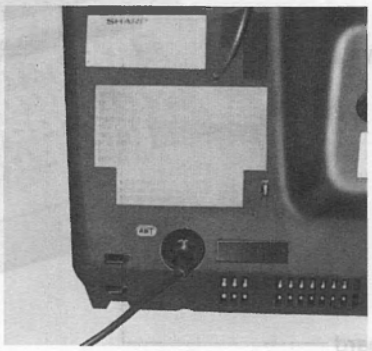
Be sure to turn off both the computer and display unit before connecting them.

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

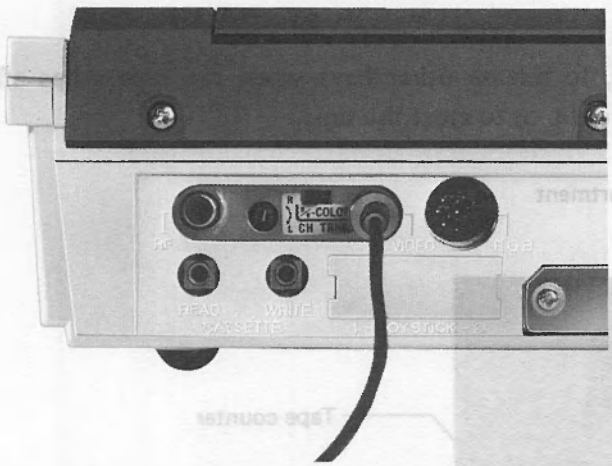
Set the channel selection switch to the 36 ± 3 ch position, depending on which is not used in your area.

Note the following when using an ordinary TV set as a display unit.

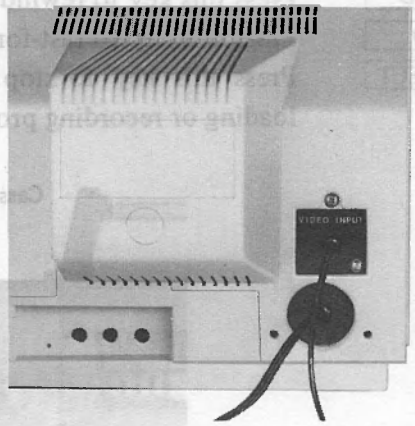
- Adjust controls (fine tuning, color control, etc.) of the TV set to optimum conditions before connecting it to the computer.
- Note that color and quality of displayed images will be poorer with a TV set than when a special color monitor unit is used. Further, note that images may be painted with the 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.



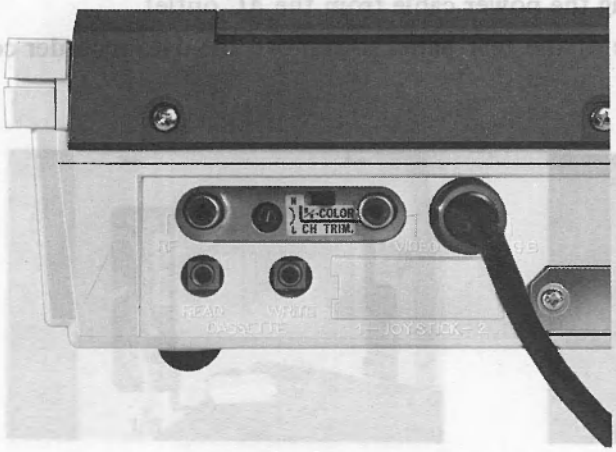
Rear panel of the MZ-700 series computer



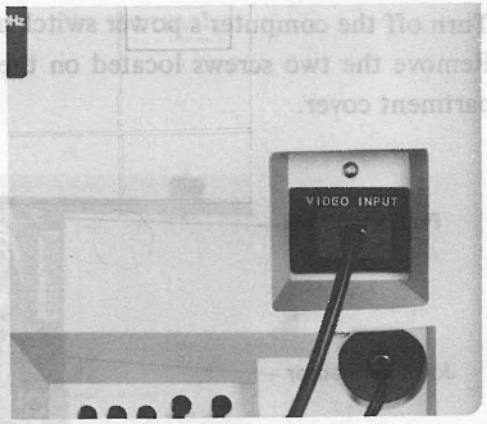
Rear panel of the MZ-1D04

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.

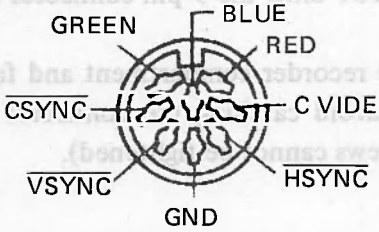


Rear panel of the MZ-700 series computer



Rear panel of the MZ-1D05

Pin assignments of the RGB signal output connector of the MZ-700 are as shown below.



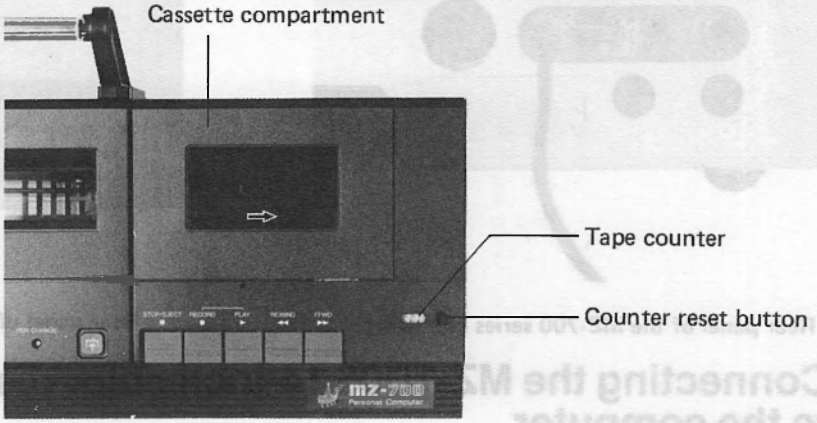
RGB signal output DIN connector
(viewed from the rear side)

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.

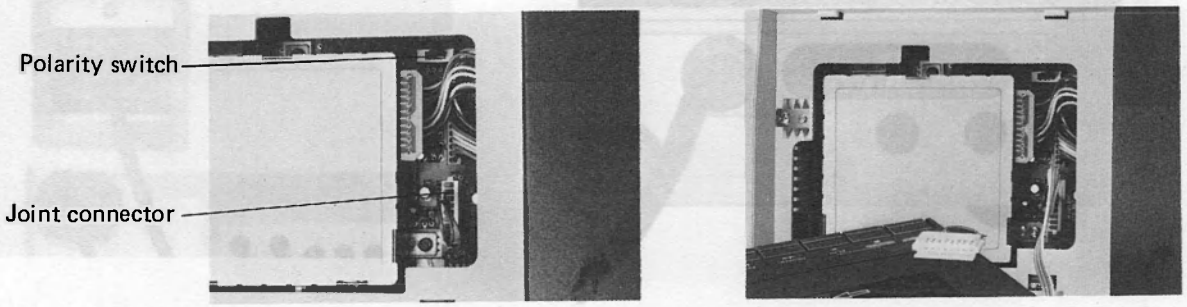
RECORD	Press this key to record programs and data.
PLAY	Press this key to load programs and data.
REWIND	Press this key to rewind the tape.
FFWD	Press this key to fast-forward the tape.
STOP/EJECT	Press this key to stop the tape, to release other keys when the tape stops after loading or recording programs or data, or to eject the tape.



■ MZ-1T01

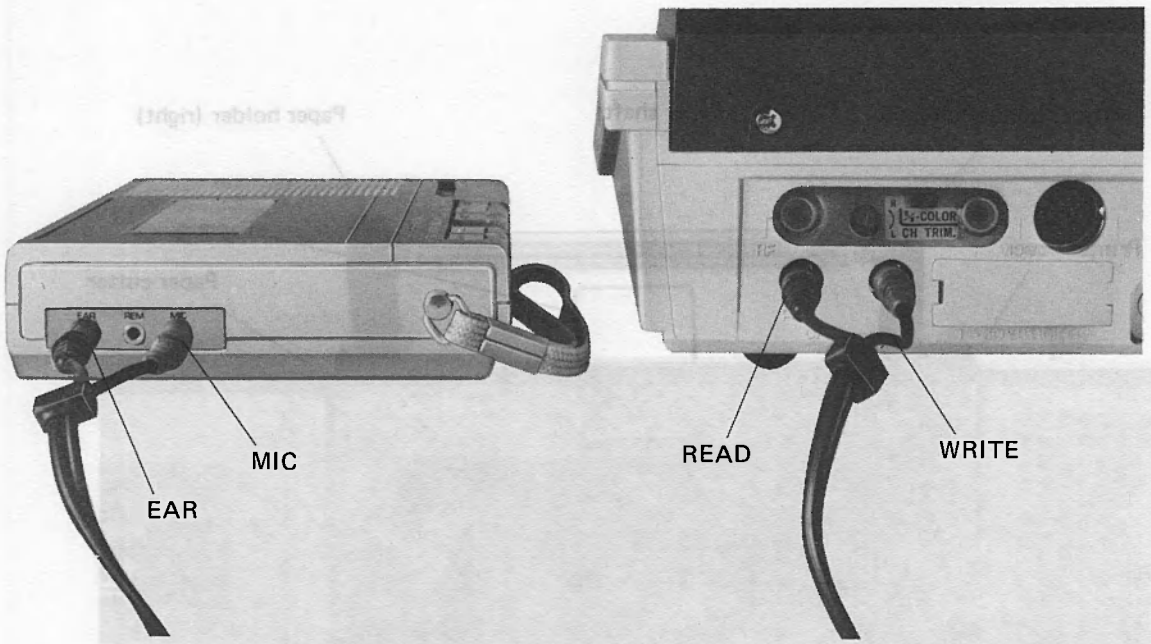
The MZ-1T01 data recorder unit can be installed in the MZ-711 (MZ-710). Installation procedures are as follows.

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.

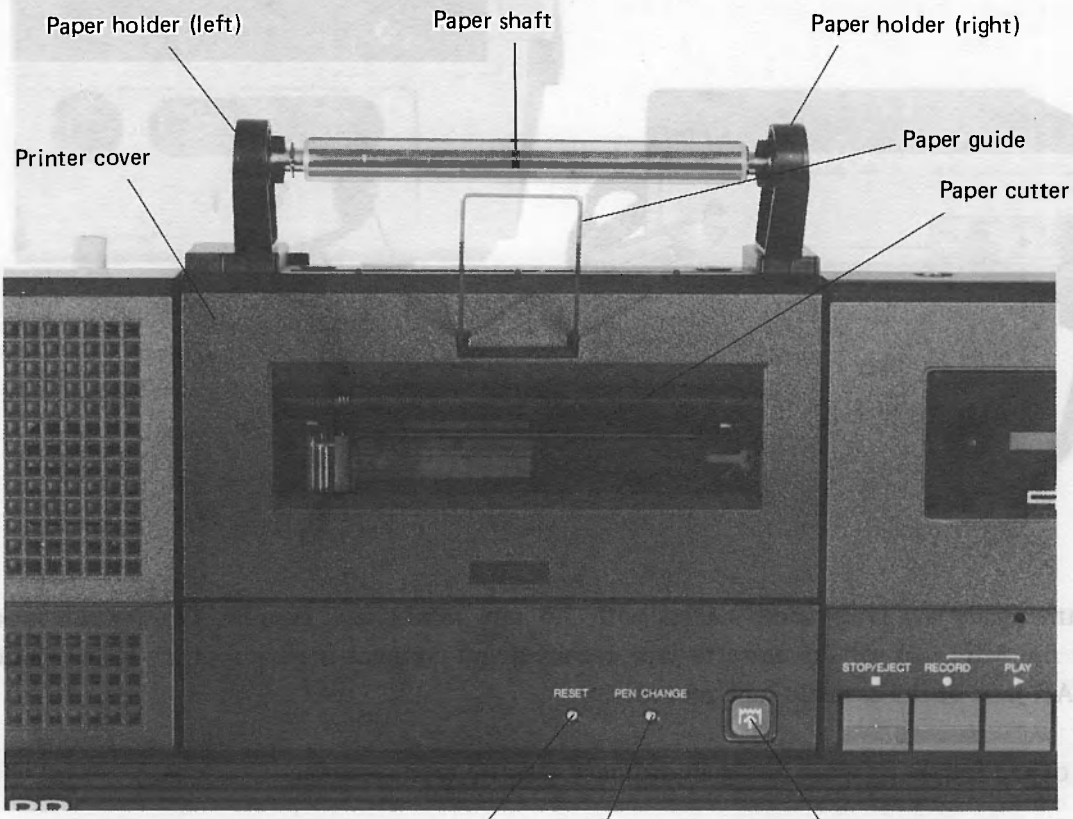
(3) The level and tone controls of the cassette tape reocrder must be adjusted to appropriate levels. Some cassette recorders (e.g. those with the automatic level control) may not be usable. In such cases, please purchase the MZ-1T01.

(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.

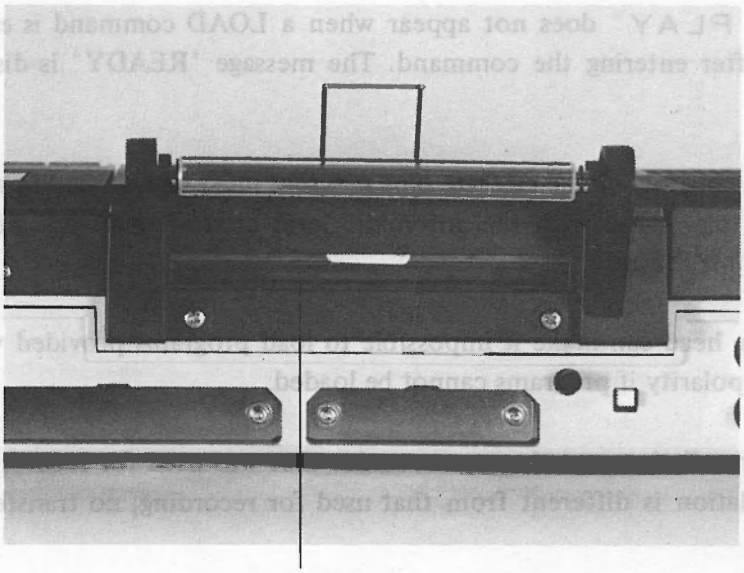
(5) For any transfer or collation, use the tape recorder that was used for recording. If the tape recorder for transfer or collation is different from that used for recording, no transfer nor collation may be possible.

(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**

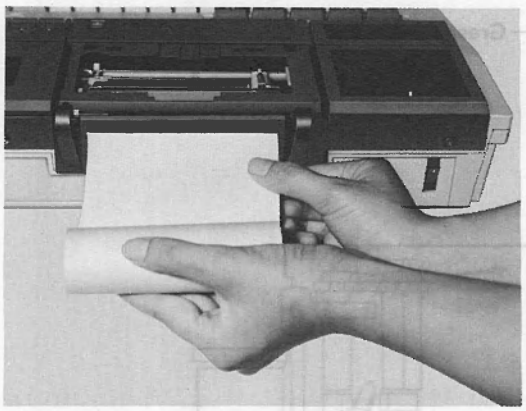
1. Remove the printer cover.
2. Cut the end of roll paper straight across and insert the end into the paper inlet. (Be careful to avoid folding or wrinkling the end of the paper when doing this.)
3. Turn on MZ-731's power switch and press the ⊡ (paper feed) key to feed paper until the top of paper is 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.

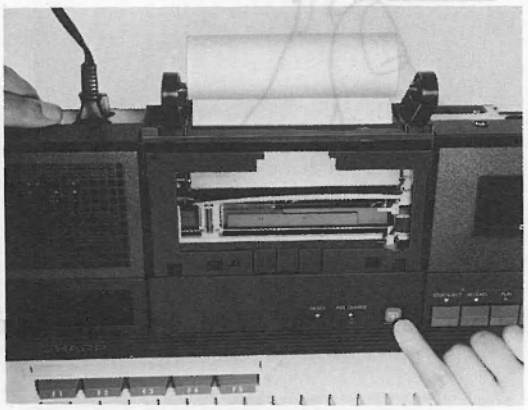
■ Roll paper for the MZ-700 series computers is available at any Sharp dealer. Do not use paper other than that specified.

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.

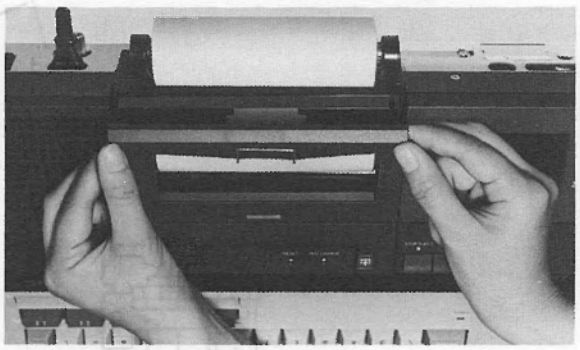
Procedures for loading roll paper



(A) Insert paper into the paper inlet.



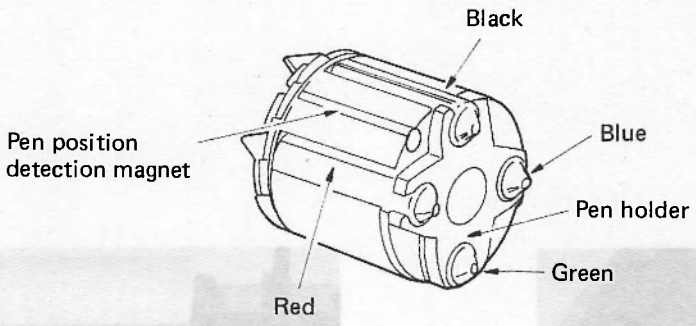
(B) Press the paper feed key to feed paper.

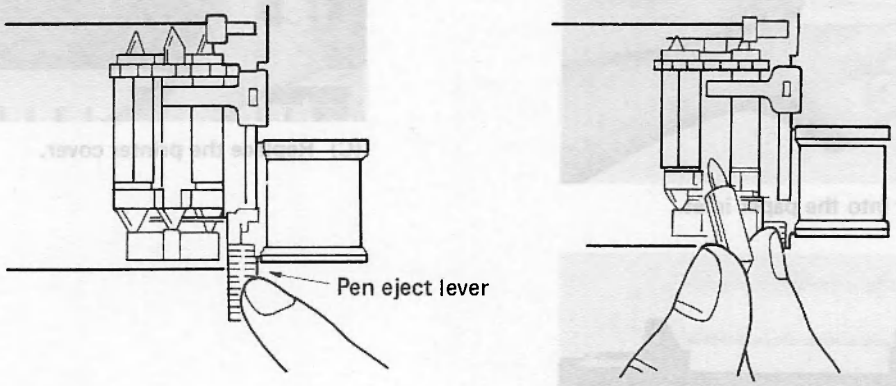


(C) Replace the printer cover.

■ **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.





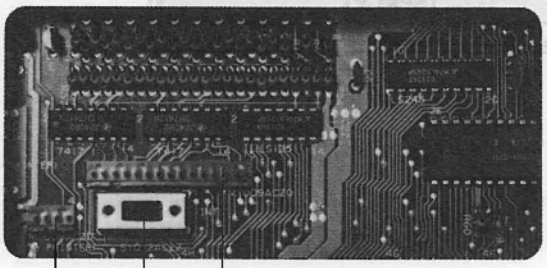
■ Replacements for the printer pens (ballpoint pens) can be purchased at the dealer where the printer was purchased.

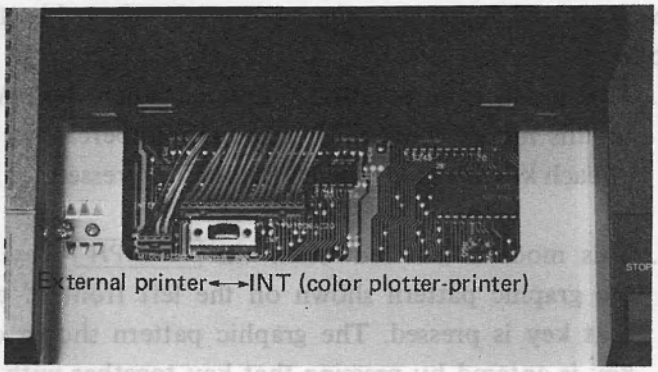
- EA-850B (black; 4 pens)
- EA-850C (black, blue, green, red; 4 pens, 1 of each color)

■ **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

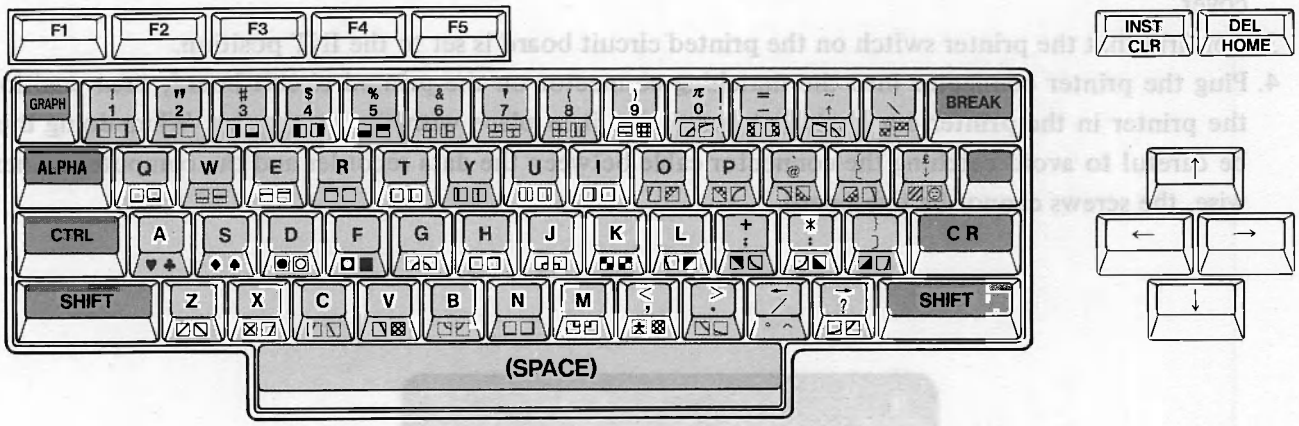
■ **Connecting an external printer (MZ-80P5(K))**

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.

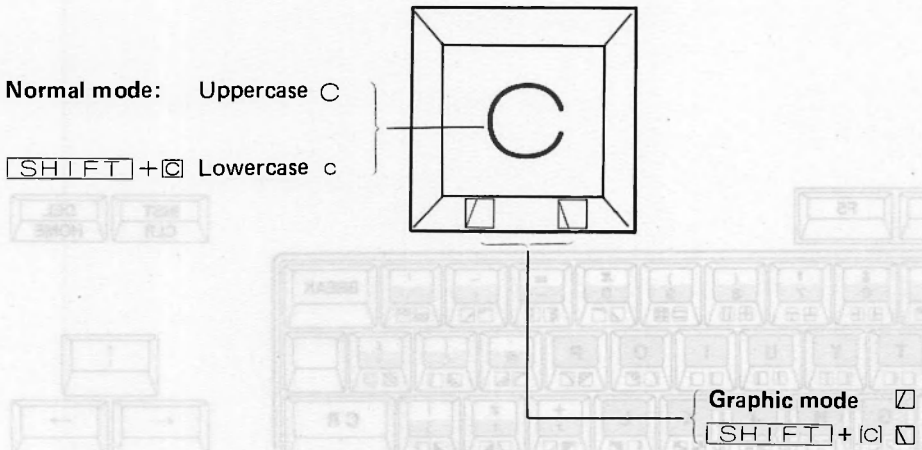
The input modes are as follows.

(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.



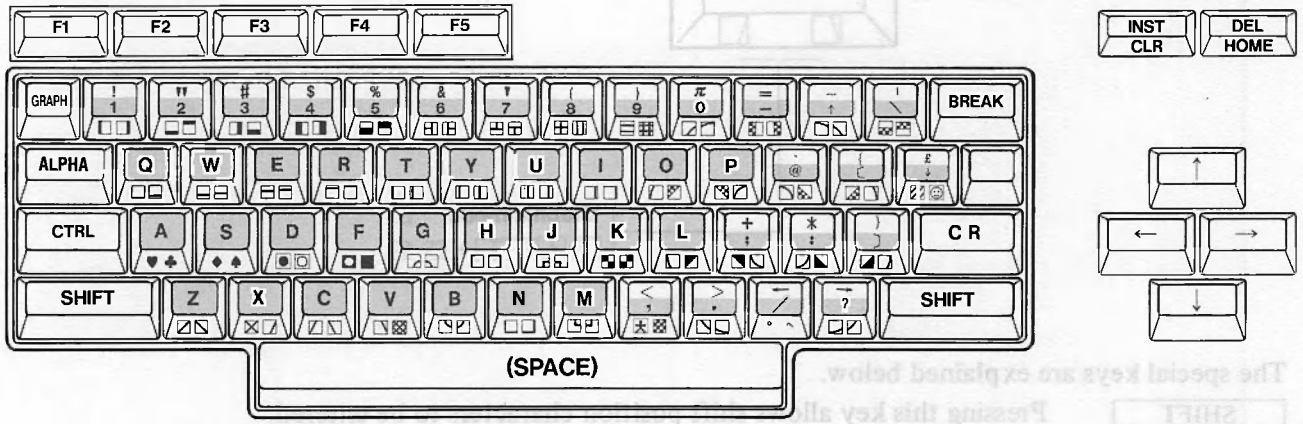
The special keys are explained below.

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.**

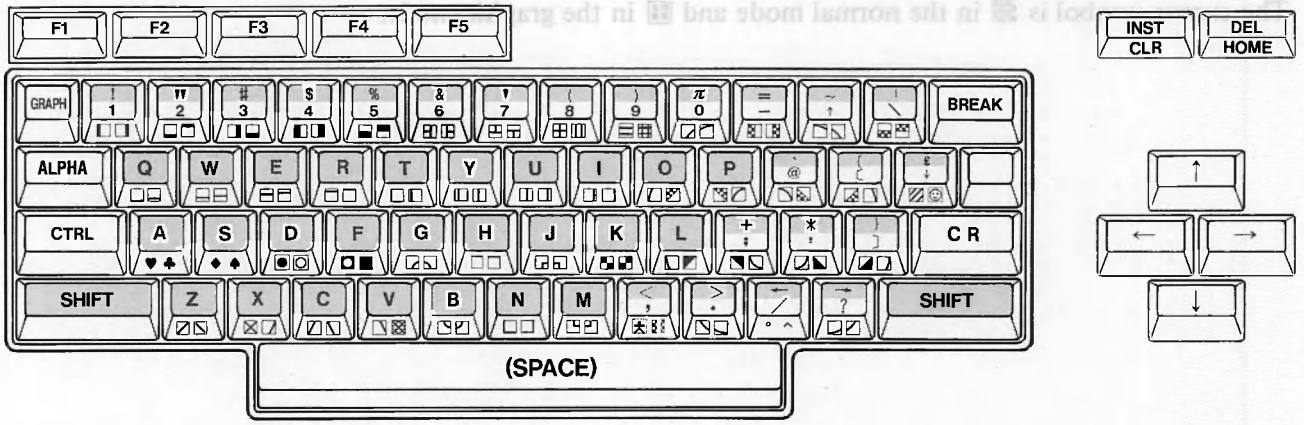
The cursor symbol is ▩ in the normal mode and ▦ in the graphic mode.

(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.

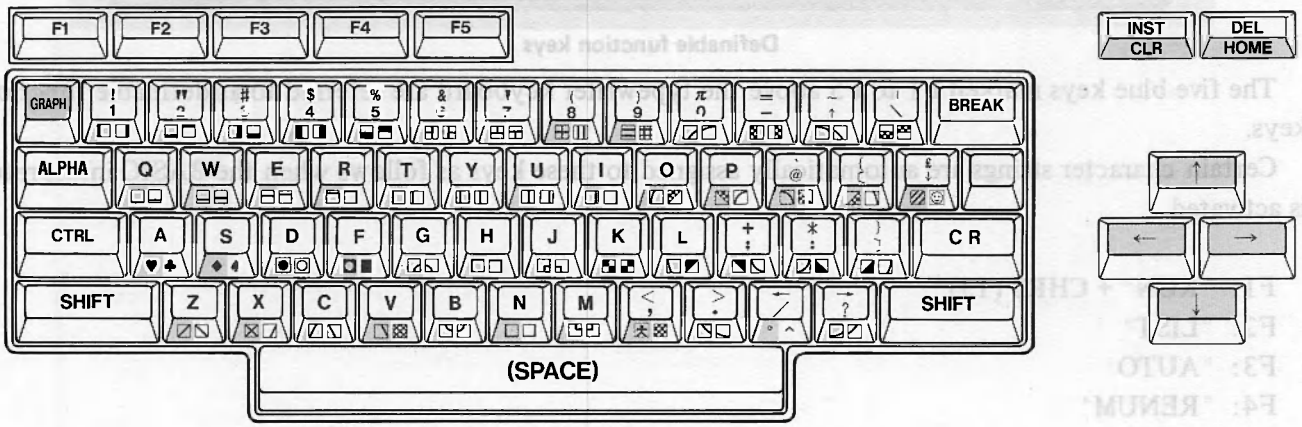


When with the SHIFT key is pressed together with other keys, lowercase letters (or other symbols indicated by the screen areas in the figure below) are entered.

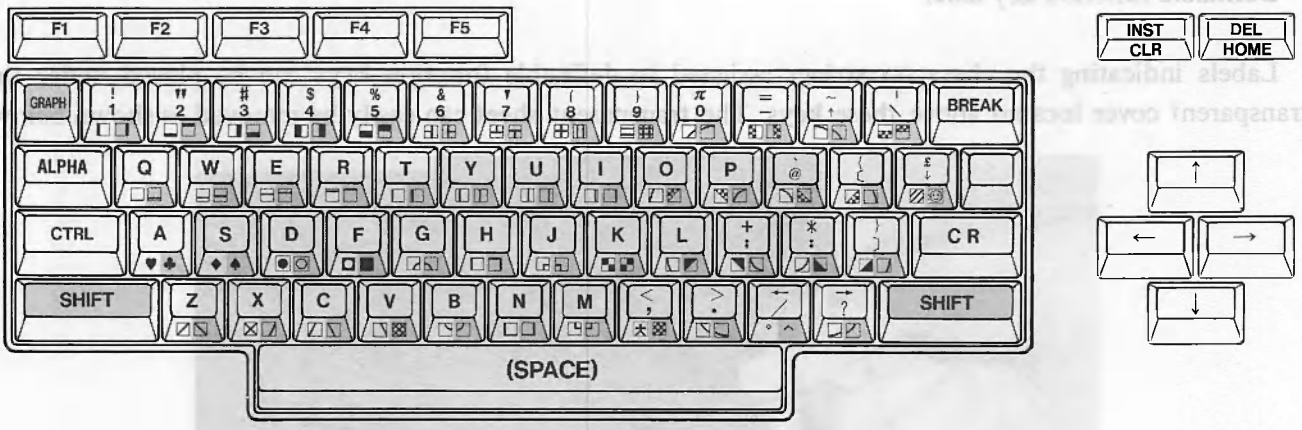


(2) Graphic mode

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.

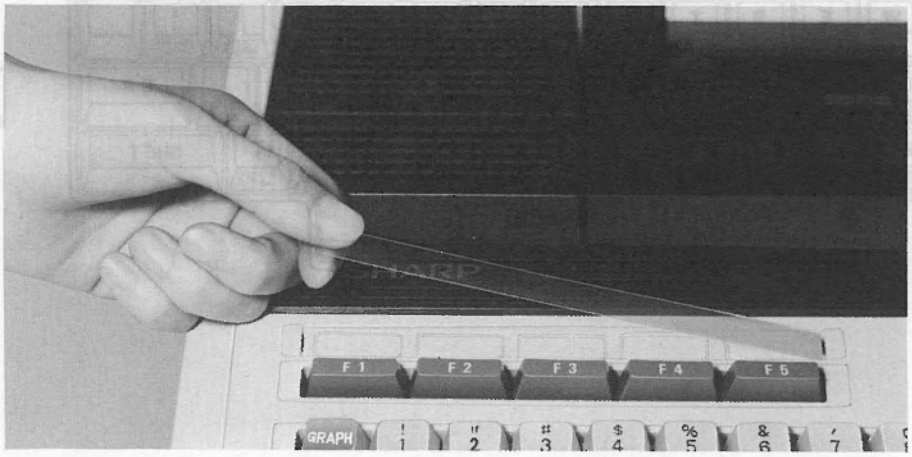
Certain character strings are automatically assigned to these keys as follows when the BASIC interpreter is activated.

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"

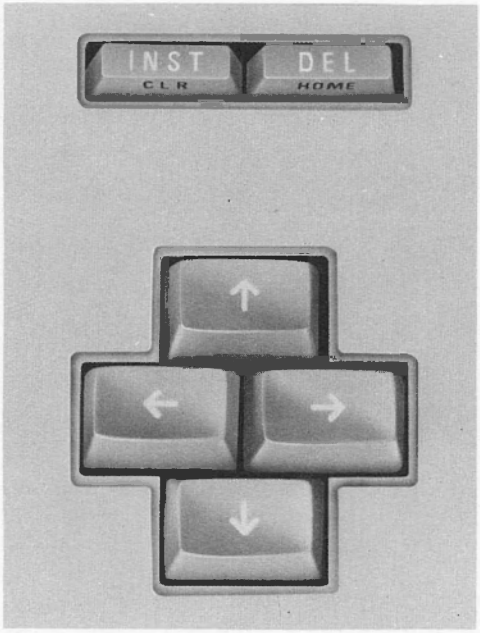
When one of these keys is pressed, the character string assigned to that key is entered; thus, statements which are frequently used can be entered just by pressing one key. The character string assigned to any of the definable function keys can be changed by the DEF KEY statement. (See page 57, DEF KEY 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. The keys are used when editing programs.

The INST CLR and DEL HOME key have the following functions.

SHIFT + INST CLR
Inserts a space at the position of the cursor and shifts all following characters one position to the right. INST: insert.

SHIFT + DEL HOME
Clears the entire screen and returns the cursor to the screen's upper left corner. Pressing this key does not affect the program memory. CLR: clear screen (all characters displayed).

See pages 18 and 19.

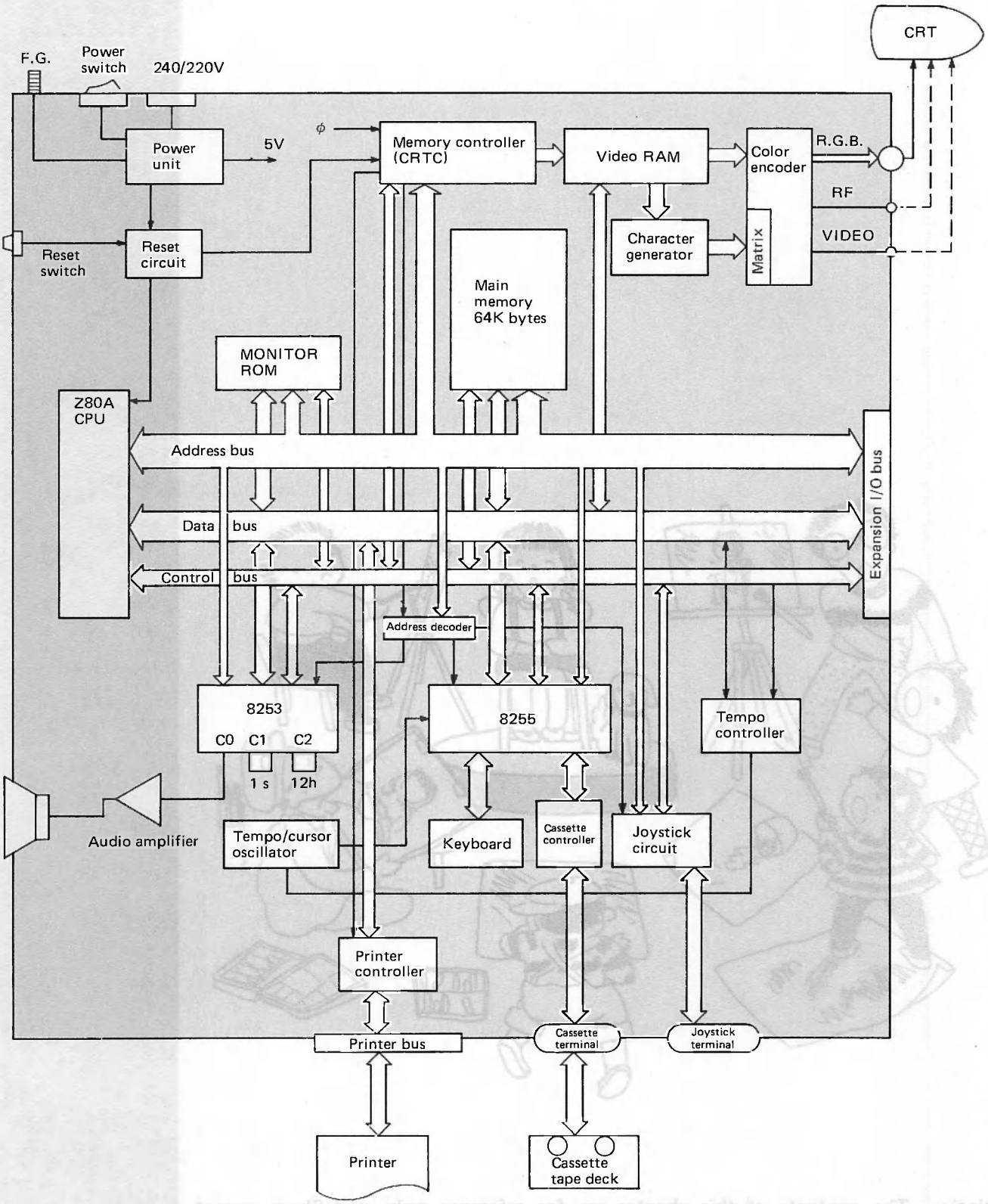
Chapter 4

Hardware

Notice: The contents of this chapter are for reference only, and Sharp cannot assume responsibility for answering any questions about its contents.

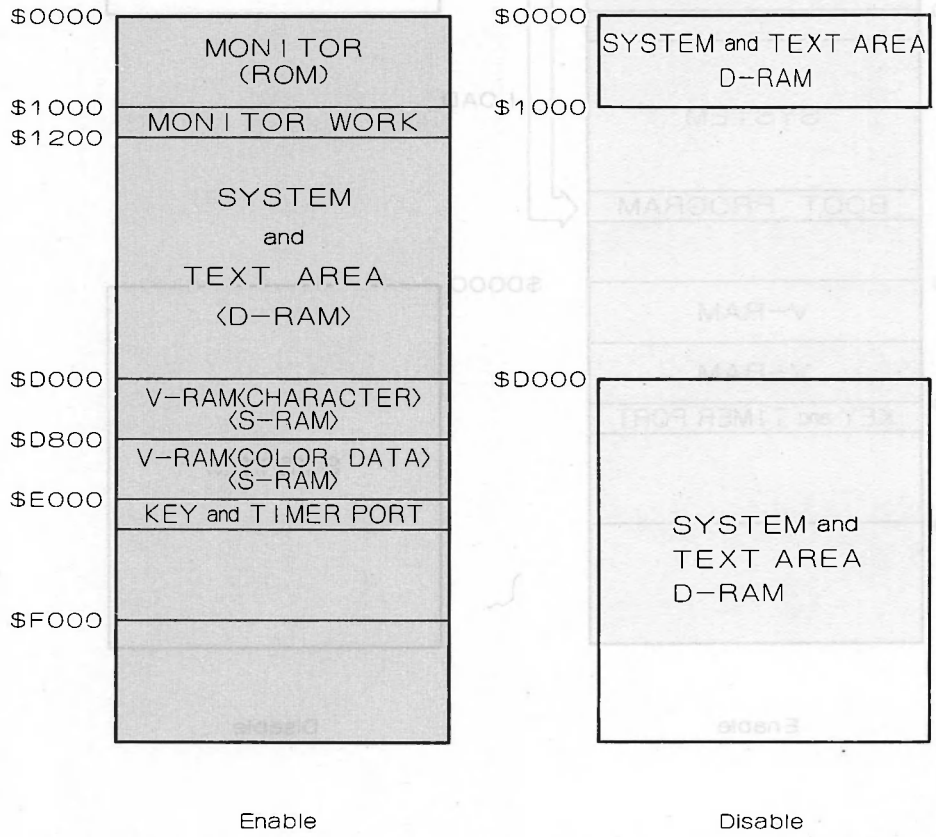
4. 1 MZ-700 System Diagram

The figure below shows the system configuration of the MZ-700 series computers.



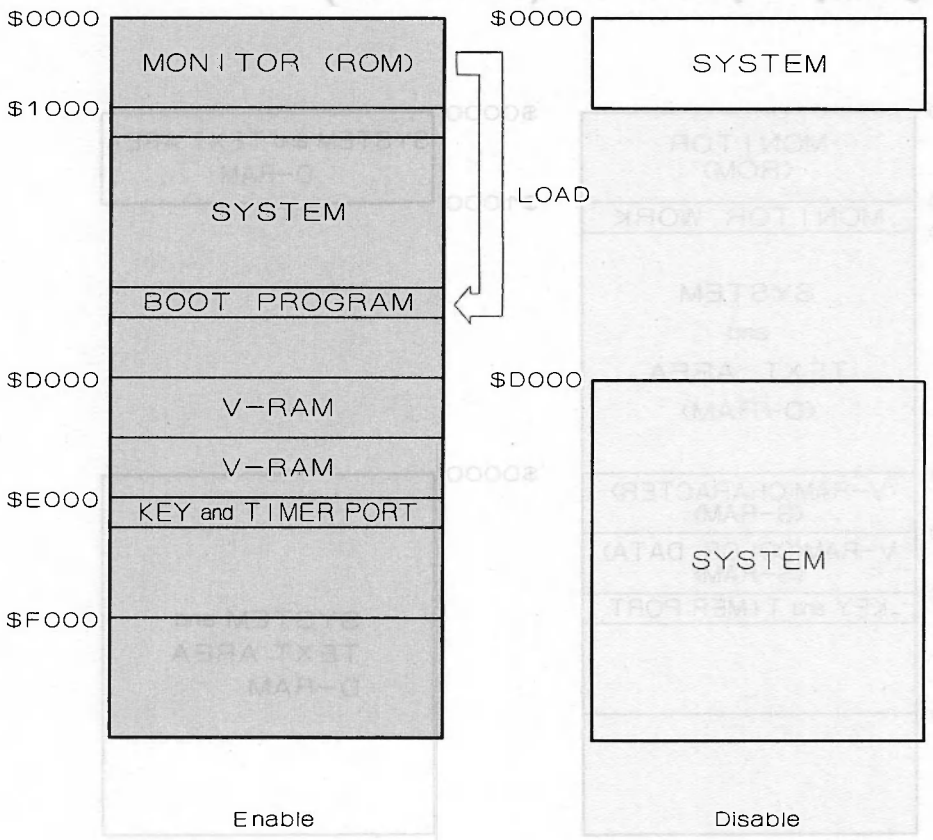
4. 2 Memory configuration

4.2.1 Memory map at power-on (80k mode)



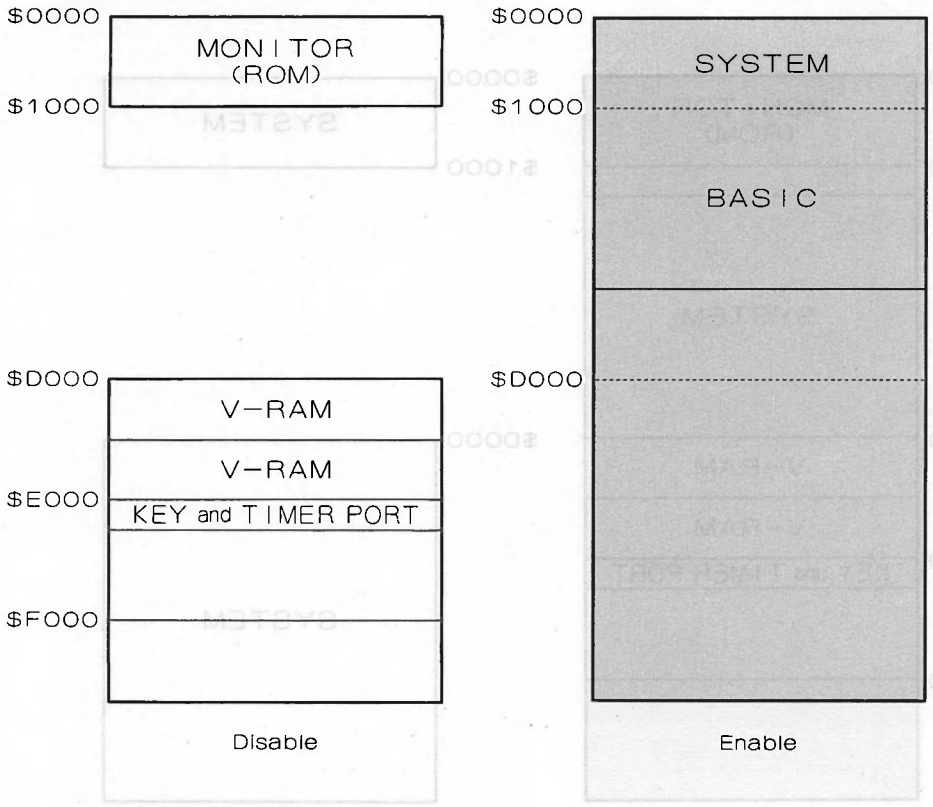
- The memory map is as shown above immediately after the power has been turned on. (The contents of the V-RAM area from $D000 to $DFFF are not the same as those of MZ-80K.)
- The entry point of the monitor ROM is the same as that of the MZ-80K.

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

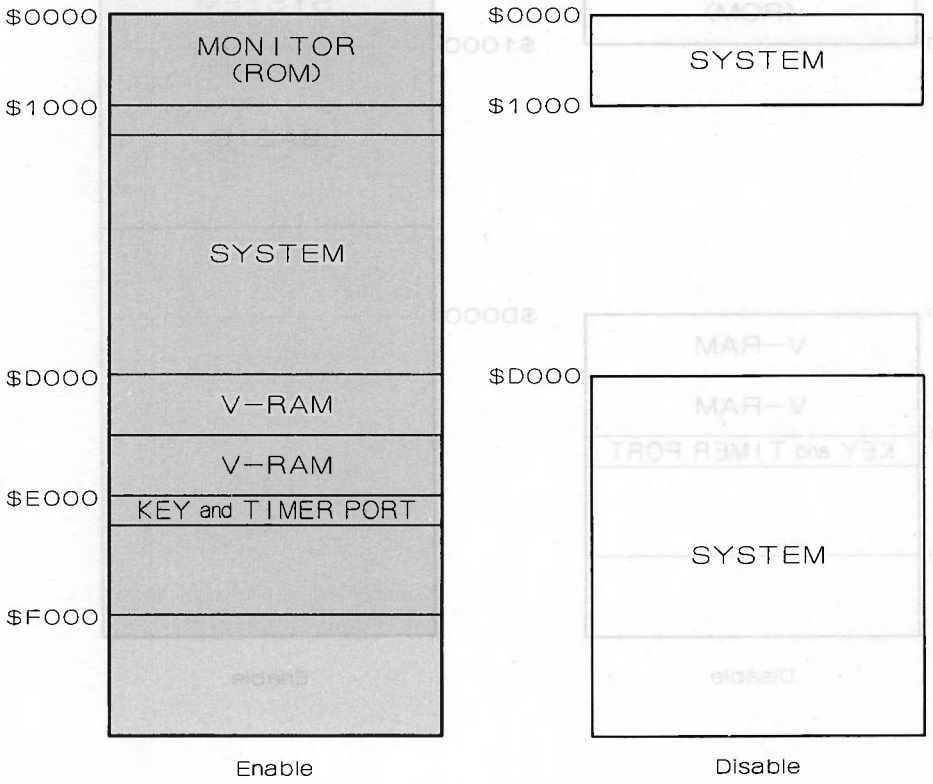
4.2.3 Memory map after the BASIC interpreter has been loaded (MZ-700 mode)



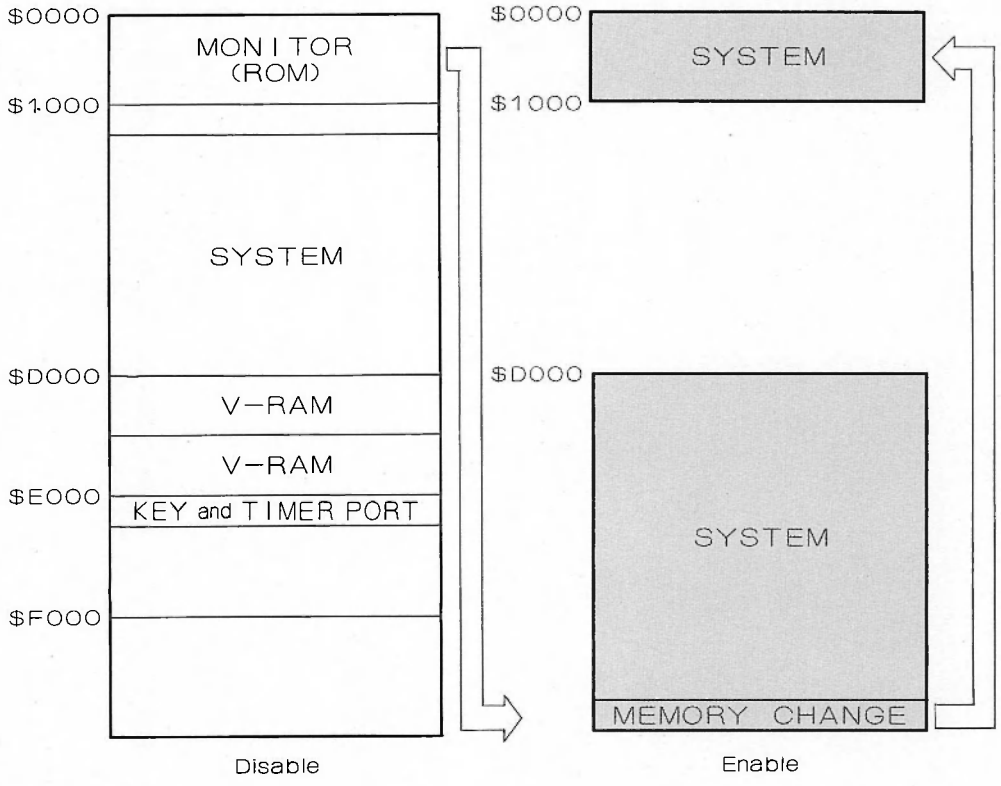
- The memory map is as shown above after the BASIC interpreter has been loaded.
- Bank switching is performed to access V-RAM or the KEY and TIMER PORT area.

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.

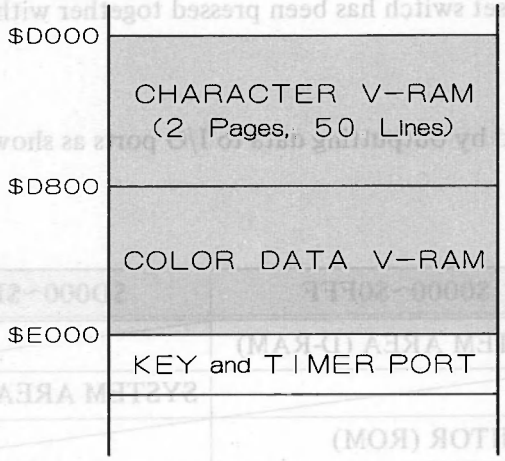
OUT ($E4), A

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

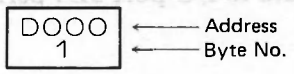
i) V-RAM (Video RAM) memory map



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):



Line \ Column	1	2	3	39	40
1	D000* 1	D001 2	D002 3	D026 39	D027 40
2	D028 41	D029 42	D02A 43	D04E 79	D04F 80
25	D3C0 961	D3C1 962	D3C2 963	D3E6 999	D3E7 1000

b) Area displayed after the screen has been scrolled up one line from the end of V-RAM:

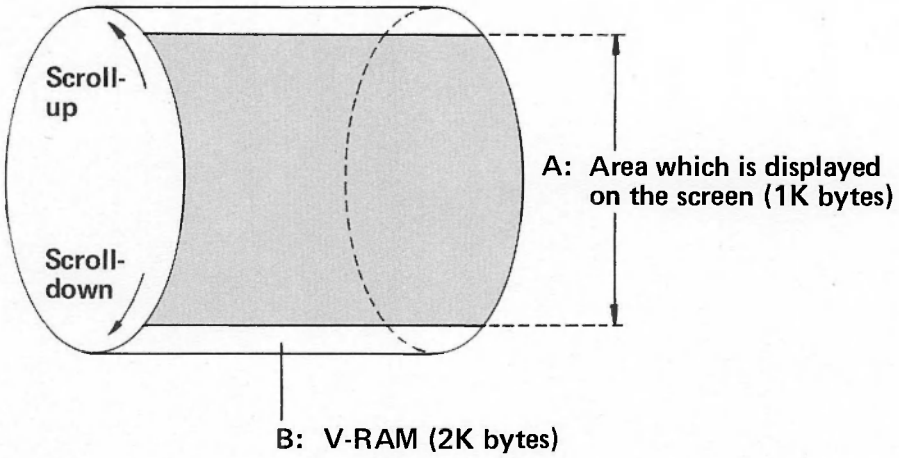
	1	2	3		39	40
1	D000 1041	D001 1042	D002 1043		D026 1079	D027 1080
2	D028 1081	D029 1082	D02A 1083		D04E 1119	D04F 1120
24	D398 1961	D399 1962	D39A 1963		D3BE 1999	D3BF 2000
25	D3C0 1	D3C1 2	D3C2 3		D3E6 39	D3E7 40

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.

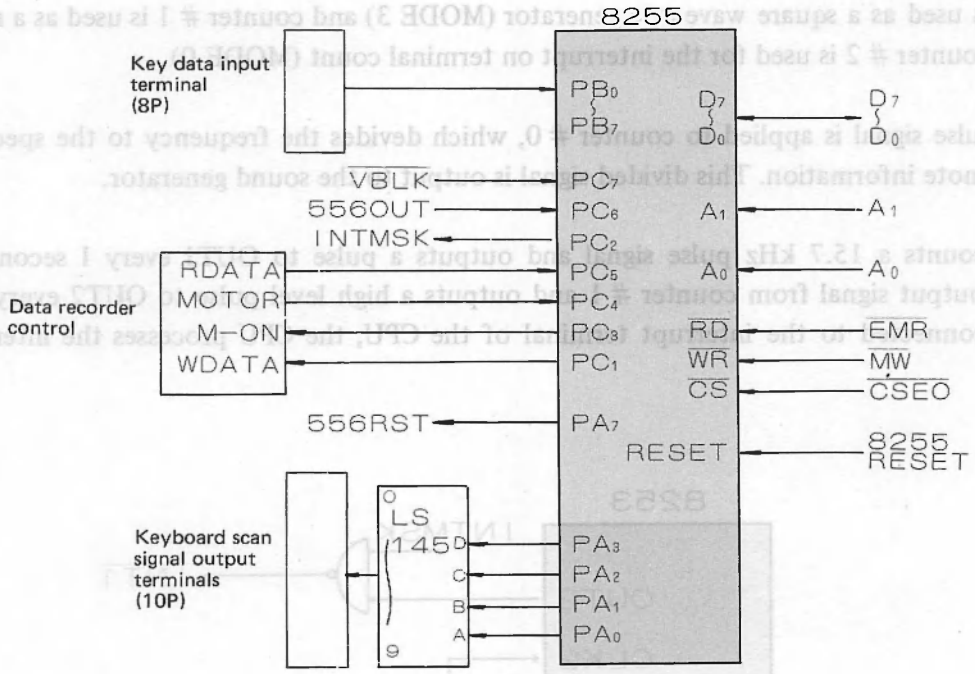
4. 3 Memory Mapped I/O ($E000-$E008)

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.

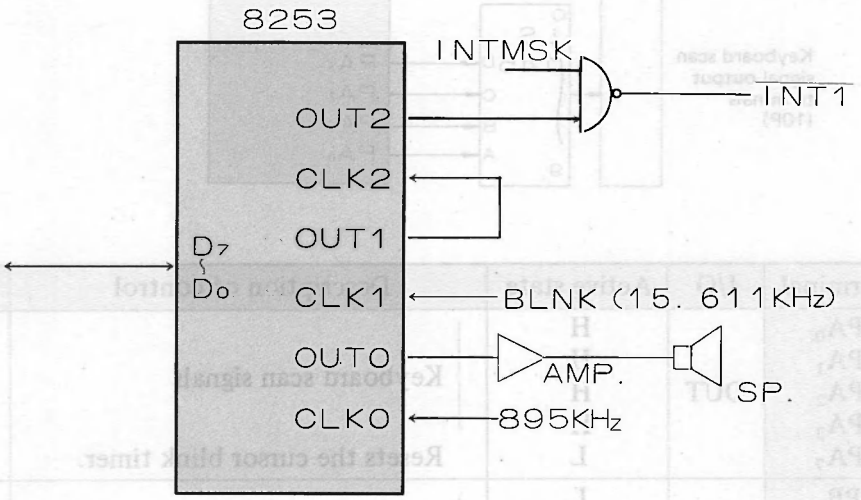
4.3.2 Signal system of the 8253

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.

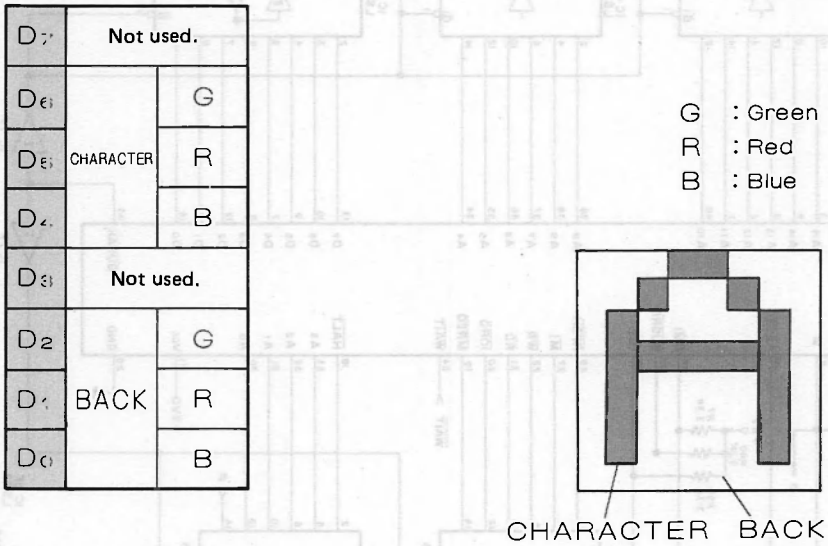
Counter # 1 counts a 15.7 kHz pulse signal and outputs a pulse to OUT1 every 1 second. Counter # 2 counts the output signal from counter # 1 and outputs a high level pulse to OUT2 every 12 hours. Since OUT2 is connected to the interrupt terminal of the CPU, the CPU processes the interrupt every 12 hours.



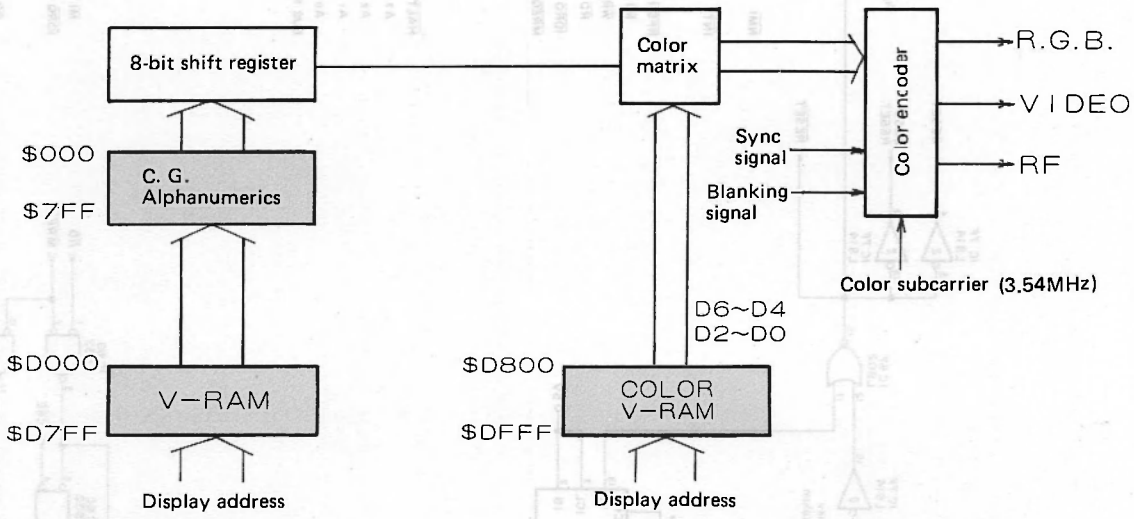
4. 4 Signal System of Color V-RAM

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.



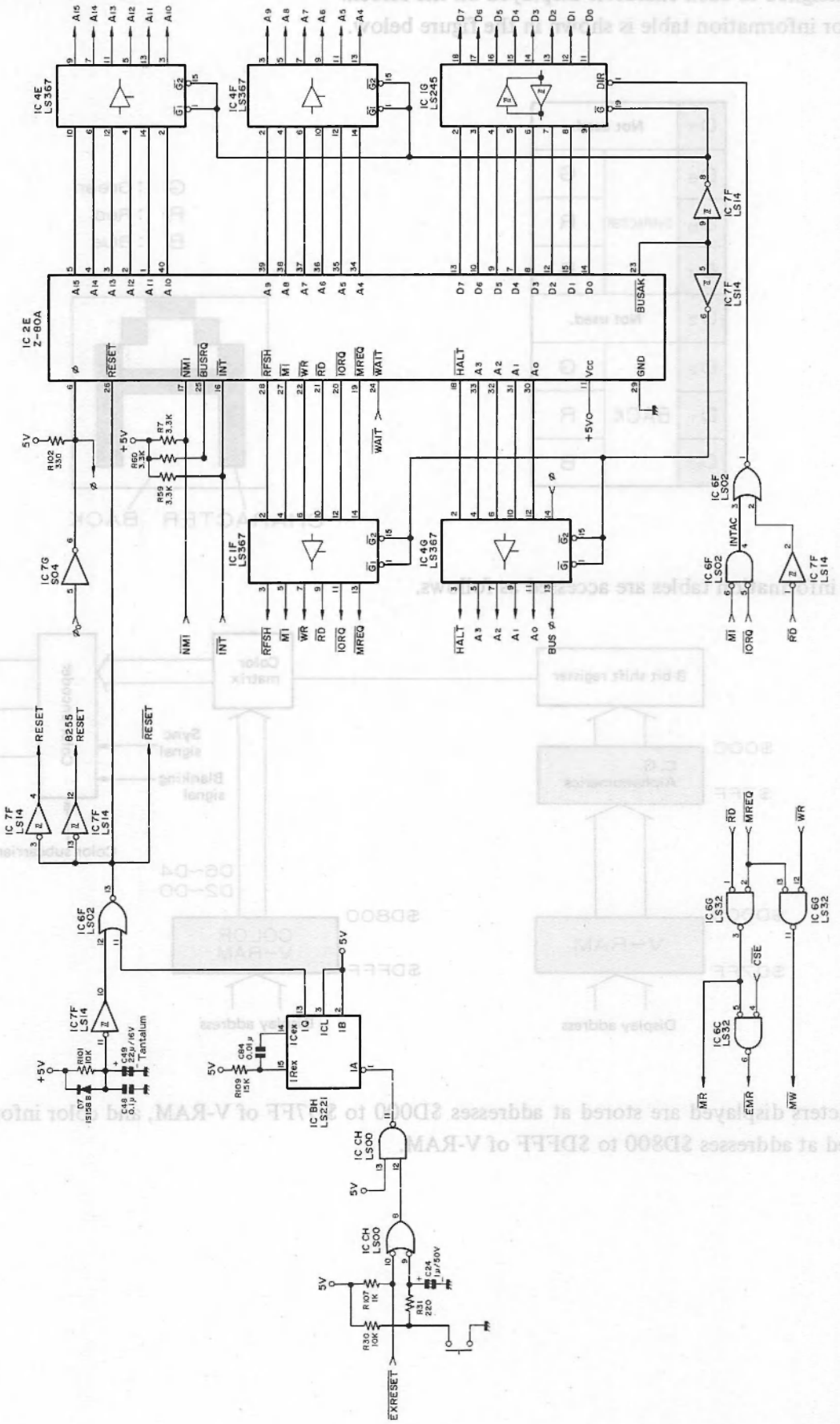
Color information tables are accessed as follows.



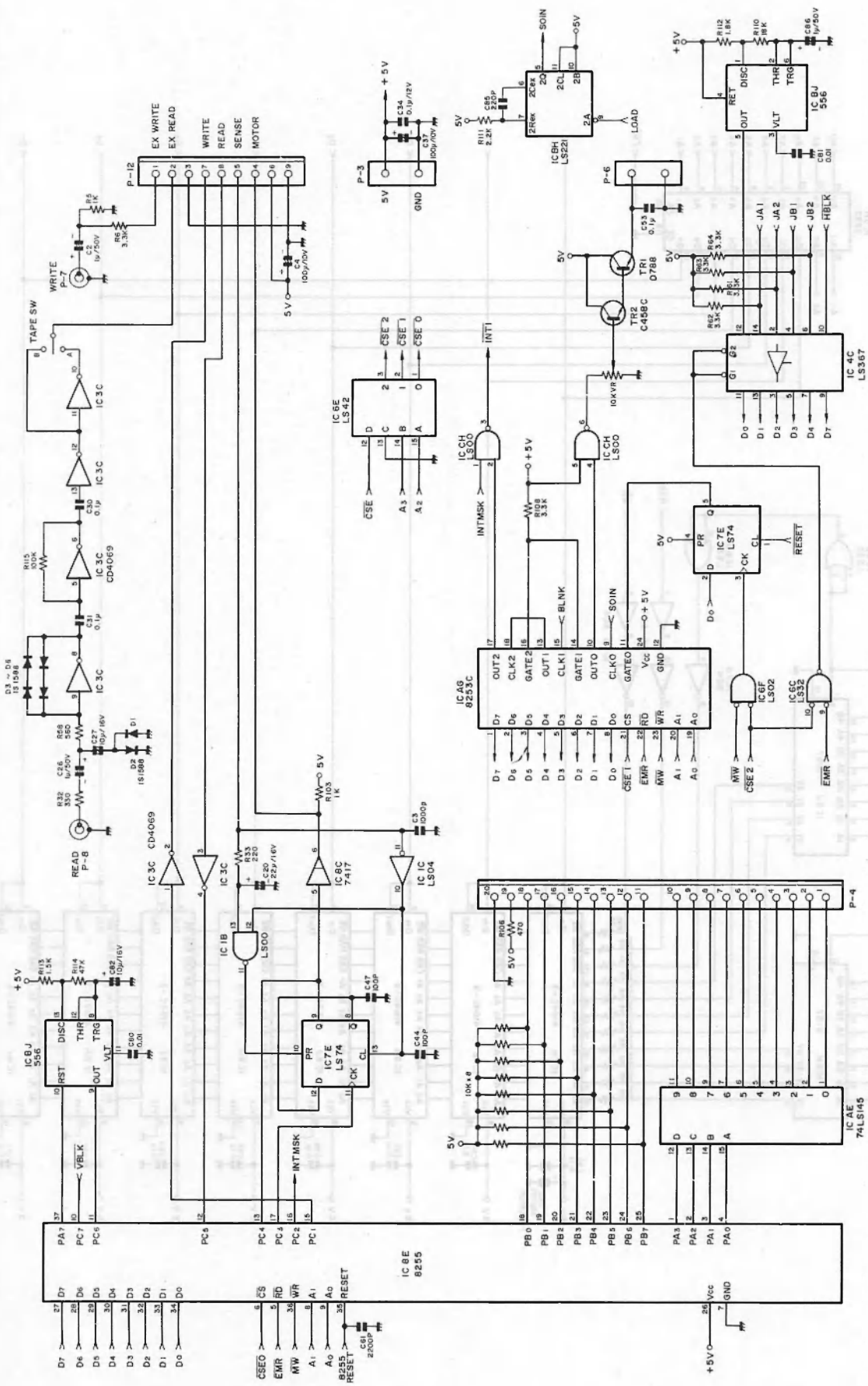
Characters displayed are stored at addresses $D000 to $D7FF of V-RAM, and color information tables are stored at addresses $D800 to $DFFF of V-RAM.

4. 5 MZ-700 Circuit Diagrams

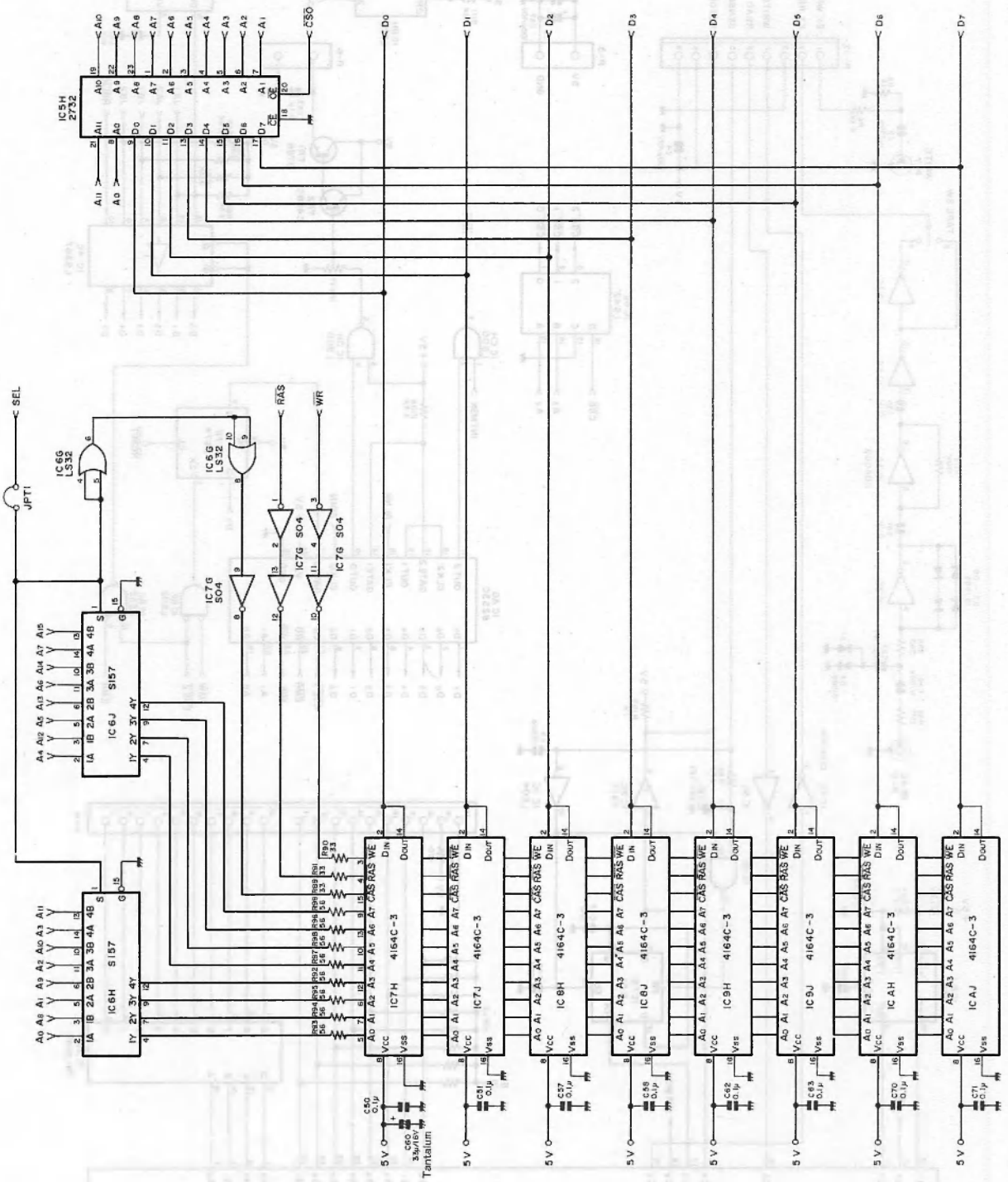
[CPU board circuit (1)]



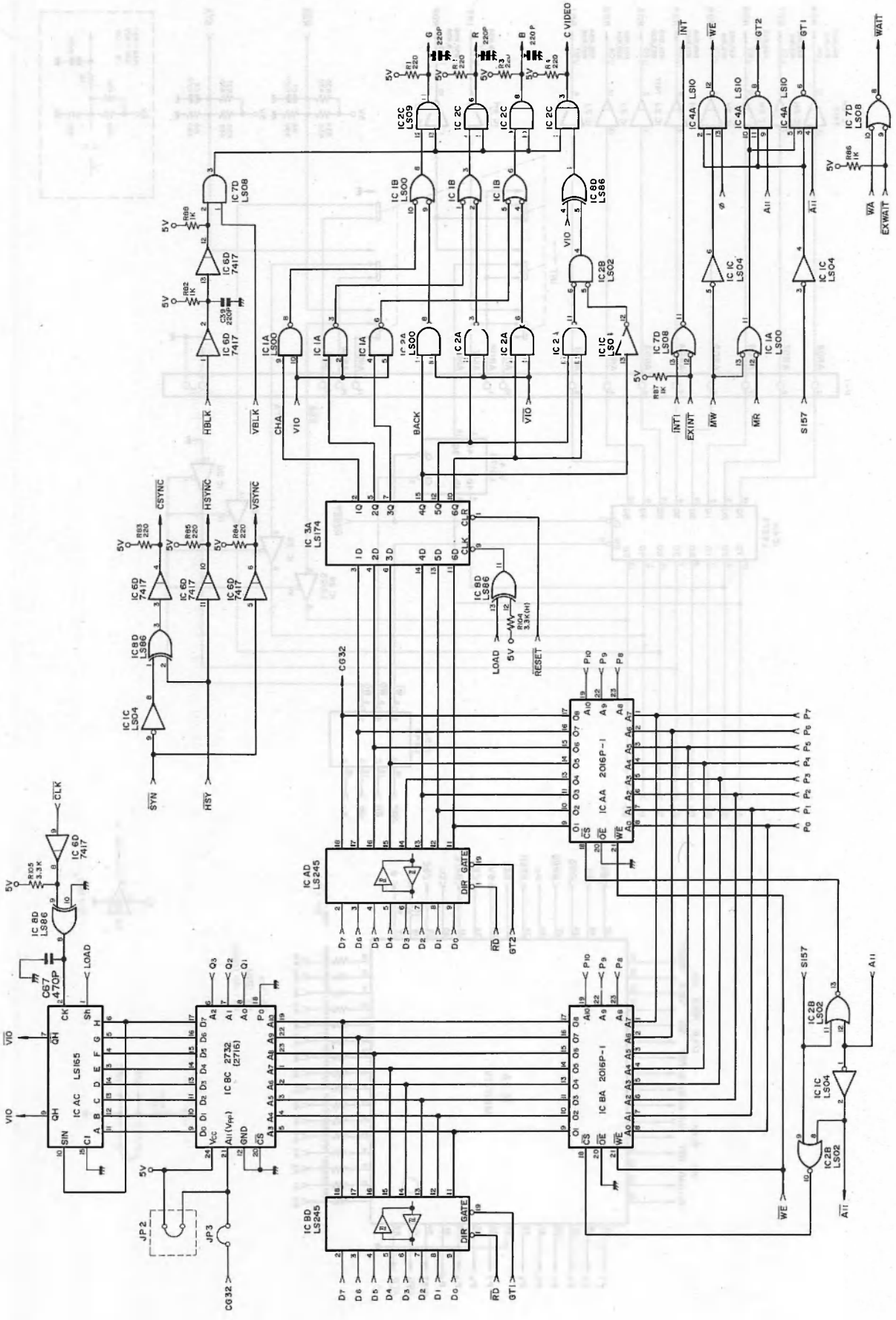
[CPU board circuit (2)]



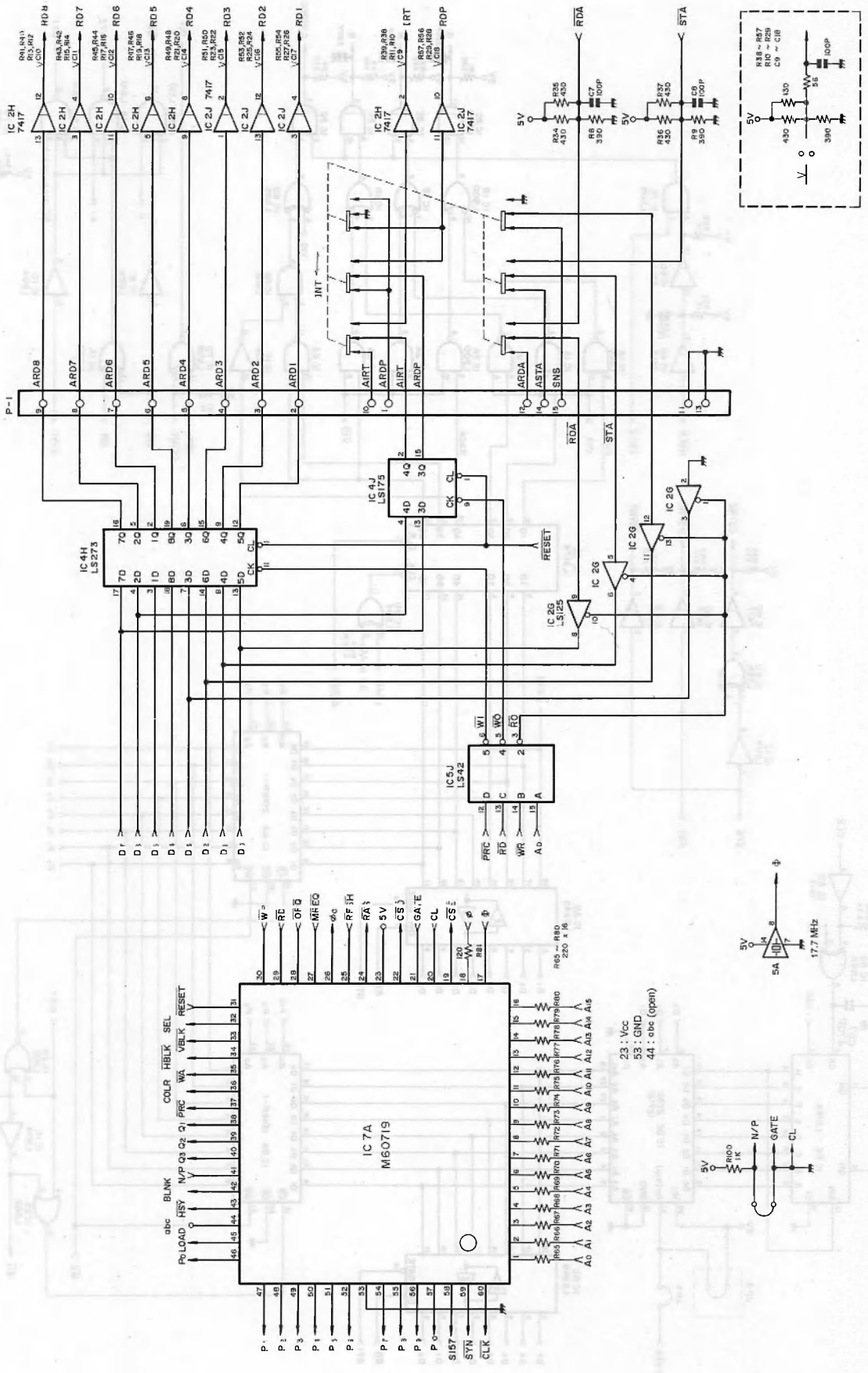
[CPU board circuit (3)]



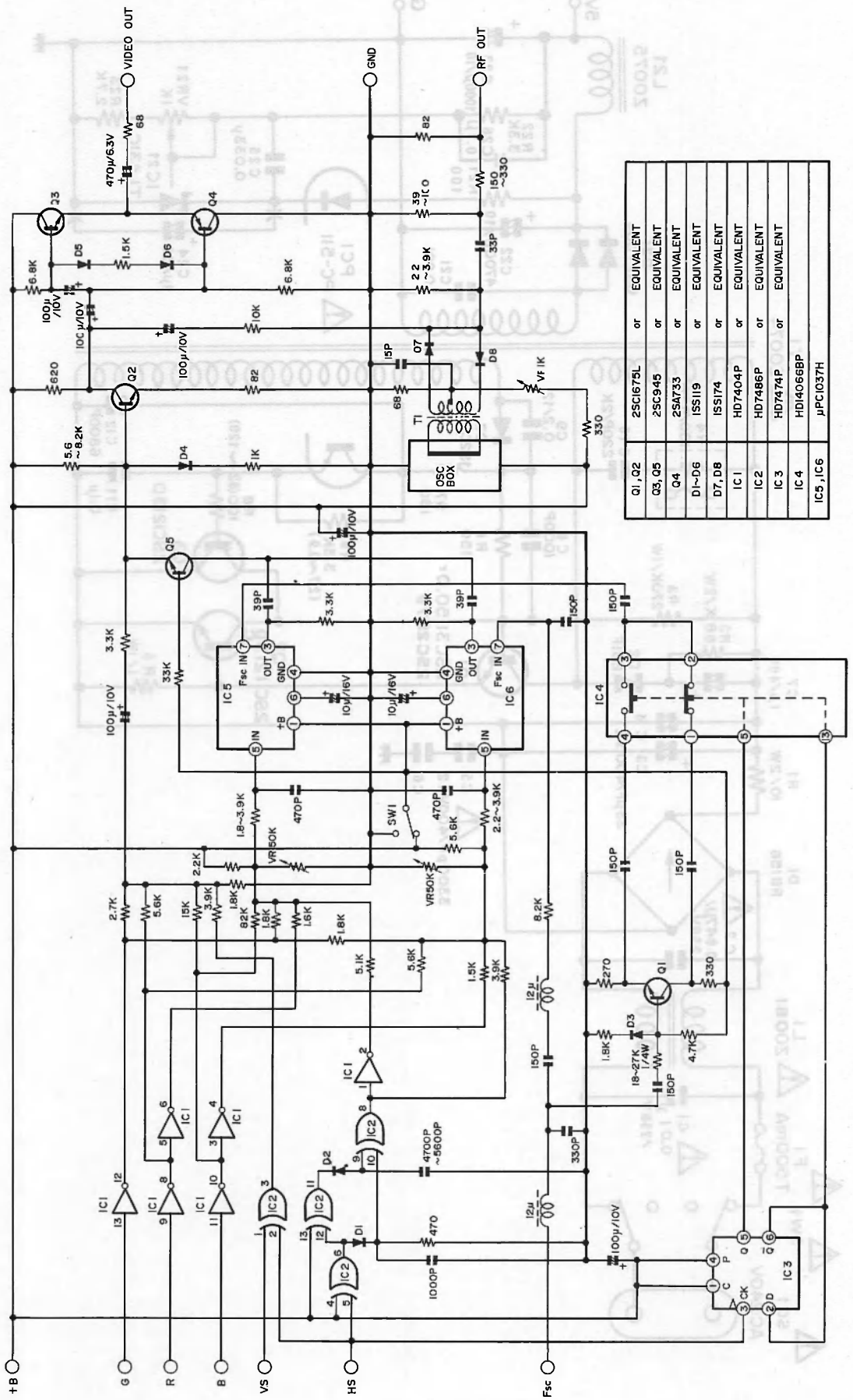
[CPU board circuit (4)]



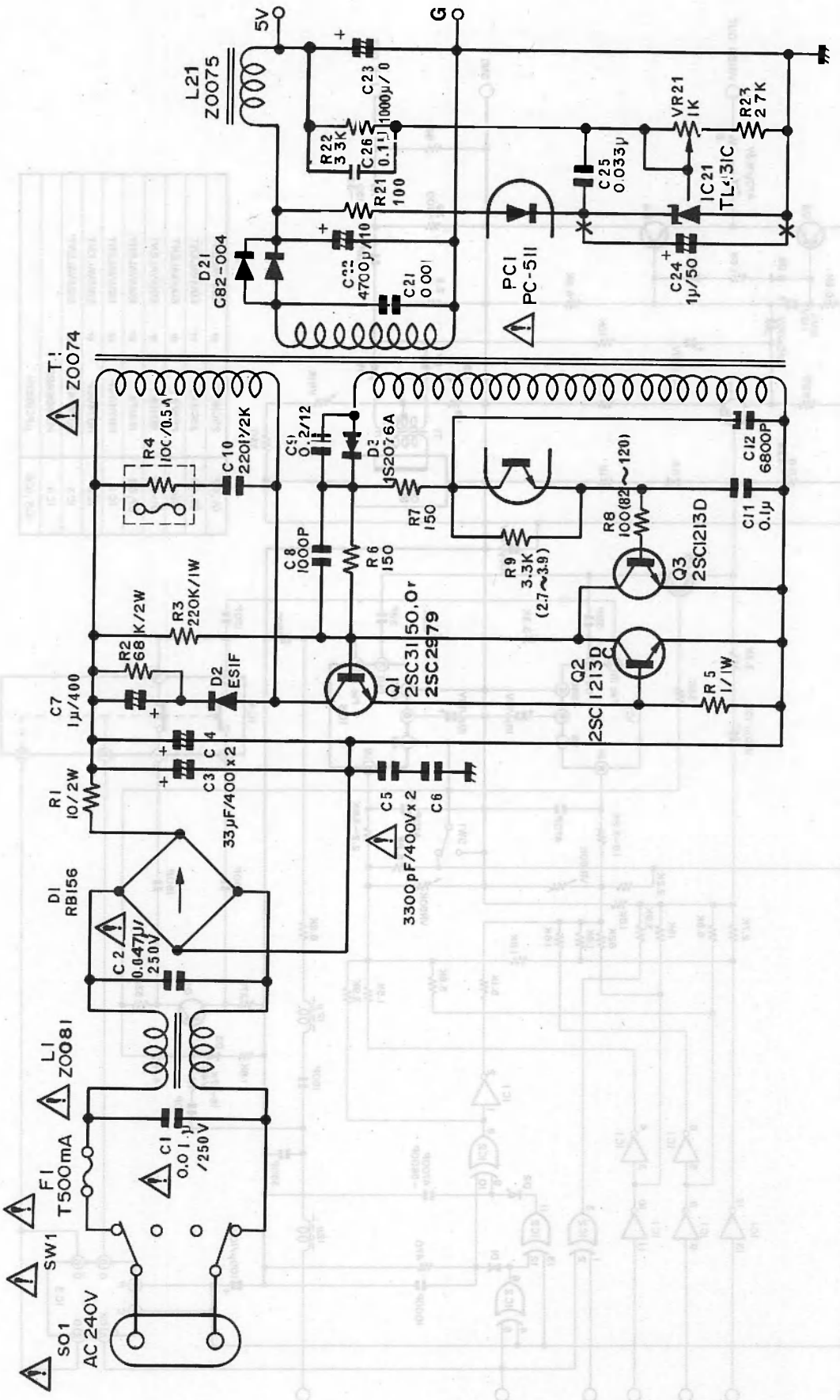
[CPU board circuit (5)]



[Color encoder circuit]



[Power unit]


5V
G
L21
Z0075
C23
1000μ/0
R22
33K
C26
0.1μ
R21
100
C25
0.033μ
VR21
1K
R23
27K
IC21
TL431C
C24
1μ/50
D21
G82-004
C22
4700μ/10
C21
0.001
PC1
PC-511
T1
Z0074
R4
100/0.5A
C10
220P/2K
C9
0.2/12
D3
1S2076A
C12
6800P
R7
150
R8
100(82~120)
C11
0.1μ
C8
1000P
R6
150
R9
3.3K
(2.7~3.9)
Q3
2SC1213D
R3
220K/1W
R2
68K/2W
D2
ESIF
Q1
2SC3150,Or
2SC2979
Q2
2SC1213D
C7
1μ/400
R5
1/1W
C4
C3
33μF/400x2
R1
10/2W
C5
C6
3300pF/400Vx2
D1
RB156
C2
0.047μ/
250V
L1
Z0081
C1
0.01μ
/250V
F1
T500mA
SW1
SO1
AC 240V

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	RDA	22 GND
	23	STA	24 GND
	25	FG	26 FG

[CPU board terminal configuration]

P-11

49	A15	$\overline{NMI}$	50
47	A14	EXINT	48
45	A13	GND	46
43	A12	$\overline{MREQ}$	44
41	A11	GND	42
39	A10	IORQ	40
37	A9	GND	38
35	A8	RD	36
33	A7	GND	34
31	A6	WR	32
29	A5	$\overline{EXWAIT}$	30
27	A4	$\overline{M1}$	28
25	A3	GND	26
23	A2	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
1	D0	GND	2

▷ mark

P-13

1	5V
2	VBLK
3	JA1
4	JA2
5	GND

P-14

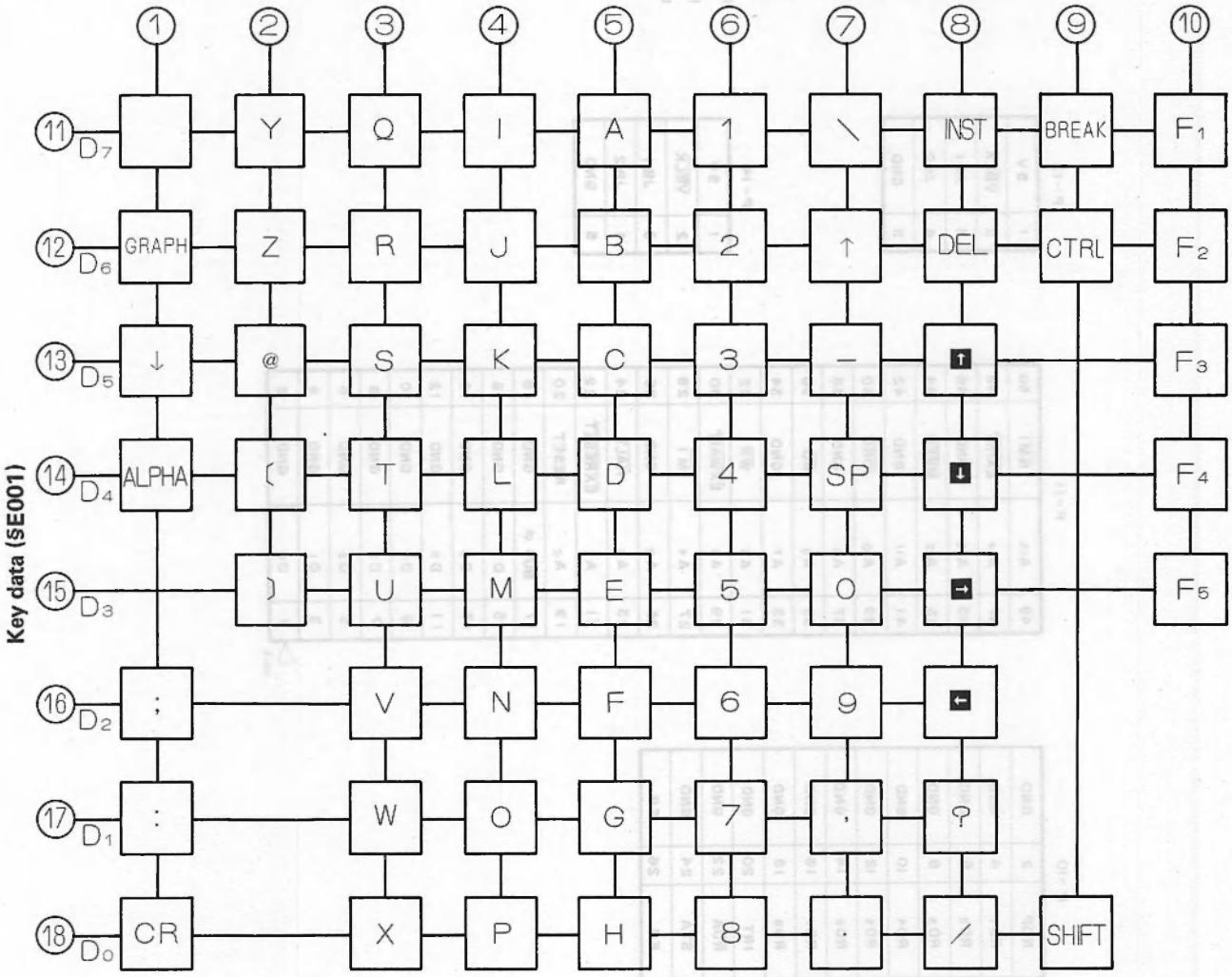
1	5V
2	VBLK
3	JB1
4	JB2
5	GND

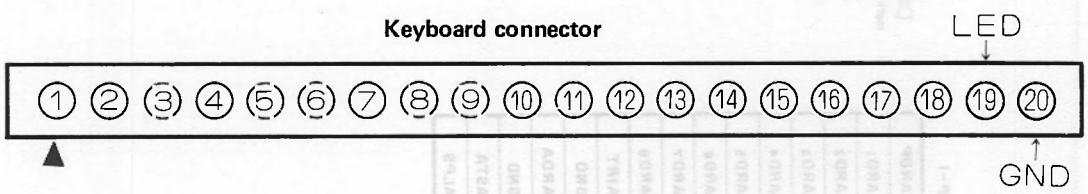
P-9

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

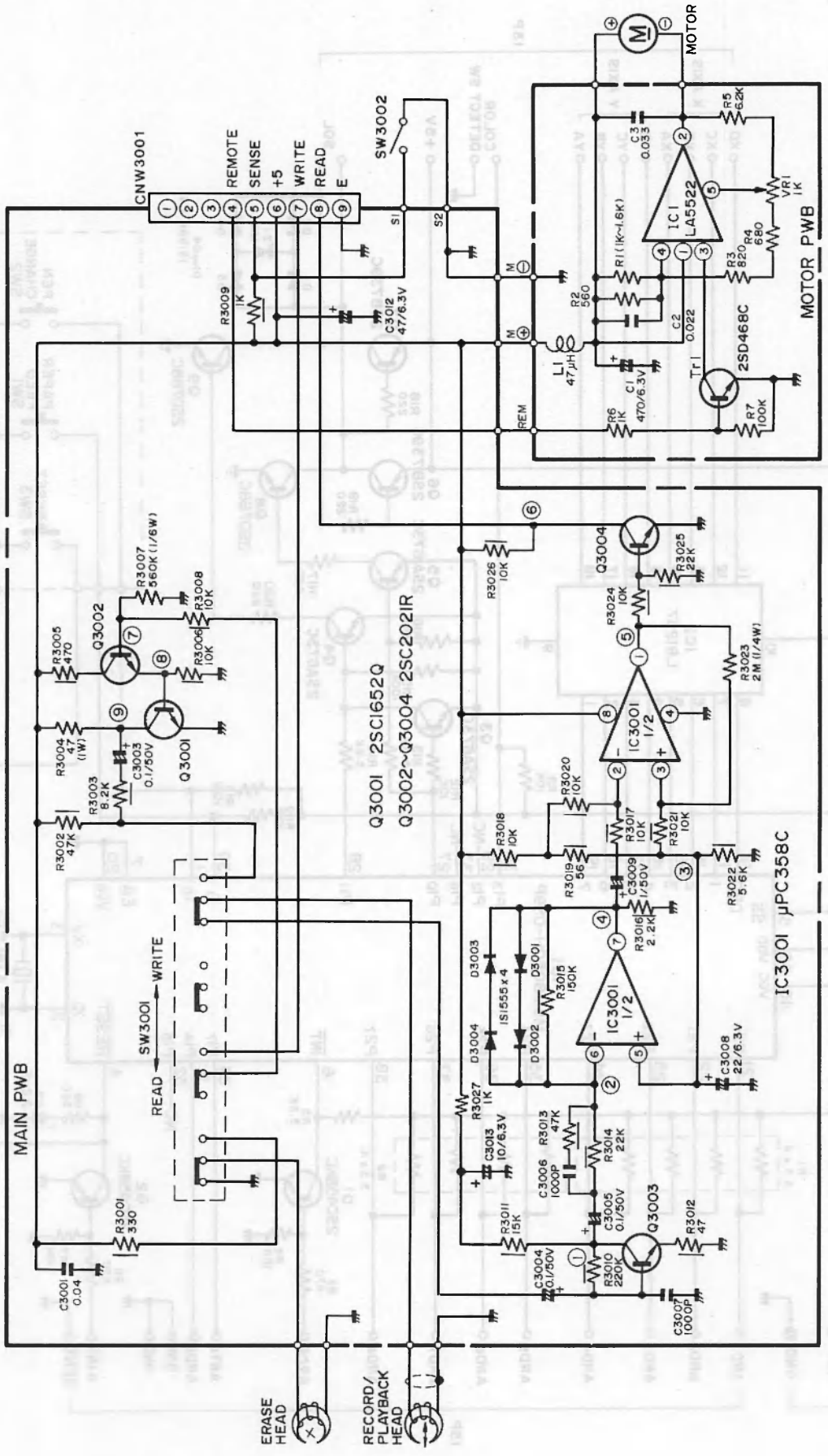
[Keyboard matrix circuit]

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.

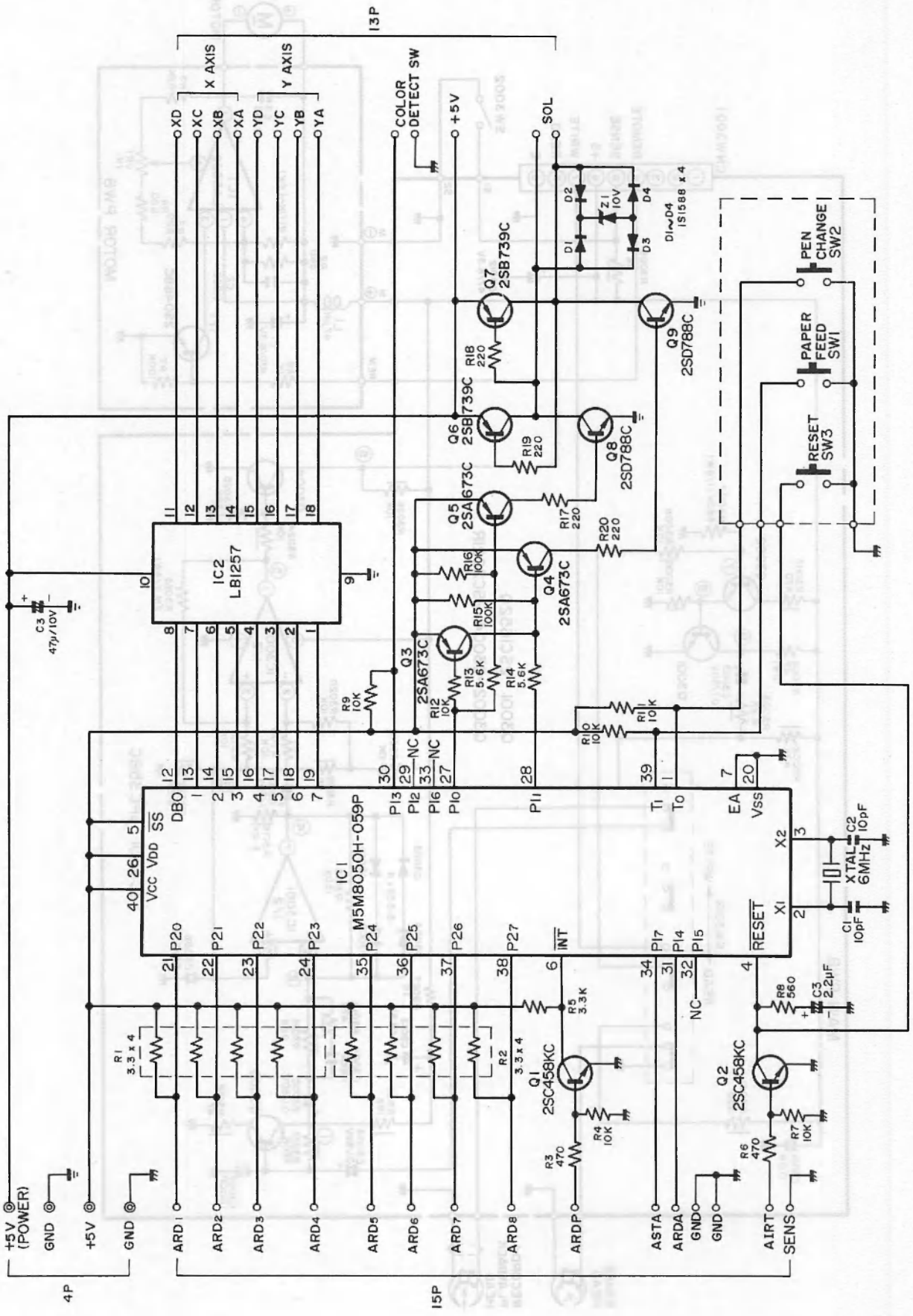




[Data recorder circuit]



[Color plotter-printer circuit]



Chapter 5

Monitor Commands and Subroutines

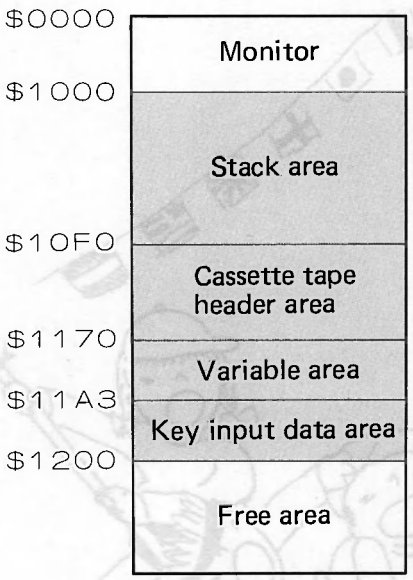
5.1 Monitor Commands

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.

```
*S[6][0][0][0][6][0][A][3][6][0][5][0]↵
FILENAME? [M][F][I][L][E]↵
↓ 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")
CALL HLHEX ↑— DE
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")
CALL 2HEX ↑— DE
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>

	Sets the ASCII character corresponding to the hexade- imal number represented by the lower 4 bits of data in ACC.	Other than AF
	ditions are as follow -. the ASCII character string CF = 0 HL ← hexadecimal number (e.g., HL = 31A5H) CF = 1 The contents of HL are not assured.	Other than AF and HL
	ALL 2HEX CF = 0 ACC ← hexadecimal number (e.g., ACC = 3AH) CF = 1 The contents of the ACC are not assured.	Other than AF and DE
	pressed, the corresponding display code is set in ACC and control is returned to the calling program.	Other than AF
	onverts ASCII codes into display co es. The call and retur conditions are as follows. ACC ← ASCII code	Other than AF
	conditions are as follows. ACC ← Display code ACC ← ASCII code	Other than AF
	calling program when the vertical blanking period is entered	All registers
	current cursor location in the HL register. The return 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. ("H" 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	H				a					
2 0010			"	2	B	R	I			e	z	Ü				
3 0011			#	3	C	S				`	w	m				
4 0100			$	4	D	T				~	s					
5 0101			%	5	E	U					u					
6 0110			&	6	F	V				t	i		→			
7 0111			'	7	G	W				g		o				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	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	SP	P	0		}	↑	π			p						SP
1	0001	A	Q	!		♠	<	!		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	~					■
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	:	−		■	→	+		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		P	0													
1 0001	A	Q	1													
2 0010	B	R	2													
3 0011	C	S	3													
4 0100	D	T	4													
5 0101	E	U	5													
6 0110	F	V	6													
7 0111	G	H	7													
8 1000	H	X	8													
9 1001	I	Y	9													
A 1010	J	Z														
B 1011	K															
C 1100	L															
D 1101	M															
E 1110	N															
F 1111	O															

■ **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				9		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]

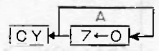
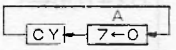
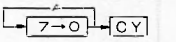
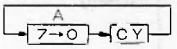
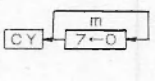
General purpose arithmetic and control group

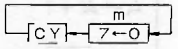
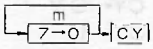
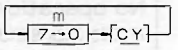
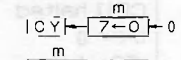
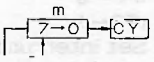
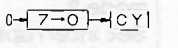
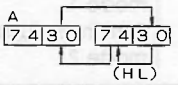
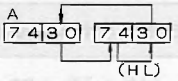
DAA	Decimal adjustment upon contents of A after add or subtract	00 100 111
CPL	$A \leftarrow \overline{A}$	00 101 111
NEG	$A \leftarrow \overline{A}+1$	11 101 101
		01 000 100
CCF	$CY \leftarrow C\,\overline{Y}$	00 111 111
SCF	CY←1	00 110 111
NOP	No operation, but PC is incremented.	00 000 000
HALT	CPU 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

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 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	BC
01	DE
10	HL
11	SP

qq	Register pair
00	BC
01	DE
10	HL
11	AF

pp	Register pair
00	BC
01	DE
10	IX
11	SP

rr	Register pair
00	BC
01	DE
10	IY
11	SP

b	Bit set
000	0
001	1
010	2
011	3
100	4
101	5
110	6
111	7

cc	Condition	
000	NZ	non zero
001	Z	zero
010	NC	non carry
011	C	carry
100	PO	parity odd
101	PE	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

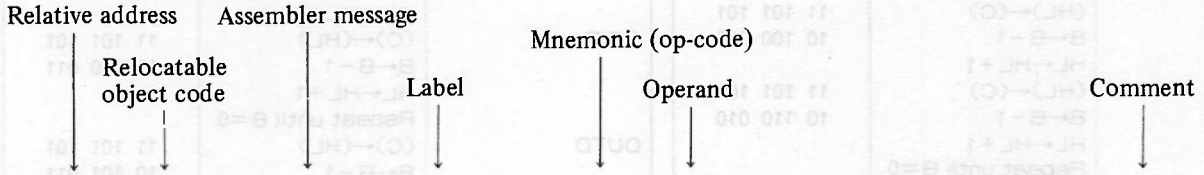
m : r, (HL), (IX + d), (IY + d)
m_b : Bit b or location m
(register pair)$_L$: Lower 8 bits of register pair

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 CO)
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

0000                    ;
0000                    ;
0000                    ;    MONITOR PROGRAM 1Z-013A
0000                    ;
0000                    ;          (MZ-700) FOR PAL
0000                    ;
0000                    ;          REV. 83.4.7
0000                    ;
0000                    ;
0000                    MONIT:  ENT
0000 C34A00                     JP      START           ; MONITOR ON
0003                    GETL:   ENT
0003 C3E607                     JP      ?GETL           ; GET LINE (END'CR')
0006                    LETNL:  ENT
0006 C30E09                     JP      ?LTNL           ; NEW LINE
0009                    NL:     ENT
0009 C31809                     JP      ?NL             ;
000C                    PRNTS:  ENT
000C C32009                     JP      ?PRTS           ; PRINT SPACE
000F                    PRNTT:  ENT
000F C32409                     JP      ?PRTT           ; PRINT TAB
0012                    PRNT:   ENT
0012 C33509                     JP      ?PRNT           ; 1 CHARACTER PRINT
0015                    MSG:    ENT
0015 C39308                     JP      ?MSG            ; 1 LINE PRINT (END'0I
)
0018                    MSGX:   ENT
0018 C3A108                     JP      ?MSGX           ; RST 3
001B                    GETKY:  ENT
001B C3BD08                     JP      ?GET            ; GET KEY
001E                    BRKEY:  ENT
001E C3320A                     JP      ?BRK            ; GET BREAK
0021                    WRINF:  ENT
0021 C33604                     JP      ?WRI            ; WRITE INFORMATION
0024                    WRDAT:  ENT
0024 C37504                     JP      ?WRD            ; WRITE DATA
0027                    RDINF:  ENT
0027 C3D804                     JP      ?RDI            ; READ INFORMATION
002A                    RDDAT:  ENT
002A C3F804                     JP      ?RDD            ; READ DATA
002D                    VERFY:  ENT
002D C38805                     JP      ?VRFY           ; VERIFING CMT
0030                    MELDY:  ENT
0030 C3C701                     JP      ?MLDY           ; RST 6
0033                    TIMST:  ENT
0033 C30803                     JP      ?TMST           ; TIME SET
0036 00                         NOP
0037 00                         NOP
0038 C33810                     JP      1038H           ; INTERRUPT ROUTINE
003B                    TIMRD:  ENT
003B C35803                     JP      ?TMRD           ; TIME READ
003E                    BELL:   ENT
003E C37705                     JP      ?BEL            ; BELL ON
0041                    XTEMP:  ENT
0041 C3E502                     JP      ?TEMP           ; TEMPO SET (1→7)
0044                    MSTA:   ENT
0044 C3AB02                     JP      MLDST           ; MELODY START
0047                    MSTP:   ENT
0047 C3BE02                     JP      MLDSP           ; MELODY STOP
004A                    ;
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,MSG73        ; ** 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

00C5 FE4C                       CP      'L'             ; LOAD PROGRAM
00C7 2848                       JR      Z,LOAD
00C9 FE46                       CP      'F'             ; FLOPPY ACCESS
00CB 2832                       JR      Z,FD
00CD FE42                       CP      'B'             ; KEY IN BELL
00CF 2826                       JR      Z,SG
00D1 FE23                       CP      '#'             ; CHANG MEMORY
00D3 2886                       JR      Z,CMYO
00D5 FE50                       CP      'P'             ; PRINTER TEST
00D7 287C                       JR      Z,PTEST
00D9 FE4D                       CP      'M'             ; MEMORY CORRECTION
00DB CAA807                     JP      Z,MCOR
00DE FE53                       CP      'S'             ; SAVED DATA
00E0 CA5E0F                     JP      Z,SAVE
00E3 FE56                       CP      'V'             ; VERIFYING DATA
00E5 CACB0F                     JP      Z,VRFY
00E8 FE44                       CP      'D'             ; DUMP DATA
00EA CA290D                     JP      Z,DUMP
00ED                    ;
00ED                    ;
00ED                            DEFS    +4
00F1                    ;
00F1 18C8                       JR      ST2             ; NOT COMMAND
00F3                    ;
00F3                    ;   JUMP COMMAND
00F3                    ;
00F3 CD3D01             GOTO:   CALL    HEXIY
00F6 E9                         JP      (HL)
00F7                    ;
00F7                    ;   KEY SOUND ON OFF
00F7                    ;
00F7 3A9D11             SG:     LD      A,(SWRK)        ; D0 = SOUND WORK
00FA 1F                         RRA
00FB 3F                         CCF                     ; CHENGE MODE
00FC 17                         RLA
00FD 18A5                       JR      SS+2
00FF                    ;
00FF                    ;   FLOPPY
00FF                    ;
00FF 2100F0             FD:     LD      HL,F000H        ; FLOPPY I/O CHECK
0102 7E                 FD2:    LD      A,(HL)
0103 B7                         OR      A
0104 20A7                       JR      NZ,ST1
0106 E9                 FD1:    JP      (HL)
0107                    ;
0107                    ;
0107                    ;   ERROR (LOADING)
0107                    ;
0107                    ?ER:    ENT                     ;
0107 FE02                       CP      02H             ; A=02H : BREAK IN
0109 28A2                       JR      Z,ST1           ;
010B 114701                     LD      DE,MSGE1        ; CHECK SUM ERROR
010E DF                         RST     3               ; CALL MSGX
010F 189C                       JR      ST1
0111                    ;
0111                    ;
0111                    ;   LOAD COMMAND
0111                    ;
0111 CDD804             LOAD:   CALL    ?RDI
0114 38F1                       JR      C,?ER
```

```
 *I  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 04            04.07.83

01 0116 CD0900            LOA0:   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
?2 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
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 05          04.07.83

01 0155                    ;
02 0155                    PTEST:  ENT
03 0155 1A                         LD      A,(DE)
04 0156 FE26                       CP      '&'
05 0158 2016                       JR      NZ,PTST1
06 015A 13                 PTST0:  INC     DE
07 015B 1A                         LD      A,(DE)
08 015C FE4C                       CP      'L'             ; 80 IN 1 LINE
09 015E 2816                       JR      Z,.LPT
10 0160 FE53                       CP      'S'             ; 80 IN 1LINE
11 0162 2817                       JR      Z,..LPT
12 0164 FE43                       CP      'C'             ; PEN CHENGE
13 0166 2823                       JR      Z,PEN
14 0168 FE47                       CP      'G'             ; GRAPH MODE
15 016A 2818                       JR      Z,PLOT
16 016C FE54                       CP      'T'             ; TEST
17 016E 2810                       JR      Z,PTRN
18 0170                    ;
19 0170 CDA501             PTST1:  CALL    PMSG            ; PLOT MESSAGE
20 0173 C3AD00                     JP      ST1
21 0176                    ;
22 0176 117004             .LPT:   LD      DE,LLPT         ; 01-09-09-0B-0D
23 0179 18F5                       JR      PTST1
24 017B                    ;
25 017B 11D503             ..LPT:  LD      DE,SLPT         ; 01-09-09-09-0D
26 017E 18F0                       JR      PTST1
27 0180                    ;
28 0180 3E04               PTRN:   LD      A,04H           ; TEST PATTERN
29 0182 1802                       JR      PLOT+2
30 0184                    ;
31 0184 3E02               PLOT:   LD      A,02H           ; GRAPH CODE
32 0186 CD8F01                     CALL    LPRNT
33 0189 18CF                       JR      PTST0
34 018B                    ;
35 018B 3E1D               PEN:    LD      A,1DH           ; 1 CHENGE CODE (TEXT MO
DE)
36 018D 18F7                       JR      PLOT+2
37 018F                    ;
38 018F                    ;
39 018F                    ;    1CHA. PRINT TO $LPT
40 018F                    ;
41 018F                    ;      IN: ACC PRINT DATA
42 018F                    ;
43 018F                    ;
44 018F 0E00               LPRNT:  LD      C,0             ; RDA TEST
45 0191 47                         LD      B,A             ; PRINT DATA STORE
46 0192 CDB601                     CALL    RDA
47 0195 78                         LD      A,B
48 0196 D3FF                       OUT     (FFH),A         ; DATA OUT
49 0198 3E80                       LD      A,80H           ; RDP HIGH
50 019A D3FE                       OUT     (FEH),A
51 019C 0E01                       LD      C,01H           ; RDA TEST
52 019E CDB601                     CALL    RDA
53 01A1 AF                         XOR     A               ; RDP LOW
54 01A2 D3FE                       OUT     (FEH),A
55 01A4 C9                         RET
56 01A5                    ;
57 01A5                    ;    $LPT  MSG.
58 01A5                    ;      IN: DE DATA LOW ADR.
59 01A5                    ;          0DH  MSG. END
60 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
```

```
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
```

```
029A 0000                       DEFW   0
029C                    OPTBL:  ENT
029C 01                         DEFB   1
029D 02                         DEFB   2
029E 03                         DEFB   3
029F 04                         DEFB   4
02A0 06                         DEFB   6
02A1 08                         DEFB   8
02A2 0C                         DEFB   0CH
02A3 10                         DEFB   10H
02A4 18                         DEFB   18H
02A5 20                         DEFB   20H
02A6                    ;
02A6                    ;
02A6                    ;
02A6                    ;       INCREMENT DE REG.
02A6                    ;
02A6                    .4DE:   ENT
02A6 13                         INC    DE
02A7 13                         INC    DE
02A8 13                         INC    DE
02A9 13                         INC    DE
02AA C9                         RET
02AB                    ;
02AB                    ;
02AB                    ;
02AB                    ;ORG 02ABH ; MLDST
02AB                    ;
02AB                    ;   MELODY START & STOP
02AB                    ;
02AB                    MLDST:  ENT
02AB 2AA111                     LD     HL,(RATIO)
02AE 7C                         LD     A,H
02AF B7                         OR     A
02B0 280C                       JR     Z,MLDSP
02B2 D5                         PUSH   DE
02B3 EB                         EX     DE,HL
02B4 2104E0                     LD     HL,CONTO
02B7 73                         LD     (HL),E
02B8 72                         LD     (HL),D
02B9 3E01                       LD     A,1
02BB D1                         POP    DE
02BC 1806                       JR     MLDS1
02BE                    ;
02BE                    MLDSP:  ENT
02BE 3E36                       LD     A,36H          ; MODE SET (8253 CO)
02C0 3207E0                     LD     (CONTF),A      ; E007H
02C3 AF                         XOR    A
02C4 3208E0             MLDS1:  LD     (SUNDG),A      ; E008H
02C7 C9                         RET                   ; TEHRO RESET
02C8                    ;
02C8                    ;   RHYTHM
02C8                    ;
02C8                    ;     B=COUNT DATA
02C8                    ;        IN
02C8                    ;    EXIT CF=1 BREAK
02C8                    ;         CF=0 OK
02C8                    ;
02C8                    RYTHM:  ENT
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 030SH
60 0308                 ;
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 11            04.07.83

01 0308                    ;  TIME SET
02 0308                    ;
03 0308                    ;      ACC=0 : AM
04 0308                    ;        =1 : PM
05 0308                    ;      DE=SEC: BINARY
06 0308                    ;
07 0308                    ?TMST:  ENT
08 0308 F3                         DI
09 0309 C5                         PUSH    BC
10 030A D5                         PUSH    DE
11 030B E5                         PUSH    HL
12 030C 329B11                     LD      (AMPM),A        ; AMPM DATA
13 030F 3EF0                       LD      A,F0H
14 0311 329C11                     LD      (TIMFG),A       ; TIME FLAG
15 0314 21C0A8                     LD      HL,A8C0H        ; 12H
16 0317 AF                         XOR     A
17 0318 ED52                       SBC     HL,DE           ; COUNT DATA = 12H-IN DA
TA
18 031A E5                         PUSH    HL
19 031B 00                         NOP
20 031C EB                         EX      DE,HL
21 031D 2107E0                     LD      HL,CONTF        ; E007H
22 0320 3674                       LD      (HL),74H
23 0322 36B0                       LD      (HL),B0H
24 0324 2B                         DEC     HL              ; CONT2
25 0325 73                         LD      (HL),E
26 0326 72                         LD      (HL),D
27 0327 2B                         DEC     HL              ; CONT1
28 0328 360A                       LD      (HL),0AH
29 032A 3600                       LD      (HL),0
30 032C 23                         INC     HL
31 032D 23                         INC     HL              ; CONTF
32 032E 3680                       LD      (HL),80H
33 0330 2B                         DEC     HL              ; CONT2
34 0331 4E                 ?TMS1:  LD      C,(HL)
35 0332 7E                         LD      A,(HL)
36 0333 BA                         CP      D
37 0334 20FB                       JR      NZ,?TMS1
38 0336 79                         LD      A,C
39 0337 BB                         CP      E
40 0338 20F7                       JR      NZ,?TMS1
41 033A 2B                         DEC     HL
42 033B 00                         NOP
43 033C 00                         NOP
44 033D 00                         NOP
45 033E 36FB                       LD      (HL),FBH        ; 1SEC
46 0340 363C                       LD      (HL),3CH
47 0342 23                         INC     HL
48 0343 D1                         POP     DE
49 0344 4E                 ?TMS2:  LD      C,(HL)
50 0345 7E                         LD      A,(HL)
51 0346 BA                         CP      D
52 0347 20FB                       JR      NZ,?TMS2
53 0349 79                         LD      A,C
54 034A BB                         CP      E
55 034B 20F7                       JR      NZ,?TMS2
56 034D E1                         POP     HL
57 034E D1                         POP     DE
58 034F C1                         POP     BC
59 0350 FB                         EI
60 0351 C9                         RET
```

```
01 0352                 ;
02 0352                 ;
03 0352                 ;   BELL DATA
04 0352                 ;
05 0352                 ?BELD:  ENT
06 0352 D7                      DEFB    D7H
07 0353 4130                    DEFM    'A0'
08 0355 0D                      DEFB    0DH
09 0356                 ;
10 0356                 ;
11 0356                 ;
12 0356                         DEFS    +2
13 0358                 ;ORG 0358H
14 0358                 ;
15 0358                 ;   TIME READ
16 0358                 ;
17 0358                 ;     EXIT  ACC=0 :AM
18 0358                 ;               =1 :PM
19 0358                 ;           DE=SEC. BINARY
20 0358                 ;
21 0358                 ?TMRD:  ENT
22 0358 E5                      PUSH    HL
23 0359 2107E0                  LD      HL,CONTF
24 035C 3680                    LD      (HL),80H
25 035E 2B                      DEC     HL              ; CONT2
26 035F F3                      DI
27 0360 5E                      LD      E,(HL)
28 0361 56                      LD      D,(HL)
29 0362 FB                      EI
30 0363 7B                      LD      A,E
31 0364 B2                      OR      D
32 0365 280E                    JR      Z,?TMR1
33 0367 AF                      XOR     A
34 0368 21C0A8                  LD      HL,A8C0H
35 036B ED52                    SBC     HL,DE
36 036D 3810                    JR      C,?TMR2
37 036F EB                      EX      DE,HL
38 0370 3A9B11                  LD      A,(AMPM)
39 0373 E1                      POP     HL
40 0374 C9                      RET
41 0375 11C0A8                  LD      DE,A8C0H        ; 12H
42 0378 3A9B11                  LD      A,(AMPM)
43 037B EE01                    XOR     1
44 037D E1                      POP     HL
45 037E C9                      RET
46 037F F3                      DI
47 0380 2106E0                  LD      HL,CONT2
48 0383 7E                      LD      A,(HL)
49 0384 2F                      CPL
50 0385 5F                      LD      E,A
51 0386 7E                      LD      A,(HL)
52 0387 2F                      CPL
53 0388 57                      LD      D,A
54 0389 FB                      EI
55 038A 13                      INC     DE
56 038B 18EB                    JR      ?TMR1+3
57 038D                 ;
58 038D                 ;   TIME INTERRUPT
59 038D                 ;
60 038D                 TIMIN:  ENT
```

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   **  Z8C ASSEMBLER SB-7201  <1Z-013A>  PAGE 13           04.07.83

01 038D F5                      PUSH    AF
02 038E C5                      PUSH    BC
03 038F D5                      PUSH    DE
04 0390 E5                      PUSH    HL
05 0391 219B11                  LD      HL,AMPM
06 0394 7E                      LD      A,(HL)
07 0395 EE01                    XOR     1
08 0397 77                      LD      (HL),A
09 0398 2107E0                  LD      HL,CONTF
10 039B 3680                    LD      (HL),80H
11 039D 2B                      DEC     HL              ; CONT2
12 039E E5                      PUSH    HL
13 039F 5E                      LD      E,(HL)
14 03A0 56                      LD      D,(HL)
15 03A1 21C0A8                  LD      HL,A8C0H
16 03A4 19                      ADD     HL,DE
17 03A5 2B                      DEC     HL
18 03A6 2B                      DEC     HL
19 03A7 EB                      EX      DE,HL
20 03A8 E1                      POP     HL
21 03A9 73                      LD      (HL),E
22 03AA 72                      LD      (HL),D
23 03AB E1                      POP     HL
24 03AC D1                      POP     DE
25 03AD C1                      POP     BC
26 03AE F1                      POP     AF
27 03AF FB                      EI
28 03B0 C9                      RET
29 03B1                 ;
30 03B1                 ;       SPACE PRINT AND DISP ACC
31 03B1                 ;
32 03B1                 ;         INPUT:HL=DISP. ADR.
33 03B1                 ;
34 03B1                 SPHEX:  ENT
35 03B1 CD2009                  CALL    ?PRTS           ; SP.PRINT
36 03B4 7E                      LD      A,(HL)
37 03B5 CDC303                  CALL    PRTHX           ; DSP OF ACC (ASCII)
38 03B8 7E                      LD      A,(HL)
39 03B9 C9                      RET
40 03BA                 ;
41 03BA                 ;
42 03BA                 ;
43 03BA                 ;ORG 03BAH
44 03BA                 ;
45 03BA                 ;  (ASCII PRINT) FOR HL
46 03BA                 ;
47 03BA                 PRTHL:  ENT
48 03BA 7C                      LD      A,H
49 03BB CDC303                  CALL    PRTHX
50 03BE 7D                      LD      A,L
51 03BF 1802                    JR      PRTHX
52 03C1                 ;
53 03C1                         DEFS    +2
54 03C3                 ;ORG 03C3H;PRTHX
55 03C3                 ;
56 03C3                 ;  (ASCII PRINT) FOR ACC
57 03C3                 ;
58 03C3                 PRTHX:  ENT
59 03C3 F5                      PUSH    AF
60 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                    ;
```

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**  Z80 ASSEMBLER SP-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
```

```
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,D7H           ; 'W'
14 043C 1ECC                        LD      E,CCH           ; '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      CCH             ; '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
```

```
01 0477 C5                      PUSH    BC
02 0478 E5                      PUSH    HL
03 0479 16D7                    LD      D,D7H           ; 'W'
04 047B 1E53                    LD      E,53H           ; 'S'
05 047D ED4B0211                LD      BC,(SIZE)       ; WRITE DATA BYTE SIZE
06 0481 2A0411                  LD      HL,(DTADR)      ; WRITE DATA ADDRESS
07 0484 78                      LD      A,B
08 0485 B1                      OR      C
09 0486 284A                    JR      Z,RET1
10 0488 18BA                    JR      WRI1
11 048A                 ;
12 048A                 ;
13 048A                 ;   TAPE WRITE
14 048A                 ;
15 048A                 ;     BC=BYTE SIZE
16 048A                 ;     HL=DATA LOW ADR.
17 048A                 ;
18 048A                 ;    EXIT  CF=0 : OK
19 048A                 ;            =1 : BREAK
20 048A                 ;
21 048A D5              WTAPE:  PUSH    DE
22 048B C5                      PUSH    BC
23 048C E5                      PUSH    HL
24 048D 1602                    LD      D,2
25 048F 3EF8                    LD      A,F8H
26 0491 3200E0                  LD      (KEYPA),A       ; E000H
27 0494 7E              WTAP1:  LD      A,(HL)
28 0495 CD6707                  CALL    WBYTE           ; 1 BYTE WRITE
29 0498 3A01E0                  LD      A,(KEYPB)       ; E001H
30 049B E681                    AND     81H             ; SHIFT & BREAK
31 049D C2A504                  JP      NZ,WTAP2
32 04A0 3E02                    LD      A,02H           ; BREAK IN CODE
33 04A2 37                      SCF
34 04A3 182D                    JR      WTAP3
35 04A5 23              WTAP2:  INC     HL
36 04A6 0B                      DEC     BC
37 04A7 78                      LD      A,B
38 04A8 B1                      OR      C
39 04A9 C29404                  JP      NZ,WTAP1
40 04AC 2A9711                  LD      HL,(SUMDT)      ; SUM DATA SET
41 04AF 7C                      LD      A,H
42 04B0 CD6707                  CALL    WBYTE
43 04B3 7D                      LD      A,L
44 04B4 CD6707                  CALL    WBYTE
45 04B7 CD1A0A                  CALL    LONG
46 04BA 15                      DEC     D
47 04BB C2C204                  JP      NZ,+7
48 04BE B7                      OR      A
49 04BF C3D204                  JP      WTAP3
50 04C2 0600                    LD      B,0
51 04C4 CD010A                  CALL    SHORT
52 04C7 05                      DEC     B
53 04C8 C2C404                  JP      NZ,-4
54 04CB E1                      POP     HL
55 04CC C1                      POP     BC
56 04CD C5                      PUSH    BC
57 04CE E5                      PUSH    HL
58 04CF C39404                  JP      WTAP1
59 04D2                 WTAP3:
60 04D2 E1              RET1:   POP     HL
```

```
01 04D3 C1                      POP     BC
02 04D4 D1                      POP     DE
03 04D5 C9                      RET
04 04D6                 ;
05 04D6                 ;
06 04D6                 ;
07 04D6                 ;
08 04D6                 ;
09 04D8                         ORG     04D8H
10 04D8                 ;
11 04D8                 ;
12 04D8                 ;   READ INFORMATION (FROM $CMT)
13 04D8                 ;
14 04D8                 ;     EXIT ACC=0 : OK CF=0
15 04D8                 ;             =1 : ER CF=1
16 04D8                 ;             =2 : BREAK CF=1
17 04D8                 ;
18 04D8                 ?RDI:   ENT
19 04D8 F3                      DI
20 04D9 D5                      PUSH    DE
21 04DA C5                      PUSH    BC
22 04DB E5                      PUSH    HL
23 04DC 16D2                    LD      D,D2H           ; 'R'
24 04DE 1ECC                    LD      E,CCH           ; 'L'
25 04E0 018000                  LD      BC,80H
26 04E3 21F010                  LD      HL,IBUFE
27 04E6                 RD1:    ENT
28 04E6 CD9F06                  CALL    MOTOR
29 04E9 DA7205                  JP      C,RTP6
30 04EC CD5B06                  CALL    TMARK
31 04EF DA7205                  JP      C,RTP6
32 04F2 CD0E05                  CALL    RTAPE
33 04F5 C35405                  JP      RTP4
34 04F8                 ;
35 04F8                 ;
36 04F8                 ;
37 04F8                 ;ORG 04F8H
38 04F8                 ;
39 04F8                 ;
40 04F8                 ;   READ DATA (FROM $CMT)
41 04F8                 ;
42 04F8                 ;     EXIT SAME UP
43 04F8                 ;
44 04F8                 ?RDD:   ENT
45 04F8 F3                      DI
46 04F9 D5                      PUSH    DE
47 04FA C5                      PUSH    BC
48 04FB E5                      PUSH    HL
49 04FC 16D2                    LD      D,D2H           ; 'R'
50 04FE 1E53                    LD      E,53H           ; 'S'
51 0500 ED4B0211                LD      BC,(SIZE)
52 0504 2A0411                  LD      HL,(DTADR)
53 0507 78                      LD      A,B
54 0508 B1                      OR      C
55 0509 CA5405                  JP      Z,RTP4
56 050C 18D8                    JR      RD1
57 050E                 ;
58 050E                 ;
59 050E                 ;   READ TAPE
60 050E                 ;
```

```
**  Z8( 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
```

```
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 ED4B02:1                LD      BC,(SIZE)
```

```
01 0590 2A0411                  LD      HL,(DTADR)
02 0593 16D2                    LD      D,D2H           ; 'R'
03 0595 1E53                    LD      E,53H           ; 'S'
04 0597 78                      LD      A,B
05 0598 B1                      OR      C
06 0599 28B9                    JR      Z,RTP4
07 059B CD1A07                  CALL    CKSUM
08 059E CD9F06                  CALL    MOTOR
09 05A1 38CF                    JR      C,RTP6
10 05A3 CD5B06                  CALL    TMARK           ; TAPE MARK DETECT
11 05A6 38CA                    JR      C,RTP6
12 05A8 CDAD05                  CALL    TVRFY
13 05AB 18A7                    JR      RTP4
14 05AD                 ;
15 05AD                 ;
16 05AD                 ;   DATA VERIFY
17 05AD                 ;
18 05AD                 ;     BC=SIZE
19 05AD                 ;     HL=DATA LOW ADR
20 05AD                 ;     CSMDT=CHECK SUM
21 05AD                 ;    EXIT ACC=0 : OK CF=0
22 05AD                 ;           =1 : ER   =1
23 05AD                 ;           =2 : BREAK-1
24 05AD                 ;
25 05AD                 ;
26 05AD                 TVRFY:  ENT
27 05AD D5                      PUSH    DE
28 05AE C5                      PUSH    BC
29 05AF E5                      PUSH    HL
30 05B0 2602                    LD      H,2
31 05B2                 TVF1:   ENT
32 05B2 0101E0                  LD      BC,KEYPB
33 05B5 1102E0                  LD      DE,CSTR
34 05B8                 TVF2:   ENT
35 05B8 CD0106                  CALL    EDGE
36 05BB DA7205                  JP      C,RTP6
37 05BE CD4A0A                  CALL    DLY3            ; CALL DLY2*3
38 05C1 1A                      LD      A,(DE)
39 05C2 E620                    AND     20H
40 05C4 CAB805                  JP      Z,TVF2
41 05C7 54                      LD      D,H
42 05C8 E1                      POP     HL
43 05C9 C1                      POP     BC
44 05CA C5                      PUSH    BC
45 05CB E5                      PUSH    HL
46 05CC                 TVF3:   ENT
47 05CC CD2406                  CALL    RBYTE
48 05CF 38A1                    JR      C,RTP6
49 05D1 BE                      CP      (HL)
50 05D2 209A                    JR      NZ,RTP7
51 05D4 23                      INC     HL
52 05D5 0B                      DEC     BC
53 05D6 78                      LD      A,B
54 05D7 B1                      OR      C
55 05D8 20F2                    JR      NZ,TVF3
56 05DA 2A9911                  LD      HL,(CSMDT)
57 05DD CD2406                  CALL    RBYTE
58 05E0 BC                      CP      H
59 05E1 208B                    JR      NZ,RTP7
60 05E3 CD2406                  CALL    RBYTE
```

```
01 05E6 BD                      CP      L
02 05E7 2085                    JR      NZ,RTP7
03 05E9 15                      DEC     D
04 05EA CA5305                  JP      Z,RTP8
05 05ED 62                      LD      H,D
06 05EE 18C2                    JR      TVF1
07 05F0                 ;
08 05F0                 ;       FLASHING DATA LOAD
09 05F0                 ;
10 05F0                 ?LOAD:  ENT
11 05F0 F5                      PUSH    AF
12 05F1 3A8E11                  LD      A,(FLASH)
13 05F4 CDB10F                  CALL    ?PONT
14 05F7 77                      LD      (HL),A
15 05F8 F1                      POP     AF
16 05F9 C9                      RET
17 05FA                 ;
18 05FA                 ;
19 05FA                 ;       NEW LINE AND PRINT HL REG.(ASCII)
20 05FA                 ;
21 05FA                 NLPHL:  ENT
22 05FA CD0900                  CALL    NL
23 05FD CDBA03                  CALL    PRTHL
24 0600 C9                      RET
25 0601                 ;
26 0601                 ;
27 0601                 ;ORG 0601H;EDGE
28 0601                 ;
29 0601                 ;
30 0601                 ;       EDGE        (TAPE DATA EDGE DETECT)
31 0601                 ;
32 0601                 ;       BC=KEYPB ($E001)
33 0601                 ;       DE=CSTR  ($E002)
34 0601                 ;       EXIT CF=0 OK :      CF=1 BREAK
35 0601                 ;
36 0601                 EDGE:   ENT
37 0601 3EF8                    LD      A,F8H           ; BREAK KEY IN
38 0603 3200E0                  LD      (KEYPA),A
39 0606 00                      NOP
40 0607                 EDG1:   ENT
41 0607 0A                      LD      A,(BC)
42 0608 E681                    AND     81H             ; SHIFT & BREAK
43 060A 2002                    JR      NZ,+4
44 060C 37                      SCF
45 060D C9                      RET
46 060E 1A                      LD      A,(DE)
47 060F E620                    AND     20H
48 0611 20F4                    JR      NZ,EDG1         ; CSTR D5 = 0
49 0613                 EDG2:   ENT
50 0613 0A                      LD      A,(BC)          ; 8
51 0614 E681                    AND     81H             ; 9
52 0616 2002                    JR      NZ,+4           ; 10/14
53 0618 37                      SCF
54 0619 C9                      RET
55 061A 1A                      LD      A,(DE)          ; 8
56 061B E620                    AND     20H             ; 9
57 061D 28F4                    JR      Z,EDG2          ; CSTR D5 = 1  :10/14
58 061F C9                      RET                     ; 11
59 0620                 ;
60 0620                 ;
```

```
   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 23            04.07.83

01 0620                          DEFS    +4
02 0624                 ;ORG 0624H;RBYTE
03 0624                 ;
04 0624                 ;
05 0624                 ;    1 BYTE READ
06 0624                 ;
07 0624                 ;      EXIT  SUMDT=STORE
08 0624                 ;       CF=1 : BREAK
09 0624                 ;
10 0624                 ;       CF=0 : DATA=ACC
11 0624                 ;
12 0624                 RBYTE:   ENT
13 0624 C5                       PUSH    BC
14 0625 D5                       PUSH    DE
15 0626 E5                       PUSH    HL
16 0627 210008                   LD      HL,0800H
17 062A 0101E0                   LD      BC,KEYPB        ; KEY DATA $E001
18 062D 1102E0                   LD      DE,CSTR         ; $TAPE DATA $E002
19 0630                 RBY1:    ENT
20 0630 CD0106                   CALL    EDGE            ; 41 OR 101
21 0633 DA5406                   JP      C,RBY3          ; 13
22 0636 CD4A0A                   CALL    DLY3            ; 20+18*63+33
23 0639 1A                       LD      A,(DE)          ; DATA READ :8
24 063A E620                     AND     20H
25 063C CA4906                   JP      Z,RBY2
26 063F E5                       PUSH    HL
27 0640 2A9711                   LD      HL,(SUMDT)
28 0643 23                       INC     HL
29 0644 229711                   LD      (SUMDT),HL
30 0647 E1                       POP     HL
31 0648 37                       SCF
32 0649                 RBY2:    ENT
33 0649 7D                       LD      A,L
34 064A 17                       RLA
35 064B 6F                       LD      L,A
36 064C 25                       DEC     H
37 064D C23006                   JP      NZ,RBY1
38 0650 CD0106                   CALL    EDGE
39 0653 7D                       LD      A,L
40 0654                 RBY3:    ENT
41 0654 E1                       POP     HL
42 0655 D1                       POP     DE
43 0656 C1                       POP     BC
44 0657 C9                       RET
45 0658                 ;
46 0658                 ;
47 0658                 ;    TAPE MARK DETECT
48 0658                 ;
49 0658                 ;      E=@L@ :INFORMATION
50 0658                 ;        =@S@ :DATA
51 0658                 ;     EXIT CF=0 :OK
52 0658                 ;              =1 :BREAK
53 0658                 ;
54 0658                          DEFS    +3
55 065B                 ;
56 065B                 TMARK:   ENT
57 065B                 ;
58 065B                 ;ORG 065BH
59 065B                 ;
60 065B CDE20F                   CALL    GAPCK
```

```
**  ZEO ASSEMBLER SB-7201  <1Z-013A>  PAEE 24          04.07.83

01 065E C5                      PUSH    BC              ; ORG 065EH
02 065F D5                      PUSH    DE
03 0660 E5                      PUSH    HL
04 0661 212828                  LD      HL,2828H
05 0664 7B                      LD      A,E
06 0665 FECC                    CP      CCH             ;'L'
07 0667 2803                    JR      Z,+5
08 0669 211414                  LD      HL,1414H
09 066C 229511                  LD      (TMCNT),HL
10 066F 0101E0                  LD      BC,KEYPB
11 0672 1102E0                  LD      DE,CSTR
12 0675                 TM1:    ENT
13 0675 2A9511                  LD      HL,(TMCNT)
14 0678                 TM2:    ENT
15 0678 CD0106                  CALL    EDGE
16 067B 381E                    JR      C,TM4
17 067D CD4A0A                  CALL    DLY3            ; CALL DLY2*3
18 0680 1A                      LD      A,(DE)
19 0681 E620                    AND     20H
20 0683 28F0                    JR      Z,TM1
21 0685 25                      DEC     H
22 0686 20F0                    JR      NZ,TM2
23 0688                 TM3:    ENT
24 0688 CD0106                  CALL    EDGE
25 068B 380E                    JR      C,TM4
26 068D CD4A0A                  CALL    DLY3            ; CALL DLY2*3
27 0690 1A                      LD      A,(DE)
28 0691 E620                    AND     20H
29 0693 20E0                    JR      NZ,TM1
30 0695 2D                      DEC     L
31 0696 20F0                    JR      NZ,TM3
32 0698 CD0106                  CALL    EDGE
33 069B                 RET3:   ENT
34 069B                 TM4:    ENT
35 069B E1                      POP     HL
36 069C D1                      POP     DE
37 069D C1                      POP     BC
38 069E C9                      RET
39 069F                 ;
40 069F                 ;
41 069F                 ;   MOTOR ON
42 069F                 ;
43 069F                 ;     IN  D=@W@ :WRITE
44 069F                 ;         =@R@ :READ
45 069F                 ;     EXIT CF=0 :OK
46 069F                 ;          =1 :BREAK
47 069F                 MOTOR:  ENT
48 069F C5                      PUSH    BC
49 06A0 D5                      PUSH    DE
50 06A1 E5                      PUSH    HL
51 06A2 060A                    LD      B,10
52 06A4                 MOT1:   ENT
53 06A4 3A02E0                  LD      A,(CSTR)
54 06A7 E610                    AND     10H
55 06A9 280E                    JR      Z,MOT4
56 06AB                 MOT2:   ENT
57 06AB 06FF                    LD      B,FFH           ; 2 SEC DELAY
58 06AD CD9609                  CALL    DLY12           ; 7 MSEC DELAY
59 06B0 1802                    JR      +4              ;MOTOR ENTRY ADJUST
60 06B2 18EB                    JR      MOTOR           ; ORG 06B2H
```

```
01 06B4 10F7                    DJNZ    -7
02 06B6 AF                      XOR     A
03 06B7                 MOT7:   ENT
04 06B7 18E2                    JR      RET3
05 06B9                 MOT4:   ENT
06 06B9 3E06                    LD      A,06H
07 06BB 2103E0                  LD      HL,CSTPT
08 06BE 77                      LD      (HL),A
09 06BF 3C                      INC     A
10 06C0 77                      LD      (HL),A
11 06C1 10E1                    DJNZ    MOT1
12 06C3 CD0900                  CALL    NL
13 06C6 7A                      LD      A,D
14 06C7 FED7                    CP      D7H             ; 'W'
15 06C9 2805                    JR      Z,MOTS
16 06CB 11FB03                  LD      DE,MSG#1        ; PLAY MARK
17 06CE 1807                    JR      MOT9
18 06D0                 MOT8:   ENT
19 06D0 110204                  LD      DE,MSG#3        ; "RECORD."
20 06D3 DF                      RST     3               ; CALL MSGX
21 06D4 11FD03                  LD      DE,MSG#2        ; "PLAY"
22 06D7                 MOT9:   ENT
23 06D7 DF                      RST     3               ; CALL MSGX
24 06D8                 MOT5:   ENT
25 06D8 3A02E0                  LD      A,(CSTR)
26 06DB E610                    AND     10H
27 06DD 20CC                    JR      NZ,MOT2
28 06DF CD320A                  CALL    ?BRK
29 06E2 20F4                    JR      NZ,MOT5
30 06E4 37                      SCF
31 06E5 18D0                    JR      MOT7
32 06E7                 ;
33 06E7                 ;       INITIAL MESSAGE
34 06E7                 ;
35 06E7                 MSG?3:  ENT
36 06E7 2A2A2020                DEFM    '**  MONITOR 1Z-013A  **'
37 06EB 4D4F4E49
38 06EF 544F5220
39 06F3 315A2D30
40 06F7 31334120
41 06FB 202A2A
42 06FE 0D                      DEFB    0DH
43 06FF                 ;
44 06FF                 ;
45 06FF                         DEFS    +1
46 0700                 ;
47 0700                 ;
48 0700                 ;ORG 0700H;MSTOP
49 0700                 ;
50 0700                 ;
51 0700                 ;  MOTOR STOP
52 0700                 ;
53 0700                 MSTOP:  ENT
54 0700 F5                      PUSH    AF
55 0701 C5                      PUSH    BC
56 0702 D5                      PUSH    DE
57 0703 060A                    LD      B,10
58 0705                 MST1:   ENT
59 0705 3A02E0                  LD      A,(CSTR)
60 0708 E610                    AND     10H
```

```
070A 280B                MST2:  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                     ;
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
```

```
**  Z8( ASSEMBLER SB-7201  <1Z-013A>  PA3E 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
```

```
0792 78                 LD      A,B
0793 B1                 OR      C
0794 20F8               JR      NZ,-6
0796                GAP2:   ENT
0796 CD1A0A             CALL    LONG
0799 15                 DEC     D
079A 20FA               JR      NZ,-4
079C                GAP3:   ENT
079C CD010A             CALL    SHORT
079F 1D                 DEC     E
07A0 20FA               JR      NZ,-4
07A2 CD1A0A             CALL    LONG
07A5 D1                 POP     DE
07A6 C1                 POP     BC
07A7 C9                 RET
07A8                ;
07A8                ;     MEMORY CORRECTION
07A8                ;        COMMAND 'M'
07A8                ;
07A8                MCOR.   ENT
07A8 CD3D01             CALL    HEXIY           ; CRRECTION ADR.
07AB                MCR1:   ENT
07AB CDFA05             CALL    NLPHL           ; COR. ADR. PRINT
07AE CDB103             CALL    SPHEX           ; ACC ⇨ ASCII DISP.
07B1 CD2009             CALL    ?PRTS           ; SPACE PRINT
07B4 CD2F01             CALL    BGETL           ; GET DATA & CHECK DATA
07B7 CD1004             CALL    HLHEX           ; HL←ASCII(DE)
07BA 381B               JR      C,MCR3
07BC CDA602             CALL    .4DE            ; (INC DE)*4
07BF 13                 INC     DE
07C0 CD1F04             CALL    2HEX            ; DATA CHECK
07C3 38E6               JR      C,MCR1
07C5 BE                 CP      (HL)
07C6 20E3               JR      NZ,MCR1
07C8 13                 INC     DE
07C9 1A                 LD      A,(DE)
07CA FE0D               CP      0DH             ; NOT CORRECTION ?
07CC 2806               JR      Z,MCR2
07CE CD1F04             CALL    2HEX            ; ACC←HL(ASCII)
07D1 38DB               JR      C,MCR1
07D3 77                 LD      (HL),A          ; DATA CORRECT
07D4                MCR2:   ENT
07D4 23                 INC     HL
07D5 18D4               JR      MCR1
07D7                ;
07D7 60             MCR3:   LD      H,B             ; MEMORY ADR.
07D8 69                 LD      L,C
07D9 18D0               JR      MCR1
07DB                ;
07DB                ;
07DB                ;
07DB                ;
07DB                ;
07E6                    ORG     07E6H
07E6                ;
07E6                ;
07E6                ;
07E6                ;    GET 1 LINE STATEMENT  *
07E6                ;
07E6                ;       DE = DATA STORE LOW ADR.
```

```
01 07E6                 ;           (END =CR )
02 07E6                 ;
03 07E6                 ;
04 07E6                 ?SETL:  ENT
05 07E6 F5                      PUSH    AF
06 07E7 C5                      PUSH    BC
07 07E8 E5                      PUSH    HL
08 07E9 D5                      PUSH    DE
09 07EA                 GETL1:  ENT
10 07EA CDB309                  CALL    ??KEY           ; ENTRY KEY
11 07ED                 AUTO3:  ENT
12 07ED F5                      PUSH    AF              ; IN KEY DATA SAVE
13 07EE 47                      LD      B,A
14 07EF 3A9D11                  LD      A,(SWRK)        ; BELL WORK
15 07F2 0F                      RRCA
16 07F3 D47705                  CALL    NC,?BEL         ; ENTRY BELL
17 07F6 78                      LD      A,B
18 07F7 217011                  LD      HL,KANAF        ; KANA & GRAPH FLAG
19 07FA E6F0                    AND     F0H
20 07FC FEC0                    CP      C0H
21 07FE D1                      POP     DE              ; Ereg=FLAGreg
22 07FF 78                      LD      A,B
23 0800 2016                    JR      NZ,GETL2
24 0802 FECD                    CP      CDH             ; CR
25 0804 2855                    JR      Z,GETL3
26 0806 FECB                    CP      CBH             ; BREAK
27 0808 CA2208                  JP      Z,BETLC
28 080B FECF                    CP      CFH             ; NIKO MARK WH.
29 080D 2809                    JR      Z,GETL2
30 080F FEC7                    CP      C7H             ; CRT EDITION
31 0811 300A                    JR      NC,GETL5
32 0813 CB1B                    RR      E               ; CY ?
33 0815 78                      LD      A,B
34 0816 3005                    JR      NC,GETL5
35 0818                 GETL2:  ENT
36 0818 CDB50D                  CALL    ?DSP
37 081B 18CD                    JR      GETL1
38 081D                 GETL5:  ENT
39 081D CDDC0D                  CALL    ?DPCT           ; CRT CONTROL
40 0820 18C8                    JR      GETL1
41 0822                 ;
42 0822                 ;     BREAK IN
43 0822                 ;
44 0822 E1              GETLC:  POP     HL
45 0823 E5                      PUSH    HL
46 0824 361B                    LD      (HL),1BH        ; BREAK CODE
47 0826 23                      INC     HL
48 0827 360D                    LD      (HL),0DH
49 0829 1853                    JR      GETLR
50 082B                 ;  GETLA
51 082B                 ;
52 082B 0F              GETLA:  RRCA                    ; CY←D7
53 082C 3037                    JR      NC,GETL6
54 082E 1833                    JR      GETLB
55 0830                 ;
56 0830                 ;
57 0830                 ;
58 0830                 ;    DELAY 7M SEC AND SWEP
59 0830                 ;
60 0830 CD9609          DSWEP:  CALL    DLY12
```

```
0833 CD500A                     CALL    ?SWEP
0836 C9                         RET
0837                    ;
0837                    ;
0837                            DEFS    36
085B                    ;
085B                    ;
085B                    ;
085B                    ; ORG 085BH;GETL3
085B                    ;
085B CDF302             GETL3:  CALL    .MANS           ; CR
085E 0628                       LD      B,40            ; 1LINE
0860 30C9                       JR      NC,GETLA
0862 25                         DEC     H               ; BEFORE LINE
0863 0650               GETLB:  LD      B,80            ; 2 LINE
0865 2E00               GETL6:  LD      L,0
0867 CDB40F                     CALL    ?PNT1
086A D1                         POP     DE              ; STORE TOP ADR.
086B D5                         PUSH    DE
086C 7E                 GETLZ:  LD      A,(HL)
086D CDCE0B                     CALL    ?DACN
0870 12                         LD      (DE),A
0871 23                         INC     HL
0872 13                         INC     DE
0873 10F7                       DJNZ    GETLZ
0875 EB                         EX      DE,HL
0876 360D               GETLU:  LD      (HL),0DH
0878 2B                         DEC     HL
0879 7E                         LD      A,(HL)
087A FE20                       CP      20H             ; SPACE THEN CR
087C                    ;
087C                    ;
087C                    ;   CR AND NEW LINE
087C                    ;
087C 28F8                       JR      Z,GETLU
087E                    ;
087E                    ;   NEW LINE RETURN
087E                    ;
087E CD0E09             GETLR:  CALL    ?LTNL
0881 D1                         POP     DE
0882 E1                         POP     HL
0883 C1                         POP     BC
0884 F1                         POP     AF
0885 C9                         RET
0886                    ;
0886                    ;
0886                    ;
0886                            DEFS    +13
0893                    ;ORG 0893H
0893                    ;
0893                    ;   MESSAGE PRINT
0893                    ;
0893                    ;    DE PRINT DATA LOW ADR.
0893                    ;       END=CR
0893                    ;
0893                    ?MSG:   ENT
0893 F5                         PUSH    AF
0894 C5                         PUSH    BC
0895 D5                         PUSH    DE
0896 1A                 MSG1:   LD      A,(DE)
```

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 31            04.07.83

0897 FE0D                       CP      0DH             ; CR
0899 280C                       JR      Z,MSGX2
089B CD3509                     CALL    ?PRNT
089E 13                         INC     DE
089F 18F5                       JR      MSG1
08A1                    ;
08A1                    ;
08A1                    ;ORS 08A1H
08A1                    ;
08A1                    ;  ALL PRINT MESSABE
08A1                    ;
08A1                    ?MSGX:  ENT
08A1 F5                         PUSH    AF
08A2 C5                         PUSH    BC
08A3 D5                         PUSH    DE
08A4 1A                 MSGX1:  LD      A,(DE)
08A5 FE0D                       CP      0DH
08A7 CAE60E             MSGX2:  JP      Z,?RSTR1
08AA CDB90B                     CALL    ?ADCN
08AD CD6C09                     CALL    PRNT3
08B0 13                         INC     DE
08B1 18F1                       JR      MSGX1
08B3                    ;
08B3                    ;    TOP OF KEYTBLS
08B3                    ;
08B3 112A0C             ?KYSM:  LD      DE,KTBLS
08B6 1842                       JR      ?KY5
08B8                    ;
08B8                    ;   BREAK CODE IN
08B8                    ;
08B8 3ECB               #BRK:   LD      A,CBH           ; BREAK CODE
08BA B7                         OR      A
08BB 1819                       JR      ?KY1
08BD                    ;
08BD                    ;
08BD                    ;ORG 08BDH
08BD                    ;
08BD                    ;   GETKEY
08BD                    ;
08BD                    ;       NOT ECHO BACK
08BD                    ;
08BD                    ;     EXIT:ACC=ASCII CODE
08BD                    ;
08BD                    ?GET:   ENT
08BD CDCA08                     CALL    ?KEY            ; KEY IN (DISPLAY CODE)
08C0 D6F0                       SUB     F0H             ; NOT KEYIN CODE
08C2 C8                         RET     Z
08C3 C6F0                       ADD     A,F0H
08C5 C3CE0B                     JP      ?DACN           ; DIAPLAY TO ASCII CODE
08C8                    ;
08C8                    ;
08C8                            DEFS    +2
08CA                    ;
08CA                    ;
08CA                    ;
08CA                    ;
08CA                    ;ORG 08CAH;?KEY
08CA                    ;
08CA                    ;   1KEY INPUT
08CA                    ;  IN       B = KEY MODE(SHIFT,CTRL,BREAK)
```

```
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,?KY8M
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,?KYGR8
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
```

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 33          04.07.83

0090E                   ;
0090E                   ;   NEWLINE
0090E                   ;
0090E                   ?LTNL:  ENT
0090E AF                        XOR     A
0090F 329411                    LD      (DPRNT),A       ; ROW POINTER
0912 3ECD                       LD      A,CDH           ; CR
0914 1843                       JR      PRNT5
0916                            DEFS    +2
0918                    ;ORG 0918H
0918                    ;
091S                    ?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
```

```
01 0946                 ;          1 CHA.
02 0946                 ;     INPUT:C=ASCII DATA (?DSP+?DPCT)
03 0946                 ;
04 0946                 ?PRT:    ENT
05 0946 79                       LD      A,C
06 0947 CDB90B                   CALL    ?ADCN           ; ASCII TO DSPLAY
07 094A 4F                       LD      C,A
08 094B FEF0                     CP      F0H
09 094D C8                       RET     Z               ; ZERO=ILLEGAL DATA
10 094E E6F0                     AND     F0H             ; MSD CHECK
11 0950 FEC0                     CP      C0H
12 0952 79                       LD      A,C
13 0953 2017                     JR      NZ,PRNT3
14 0955 FEC7                     CP      C7H
15 0957 3013                     JR      NC,PRNT3        ; CRT EDITOR
16 0959                 PRNT5:   ENT
17 0959 CDDC0D                   CALL    ?DPCT
18 095C FEC3                     CP      C3H
19 095E 280F                     JR      Z,PRNT4
20 0960 FEC5                     CP      C5H             ; HOME
21 0962 2803                     JR      Z,PRNT2
22 0964 FEC6                     CP      C6H             ; CLR
23 0966 C0                       RET     NZ
24 0967 AF              PRNT2:   XOR     A
25 0968 329411                   LD      (DPRNT),A
26 096B C9                       RET
27 096C                 PRNT3:   ENT
28 096C CDB50D                   CALL    ?DSP
29 096F 3A9411          PRNT4:   LD      A,(DPRNT)       ; TAB POINT+1
30 0972 3C                       INC     A
31 0973 FE50                     CP      +80
32 0975 38F1                     JR      C,PRNT2+1
33 0977 D650                     SUB     +80
34 0979 18ED                     JR      PRNT2+1
35 097B                 ;
36 097B                 ;
37 097B                 ;
38 097B                 ;
39 097B                 ;
40 097B                 ;    FLASSING BYPASS 1
41 097B                 ;
42 097B                 FLAS1:   ENT
43 097B 3A8E11                   LD      A,(FLASH)
44 097E 186F                     JR      FLAS2
45 0980                 ;
46 0980                 ;    BREAK SUBROUTINE BYPASS 1
47 0980                 ;
48 0980                 ;        CTRL OR NOT KEY
49 0980                 ;
50 0980                 ?BRK2:   ENT
51 0980 CB6F                     BIT     5,A             ; NOT OR CTRL
52 0982 2802                     JR      Z,?BRK3         ; CTRL
53 0984 B7                       OR      A               ; NOTKEY A=7FH
54 0985 C9                       RET
55 0986                 ;
56 0986 3E20            ?BRK3:   LD      A,20H           ; CTRL D5=1
57 0988 B7                       OR      A               ; ZERO FLS. CLR
58 0989 37                       SCF
59 098A C9                       RET
60 098B                 ;
```

```
*I  Z8C 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 CDCA08                  CALL    ?KEY
```

```
09C8 F5                         PUSH    AF
09C9 BC                         CP      H               ; CHATER CHECK
09CA E1                         POP     HL
09CB 20EF                       JR      NZ,KSL2
09CD E5                         PUSH    HL
09CE F1                         POP     AF              ; IN KEY DATA
09CF CDF005                     CALL    ?LOAD           ; FLSHING DATA LOAD
09D2 E1                         POP     HL
09D3 C9                         RET
09D4                    ;
09D4                    ;
09D4                    ;   CLEAR 2
09D4                    ;
09D4                    #CLR08: ENT                     ; CY FLG.
09D4 AF                         XOR     A
09D5                    #CLR8:  ENT
09D5 010008                     LD      BC,0800H
09D8                    CLEAR:  ENT                     ; BC = CLR BYTE SIZE
09D8 D5                         PUSH    DE              ; A = CLR DATA
09D9 57                         LD      D,A
09DA                    CLEAR1: ENT
09DA 72                         LD      (HL),D
09DB 23                         INC     HL
09DC 0B                         DEC     BC
09DD 78                         LD      A,B
09DE B1                         OR      C
09DF 20F9                       JR      NZ,CLEAR1
09E1 D1                         POP     DE
09E2 C9                         RET
09E3                    ;
09E3                    ;
09E3                    ;
09E3                    ;   FLASHING 2
09E3                    ;
09E3                    ?FLS:   ENT
09E3 F5                         PUSH    AF
09E4 E5                         PUSH    HL
09E5 3A02E0                     LD      A,(KEYPC)
09E8 07                         RLCA
09E9 07                         RLCA
09EA 388F                       JR      C,FLAS1
09EC 3A9211                     LD      A,(FLSDT)
09EF                    FLAS2:  ENT
09EF CDB10F                     CALL    ?PONT           ; DISPLAY POSITION
09F2 77                         LD      (HL),A
09F3                    FLAS3:  ENT
09F3 E1                         POP     HL
09F4 F1                         POP     AF
09F5 C9                         RET
09F6                    ;
09F6                    ;
09F6                    ;
09F6                            DEFS    +9
09FF                    ;
09FF                    ;
09FF                    ;ORG 09FF ; ?FLAS
09FF                    ;
09FF                    ?FLAS:  ENT
09FF 18E2                       JR      ?FLS
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 37          04.07.83

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
```

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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 38          04.07.83

01 0A42 3004                    JR      NC,?BRK1        ; BREAK ?
02 0A44 3E40                    LD      A,40H           ; SHIFT D6=1
03 0A46 37                      SCF
04 0A47 C9                      RET
05 0A48                 ;
06 0A48                 ;
07 0A48 AF              ?BRK1:  XOR     A               ; SHIFT ?
08 0A49 C9                      RET
09 0A4A                 ;
10 0A4A                 ;
11 0A4A                 ;   320 U SEC DELAY
12 0A4A                 ;
13 0A4A                 DLY3:   ENT
14 0A4A 3E3F                    LD      A,3FH           ; 18*63+33
15 0A4C C36207                  JP      0762H           ; JP DLY2+2
16 0A4F                 ;
17 0A4F                 ;
18 0A4F                         DEFS    +1
19 0A50                 ;
20 0A50                 ;
21 0A50                 ;
22 0A50                 ;ORG 0A50H ; ?SWEP
23 0A50                 ;
24 0A50                 ;
25 0A50                 ;   KEY BOAD SWEEP
26 0A50                 ;
27 0A50                 ;   EXIT B,D7=0  NO DATA
28 0A50                 ;            =1   DATA
29 0A50                 ;          D6=0   SHIFT OFF
30 0A50                 ;            =1   SHIFT ON
31 0A50                 ;          D5=0   CTRL OFF
32 0A50                 ;            =1   CTRL ON
33 0A50                 ;          D4-0   SHIFT+CTRL OFF
34 0A50                 ;            =1   SHIFT+CTRL ON
35 0A50                 ;           C     = ROW & COLOUMN
36 0A50                 ;                 7 6 5 4 3 2 1 0
37 0A50                 ;                 * * ↑ ↑ ↑ ← ← ←
38 0A50                 ;
39 0A50                 ?SWEP:  ENT
40 0A50 D5                      PUSH    DE
41 0A51 E5                      PUSH    HL
42 0A52 AF                      XOR     A
43 0A53 06F8                    LD      B,F8H
44 0A55 57                      LD      D,A
45 0A56 CD320A                  CALL    ?BRK
46 0A59 2004                    JR      NZ,SWEP6
47 0A5B 1688                    LD      D,88H           ; BREAK ON
48 0A5D 1814                    JR      SWEP9
49 0A5F                 SWEP6:  ENT
50 0A5F 3005                    JR      NC,SWEP0
51 0A61 57                      LD      D,A
52 0A62 1802                    JR      SWEP0
53 0A64                 SWEP01: ENT
54 0A64 CBFA                    SET     7,D
55 0A66                 SWEP0:  ENT
56 0A66 05                      DEC     B
57 0A67 78                      LD      A,B
58 0A68 3200E0                  LD      (KEYPA),A
59 0A6B FEEF                    CP      EFH             ; MAP SWEEP END ?
60 0A6D 2008                    JR      NZ,SWEP3
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 39          04.07.83

01 0A6F FEF8                    CP      F8H             ; BREAK KEY ROW
02 0A71 28F3                    JR      Z,SWEP0
03 0A73                 SWEP9:  ENT
04 0A73 42                      LD      B,D
05 0A74 E1                      POP     HL
06 0A75 D1                      POP     DE
07 0A76 C9                      RET
08 0A77                 ;
09 0A77                 SWEP3:  ENT
10 0A77 3A01E0                  LD      A,(KEYPB)
11 0A7A 2F                      CPL
12 0A7B B7                      OR      A
13 0A7C 28E8                    JR      Z,SWEP0
14 0A7E 5F                      LD      E,A
15 0A7F                 SWEP2:  ENT
16 0A7F 2608                    LD      H,8
17 0A81 78                      LD      A,B
18 0A82 E60F                    AND     0FH
19 0A84 07                      RLCA
20 0A85 07                      RLCA
21 0A86 07                      RLCA
22 0A87 4F                      LD      C,A
23 0A88 7B                      LD      A,E
24 0A89 25                      DEC     H
25 0A8A 0F                      RRCA
26 0A8B 30FC                    JR      NC,-2
27 0A8D 7C                      LD      A,H
28 0A8E 81                      ADD     A,C
29 0A8F 4F                      LD      C,A
30 0A90 18D2                    JR      SWEP01
31 0A92                 ;
32 0A92                 ;
33 0A92                 ;   ASCII TO DISPLAY CODE TABL  ;
34 0A92                 ;
35 0A92                 ATBL:
36 0A92                 ;  00 - 0F  ;
37 0A92 F0                      DEFB    F0H             ; ↑@
38 0A93 F0                      DEFB    F0H             ; ↑A
39 0A94 F0                      DEFB    F0H             ; ↑B
40 0A95 F3                      DEFB    F3H             ; ↑C
41 0A96 F0                      DEFB    F0H             ; ↑D
42 0A97 F5                      DEFB    F5H             ; ↑E
43 0A98 F0                      DEFB    F0H             ; ↑F
44 0A99 F0                      DEFB    F0H             ; ↑G
45 0A9A F0                      DEFB    F0H             ; ↑H
46 0A9B F0                      DEFB    F0H             ; ↑I
47 0A9C F0                      DEFB    F0H             ; ↑J
48 0A9D F0                      DEFB    F0H             ; ↑K
49 0A9E F0                      DEFB    F0H             ; ↑L
50 0A9F F0                      DEFB    F0H             ; ↑M
51 0AA0 F0                      DEFB    F0H             ; ↑N
52 0AA1 F0                      DEFB    F0H             ; ↑O
53 0AA2                 ;  10 - 1F
54 0AA2 F0                      DEFB    F0H             ; ↑P
55 0AA3 C1                      DEFB    C1H             ; ↑Q CUR. DOWN
56 0AA4 C2                      DEFB    C2H             ; ↑R CUR. UP
57 0AA5 C3                      DEFB    C3H             ; ↑S CUR. RIGHT
58 0AA6 C4                      DEFB    C4H             ; ↑T CUR. LEFT
59 0AA7 C5                      DEFB    C5H             ; ↑U HOME
60 0AA8 C6                      DEFB    C6H             ; ↑V CLEAR
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 40          04.07.83

01 0AA9 F0                      DEFB    F0H             ; ↑W
02 0AAA F0                      DEFB    F0H             ; ↑X
03 0AAB F0                      DEFB    F0H             ; ↑Y
04 0AAC F0                      DEFB    F0H             ; ↑Z SEP.
05 0AAD F0                      DEFB    F0H             ; ↑[
06 0AAE F0                      DEFB    F0H             ; ↑\
07 0AAF F0                      DEFB    F0H             ; ↑]
08 0AB0 F0                      DEFB    F0H             ; ↑^
09 0AB1 F0                      DEFB    F0H             ; ↑-
10 0AB2                 ;  20 - 2F  ;
11 0AB2 00                      DEFB    00H             ; SPACE
12 0AB3 61                      DEFB    61H             ; !
13 0AB4 62                      DEFB    62H             ; "
14 0AB5 63                      DEFB    63H             ; #
15 0AB6 64                      DEFB    64H             ; $
16 0AB7 65                      DEFB    65H             ; %
17 0AB8 66                      DEFB    66H             ; &
18 0AB9 67                      DEFB    67H             ; '
19 0ABA 68                      DEFB    68H             ; (
20 0ABB 69                      DEFB    69H             ; )
21 0ABC 6B                      DEFB    6BH             ; *
22 0ABD 6A                      DEFB    6AH             ; +
23 0ABE 2F                      DEFB    2FH             ; ,
24 0ABF 2A                      DEFB    2AH             ; -
25 0AC0 2E                      DEFB    2EH             ; .
26 0AC1 2D                      DEFB    2DH
27 0AC2                 ;  30 -3F  ;
28 0AC2 20                      DEFB    20H             ; 0
29 0AC3 21                      DEFB    21H             ; 1
30 0AC4 22                      DEFB    22H             ; 2
31 0AC5 23                      DEFB    23H             ; 3
32 0AC6 24                      DEFB    24H             ; 4
33 0AC7 25                      DEFB    25H             ; 5
34 0AC8 26                      DEFB    26H             ; 6
35 0AC9 27                      DEFB    27H             ; 7
36 0ACA 28                      DEFB    28H             ; 8
37 0ACB 29                      DEFB    29H             ; 9
38 0ACC 4F                      DEFB    4FH             ; :
39 0ACD 2C                      DEFB    2CH             ; ;
40 0ACE 51                      DEFB    51H             ; <
41 0ACF 2B                      DEFB    2BH             ; =
42 0AD0 57                      DEFB    57H             ; >
43 0AD1 49                      DEFB    49H             ; ?
44 0AD2                 ;  40 - 4F  ;
45 0AD2 55                      DEFB    55H             ; @
46 0AD3 01                      DEFB    01H             ; A
47 0AD4 02                      DEFB    02H             ; B
48 0AD5 03                      DEFB    03H             ; C
49 0AD6 04                      DEFB    04H             ; D
50 0AD7 05                      DEFB    05H             ; E
51 0AD8 06                      DEFB    06H             ; F
52 0AD9 07                      DEFB    07H             ; G
53 0ADA 08                      DEFB    08H             ; H
54 0ADB 09                      DEFB    09H             ; I
55 0ADC 0A                      DEFB    0AH             ; J
56 0ADD 0B                      DEFB    0BH             ; K
57 0ADE 0C                      DEFB    0CH             ; L
58 0ADF 0D                      DEFB    0DH             ; M
59 0AE0 0E                      DEFB    0EH             ; U
60 0AE1 0F                      DEFB    0FH             ; O
```

```
01 0AE2                 ;  50 - 5F ;
02 0AE2 10                      DEFB    10H             ; P
03 0AE3 11                      DEFB    11H             ; Q
04 0AE4 12                      DEFB    12H             ; R
05 0AE5 13                      DEFB    13H             ; S
06 0AE6 14                      DEFB    14H             ; T
07 0AE7 15                      DEFB    15H             ; U
08 0AE8 16                      DEFB    16H             ; V
09 0AE9 17                      DEFB    17H             ; W
10 0AEA 18                      DEFB    18H             ; X
11 0AEB 19                      DEFB    19H             ; Y
12 0AEC 1A                      DEFB    1AH             ; Z
13 0AED 52                      DEFB    52H             ; [
14 0AEE 59                      DEFB    59H             ; \
15 0AEF 54                      DEFB    54H             ; ]
16 0AF0 50                      DEFB    50H             ; ^
17 0AF1 45                      DEFB    45H             ; _
18 0AF2                 ;  60 - 6F ;
19 0AF2 C7                      DEFB    C7H             ; UFO
20 0AF3 C8                      DEFB    C8H
21 0AF4 C9                      DEFB    C9H
22 0AF5 CA                      DEFB    CAH
23 0AF6 CB                      DEFB    CBH
24 0AF7 CC                      DEFB    CCH
25 0AF8 CD                      DEFB    CDH
26 0AF9 CE                      DEFB    CEH
27 0AFA CF                      DEFB    CFH
28 0AFB DF                      DEFB    DFH
29 0AFC E7                      DEFB    E7H
30 0AFD E8                      DEFB    E8H
31 0AFE E5                      DEFB    E5H
32 0AFF E9                      DEFB    E9H
33 0B00 EC                      DEFB    ECH
34 0B01 ED                      DEFB    EDH
35 0B02                 ;  70 - 7F ;
36 0B02 D0                      DEFB    D0H
37 0B03 D1                      DEFB    D1H
38 0B04 D2                      DEFB    D2H
39 0B05 D3                      DEFB    D3H
40 0B06 D4                      DEFB    D4H
41 0B07 D5                      DEFB    D5H
42 0B08 D6                      DEFB    D6H
43 0B09 D7                      DEFB    D7H
44 0B0A D8                      DEFB    D8H
45 0B0B D9                      DEFB    D9H
46 0B0C DA                      DEFB    DAH
47 0B0D DB                      DEFB    DBH
48 0B0E DC                      DEFB    DCH
49 0B0F DD                      DEFB    DDH
50 0B10 DE                      DEFB    DEH
51 0B11 C0                      DEFB    C0H
52 0B12                 ;  80 - 8F ;
53 0B12 80                      DEFB    80H             ; }
54 0B13 BD                      DEFB    BDH             ;
55 0B14 9D                      DEFB    9DH
56 0B15 B1                      DEFB    B1H
57 0B16 B5                      DEFB    B5H
58 0B17 B9                      DEFB    B9H
59 0B18 B4                      DEFB    B4H             ;
60 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  ;
```

```
**  Z8C 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
```

```
**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 44          04.07.83

0B8B 7D                         DEFB    7DH
0B8C 44                         DEFB    44H
0B8D 1B                         DEFB    1BH
0B8E 58                         DEFB    58H
0B8F 79                         DEFB    79H
0B90 42                         DEFB    42H
0B91 60                         DEFB    60H
0B92                    ;
0B92                    ;
0B92                    ;   FLASHING DATA SAVE
0B92                    ;
0B92                    ?SAVE:  ENT
0B92 219211                     LD      HL,FLSDT
0B95 36EF                       LD      (HL),EFH        ; NOMAL CURSOR
0B97 3A7011                     LD      A,(KANAF)
0B9A 0F                         RRCA
0B9B 3803                       JR      C,SV0-2         ; GRAPH MODE
0B9D 0F                         RRCA
0B9E 3002                       JR      NC,SV0          ; NORMAL MODE
0BA0 36FF                       LD      (HL),FFH        ; GRAPH CURSOR
0BA2                    SV0:    ENT
0BA2 7E                         LD      A,(HL)
0BA3 F5                         PUSH    AF
0BA4 CDB10F                     CALL    ?PONT           ; FLASING POSITION
0BA7 7E                         LD      A,(HL)
0BA8 328E11                     LD      (FLASH),A
0BAB F1                         POP     AF
0BAC 77                         LD      (HL),A
0BAD AF                         XOR     A
0BAE 2100E0                     LD      HL,KEYPA
0BB1 77                         LD      (HL),A
0BB2 2F                         CPL
0BB3 77                         LD      (HL),A
0BB4 C9                         RET
0BB5                    SV1:    ENT
0BB5 3643                       LD      (HL),43H        ; KANA CURSOR
0BB7 18E9                       JR      SV0
0BB9                    ;
0BB9                    ;ORG 0BB9H;?ADCN
0BB9                    ;
0BB9                    ;
0BB9                    ;   ASCII TO DISPLAY CODE CONVERTE
0BB9                    ;
0BB9                    ;       IN    ACC:ASCII
0BB9                    ;       EXIT  ACC:DISPLAY CODE
0BB9                    ;
0BB9                    ?ADCN:  ENT
0BB9 C5                         PUSH    BC
0BBA E5                         PUSH    HL
0BBB 21920A                     LD      HL,ATBL
0BBE 4F                         LD      C,A
0BBF 0600                       LD      B,0
0BC1 09                         ADD     HL,BC
0BC2 7E                         LD      A,(HL)
0BC3 181B                       JR      DACN3
0BC5                    ;
0BC5 56312E30           VRNS:   DEFM    "V1.0A"         ; VERSION MANAGEMENT
0BC9 41
0BCA 0D                         DEFB    0DH
0BCB                            DEFS    +3
```

```
01 0BCE                 ;
02 0BCE                 ;
03 0BCE                 ;ORG 0BCEH;?DACN
04 0BCE                 ;
05 0BCE                 ;   DISPLAY CODE TO ASCII CONV.  ;
06 0BCE                 ;
07 0BCE                 ;      IN    ACC = DISPLAY CODE
08 0BCE                 ;      EXIT ACC = ASCII
09 0BCE                 ;
10 0BCE                 ?DACN:  ENT
11 0BCE C5                      PUSH   BC
12 0BCF E5                      PUSH   HL
13 0BD0 D5                      PUSH   DE
14 0BD1 21920A                  LD     HL,ATBL
15 0BD4 54                      LD     D,H
16 0BD5 5D                      LD     E,L
17 0BD6 010001                  LD     BC,0100H
18 0BD9 EDB1                    CPIR
19 0BDB 2806                    JR     Z,DACN1
20 0BDD 3EF0                    LD     A,F0H
21 0BDF                 DACN2:  ENT
22 0BDF D1                      POP    DE
23 0BE0                 DACN3:  ENT
24 0BE0 E1                      POP    HL
25 0BE1 C1                      POP    BC
26 0BE2 C9                      RET
27 0BE3                 ;
28 0BE3                 DACN1:  ENT
29 0BE3 B7                      OR     A
30 0BE4 2B                      DEC    HL
31 0BE5 ED52                    SBC    HL,DE
32 0BE7 7D                      LD     A,L
33 0BE8 18F5                    JR     DACN2
34 0BEA                 ;
35 0BEA                 ;
36 0BEA                 ;
37 0BEA                 ;   KEY MATRIX TO DISPLAY CODE TABL
38 0BEA                 ;
39 0BEA                 KTBL:   ENT
40 0BEA                 ;S0   00 - 07  ;
41 0BEA BF                      DEFB   BFH             ; SPARE
42 0BEB CA                      DEFB   CAH             ; GRAPH
43 0BEC 58                      DEFB   58H             ; ↓
44 0BED C9                      DEFB   C9H             ; ALPHA
45 0BEE F0                      DEFB   F0H             ; NO
46 0BEF 2C                      DEFB   2CH             ; ;
47 0BF0 4F                      DEFB   4FH             ; :
48 0BF1 CD                      DEFB   CDH             ; CR
49 0BF2                 ;S1   08 - 0F  ;
50 0BF2 19                      DEFB   19H             ; Y
51 0BF3 1A                      DEFB   1AH             ; Z
52 0BF4 55                      DEFB   55H             ; @
53 0BF5 52                      DEFB   52H             ; [
54 0BF6 54                      DEFB   54H             ; ]
55 0BF7 F0                      DEFB   F0H             ; NULL
56 0BF8 F0                      DEFB   F0H             ; NULL
57 0BF9 F0                      DEFB   F0H             ; NULL
58 0BFA                 ;S2   0 - 17  ;
59 0BFA 11                      DEFB   11H             ; Q
60 0BFB 12                      DEFB   12H             ; R
```

```
01 0BFC 13                      DEFB    13H             ; S
02 0BFD 14                      DEFB    14H             ; T
03 0BFE 15                      DEFB    15H             ; U
04 0BFF 16                      DEFB    16H             ; V
05 0C00 17                      DEFB    17H             ; W
06 0C01 18                      DEFB    18H             ; X
07 0C02                 ;S3     18 - 1F ;
08 0C02 09                      DEFB    09H             ; I
09 0C03 0A                      DEFB    0AH             ; J
10 0C04 0B                      DEFB    0BH             ; K
11 0C05 0C                      DEFB    0CH             ; L
12 0C06 0D                      DEFB    0DH             ; M
13 0C07 0E                      DEFB    0EH             ; N
14 0C08 0F                      DEFB    0FH             ; O
15 0C09 10                      DEFB    10H             ; P
16 0C0A                 ;S4   20 - 27  ;
17 0C0A 01                      DEFB    01H             ; A
18 0C0B 02                      DEFB    02H             ; B
19 0C0C 03                      DEFB    03H             ; C
20 0C0D 04                      DEFB    04H             ; D
21 0C0E 05                      DEFB    05H             ; E
22 0C0F 06                      DEFB    06H             ; F
23 0C10 07                      DEFB    07H             ; G
24 0C11 08                      DEFB    08H             ; H
25 0C12                 ;S5   28 - 2F  ;
26 0C12 21                      DEFB    21H             ; 1
27 0C13 22                      DEFB    22H             ; 2
28 0C14 23                      DEFB    23H             ; 3
29 0C15 24                      DEFB    24H             ; 4
30 0C16 25                      DEFB    25H             ; 5
31 0C17 26                      DEFB    26H             ; 6
32 0C18 27                      DEFB    27H             ; 7
33 0C19 28                      DEFB    28H             ; 8
34 0C1A                 ;S6   30 - 37  ;
35 0C1A 59                      DEFB    59H             ; \
36 0C1B 50                      DEFB    50H             ; ↑
37 0C1C 2A                      DEFB    2AH             ; -
38 0C1D 00                      DEFB    00H             ; SPACE
39 0C1E 20                      DEFB    20H             ; 0
40 0C1F 29                      DEFB    29H             ; 9
41 0C20 2F                      DEFB    2FH             ; ,
42 0C21 2E                      DEFB    2EH             ; .
43 0C22                 ;S7   38 - 3F  ;
44 0C22 C8                      DEFB    C8H             ; INST.
45 0C23 C7                      DEFB    C7H             ; DEL.
46 0C24 C2                      DEFB    C2H             ; CURSOR UP
47 0C25 C1                      DEFB    C1H             ; CURSOR DOWN
48 0C26 C3                      DEFB    C3H             ; CURSOR RIGHT
49 0C27 C4                      DEFB    C4H             ; CURSOR LEFT
50 0C28 49                      DEFB    49H             ; ?
51 0C29 2D                      DEFB    2DH             ; /
52 0C2A                 ;
53 0C2A                 ;    KTBL SHIFT ON
54 0C2A                 ;
55 0C2A                 KTBLS:  ENT
56 0C2A                 ;S0    00-07
57 0C2A BF                      DEFB    BFH             ; SPARE
58 0C2B CA                      DEFB    CAH             ; GRAPH
59 0C2C 1B                      DEFB    1BH             ; POND
60 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             ; `
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             ; #J
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
```

```
01 0C95 7B                      DEFB    7BH             ; #4
02 0C96 3A                      DEFB    3AH             ; #5
03 0C97 5E                      DEFB    5EH             ; #6
04 0C98 1F                      DEFB    1FH             ; #7
05 0C99 BD                      DEFB    BDH             ; #8
06 0C9A                 ;S6     30-3F
07 0C9A D4                      DEFB    D4H             ; #YEN
08 0C9B 9E                      DEFB    9EH             ; #+
09 0C9C D2                      DEFB    D2H             ; #-
10 0C9D 00                      DEFB    00H             ; SPACE
11 0C9E 9C                      DEFB    9CH             ; #0
12 0C9F A1                      DEFB    A1H             ; #9
13 0CA0 CA                      DEFB    CAH             ; #,
14 0CA1 B8                      DEFB    B8H             ; #.
15 0CA2                 ;S7     38-3F
16 0CA2 C8                      DEFB    C8H             ; INST
17 0CA3 C7                      DEFB    C7H             ; DEL.
18 0CA4 C2                      DEFB    C2H             ; CURSOR UP
19 0CA5 C1                      DEFB    C1H             ; CURSOR DOWN
20 0CA6 C3                      DEFB    C3H             ; CURSOR RIGHT
21 0CA7 C4                      DEFB    C4H             ; CURSOR LEFT
22 0CA8 BA                      DEFB    BAH             ; #?
23 0CA9 DB                      DEFB    DBH             ; #/
24 0CAA                 ;
25 0CAA                 ;       CONTROL CODE
26 0CAA                 ;
27 0CAA                 KTBLC:  ENT
28 0CAA                 ;S0     00-07H
29 0CAA F0                      DEFB    F0H             ;
30 0CAB F0                      DEFB    F0H
31 0CAC F0                      DEFB    F0H             ; ↑
32 0CAD F0                      DEFB    F0H
33 0CAE F0                      DEFB    F0H
34 0CAF F0                      DEFB    F0H
35 0CB0 F0                      DEFB    F0H
36 0CB1 F0                      DEFB    F0H
37 0CB2                 ;S1     08-0F
38 0CB2 F0                      DEFB    F0H             ; ↑Y  E3
39 0CB3 5A                      DEFB    5AH             ; ↑Z  E4 (CHECKER)
40 0CB4 F0                      DEFB    F0H             ; ↑@
41 0CB5 F0                      DEFB    F0H             ; ↑[  E5
42 0CB6 F0                      DEFB    F0H             ; ↑J  E7
43 0CB7 F0                      DEFB    F0H
44 0CB8 F0                      DEFB    F0H
45 0CB9 F0                      DEFB    F0H
46 0CBA                 ;S2     10-17
47 0CBA C1                      DEFB    C1H             ; ↑@
48 0CBB C2                      DEFB    C2H             ; ↑R
49 0CBC C3                      DEFB    C3H             ; ↑S
50 0CBD C4                      DEFB    C4H             ; ↑T
51 0CBE C5                      DEFB    C5H             ; ↑U
52 0CBF C6                      DEFB    C6H             ; ↑V
53 0CC0 F0                      DEFB    F0H             ; ↑W  E1
54 0CC1 F0                      DEFB    F0H             ; ↑X  E2
55 0CC2                 ;S3     18-1F
56 0CC2 F0                      DEFB    F0H             ; ↑I  F9
57 0CC3 F0                      DEFB    F0H             ; ↑J  FA
58 0CC4 F0                      DEFB    F0H             ; ↑K  FB
59 0CC5 F0                      DEFB    F0H             ; ↑L  FC
60 0CC6 F0                      DEFB    F0H             ; ↑M  FD
```

```
01 0CC7 F0                      DEFB    F0H             ; ↑N  FE
02 0CC8 F0                      DEFB    F0H             ; ↑O  FF
03 0CC9 F0                      DEFB    F0H             ; ↑P  E0
04 0CCA                 ;S4     20-27
05 0CCA F0                      DEFB    F0H             ; ↑A  F1
06 0CCB F0                      DEFB    F0H             ; ↑B  F2
07 0CCC F0                      DEFB    F0H             ; ↑C  F3
08 0CCD F0                      DEFB    F0H             ; ↑D  F4
09 0CCE F0                      DEFB    F0H             ; ↑E  F5
10 0CCF F0                      DEFB    F0H             ; ↑F  F6
11 0CD0 F0                      DEFB    F0H             ; ↑G  F7
12 0CD1 F0                      DEFB    F0H             ; ↑H  F8
13 0CD2                 ;S5     28-2F
14 0CD2 F0                      DEFB    F0H
15 0CD3 F0                      DEFB    F0H
16 0CD4 F0                      DEFB    F0H
17 0CD5 F0                      DEFB    F0H
18 0CD6 F0                      DEFB    F0H
19 0CD7 F0                      DEFB    F0H
20 0CD8 F0                      DEFB    F0H
21 0CD9 F0                      DEFB    F0H
22 0CDA                 ;S6     30-37
23 0CDA F0                      DEFB    F0H             ; ↑YEN E6
24 0CDB F0                      DEFB    F0H
25 0CDC F0                      DEFB    F0H
26 0CDD F0                      DEFB    F0H
27 0CDE F0                      DEFB    F0H
28 0CDF F0                      DEFB    F0H             ; ↑, EF
29 0CE0 F0                      DEFB    F0H
30 0CE1                 ;S7     38-3F
31 0CE1 F0                      DEFB    F0H
32 0CE2 F0                      DEFB    F0H
33 0CE3 F0                      DEFB    F0H
34 0CE4 F0                      DEFB    F0H
35 0CE5 F0                      DEFB    F0H
36 0CE6 F0                      DEFB    F0H
37 0CE7 F0                      DEFB    F0H
38 0CE8 F0                      DEFB    F0H             ; ↑/ EE
39 0CE9                 ;
40 0CE9                 ;   KANA
41 0CE9                 ;
42 0CE9                 KTBLG:  ENT
43 0CE9                 ;S0     00-07
44 0CE9 BF                      DEFB    BFH             ; SPARE
45 0CEA F0                      DEFB    F0H             ; GRAPH BUT NULL
46 0CEB CF                      DEFB    CFH             ; NIKO WH.
47 0CEC C9                      DEFB    C9H             ; ALPHA
48 0CED F0                      DEFB    F0H             ; NO
49 0CEE B5                      DEFB    B5H             ; MO
50 0CEF 4D                      DEFB    4DH             ; DAKU TEN
51 0CF0 CD                      DEFB    CDH             ; CR
52 0CF1                 ;S1     08-0F
53 0CF1 35                      DEFB    35H             ; HA
54 0CF2 77                      DEFB    77H             ; TA
55 0CF3 D7                      DEFB    D7H             ; WA
56 0CF4 B3                      DEFB    B3H             ; YO
57 0CF5 B7                      DEFB    B7H             ; HANDAKU
58 0CF6 F0                      DEFB    F0H
59 0CF7 F0                      DEFB    F0H
60 0CF8 F0                      DEFB    F0H
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   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 51          04.07.83

01 0CF9                    ;S2       10-17
02 0CF9 7C                           DEFB   7CH            ; KA
03 0CFA 70                           DEFB   70H            ; KE
04 0CFB 41                           DEFB   41H            ; SHI
05 0CFC 31                           DEFB   31H            ; KO
06 0CFD 39                           DEFB   39H            ; HI
07 0CFE A6                           DEFB   A6H            ; TE
08 0CFF 78                           DEFB   78H            ; KI
09 0D00 DD                           DEFB   DDH            ; CHI
10 0D01                    ;S3       18-1F
11 0D01 3D                           DEFB   3DH            ; FU
12 0D02 5D                           DEFB   5DH            ; MI
13 0D03 6C                           DEFB   6CH            ; MU
14 0D04 56                           DEFB   56H            ; ME
15 0D05 1D                           DEFB   1DH            ; RHI
16 0D06 33                           DEFB   33H            ; RA
17 0D07 D5                           DEFB   D5H            ; HE
18 0D08 B1                           DEFB   B1H            ; HO
19 0D09                    ;S4       20-27
20 0D09 46                           DEFB   46H            ; SA
21 0D0A 6E                           DEFB   6EH            ; TO
22 0D0B D9                           DEFB   D9H            ; THU
23 0D0C 48                           DEFB   48H            ; SU
24 0D0D 74                           DEFB   74H            ; KU
25 0D0E 43                           DEFB   43H            ; SE
26 0D0F 4C                           DEFB   4CH            ; SO
27 0D10 73                           DEFB   73H            ; MA
28 0D11                    ;S5       28-2F
29 0D11 3F                           DEFB   3FH            ; A
30 0D12 36                           DEFB   36H            ; I
31 0D13 7E                           DEFB   7EH            ; U
32 0D14 3B                           DEFB   3BH            ; E
33 0D15 7A                           DEFB   7AH            ; O
34 0D16 1E                           DEFB   1EH            ; NA
35 0D17 5F                           DEFB   5FH            ; NI
36 0D18 A2                           DEFB   A2H            ; NU
37 0D19                    ;S6       30-37
38 0D19 D3                           DEFB   D3H            ; YO
39 0D1A 9F                           DEFB   9FH            ; YU
40 0D1B D1                           DEFB   D1H            ; YA
41 0D1C 00                           DEFB   00H            ; SPACE
42 0D1D 9D                           DEFB   9DH            ; NO
43 0D1E A3                           DEFB   A3H            ; NE
44 0D1F D0                           DEFB   D0H            ; RU
45 0D20 B9                           DEFB   B9H            ; RE
46 0D21                    ;S7       38-3F
47 0D21 C6                           DEFB   C6H            ; ?CLR
48 0D22 C5                           DEFB   C5H            ; ?HOME
49 0D23 C2                           DEFB   C2H            ; ?CURSOR UP
50 0D24 C1                           DEFB   C1H            ; ?CURSOR DOWN
51 0D25 C3                           DEFB   C3H            ; ?CURSOR RIGHT
52 0D26 C4                           DEFB   C4H            ; ?CURSOR LEFT
53 0D27 BB                           DEFB   BBH            ; DASH
54 0D28 BE                           DEFB   BEH            ; RO
55 0D29                    ;
56 0D29                    ;      MEMORY DUMP
57 0D29                    ;         COMMAND 'D'
58 0D29                    ;
59 0D29                    DUMP:    ENT
60 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                    ;
```

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**  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 53          04.07.83

01 0DA6                 ;    V-BLANK CHECK  ;
02 0DA6                 ;
03 0DA6                 ?BLNK:  ENT
04 0DA6 F5                      PUSH    AF
05 0DA7 3A02E0                  LD      A,(KEYPC)       ; V-BLNK
06 0DAA 07                      RLCA
07 0DAB 30FA                    JR      NC,-4
08 0DAD 3A02E0                  LD      A,(KEYPC)
09 0DB0 07                      RLCA
10 0DB1 38FA                    JR      C,-4
11 0DB3 F1                      POP     AF
12 0DB4 C9                      RET
13 0DB5                 ;
14 0DB5                 ;ORG 0DB5H;?DSF
15 0DB5                 ;
16 0DB5                 ;
17 0DB5                 ;
18 0DB5                 ;  DISPLAY ON POINTER  ;
19 0DB5                 ;
20 0DB5                 ;     ACC = DISPLAY CODE
21 0DB5                 ;     EXCEPT FOH
22 0DB5                 ;
23 0DB5                 ?DSP:   ENT
24 0DB5 F5                      PUSH    AF
25 0DB6 C5                      PUSH    BC
26 0DB7 D5                      PUSH    DE
27 0DB8 E5                      PUSH    HL
28 0DB9                 DSP01:  ENT
29 0DB9 CDB10F                  CALL    ?PONT           ; DSPLAY POSITION
30 0DBC 77                      LD      (HL),A
31 0DBD 2A7111                  LD      HL,(DSPXY)
32 0DC0 7D                      LD      A,L
33 0DC1 FE27                    CP      +39
34 0DC3 200B                    JR      NZ,DSP04
35 0DC5 CDF302                  CALL    .MANG
36 0DC8 3806                    JR      C,DSP04
37 0DCA EB                      EX      DE,HL
38 0DCB 3601                    LD      (HL),+1         ; LOGICAL 1ST COLUMN
39 0DCD 23                      INC     HL
40 0DCE 3600                    LD      (HL),0          ; LOGICAL 2ND COLUMN
41 0DD0                 DSP04:  ENT
42 0DD0 3EC3                    LD      A,C3H           ; CURSL
43 0DD2 180C                    JR      ?DPCT+4
44 0DD4                 ;
45 0DD4                 ;
46 0DD4                 ;
47 0DD4                 ;
48 0DD4                 ;     GRAPHIC STATUS CHECK
49 0DD4                 ;
50 0DD4 3A7011          GRSTAS: LD      A,(KANAF)
51 0DD7 FE01                    CP      01H
52 0DD9 3ECA                    LD      A,CAH
53 0DDB C9                      RET
54 0DDC                 ;
55 0DDC                 ;
56 0DDC                 ;
57 0DDC                 ;
58 0DDC                 ;
59 0DDC                 ;
60 0DDC                 ;ORG 0DDCH;?DPCT
```

```
0ODC                    ;
0ODC                    ;
0ODC                    ;   DISPLAY CONTROL   ;
0ODC                    ;
0ODC                    ;     ACC = CONTROL CODE
0ODC                    ;
0ODC                    ?DPCT:  ENT
0ODC F5                         PUSH    AF
0ODD C5                         PUSH    BC
0ODE D5                         PUSH    DE
0ODF E5                         PUSH    HL
0OE0 47                         LD      B,A
0OE1 E6F0                       AND     F0H
0OE3 FEC0                       CP      C0H
0OE5 201B                       JR      NZ,CURS5
0OE7 A8                         XOR     B
0OE8 07                         RLCA
0OE9 4F                         LD      C,A
0OEA 0600                       LD      B,+0
0OEC 21AA0E                     LD      HL,CTBL         ; PAGE MODE1
0OEF 09                         ADD     HL,BC
0OF0 5E                         LD      E,(HL)
0OF1 23                         INC     HL
0OF2 56                         LD      D,(HL)
0OF3 2A7111                     LD      HL,(DSPXY)
0OF6 EB                         EX      DE,HL
0OF7 E9                         JP      (HL)
0OF8                    ;
0OF8                    ;
0OF8                    ;
0OF8                    CURSD:  ENT
0OF8 EB                         EX      DE,HL           ; LD HL,(DSPXY)
0OF9 7C                         LD      A,H
0OFA FE18                       CP      +24
0OFC 2825                       JR      Z,CURS4
0OFE 24                         INC     H
0OFF                    CURS1:  ENT
0OFF
0OFF
0OFF
0OFF                    CURS3:  ENT
0OFF 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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```
0E77 EDB0                       LDIR
0E79 C1                         POP     BC
0E7A D5                         PUSH    DE
0E7B 1100D8                     LD      DE,SCRN+800H    ; COLOR RAM SCROLL
0E7E 2128D8                     LD      HL,SCRN+828H    ; SCROLL TOP + 40
0E81 EDB0                       LDIR
0E83 0628                       LD      B,40            ; ONE LINE
0E85 EB                         EX      DE,HL
0E86 3E71                       LD      A,71H           ; COLOR RAM INITIAL DATA
0E88 CDDD0F                     CALL    ?DINT
0E8B E1                         POP     HL
0E8C 0628                       LD      B,40
0E8E CDD80F                     CALL    ?CLER           ; LAST LINE CLEAR
0E91 011A00                     LD      BC,26           ; ROW NUMBER +1
0E94 117311                     LD      DE,MANG         ; LOGICAL MANAGEMENT
0E97 217411                     LD      HL,MANG+1
0E9A EDB0                       LDIR
0E9C 3600                       LD      (HL),0
0E9E 3A7311                     LD      A,(MANG)
0EA1 B7                         OR      A
0EA2 2841                       JR      Z,?RSTR
0EA4 217211                     LD      HL,DSPXY+1
0EA7 35                         DEC     (HL)
0EA8 18C3                       JR      SCROL
0EAA                    ;
0EAA                    ;       CONTROL CODE TABLE
0EAA                    ;
0EAA                    CTBL:   ENT
0EAA 6D0E                       DEFW    SCROL           ; SCROLLING
0EAC F80D                       DEFW    CURSD           ; CURSOR
0EAE 050E                       DEFW    CURSU
0EB0 0D0E                       DEFW    CURSR
0EB2 250E                       DEFW    CURSL
0EB4 4D0E                       DEFW    HOME
0EB6 3A0E                       DEFW    CLRS
0EB8 F80E                       DEFW    DEL
0EBA 380F                       DEFW    INST
0EBC E10E                       DEFW    ALPHA
0EBE EE0E                       DEFW    KANA
0EC0 E50E                       DEFW    ?RSTR
0EC2 E50E                       DEFW    ?RSTR
0EC4 5A0E                       DEFW    CR
0EC6 E50E                       DEFW    ?RSTR
0EC8 E50E                       DEFW    ?RSTR
0ECA                    ;
0ECA                    ;
0ECA                    ;
0ECA                    ;       INST BYPASS
0ECA                    ;
0ECA CBDC               INST2:  SET     3,H             ; COLOR RAM
0ECC 7E                         LD      A,(HL)          ; FROM
0ECD 23                         INC     HL
0ECE 77                         LD      (HL),A          ; TO
0ECF 2B                         DEC     HL              ; ADR ADJ.
0ED0 CB9C                       RES     3,H
0ED2 EDA8                       LDD                     ; CHA. TRNS.
0ED4 79                         LD      A,C
0ED5 B0                         OR      B               ; BC=0 ?
0ED6 20F2                       JR      NZ,INST2
0ED8 EB                         EX      DE,HL
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   **  Z8( ASSEMBLER SB-7201  <1Z-013A>  PA:E 57          04.07.83

01 0ED9 3600                    LD      (HL),0
02 0EDB CBDC                    SET     3,H             ; COLOR RAM
03 0EDD 3671                    LD      (HL),71H
04 0EDF 1804                    JR      ?RSTR
05 0EE1                 ;
06 0EE1                 ;
07 0EE1                 ;
08 0EE1                 ;
09 0EE1                 ;ORG 0EE1H;ALPHA
10 0EE1                 ;
11 0EE1                 ALPHA:  ENT
12 0EE1 AF                      XOR     A
13 0EE2                 ALPH1:  ENT
14 0EE2 327011                  LD      (KANAF),A
15 0EE5                 ;
16 0EE5                 ;
17 0EE5                 ;  RESTORE  ;
18 0EE5                 ;
19 0EE5                 ?RSTR:  ENT
20 0EE5 E1                      POP     HL
21 0EE6                 ?RSTR1: ENT
22 0EE6 D1                      POP     DE
23 0EE7 C1                      POP     BC
24 0EE8 F1                      POP     AF
25 0EE9 C9                      RET
26 0EEA                 ;
27 0EEA                 ;  MONITOR WORK AREA  ;
28 0EEA                 ;
29 D000  P              SCRN:   EQU     D000H
30 E003  P              KANST:  EQU     E003H           ; KANA STATUS PORT
31 0EEA                 ;
32 0EEA                 ;
33 0EEA                 ;
34 0EEA                         DEFS    +4
35 0EEE                 ;ORG 0EEEH;KANA
36 0EEE                 ;
37 0EEE                 KANA:   ENT
38 0EEE CDD40D                  CALL    GRSTAS
39 0EF1 CAB90D                  JP      Z,DSP01         ; NOT GRAPH KEY THEN JU
P
40 0EF4 3E01                    LD      A,+1
41 0EF6 18EA                    JR      ALPH1
42 0EF8                 ;
43 0EF8                 ;
44 0EF8                 DEL:    ENT
45 0EF8 EB                      EX      DE,HL           ; LD HL,(DSPXY)
46 0EF9 7C                      LD      A,H             ; HOME ?
47 0EFA B5                      OR      L
48 0EFB 28E8                    JR      Z,?RSTR
49 0EFD 7D                      LD      A,L
50 0EFE B7                      OR      A
51 0EFF 200D                    JR      NZ,DEL1         ; LEFT SIDE ?
52 0F01 CDF302                  CALL    .MANG
53 0F04 3808                    JR      C,DEL1
54 0F06 CDB10F                  CALL    ?PONT
55 0F09 2B                      DEC     HL
56 0F0A 3600                    LD      (HL),+0
57 0F0C 1825                    JR      INST-5          ; JP CURSL
58 0F0E                 DEL1:   ENT
59 0F0E CDF302                  CALL    .MANG
60 0F11 0F                      RRCA
```

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01 0F12 3E28                    LD      A,40
02 0F14 3001                    JR      NC,+3
03 0F16 07                      RLCA                    ; ACC=80
04 0F17 95                      SUB     L
05 0F18 47                      LD      B,A             ; TRNS. BYTE
06 0F19 CDB10F                  CALL    ?PONT
07 0F1C 7E              DEL2:   LD      A,(HL)          ; CHA. FROM ADR
08 0F1D 2B                      DEC     HL
09 0F1E 77                      LD      (HL),A          ; TO
10 0F1F 23                      INC     HL
11 0F20 CBDC                    SET     3,H             ; COLOR RAM
12 0F22 7E                      LD      A,(HL)
13 0F23 2B                      DEC     HL
14 0F24 77                      LD      (HL),A
15 0F25 CB9C                    RES     3,H             ; CHA.
16 0F27 23                      INC     HL
17 0F28 23                      INC     HL              ; NEXT
18 0F29 10F1                    DJNZ    DEL2
19 0F2B 2B                      DEC     HL              ; ADR.ADJUST
20 0F2C 3600                    LD      (HL),0
21 0F2E CBDC                    SET     3,H
22 0F30 217100                  LD      HL,71H          ; BLUE + WHITE
23 0F33 3EC4                    LD      A,C4H           ; JP CURSL
24 0F35 C3E00D                  JP      ?DPCT+4
25 0F38                 ;
26 0F38                 INST:   ENT
27 0F38 CDF302                  CALL    .MAN8
28 0F3B 0F                      RRCA
29 0F3C 2E27                    LD      L,+39
30 0F3E 7D                      LD      A,L
31 0F3F 3001                    JR      NC,+3
32 0F41 24                      INC     H
33 0F42 CDB40F                  CALL    ?PNT1
34 0F45 E5                      PUSH    HL
35 0F46 2A7111                  LD      HL,(DSPXY)
36 0F49 3002                    JR      NC,+4
37 0F4B 3E4F                    LD      A,+79
38 0F4D 95                      SUB     L
39 0F4E 0600                    LD      B,0
40 0F50 4F                      LD      C,A
41 0F51 D1                      POP     DE
42 0F52 2891                    JR      Z,?RSTR
43 0F54 1A                      LD      A,(DE)
44 0F55 B7                      OR      A
45 0F56 208D                    JR      NZ,?RSTR
46 0F58 62                      LD      H,D             ; HL←DE
47 0F59 6B                      LD      L,E
48 0F5A 2B                      DEC     HL
49 0F5B C3CA0E                  JP      INST2           ; JUMP NEXT (BYPASS)
50 0F5E                 ;
51 0F5E                 ;
52 0F5E                 ;   PROGRAM SAVE
53 0F5E                 ;
54 0F5E                 ;     CMD. 'S'
55 0F5E                 ;
56 0F5E                 SAVE:   ENT
57 0F5E CD3D01                  CALL    HEXIY           ; START ADR.
58 0F61 220411                  LD      (DTADR),HL      ; DATA ADR. BUFFER
59 0F64 44                      LD      B,H
60 0F65 4D                      LD      C,L
```

```
   **  Z80 ASSEMBLER SB-7201  <1Z-013A>  PAGE 59            04.07.83

01 0F66 CDA602                    CALL    .4DE
02 0F69 CD3D01                    CALL    HEXIY           ; END ADR.
03 0F6C ED42                      SBC     HL,BC           ; BYTE SIZE
04 0F6E 23                        INC     HL
05 0F6F 220211                    LD      (SIZE),HL       ; BYTE SIZE BUFFER
06 0F72 CDA602                    CALL    .4DE
07 0F75 CD3D01                    CALL    HEXIY           ; EXECUTE ADR.
08 0F78 220611                    LD      (EXADR),HL      ; BUFFER
09 0F7B CD0900                    CALL    NL
10 0F7E 118B09                    LD      DE,MSGSV        ; SAVED FILENAME
11 0F81 DF                        RST     3               ; CALL MSGX
12 0F82 CD2F01                    CALL    BGETL           ; FILENAME INPUT
13 0F85 CDA602                    CALL    .4DE
14 0F88 CDA602                    CALL    .4DE
15 0F8B 21F110                    LD      HL,NAME         ; NAME BUFFER
16 0F8E                   SAV1:   ENT
17 0F8E 13                        INC     DE
18 0F8F 1A                        LD      A,(DE)
19 0F90 77                        LD      (HL),A          ; FILENAME TRANS.
20 0F91 23                        INC     HL
21 0F92 FE0D                      CP      0DH             ; END CODE
22 0F94 20F8                      JR      NZ,SAV1
23 0F96 3E01                      LD      A,01H           ; ATTRIBUE:OBJ.
24 0F98 32F010                    LD      (ATRB),A
25 0F9B CD3604                    CALL    ?WRI
26 0F9E DA0701                    JP      C,?ER           ; WRITE ERROR
27 0FA1 CD7504                    CALL    ?WRD            ; DATA
28 0FA4 DA0701                    JP      C,?ER
29 0FA7 CD0900                    CALL    NL
30 0FAA 114209                    LD      DE,MSGOK        ; OK MESSAGE
31 0FAD DF                        RST     3               ; CALL MSGX
32 0FAE C3AD00                    JP      ST1
33 0FB1                   ;
34 0FB1                   ;
35 0FB1                   ;ORG 0FB1H;?PONT
36 0FB1                   ;
37 0FB1                   ;
38 0FB1                   ;  COMPUTE POINT ADR .  ;
39 0FB1                   ;
40 0FB1                   ;     HL = SCREEN CORDINATE
41 0FB1                   ;     EXIT
42 0FB1                   ;     HL = POINT ADR. ON SCREEN
43 0FB1                   ;
44 0FB1                   ?PONT:  ENT
45 0FB1 2A7111                    LD      HL,(DSPXY)
46 0FB4                   ;
47 0FB4                   ;ORG 0FB4H;?PNT1
48 0FB4                   ;
49 0FB4                   ?PNT1:  ENT
50 0FB4 F5                        PUSH    AF
51 0FB5 C5                        PUSH    BC
52 0FB6 D5                        PUSH    DE
53 0FB7 E5                        PUSH    HL
54 0FB8 C1                        POP     BC
55 0FB9 112800                    LD      DE,0028H        ; 40
56 0FBC 21D8CF                    LD      HL,SCRN-40
57 0FBF                   ?PNT2:  ENT
58 0FBF 19                        ADD     HL,DE
59 0FC0 05                        DEC     B
60 0FC1 F2BF0F                    JP      P,-2
```

```
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,8APCK3
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 B
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
```

BUFFER

#BRK	0B8B	#CLR08	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	0SFE	?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	LOA0	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	001B	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
ONTY0	119F	OPTBL	029C	PEN	018B	PLOT	0184	PMSG	01A5
PMSG1	01AB	PRNT	0012	PRNT2	0967	PRNT3	096C	PRNT4	096F
PRNT5	0959	PRNTS	000C	PRNTT	000F	PRTHL	03BA	PRTHX	03C3
PTEST	0155	PTRN	0180	PTST0	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	05BB	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 s Color Plotter-Printer Control Codes

A s.1 Control codes used in the text mode

- Text code (s01)
  Sets the printer in the text mode.
- Graphic code (s02) ..... Same as the BASIC MODE GR statement.
  Sets the printer in the graphic mode.
- Line up (s03) ..... Same as the BASIC CKLP-1 statement.
  Moves the paper one line in the reverse direction. The line counter is decremented by 1.
- Pen test (s04 ..... Same as the BASIC TEST statement.
  Writes the following patterns to start ink flowing from the pens, then sets scale = 1 (40 dot/line), color = 0.

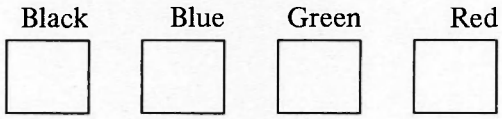
  Black Blue Green Red

- Reduction scale (s09) + (s09) + (s09)
  Reduces the scale from 1 to 0 (80 dot/line).
- Reduction cancel (s09) + (s09) + (s08)
  Enlarges the scale from 0 to 1 (40 dot/line).
- Line counter set (s09) + (s09) + $(ASCII)_3$ + $(ASCII)_2$ + $(ASCII)_1$ + $(ASCII)_0$ + (s0D)
  Same as the BASIC statement.

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	$Pc_1 c_2 c_3 \ldots cn$ (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.

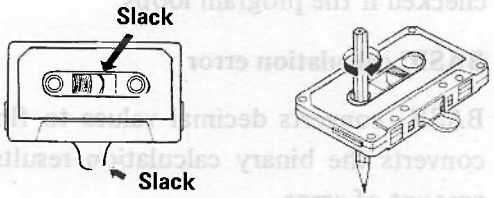
A. 7 Notes Concerning Operation

■ **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.

Remove record lock-out tab with a screwdriver.

■ **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.

SHARP CORPORATION
OSAKA, JAPAN

Printed in Japan
Gedruckt in Japan
Imprimé au Japon

3H 5.305-I
TINSE1066ACZZ