HB-G900P/F

SERVICE MANUAL

PERSONAL COMPUTER

SONY®

Part 1
Scanned and converted to PDF by HansO, 2001
Original by Bas Kornalijnslijper, MCWF

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HB-G900P/F

CHAPTER 1
OPERATION

1-1. OPERATION

TABLE OF CONTENTS

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

WARNING

To prevent fire or shock hazard, do not expose the unit to rain or moisture.

To avoid electrical shock, do not open the cabinet. Refer servicing to qualified personnel only.

WARNING FOR THE CUSTOMERS IN THE UNITED KINGDOM
THIS APPARATUS MUST BE EARTHED

IMPORTANT
The wires in this mains lead are coloured in accordance with the following code:
   Green-and-yellow: Earth
   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 green-and-yellow must be connected to the terminal in the plug which is marked by the letter E or by the safety earth symbol ⏚ or coloured green or green-and-yellow. 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.

FEATURES

Computer of MSX Version 2.0
This computer is designed on the MSX standards Version 2.0, the powerful version of MSX, especially on graphics.
To display clear pictures, this computer is equipped with an analog RGB connector for a color monitor.
The built-in MSX-BASIC Version 2.0[1] has many commands, statements and functions which give the use of the features of the MSX Version 2.0.

Extended MSX2-BASIC commands for controlling a videodisc player (Video Utility)
The built-in MSX2-BASIC has extended commands which allow you to control a Sony LDP-180P videodisc player from the computer.

"Genlock" synchronization capability
This computer utilizes a circuit that allows GENLOCK synchronization of the computer video output with an external video signal. When the computer video signal is gen-locked to an external video signal, video and color synchronization problem do not occur, and the computer images can be overlayed (superimposed) onto the video images or these images can be switched. When this computer is used in conjuction with a Sony HBI-G900P Videotizer, the superimposed images can be recorded.

Built-in floppydisk drive
The built-in disk drive allows you to read or write data/programs on a 3.5-inch micro floppydisk, either single- or double-sided.
A Sony HBD-900 micro floppydisk drive unit can be built in this computer as the second disk drive.

Resident RS-232C interface
This computer is equipped with an RS-232C interface connector which enables the communication between this computer and other apparatus. The built-in MSX2-BASIC also has extended commands for RS-232C communication.

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1) In this manual, MSX-BASIC Version 2.0 is referred to as MSX2-BASIC.

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SUPPLIED MANUALS AND A DISK

MANUALS

The following manuals are supplied with this computer. Please refer to the appropriate manuals according to your intended use of the computer.

Operating Instruction (this manual)
Provides a system outline and basic handling instructions. Please read this manual first.

A Guide to MSX-BASIC Version 2.0
This book introduces you to MSX2-BASIC. It consists of two courses: the introductory course is for those who are learning BASIC for the first time and the advanced course gives more details about MSX2-BASIC.

MSX-BASIC Version 2.0 Programming Reference Manual
Provides a detailed explanation of each MSX2-BASIC command and gives program examples so that MSX2-BASIC can be fully utilized by the BASIC user.
Explanation of MSX-DOS is also included in this manual.

Reference Chart
All MSX2-BASIC commands are briefly explained. Please use this chart as a handy reference during daily programming.

Video Utility
Provides the usage and detailed explanation of the extended MSX2-BASIC commands which control a videodisc player.

A Guide to RS-232C Communication
Explains the RS-232C standards for communication between this computer and other apparatus and explains in detail the commands for communication.

DISK

MSX-DOS/Character Font System and Font Disk
MSX disk operating system, MSX-DOS, for use with the softwares to be commercially available in the future is included. For explanation of MSX-DOS and its commands, refer to the MSX-BASIC Version 2.0 Programming Reference Manual.
This disk also includes character font files for the Video Utility built-in the computer. Refer to the supplied Video Utility manual.

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PRECAUTIONS

On safety
- Operate the unit on 220V–240V AC.
- Should any solid object or liquid fall into the cabinet, turn the power off and have the unit checked by qualified personnel before operating it any further.
- Unplug the unit from the wall outlet if it is not to be used for an extended period of time.
- Do not place or drop heavy objects on the power cord. Use of a damaged cord is dangerous. To disconnect the cord, pull it out by the plug—never pull the cord itself.
- The nameplate indicating operating voltage, power consumption, etc. is located on the bottom.
- The caution labels are located on the bottom of the unit.

On installation
- The computer consists of high-precision electronic parts. Do not drop it or bump it against other objects. Do not place it in a place subject to vibration or on an unstable bases.
- Do not install the unit near heat sources such as a radiator or an air duct, or in a place subject to direct sunlight, excessive dust, and/or moisture.
- Provide adequate air circulation to prevent internal heat build-up. Do not place the unit on surfaces (rugs, blankets) or near materials (curtains, draperies) that may block the ventilation slots.
- Use only the specified peripheral equipment; otherwise, trouble may result. Before connecting peripheral equipment, be sure to turn the power off or the internal IC chip may be damaged.
- Do not place an electric equipment which incorporates an electromagnet, such as a TV set or a speaker, near this unit. If affected by an electromagnetic field, it may malfunction.
- Since the computer handles high-frequency signals, use of the computer near a radio, TV, audio tuner, etc., may cause noise in the operation of such equipment. In such cases, move the computer and the equipment in question away from each other.

On cleaning
- Clean the cabinet and keyboard with a soft, dry cloth, or a soft cloth lightly moistened with a mild detergent solution. Do not use any type of solvent, such as alcohol or benzine, which might damage the finish.

DISK CARE

Disk handling
- Use only 3.5-inch micro floppydisks, either single- or double-sided with an 80-track per side system. Manual-shutter type disks cannot be used.
- Before using a new (unused) disk, be sure to "format" the disk to prepare it to store and read data by using a fixed format. See "FORMAT" command in the MSX-BASIC Version 2.0 Programming Reference Manual. Note that formatting of a disk erases all previous information stored on that disk.
- Never touch the exposed surface of the disk. Even minor dirt or dust may adversely affect contact with the head or cause a disk read/write error.
- Keep disks away from equipment with magnets, such as speakers or amplifiers, because their magnets could cause erasure or dropouts of stored data.
- Do not expose disks to direct sunlight, extremely cold temperature, or moisture.
- Protect disks from dust by storing them in their case or a box.

Write protect tab
- A write-protect tab is attached to the back of the disk to protect your recorded information. Make sure that this tab is in upper position to record data on the disk. To prevent the loss of recorded data due to accidental erasure, slide the tab downwards as shown.
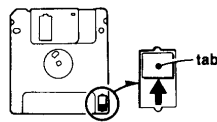
Possible to write　　　　　**Write protected**
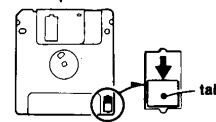
Label
- Use the specified labels.
- If there is no space to write on a label, peel the label off, and attach a new label. Do not attach a new label over the old one, because the cumulative thickness may cause a read/write error or trouble with the micro floppydisk unit.

If trouble occurs, unplug the unit, and contact your designated Sony dealer.

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PARTS IDENTIFICATION

Front panel

1	Power switch/indicator
2	GENLOCK indicator
3	Display indicators
4	Disk insertion slot
5	IN USE indicator
6	Disk eject button
7	RESET button
8	Cartridge slot 1
9	COMPUTER SOUND control
10	CONTROLLER A/B jacks
11	KEYBOARD jack

1 Power switch/indicator
Press to turn on the power, and the indicator lights. Press again to turn off the power.

2 GENLOCK indicator
This indicates the current genlock mode. It lights when the computer output is in the external synchronization mode and goes off when in the internal synchronization mode.

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3 Display indicators
These indicate the image(s) displayed on the color monitor connected to the computer. The image to be displayed is selected by specifying the "mode" parameter of the MSX2-BASIC SET VIDEO command.

COMPUTER:	Lights when the computer output is to be displayed. (When "mode" is 0.)
SUPERIMPOSE:	Lights when the computer output is superimposed over the external video signal. (When "mode" is 1 or 2. However, only the computer output is visible in mode 1.)
VIDEO:	Lights when the external video signal is to be displayed. (When "mode" is 3.)

For details, refer to "SUPERIMPOSE FUNCTION".

4 Disk insertion slot
Insert a disk here.

5 IN USE indicator
The indicator lights while data is being read or written on the disk. Do not turn off the power of the computer, press the RESET button or eject the disk while this indicator in on.

6 Disk eject button
Press to eject a disk.

7 RESET button
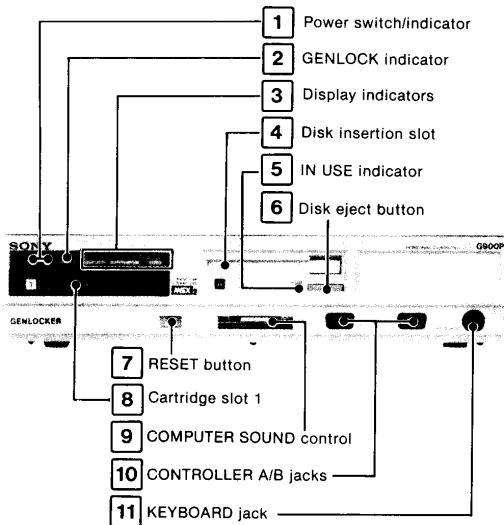Press to reset the computer to the initial state. When the computer is reset, the contents of the built-in memory will be destroyed.

8 Cartridge slot 1
Insert an MSX ROM, RAM or interface cartridge.

9 COMPUTER SOUND control
Slide to adjust the volume of the computer sound.
The volume of the sound input from the AUDIO IN jacks [13] or RGB connector [18] and output from the AUDIO OUT jacks [14] and RGB connector is not changed using this control.
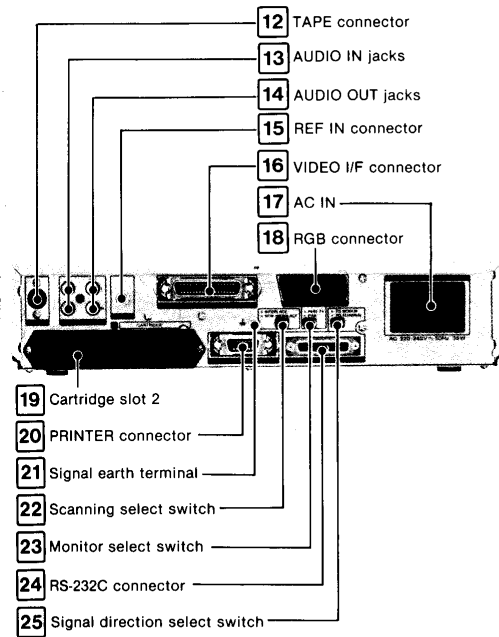
10 CONTROLLER A/B jacks
Connect joystick controllers.

11 KEYBOARD jack
Connect the supplied keyboard.

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Rear panel


```
┌12┐ TAPE connector
┌13┐ AUDIO IN jacks
┌14┐ AUDIO OUT jacks
┌15┐ REF IN connector
┌16┐ VIDEO I/F connector
┌17┐ AC IN
┌18┐ RGB connector
```

```
┌19┐ Cartridge slot 2
┌20┐ PRINTER connector
┌21┐ Signal earth terminal
┌22┐ Scanning select switch
┌23┐ Monitor select switch
┌24┐ RS-232C connector
┌25┐ Signal direction select switch
```

[12] TAPE connector (8-pin DIN)

Connect to a tape recorder to save or load a program or data.

[13] AUDIO IN jacks (phono)

Connect to the audio output of the external video equipment. The audio signal from these jacks can be mixed with the computer sound and can be output from the AUDIO OUT jacks [14] and the RGB connector [18] .

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[14] AUDIO OUT jacks (phono)

Connect to the audio input of the color monitor or audio equipment. The computer sound and/or the external audio sound is output through these jacks. The MSX2-BASIC SET VIDEO command selects the output sound signal.

When the computer's power is off, the sound from the AUDIO IN jacks will be output from these jacks.

[15] REF IN connector (BNC)

Connect to the video output of the extenal video equipment. The computer's video output signal can be synchronized with the video signal input from this connector. The computer picture can be superimposed over the video picture of the signal input from this connector.

[16] VIDEO I/F connector (36-pin)

Connect a Sony HBI-G900P Videotizer.

[17] AC IN

Connect to a wall outlet using the supplied ac power cord.

[18] RGB connector (21-pin)

Connect a color monitor equipped with a peri-TV connector (21-pin) or a Sony PVM monitor equipped with an RGB connector (25-pin).

[19] Cartridge slot 2

Insert an MSX ROM, RAM or interface cartridge.

[20] PRINTER connector (14-pin)

Connect an 8-bit parallel transfer printer of MSX specifications.

[21] Signal earth terminal

[22] Scanning select switch

This switch is effective only when the internal synchronization is selected by the MSX2-BASIC SET VIDEO command.

Depress and lock the switch (NON INTERLACE) to select non-interlace scanning.

Press again and release (INTERLACE) to select interlace scanning. Normally, select interlace scanning mode. When the characters displayed on the screen is invisible, select non-interlace scanning.

[23] Monitor select switch

Depress and lock the switch (PVM) when a Sony PVM monitor equipped with an RGB connector (25-pin) is connected.

Press again and release (PERI-TV) when a color monitor equipped with a peri-TV connector (21-pin) is connected.

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24 **RS-232C connector (25-pin)**

This connector is used for serial data communication with other computer systems or peripherals equipped with an RS-232C connector.

25 **Signal direction select switch**

Depress and lock the switch (TO TERMINAL) to connect to a terminal device (DTE) for RS-232C communications.
Press again and release (TO MODEM) to connect to a modem (DCE).

Keyboard
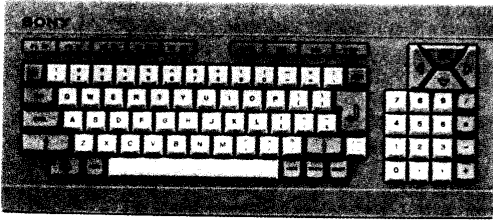
Use to enter programs and data into the computer.

CONNECTIONS

Before making connections, be sure to turn off the computer and all the devices to be connected.

CONNECTING THE KEYBOARD

Align and insert

KEY-BOARD

Keyboard, supplied

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13
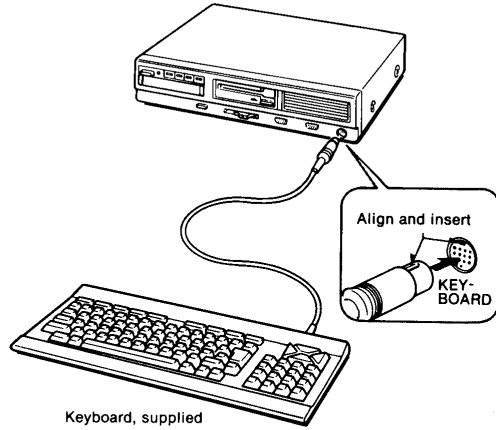
CONNECTING A COLOR MONITOR

To connect a color monitor equipped with a peri-TV connector (21-pin)

Set to ⊓ (PERI-TV)

RGB

Computer (rear)

to peri-TV connector

VMC-212ICE (optional)

Color monitor
Sony KX 14CP1, etc.
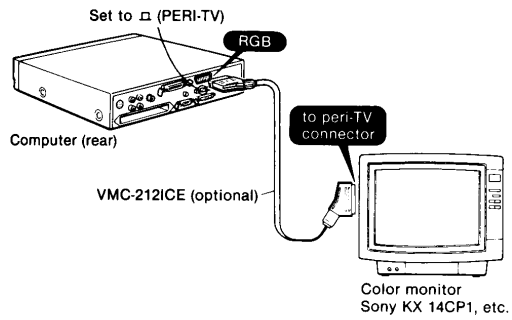
To connect a Sony PVM color monitor equipped with an RGB connector (25-pin)

Set to ⊐ (PVM)

RGB

Computer (rear)

HBK-2125CE (optional)

to 25-pin analog RGB

Color monitor
Sony PVM-137IQ, etc.
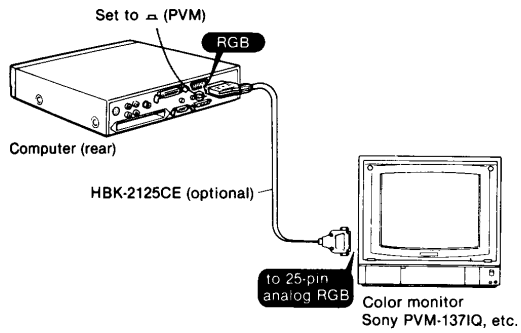
CONNECTING A JOYSTICK CONTROLLER

CONTROLLER

Computer

Joystick controller
Sony JS-55, etc.

CONNECTING A PRINTER

Computer (rear)

PRINTER

Printer
Sony PRN-T24, etc.

Cable appropriate for the computer and the printer

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15
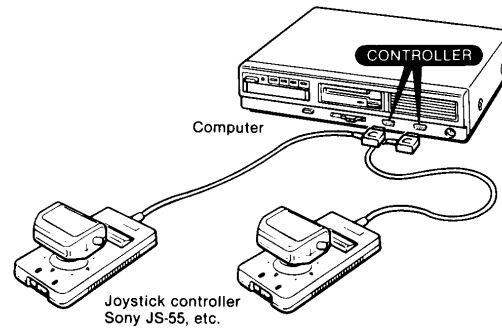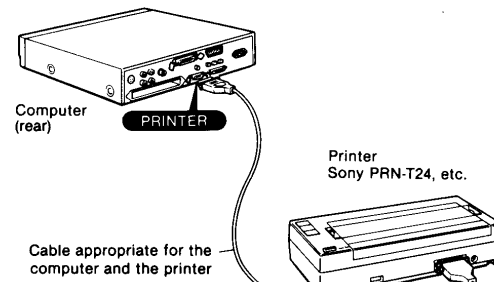
CONNECTING A TAPE RECORDER FOR USE AS AN EXTERNAL MEMORY

HBK-50 cassette interface cable (optional)

Data recorder
Sony SDC-500, etc.

White: to earphone jack

Black: to remote control jack

Red: to microphone jack
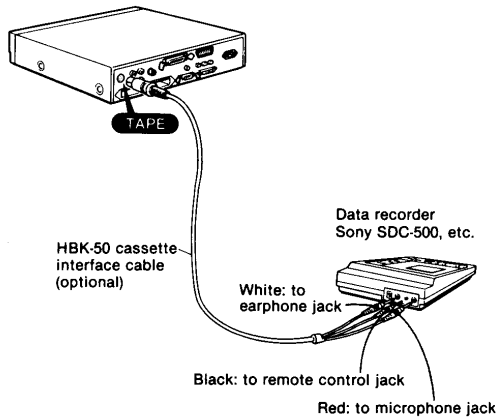
● If the recorder does not have a remote control jack, leave the black plug unconnected.

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HOW TO START UP

TO START MSX-DISK BASIC

1 Remove any program cartridges and floppydisks from the cartridge and disk slots.
2 Turn on the color monitor and computer.
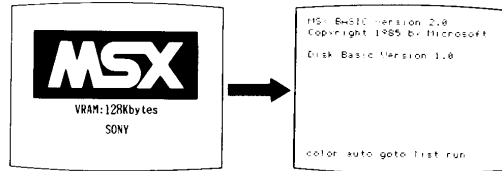
The computer enters the MSX-Disk BASIC command state.
You can now enter BASIC program or use commercially available BASIC programs.
MSX-Disk BASIC includes all MSX2-BASIC commands and the commands which allow you to make use of floppydisks at the same time.
You can also use the extended commands for controlling a videodisc player (Video Utility) and for RS-232C communication.
When programming your own BASIC program, refer to the "MSX-BASIC Version 2.0 Programming Reference Manual" and "A Guide to MSX-BASIC Version 2.0". For the video utility commands, refer to the Video Utility manual supplied. For RS-232C communication, refer to "A Guide to RS-232C Communication". When using commercially available BASIC programs, refer to the manual supplied with the program.

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● Some commercially available BASIC programs may not be used with the MSX-Disk BASIC. It can only be used with the MSX2-BASIC. To start the MSX2-BASIC:

1 Remove any program cartridges or floppydisks from the cartridge and disk slots.
2 Turn on the color monitor.
3 While pressing the ⌈0⌋ key, turn on the computer. Keep pressing the ⌈0⌋ key until the following screen is displayed.
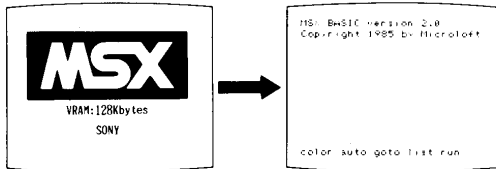
Now the MSX2-BASIC is started. The MSX2-BASIC does not have the commands which allow you to make use of floppydisks.

TO START A GAME OR OTHER PROGRAMS IN A FLOPPYDISK

1 Remove any program cartridges from the cartridge slots.
2 Insert the floppydisk into the disk insertion slot.
3 Turn on the color monitor and computer.

For details about starting and using the program, refer to the instruction manual of the program.

> Do not remove the disk, press the RESET button, or turn the power switch off while the IN USE indicator is on.
> The contents of the disk may be destroyed.

TO START A GAME OR OTHER PROGRAMS IN AN MSX CARTRIDGE

1 Remove any program disks from the disk insertion slots.
2 Insert the cartridge into a cartridge slot. When cartridge slot 1 (front) is used, insert the cartridge with the label facing downwards. When the cartridge slot 2 (rear) is used, insert with the label facing upward.
3 Turn on the color monitor and computer.

The program will start. If cartridges are inserted both in the slots 1 and 2, the program in the cartridge in the slot 1 will start.
For details about starting and using the program, refer to the instruction manual of the program.

> Do not insert or remove the cartridge while the computer's power is 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.

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KEYBOARD

CHARACTER INPUT

To enter characters (Normal mode)

Character to be entered	Key(s) to press	Example	
		Character	Key(s)
Capital letter	⟨⇧⟩ + Alphabet key	A	⟨⇧⟩ + ⟨A⟩
Small letter	Alphabet key	a	⟨A⟩
Symbol on the upper part of keytop	⟨⇧⟩ + Key	"	⟨⇧⟩ + ⟨:⟩
Symbol on the lower part of keytop	Key	'	⟨:⟩

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

To enter capital letters continuously

Press the ⟨⚲⟩ key to light up the indicator on the key. In this mode (cap lock mode), capital letters will be entered by pressing the alphabet keys. Numbers and symbols will be entered in the same way as in the normal mode. To return to the normal mode, press the ⟨⚲⟩ key to turn off the indicator.

To put an accent mark on a character

Key ⟨:⟩ is used to put an accent mark on a character.

1 Enter an accent mark.
   To enter `, press ⟨:⟩.
   To enter ´, press ⟨⇧⟩ + ⟨:⟩.
   To enter ^, press ⟨CODE⟩ + ⟨:⟩.
   To enter ¨, press ⟨CODE⟩ + ⟨⇧⟩ + ⟨:⟩.

2 Press the key for the letter needing the accent mark.

To enter a graphic character or symbol

The following graphic characters and symbols can be entered.

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To enter δ , Δ, ☐ and ◙, for example,

Graphic pattern to be entered	Key(s) to press
δ	[CODE] + [↓]
Δ	[CODE] + [⇧] + [↓]
☐	[GRAPH] + [↓]
◙	[GRAPH] + [⇧] + [↓]

Graphic pattern decals

Graphic pattern decals are supplied for your convenience when entering graphic patterns. Place the decal on the front of the corresponding key. Rub the decal and peel the backing sheet off.

Rub the pattern and peel the sheet off.

NUMERIC KEYS

The numeric keys are located to the right of the keyboard. The characters on the numeric keys can be entered whether the ⓞ or [⇧] key is pressed or not.

Note
When some commericially available programs are applied, the numeric keys cannot be used. In this case, use the number input keys on the left of the keyboard to enter numbers.

HOW TO SET THE CALENDAR-CLOCK

A calendar clock is incorporated in the HB-G900P, which is backed up by a nickel-cadmium battery so that the contents of the calendar-clock will not be erased, even when the power switch is turned off.

TO SET THE DATE

1 Start up MSX-Disk BASIC, referring to page 17.
2 Enter SET DATE "DD/MM/YY" from the keyboard.
  DD is a 2-digit day number, MM a 2-digit month number, and YY a 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 [J] key.
  The date will be set.

TO SET THE TIME

1 Start up MSX-Disk BASIC, referring to page 17.
2 Enter SET TIME "HH:MM:SS" from the keyboard.
  HH is a 2-digit hour number (24-cycle), MM a 2-digit minute number, and SS a 2-digit second number.
  For example, to set 2:30 pm and 00 seconds, you must type SET TIME "14:30:00" on the keyboard.
3 Press the [J] 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 [J] key, correct the required part with the [INS] or [DEL] key.
If you have already pressed the [J] key, start from step 1 again.

To enter δ , Δ, ⟨O⟩and ⬣, for example,

Graphic pattern to be entered	Key(s) to press
δ	[CODE] + ⟨♩⟩
Δ	[CODE] + [⇧] + ⟨♩⟩
⟨O⟩	[GRAPH] + ⟨♩⟩
⬣	[GRAPH] + [⇧] + ⟨♩⟩

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  For example, to set 2:30 pm and 00 seconds, you must type **SET TIME "14:30:00"** on the keyboard.
3 Press the ⟨J⟩ key.
  The time will be set and the clock will start.

If you make a mistake while setting the calendar-clock
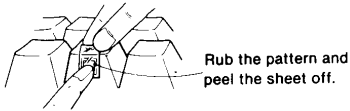If you have not pressed the ⟨J⟩ key, correct the required part with the [INS] or [DEL] key.
If you have already pressed the ⟨J⟩ key, start from step 1 again.

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TO SUPERIMPOSE THE COMPUTER PICTURE OVER THE PICTURE RECEIVED BY THE TUNER BUILT-IN THE MONITOR

When a color monitor with a peri-TV connector (21-pin) is used (System 1)

Connection

Computer
(rear)

Set to ⊓
(PERI-TV)

Color monitor with
a peri-TV connector

to peri-TV connector
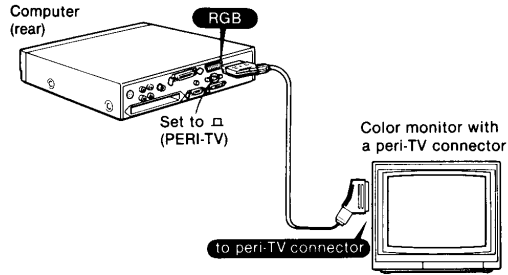
Video signal flow of this system

In this system, the video signal received by the tuner built-in the monitor will be input to the computer through the RGB connector.
The computer video signal will be gen-locked with this video signal and will be output from the RGB connector.
The picture of the computer will be superimposed over the picture of the video signal received by the tuner in the monitor.
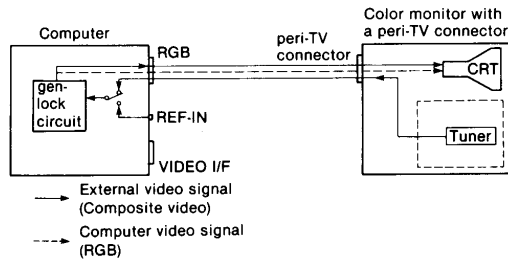
→ External video signal
(Composite video)

--→ Computer video signal
(RGB)

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Selecting of the display

The picture to be displayed on the monitor screen will be selected by executing the MSX2-BASIC SET VIDEO command as follows:

Picture to be displayed	Statement to be executed
Computer	SET VIDEO 0,0,0,0,*,0,1 (internal sync)
	SET VIDEO 1,0,0,1,*,0,1 (external sync)
Superimposed	SET VIDEO 2,0,0,1,*,0,1
Video	SET VIDEO 3,0,0,1,*,0,1

● Refer to page 32 and 33.
● * is the parameter to select the audio output

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TO SUPERIMPOSE THE COMPUTER PICTURE OVER THE EXTERNAL VIDEO PICTURE

When a color monitor with a peri-TV connector (21-pin) is used (System 2)

Connection

Video signal flow of this system

In this system, the video signal from the external video equipment will be input to the computer through the REF IN connector.

The computer video signal will be gen-locked with this video signal. The computer video signal and the video signal from the external video equipmet will be output from the RGB connector. The picture of the computer will be superimposed over the picture of the external video equipment in the monitor.

→ External video signal (Composite video)

----→ Computer video signal (RGB)

Selecting of the display

The picture to be displayed on the monitor screen will be selected by executing the MSX2-BASIC SET VIDEO command as follows:

Picture to be displayed	Statement to be executed
Computer	SET VIDEO 0,0,0,0, *,1,1 (internal sync)
	SET VIDEO 1,0,0,1, *,1,1 (external sync)
Superimposed Video	SET VIDEO 2,0,0,1, *,1,1
	SET VIDEO 3,0,0,1, *,1,1

● Refer to page 32 and 33.
● * is the parameter to select the audio output.

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When a Sony PVM color monitor with an RGB connector (25-pin) is used (System 3)

Connection
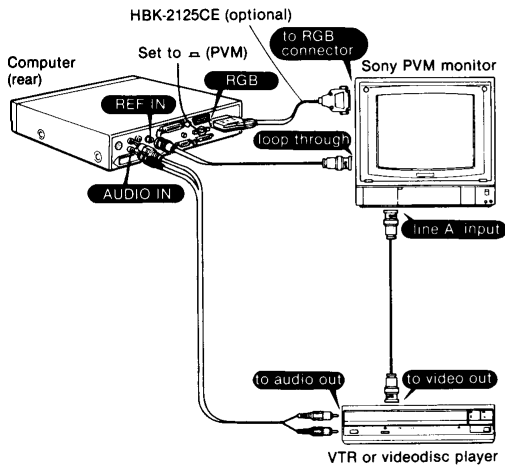
HBK-2125CE (optional)

Set to ▭ (PVM)

to RGB connector

Computer (rear)

REF IN

RGB

loop through

AUDIO IN

Sony PVM monitor

line A input

to audio out   to video out

VTR or videodisc player

Video signal flow of this system
In this system, the video signal from the external video equipment will be input to the computer through the REF IN connector.
The computer video signal will be gen-locked with this video signal.
The computer video signal and the video signal from the external video equipment will be output from the RGB connector.
The picture of the computer will be superimposed over the picture of the external video equipment in the monitor.

Computer

gen-lock circuit

RGB

REF-IN

VIDEO I/F

RGB connector

loop through

Video input

Sony PVM monitor

CRT

Video equipment

Video out

→ External video signal (Composite video)

- - → Computer video signal (RGB)

Selecting of the display
The picture to be displayed on the monitor screen will be selected by executing the MSX2-BASIC SET VIDEO command as follows:

Picture to be displayed	Statement to be executed
Computer	SET VIDEO 0,0,0,0,*,1,1 (internal sync)
	SET VIDEO 1,0,0,1,*,1,1 (external sync)
Superimposed	SET VIDEO 2,0,0,1,*,1,1
Video	SET VIDEO 3,0,0,1,*,1,0

● Refer to page 32 and 33.
● * is the parameter to select the audio output.

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SELECTING OF THE PICTURE TO BE DISPLAYED —SET VIDEO COMMAND—

SET VIDEO [mode],[YM],[CB],[sync],[sound],[video input],[AV control]

Parameter / Function / System	Mode — Picture to be displayed is:	YM — No function	CB — VDP color bus state is:	Sync — Computer's video output is gen-locked with:
1 page 26	0: Computer 1: Computer 2: Superimposed 3: Picture of the video signal received by the tuner			0: Internal 1: Video signal connected to RGB (video signal received by the tuner.)
2 page 28			0: Output state	
3 page 30	0: Computer 1: Computer 2: Superimposed 3: Picture of the video equipment connected to REF IN			0: Internal 1: Video signal connected to REF IN

Sound — Audio output from RGB and AUDIO OUT is:	Video input — Video signal input to the computer is:	AV control
0: Computer 1: Audio from audio R input of RGB is mixed with computer sound. 2: Audio from audio L input of RGB is mixed. 3: Audio from audio R and L input of RGB is mixed.	0: Video signal input from RGB	1
0: Computer 1: Audio from AUDIO R IN (phono) is mixed with computer sound 2: Audio from AUDIO L IN (phono) is mixed with computer sound. 3: Audio from AUDIO R and L IN(phono) is mixed with computer sound.	1: Video signal input from REF IN	0: Specify when only the picture of the external video equipment is to be displayed. "mode" can be any value. 1 Specify when "mode" is 0, 1 or 2.

Information on specifying "mode"

When "0" is to be specified as "mode" (mode 0), select the internal sync by specifying "0" as "Sync".

When the mode 1, 2 or 3 is specified, select the external sync by specifying "1" as "Sync". The computer's video output signal will be gen-locked with the external video signal selected by "video input".

When mode 2 is specified, the picture of the computer is superimposed over the picture of the external video signal and the SUPER-IMPOSE indicator on the front of the computer lights.

When mode 1 is specified, the picture of the computer is superimposed over the picture of the external video signal and the SUPER-IMPOSE indicator on the front of the compu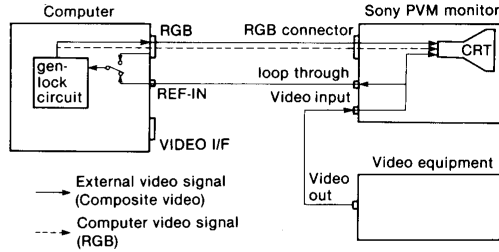ter lights. However, the picture of the external video signal is invisible and only the computer's picture can be seen. In mode 1, the computer's video output is gen-locked with the external video signal. Therefore, the displayed picture can smoothly be switched to the superimposed picture or the picture of the external video signal.

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SAMPLE PROGRAM

The following is the sample program for the system 2 (page 28).
By executing this program, red, green and blue boxes are drawn and
the picture on the screen will then be selected.

```
10 REM ===============================================
20 REM        SAMPLE-PROGRAM for HB-G900P
30 REM             : RGB-BOX
40 REM             : MODE-SELECT
50 REM ===============================================
60 '
70 SCREEN 5:COLOR ,0,0
80 SET VIDEO 0,,,0,,1,1
90 '
100 '-----------------------------------------------
110 '      DRAW RGB-BOX
120 '-----------------------------------------------
130 LINE ( 0,  0)-(255,211),0,BF
140 LINE ( 80, 50)-(130,100),8,BF
150 LINE (105, 75)-(155,125),2,BF
160 LINE (130,100)-(180,150),4,BF
170 '
180 '-----------------------------------------------
190 '     MODE-SELECT
200 '        0 : COMPUTER MODE
210 '        1 : SUPER MODE ( TRANSPARENT = COMPUTER )
220 '        2 : SUPER MODE ( TRANSPARENT = VIDEO )
230 '        3 : EXT-VIDEO MODE
240 '-----------------------------------------------
250 '
260 A$=INKEY$:IF A$="" THEN GOTO 260
270 '
280 IF A$="0" THEN SET VIDEO 0,,,0,,1,1
290 '
300 IF A$="1" THEN SET VIDEO 1,,,1,,1,1
310 '
320 IF A$="2" THEN SET VIDEO 2,,,1,,1,1
330 '
340 IF A$="3" THEN SET VIDEO 3,,,1,,1,1
350 '
360 GOTO 260
```

MEMORY MAP
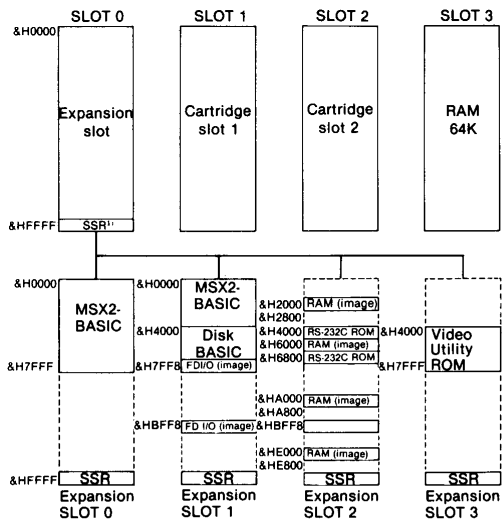
The capacity of the free area (RAM capacity excluding the system
area) can be checked by the FRE function.

1) SSR: Slot Select Register

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Recording density	8717 bits/inch
Track density	135 tracks/inch
Total no. of cylinders	80 cylinders
Total no. of tracks	160 tracks
Recording method	MFM (Modified-Frequency Modulation)
Disk rotation speed	300 rpm
Data transfer rate	250K 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–240 V AC ±10%, 50 Hz
Power consumption	35 W (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. 355×80×325 mm (w/h/d)
	(14×3$\frac{1}{4}$×12$\frac{7}{8}$ inches)
	Keyboard: Approx. 405×30×180 mm (w/h/d)
	(16×1$\frac{3}{16}$×7$\frac{1}{8}$ inches)
Weight	approx. 6.5 kg (14 lb 5 oz)
Accessories supplied	Graphic decals
	MSX-DOS/Character Font
	System and Font Disk .... (1)
	Operating Instructions (1)
	A Guide to MSX-BASIC Version 2.0 (1)
	MSX-BASIC Version 2.0
	Programming
	Reference Manual (1)
	Reference chart (1)
	Video Utility manual (1)
	A Guide to RS-232C Communication (1)

While the information given is true at the time of printing, small production change in the course of our company's policy of improvement through research and design might not necessarily be indicated in the specifications. We would ask you to check with your appointed Sony dealer if clarification on any point is required.

Note

This appliance conforms with EEC Directrives 76/889 and 82/499 regarding interference suppression.

Pin assignment

RGB

Pin No.	Signal	Signal level	Impedance
1	Audio (R) output	nominal: 0.5 V maximum: 2 V	less than 1 K ohm
2	Audio (R) input	nominal: 0.5 V maximum: 2 V	more than 10 K ohms
3	Audio (L) output	nominal: 0.5 V maximum: 2 V	less than 1 K ohm
4	Audio common return		
5	Blue return		
6	Audio (L) input	nominal: 0.5 V minimum: 0.2 V maximum: 2 V	more than 10 K ohms
7	Blue input/output	0.7 Vp-p	75 ohms
8	Function switching[1]	logical "0": 0.2 V logical "1": 9.5 V-12 V	
9	Green return		
10	—		
11	Green output	0.7 Vp-p	75 ohms
12	—		
13	Red return		
14	Intercommunication data line common return		
15	Red output	0.7 Vp-p	75 ohms
16	Blanking output[1]	logical "0": 0-0.4 V logical "1": 1-3 V	75 ohms
17	Video return		
18	Blanking return		
19	Video output[2]	1 Vp-p (composite video)	75 ohms
20	Video input	1 Vp-p (composite video)	75 ohms
21	Common return		

1) When a PVM monitor is conncted, the signal level will be:
   logical "0": 0 V
   logical "1": 5 V
2) When a PVM monitor is connected, the signal level will be:
   1Vp-p (composite sync)

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SONY.

MSX 2

VIDEO I/F

Pin No.	Signal	Signal level
1	Video input	1.0 Vp-p, 75 ohm term.
2	Video output	1.0 Vp-p, 75 ohm term.
3	R	0.7 Vp-p, 75 ohm term.
4	G	0.7 Vp-p, 75 ohm term.
5	B	0.7 Vp-p, 75 ohm term.
6	Ys	TTL
7	Ym	No-connect
8	SYNC	TTL
9	BF	TTL
10	SYM0	TTL
11	VIDEO/NO VIDEO	TTL
12	C0 (B1)	TTL
13	C2 (R0)	TTL
14	C4 (R2)	TTL
15	C6 (G1)	TTL
16	RCA/21 pin	TTL
17	SC	TTL
18	DLCLK	TTL
19	GND	
20	GND	
21	GND	
22	GND	
23	GND	
24	GND	
25	Computer sync	TTL
26	ALT	TTL
27	BLK	TTL
28	SYM1	TTL
29	GND	
30	C1 (B2)	TTL
31	C3 (R1)	TTL
32	C5 (G0)	TTL
33	C7 (G2)	TTL
34	GND	
35	GND	
36	GND	

MSX-BASIC
Version 2.0
REFERENCE CHART

HITBIT

HB-G900P/F

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)

SET VIDEO [mode], [brightness], [color bus], [sync], [sound], [video input], [AV control]	Specify superimposing and other modes. (used only with computers that have the superimpose function)
	Mode
	  0: computer signal (internal sync only)
	  1: computer signal
	  2: superimpose
	  3: TV signal
	Brightness
	  0: normal brightness
	  1: half-brightness
	Color Bus
	  0: VDP color bus input
	  1: VDP color bus output
	Simultaneous
	  0: internal sync
	  1: external sync
	Sound
	  0: external sound signal not mixed
	  1: right channel external sound signal mixed
	  2: left channel external sound signal mixed.
	  3: both channels external sound signal mixed
	Video Input
	  0: select RGB multiconnector input
	  1: select external video input connector input
	AV Control
	  0: TV signal
	  1: External video
		SET VIDEO 2

MEMORY SWITCH FUNCTION COMMANDS

format	function	example
SET ADJUST (X, Y)	Change the location of the display on the screen	SET ADJUST (– 4, 3)
SET BEEP [sound], [volume]	Select the BEEP sound.	SET BEEP 2, 3
SET TITLE ["title"], [color]	Set the title to be displayed on the initial screen display.	SET TITLE "SONY"
SET PROMPT "prompt"	Set the prompt statement to be displayed when BASIC is in a command-wait status.	SET PROMPT "Ready"
SET PASSWORD "password"	Set the system password.	SET PASSWORD "BASIC"
SET SCREEN	Set the current SCREEN values as the initial start-up values.	

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.	10 A$="ABCDEFG" 20 PRINT USING "!";A$ 30 PRINT USING "\ \";A$
	"\n spaces \" Outputs n+2 characters.	40 PRINT USING "SSS&TTT";A$
	"&" Output the entire string.	
	"#" Specify the number of display digits of the numeric data.	PRINT USING "# # #.# #";123.45,10.5
	"+" Add + or – before (after) numeric data.	PRINT USING "+ # # #";100, – 200
	"–" Add – after negative numeric data.	PRINT USING "# # # –";100, – 200
	"* *" Fill space befor numeric data with *.	PRINT USING "* * # # #";100, – 200
	"££" Put £ in front of numeric data.	PRINT USING "££ # # #";100, – 200
	"* *£" Put £ in front of numeric data and fill space In front of it with *.	PRINT USING "* * £ # # #";10, – 20
	"," Put, after every third digit to the left of the decimal point.	PRINT USING "# # # #,.# #";1234.56
	"^^^^" Output with floating decimal points.	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 l [STEP increment] NEXT [variable]	Repeat the program execution between FOR and NEXT.	FOR I=1 TO 10 STEP 2 l NEXT I
GOSUB line number l RETURN [line number]	Transfer control to the specified subroutine. Return to the main routine with RETURN.	100 GOSUB 100 l 1000 l 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: Supress 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
	Interlace 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 SPRITE$ (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 SPRITE$(0) = CHR$(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 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 $\begin{bmatrix} \# \\ + \\ - \end{bmatrix}$ G $\begin{bmatrix} \# \\ + \\ - \end{bmatrix}$	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"

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format	function	example
☐ 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, &HE800 BSAVE "CHART", 0, &H3FFF,S
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 NAMS, 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.	STIRG (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 × 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 form 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. ($-32768 \le X \le 32767$)
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$, N)	: Give N characters from the right of X$.
SPACE$ (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. ($-32768 \le X \le 65535$)
CHR$ (X)	: Give a character whose character code is X.
HEX$ (X)	: Give a hexadecimal expression of X as a string type data. ($-32768 \le X \le 65535$)
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. ($-32768 \le X \le 65535$)
STR$ (X)	: Convert to the string type.
VAL (X$)	: Convert to the numeric type.
⊟ CVI, CVS, CVD	: Change character string data in a random access file to numeric data.
⊟ MKI$, 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.

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.
▢ From the disk 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.
SPRITE$ (sprite number) : Retain the sprite pattern.
[Example] SPRITE$(1) = CHR$(&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 Fine 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	^	power	
	−	change signs	
	*,/	multiplication, division	
	\	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	

CHAPTER 2
SERVICE INFORMATION

2-1. DISASSEMBLY

### 2-1-1. Removal of Cabinet and Bottom Cover

① Remove the four screws.

② Lift up the backward of the cabinet as direction Arrow Ⓐ.

③ LOOSEN the nine screws of the bottom cover.

④ Remove the cabinet in the direction indicated by the Arrow Ⓑ.
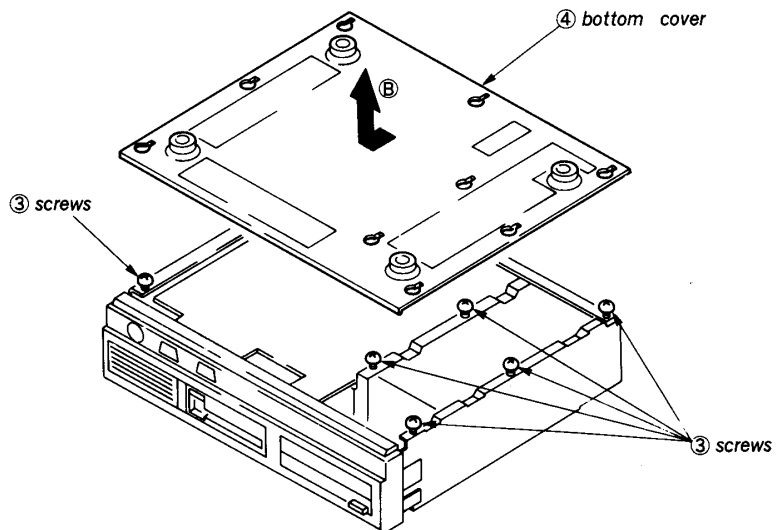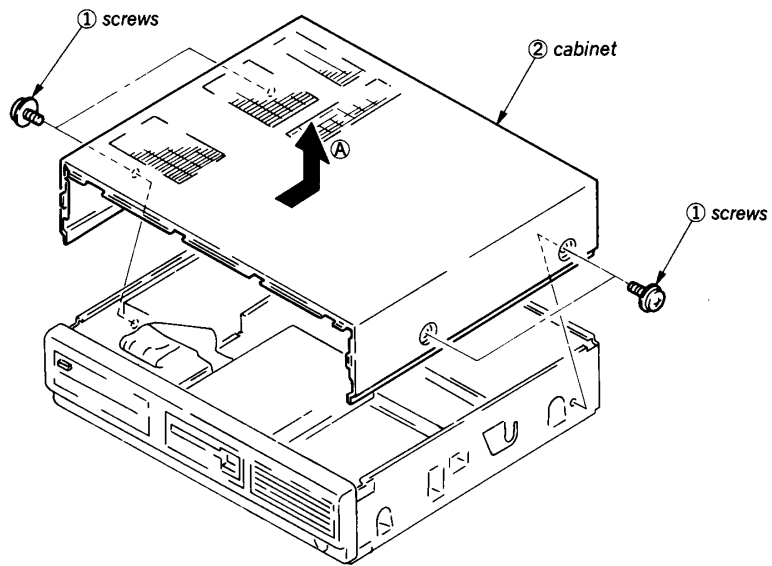
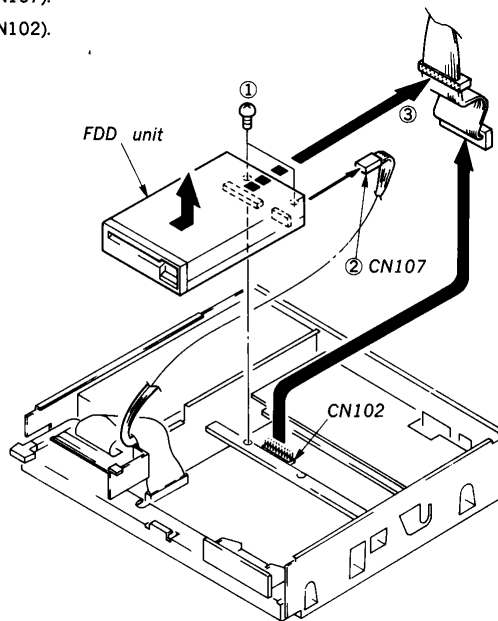## 2-1-2. Removal of the Front Panel

① Remove the two screws of the chassis.

② Remove the three screws of the chassis.

③ Remove the knob of the Front panel.

④ Disconnect the Connector (CN601).

④(CN601)

① screw

② screws

③ knob

① screew
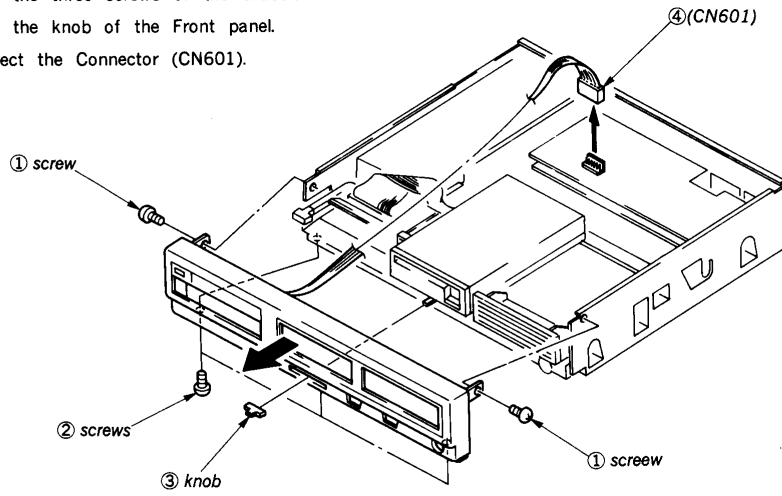
2-1-3. Removal of FDD Unit

① Remove two screws

② Disconnect the Connector (CN107).

③ Disconnect the Connector (CN102).

①

③

FDD unit

② CN107

CN102

HB-G900P/F

2-1-4. Removal SG-106 Board and DSP-8 Board

① Remove the three screws.

② Disconnect the Connector (CN303).

③ Disconnect the Connector (CN502).

④ Disconnect the Connector (CN304).

⑤ Disconnect the Connector (CN505).

⑥ Disconnect the Connector (CN101).

⑤ CN505

① screws

① screws

② CN303

③ CN502

SG-106 Board

④ CN304

DSP-8 Board

⑥ CN101
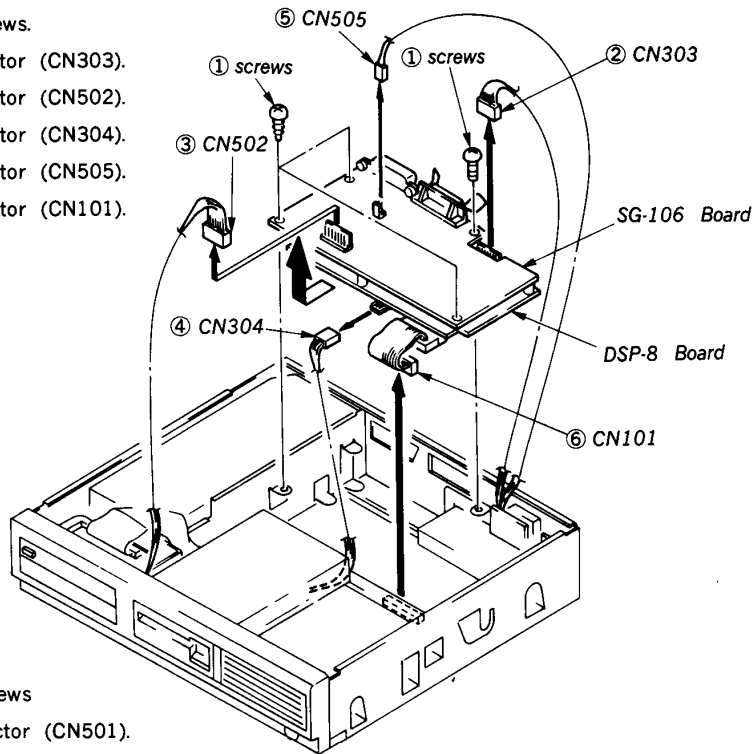
⑦ Remove the three screws

⑧ Disconnect the Connector (CN501).

⑨ Disconnect the Connector (CN503).

⑩ Disconnect the Connector (CN504).

⑪ Disconnect the Connector (CN301).

⑧ CN501

⑦

⑦

⑦

⑨ CN503

⑩ CN504

SG-106 Board

DSP-8 Board

⑪CN301

HB-G900P/F

2-3
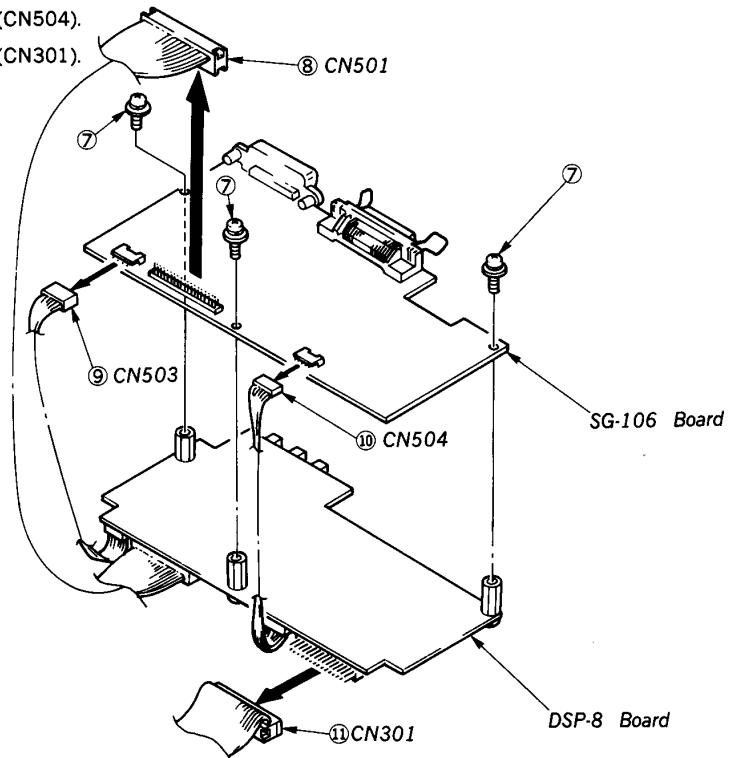
2-1-5. Removal of the Power Supply Unit

① Remove the four screws.

② Disconnect the Connector (CN108).

③ Disconnect the Connector (CN107).

④ Remove the Power supply unit.

④ *Power supply unit*

③ *CN107*

② *CN108*

① *screws*
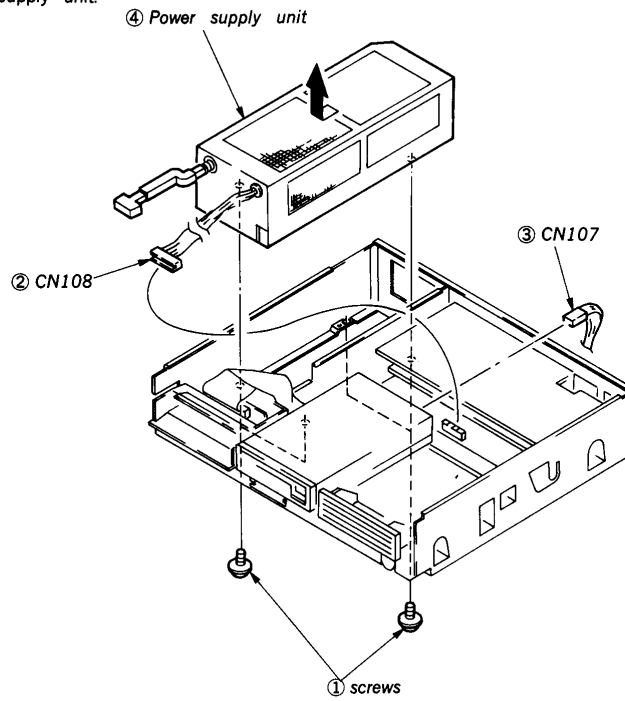
2-2. INSTALLATION

This drive unit is designed to be installed in a Sony personal computer HB-G900P/F/D.

INSTALLATION
Cette unité à disque est conçue pour être installée sur l'ordinateur domestique HB-G900P/F/D de Sony.

1

HB-G900P/F/D
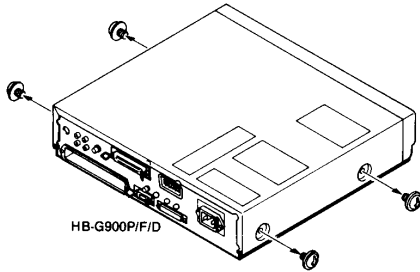
2
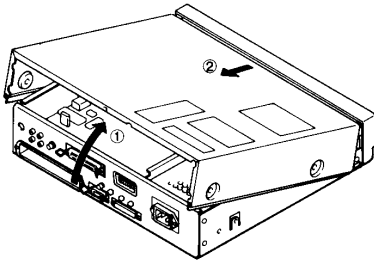
3
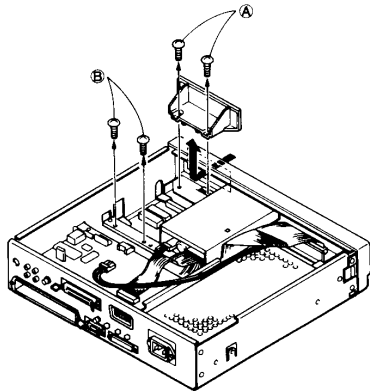
4 Slide the unit toward the front until it stops.
Faire glisser l'unité vers l'avant jusqu'à ce qu'elle s'arrête.

HBD-G900
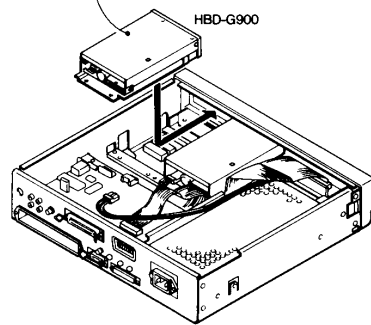
5
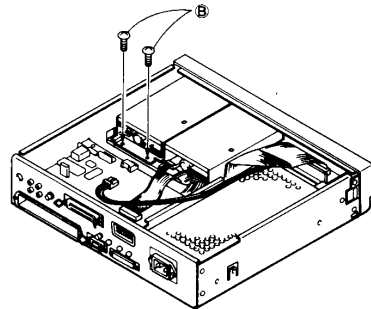
6
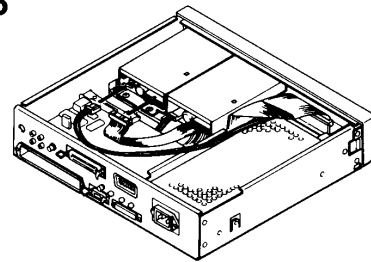
7 Replace the cover and tighten the screws.
Remettre le couvercle en place et serrer les vis.

HB-G900P/F   2-5
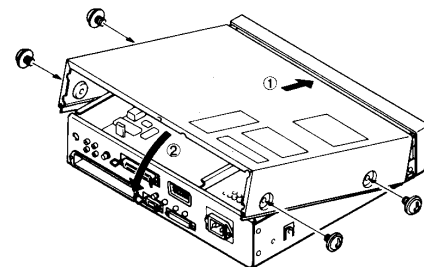
2-3. REPAIR PARTS

1. Safety Related Components Warning.
   Components identified by shading marked with ⚠ on the schematic diagrams, exploded views and electrical spare parts list are critical to safe operation. Replace these components with Sony parts whose part numbers appear in this manual or in service bulletins and service manual supplements published by Sony.

2. Replacement Parts supplied from Sony Parts Center will sometimes have a different shape from the original parts. This is due to "accommodating the improved parts and/or engineering changes" or "standardization of genuine parts".
   This manual's exploded views and electrical spare parts list indicate the parts numbers of "the standardized genuine parts at present".
   Regarding engineering parts changes in our engineering department, refer to Sony service bulletins and service manual supplements.

3. Printed Components in Bold-Face type on the exploded views and electrical spare parts list are normally stocked for replacement purposes. The remaining parts are not normally required for routine service work. Orders for parts not shown in Bold-Face type will be processed, but allow for additional delivery time.

4. Abbreviations

Ref. No.	Description
C□□, CV□□	CAPACITOR
CN□□	CONNECTOR
CP□□	COMBINATION PARTS
D□□	DIODE
DL□□	DELAY LINE
F□□	FUSE
FL□□	FILTER
IC□□	IC
L□□, LV□□	INDUCTOR
M□□	MOTOR
ME□□	METER
PL□□	LAMP
Q□□	TRANSISTOR
R□□, RV□□	RESISTOR
RY□□	RELAY
S□□	SWITCH
T□□	TRANSFORMER
TH□□	THERMISTOR
X□□	CRYSTAL

5. Units for Capacitors, Inductors and Resistors
   The following units are assumed in schematic diagrams, electrical parts list and exploded views unless otherwise specified:
   Capacitors: μF
   Inductors: μH
   Resistors: ohm

2-4. CIRCUIT DESCRIPTION

Block diagram of PU-39 board
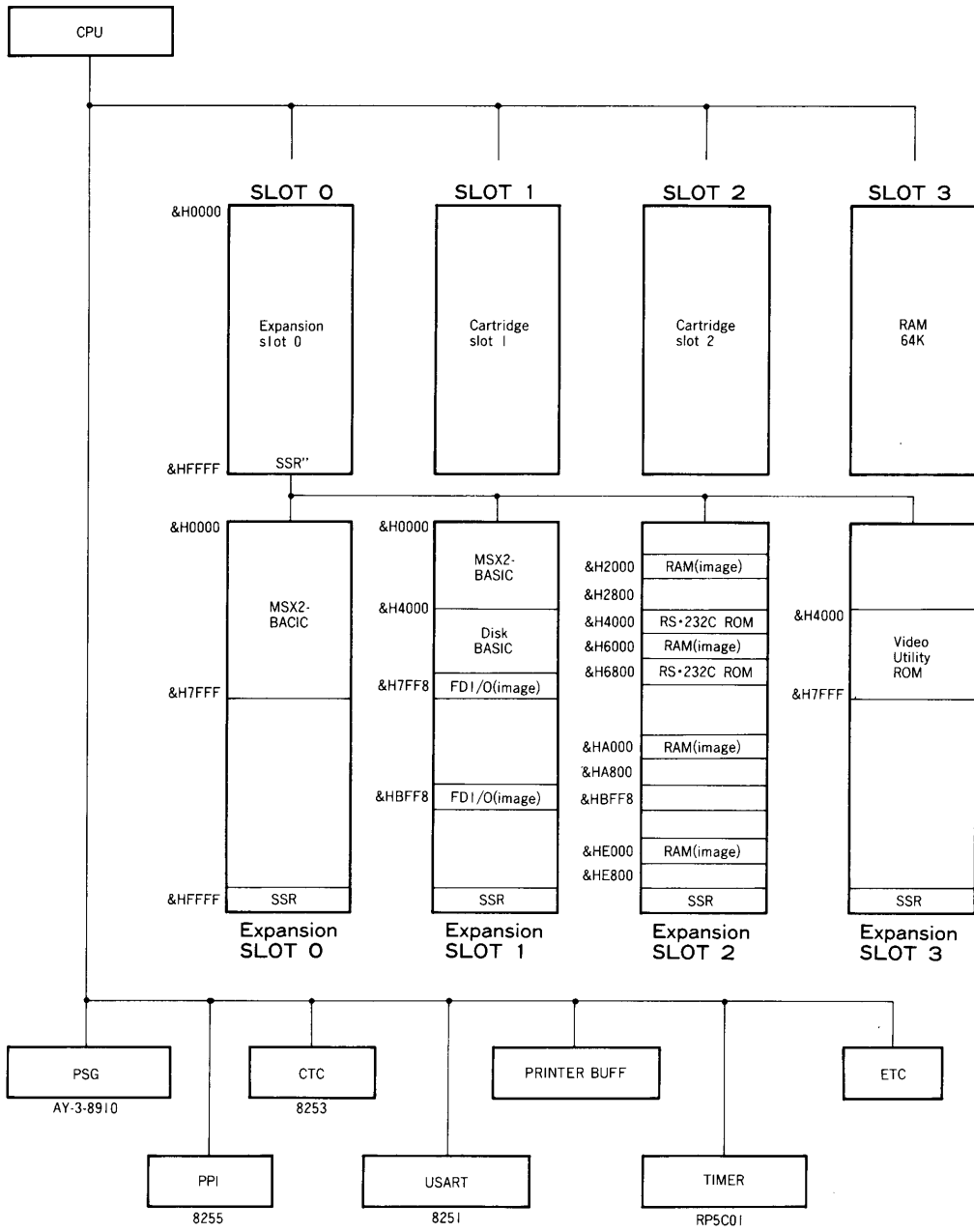
Circuit Description

The circuit is described here based on the schematic diagram.

PU-39 (1) (CPU, memory block)

(1) CPU (IC127)

The CPU uses a Z80A or equivalent. One WAIT status is established during MI cycle and VDP access, with a clock frequency of 3.579545 MHz.

(2) RAM (IC121, IC115)

The RAM consists of two 64 k x 4 bit DRAMs and is located in basic slot 3.

(3) MSX2 BASIC ROM (IC120)

The 32 k-byte MSX2 BASIC ROM is located in page 0, 1 of extended slot 00.

(4) MSX2 BASIC EX + DISK BASIC (IC114)

The MSX2 BASIC EX and DISK BASIC are mounted on a 32 k-byte ROM and located in page 0, 1 of extended slot 01.

(5) RS-232C ROM + utility ROM (IC109)

The RS-232C ROM and utility ROM are mounted on a 32 k-byte ROM. The RS-232C ROM is located in page 1 of extended slot 02, and the utility ROM in page 1 of extended slot 03.

(6) RS-232C ROM (IC126)

The RS-232C ROM is used to support a multichannel RS-232C interface and enlarge the receive buffer capacity. The RAM can be accessed at either addresses 6000 H-67 FFH or A000-A7 FFH of extended slot 02 to improve the execution speed.

PU-36 (2) (Bus buffler block)

This block consists of address, data, and controol bus buffers.

PU-39 (3) (Slot block)

Slot pin assignment is shown below.

Cartridge Bus
○ LIST OF SIGNAL PINS

PIN NO.	NAME	I/O*	PIN NO.	NAME	I/O*
1	$\overline{CS1}$	O	26	A13	O
2	$\overline{CS2}$	O	27	A1	O
3	$\overline{CS12}$	O	28	A0	O
4	$\overline{SLTSL}$	O	29	A3	O
5	Reserved #	—	30	A2	O
6	$\overline{RFSH}$	O	31	A5	O
7	$\overline{WAIT}$%	I	32	A4	O
8	$\overline{INT}$%	I	33	D1	I/O
9	$\overline{M1}$	O	34	D0	I/O
10	$\overline{BUSDIR}$	I	35	D3	I/O
11	$\overline{IORQ}$	O	36	D2	I/O
12	$\overline{MERQ}$	O	37	D5	I/O
13	$\overline{WR}$	O	38	D4	I/O
14	$\overline{RD}$	O	39	D7	I/O
15	$\overline{RESET}$	O	40	D6	I/O
16	Reserved #	—	41	GND	—
17	A9	O	42	CLOCK	O
18	A15	O	43	GND	—
19	A11	O	44	SW1	—
20	A10	O	45	+5 V	—
21	A7	O	46	SW2	—
22	A6	O	47	+5 V	—
23	A12	O	48	+12 V	—
24	A8	O	49	SOUNDIN	I
25	A14	O	50	−12 V	—

* The Input/output directions are relative to the main unit.

\# Do not use the Reserved PINs.

% OPEN COLLECTOR output

○ LIST OF SIGNAL PINS

PIN NO.	NAME	DESCRIPTION
1	$\overline{CS1}$	ROM 4000 to 7FFFF, selected signal
2	$\overline{CS2}$	ROM 8000 to BFFF, selected signal
3	$\overline{CS12}$	ROM 4000 to BFFF, selected signal (for 256 K ROM)
4	$\overline{SLTSL}$	Slot select signal
5	Reserved	Reserved for future expansion. Do not use this pin.
6	$\overline{RFSH}$	Refresh signal
7	$\overline{WAIT}$	Wait signal to CPU
8	$\overline{INT}$	Interrupt request signal
9	$\overline{M1}$	Fetch cycle signal of CPU
10	BUSDIR	This signal controls the direction of the external data bus butter when the cartridge is selected. It is LOW when the data is sent by the cartridge.
11	$\overline{IORQ}$	I/O request signal
12	$\overline{MERQ}$	Memory request signal
13	$\overline{WR}$	Write signal
14	$\overline{RD}$	Read signal
15	$\overline{RESET}$	System reset signal
16	Reserved	Reserved for future expansion. Do not use this pin.
17~32	A0~A15	Address bus
33~40	D0~D7	Data bus
41	GND	Ground
42	CLOCK	CPU clock, 3.579 MHz
43	GND	Ground
44, 46	SW1, SW2	Detect Insert/Remove for protection
45, 47	+5 V	+5 V power supply
48	+12 V	+12 V power supply
49	SOUNDIN	Sound input (−5 dbm)
50	−12 V	−12 V power supply

NOTE
The CS signals imply a memory request and a read signal.
Thus they cannot be used as chip select for writable devices such as RAMs.

PU-39 (4) (Memory map decoder)

(1) Extended slot register
The upper block diagram in the schematic diagram is shown below.
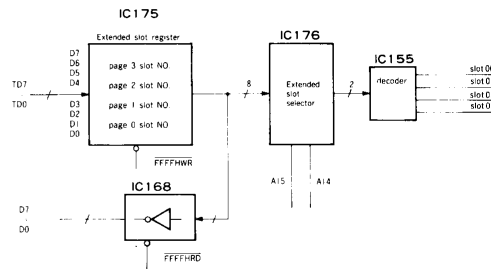
The extended slot register is used to latch each page slot number of the exteded slots. Each page is determined using A14 and A15, and the slot number corresponding to the page is output to IC176. The extended slot enable signal is generated by decoding the slot number.
Inverter IC168 is used to indicate existended slotregister IC175 to the CPU.

(2) Basic slot selector
The lower block diagram of the schematic diagram is shown below.
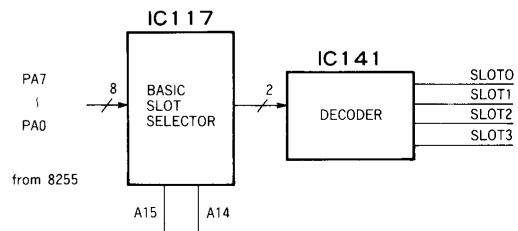
Using IC117, the page slot number corresponding to A14 and A15 is selected from each page slot number latched into 8255 port A. The basic slot enable signal is generated by decoding the slot number.

PU-39 (5) (I/O decoder)

The I/O decoder produces various I/O device chip select signals and read/write signals from the address signal. I/O mapping is shown on the next page.

PSG Bit Assignments

PORT	BIT	I/O	CONNECTOR PIN NO.		NOTES
A	0	I N P U T	J3-PIN 1	#1	FWD1
			J4-PIN 1 *	#2	FWD2
	1		J3-PIN 2	#1	BACK1
			J4-PIN 2 *	#2	BACK2
	2		J3-PIN 3	#1	LEFT1
			J4-PIN 3 *	#3	LEFT2
	3		J3-PIN 4	#1	LIGHT1
			J4-PIN 4 *	#2	RIGHT2
	4		J3-PIN 6	#1	TRBA1
			J4-PIN 6 *	#2	TRGA2
	5		J3-PIN 7	#1	TRGB1
			J4-PIN 7 *	#2	TRGB2
	6		KEY LAYOUT Select	#4	Japanese version only
	7		CSAR (Cassette tape READ)		
B	0	O U T P U T	J3-PIN 6	#3	
	1		J3-PIN 7	#3	"H" Level
	2		J4-PIN 6 *	#3	
	3		J4-PIN 7 *	#3	
	4		J3-PIN 8 *		
	5		J4-PIN 8 *		
	6		PORT A INPUT SELECT		Selects J3 or J4
	7		KLAMP (KANA LAMP L = ON)		Japanese version only

#1 Available if bit 6 of port B is LOW and is used by JOYSTICK1

#2 Available if bit 6 of port B is HIGH and is used by JOYSTICK2

#3 Set these pins to "H" when using them as an input port.
Connect an open collector buffer to the output.

#4 JIS layout - "H", syllable layout - "L"

〈Remark〉   PIN 5: +5 V
            PIN 9: GND

○ On the minimum MSX system, there is no J4 connector.

8255 (PPI) Bit Assignments

PORT	BIT	SIGNAL NAME	DESCRIPTION
A	0	O U T P U T	CS0L	0000-3FFF Address slot select signal
	1		CS0H	
	2		CS1L	4000-7FFF Address slot select signal
	3		CS1H	
	4		CS2L	8000-BFFF Address slot select signal
	5		CS2H	
	6		CS3L	C000-FFFF Address slot select signal
	7		CS3H	
B	0	I N P U T		Keyboard return signal
	1			
	2			
	3			
	4			
	5			
	6			
	7			
C	0	O U T P U T	KB0	Keyboard scan signal
	1		KB1	
	2		KB2	
	3		KB3	
	4		CASON	Cassette control signal (L = ON)
	5		CASW	Cassette write signal
	6		CAPS	CAPS lamp signal (L = ON)
	7		SOUND	Software-controlled sound output

PU-39 (6) (PSG, PPI)

(1) PSG (IC110)

The PSG generator is used to generate an eight-octave, treble-chord pure tone. It also inputs a cassette playback signal by controlling the joystick port. Bit assignment of the joystick port is shown on the next page.
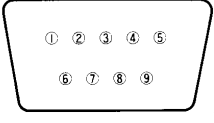
(2) PPI (IC111)

The PPI has three input/output ports. A slot select signal is output at port A every page. A keyboard return signal is output at port B. Keyboard scan, cassette control, and recordng signals are output at port C. Bit assignment is shown on the next page.

(3) Joystick port (MSX compatible)

Two ports are provided for the joystick port. A scan signal is output from PSG generators IOB4 and IOB5, then input througt a joystick switching circuit to PSG generators IOA0 and IOA5.

Pin assignment of a 9-pin D-SUB connector and the joystick switching circit block diagram shown below.

PIN NO.	SIGNAL NAME	DIRECTION	PIN CONNECTION
1	FWD	Input	
2	BACK	Input	
3	LEFT	Input	
4	RIGHT	Input	① ② ③ ④ ⑤
5	+5 V*	———	⑥ ⑦ ⑧ ⑨
6	TRG 1	Input/Output	
7	TRG 2	Output	
8	OUTPUT	Output	
9	GND	———	

* Current capacity: 50 mA each
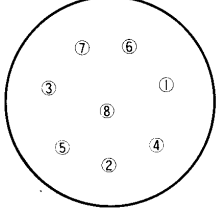
(4) Cassette interface (MSX compatible)

During data loading, data is input from CN107 CMTIN and input through comparator IC134 to PSG IOA7.

During data saving, data is output from PPI PC5 and saved from CN107 CMTOUT to the data recorder through a filter. The remote terminal of the data recorder is controlled using PPI PC4.

Pin assignment of an 8-pin DIN connector is shown below.

○ TABLE OF SIGNAL PINS

PIN NO.	SIGNAL NAME	DIRECTION	PIN CONNECTION
1	GND	———	
2	GND	———	
3	GND	———	⑦ ⑥
4	CMTOUT	OUTPUT	③ ①
5	CMTIN	INPUT	⑧
6	REMOTE +	OUTPUT	⑤ ④
7	REMOTE −	OUTPUT	②
8	GND	———	

(5) Keyboard (MSX compatible)+numeric keypad

A keyboard scan signal is output from PPIs (IC111) PC0 through PC3 at port C. The signal corresponding to the key is input through a Keyboard matrix cimcuit to PB0 through PB7.

The CAP LOCK LED signal is output from PPI PC6.

(4) RS-232C

The HB-G900 has an internal RS-232C interface. Therefore, the unit can be connected to an LDP, printer, character display, or MODEM which has an RS-232C interface.

However, the signal direction at the 25-pin D-SUB connector pin is reversed depending on whether the destination to be connected is a terminal or MODEM. To select the signal direction, turn the relay on the connector board (CN-104 board) on or off using the HB-G900 rear switch.

Pin assignment of a 25-pin D-SUB connector is shown below.

Pin	Signal	Pin	Signal
1	Frame Ground	14	
2	Transmit Data	15	
3	Receive Data	16	
4	Request To Send	17	
5	Clear To Send	18	
6	Data Set Ready	19	
7	Signal Ground	20	Data Terminal Ready
8	Carrier Detect	21	
9		22	Ring Indicator
10		23	
11		24	
12		25	
13			

PU-39 (9) (Printer, timer)

(1) Printr (MSXI compatible)

The CPU reads a busy signal from the printer and outputs 8-bit parallel data to the printer through handshaking. Pin assignment of a 14-pin Amphenol connector is shown below.

PIN NO.	SIGNAL NAME	I/O	PIN CONNECTION
1	PSTB	O	
2	PDB0	O	
3	PDB1	O	
4	PDB2	O	
5	PDB3	O	7 6 5 4 3 2 1
6	PDB4	O	
7	PDB5	O	14 13 12 11 10 9 8
8	PDB6	O	
9	PDB7	O	
10	N.C.	—	
11	BUSY	I	
12	N.C.	—	
13	N.C.	—	
14	GND	—	

HB-G900P/F

(2) Timer (IC108)

For accessing from the CPU to a timer, the registr number in the timer is written and lathed into IC112 to read and write the register in the timer. The circuit attached to Vcc of IC108 (RP5C01) is used to back up the battery.
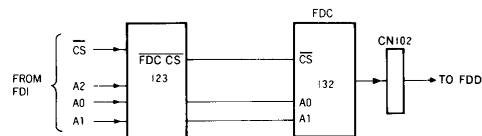
PU-39 (10) (FDC)

Memory Map Det

Address Port	Write Mode of CPU	Read Mode of CPU
7FF8H	Command Register	Status Register
7FF9H	Track Register	Track Register
7FFAH	Sector Register	Sector Register
7FFBH	Data Register	Data Register
7FFCH	SideSelect	SideSelect
7FFDH	DriveSelect	Drive Select
7FFFH		IRQ/DRQ Status

Selection of Individual FDC (IC132) Registers
Individual registers of the FDC (IC132) have been allocated to addresses 7FFBH, and are selected by address signals A0 through A2 and signal $\overline{CS}$.

CR	; COMMAND REGISTER
DR	; DATA REGISTER
DSR	; DATA SHIFT REGISTER
SCR	; SECTOR REGISTER
TR	; TRACK REGISTER
STR	; STATUS REGISTER

REGISTER SELECTION

CS	A1	A0	RE = 0	WE = 0
1	X	X	NON SELECT	DAL = HI-Z
0	0	0	STR	CR
0	0	1	TR	TR
0	1	0	SCR	SCR
0	1	1	DR DR	.

0	: LOW LEVEL
1	: HIGH LEVEL
X	: DON'T CARE
HI-Z	: HIGH IMPEDANCE

(4) RS-232C

The HB-G900 has an internal RS-232C interface. Therefore, the unit can be connected to an LDP, printer, character display, or MODEM which has an RS-232C interface.

However, the signal direction at the 25-pin D-SUB connector pin is reversed depending on whether the destination to be connected is a terminal or MODEM. To select the signal direction, turn the relay on the connector board (CN-104 board) on or off using the HB-G900 rear switch.

Pin assignment of a 25-pin D-SUB connector is shown below.

Pin	Signal	Pin	Signal
1	Frame Ground	14	
2	Transmit Data	15	
3	Receive Data	16	
4	Request To Send	17	
5	Clear To Send	18	
6	Data Set Ready	19	
7	Signal Ground	20	Data Terminal Ready
8	Carrier Detect	21	
9		22	Ring Indicator
10		23	
11		24	
12		25	
13			

PU-39 (9) (Printer, timer)

(1) Printr (MSXI compatible)

The CPU reads a busy signal from the printer and outputs 8-bit parallel data to the printer through handshaking. Pin assignment of a 14-pin Amphenol connector is shown below.

PIN NO.	SIGNAL NAME	I/O	PIN CONNECTION
1	PSTB	O	
2	PDB0	O	
3	PDB1	O	
4	PDB2	O	
5	PDB3	O	
6	PDB4	O	
7	PDB5	O	
8	PDB6	O	
9	PDB7	O	
10	N.C.	—	
11	BUSY	I	
12	N.C.	—	
13	N.C.	—	
14	GND	—	

(2) Timer (IC108)

For accessing from the CPU to a timer, the registr number in the timer is written and lathed into IC112 to read and write the register in the timer. The circuit attached to Vcc of IC108 (RP5C01) is used to back up the battery.
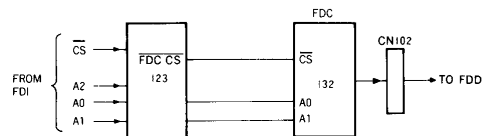
PU-39 (10) (FDC)

Memory Map Det

Address Port	Write Mode of CPU	Read Mode of CPU
7FF8H	Command Register	Status Register
7FF9H	Track Register	Track Register
7FFAH	Sector Register	Sector Register
7FFBH	Data Register	Data Register
7FFCH	SideSelect	SideSelect
7FFDH	DriveSelect	Drive Select
7FFFH		IRQ/DRQ Status

Selection of Individual FDC (IC132) Registers
Individual registers of the FDC (IC132) have been allocated to addresses 7FFBH, and are selected by address signals A0 through A2 and signal $\overline{CS}$.


CR	;	COMMAND REGISTER
DR	;	DATA REGISTER
DSR	;	DATA SHIFT REGISTER
SCR	;	SECTOR REGISTER
TR	;	TRACK REGISTER
STR	;	STATUS REGISTER

REGISTER SELECTION

CS	A1	A0	RE = 0	WE = 0
1	X	X	NON SELECT	DAL = HI-Z
0	0	0	STR	CR
0	0	1	TR	TR
0	1	0	SCR	SCR
0	1	1	DR DR	.

0	:	LOW LEVEL
1	:	HIGH LEVEL
X	:	DON'T CARE
HI-Z	:	HIGH IMPEDANCE

PU-39 (11) (Board connected to the DSP board)
Connector CN101 is used to connect the PU-39 board
and DSP-8 board.
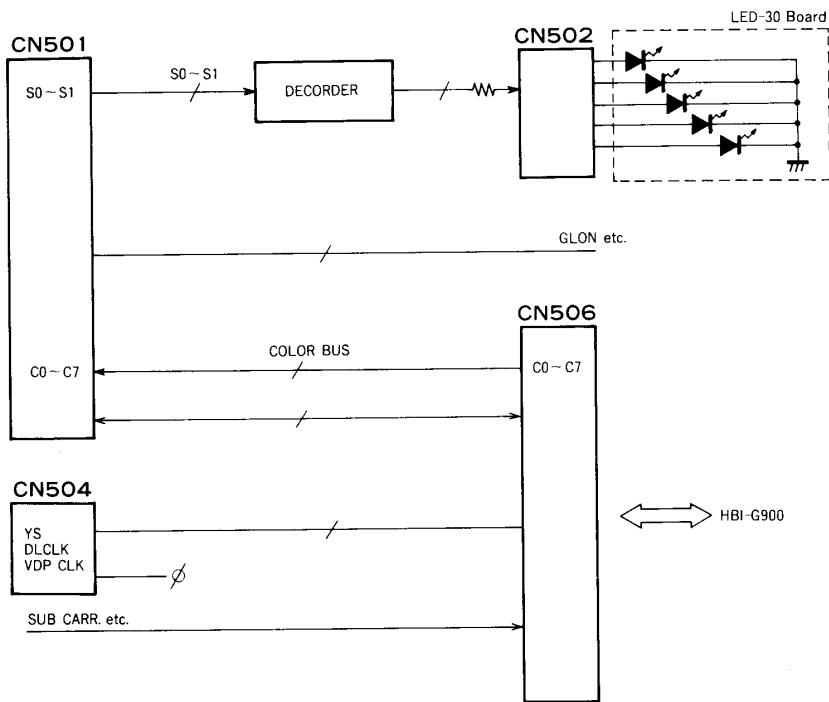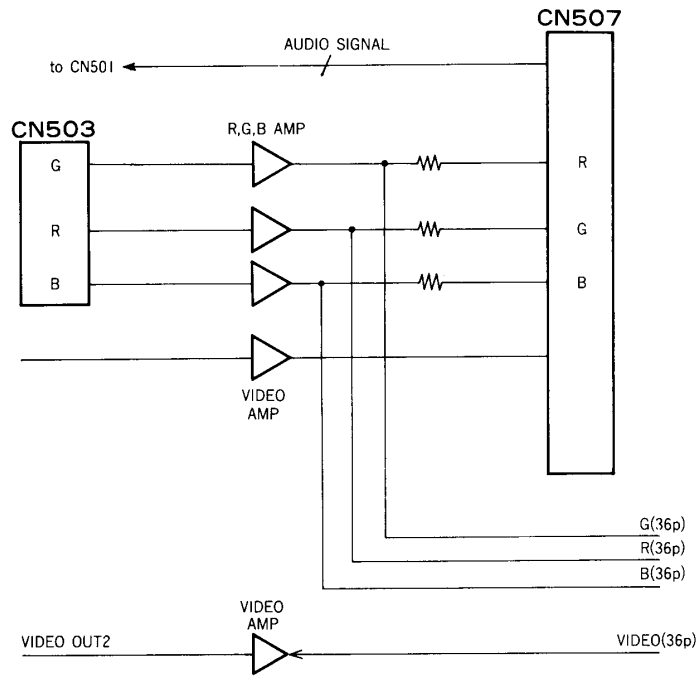An audio mixer and amplifier are shown on the upper
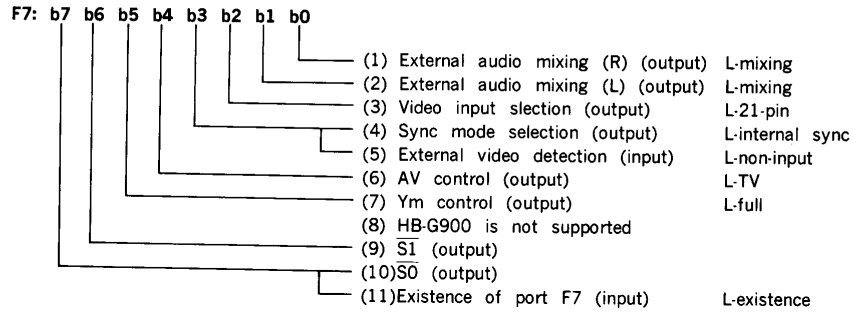left of the schematic diagram.

HB-G900P/F
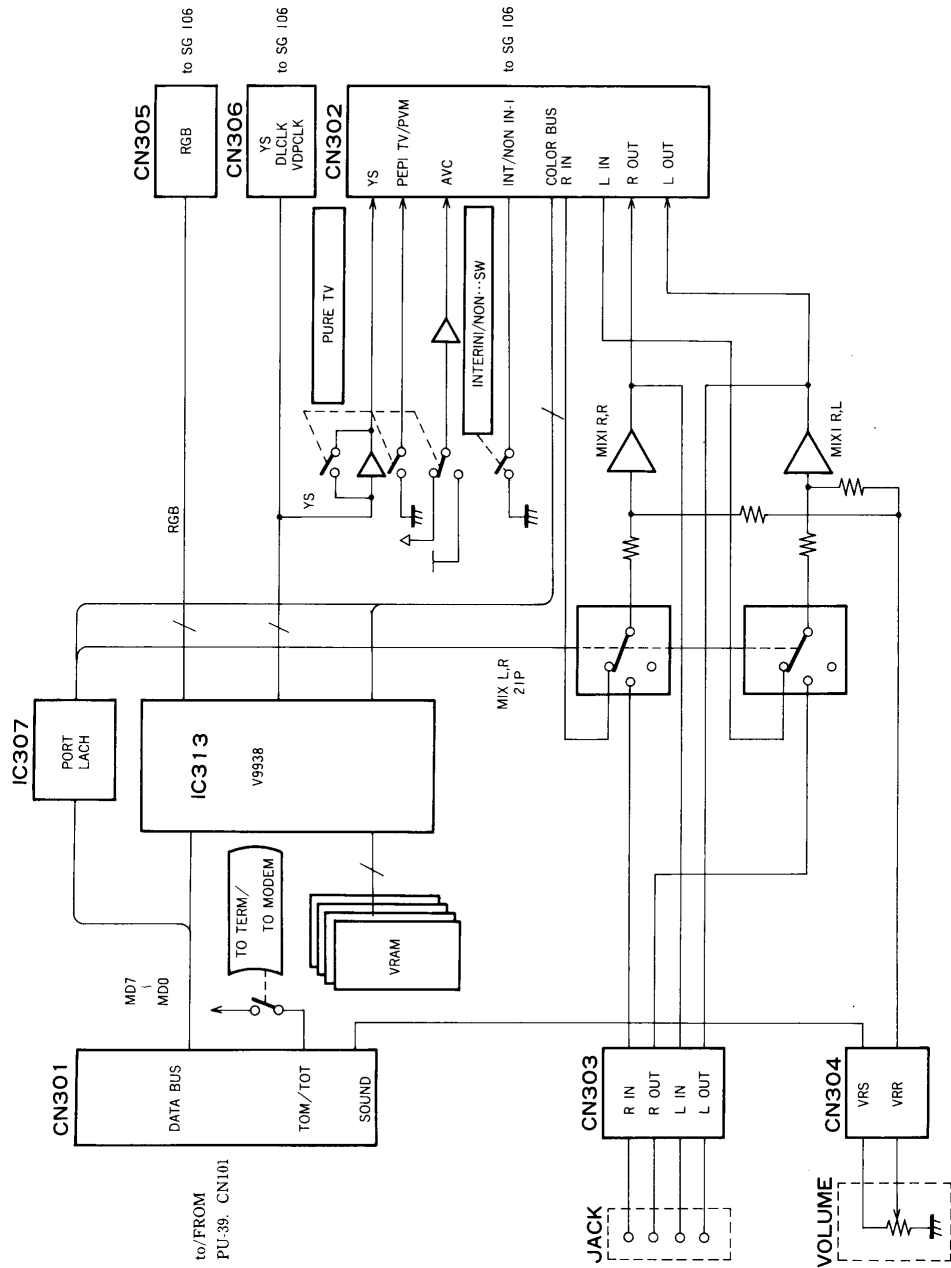
SYNC BLOCK DIAGRAM

2-15

HB-G900P/F
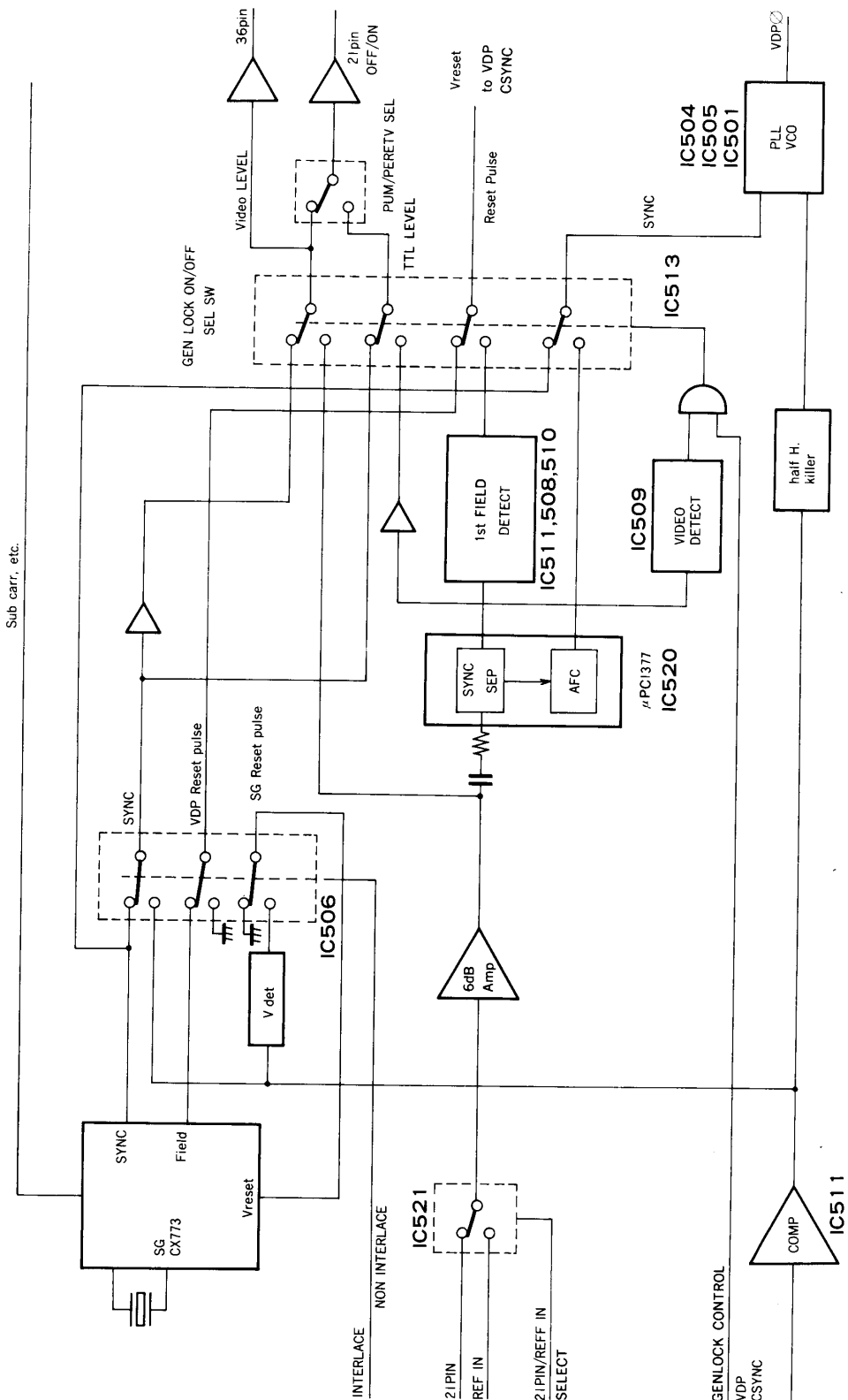
DSP-8 board

(1) VDP, VRAM (IC313, IC309, IC310, IC311, IC312)
 The VDP uses V9938 and has a screen display function.
 The VRAM has a capacity of 128k bytes.

(2) F7 port latch (IC307)

F7: b7 b6 b5 b4 b3 b2 b1 b0

(1) External audio mixing (R) (output)   L-mixing
(2) External audio mixing (L) (output)   L-mixing
(3) Video input slection (output)   L-21-pin
(4) Sync mode selection (output)   L-internal sync
(5) External video detection (input)   L-non-input
(6) AV control (output)   L-TV
(7) Ym control (output)   L-full
(8) HB-G900 is not supported
(9) $\overline{S1}$ (output)
(10) $\overline{S0}$ (output)
(11) Existence of port F7 (input)   L-existence

Bit contents

Inverted negative logics C0 and C1 in bits 4 and 5 of VDP register 9 are output to bits 7 and 6. The relationship between bits 6 and 7 and the display mode is shown in the table below. Bit 7 indicates existence of port F7 during signal input. When bit 7 is set to low (0), the F7 port is present.

b7	b6	Display mode
0	0	Not defined
0	1	Television screen
1	0	Computer display/Superimpose
1	1	Computer display

The Ym of bit 5 is not supported because it does not conform to the CENELEC specifications. For the AV control of bit 4, when the output is high or the RGB multiconnector video input is low, a broadcast wave video signal is selected. Bit 3 detects the video input during signal input and indicates existence of an input signal from the input terminal selected using bit 2. When signal input is detected, output is 1 (high). Bit 3 is not influenced by the mode set using bits 6 and 7. The sync mode is selected during signal output.
Bit 2 is used to select video and audio input terminals. An RGB multiconnector is selected when the input is 0, and a BNC connector is selected when it is 1.
Bit 1 indicates external audio input mixing the left channel. Bit 0 indicates external audio dnput mixing in the right channel. For 0, the computer sound is mixed with an external input sound since mixing is on. For 1, only the computer sound is output since mixing is off.

Initialized value
Initializing is performed using a system program.
Initalizing
Initializing is performed using an MSX-BASIC version 2 set video command.

(3) Audio mixer
 The computer sound and external input sound mixed using the audio mixer.
 Use bit 2 at port F7 to input the external sound from either an RGB multiconnectror a pin jack. The mixing mode can be selected using bits 1 and 0 at port F7. The above selection can be set using a set video command.
 The volume control on the front panel is used to adjust the computer volume. The external sound cannot be controlled using the volume control.
 The pin jack block is through-output using relays RY301 and RY302 when the power is turned off.

HB-G900P/F

Switching Specifications

1. INTERLACE/NONINTERLACE

Output of an RGB multiconnector composite sync signal from CX-773B (INTERLACE only) or VDP-9938 (INTER-LACE and NONINTERLACE selected using software) is selected. When the switch is set to INTERLACE, a correct PAL signal is output.
When the switch is eet to NONITERLACAE, an NTSC signal is output instead of the PAL signal.
The switch is set to INTERLACE at the factory.

2. PERI TV/PVM

The output signal from a 21-pin RGB connector into the CENELEC or PVM specifications is selected. The selected signal is shown in the table below.
The switch is set to PERI TV as the factory.

	PERI TV	PVM
AVC	$0\sim+12$ V	$0\sim+5$ V
YS	0.7 V_{P-P}	TTL level
C.SYNC	0.3 V_{P-P} or video signal	TTL level

3. TO MODEM/TO TERMINAL

The signal lina is selected depending on whether the destination device connected to the RS-232C connector is a terminal or a MODEM. The selected signal is shown below.

Transmitted data ←——→ Received data
CTS   ←——→   RTS
DTR   ←——→   DSR

The signal line is set to MODEM at the factory.
(4) Color bus, DLCLK
When the HBI-900G is connected for digitization, the A/D-converted data is loaded into VDP through the color bus.
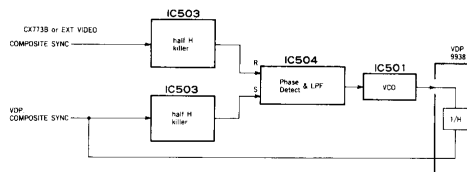The timing signal for loading is a DLCLK.
(5) YS
This is switching signal used to superimpose the computer graphics and video signal.

SG-106 Board

(1) PLL circuit (TC5081, 74LS628)
The block diagram is shown below.

In the internal sync mode, the PLL circuit is constituted using the composite sync signal output from CX-773B as the reference signal. The phase detector is used to compare the edges of the composite sync signals isput to terminals R and S and to output the resultant error signals to the PD OUT terminal. The error signals are then input to the AIN termdnal and fed through a low-pass filter to VCO IC501 . The Y output from the VCO is input to the VDP clock terminal. The clock is varied from 20.26 MHz (min.) to 22.55 MHz (max.). In the external sync mode, the PLL circuit is constituted using the AFC (IC520) H OUT signal as the reference signal.

(2) Video signal generator (CX-773B)
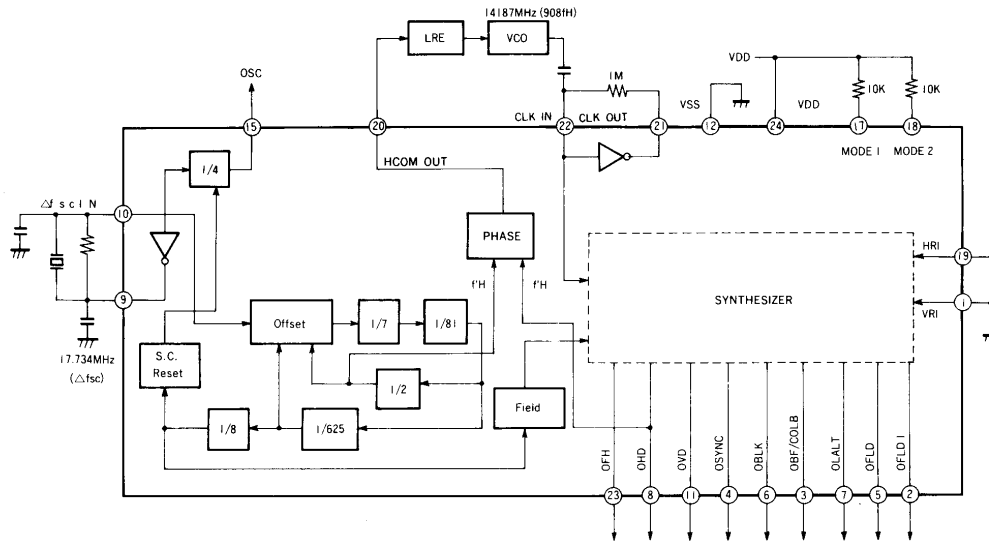
The video signal generator configuration is shown above.

In the internal sync mode, the generator functions primarily as follows:
- Outputs the composite sync signal as a PLL reference signal.
- Outputs various signals (subcarrier, alternating-current pulse, etc.) to the 36-pin Amphenol connector to generate an encoded video signal when the HBI-G900 is connected.

## (3) Sync separator (μPC1377C) IC520

The block diagram is shown below.
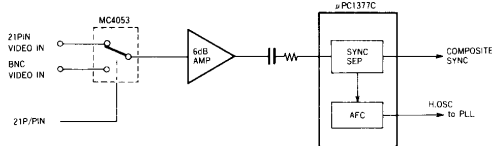
The selected video signal is amplified by 6 dB using a set video command and fed to the sync separator (μPC1377C).

The sync-separated composite sync signal is used in a first field detector. In the external sync mode, the composite sync signal is also used as a PVM monitor composite sync signal. The sync separator has an internal AFC circuit. The H signal output through the AFC circuit is used as a PLL reference signal in the external sync mode. Use of the AFC circuit can suppress computer graphics distortion caused by the VTR faulty playback.

## (4) First field detetector

The block diagram is shown below.
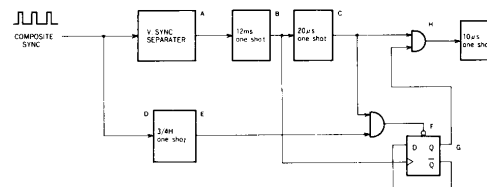
The timing chart is shown on the next page.

The first field detector operation is described here. A V sync signal is detectd from the sync-separated composite sync signal. V reset pulse C is generated after 20 μsec from the trailing edge of the V sync signal (the trailing edge is adjusted using RV). However, in this case, V reset operations cannot be performed in the first field. Threfore, masking is required so that the V reset pulse is not generated in the second field. Frame signal G is obtained by inserting a V sync signal into the flip-flop and frequency-dividing the signal by two.

The frame signal is reset every first field. First field signal F is obtained by ANDing a 3/4 H one-shot pulse and a 20 μsec pulse. (The fimst field signal can be distinguished from the second field signal by applying the 3/4 one-shot pulse.) A 12 msec one-shot multivibrator is used to prevent the computer graphics from being vertically distorted by using the false V sync signal and V sync signal from the VTR.

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First Field Detector Timing Chart
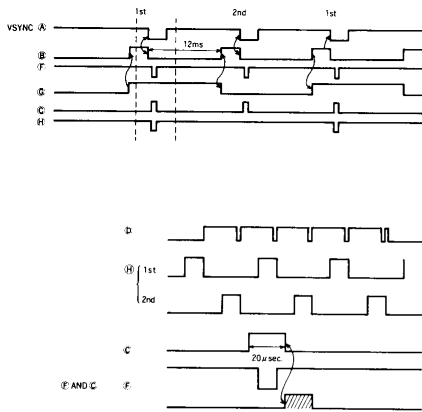
The first field signal can be distinguished from the second field signal by applying a 3/4 one-shot pulse.
SL74 reset
V reset pulse fed to VDP

(5) INTERLACE/NONINTERLACE select switch
Refer to the Switching Specifications.
(6) GENLOCK ON/OFF select switch
When external synchronization is selected using a set video command an external video signal is input, the select switch is set to the external sync mode. The sync block is separated from signal generator CX-773B and switched to the external video block.

I/O interface

Keyboard	Separate keyboard
	Software scanning
	Total number of keys: 75
	Control keys: 12
	Function keys: 5
	Edit keys: 8
	Numeric keys: 16
RGB input/output	21-pin multi connector (see page 39)
Reference input	BNC connector
	1 Vp-p, 75 ohms terminate, sync negative
Video interface	36-pin connector (See page 40)
Audio input	Phono jack
	Input impedance: more than 10K ohms
Audio output	Phono jack
	Output impedance: less than 1K ohms
Sound generator	8-octave, 3 tones and 1 noise output
Audio cassette interface	
	8-pin DIN jack
	Baud rate: 1200/2400 bps
	Remote control function provided
Printer interface	14-pin connector
	TTL level
	Standard 8-bit parallel transfer
RS-232C interface	25-pin connector
	RS-232C standards
	Baud rate: 75-19200 bps (selectable)
General purpose interface	
	9-pin connector (2)
	For connection of joystick, etc.
MSX cartridge slot	2

Disk drive section

Disk used	3.5˝ micro floppydisk
Disk type	Double- or single-sided
Recording capacity	Unformatted: 1M bytes
(double-sided)	Formatted: 720K bytes
	Bytes/sector: 512
	Sectors/track: 9
	Tracks/cylinder: 2
	Tracks/disk: 160
	Bytes/disk: 720K

Pin assignment

RGB

VIDEO I/F

Pin No.	Signal	Signal level	Impedance
1	Audio (R) output	nominal: 0.5 V maximum: 2 V	less than 1 K ohm
2	Audio (R) input	nominal: 0.5 V maximum: 2 V	more than 10 K ohms
3	Audio (L) output	nominal: 0.5 V maximum: 2 V	less than 1 K ohm
4	Audio common return		
5	Blue return		
6	Audio (L) input	nominal: 0.5 V minimum: 0.2 V maximum: 2 V	more than 10 K ohms
7	Blue input/output	0.7 Vp-p	75 ohms
8	Function switching[1]	logical "0": 0.2 V logical "1": 9.5 V-12 V	
9	Green return		
10	—		
11	Green output	0.7 Vp-p	75 ohms
12	—		
13	Red return		
14	Intercommunication data line common return		
15	Red output	0.7 Vp-p	75 ohms
16	Blanking output[1]	logical "0": 0-0.4 V logical "1": 1-3 V	75 ohms
17	Video return		
18	Blanking return		
19	Video output[2]	1 Vp-p (composite video)	75 ohms
20	Video input	1 Vp-p (composite video)	75 ohms
21	Common return		

Pin No.	Signal	Signal level
1	Video input	1.0 Vp-p, 75 ohm term.
2	Video output	1.0 Vp-p, 75 ohm term.
3	R	0.7 Vp-p, 75 ohm term.
4	G	0.7 Vp-p, 75 ohm term.
5	B	0.7 Vp-p, 75 ohm term.
6	Ys	TTL
7	Ym	No-connect
8	SYNC	TTL
9	BF	TTL
10	SYM0	TTL
11	VIDEO/NO VIDEO	TTL
12	C0 (B1)	TTL
13	C2 (R0)	TTL
14	C4 (R2)	TTL
15	C6 (G1)	TTL
16	RCA/21 pin	TTL
17	SC	TTL
18	DLCLK	TTL
19	GND	
20	GND	
21	GND	
22	GND	
23	GND	
24	GND	
25	Computer sync	TTL
26	ALT	TTL
27	BLK	TTL
28	SYM1	TTL
29	GND	
30	C1 (B2)	TTL
31	C3 (R1)	TTL
32	C5 (G0)	TTL
33	C7 (G2)	TTL
34	GND	
35	GND	
36	GND	

1) When a PVM monitor is conncted, the signal level will be:
   logical "0": 0 V
   logical "1": 5 V
2) When a PVM monitor is connected, the signal level will be:
   IVp-p (composite sync)

A/V Control   F7H Port

	Write			Read
b7	$\overline{S0}$			F7 port ID L: ACTIVE
6	$\overline{S1}$			*
5	Ym Control	L: Full		*
4	AV Control	L: TV		*
3	Sync Mode	L: Internal		Video sense L: NON
2	Video Input Select	L: 21 pin		*
1	Audio L	L: Mix On		*
0	Audio R	L: Mix On		*

System Control   F5H Port

	Write
b7	*
6	*
5	*
4	*
3	F7 port EN L: Enable
2	*
1	*
0	*

Floppy Disk Controller   D0~D3H
　　　　　　　　　　+Memory Map

Calender Clock   B4H, B5H Port
B4 Address Latch

	Write
b7	*
6	*
5	*
4	*
3	A3
2	A2
1	A1
0	A0

B5 Data

	Write	Read
b7	*	*
6	*	*
5	*	*
4	*	*
3	D3	D3
2	D2	D2
1	D1	D1
0	D0	D0

PPI (8255) A8~ABH

	A8H Aport	A9H Bport
b7	D7	D7
6	D6	D6
5	D5	D5
4	D4	D4
3	D3	D3
2	D2	D2
1	D1	D1
0	D0	D0

ABH COMMAND REGISTER
WRITE

b7	1	
6	} PAGP	$\left.\begin{matrix}0\\0\end{matrix}\right\}$ model $\left.\begin{matrix}0\\1\end{matrix}\right\}$ model1 $\left.\begin{matrix}1,1\\1,0\end{matrix}\right\}$ model2
5		
4	PA0-7	0: Output
3	PA4-7	0: Output
2	PBGP	0: model0 1: model1
1	PB0-7	0: Output
0	PC0-3	0: Output

PSG (AY-3-8910) A0-A2H

A0H   ADDRESS   LATCH
Write

b7	AD7
6	AD6
5	AD5
4	AD4
3	AD3
2	AD2
1	AD1
0	AD0

A1H	DATA WRITE WRITE (A1H only)	A2H DTAT READ READ (A2H only)
b7	D7	D7
6	D6	D6
5	D5	D5
4	D4	D4
3	D3	D3
2	D2	D2
1	D1	D1
0	D0	D0

VDP (9938) 98-9BH

98H	Video RAM data	R/W
99H	Command & Status Register	R/W
9AH	Color palette Register data	W
9BH	Indirect assignment data	W

For bit assignment, refer to the VPP technical data book. because of its many registers.

PRINTER 90H-91H

90H	Write	Read
b7 | b2	*	*
b1	*	Busy state 1 : Not busy
b0	Strobe output L : enable	*

91H	Write
b7 | b0	D7-D0

PS-232C 80-87H port

80H   8251   Data port
                 Write/Read
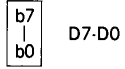
| b7 |
| I | D7-D0
| b0 |

81H   8251   Command/port
                 Write   Read
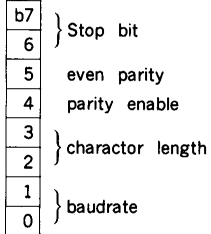
| b7 | } Stop bit   *   DSR
| 6 | reset   Break charactor
| 5 | even parity   RTS   Framing error
| 4 | parity enable   ⇨ error reset   Over run error
| 3 | } charactor length B reak charactor   parity error
| 2 | Receive enable   TXD
| 1 | } baudrate   DTR   RX ready
| 0 | Tramsmit enabae   TX ready
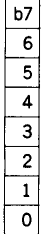
82H   Read
| b7 | CTS   0 : enable
| 6 | Counter2
| 5 | *
| 4 | *
| 3 | *
| 2 | *
| 1 | RI   0 : Asserted
| 0 | CD   0 : Asserted

83H   Write
| b7 |
| I | *
| b1 |
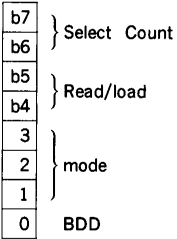| b0 | Rx ready   0 : enable interrupt
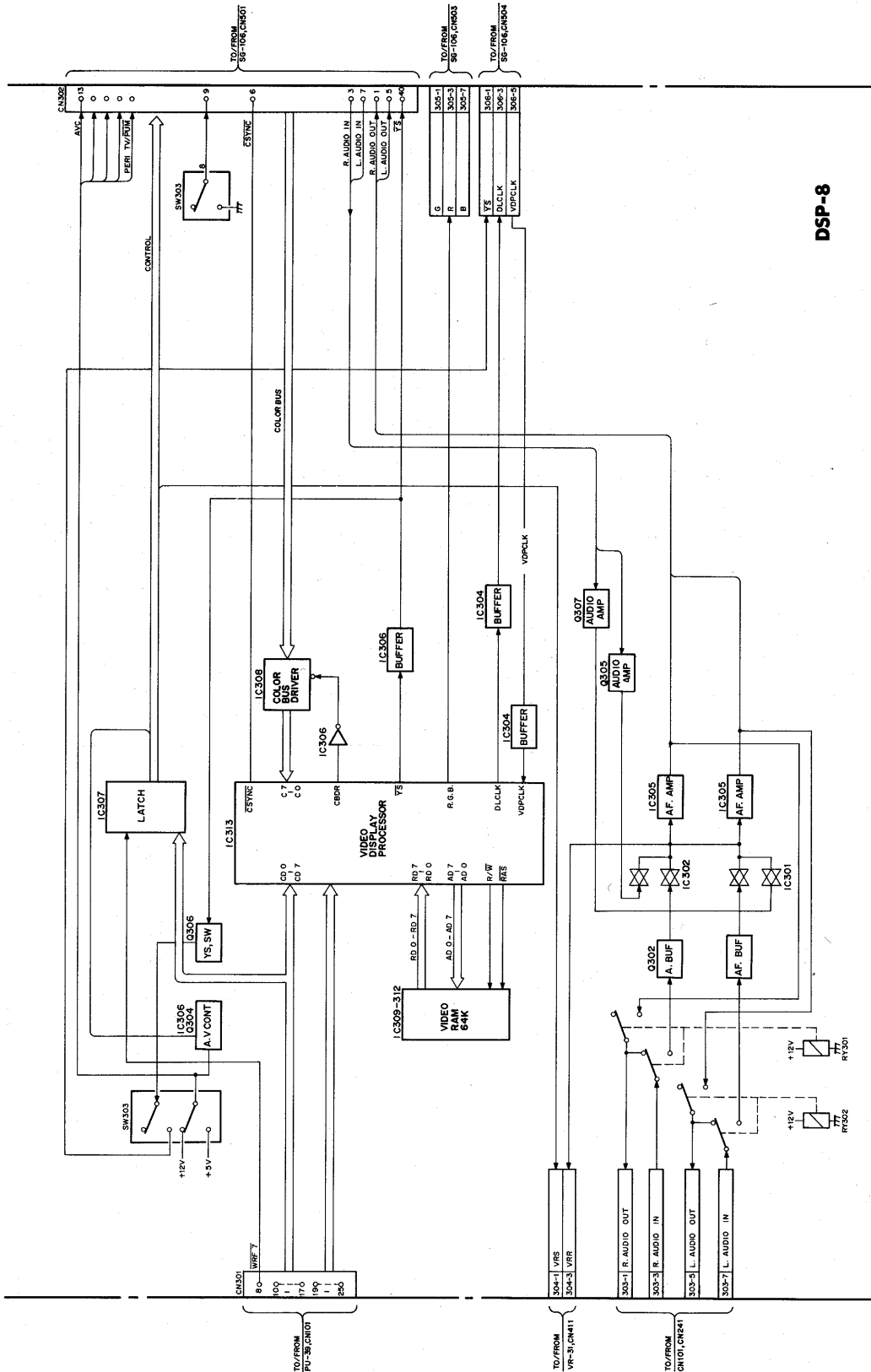
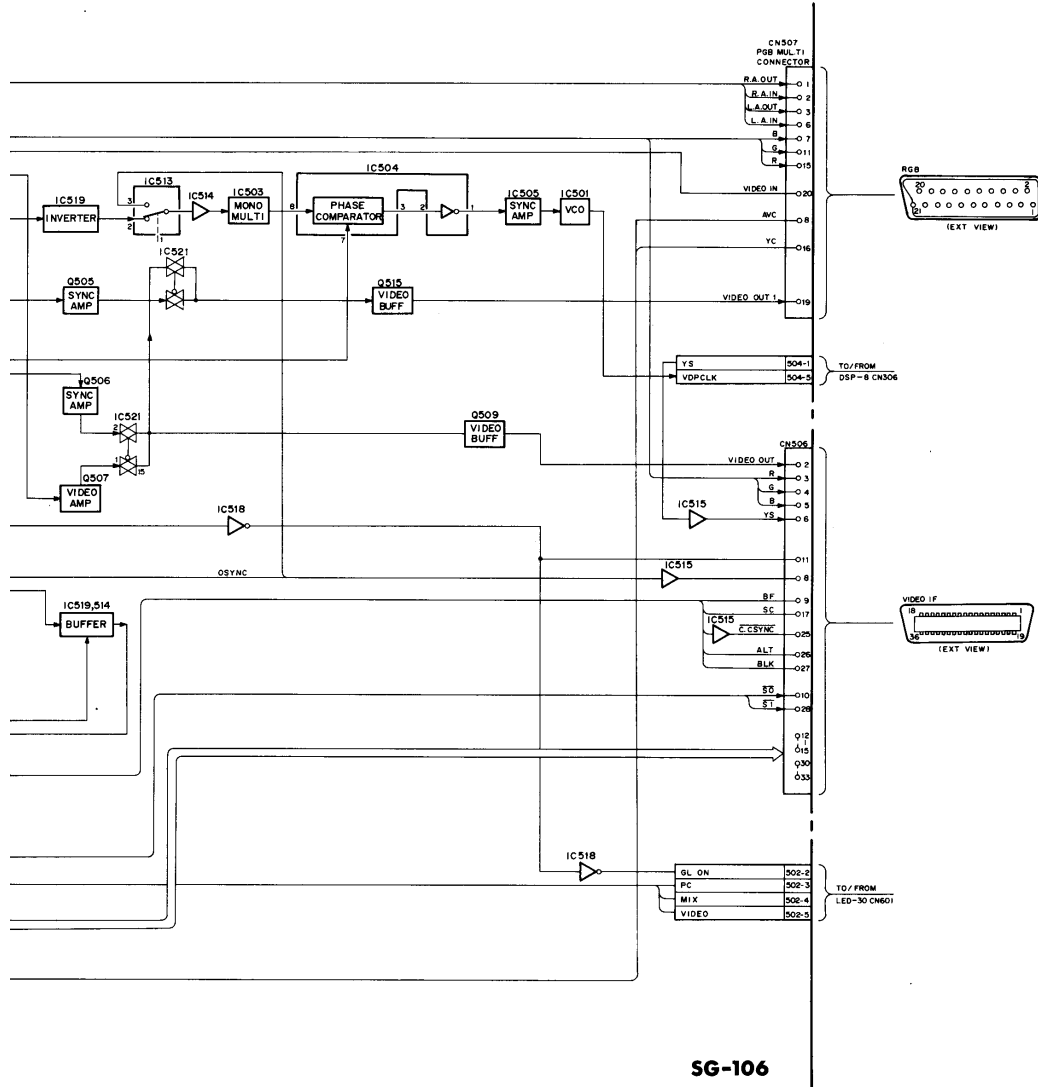84H — Counter0, 85 H— Counter1,
86H — Counter2, data Write/read
87H   Mode Registor
       Write
| b7 |
| b6 | } Select Count
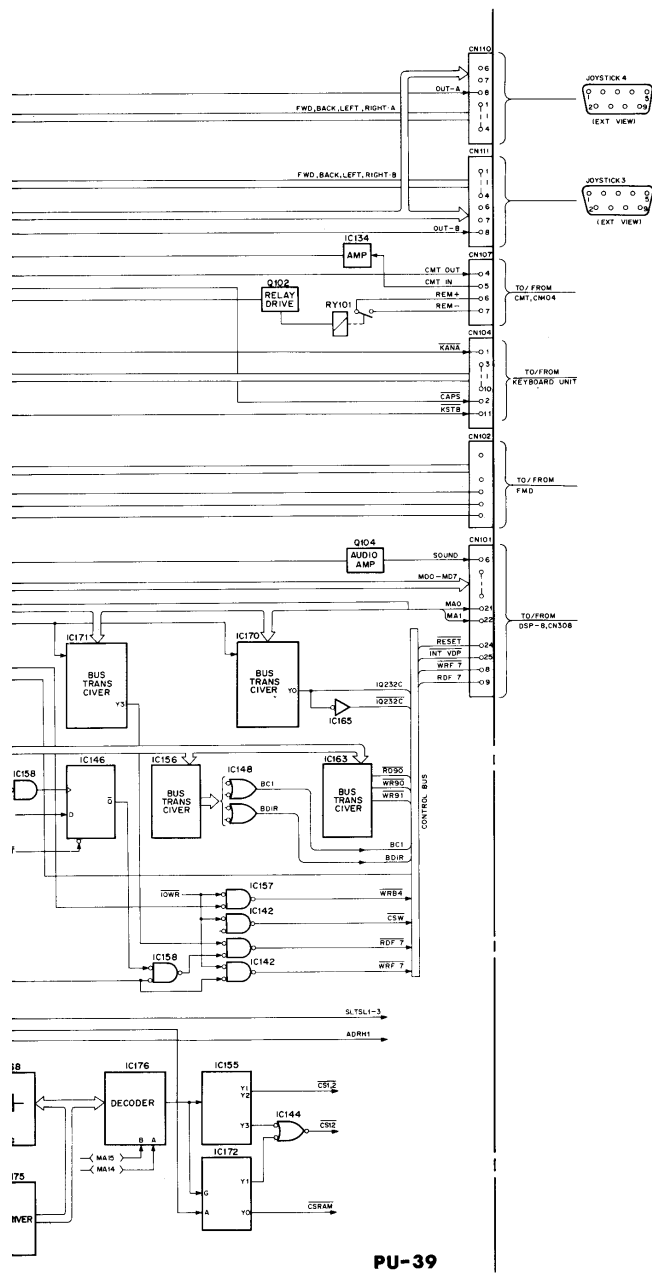| b5 |
| b4 | } Read/load
| 3 |)
| 2 | } mode
| 1 |)
| 0 | BDD

DSP-8

SG-106

3-3. PU-39

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