

HB-F500P / F500F

SERVICE MANUAL

AEP Model

: HB-F500P

France Model

: HB-F500F

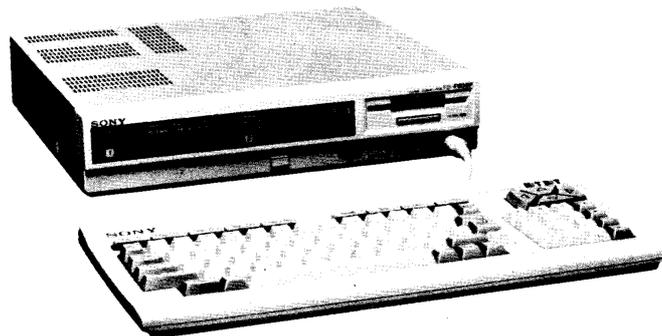


PHOTO: AEP model

HOME COMPUTER
SONY[®]

PART 1

*Scanned and converted to PDF by HansO, 2001
Original supplied by Bas Kornalijnslijper, MCWF*

CHAPTER 1 OPERATION

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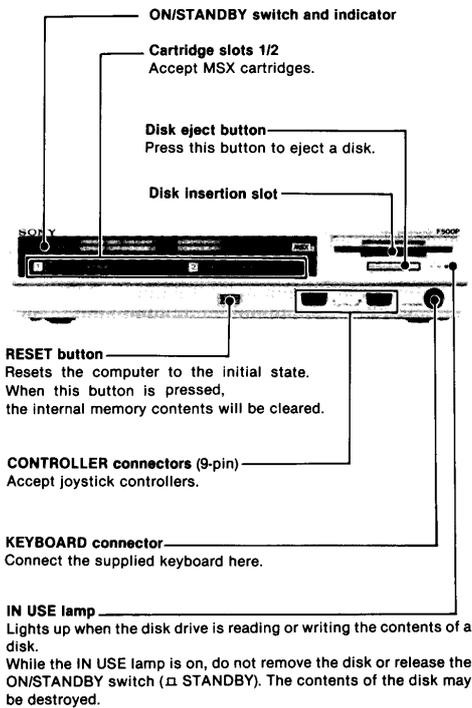
Use this computer only with peripherals and software having the **MSX**
or **MSX₂** mark.

SPECIFICATIONS

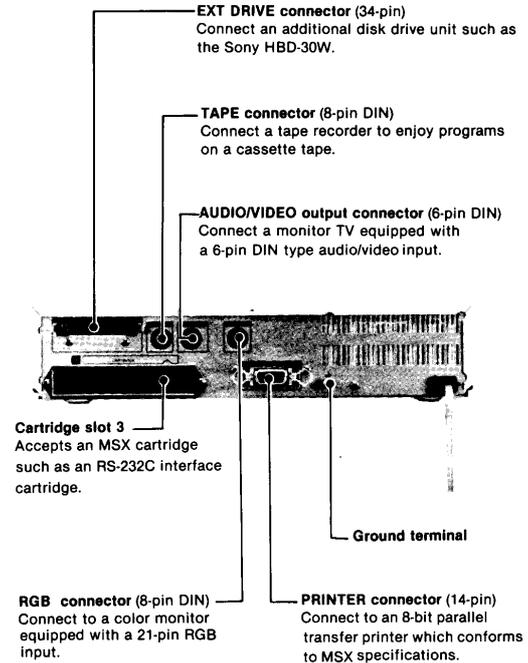
CPU			
Processor used	Z80A	Input/Output	
Clock frequency	3.58 MHz	RGB output	8-pin DIN RGB video: 0-0.7V, 75 ohms Audio: -5dBs (0dBs = 0.775V)
WAIT	1 WAIT at CPU M1 cycle	AUDIO/VIDEO output	6-pin DIN Composite video: 1Vp-p, 75 ohms, sync negative Audio: -5dBs
Interrupt	Maskable interrupt Z80A mode 0 mode 1 mode 2	Sound generator	8-octave, 3 tones and 1 noise output
Resetting	Automatic at power on/Manual (Memory contents are not maintained.)	Audio cassette interface	8-pin DIN jack Baud rate: 1200/2400 bps Remote control function provided
Memory		Printer interface	14-pin connector TTL level Standard 8-bit parallel transfer
ROM	64K Bytes (BASIC 48K bytes, DISK BASIC 16K bytes)	General purpose interface	9-pin connector (2) For connection of joystick, etc.
RAM	192K Bytes (MAIN RAM 64K bytes, VRAM 128K bytes)	MSX cartridge slot	3
CRT display		Drive section	
CRT controller	V9938	Disk used	3.5" micro floppydisk
Display screen	Character/graphic display and border area	Disk type	Double-sided or Single-sided
Screen mode	Screen 0: 40 characters x 24 lines or 80 characters x 24 lines 16 colors out of 512 colors Screen 1: 32 characters x 24 lines 16 colors out of 512 colors Screen 2: 256(horizontal) x 192(vertical) dots 16 colors out of 512 colors Screen 3: 64 x 48 dots 16 colors out of 512 colors Screen 4: 256 x 192 dots 16 colors out of 512 colors Screen 5: 256 x 212 dots, 16 colors out of 512 colors, 4 pages Screen 6: 512 x 212 dots, 4 colors out of 512 colors, 4 pages Screen 7: 512 x 212 dots, 16 colors out of 512 colors, 2 pages Screen 8: 256 x 212 dots, 256 colors, 2 pages Initial state: Screen 0: 29 characters x 24 lines	Recording capacity	Unformatted: 1M bytes Formatted: 720K bytes Bytes/sector: 512 Sectors/track: 9 Tracks/cylinder: 2 Tracks/disk: 160 Bytes/disk: 720K
Character font	5 x 7 dot matrix/character	Recording density	8717 bits/inch
Output interface	RGB video signal output: 0-0.7V ±20%, 75 ohms PAL composite video signal output: 1V p-p, 75 ohms, sync negative	Track density	135 tracks/inch
Keyboard (KBD-1P)		Total no. of cylinders	80 cylinders
Scanning method	Software scanning	Total no. of tracks	160 tracks
Total number of keys	90 Control keys: 12 Function keys: 5 Edit keys: 8 Numeric key: 16	Recording method	MFM (Modified-Frequency Modulation)
		Disk rotation speed	300rpm
		Data transfer rate	250 K bits/sec
		Average latency time	100 msec
		Access time	Average: 350 msec Between tracks: 12 msec Settling time: 30 msec
		General	
		Power requirement	220 V ac, 50/60 Hz
		Power consumption	45W (main unit only)
		Operating conditions	Temperature: 5°C to 35°C (41°F to 95°F) Humidity: 20 to 80%
		Storage temperature	-15°C to +60°C (5°F to 140°F)
		Dimensions	Main unit: Approx. 355x76x325 mm (w/h/d) (14x3x13 inches) Keyboard: Approx. 409x32x183 mm (w/h/d) (16 ¹ / ₁₀ x1 ¹ / ₄ x7 ¹ / ₈ inches)
		Weight	Main unit: Approx. 6.3kg (13lb 14oz), Keyboard: Approx 1.2kg (2lb 10oz)

LOCATION AND FUNCTION OF CONTROLS

Front panel

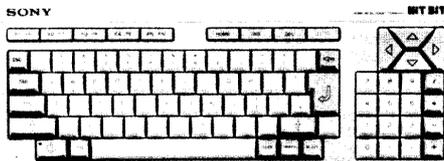


Rear panel



Keyboard

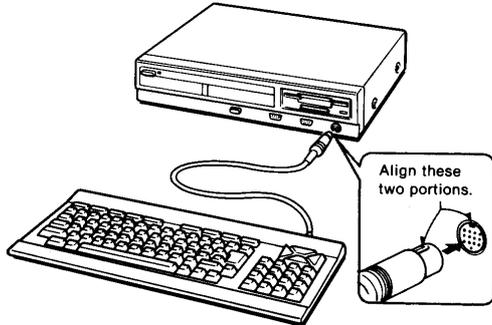
Used to enter programs and data into the computer.



CONNECTION

Before making connections, be sure to turn off the computer as well as equipment to be connected.

CONNECTING THE KEYBOARD



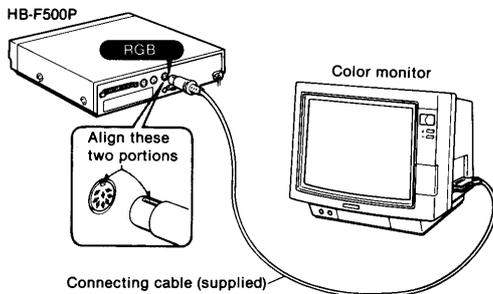
CONNECTING A MONITOR TV

Depending on the type of TV set you have, connection differs.
 — If you have a monitor TV with an RGB connector (DIN 8-pin), see this page.
 — If you have a monitor TV with an AUDIO/VIDEO connector (DIN 6-pin), see next page.

Notes

- Be careful not to connect the supplied RGB connecting cable to the TAPE connector.
- For a clear view of the display, use of a color monitor with a 21-pin RGB connector is recommended. When an ordinary television set is used, characters in the 80 character mode display cannot be viewed clearly.

CONNECTING A COLOR MONITOR WITH AN RGB CONNECTOR

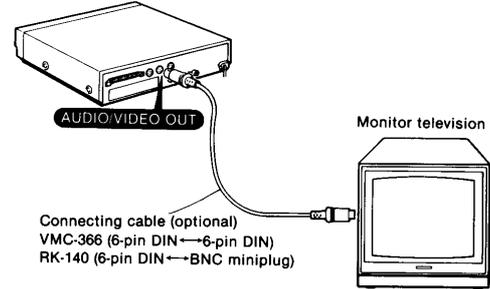


Note

With certain television sets, when the computer connected to the RGB connector is turned on, the television set will automatically switch to RGB, regardless of other equipment connected to the television set. When you want to use other equipment connected to the television set, turn the computer's power off. For further details, refer to the instruction manual of the television set.

CONNECTING A MONITOR TV WITH AN AUDIO/VIDEO INPUT

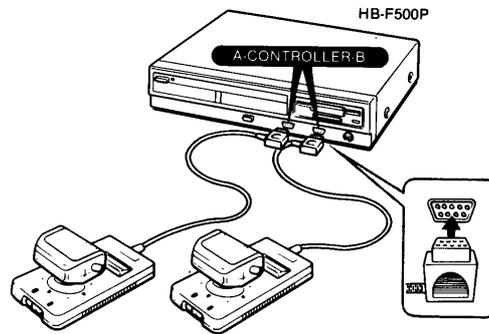
HB-F500P



Connecting cable (optional)
 VMC-366 (6-pin DIN → 6-pin DIN)
 RK-140 (6-pin DIN → BNC miniplug)

CONNECTING A JOYSTICK CONTROLLER

Remove the protection cap on the joystick connector before use. Replace the cap when the joystick controller is not connected.

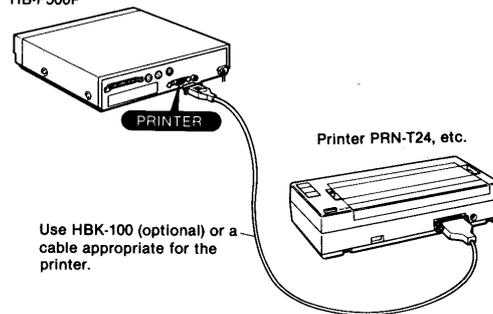


Joystick controller JS-55, etc.

CONNECTING A PRINTER

Use a printer having an MSX mark, such as the Sony PRN-T24 thermal printer.

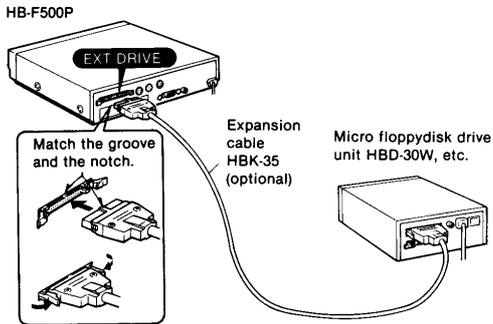
HB-F500P



Use HBK-100 (optional) or a cable appropriate for the printer.

CONNECTING AN ADDITIONAL FLOPPYDISK DRIVE UNIT

You can connect a second disk drive unit displaying an MSX mark, such as the Sony HBD-30W.

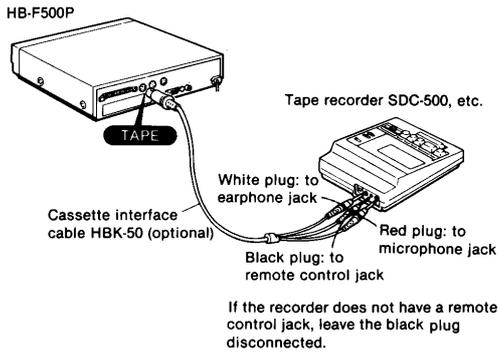


Note

Do not connect a micro floppydisk drive unit to the cartridge slots. The disk drive unit will not operate properly.

CONNECTING A TAPE RECORDER FOR USE AS AN EXTERNAL MEMORY

You can enjoy programs on a cassette tape by using a data recorder or a cassette tape recorder. For details, refer to MSX-BASIC Version 2.0 Programming Reference Manual.



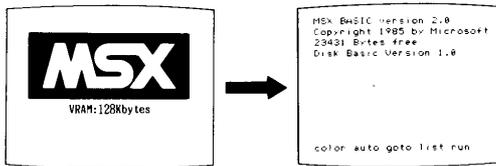
HOW TO START UP

There are four main programs for the HB-F500P.

- Programs built-in the HB-500P:
 - MSX-Disk BASIC: Normally when the color monitor and computer are turned on, the computer performs commands in MSX-Disk BASIC. MSX-Disk BASIC is fully equipped with commands which allow you to make use of the floppydisk.
 - MSX-BASIC: When a cartridge or cassette tape software cannot be started up with MSX-Disk BASIC, use MSX-BASIC. MSX-BASIC does not occupy as much memory as MSX-Disk BASIC but it cannot be used with floppydisks.
- Software supplied with the HB-F500P:
 - MSX-DOS
- Commercially available programs on a floppydisk.
- Commercially available programs on MSX-cartridge form.

TO START UP MSX-DISK BASIC

- 1 Remove the program cartridges or floppydisk from the cartridge slots or the disk slot.
- 2 Turn on the monitor TV and computer.

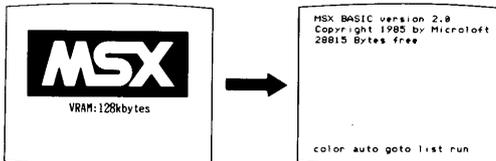


The computer enters the MSX-Disk BASIC command state. For programming your own BASIC program refer to the MSX-BASIC Version 2.0 Programming Reference Manual.

TO START UP MSX-BASIC

Certain programs on a cassette tape or a program cartridge cannot be started up with MSX-Disk BASIC. In this case, start up with MSX-BASIC.

- 1 When a program on a cassette tape is to be used, remove the program cartridges from the cartridge slots.
- 2 Turn on the monitor TV.
- 3 While pressing the **[SHIFT]** key, turn on the computer. Keep the **[SHIFT]** key pressed until the display changes as shown below. The display shows "28815 Bytes free" on MSX-BASIC.



The computer enters the MSX-BASIC command state.

Note

Once MSX-BASIC is started up, the ON/STANDBY switch must be released (**[STANDBY]**) or the **[RESET]** button must be pressed before MSX-Disk BASIC can be started up.

TO START A GAME OR OTHER PROGRAMS ON A FLOPPYDISK SUCH AS THE SUPPLIED MSX-DOS

- 1 Insert the floppydisk into the disk insertion slot.
- 2 Turn on the monitor TV and computer.
The program on the floppydisk is activated.

For further information about the program, refer to the program instruction manual.
For further information about MSX DOS, refer to MSX-BASIC Version 2.0 Programming Reference Manual.

Do not remove the disk or release the ON/STANDBY switch (⏻) while the IN USE lamp is lit. Otherwise, the contents of the disk may be destroyed.

TO START A GAME OR OTHER PROGRAMS ON AN MSX CARTRIDGE

- 1 Insert the cartridge into the cartridge slot with the label facing downwards.
To insert the cartridge in the rear slot, face the label upwards.
- 2 Turn on the monitor TV and computer.
The cartridge program will start.

For details, refer to the program cartridge instruction manual.

Do not insert or remove the cartridge when the ON/STANDBY switch is depressed (⏻ ON).

THE COMPUTER DOES NOT START UP

If the display below appears, you must enter a password. The system will not start up until you have entered the correct password.
If you have forgotten the password, you can start the system by holding down the **GRAPH** and the **STOP** keys and pressing the **RESET** button until the display changes.



KEYBOARD

CHARACTER INPUT

To enter characters

Together with the **SHIFT**, **CODE** and **GRAPH** key, a key can enter up to 6 kinds of characters.

Type of character	Key to press	Example	
		Key (s)	Character
Capital letter	SHIFT + Key	SHIFT + A	A
Small letter	Key only	A	a
Symbol on the upper part of keytop	SHIFT + Key	SHIFT + "	"
Symbol on the lower part of keytop	Key only	"	'

"Key 1 + Key 2" in the table indicates pressing Key 2 while pressing Key 1

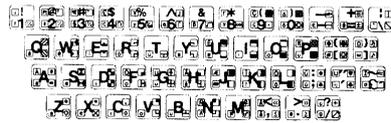
To enter only capital letters, lock the **LOCK** key. The indicator on the key lights up. The 26 alphabet letters will be entered in caps, but numbers and symbols will be entered in normal mode.

To put an accent mark on a character using the **CODE** key

- 1 Enter the appropriate accent mark
To enter ` , press the **CODE** + **GRAVE** key
To enter ^ , press the **CODE** key only
To enter ~ , press the **SHIFT** + **CODE** + **GRAVE** key
To enter ~ , press the **CODE** + **GRAVE** key
- 2 Press the letter needing an accent mark. The character with an accent mark will be displayed.

To enter a graphic character or symbol

The following graphic characters and symbols can be entered.

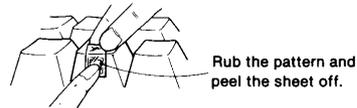


For example:

- To enter **A** , press **SHIFT** + **CODE** + **A** key
- To enter **8** , press **CODE** + **8** key
- To enter **Q** , press **SHIFT** + **GRAPH** + **A** key
- To enter **Q** , press **GRAPH** + **A** key

How to affix the graphic pattern decal

Adhere the supplied graphic pattern decal to the front of the key to display the characters and symbols on the key.



NUMERIC KEYS

The numeric keys are located to the right of the keyboard. The characters on the numeric keys can be entered whether the **SHIFT** or **LOCK** key is pressed or not.

Note

In some cases, the numeric keys cannot be used with commercially available programs.
For example, when playing a game, you may not be able to enter the number of players on the numeric keys. In this case, use the number input keys on the left side of the keyboard.

HOW TO SET THE CALENDAR CLOCK

A calendar clock is incorporated in the HB-F500P, which is backed up by a nickel-cadmium battery so that the contents of the calendar clock will not be erased, even if the POWER switch is turned off.

TO SET THE DATE

- 1 Start up MSX-Disk BASIC, by referring to page 1-5.
- 2 Type **SET DATE "DD/MM/YY"** from the keyboard.
DD is the 2-digit day number, MM the 2-digit month number, and YY the 2-digit year number.
For example, to set 10th January, 1986, you must type **SET DATE "10/01/86"** on the keyboard.
- 3 Press the **[F1]** key.
The date will be set.

TO SET THE TIME

- 1 Start up MSX-Disk BASIC, referring to page 1-5.
- 2 Type **SET TIME "HH:MM:SS"** from the keyboard.
HH is the 2-digit number of hours (24 hour-cycle), MM the 2-digit number of minutes, and SS the 2-digit number of seconds.
For example, to set 2:30 pm and 0 seconds, you must type **SET TIME "14:30:00"** on the keyboard.
- 3 As soon as you hear the time signal on the telephone, radio or TV, press the **[F1]** key.
The time will be set and the clock will start.

If you make a mistake while setting the calendar clock

If you have not pressed the **[F1]** key, correct the required part with the **[NS]** or **[DEL]** key.
If you have already pressed the **[F1]** key, start from step 1 again.

LIFE OF THE BACK-UP BATTERY

The nickel-cadmium battery inside the computer lasts for 1 week when the HB-F500P is turned off after operating on for 8 hours. The battery is recharged each time the computer is turned on. A fully charged battery will last for approximately 2 months.

When the battery becomes weak, the calendar clock will not operate properly and the contents of the memory switch function (such as those set by the title and prompt statements, screen statement, beep statement) will be erased. Therefore, when the computer is used for the first time or, if it has not been operated for a long time, the battery may be weak and the memory switch function may not operate properly. It is recommended that the HB-500P be turned on from time to time to recharge the battery.

FORMATTING A DISK

In order to use a new disk, you must first "format" it. When data is written on the disk, it is written in a certain order which enables the required data to be easily accessed after it has been saved. The form in which the data is to be written is set when a disk is formatted.

- 1 Start up MSX-Disk BASIC, referring to page 1-5.
- 2 Type **call format** from the keyboard.
- 3 Press the **[F1]** key.
The following message will appear on the screen.

```
call format
Drive name? (A,B)
```

- 4 Press the A or B key according to the disk drive you want to use to format the disk.
To format the disk in the built-in disk drive, press the **[A]** key.
To format the disk in the additional disk drive connected to the EXT DRIVE connector, press the **[B]** key.
If you have no other disk drives connected to the computer, press the **[A]** key.
The following message will appear on the screen.

```
1 - Single sided, 9 sectors
2 - Double sided, 9 sectors
```

- 5 Press the 1 key to format a single-sided floppydisk.
Press the 2 key to format a double-sided floppydisk.
The following message will appear on the screen.

```
Strike a key when ready
```

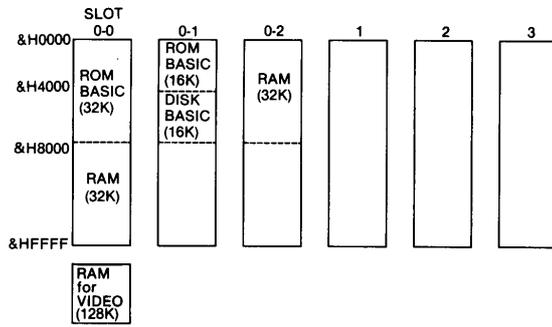
- 6 Insert the new disk into the disk drive you have selected.
- 7 Press any key on the keyboard and formatting begins.
When formatting is completed, the following message will appear on the screen.

```
Format complete
```

Notes

- Formatting can also be done with the MSX-DOS. For further information, refer to "MSX-BASIC Version 2.0 Programming Reference Manual".
- Disks that are unformatted or have been processed in a different format other than MSX-Disk BASIC cannot be used.
- Formatting a disk erases all previously stored data and/or programs on that disk.

MEMORY MAP



MSX-BASIC

Version 2.0

REFERENCE CHART

COMMANDS AND STATEMENTS

COMMANDS FOR PROGRAMMING

format	function	example
AUTO [starting line number] [, increment]	Generate line numbers automatically.	AUTO 100, 10
DELETE [line number] [- line number]	Delete lines in a program.	DELETE 30-60
LIST [starting line number] [-] [end line number]	Display program list.	LIST
NEW	Erase program.	
RENUM [new starting line number], [old starting line number], [increment]	Renumber lines.	RENUM 100, 10, 10
REM or '	Insert a comment.	REM---PROGRAM 1---
KEY LIST	Display the function key contents.	

COMMANDS FOR DEFINITION AND SETTING

format	function	example
CLEAR [size of character area] [, highest address]	Initialize all variables and set the size of the character string area and the highest memory to be used by BASIC.	CLEAR 400, 55296
DIM variable name (maximum value of a subscript [, maximum value of a subscript] ...) [, variable name (), ...]	Declare the name, type, size and dimension of array.	DIM A\$(100)
DEF $\left. \begin{array}{l} \text{INT} \\ \text{SNG} \\ \text{DBL} \\ \text{STR} \end{array} \right\}$ character [- character] [, character [- character]] ...	Define matching between the first character of a variable name and the type of variable. (INT: integer, SNG: single precision, DBL: double precision, STR: string)	DEFINT I-N
DEF FN function name [(parameter [, parameter] ...)] =expression	Define user functions.	DEF FNA (X)=A * X^2+B * X+C
ERASE [array variable name] [, array variable name] ...	Erase arrays	ERASE A, B, C
KEY function key number, character string	Define strings for function keys.	KEY 1, "LLIST"+CHR\$(13)

COMMANDS FOR DATA INPUT/OUTPUT

format	function	example
DATA constant [, constant] [, constant] ...	Give data to be read with a READ statement.	DATA 3, 4, 5, 6, ABC, "C, D"
INPUT ["prompt statement";] variable [, variable] [, variable] ...	Give value of variable from the keyboard.	INPUT "A\$=";A\$
LINE INPUT ["prompt statement";] variable	Give string of up to 254 characters from the keyboard to the string type variable	LINE INPUT "C\$=";C\$
[LET] variable=x	Assign data to the variable.	LET A=A+5
MID\$(X\$, M[, N])	Replace characters beginning with the Mth character of the string X\$ with characters from the beginning to Nth character of Y\$.	MID\$(A\$, 2, 5)=B\$
PRINT [expression] [separator] [expression] [separator] ... or ? [expression] [separator] [expression] [separator] ...	Output data onto display screen. A separator is a semi-colon (;), a comma (,) or a space.	PRINT A;B;C
PRINT USING format symbol; expression [, expression] ...	Output data onto display screen in the specified format. Format symbols: "!" Output the first character. "\n spaces \\" Outputs n+2 characters. "&" Output the entire string. "# " Specify the number of display digits of the numeric data. "+ " Add + or - before (after) numeric data. "- " Add - after negative numeric data. "* * " Fill space before numeric data with *. "££" Put £ in front of numeric data. "* * £" Put £ in front of numeric data and fill space in front of it with *. ", " Put, after every third digit to the left of the decimal point. "^^^" Output with floating decimal points.	10 A\$="ABCDEFGH" 20 PRINT USING "!";A\$ 30 PRINT USING "\ \\";A\$ 40 PRINT USING "SS&TTT";A\$ PRINT USING "###.##";123.45,10.5 PRINT USING "+###";100,-200 PRINT USING "-###";100,-200 PRINT USING "*###";100,-200 PRINT USING "££###";100,-200 PRINT USING "* * £###";10,-20 PRINT USING ",###.##";1234.56 PRINT USING "###^^^";123.98
READ variable [, variable] [, variable] ...	Read data in DATA statement.	READ A\$
RESTORE [line number]	Specify the DATA statement to be read with a READ statement executed next.	RESTORE100
SWAP variable, variable	Exchange values of two variables.	SWAP A,B

COMMANDS FOR CONTROLLING PROGRAM EXECUTION AND FLOW

format	function	example
RUN [line number]	Start program execution.	RUN 100
 RUN "[drive name] file name [. type name]" [, R]	Load program and execute it	RUN "PROG.BAS"
STOP	Interrupt program execution.	
CONT	Restart program execution.	
END	Terminate program execution.	
TRON	Display line number that was executed.	
TROFF	Cancel TRON.	
FOR variable=initial value TO end value [STEP increment] NEXT [variable]	Repeat the program execution between FOR and NEXT.	FOR I=1 TO 10 STEP 2 NEXT I
GOSUB line number RETURN [line number]	Transfer control to the specified subroutine. Return to the main routine with RETURN.	100 GOSUB 100 1000 1100 RETURN
GOTO line number	Transfer control to the specified line.	GOTO 100
IF expression { THEN { statement line number } GOTO line number } { ELSE { statement line number } }	Branch control according to the expression value.	IF X=0 THEN 100 ELSE 200
ON expression GOTO line number [, line number] ...	Branch control according to the expression value.	ON A GOTO 100, 200, 300
ON expression GOSUB line number [, line number] ...	Branch control according to the expression value.	ON SGN (A)+2 GOSUB 1000, 2000, 3000

COMMANDS FOR DISPLAY SCREEN

format	function	example
SCREEN [mode], [sprite size], [key click switch], [baud rate], [printer type], [interlace mode]	Specify the screen display mode. Mode 0: 80 × 24 character text mode 1: 32 × 24 text mode 2: 256 × 192 dot, 16-color graphic mode 3: 64 × 48 dot, 16-color multicolor mode 4: 256 × 192 dot, 16-color graphic mode, sprite enhanced 5: 256 × 212 dot, 16-color graphic mode, sprite enhanced 6: 512 × 212 dot, 4-color graphic mode, sprite enhanced 7: 512 × 212 dot, 16-color graphic mode, sprite enhanced 8: 256 × 212 dot, 256-color graphic mode, sprite enhanced Sprite size 0: 8 × 8 dot unmagnified 1: 8 × 8 dot magnified 2: 16 × 16 dot unmagnified 3: 16 × 16 dot magnified Key click switch 0: Suppress key click sounds. 1: Produce key click sounds. Baud rate 0: 1200 baud 1: 2400 baud Printer type 0: MSX printer 1: Non-MSX printer Interface mode 0: non-interlace 1: interlace 2: interlace, even/odd page change display 3: interlace, even/odd page change display	SCREEN 2, 0,0
SET PAGE [display page], [active page]	Specify the display page and the active page.	SET PAGE 0, 1

WIDTH number of characters	Specify the number of characters per line in the text mode.	WIDTH 28
CLS	Erase all displays on the screen.	
KEY {ON } {OFF }	Display or erase the contents of function keys.	KEY OFF
LOCATE [x-coordinate], [y-coordinate], [cursor switch]	Move the cursor. Cursor switch 0: Not display the cursor. 1: Display the cursor.	LOCATE 10, 12, 1
COLOR [foreground color], [background color], [border color]	Specify colors of the foreground, background and the border.	COLOR 8, 15, 2
COLOR=(palette number, red brightness, green brightness, blue brightness)	Assign colors to the color palette	COLOR=(2, 0, 3, 7)
COLOR=RESTORE	Assign the content of the color lookup table in the video RAM to the VDP color palette register.	
COLOR[=NEW]	Return color palette to initial default settings	
PUT SPRITE sprite plane number, [[STEP] (x-coordinate, y-coordinate)], [color], [sprite number]	Display the specified sprite pattern at the specified position on the specified sprite plane.	PUT SPRITE 0, (100, 50), 7, 2
COLOR SPRITES\$ (sprite plane no.)="character expression"	Specify the color of each line of a sprite. Significance of each character bit: B7 B6 B4 B3 B2 B1 B0 B7: For 1, moves sprite 32 dots to the left. B6: For 1, ignores sprite priority position and overlap, and displays the color whose code is the result of OR of the overlapping colors. B5: For 1, ignores sprite overlap. B4: Not used. B3—B0: color code	COLOR SPRITES\$(0) =CHR\$(1) + CHR\$(7)
COLOR SPRITE (sprite plane no.)=palette no.	Change the color of the sprite on the specified sprite plane.	COLOR SPRITE (1)=4
Logical Operations	PSET, PRESET, AND, OR, XOR, TPSET, TPRESET, TAND, TOR, TXOR	

COMMANDS FOR GRAPHIC DISPLAY

format	function	example
CIRCLE [STEP] (x-coordinate, y-coordinate), radius, [color code], [start angle], [end angle], [aspect ratio]	Draw a circle.	CIRCLE (80, 60), 15, 8
DRAW "graphic subcommands"	Draw an arbitrary graphic.	DRAW "S40U5R5D5L5"
LINE [[STEP] (x-coordinate, y-coordinate)]-[STEP] (x-coordinate, y-coordinate), [color code] { [, B] } [, BF] } [, logical operation]	Draw a line or a square.	LINE -STEP (20, 50),, B
PAINT [STEP] (x-coordinate, y-coordinate), [display color], [border line color code]	Color the area inside the border line.	PAINT (120, 100)
PSET [STEP] (x-coordinate, y-coordinate), [color code], [logical operation]	Mark a dot.	PSET STEP (10, 10), 14
PRESET [STEP] (x-coordinate, y-coordinate), [color code], [logical operation]	Mark or erase a dot.	PRESET (100, 100)

COMMANDS FOR SCREEN DATA PROCESSING

format	function	example
COPY (X1, Y1)-(X2, Y2) [, source page] TO (X3, Y3), [destination page], [logical operation]	Transfer image data in the VRAM to other sectors in the VRAM	COPY (20, 30)-(70, 50), 1 TO (90, 60), 0, AND
COPY (X1, Y1)-(X2, Y2) [, source page] TO array variable name	Transfer image data in the VRAM to an array variable	COPY (20-,30)-(70,50), 0 TO S
COPY array variable name [, direction] TO (X3, Y3), [destination page], [logical operation]	Transfer image data in an array variable to the VRAM	COPY S,1 TO (100, 100), 1, XOR
 COPY (X1, Y1)-(X2, Y2) [, source page] TO "[drive name] file name [. type name]"	Save the image data in the VRAM to the disk file.	COPY (10, 10)-(120, 90) TO "PORTRAIT.PIC"
 COPY "[drive name] file name [. type name]" [, direction] TO (X3, Y3), [destination page], [logical operation]	Load image data in the disk file to the VRAM	COPY "PORTRAIT.PIC" TO (10, 10)
 COPY "[drive name] file name [. type name]" TO array variable name	Load image data in the disk file to the array variable	COPY "PORTRAIT.PIC" TO S
 COPY array variable name TO "[drive name] file name [. type name]"	Save the image data in an array variable to the disk file.	COPY S TO "PORTRAIT.PIC"
COPY SCREEN [mode], [mask]	Digitize an external video signal and write it in the VDP. (used only with computers that have the digitize function) Mode 0: the signal of 1 field is digitized and written on the display page 1: signals of 2 fields (1 frame) are digitized: one is written on the display page, and one is written on the page whose page number is smaller than that of the display page by one.	

Graphic subcommands (When B is added, a subcommand changes the starting point only without drawing lines.
If N is added, it draws lines but does not move starting point.)

subcommand	function	initial value	subcommand	function	initial value
Mx, y	To an absolute position (x, y)		Fn	Move down to the right.	n=1
M±x, ±y	Move by ±x, ±y from current position.		Gn	Move down to the left.	n=1
Un	Move up.	n=1	Hn	Move up to the left.	n=1
Dn	Move down.	n=1	An	Rotate the coordinate system.	
Rn	Move to the right.	n=1	Cn	Specify a color.	n=15
Ln	Move to the left.	n=1	Sn	Specify the unit number of dots.	n=4
En	Move up to the right.	n=1	X string type variable;	Execute the subcommand assigned to the string type variable.	

COMMANDS FOR MUSIC PERFORMANCE

format	function	example
BEEP	Generate a beep sound.	BEEP: BEEP: BEEP
SOUND PSG register number, expression	Write data into PSG register.	SOUND 7, 7
PLAY "music subcommands" [, "music subcommands"] [, "music subcommands"]	Play music.	PLAY "O4L4CEGEL1C"

Music subcommands

subcommand	function and range	initial value	subcommand	function and range	initial value
A $\left[\begin{array}{c} \# \\ + \\ - \end{array} \right] -$ G $\left[\begin{array}{c} \# \\ + \\ - \end{array} \right]$	Music notes		Tn	Tempo $32 \leq n \leq 255$	n=120
On	Octave $1 \leq n \leq 8$	n=4	Vn	Volume $0 \leq n \leq 15$	n=8
Nn	Pitch $0 \leq n \leq 96$		Mn	Envelope frequency $1 \leq n \leq 65535$	n=255
Ln	Length $1 \leq n \leq 64$	n=4	Sn	Envelope pattern $1 \leq n \leq 15$	n=1
Rn	Rest $1 \leq n \leq 64$	n=4		Dot	
X string type variable;	Execute the subcommand assigned to the string type variable.				

COMMANDS FOR PROGRAM AND DATA FILES

format	function	example
MAXFILES=expression	Set the number of files that can be opened in a program.	MAXFILES=3
OPEN "[device name] [file name [. type name]]" [FOR mode] AS [#] file number [LEN=record length]	Open a file and specify a mode. Modes: OUTPUT.. Write INPUT Read When the mode is specified a sequential file is opened. When the mode is not specified, a random access file is opened.	OPEN "CRT : TEST" FOR OUTPUT AS #1
PRINT # file number, [expression] [separator] [expression]	Write data into sequential file in sequence.	PRINT #1, "ABC"
PRINT # file number, USING format symbol; expression [, expression] ...	Write data into sequential file in sequence in the specified format. (See PRINT USING.)	PRINT #1, USING "\ \";A\$
INPUT # file number, variable [, variable] ...	Read data from sequential file in sequence and assign them to variables.	INPUT #1, A, B, C
LINE INPUT # file number, string type variable	Read string up to 254 characters from sequential file and assign them to variable.	LINE INPUT #1, A\$
CLOSE [#] [file number] [, file number] ...	Close files.	CLOSE #1, 2
SAVE "[device name] [file name]"	Save an ASCII format program (other than disk).	SAVE "CAS:PROGRAM"
 SAVE "[drive name] file name [. type name]" [,A]	Save a program on the disk. The program is saved in the ASCII format when the A option is specified, and in intermediate language when the A option is omitted.	SAVE "GAME1.BAS" SAVE "GAME2.ASC",A
LOAD "[device name] [file name]"	Load an ASCII format program (other than disk).	LOAD "CAS:PROGRAM"
 LOAD "[drive name] file name [. type name]" [,R]	Load a program from the disk.	LOAD "GAME1.BAS";R
MERGE "[device name] [file name]"	Load an ASCII format program and merge it with the program in memory.	MERGE "CAS:PROG2"

 MERGE "[drive name] [file name [. type name]]"	Load a program from the disk saved in the ASCII format and merge it with a program in memory.	MERGE "GAME2.ASC"
BSAVE "[device name] [file name]"; start address, end address [, execution starting address]	Save the contents of memory within the specified range (other than disk).	BSAVE "CAS:GAME"; &H3000, &H3FFF
 BSAVE "[drive name] [file name [. type name]]"; start address, end address [, execution start address] {[,S]}	Save the content of the main memory (without S option) or the video RAM on the disk (with S option).	BSAVE "PROG.BIN"; &HE000, &HE8000 BSAVE "CHART"; 0, &H3FFFS
BLOAD "[device name] [file name]" [, R] [, offset]	Load machine language program (other than disk). Load and execute program when, R is added. The offset is one for the memory address at the time of loading.	BLOAD "CAS:GAME"; R
 BLOAD "[drive name] [file name [. type name]]" {[,R]} {[,S]} [, offset]	Load a machine language program from the disk. When the R option is specified, loads the program and executes it. When the S option is specified, loads the file data to the video RAM.	BLOAD "PROG.BIN";R BLOAD "CHART";S
CSAVE "file name" [, baud rate]	Save a program onto cassette tape in intermediate language. Baud rate: 1. 1200 baud 2. 2400 baud	CSAVE "STAR"
CLOAD ["file name"]	Load program from cassette tape.	CLOAD "STAR"
CLOAD? ["file name"]	Compare program saved on cassette tape and program in memory.	CLOAD? "STAR"
 FIELD [#] file number, character length AS string variable [,character length AS string variable]	Define 1 random access file record.	FIELD # 1, 12, AS NAM\$, 14 AS TEL\$
 LSET string variable= string expression RSET string variable= string expression	Write the content of a string expression to the string variable defined in the record. (LSET provides left justification; RSET provides right justification)	LSET TEL\$=B\$ RSET NAM\$="TOM"
 PUT [#] file number [, record number]	Write the content of a record to a random access file on the disk.	PUT #1,1
 GET [#] file number [, record number]	Read 1 record from a random access file on the disk.	GET #1, 10

Device name

CAS:..... Cassette tape
 CRT:..... Text mode screen
 GRP:..... Graphic mode screen
 LPT:..... Printer
 MEM:..... Memory disk
 A:..... Floppy disk drive names
 B:..... Floppy disk drive names
 C:..... Floppy disk drive names
 D:..... Floppy disk drive names
 E:..... Floppy disk drive names
 F:..... Floppy disk drive names
 G:..... Floppy disk drive names
 H:..... Floppy disk drive names

COMMANDS FOR FLOPPY DISK AND MEMORY DISK MANAGEMENT

format	function	example
CALL FORMAT	Format a disk.	
 FILES [{"drive name"} [file name [. type name]]]	Display file names saved on the disk.	FILES FILES " * .BAS"
 KILL [{"drive name"} file name [. type name]]	Erase a file on the disk.	KILL "TEST.BAS"
 NAME [{"drive name"} old file name [. old type name]] AS "new file name [. new type name]]"	Change the name of a file on the disk.	NAME "OLD.DAT" AS "NEW.DAT"
 COPY [{"drive name 1"} file name [.type name]] [TO [{"drive name 2"} file name [.type name]]]	Copy a file on the disk to the same disk or to another disk.	COPY "ABC.BAS" TO "XYZ.BAS" COPY "A:ABC.BAS" TO "B:"
CALL MEMINI [(size)]	Allocate a section of memory to be used as a memory disk, and initialize it.	CALL MEMINI (20000)
CALL MFILES	Display file names on the memory disk.	
CALL MKILL ("file name [.type name]]")	Erase a file on the memory disk.	CALL MKILL ("ADRS.DAT")
CALL MNAME ("old file name [. old type name]]" AS "new file name [. new type name]]")	Change a file name on the memory disk.	CALL MFILES ("OLD.DAT" AS "NEW.DAT")

COMMANDS FOR INTERRUPT

format	function	example
ON KEY GOSUB line number [, line number] ...	Interrupt with a function key.	ON KEY GOSUB 1000, 2000, 3000
KEY (function key number) ON	Enable an interrupt with a function key.	KEY (1) ON
KEY (function key number) OFF	Disable an interrupt with a function key.	KEY (2) OFF
KEY (function key number) STOP	Hold an interrupt with a function key.	KEY (3) STOP
ON STRIG GOSUB line number [, line number] ...	Interrupt with a trigger button of the joystick.	ON STRIG GOSUB 1000, 2000
STRIG (pointing device number) ON	Enable an interrupt with a joystick. Joystick number: 0 space bar 1 joystick 1 2 joystick 2	STRIG (1) ON
STRIG (pointing device number) OFF	Disable an interrupt with a joystick.	STRIG (2) OFF
STRIG (pointing device number) STOP	Hold an interrupt with a joystick.	STRIG (0) STOP
ON STOP GOSUB line number	Interrupt with the CTRL and STOP keys.	ON STOP GOSUB 1000
STOP ON	Enable an interrupt with the CTRL and STOP keys.	
STOP OFF	Disable an interrupt with the CTRL and STOP keys.	
STOP STOP	Hold an interrupt with the CTRL and STOP keys.	
ON SPRITE GOSUB line number	Interrupt with an overlap of sprite patterns.	ON SPRITE GOSUB 1000
SPRITE ON	Enable an interrupt with an overlap of sprite patterns.	
SPRITE OFF	Disable an interrupt with an overlap of sprite patterns.	
SPRITE STOP	Hold an interrupt with an overlap of sprite patterns.	
ON INTERVAL= interval time GOSUB line number	Interrupt after an interval. Time between interrupts is the interval \times 1/50 second.	ON INTERVAL=120 GOSUB 1000
INTERVAL ON	Enable intervalled interrupts.	
INTERVAL OFF	Disable intervalled interrupts.	
INTERVAL STOP	Hold intervalled interrupts.	

COMMANDS FOR CONNECTED DEVICES

format	function	example
LPRINT [expression] [separator] [expression] [separator] [expression] ...	Output data on the printer.	LPRINT A, B, C
LPRINT USING format symbol; expression [separator] [expression] [separator] ...	Output data on the printer in the specified format. (See PRINT USING.)	LPRINT USING "###"; A, B
LLIST [starting line number] [-] [end line number]	Print program list on a connected printer.	LLIST 100-200
MOTOR { ON OFF }	Turn the tape recorder motor on or off.	MOTOR OFF

COMMANDS FOR INTERNAL CLOCK

format	function	example
SET DATE "DD/MM/YY" [,A]	Set the date on the internal clock.	SET DATE "05/10/85"
GET DATE D\$ [,A]	Assign the current date to a variable.	GET DATE D\$
SET TIME "HH:MM:SS" [,A]	Set the time on the internal clock.	SET TIME "14:05:00"
GET TIME T\$ [,A]	Assign the current time to a variable.	GET TIME T\$

COMMANDS FOR ERROR PROCESSING

format	function	example
ERROR error number	Generate an error of the specified error code. Define error codes.	ERROR 3 IF A > 100 THEN ERROR 250
ON ERROR GOTO line number	Transfer control to the specified line when an error occurs.	ON ERROR GOTO 1000
RESUME { 0 line number } NEXT	Return control to the main program after executing an error processing routine.	RESUME 10

COMMANDS FOR MACHINE LANGUAGE SUBROUTINES

format	function	example
DEFUSR [integers]=starting address	Define the starting address of user subroutine.	DEFUSR0=53248
POKE address, expression	Write data into memory.	POKE &HA400, &HFF

COMMANDS FOR I/O PORT AND MEMORY

format	function	example
OUT port number, expression	Output data to the I/O port.	OUT &H90, 3
WAIT port number, expression 1 [, expression 2]	Hold program execution until the input data from the I/O port reaches a certain value.	WAIT &H90, 255
VPOKE address, expression	Write one bit of data to the video RAM.	VPOKE 263, 01

COMMANDS FOR EXTENDED COMMANDS

format	function	example
CALL subroutine name or __subroutine name CALL extended command [argument, argument ...] or __extended command [argument, argument ...]	Transfer control to the machine language subroutine, or transfer control to an extended command of the ROM cartridge.	CALL SUB

COMMAND FOR SHIFTING CONTROL TO MSX-DOS

format	function	example
 CALL SYSTEM	Shift control to MSX-DOS.	

FUNCTIONS

NUMERICAL FUNCTIONS

ABS (X)	: Give an absolute value.
ATN (X)	: Give arc tangent.
CDBL (X)	: Convert to the double precision type.
CINT (X)	: Convert to the integer type. ($-32768 \leq X \leq 32767$)
COS (X)	: Give cosine of X radians.
CSNG (X)	: Convert to the single precision type.
ERL	: Give the number of the line with an error.
ERR	: Give the error code.
EXP (X)	: Give e^x .
FIX (X)	: Give the integer part of X
INT (X)	: Give the maximum integer less than or equal to X
LOG (X)	: Give natural logarithm.
RND (X)	: Give random number.
SGN (X)	: Give 1 if $X > 0$, 0 if $X = 0$ and -1 if $X < 0$
SIN (X)	: Give sine of X radians.
SQR (X)	: Give square root.
TAN (X)	: Give tangent of X radians.

STRING FUNCTIONS

LEFT\$ (X\$, N)	: Give N characters from the left of X\$.
MID\$ (X\$, M [, N])	: Give N characters beginning with the Mth character from the left of X\$.
RIGHT\$ (X\$, N)	: Give N characters from the right of X\$.
SPACES\$ (N)	: Give N spaces.
STRING\$ (N, J)	: Give N characters whose character code is J.
STRING\$ (N, X\$)	: Give N times the first character of X\$.
TAB (N)	: Move the cursor to the Nth position.
SPC (N)	: Give N spaces.

FUNCTION FOR CONVERSION BETWEEN NUMERICAL AND STRING TYPES

ASC (X\$)	: Give the character code of the first character of X\$.
BIN\$ (X)	: Give a binary expression of X as a string type data. ($-32768 \leq X \leq 65535$)
CHR\$ (X)	: Give a character whose character code is X.
HEX\$ (X)	: Give a hexadecimal expression of X as a string type data. ($-32768 \leq X \leq 65535$)
INSTR ([N,] X\$, Y\$)	: Give the position of Y\$ after the Nth character of X\$.
LEN (X\$)	: Give a number of characters of X\$.
OCT\$ (X)	: Give an octal expression of X as a string type data. ($-32768 \leq X \leq 65535$)
STR\$ (X)	: Convert to the string type.
VAL (X\$)	: Convert to the numeric type.
<input type="checkbox"/> CVI, CVS, CVD	: Change character string data in a random access file to numeric data.
<input type="checkbox"/> MKI\$, MKS\$, MKD\$: Change numeric data into string data to write in a random access file.

OTHER FUNCTION

PLAY (N)	: Check if music is playing. When N=1, 2 or 3 it gives -1 when music is playing; otherwise it gives 0. When N=0, the status (-1 or 0) of each music subcommand are ORed and the result is given.
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FUNCTIONS FOR DATA INPUT

From the screen

CSRLIN : Give y-coordinate of the cursor.
 POS (X) : Give x-coordinate of the cursor.
 POINT (X, Y) : Give color code at point (X, Y).

From data file

EOF (file number) : Give -1 when last data in file is read; otherwise give 0.
 INPUT\$(N, [#] file number) : Input and give N characters from the file.
 LOF (file number) : Give the file length (bytes).
 LOC (file number) : Give the current location in the file.

From the printer

LPOS (X) : Give the position of the print head in the printer buffer.

From memory

FRE (0) : Give unused area in memory.
 FRE (" ") : Give unused part or string area.
 PEEK (address) : Give the memory contents of the address.
 VARPTR (variable) : Give the starting address of the memory area storing the variable.
 VARPTR (# file number) : Give the first address of the file control block to which the specified file is assigned.
 VPEEK (address) : Give the video RAM contents of the address.

From the keyboard

INKEY\$: Give the character corresponding to the pressed key.
 INPUT\$(X) : Input X characters from the keyboard.
 DSKF (drive number) : Give the space remaining in the disk in cluster units.

From I/O port

INP (port number) : Input data from the I/O port.

From machine language subroutine

USR { 0 to 9 } (X) : Give the value from the user subroutine.

From joystick, paddle or touch pad

STICK (N) : Give the direction of the joystick. (N=0 for cursor move keys)
 (Center=0, Up=1, Right up=2, Right=3, Right down=4, Down=5, Left down=6, Left=7, Left up=8)
 STRIG (N) : Give -1 when the joystick trigger button is pressed; otherwise, give 0. (N=0 for the space bar)
 PDL (N) : Input data from the paddle.
 PAD (N) : Give status of the touch pad, light pen, mouse, or track ball.
 When N=0 or 4: Give -1 if the touch pad is touched; otherwise, give 0.
 When N=1 or 5: Give the x-coordinate of the position where the touch pad is touched.
 When N=2 or 6: Give the y-coordinate of the position where the touch pad is touched.
 When N=3 or 7: Give -1 if the touch pad switch is touched; otherwise, give 0.
 N=8: -1 if light pen data is valid; 0 if invalid
 N=9: light pen X-coordinate
 N=10: light pen Y-coordinate
 N=11: -1 if light pen switch is pressed; 0 if not pressed
 N=12 or 16: request mouse or track ball input (-1 is always returned)
 N=13 or 17: mouse or track ball X-coordinate
 N=14 or 18: mouse or track ball Y-coordinate
 N=15 or 19: 0 is always returned

CONSTANTS AND VARIABLES

Constant	String type	Character string of 0 to 255 characters (enclosed in quotation marks)
	Integer type	- 32768 to + 32767
	Floating-point type	Significant digits: 6 (single precision) or 14 (double precision) Exponent part: - 64 to + 62
	Hexadecimal expression	Takes a prefix "&H"
	Octal expression	Takes prefix "&O" or "O"
	Binary expression	Takes a prefix "&B"

Variable	Variable name	First two characters are effective.
	Type declarator	Written after variable name % : Integer type ! : Single precision # : Double precision \$: String type

SPECIAL VARIABLES

TIME : Retain a value in the timer. Can be rewritten.

SPRITES (sprite number) : Retain the sprite pattern.

[Example] SPRITES(1)=CHR\$(&H18)+CHR\$(&H3C)+CHR\$(&H7E)+CHR\$(&HFF)+CHR\$(&H18)+CHR\$(&H18)+CHR\$(&H18)+CHR\$(&H18)

● Special commands and functions for VDP (Video Display Processor)

BASE (expression) : Used to read or write the base address of the VDP table.

VDP (numeric value) : Used to read or write the contents of the VDP register.

ERROR MESSAGES

1 NEXT without FOR	: No FOR statement corresponding to NEXT statement.
2 Syntax error	: Syntax error in the statement.
3 RETURN without GOSUB	: No GOSUB statement corresponding to RETURN statement.
4 Out of DATA	: No more data to be read.
5 Illegal function call	: Illegal specification in function or command.
6 Overflow	: Too big or too small data.
7 Out of memory	: No more memory.
8 Undefined line number	: Undefined line number was specified.
9 Subscript out of range	: Array subscript outside defined range.
10 Redimensioned array	: Array in DIM statement was already specified.
11 Division by zero	: Divided by zero.
12 Illegal direct	: The command can not be used in direct command mode.
13 Type mismatch	: Data type mismatch.
14 Out of string space	: No more string variable area.
15 String too long	: String is too long.
16 String formula too complex	: String is too complex.
17 Can't CONTINUE	: Impossible to continue program execution.
18 Undefined user function	: A function which is not defined by DEF FN statement was used.
19 Device I/O error	: Error in connected equipment.
20 Verify error	: Program in cassette tape and program in memory differ.
21 No RESUME	: No RESUME statement that corresponds to ON ERROR statement.
22 RESUME without error	: No ON ERROR statement that corresponds to RESUME statement.
23 Unprintable error	: An error without an error message has occurred.
24 Missing operand	: Operand is missing.
25 Line buffer overflow	: The entered program exceeds the buffer size.

50	FIELD overflow	: The specified area of a FIELD statement has exceeded the length of the record.
51	Internal error	: Memory content or text is not normal.
52	Bad file number	: Incorrect file number.
53	File not found	: The specified file does not exist.
54	File already open	: The file is already open.
55	Input past end	: Last data has been already read.
56	Bad file name	: Incorrect file specification.
57	Direct statement in file	: Command in direct command mode was entered during file loading.
58	Sequential I/O only	: When a GET statement or PUT statement is attempted for a sequential file.
59	File not OPEN	: The file needs to be opened.
60	Bad FAT	: The disk has not been formatted.
61	Bad file mode	: Sequential file, random access file command or function mistake.
62	Bad drive name	: Disk drive not in use was specified.
63	Bad sector number	: Record specified in PUT or GET statement is 0 or larger than 32767.
64	File still open	: File has not been closed.
65	File already exists	: New file name specified in a NAME, CALL MNAME statement already exists.
66	Disk full	: No more space on the disk.
	[RAM] disk full	: No space on the memory disk.
67	Too many files	: The number of files has exceeded 255.
68	Disk write protected	: Writing was performed on a write-protected disk.
69	Disk I/O error	: An error occurred which makes recovery impossible at the time of disk input or output.
70	Disk offline	: Disk drive is not connected.
	[RAM] disk offline	: Memory disk use was attempted without executing CALL MEMINI.
71	Rename across disk	: NAME statement was attempted between different disk drives.

COLOR CODE

code	color	code	color
0	Transparent	8	Medium red
1	Black	9	Light red
2	Medium green	10	Dark yellow
3	Light green	11	Light yellow
4	Dark blue	12	Dark green
5	Light blue	13	Magenta
6	Dark red	14	Gray
7	Sky blue	15	White

OPERATORS

Arithmetic operators	\wedge power $-$ change signs $*,/$ multiplication, division \backslash integral division MOD integral residue $+, -$ addition, subtraction (Priority increases from bottom to up)
Relational operators	$< > =$ comparison
Logical operators	NOT negation AND logical product OR logical sum XOR exclusive logical sum EQV negation of exclusive logical sum IMP implication