HB-101P/201P

SERVICE MANUAL

HOME COMPUTER

SONY®

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CHAPTER 1
OPERATION

This manual covers the model HB-101P type 1, model HB-101P type 2 and model HB-201P.

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

This manual explains the HP-101P type 1, HB-101P type 2 and HB-201P Sony home computer. The differences among the three are as follows:

	HB-101P type 1	HB-101P type 2	HB-201P
Memory capacity	32K RAM	32K RAM	64K RAM
Operating voltage	120 V/240 V ac ±10%, adjustable	220 V ac ±10%	220 V ac ±10%
Channel adjustment knob	Not supplied	Supplied	Supplied

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.

FEATURES

Possible to connect two types of monitor TV
The HB-101P/201P has an RF connector and a 6-pin DIN-type VIDEO/AUDIO connector for video/audio output.

Built-in MSX-BASIC
The built-in MSX-BASIC has various commands, statements and functions which allow you easy program development. With the MSX-BASIC sprite function, you can make and move the different patterns on each of the 32 sprite planes.
The sound generator makes it possible to output three tones and one noise simultaneously, so that you can generate various effect sound or music by using the PLAY and SOUND statement of the MSX-BASIC.
Two supplied manuals for the MSX-BASIC will tell you not only how to use the MSX-BASIC but also the pleasure of programming.

Easy-to-use Personal Data Bank
The Personal Data Bank, which is the other built-in software, makes it easy to handle personal data such as addresses, phone numbers, and so on. Convenient to use, you are sure to find many uses for it.

Pause function
The action of a video game, for example, on the monitor TV can be stopped momentarily by pressing the PAUSE button.

Various peripherals for the HB-101P/201P
Various peripherals can be connected: MSX-BASIC program and data and the Personal Data Bank data can be saved on an audio cassette tape, a data cartridge, or a micro floppydisk. To print out data or graphics, the color plotter printer is useful. When playing a computer game, you can use up to two joystick controllers to make the game more exciting.

Peripheral devices for HB-101P/201P

Device name	Major features
HBD-50 Micro Floppydisk Drive	• High-density information storage • Easy-to-operate • Fast recall of data
JS-55 Joystick	• Designed for left- or right handed players • Shoot buttons on both left and right
JS-75 Wireless Joystick	• No cords to get tangled • Can be operated from up to 7 meters away
SDC-500 Datacorder	• Easy to operate with any computer • High-speed data transfer
PRN-C41 Color Plotter Printer	• Four-color printer: black, blue, green and red • Light weight and compact • Can use any paper up to 114 mm in width

PRECAUTIONS

On safety

- Check that the operating voltage of your computer is identical with the voltage of your local power supply.
- 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.
- 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.

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 base.
- 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.
- Do not place electronic equipment near the computer. It may malfunction if affected by an electromagnetic field.
- 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.

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.

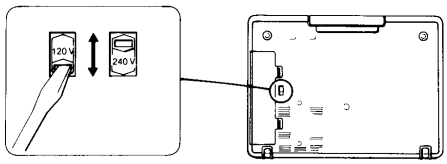
If trouble occurs, unplug the unit, and contact your designated Sony dealer.

OPERATING VOLTAGE

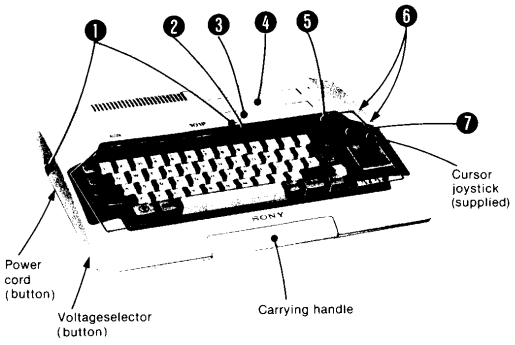
Before connecting the computer to the power source, check that its operating voltage is the same as the local power line voltage.

The HB-101P type 2 and the HB-201P operates on 220 V ac.

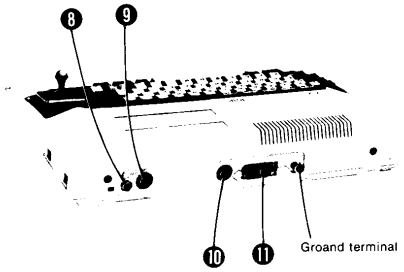
The HB-101P type 1 operates on either 120 or 240 V ac. The voltage selector is located on the bottom of the computer, at the side of the power cord compartment. If the selector needs to be reset, disconnect the ac power cord and adjust the selector with a small screwdriver so that the apparopriate voltage indication appears.



LOCATION AND FUNCTION OF PARTS AND CONTROLS



Rear



❶ POWER switch and indicator
Press the switch to turn on the computer. To turn off, press the switch again. The indicator lights up while the power is on.

Caution
If the power is turned on again immediately after being turned off, the computer may not operate correctly. When you turn off the power, wait a moment before turning it on again.

❷ Keyboard
Is used to input the program and the data into the computer. For details, see page 18.

❸ Cartridge slot [1]
Accepts a ROM cartridge or a RAM cartridge here.

❹ Cartridge slot [2]
This slot can be used to insert a ROM cartridge or a RAM cartridge (an expansion memory cartridge, a game cartridge and so on) as the secondary slot. This slot is the same as cartridge slot [1].

❺ RESET button
Press this button if there is a program overrun to reset the computer to the initial state. When the button is pressed, the built-in memory contents will be destroyed.

❻ CONTROLLER A and B connectors
Accepts joystick controllers. When using only one joystick controller, connect it to the CONTROLLER A connector.

Caution
Do not touch the connectors with hands.

❼ PAUSE button
Press this button to momentarily stop the action on the monitor TV. The lamp on the button lights up while the action is stopped. For example, use this button if you want to stop the motion of a video game for a moment.
To start up the action again, press the button again.

❽ RF (RF output) connector
When using a normal TV receiver, connect this connector to the TV antenna terminal with a 75-ohm coaxial cable.

⑨ VIDEO/AUDIO (video/audio output) connector (6-pin DIN connector)
Connect to the monitor TV with a 6-pin DIN connector. This connector outputs both the video and the audio signals.

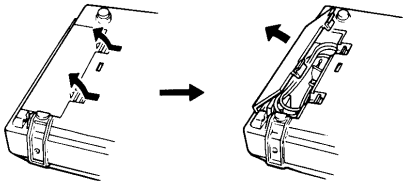
⑩ TAPE connector (8-pin DIN connector)
Connect to a tape recorder to save a program or data on a cassette tape or to load them into the computer from a tape.

⑪ PRINTER connector (14-pin connector)
Connect an 8-bit parallel transfer printer with MSX specifications such as the Sony PRN-C41 color plotter printer.

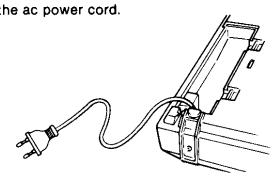
CONNECTION TO A POWER OUTLET

The ac power cord is stored in the ac power cord compartment on the bottom of the computer.

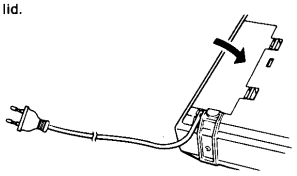
1 Remove the ac power cord compartment lid.



2 Take out the ac power cord.



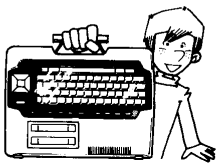
3 Pass the ac power cord through the aparture of the compartment and close the lid.



4 Connect the ac power cord to a wall outlet.

Disconnection
When the computer is not to be used for an extended period of time, or is to be carried to another place, disconnect the ac power cord and store it in the ac power cord compartment.

When the cord is placed in the compartment, you can carry the computer by the carrying handle.



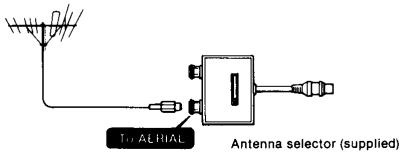
CONNECTION OF PERIPHERALS

Make sure to turn off the computer and all the devices to be connected.

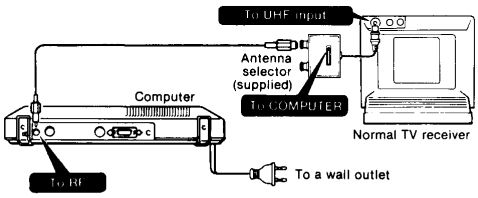
CONNECTING A MONITOR TV

Connecting a normal TV receiver

1 Connect the TV antenna terminal to the supplied antenna selector.



2 Connect a TV receiver to the computer.

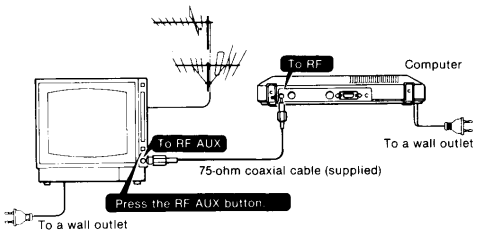


3 Select the channel UHF 36 for the computer.
The RF output of the computer is set to the channel UHF 36 at factory.

Note
The HB-101P type 2 and the HB-201P are equipped with the channel adjustment knob.
If the channel UHF 36 is occupid, or if the display distorts on the channel UHF 36, turn the knob at the rear of the computer with a small screwdriver to change the UHF channel.
When you turn the knob clockwise, the channel changes to 35, and if the knob is turned counterclockwise, the channel changes to 37. The channel can be set from 35 to 37 with the knob.

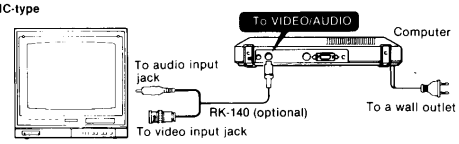
Note
Set the switch of the antenna selector to the COMPUTER position when using the computer. To watch TV, set it to the AERIAL position.

Connecting a monitor TV with RF AUX connector in front



If your monitor TV has a composite video signal input (BNC-type or 6-pin DIN type)

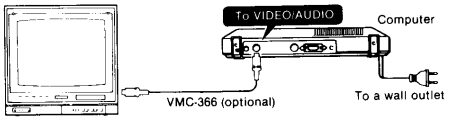
BNC-type



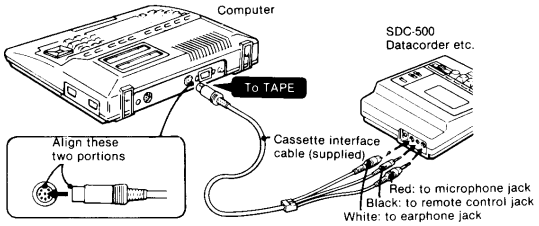
Note

The VMC-262M connecting cable with the EAC-57 adaptor can be used instead of the RK-140.

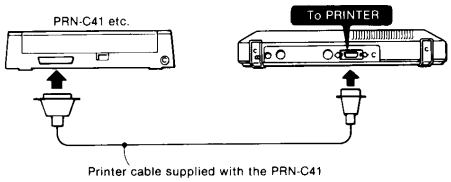
6-pin DIN type



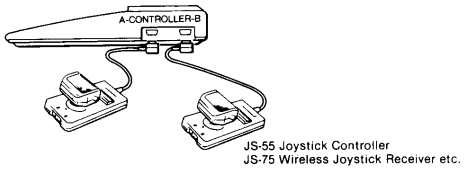
CONNECTING A TAPE RECORDER AS AN EXTERNAL MEMORY



CONNECTING A PRINTER



CONNECTING A JOYSTICK CONTROLLER



HOW TO START UP

The computer itself consists of many electronic parts such as LSIs and ICs, and other electrical and mechanical parts. These are called "hardware".
The computer can perform various kinds of jobs using programs that determine the sequence the computer should follow to do the job. (These programs are also called "software".)

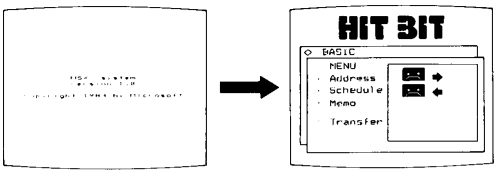
For the HB-101P/201P, there are mainly three types of program:

- Progrms built in the HB-101P/201P
  Personal Data Bank
  MSX-BASIC interpreter
- Commercially available programs in MSX-cartridge form
  Games and other useful programs are available.
- User designed programes in MSX-BASIC
  You can make your own programs using the built-in MSX-BASIC interpreter. A knowledge of BASIC programming is required.

When all the necessary connections have been made, select the program and follow the appropriate steps to get started.

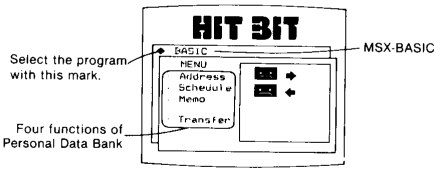
TO START UP THE PERSONAL DATA BANK OR MSX-BASIC

1 Turn on the monitor TV and the computer.



The display now shows what the computer can do.

2 Move the ◆ mark to the desired program by using the cursor keys (▽△) and press the key.



When you select "BASIC", the computer enters the MSX-BASIC command wait state.
For further operation, refer to "Introduction to MSX-BASIC" and "MSX-BASIC Programming Reference Manual".
When you select one of the four programs of Personal Data Bank, refer to "How to use the Personal Data Bank" for further operation.

- Data created by the Personal Data Bank can be saved on the optional HBI-55 data cartridge or using HBD-50 micro floppydisk unit.
  To use the data cartridge or micro floppydisk unit, first insert the data cartridge or the interface cartridge of the micro floppydisk unit into the cartridge slot [1] or [2], then turn on the power.
  Refer to "How to use the Personal Data Bank" for details.

Note on MSX-DOS
When MSX-DOS commands (except DIR, FORMAT and BASIC) are used, data created by the Personal Data Bank are not maintained. Therefore, be sure to save data before transferring control from the Personal Data Bank to MSX-DOS.
Once the above MSX-DOS commands are used, the following MSX-BASIC commands cannot be used:
SAVE "CAT:", LOAD "CAT:", CALL HITBIT

TO START UP A GAME OR OTHER PROGRAMS IN AN MSX CARTRIDGE

Insert the cartridge into cartridge slot 1 or 2 with the illustration side toward you. Then, turn on the monitor TV and the computer.
For details, refer to the instruction manual of the program cartridge.

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

Using the PAUSE button
To momentarily stop the action of games, etc., press the PAUSE button located above the keys. To resume the game, press the PAUSE button again. This does not affect the game score, etc.

Caution
With some software, use of the PAUSE button may distort the display.

Using the curstick (cursor joystick)
Insert the supplied curstick into the center hole of the cursor keys.

This allows you to use the cursor keys as an 8-direction joystick.

TO SAVE AND LOAD AN MSX-BASIC PROGRAM

The MSX-BASIC program and data entered from the keyboard can be saved on a cassette tape or a micro floppydisk. This chapter explains how to save a program on a cassette tape and load it from the tape. As to save or load the program using a data cartridge, refer to the instruction manual of the Sony HBI-55 Data Cartridge.

TO SAVE A PROGRAM

1. Insert a cassette tape into the cassette tape recorder, and adjust the volume and tone control to a center position.
2. Type the save command of MSX-BASIC from the keyboard.
   CSAVE "program name"
   Define the program name within six characters. The first character must be a letter.
3. Press the REC (record)/SAVE button of the recorder.
   The tape starts as soon as the button is pressed.
4. Press the key of the computer.
   The program is then saved on the tape.
5. When a program has been saved and message "Ok" is displayed on the screen, press the STOP button of the recorder.

Note
When the remote control plug is connected to the recorder, the tape start and stop functions of the recorder are controlled from the computer.

TO LOAD A PROGRAM

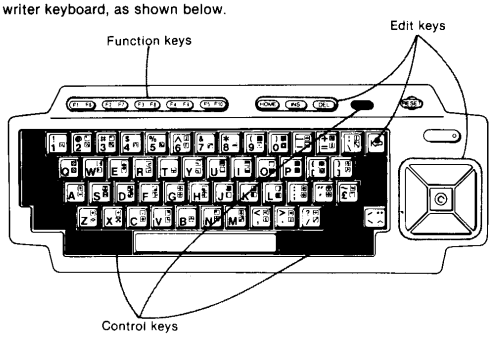
1. Insert the cassette tape containing the desired program into the cassette tape recorder and rewind the tape. Then adjust the volume and tone controls to an appropriate position.
2. Type the load command of MSX-BASIC from the keyboard.
   CLOAD "program name"
3. Press the key of the computer.
4. Press the PLAY/LOAD button of the recorder.
5. When loading is finished, press the STOP button of the recorder.

Note
If the program is not loaded, readjust the volume and tone controls and try again.

KEYBOARD OPERATION

KEY ARRANGEMENT

Alphanumeric characters are arranged in the standard QWERTY typewriter keyboard, as shown below.



The keyboard has character input, control, edit and function keys. When a character input key is pressed, the corresponding character is entered into the computer. When a control key is pressed, the corresponding operation is performed.

Character input keys: A to Z, 0 to 9, +, ?, –, ", and so forth.
The space bar generates a blank space.

Edit keys: HOME, INS, DEL, and cursor move keys

Control keys: CODE, GRAPH, CTRL, TAB, ESC, STOP, and SELECT.

Function keys: F1 (F6) to F5 (F10)

A graphic pattern sheet is supplied on page 27. Use this sheet to see at a glance what keys to press to enter a desired symbol or a graphic pattern.

To enter these patterns or characters, see page 20.

CHARACTER INPUT

To enter characters

When a character input key is pressed, the small letter or symbol printed on the lower part on the key top is entered.

Pressed key	Character or symbol to be entered
T	t
6	6

When a character input key is pressed with the key, the capital letter or symbol printed on the upper part of the key top is entered.

Pressed key	Character or symbol to be entered
+ S	S
+	+

To enter only capital letters

Depress the key. When this key is pressed, it will lock; when pressed again, it will unlock. While this key locks, the indicator on the key lights up, and the 26 alphabet letters are entered in caps (just as when the key is pressed in the normal mode), but numbers and symbols are entered in the normal mode.

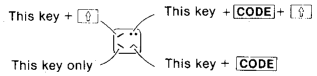
Locked key	Pressed key	Character or symbol to be entered
	K	K
	7	7

To put an accent mark on a character

Key [´] is used to put an accent mark on a character.

To put the accent mark printed on the lower-left of the key (`) on a character, first, press key [´] (in this step, no symbol is displayed on the screen). Then, press the character input key needing an accent mark. The character with an accent mark is displayed.

In the same way, to put the accent mark on the upper-left of the key [´] (´), press the key while pressing the [⇧] key. To put the accent mark on the lower-right of the key [´] (^), press the key together with the [CODE] key. To put the accent mark on the upper-right of the key [´] (¨), press the key while pressing the [⇧] key and the [CODE] key.



To enter a character or symbol printed on the graphic pattern sheet

The procedure to enter a character or symbol printed on the supplied graphic pattern sheet is as follows:

To enter graphic patterns

To enter the graphic pattern printed on the lower-right part of the key on the graphic pattern sheet, press the corresponding keyboard character input key while pressing the [GRAPH] key.

Pressed key	Graphic pattern to be entered
[GRAPH] + [J]	♣
[GRAPH] + [G]	▨

To enter the graphic pattern printed on the upper-right part of the key on the graphic pattern sheet, press the corresponding keyboard character input key while pressing the [GRAPH] key and the [⇧] key.

Pressed key	Graphic pattern to be entered
[GRAPH] + [⇧] + [J]	♫
[GRAPH] + [⇧] + [M]	÷

To enter special characters

To enter the character or symbol printed on the lower-left part of the key on the graphic pattern sheet, press the corresponding keyboard character input key while pressing the [CODE] key.

Pressed key	Character or symbol to be entered
[CODE] + [O]	ó
[CODE] + [M]	μ

To enter the character or symbol printed on the upper-left part of the key on the graphic pattern sheet, press the corresponding keyboard character input key while pressing the [CODE] key and the [⇧] key.

Pressed key	Character or symbol to be entered
[CODE] + [⇧] + [E]	Σ
[CODE] + [⇧] + [N]	Ñ

Note

When using the [CODE] key, release the Ⓒ key.

EDIT KEY FUNCTIONS

Keys [HOME], [INS], [DEL], [←] and cursor move keys ([↑] [←] [→] [↓]) are mainly used for editing a line or screen. Each function is determined by the software used, so read the relevant Software Guide for details.

Under MSX-BASIC, the edit keys function as follows:

[HOME] key

When this key is pressed, the cursor moves to the upper-left corner of the display screen. The characters displayed on the screen remain.

When pressing this key together with the [⇧] key, the cursor moves to the upper-left corner of the screen, while any character displayed on the screen is erased.

[INS] (insert) key

Once this key is pressed, the computer is set to the insert mode. In this mode, the cursor becomes smaller and the character at the cursor position and the followings are moved one space to the right when a key is pressed, and you can insert as many characters as you want.

When pressing this key again or moving the cursor with cursor move keys, the insert mode will be released.

DEL (delete) key
The character at the cursor position is deleted. All characters after the deleted character are moved one space to the left.

(back space) key
When this key is pressed, the cursor moves one space to the left and the character in that position is deleted.

(cursor move) keys
These keys are used to move the cursor one space in the direction of the triangle: to the right, to the left, up or down. Any character which the cursor moves over does not change.

CONTROL KEY FUNCTIONS

key
When this key is pressed together with a character input key, the corresponding symbol in the shift position (upper-left symbol on the key) or corresponding capital letter is entered.

key
When this key is pressed, it will lock so that all letters are entered in capitals. Numbers and symbols will be entered normally even if this key locks. When the key is pressed again, it will unlock. While this key is locked, the indicator on the key lights up.

CODE key
When this key is pressed together with a character input key, the lower-left character or symbol printed on the graphic pattern sheet (supplied at the end of this manual) is entered.
When this key is pressed together with a character input key and the key, the upper-left character or symbol on the graphic pattern sheet is entered.

GRAPH key
When this key is pressed together with a character input key, the lower-right graphic pattern printed on the key is entered.
When this key is pressed together with a character input key and the key, the upper-right graphic pattern printed on the key is entered.

CTRL (control) key
When this key is pressed together with certain keys, a special operation is performed. The key function is determined by the software used. Under MSX-BASIC, the following key combinations are available:

CTRL + B : moves the cursor to the beginning of the word at the cursor position. When the cursor is positioned at the beginning of a word, the cursor moves to the begining of the preceding word.
CTRL + C : releases to input wait state or automatic line number generation.
CTRL + E : deletes the character between the cursor position and the end of the line.
CTRL + F : moves the cursor to the beginning of the next word.
CTRL + G : generates a beep sound.
CTRL + H : has the same function as the key.
CTRL + I : has the same function as the TAB key.
CTRL + J : moves the cursor one line down.
CTRL + K : has the same function as the HOME key.
CTRL + L : has the same function as the key + HOME key.
CTRL + M : has the same function as the key.
CTRL + N : moves the cursor to a position next to the last character in the line.
CTRL + R : has the same function as the INS key.
CTRL + U : deletes the characters of the line at the cursor position.
CTRL + X : has the same function as the SELECT key.
CTRL + \ : moves the cursor to the right.
CTRL +] : moves the cursor to the left.
CTRL + ^ : moves the cursor up.
CTRL + _ (underline): moves the cursor down.

TAB key
This key is used to move the cursor to the next tab position. In MSX-BASIC, tabs are set at every eight characters. Any characters which the cursor goes over are deleted when the cursor moves to the next tab position.

key
Press this key to indicate the end of a line of data or commands input from the keyboard. Press this key every time you finish entering a line.

ESC (escape) key
The function of this key is determined by the software used. Under MSX-BASIC, this key is inoperative.

STOP key
Press this key to interrupt program execution or listing. You can restart the program by pressing this key again.
Pressing this key together with the CTRL key does the same. In this case, however, you can restart program execution with the CONT command, but listing cannot be continued.

SELECT key
The function of this key is determined by the software used. Under MSX-BASIC, this key is not used.

FUNCTION KEYS

Keys [F1] to [F5] ([F6] to [F10]) are called function keys. The functions of these keys are determined by the software. Therefore, read the relevant Software Guide for their functions. In MSX-BASIC, keys [F1] to [F5] function as follows (When these keys are pressed while pressing the [⇧] key, they function as keys [F6] to [F10].):

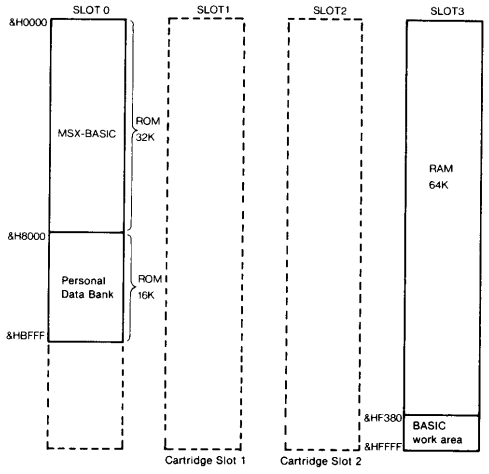
Function key only	Function key + [⇧] key
[F1] color	[F6] color 15, 4, 4
[F2] auto	[F7] cload"
[F3] goto	[F8] cont
[F4] list	[F9] list.
[F5] run	[F10] cls: run

MEMORY EXPANSION OF THE HB-101P

The main memory capacity of the HB-101P (type 1 and 2) is 32K bytes. To expand the main memory capacity, use the optional expansion memory cartrigde HBM-64 (64K bytes).

Note
The main memory capacity is 32K bytes even with the HBM-64 installed when MSX-BASIC is used.

HB-201P

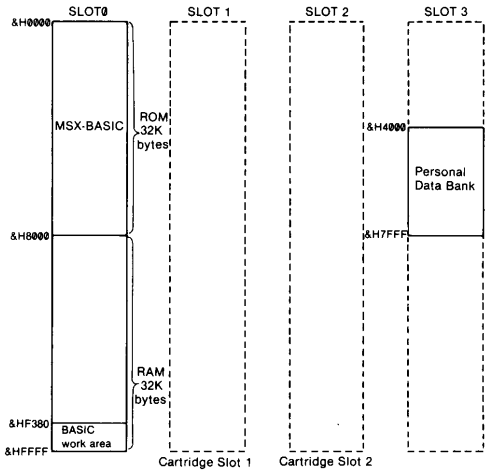


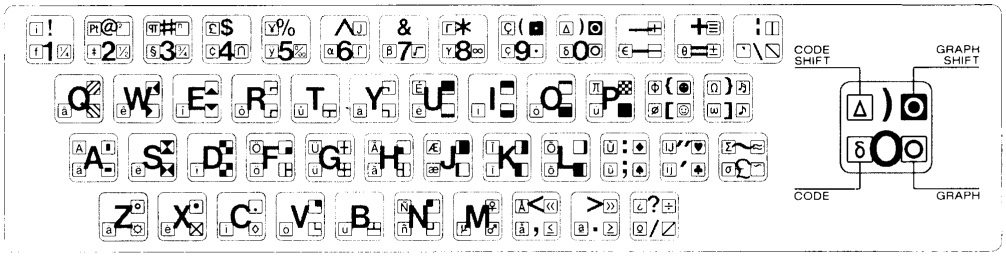
BASIC program is written from the address &H8000.
The capacity of the free area (RAM capacity excluding the system area) can be checked by the FRE function.

Note
When MSX-Disk BASIC is used, BASIC work area is mapped from the address &HE278.

MEMORY MAP

HB-101P




CODE
SHIFT
GRAPH
SHIFT
CODE
GRAPH

SPECIFICATIONS

CPU

Processor used	Z-80A
Clock frequency	3.56250 MHz
WAIT	1 WAIT at CPU M1 cycle
Interrupt	Maskable interrupt Z-80A mode 0 mode 1 mode 2
Resetting	Automatic at power on/Manual (Memory contents are not maintained.)

Memory

Main memory	HB-101P type 1 and type 2 32K bytes RAM HB-201P 64K bytes RAM
ROM	48K bytes MSX-BASIC: 32K bytes Utility Program: 16K bytes

CRT display

CRT controller	TMS9129NL
Display screen	Character display, graphic display and border are
Character display	8×8 dot matrix/character 37 characters×24 lines, 16 colors (max. 40×24) (The initial state in MSX-BASIC is set to this mod
Graphic display	16 colors Graphic I·II 256 (horizontal) ×192 (vertical) dots Multi-color 64 blocks (horizontal) ×48 blocks (vertical) Sprite function Number of sprite plane: 32
Border area	16-color display
Output interface	PAL video output: composite video signal 1 V p-p, 75 ohms, sync negative RF signal: TV UHF 36 ch For the HB-101P type 2 and the HB-201P, adjustable within the range from 35 ch to 37 ch. Audio output: −5 dBs

I/O interface

Keyboard	Software scanning Total number of keys: 74 Control keys: 12 Function keys: 5 Edit keys: 8
Audio cassette interface	8-pin DIN jack Baud rate: 1200/2400 bauds Baud rate is selectable with the CSAVE command or the SCREEN command of MSX-BASIC. Remote control function provided
Sound generator	8-octave, 3 tones and 1 noise output
Printer interface	14-pin connector TTL level Standard 8-bit parallel transfer
General purpose interface	9-pin connector (2) For connection of joystick, etc.
MSX cartridge slot (2)	

General

Power requirement	HB-101P type 1 120 V/240 V ac ±10% adjustable, 50/60 Hz HB-101P type 2 and HB-201P 220 V ac ±10%, 50/60 Hz
Power consumption	15 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	Approx. 380×70×275 mm (w/h/d) (15×2⅞×10⅞ inches) main unit only, including projecting parts and controls
Weight	Approx. 3.1 kg (7 lb 12 oz) main unit only
Accessories supplied	75-ohm coaxial cable (1) Cassette interface cable (1) Antenna selector (1) Operating Instructions (1) How to use Personal Data Bank (1) Introduction to MSX-BASIC (1) MSX-BASIC Programming Reference Manual (1) Curstick (curson joystick) (1)

Design and specifications subject to change without notice.

-11 (1)

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SONY®

MSX

MSX-BASIC
REFERENCE CHART

HIT BIT

*MSX is a trademark of Microsoft Corp.

Printed in Japan

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

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 (joystick number) ON	Enable an interrupt with a joystick. Joystick number: 0 ..... space bar 1 ..... joystick 1 2 ..... joystick 2	STRIG (1) ON
STRIG (joystick number) OFF	Disable an interrupt with a joystick.	STRIG (2) OFF
STRIG (joystick 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 GOSUB line number	Interrupt after an interval. Time between interrupts is the interval × 1/50 second.	ON INTERVAL=100 GOSUB 1000
INTERVAL ON	Enable intervalled interrupts.	
INTERVAL OFF	Disable intervalled interrupts.	
INTERVAL STOP	Hold intervalled interrupts.	

COMMANDS FOR CONNECTED DEVICE

format	function	example
LPRINT [expression] [separator expression] [separator expression] ...	Output data on the printer.	LPRINT A, B, C
LPRINT USING format symbol; expression	Output data on the printer in the specified format. (See PRINT USING.)	LPRINT USING "# # #"; A, B
MOTOR [{ON / OFF}]	Turn the tape recorder motor on or off.	MOTOR OFF

COMMANDS FOR ERROR PROCESSING

format	function	example
ERROR error code	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 / NEXT / line number}]	Return control to the main program after executing an error processing routine.	RESUME 10

COMMANDS FOR MACHINE LANGUAGE SUBROUTINES

format	function	example
DEFUSR [numeric]=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 [, expression]	Hold program execution until the input data form the I/O port reaches a certain value.	WAIT &H90, 255
VPOKE address, expression	Output 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

FUNCTIONS

NUMERICAL FUNCTIONS

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

STRING FUNCTIONS

LEFT$ (X$, N)	: Give N characters from the left of X$.
MID$ (X$, M [, N])	: Give N characters beginning with the Mth character from the left of X$.
RIGHT$ (X$, N)	: Give N characters from the right of X$.
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. ($-32768 \leq X \leq 65535$)
CHR$ (X)	: Give a character whose character code is X.
HEX$ (X)	: Give a hexadecimal expression of X as a string type data. ($-32768 \leq X \leq 65535$)
INSTR ([N,] X$, Y$)	: Give the position of Y$ after the Nth character of X$.
LEN (X$)	: Give a number of characters of X$.
OCT$ (X)	: Give an octal expression of X as a string type data. ($-32768 \leq X \leq 65535$)
STR$ (X)	: Convert to the string type.
VAL (X$)	: Convert to the numeric type.

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.

FUNCTION 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.

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.
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 I/O port

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

From machine language subroutine

USER { 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. When N=0 or 4: Give -1 if the touch pad is touched; otherwise, give 0. When N=1 or 5: Give x-coordinate of the position touched. When N=2 or 6: Give y-coordinate of the position touched. When N=3 or 7: Give -1 if the switch is pressed; otherwise, give 0.

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 +63
	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 : Inpossible 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 occured.
24 Missing operand : Operand is missing.
25 Line buffer overflow : The entered program exceeds the buffer size.
51 Internal error : Memory content or text is not normal.
52 Bad file number : Incorrect file number.
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.
59 Fine not OPEN : The file needs to be opened.

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
LLIST [starting line number] [-] [end line number]	Print program list on a connected printer.	LLIST 100-200
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 area and the high memory.	CLEAR 400, 55296
DIM variable name (maximum value of subscript [maxmum value of subscript] ...)	Declare the name, type, size and dimension of array.	DIM A$ (100)
DEF {INT / SNG / DBL / STR} 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)]=expression	Define user functions.	DEF FNA (X)=A*X^2+B*X+C
ERASE [name of array variable] [, name of array variable] ...	Erase arrays	ERASE A, B, C
KEY function key number, character string	Define strings for function keys.	KEY 1, "LLIST"+CHR$ (13)

COMMANDS FOR DATA INPUT/OUTPUT

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

COMMANDS FOR CONTROLLING PROGRAM EXECUTION AND FLOW

format	function	example
RUN [line number]	Start program execution.	RUN 100
STOP	Interrupt program execution.	
CONT	Restart program execution.	
END	Terminate program execution.	
TRON	Display line number that was executed.	
TROFF	Cancel TRON.	

FOR variable=initial value TO end value
  | [STEP increment]
NEXT [variable] [, variable] ...
	Repeat the program execution between FOR and NEXT.	FOR I=1 TO 10 STEP 2
		  |
		NEXT I

GOSUB line number
  |
RETURN [line number]
	Transfer control to the specified subroutine. Return to the main routine with RUTURN	100 GOSUB 100
		  |
		1000
		  |
		1100 RETURN

GOTO line number	Transfer control to the specified line.	GOTO 100
IF expression { THEN { statement / line number } / GOTO line number } [ELSE { statement / line nuber }]	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]	Specify the screen display mode. Mode Ø: 40×24 character text mode 1: 32×24 character text mode 2: high resolution graphic mode 3: multi-color mode Sprite size Ø: 8×8 dot unmagnified 1: 8×8 dot magnified 2: 16×16 dot unmagnified 3: 16×16 dot magnified Key click switch Ø: Supress key click sounds. 1: Produce key click sounds. Baud rate Ø: 1200 baud 1: 2400 baud Printer type Ø: MSX printer 1: Non-MSX printer	SCREEN 2, Ø,Ø
WIDTH number of display characters per line	Specify the number of characters per line in the text mode.	WIDTH 28
CLS	Erase all displays on the screen.	
LOCATE [x-coordinate], [y-coordinate], [cursor switch]	Move the cursor. Cursor switch Ø: Not display the cursor. 1: Display the cursor.	LOCATE 1Ø, 12, 1
COLOR [foreground color], [background color], [border color]	Specify colors of the foreground, background and the border.	COLOR 8, 15, 2
PUT SPRITE sprite plane number, [, [STEP] (x-coordinate, y-coordinate)], [color code], [sprite number]	Display the specified sprite pattern at the specified position on the specified sprite plane.	PUT SPRITE Ø, (1ØØ, 5Ø), 7, 2
CIRCLE [STEP] (x-coordinate, y-coordinate), radius, [color code], [start angle], [end angle], [aspect ratio]	Draw a circle.	CIRCLE (8Ø, 6Ø), 15, 8
DRAW "graphic subcommands"	Draw an arbitrary graphic.	DRAW "S4ØU5R5D5L5"
LINE [[STEP] (x-coordinate, y-coordinate)]-[STEP] (x-coordinate, y-coordinate), [color code] {, [B] / , [BF]}	Draw a line or a square.	LINE -STEP (2Ø, 5Ø),, B
PAINT [STEP] (x-coordinate, y-coordinate), [color code], [border line color code]	Color the area inside the border line.	PAINT (12Ø, 1ØØ)
PSET [STEP] (x-coordinate, y-coordinate) [, color code]	Mark a dot.	PSET STEP (1Ø, 1Ø), 14
PRESET [STEP] (x-coordinate, y-coordinate) [, color code]	Mark or erase a dot.	PRESET (1ØØ, 1ØØ)
KEY {ON / OFF}	Display or erase the contents of function keys.	KEY OFF

Graphic subcommands

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

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

COMMANDS FOR MUSIC PERFORMANCE

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

Music subcommands

subcommand	function and range	initial value	subcommand	function and range	initial value
A[#/+/−]-G[#/+/−]	Music notes		Tn	Tempo 32≦n≦255	n=120
On	Octave 1≦n≦8	n=4	Vn	Volume 0≦n≦15	n=8
Nn	Pitch 0≦n≦96		Mn	Envelope frequency 1≦n≦65535	n=255
Ln	Length 1≦n≦64	n=4	Sn	Envelope pattern 1≦n≦15	n=1
Rn	Rest 1≦n≦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]" [FOR mode] AS [#] file number	Open a file and specify a mode. Modes: OUTPUT..... Write INPUT..... Read	OPEN "CRT : TEST" FOR OUTPUT AS #1
PRINT # file number, expression	Write data into file in sequence.	PRINT #1, "ABC"
PRINT # file number, USING format symbol; expression	Write data into file in sequence in the specified format. (See PRINT USING.)	PRINT #1, USING "\ \";A$
INPUT # file number, variable [, variable] ...	Read data from 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 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 the program.	SAVE "CAS:PROGRAM"
LOAD "device name [file name]"	Load the program.	LOAD "CAS:PROGRAM"
MERGE "device name [file name]"	Load ASCII codes program and merge it with the program in memory.	MERGE "CAS:PROG2"
BSAVE "device name [file name]", starting address, end address [, execution starting address]	Save the contents of memory within the specified range.	BSAVE "CAS:GAME", &H3000, &H3FFF
BLOAD "device name [file name]" [, R] [, offset]	Load machine language program. 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
CSAVE "file name" [, baud rate]	Save the program into cassette tape. Baud rate: 1..... 1,200 baud 2..... 2,400 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"

Device name

CAS: ..... cassette tape
CRT: ..... text mode screen
GRP: ..... graphic mode screen
LPT: ..... printer
CAT: ·····data cartridge

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]" [FOR mode] AS [#] file number	Open a file and specify a mode. Modes: OUTPUT..... Write INPUT..... Read	OPEN "CRT : TEST" FOR OUTPUT AS #1
PRINT # file number, expression	Write data into file in sequence.	PRINT #1, "ABC"
PRINT # file number, USING format symbol; expression	Write data into file in sequence in the specified format. (See PRINT USING.)	PRINT #1, USING "\ \";A$
INPUT # file number, variable [, variable] ...	Read data from 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 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 the program.	SAVE "CAS:PROGRAM"
LOAD "device name [file name]"	Load the program.	LOAD "CAS:PROGRAM"
MERGE "device name [file name]"	Load ASCII codes program and merge it with the program in memory.	MERGE "CAS:PROG2"
BSAVE "device name [file name]", starting address, end address [, execution starting address]	Save the contents of memory within the specified range.	BSAVE "CAS:GAME", &H3000, &H3FFF
BLOAD "device name [file name]" [, R] [, offset]	Load machine language program. 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
CSAVE "file name" [, baud rate]	Save the program into cassette tape. Baud rate: 1..... 1,200 baud 2..... 2,400 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"

Device name

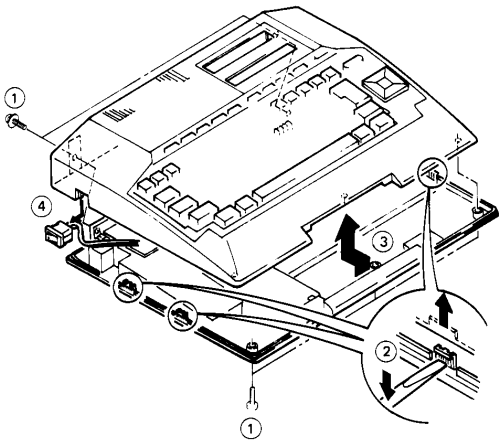
CAS: ..... cassette tape
CRT: ..... text mode screen
GRP: ..... graphic mode screen
LPT: ..... printer
CAT: ·····data cartridge

CHAPTER 2
SERVICE INFORMATION

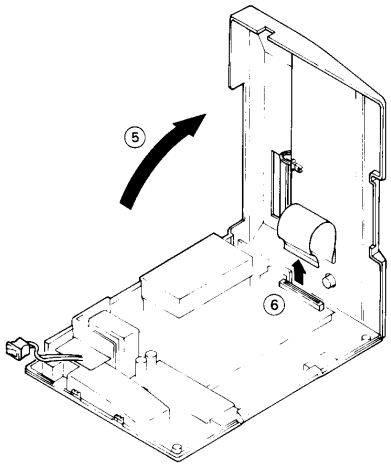
2-1. REMOVAL PROCEDURES

2-1-1. Removal of Upper Cabinet

① Remove 5 screws.
② Insert a flat blade screwdriver into slits (right and left) and undo claws.
③ Raise front part of cabinet and move it in the direction of arrow, and then, undo claws of back part of cabinet.
④ Pull out POWER SW in the direction of arrow from cabinet.

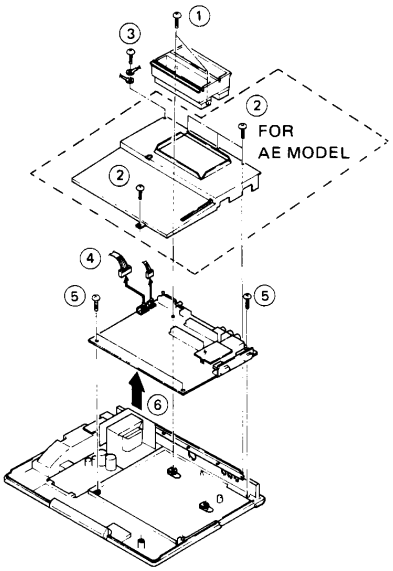


⑤ Remove upper cabinet in the direction of arrow.
⑥ Pull out tape cord of key board.



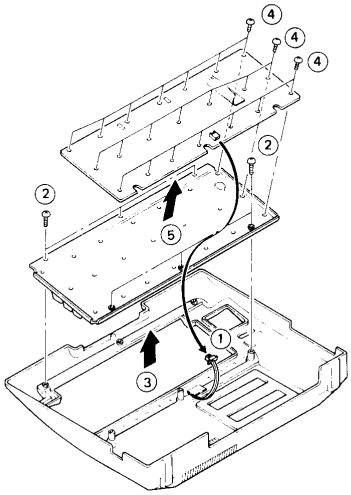
2-1-2. Removal of PU-34 Board

① Remove 2 screws of cartridge holder.
② Remove 4 screws on shield board (upper).
③ Remove a screw of grounding rug.
④ Remove 2 connectors (CN13, 14).
⑤ Remove 3 screws on PU-34 board.
⑥ Remove PU-34 board in the direction of arrow.



2-1-3. Removal of Keyboard

① Remove LED connector.
② Remove 6 keyboard unit fixing screws.
③ Remove keyboard unit in the direction of arrow.
④ Remove 21 screws on keyboard.
⑤ Remove keyboard in the direction of arrow.



2-2. PROVIDING OF FIRMWARE ROM

Firmware ROM (IC8) provide a MASK ROM (MSM38128A-F6RS HB-101P, TMM23128P-8712 HB-201P).
To mount it to IC8 and switch JW1 of MASK/EP switching jumper to MASK ROM side.

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
Q□□	TRANSISTOR
R□□, RV□□	RESISTOR
RY□□	RELAY
S□□	SWITCH
SB□□	SOLAR BATTERY
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

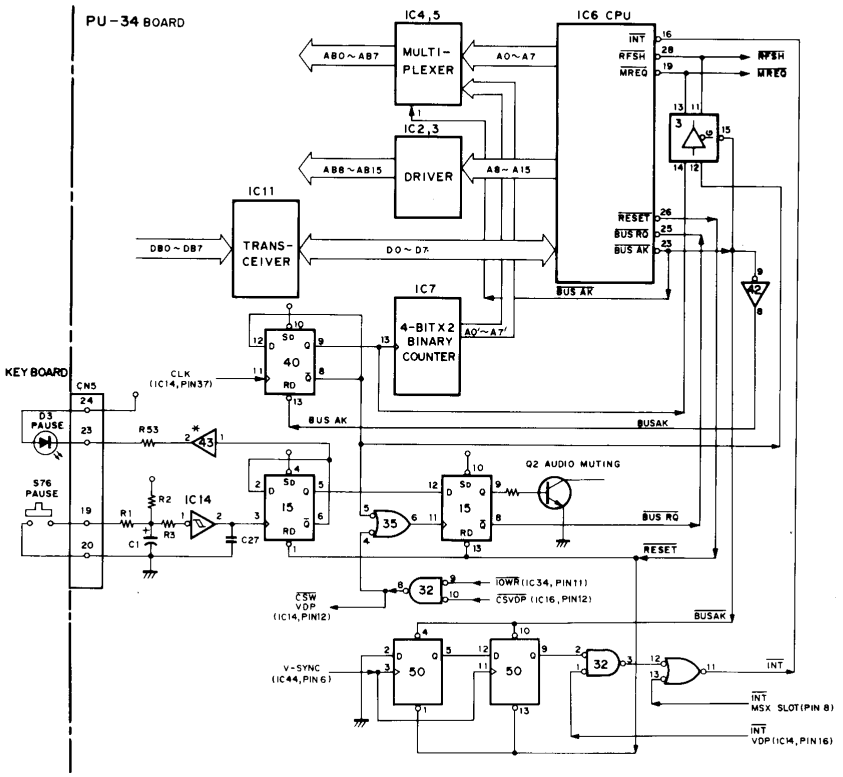
CHAPTER 3
THEORY OF OPERATION

3-1. PAUSE CIRCUIT

$\overline{BUSRQ}$ is one of the Z80 CPU control signals. When $\overline{BUSRQ}$ goes low, the CPU sets all the data/address bus signals, $\overline{MREQ}$, $\overline{IORQ}$, $\overline{RD}$ and $\overline{WR}$ in the high impedance state after terminating the current instruction execution. The CPU then stops the operations, and causes $\overline{BUSAK}$ to go low to inform control that the buses have been opened.
$\overline{BUSRQ}$ is not used in the MSX specification, but it is used to implement the pause function in the HB-101P/201P specification.

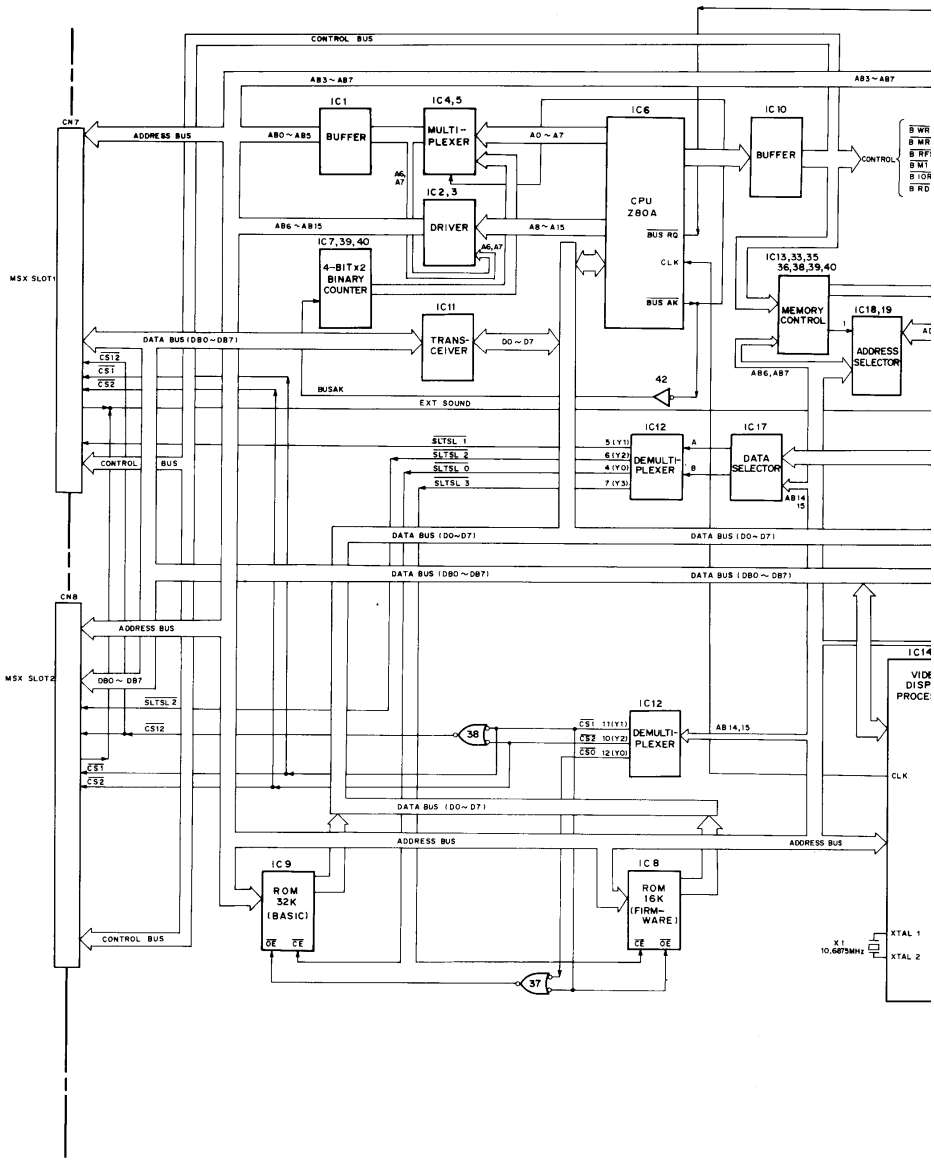
[Circuit operation]

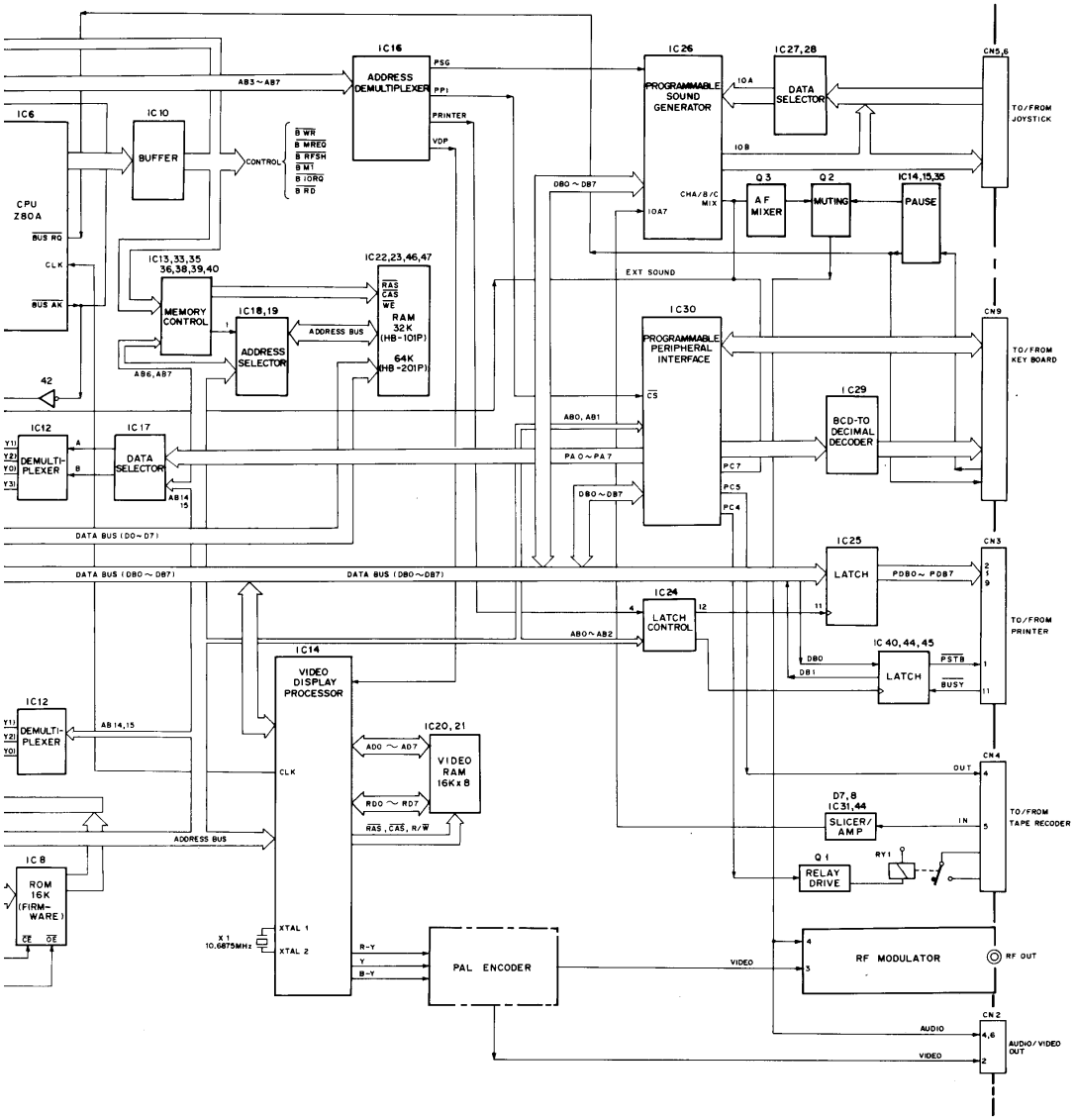
If S76 (pause button) on the keyboard is pressed during program execution,i.e., playing a game, control goes to the pause state. The waveform shape circuit consists of R2, R3, C1 and IC14. When the output signal of IC14 rises, the signal voltage at pin 5 (Q) of IC15(flip-flop 1) goes high and the signal voltage at pin 6 ($\overline{Q}$) of IC15 goes low.
When the $\overline{Q}$ signal goes low, LED D3 (PAUSE LED) lights. The Q signal (at pin 5 of IC15) is fed to pin 12 of IC15 (flip-flop 2). When $\overline{CSVDP}$ at pin 12 of IC16 goes low, the signal voltage at pin 6 of IC35 rises and flip-flop 2 (IC15) is set. At that time, the Q signal (at pin 9 of IC15) is generated to mute the audio signal. When the $\overline{Q}$ signal appears at pin 8 of IC15, $\overline{BUSRQ}$ is fed to the CPU so as to stop the CPU and to enter the CPU into pause state. The main memory consisting of IC22, IC23, IC46 and IC47 is made by using dynamic RAM's and it needs refreshing by any other circuit than the CPU while the CPU is being stopped. Refreshing is carried out in the following manner during this time.
When the CPU receives $\overline{BUSRQ}$, $\overline{BUSAK}$ goes low and BUSAK obtained by inverting $\overline{BUSAK}$ with IC42 is fed to pin 13 of IC40 so as to release IC40 from the reset state. Then, the Q (pin 9 of IC40) signal is fed to pin 13 of IC7 and IC7 starts generating the refresh addresses. At that time, $\overline{BUSAK}$ is fed to pins 1 of IC4 and IC5, respectively. The CPU address bus is then replaced with the refresh address bus. $\overline{BUSAK}$ is fed to pin 15 of IC3 so as to generate both $\overline{MREQ}$ and $\overline{RFSH}$.
The main memory is thus refreshed.
When S76 (pause button) is pressed, IC15 is reset and $\overline{BUSAK}$ goes high. In this state, operations are carried out in the reverse processes and then the CPU starts operating.
When $\overline{BUSAK}$ goes high, it is fed to pins 4 and 10 of IC50 and flip-flop IC50 is released from the set state. If the V SYNC signal obtained from the composite video signal by using the sync separator is fed to pins 3 and 11 of IC50 during 2 clocks, the Q signal at pin 9 of IC9 goes low and $\overline{INT}$ (at pin 1 of IC32) sent from the VDP (at pin 16 of IC14) becomes valid. Thus, control permits the next S76 signal on the pause button to be accepted.



CHAPTER 4
BLOCK DIAGRAM

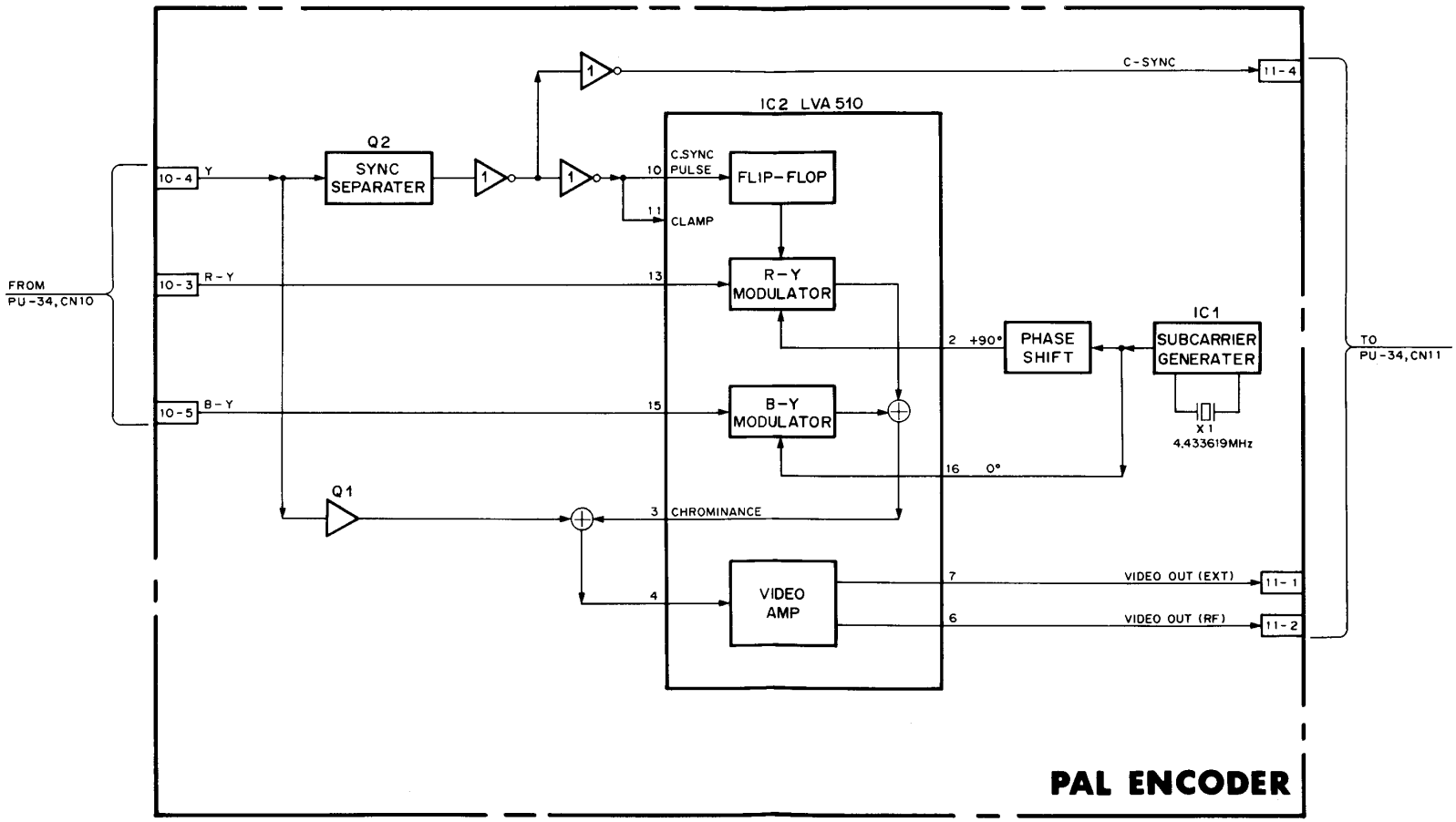
4-1. PU-34 BOARD





PU-34

HB-101P/201P(AE/E)


FROM
PU-34, CN10
10-4
Y
10-3
R-Y
10-5
B-Y
Q2
SYNC
SEPARATER
Q1
IC2 LVA 510
C.SYNC
PULSE
10
FLIP-FLOP
11
CLAMP
13
R-Y
MODULATOR
15
B-Y
MODULATOR
3
CHROMINANCE
4
VIDEO
AMP
C-SYNC
11-4
2 +90°
PHASE
SHIFT
IC1
SUBCARRIER
GENERATER
X1
4.433619MHz
16 0°
7
VIDEO OUT (EXT)
11-1
6
VIDEO OUT (RF)
11-2
TO
PU-34, CN11
PAL ENCODER

第5章 回路図・マウント図

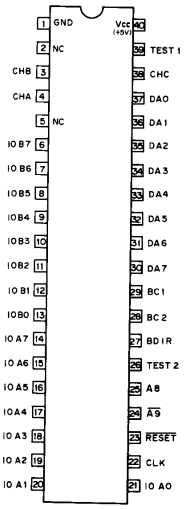
CHAPTER 5 SCHMATIC DIAGRAM

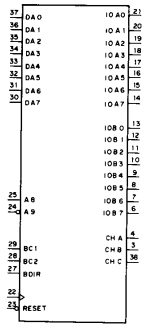
5-1. 半導体一覧

5-1. SEMICONDUCTOR PIN ASSIGNMENTS

TYPE	PAGE
10E-2	5-11
1N4148H	5-11
1S1555	5-11
1S2076	5-11
1S2473	5-11
1SS119	5-11
1SS133	5-11
1SS148	5-11
1SS202	5-11
2SA1027R	5-11
2SA1048	5-11
2SA1115	5-11
2SA1175	5-11
2SA733	5-11
2SA952	5-11
2SB808	5-11
2SB810	5-11
2SB811	5-11
2SC1364	5-11
2SC2458	5-11
2SC2603	5-11
2SC2785	5-11
2SC945	5-11
AY-3-8910	5-2
CX23044	5-10
CX23045	5-2
HD74LS00P	5-6
HD74LS02P	5-6
HD74LS04P	5-6
HD74LS08P	5-7
HD74LS138P	5-7
HD74LS153P	5-8
HD74LS157P	5-8
HD74LS32P	5-9
HD74LS367AP	5-9
HD74LS393P	5-9
HD74LS645P	5-9
HD74LS74AP	5-9
HM48416AP-15	5-5
HN613256P	5-3
LH0080A	5-3
MB74LS02	5-6
MB74LS04	5-6
MB74LS08	5-7
MB74LS126A	5-7
MB74LS139	5-7
MB74LS14	5-7
MB74LS145	5-7
MB74LS153	5-8
MB74LS157	5-8
MB74LS244	5-8
MB74LS32	5-8
MB74LS367A	5-9
MB74LS393	5-9
MB74LS74A	5-9
MSM38128ARS	5-4
MSM38256RS	5-4
NJM79L ? ?A	5-10
S2V20	5-11
SIB01-02	5-11
SI-3052V	5-10
SLP-271E	5-11
SN7407N	5-6
SN74LS00N	5-6
SN74LS02N	5-6
SN74LS04N	5-6
SN74LS08N	5-7
SN74LS126AN	5-7
SN74LS138N	5-7
SN74LS139N	5-7
SN74LS14N	5-7
SN74LS145N	5-7
SN74LS145N-R	5-7
SN74LS153N	5-8
SN74LS157N	5-8
SN74LS244N	5-8
SN74LS245N	5-8
SN74LS273N	5-8
SN74LS32N	5-9
SN74LS367AN	5-9
SN74LS393N	5-9
SN74LS645N	5-9
SN74LS74AN	5-9
TMM23128P	5-4
TMS4416-15NL	5-5
TMS9118NL	5-5
TMS9129NL	5-5
U05G	5-11
US1035	5-11
uPC311C	5-10
uPC78L ? ?	5-10
uPD41254C-15	5-12
uPD780C-1	5-3
uPD8255AC-5	5-6
YM-2149	5-2

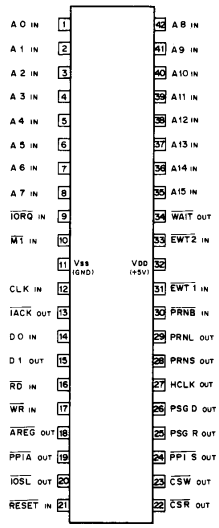
AY-3-8910 (GENERAL INSTRUMENT)
YM-2149 (YAMAHA)
PROGRAMMABLE SOUND GENERATOR
— TOP VIEW —

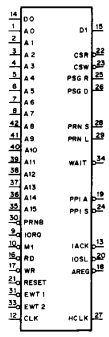




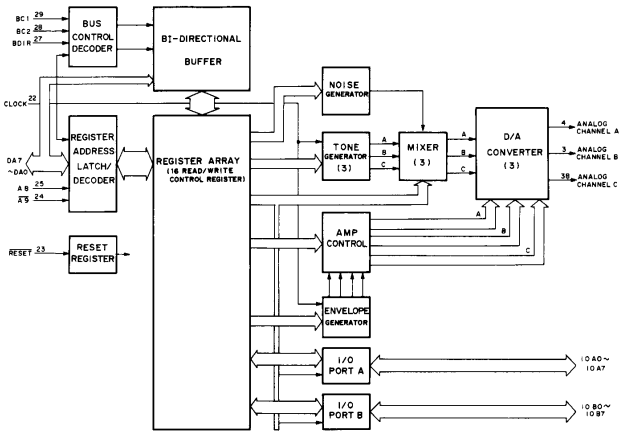
BC1,2; BUS CONTROL 1,2
BDIR; BUS DIRECTION
CHA~CHC; ANALOG CHANNEL
CLK; CLOCK
DA0~DA7; DATA ADDRESS
IOA0~IOA7; INPUT/OUTPUT A
IOB0~IOB7, INPUT/OUTPUT B
RESET; RESET

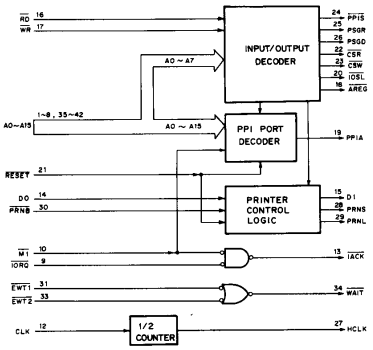
CX23045 (SONY)
C-MOS GATE ARRAY (I/O ADDRESS DECODER)
— TOP VIEW —



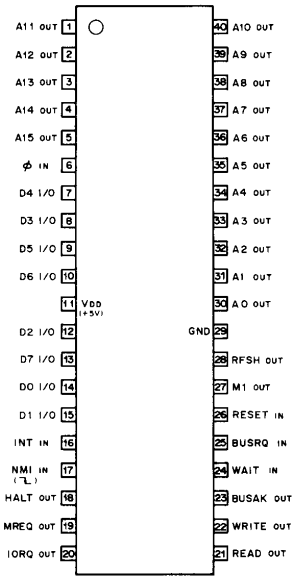


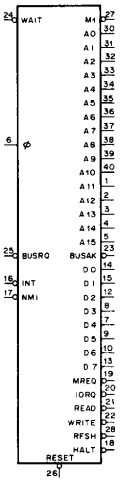
AO~A15 ; ADDRESS
AREG ; ADDITIONAL REGISTER
CLK/HCLK ; CLOCK/HALF CLOCK
CSR/CSW ; CHIP SELECT READ/WRITE
DO, 1 ; DATA
EWT 1/2 ; EXTERNAL WAIT 1/2
IACK ; INTERNAL ACKNOWLEDGE
IORQ ; IO REQUEST
IOSL ; IO SELECT
M1 ; MACHINE CYCLE 1
PPIA/PPIS ; PPI A-PORT ACCESS/SELECT
PRN B/L/S ; PRINTER BUSY/LUTCH/STROBE
PSG D/R ; PSG DATA STROBE/READ STROBE
RD ; READ
WR ; WRITE



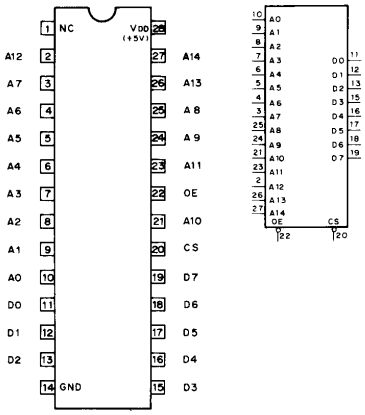


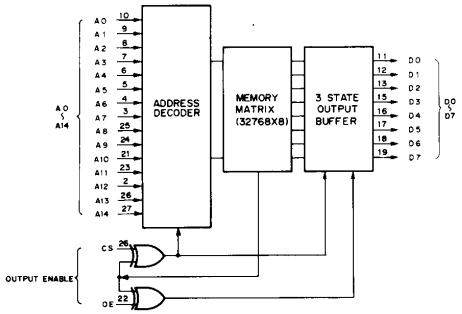
LH0080A (SHARP)
uPD780C-1 (NEC)
N-MOS 8-BIT MICROPROCESSOR
— TOP VIEW —



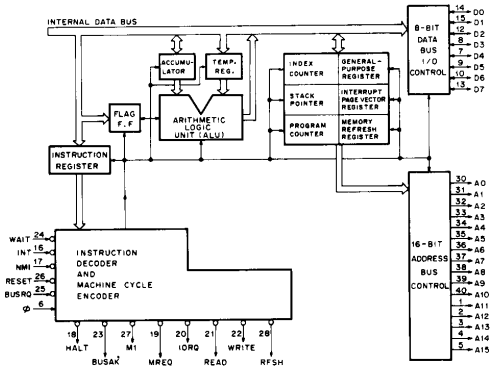


HN613256P (HITACHI)
C-MOS MASK PROGRAMMABLE ROM 256K-BIT (32768x8)
— TOP VIEW —





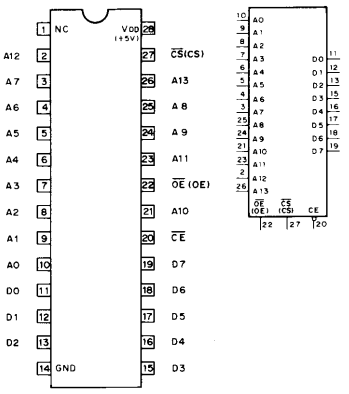
AO~A14 ; ADDRESS INPUT
CS ; CHIP SELECT
DO~D7 ; DATA
OE ; OUTPUT ENABLE

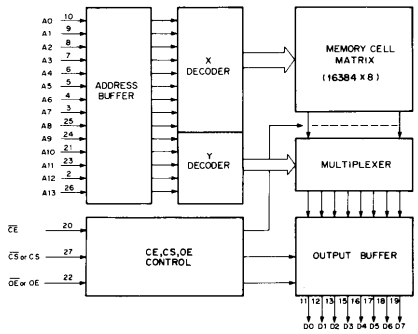


TEMP. REG. ; TEMPORARY REGISTER

φ ; CLOCK
AO-A15 ; 3-STATE ADDRESS OUTPUT
BUSAK ; BUS ACKNOWLEDGE
BUSRQ ; BUS REQUEST
DO-D7 ; 3-STATE DATA INPUT/OUTPUT
HALT ; HALT STATE
INT ; INTERRUPT REQUEST
IORQ ; 3-STATE I/O REQUEST
M1 ; MACHINE CYCLE 1
MREQ ; 3-STATE MEMORY REQUEST
NMI ; NON-MASKABLE INTERRUPT (DOWN EDGE TRIGGER)
READ ; 3-STATE MEMORY READ
RFSH ; REFRESH
WRITE ; 3-STATE MEMORY WRITE

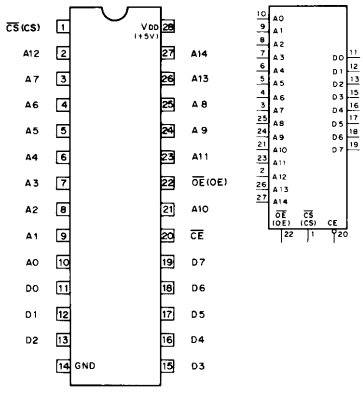
MSM38128ARS (OKI)
TMM23128P (TOSHIBA)
N-MOS MASK PROGRAMMABLE ROM 128K-BIT (16384x8)
— TOP VIEW —

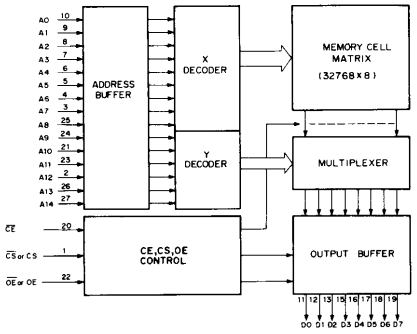




A0 ~ A12 ; ADDRESS INPUT
CE ; CHIP ENABLE
CS ; CHIP SELECT
D0 ~ D7 ; DATA
OE ; OUTPUT ENABLE

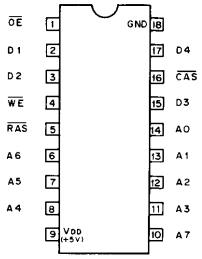
MSM38256RS (OKI)
N-MOS MASK PROGRAMMABLE ROM 256K-BIT (32768x8)
— TOP VIEW —

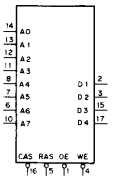




A0 ~ A14 ; ADDRESS INPUT
CE ; CHIP ENABLE
CS ; CHIP SELECT
D0 ~ D7 ; DATA
OE ; OUTPUT ENABLE

HM48416AP-15 (HITACHI) (ACCESS TIME = 150nS)
TMS4416-15NL (TI) (ACCESS TIME = 150nS)
N-MOS 16384-WORD BY 4-BIT DYNAMIC RAM
— TOP VIEW —

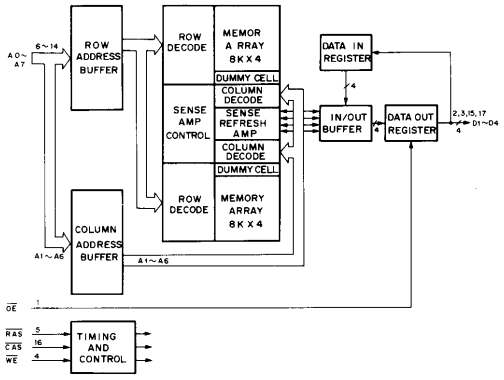




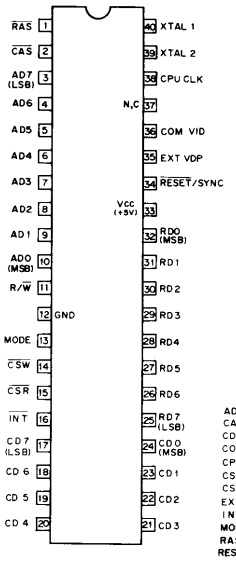
A0~A7 ; ADDRESS INPUT
CAS ; COLUMN ADDRESS STROBE
D1~D4 ; DATA IN/OUT
OE ; OUTPUT ENABLE
RAS ; ROW ADDRESS STROBE
WE ; WRITE ENABLE

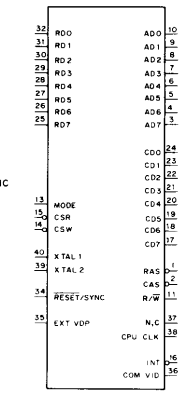
MODE	CONTROL		DATA
	WE	OE	D1~D4
——	0	0	X
WRITE	0	1	DATA IN
READ	1	0	DATA OUT
——	1	1	HI-Z

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



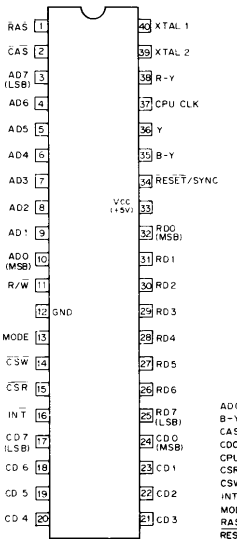
TMS9118NL (TI)
N-MOS VIDEO DISPLAY PROCESSOR
— TOP VIEW —

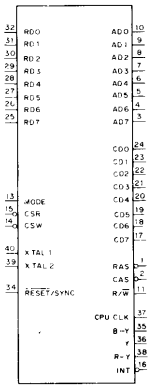




AD0~AD7 ; VRAM ADDRESS/DATA
CAS ; VRAM COLUMN ADDRESS STROBE
CD0~CD7 ; CPU DATA
COM VID ; COMPOSITE VIDEO OUTPUT
CPU CLK ; COLOR BURST CLOCK
CSR ; CPU-VDP READ STROBE
CSW ; CPU-VDP WHITE STROBE
EXT VDP ; EXTERNAL VDP INPUT
INT ; CPU INTERRUPT OUTPUT
MODE ; CPU MODE SELECT
RAS ; VRAM ROW ADDRESS STROBE
RESET/SYNC ; RESET/EXT VIDEO SYNC
RD0~RD7 ; VRAM READ DATA
R/W ; VRAM READ/WRITE
X TAL 1,2 ; CRYSTAL INPUT

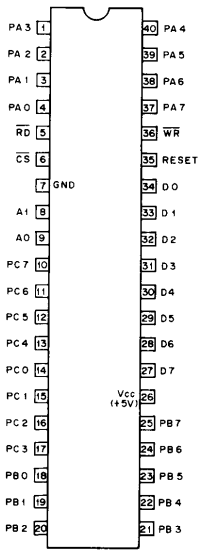
TMS9129NL (TI) (PAL COLOR-DIFFERENCE SIGNAL)
N-MOS VIDEO DISPLAY PROCESSOR
— TOP VIEW —

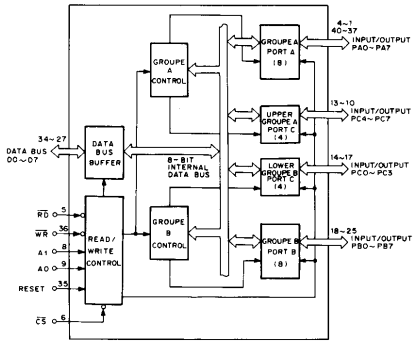




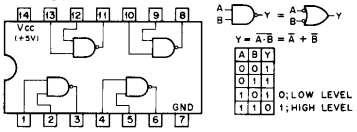
AD0~AD7 ; VRAM ADDRESS
B-Y ; B-Y SIGNAL
CAS ; VRAM COLUMN ADDRESS STROBE
CD0~CD7 ; CPU DATA
CPU CLK ; VDP OUTPUT CLOCK
CSR ; CPU-VDP READ STROBO
CSW ; CDP-VDP WRITE STROBO
INT ; CPU INTERRUPT OUTPUT
MODE ; CPU MODE SELECT
RAS ; VRAM ROW ADDRESS STROBE
RESET/SYNC ; RESET/EXT VIDEO SYNC
RD0~RD7 ; VRAM READ/WRITE DATA
R/W ; VRAM READ/WRITE
R-Y ; R-Y SIGNAL
X TAL 1,2 ; CRYSTAL INPUT
Y ; Y SIGNAL

uPD8255AC-5 (NEC)
PROGRAMMABLE PERIPHERAL INTERFACE
— TOP VIEW —





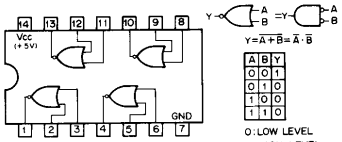
HD74LS00P (HITACHI)
SN74S100N (TI)
TTL 2-INPUT POSITIVE-NAND GATE
— TOP VIEW —



A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

0; LOW LEVEL
1; HIGH LEVEL

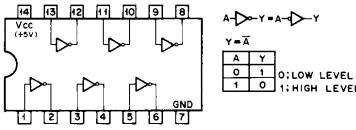
HD74LS02P (HITACHI)
MB74LS02 (FIJITSU)
SN74LS02N (TI)
TTL 2-INPUT POSITIVE-NOR GATE
— TOP VIEW —



A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

0; LOW LEVEL
1; HIGH LEVEL

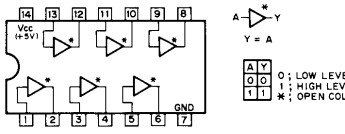
HD74LS04P (HITACHI)
MB74LS04 (FUJITSU)
SN74LS04N (TI)
TTL INVERTER
— TOP VIEW —



A	Y
0	1
1	0

0; LOW LEVEL
1; HIGH LEVEL

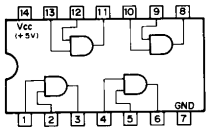
SN7407N (TI)
TTL BUFFER/DRIVER WITH OPEN-COLLECTOR
— TOP VIEW —

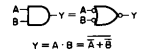


A	Y
0	0
1	*

0 ; LOW LEVEL
1 ; HIGH LEVEL
* ; OPEN COLLECTOR

HD74LS08P (HITACHI)
MB74LS08 (FUJITSU)
SN74LS08N (TI)
TTL 2-INPUT POSITIVE-AND GATE
— TOP VIEW —

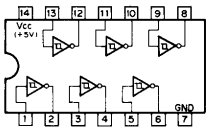


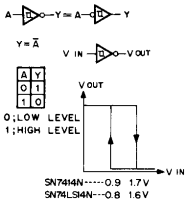


A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

0 ; LOW LEVEL
1 ; HIGH LEVEL

MB74LS14 (FUJITSU)
SN74LS14N (TI)
TTL SCHMITT TRIGGER INVERTER
— TOP VIEW —

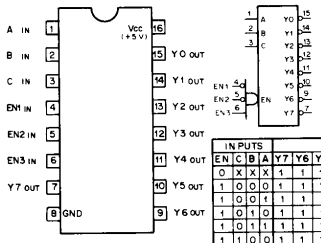




A	Y
0	1
1	0

0 ; LOW LEVEL
1 ; HIGH LEVEL

HD74LS138P (HITACHI)
SN74LS138N (TI)
TTL 3-TO-8-LINE DECODER/DEMULTIPLEXER
— TOP VIEW —

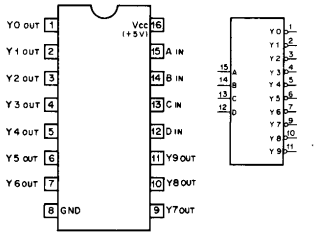


INPUTS				OUTPUTS							
EN	C	B	A	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
0	X	X	X	1	1	1	1	1	1	1	1
1	0	0	0	1	1	1	1	1	1	1	0
1	0	0	1	1	1	1	1	1	1	0	1
1	0	1	0	1	1	1	1	1	0	1	1
1	0	1	1	1	1	1	1	0	1	1	1
1	1	0	0	1	1	1	0	1	1	1	1
1	1	0	1	1	1	0	1	1	1	1	1
1	1	1	0	1	0	1	1	1	1	1	1
1	1	1	1	0	1	1	1	1	1	1	1

EN = $\overline{EN1}\cdot\overline{EN2}\cdot EN3$

0 ; LOW LEVEL
1 ; HIGH LEVEL
X ; DON'T CARE

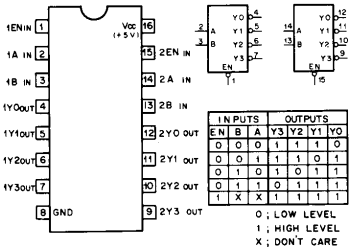
MB74LS145 (FUJITSU)
SN74LS145N (TI)
SN74LS145N-R (TI)
TTL BCD-TO-DECIMAL DECODER/DRIVER
— TOP VIEW —



STATE	INPUTS				OUTPUTS									
	D	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9
0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
1	0	0	0	1	1	0	1	1	1	1	1	1	1	1
2	0	0	1	0	1	1	0	1	1	1	1	1	1	1
3	0	0	1	1	1	1	1	0	1	1	1	1	1	1
4	0	1	0	0	1	1	1	1	0	1	1	1	1	1
5	0	1	0	1	1	1	1	1	1	0	1	1	1	1
6	0	1	1	0	1	1	1	1	1	1	0	1	1	1
7	0	1	1	1	1	1	1	1	1	1	1	0	1	1
8	1	0	0	0	1	1	1	1	1	1	1	1	0	1
9	1	0	0	1	1	1	1	1	1	1	1	1	1	0
INVALID	1	0	1	0	1	1	1	1	1	1	1	1	1	1
	1	0	1	1	1	1	1	1	1	1	1	1	1	1
	1	1	0	0	1	1	1	1	1	1	1	1	1	1
	1	1	0	1	1	1	1	1	1	1	1	1	1	1
	1	1	1	0	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1	1	1	1	1

0 ; LOW LEVEL
1 ; HIGH LEVEL

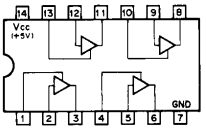
MB74LS139 (FUJITSU)
SN74LS139N (TI)
TTL 2-TO-4-LINE DECODER/DEMULTIPLEXER
— TOP VIEW —

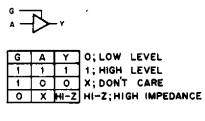


INPUTS			OUTPUTS			
EN	B	A	Y3	Y2	Y1	Y0
0	0	0	1	1	1	0
0	0	1	1	1	0	1
0	1	0	1	0	1	1
0	1	1	0	1	1	1
1	X	X	1	1	1	1

0 ; LOW LEVEL
1 ; HIGH LEVEL
X ; DON'T CARE

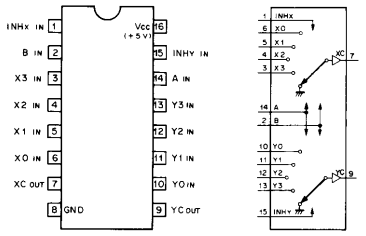
MB74LS126A (FUJITSU)
SN74LS126AN (TI)
TTL BUS BUFFER GATE WITH 3-STATE OUTPUT
— TOP VIEW —





G	A	Y	
1	1	1	0 ; LOW LEVEL
1	1	1	1 ; HIGH LEVEL
1	0	0	X ; DON'T CARE
0	X	HI-Z	HI-Z ; HIGH IMPEDANCE

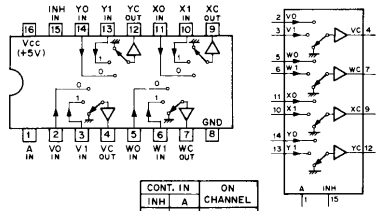
HD74LS153P (HITACHI)
MB74LS153 (FUJITSU)
SN74LS153N (TI)
TTL 4-LINE-TO-1 LINE DATA SELECTOR/MULTIPLEXER
— TOP VIEW —



CONTROL IN			ON CHANNEL
INH	B	A	
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	X	X	GND

0 : LOW LEVEL
1 : HIGH LEVEL
X : DON'T CARE

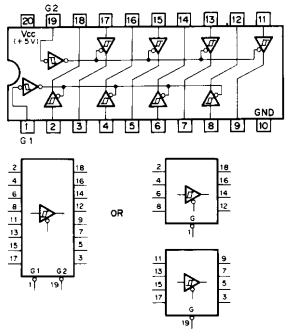
HD74LS157P (HITACHI)
MB74LS157 (FUJITSU)
SN74LS157N (TI)
TTL 2-LINE-TO-1-LINE DATA SELECTOR/MULTIPLEXER
— TOP VIEW —



CONT. IN		ON CHANNEL
INH	A	
0	0	0
0	1	1
1	X	GND

0 ; LOW LEVEL
1 ; HIGH LEVEL
X ; DON'T CARE

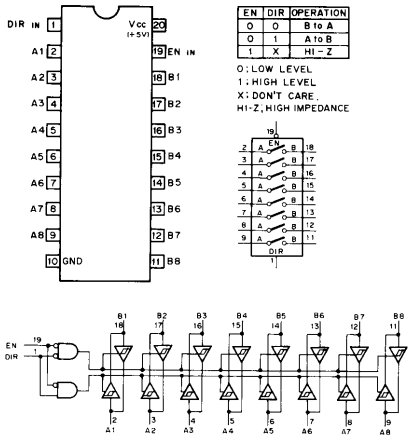
MB74LS244 (FUJITSU)
SN74LS244N (TI)
TTL 3-STATE SCHMITT TRIGGER BUFFER/DRIVER
— TOP VIEW —



G	A	Y
0	0	0
0	1	1
1	X	HI-Z

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

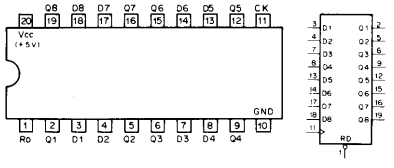
SN74LS245N (TI)
TTL BILATERAL SCHMITT TRIGGER BUS TRANSCEIVERS WITH 3-STATE OUTPUT
— TOP VIEW —



EN	DIR	OPERATION
0	0	B to A
0	1	A to B
1	X	HI-Z

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

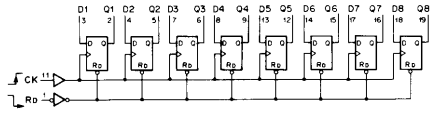
SN74LS273N (TI)
TTL D-TYPE FLIP-FLOP WITH DIRECT RESET
— TOP VIEW —



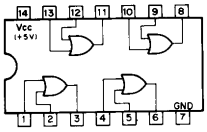
EACH FLIP-FLOP

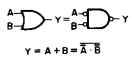
INPUTS			OUT
RD	CK	D	Q
0	X	X	0
1	↑	0	0
1	↑	1	1
1	0	X	Q0

0 ; LOW LEVEL
1 ; HIGH LEVEL
X ; DON'T CARE



HD74LS32P (HITACHI)
MB74LS32 (FUJITSU)
SN74LS32N (TI)
TTL 2-INPUT POSITIVE-OR-GATE
— TOP VIEW —

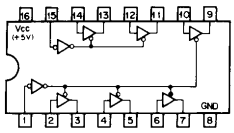




A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

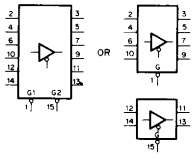
0;LOW LEVEL
1;HIGH LEVEL

HD74LS367AP (HITACHI)
MB74LS367A (FUJITSU)
SN74LS367AN (TI)
TTL BUS DRIVER WITH 3-STATE OUTPUTS
— TOP VIEW —

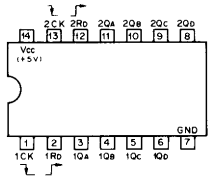


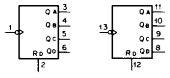
G	A	Y
0	0	0
0	1	1
1	X	Hi-Z

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



HD74LS393P (HITACHI)
MB74LS393 (FUJITSU)
SN74LS393N (TI)
TTL 4-BIT BINARY COUNTER
— TOP VIEW —





RESET/COUNT FUNCTION

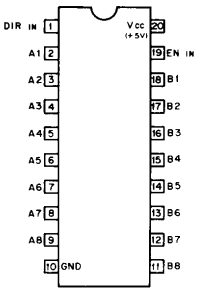
Rd	Qd	Qc	Qb	Qa
1	0	0	0	0
0	COUNT			

0;LOW LEVEL
1;HIGH LEVEL

COUNT SEQUENCE

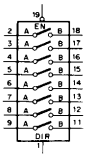
COUNT	Qd	Qc	Qb	Qa
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

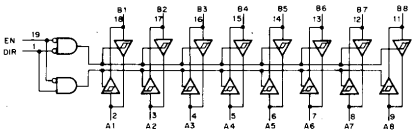
HD74LS645P (HITACHI)
SN74LS645N (TI)
TTL BILATERAL SCHMITT TRIGGER BUS TRANSCEIVERS WITH 3-STATE OUTPUT
— TOP VIEW —



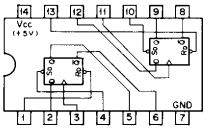
EN	DIR	OPERATION
0	0	B to A
0	1	A to B
1	X	HI-Z

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





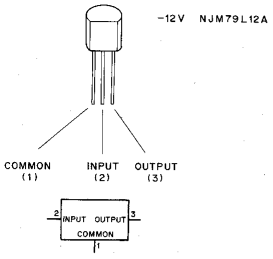
HD74LS74AP (HITACHI)
MB74LS74A (FUJITSU)
SN74LS74AN (TI)
TTL D-TYPE FLIP FLOP WITH DIRECT SET/RESET
— TOP VIEW —



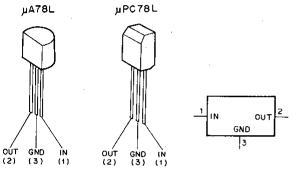
INPUTS				OUTPUTS	
$\overline{S}_D$	$\overline{R}_D$	CK	D	Q_{n+1}	$\overline{Q}_{n+1}$
0	1	X	X	1	0
1	0	X	X	0	1
0	0	X	X	1*	1*
1	1	↑	1	1	0
1	1	↑	0	0	1
1	1	0	X	Q_n	$\overline{Q}_n$

0;LOW LEVEL
1;HIGH LEVEL
X;DON'T CARE
1*;NONSTABLE

NJM79L??A (JRC)
NEGATIVE VOLTAGE REGULATOR (40mA)
— FRONT VIEW —

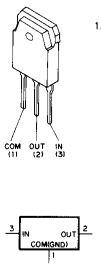


uPC78L??(NEC)
POSITIVE VOLTAGE REGULATOR (100mA)

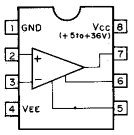


2.6V	μA78L26AWV	μA78L02ACL	
5V	μA78L05AWV	μA78L05ACL	μPC78L05(A)
6.2V	μA78L62AWV	μA78L06ACL	
8V		μA78L08ACL	μPC78L08
8.2V	μA78L82AWV		
9V	μA78L09AWV	μA78L09ACL	
10V		μA78L10ACL	
12V	μA78L12AWV	μA78L12ACL	μPC78L12
15V	μA78L15AWV	μA78L15ACL	μPC78L15
18V	μA78L18AWV		
24V	μA78L24AWV		

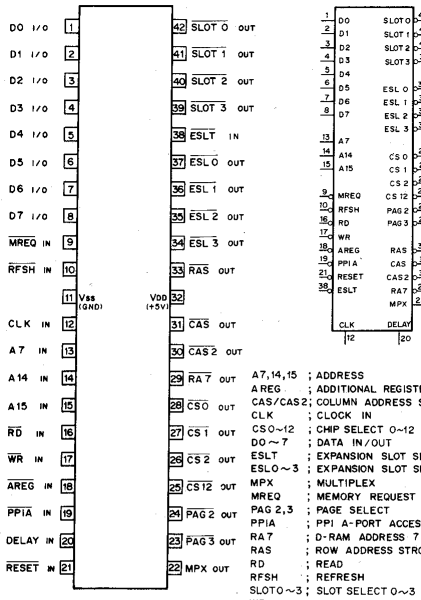
SI-3052V (SANKEN)
POSITIVE VOLTAGE REGULATOR (2A)



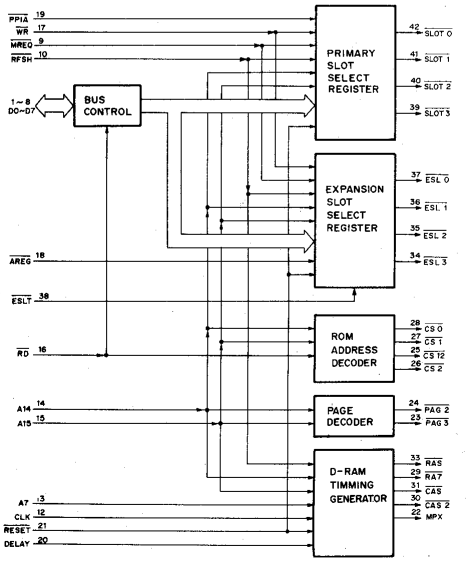
uPC311C (NEC)
VOLTAGE COMPARATOR
— TOP VIEW —



CX23044 (SONY)
C-MOS GATE ARRAY (SLOT CONTROL, MEMORY ADDRESS DECODER, ETC)
— TOP VIEW —



A7,14,15 ; ADDRESS
AREG ; ADDITIONAL REGISTER
CAS/CAS2 ; COLUMN ADDRESS STROBE/2
CLK ; CLOCK IN
CS0~12 ; CHIP SELECT 0~12
D0~7 ; DATA IN/OUT
ESLT ; EXPANSION SLOT SELECT
ESL0~3 ; EXPANSION SLOT SELECT 0~3
MPX ; MULTIPLEX
MREQ ; MEMORY REQUEST
PAG 2,3 ; PAGE SELECT
PPIA ; PPI A-PORT ACCESS
RA7 ; D-RAM ADDRESS 7
RAS ; ROW ADDRESS STROBE
RD ; READ
RFSH ; REFRESH
SLOT0~3 ; SLOT SELECT 0~3
WR ; WRITE



PAGE ADDRESS DECODER OUTPUT FOR ROM

INPUT					OUTPUT			
RD	MREQ	RFSH	A15	A14	CS0	CS1	CS12	CS2
0	0	1	0	0	0	1	1	1
0	0	1	0	1	0	0	0	1
0	0	1	1	0	1	1	0	0
0	0	1	1	1	1	1	1	1
X	X	0	X	X	1	1	1	1
X	1	X	X	X	1	1	1	1
1	X	X	X	X	1	1	1	1

0 ; LOW LEVEL
1 ; HIGH LEVEL
X ; DON'T CARE

PAGE ADDRESS DECODER OUTPUT FOR RAM

INPUT				OUTPUT	
MREQ	RFSH	A15	A14	PAG2	PAG3
0	1	0	0	1	1
0	1	0	1	1	1
0	1	1	0	0	1
0	1	1	1	1	0
X	0	X	X	1	1
1	X	X	X	1	1

0 ; LOW LEVEL
1 ; HIGH LEVEL
X ; DON'T CARE

SLOT SELECT OUTPUT

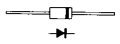
PAGE SELECT	ADDRESS A15	ADDRESS A14	PPI PORT A PA7	PA6	PA5	PA4	PA3	PA2	PA1	PA0	OUTPUT SLOT NO
PAGE 0	0	0	X	X	X	X	X	X	0	0	SLOT 0
			X	X	X	X	X	X	0	1	SLOT 1
			X	X	X	X	X	X	1	0	SLOT 2
			X	X	X	X	X	X	1	1	SLOT 3
PAGE 1	0	1	X	X	X	X	0	0	X	X	SLOT 0
			X	X	X	X	0	1	X	X	SLOT 1
			X	X	X	X	1	0	X	X	SLOT 2
			X	X	X	X	1	1	X	X	SLOT 3
PAGE 2	1	0	X	X	0	0	X	X	X	X	SLOT 0
			X	X	0	1	X	X	X	X	SLOT 1
			X	X	1	0	X	X	X	X	SLOT 2
			X	X	1	1	X	X	X	X	SLOT 3
PAGE 3	1	1	0	0	X	X	X	X	X	X	SLOT 0
			0	1	X	X	X	X	X	X	SLOT 1
			1	0	X	X	X	X	X	X	SLOT 2
			1	1	X	X	X	X	X	X	SLOT 3

OUTPUT CONDITION
MREQ 1
RFSH 0
0 ; LOW LEVEL
1 ; HIGH LEVEL
X ; DON'T CARE

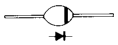
EXPANSION SLOT SELECT

EXPANSION PAGE	ADDRESS A15	ADDRESS A14	EXPANSION ADDRESS EA7	EA6	EA5	EA4	EA3	EA2	EA1	EA0	EXPANSION SLOT NO
PAGE 0	0	0	X	X	X	X	X	X	0	0	ESL 0
			X	X	X	X	X	X	0	1	ESL 1
			X	X	X	X	X	X	1	0	ESL 2
			X	X	X	X	X	X	1	1	ESL 3
PAGE 1	0	1	X	X	X	X	0	0	X	X	ESL 0
			X	X	X	X	0	1	X	X	ESL 1
			X	X	X	X	1	0	X	X	ESL 2
			X	X	X	X	1	1	X	X	ESL 3
PAGE 2	1	0	X	X	0	0	X	X	X	X	ESL 0
			X	X	0	1	X	X	X	X	ESL 1
			X	X	1	0	X	X	X	X	ESL 2
			X	X	1	1	X	X	X	X	ESL 3
PAGE 3	1	1	0	0	X	X	X	X	X	X	ESL 0
			0	1	X	X	X	X	X	X	ESL 1
			1	0	X	X	X	X	X	X	ESL 2
			1	1	X	X	X	X	X	X	ESL 3

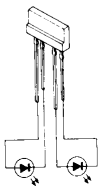
OUTPUT CONDITION
ESLT ; 0
MREQ ; 0
RFSH ; 1
0 ; LOW LEVEL
1 ; HIGH LEVEL
X ; DON'T CARE



10E-2
1N4148H
1S1555
1S2076
1S2473
1SS119
1SS133
1SS148
1SS202
S2V20
SIB01-02
US1035

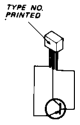


U05G



SLP-271E: GREEN

2SA733
2SA952

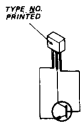


2SA1175
2SB810
2SB811

2SA1048
2SA1115
2SB808

2SC1364
2SC945

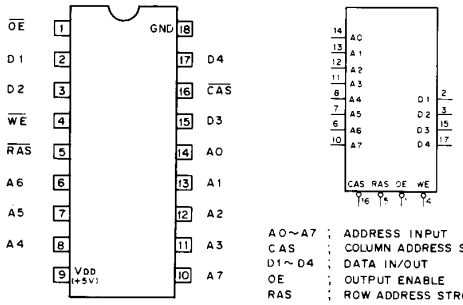
2SC2458
2SC2603



2SC2785

2SA1027R

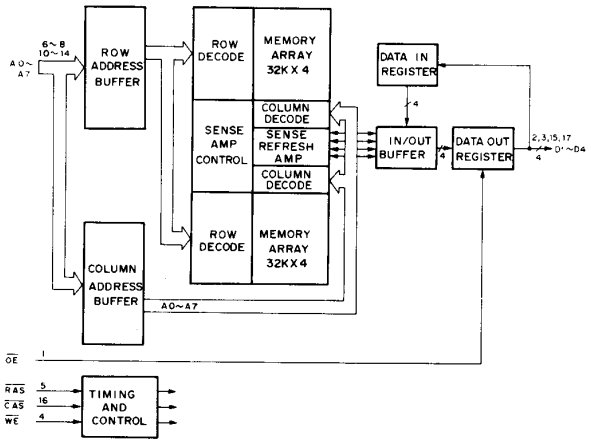
uPD41254C-15 (NEC) (ACCESS TIME = 150nS)
N-MOS 65536-WORD BY 4-BIT DYNAMIC RAM
— TOP VIEW —

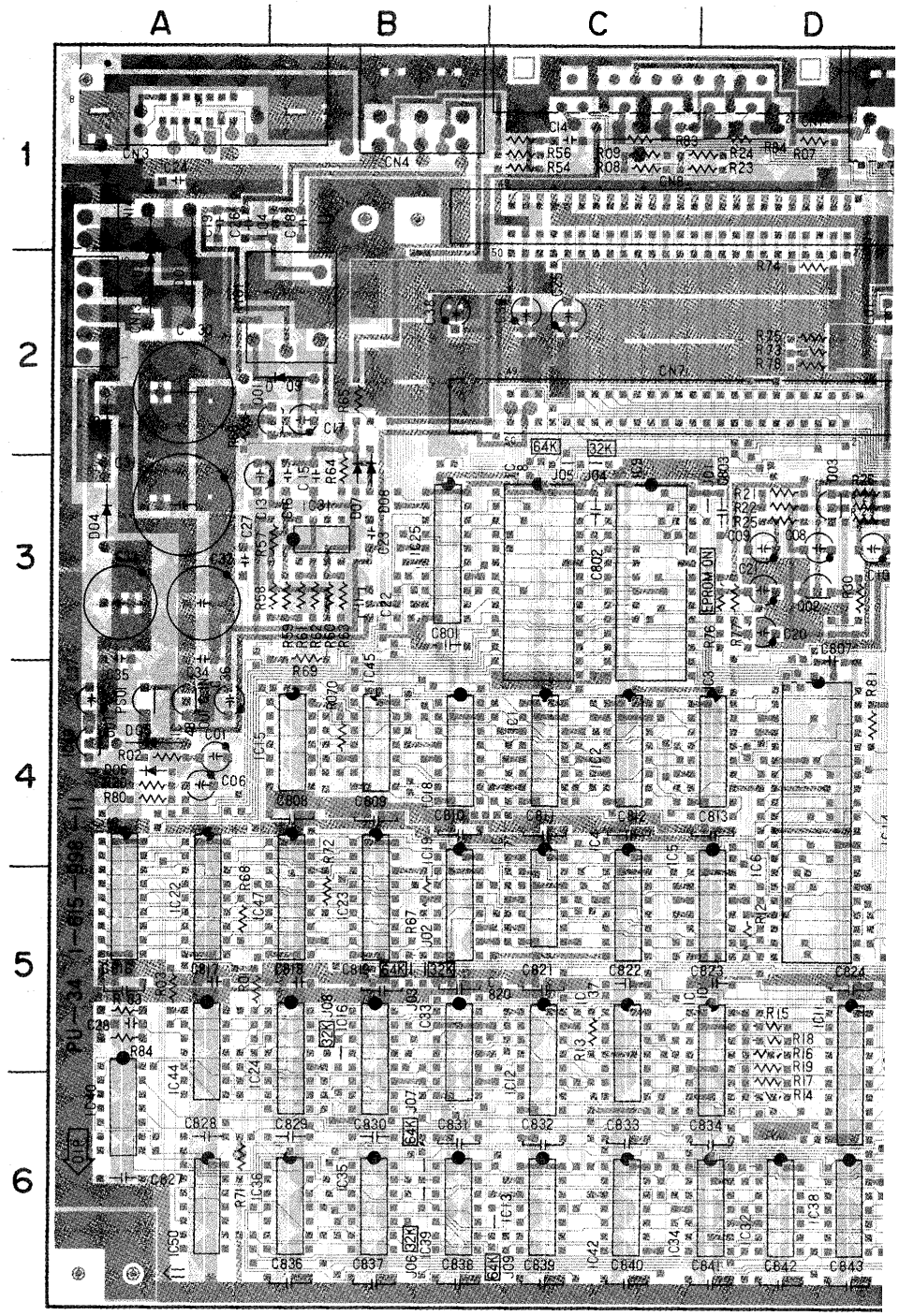


A0~A7 ; ADDRESS INPUT
CAS ; COLUMN ADDRESS STROBE
D1~D4 ; DATA IN/OUT
OE ; OUTPUT ENABLE
RAS ; ROW ADDRESS STROBE
WE ; WRITE ENABLE

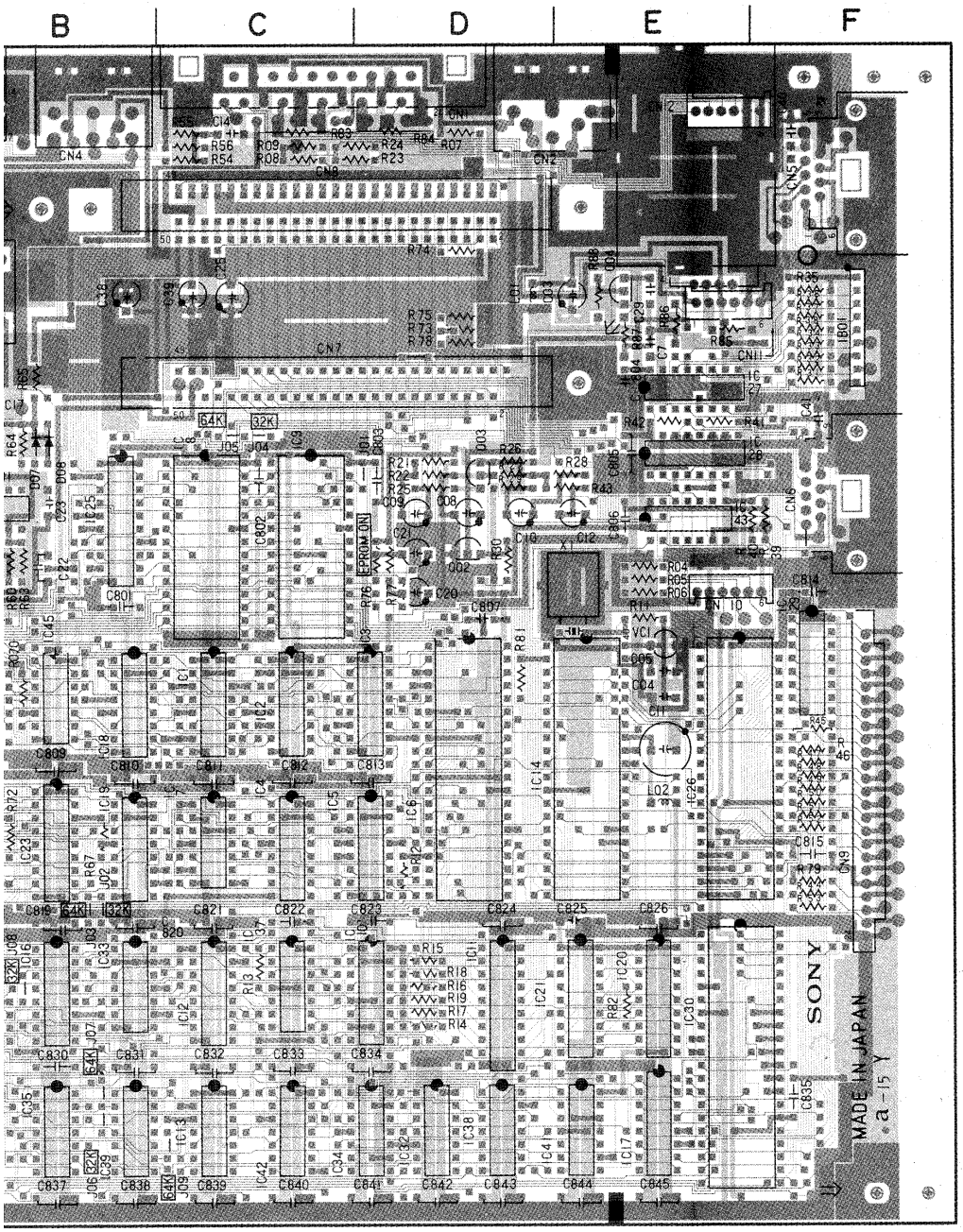
MODE	CONTROL		DATA
	WE	OE	D1~D4
—	0	0	X
WRITE	0	1	DATA IN
READ	1	0	DATA OUT
—	1	1	HI-Z

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





Note: The blue pattern on board layout is COMPONENT SIDE.
The gray pattern on board layout is SOLDERING SIDE.



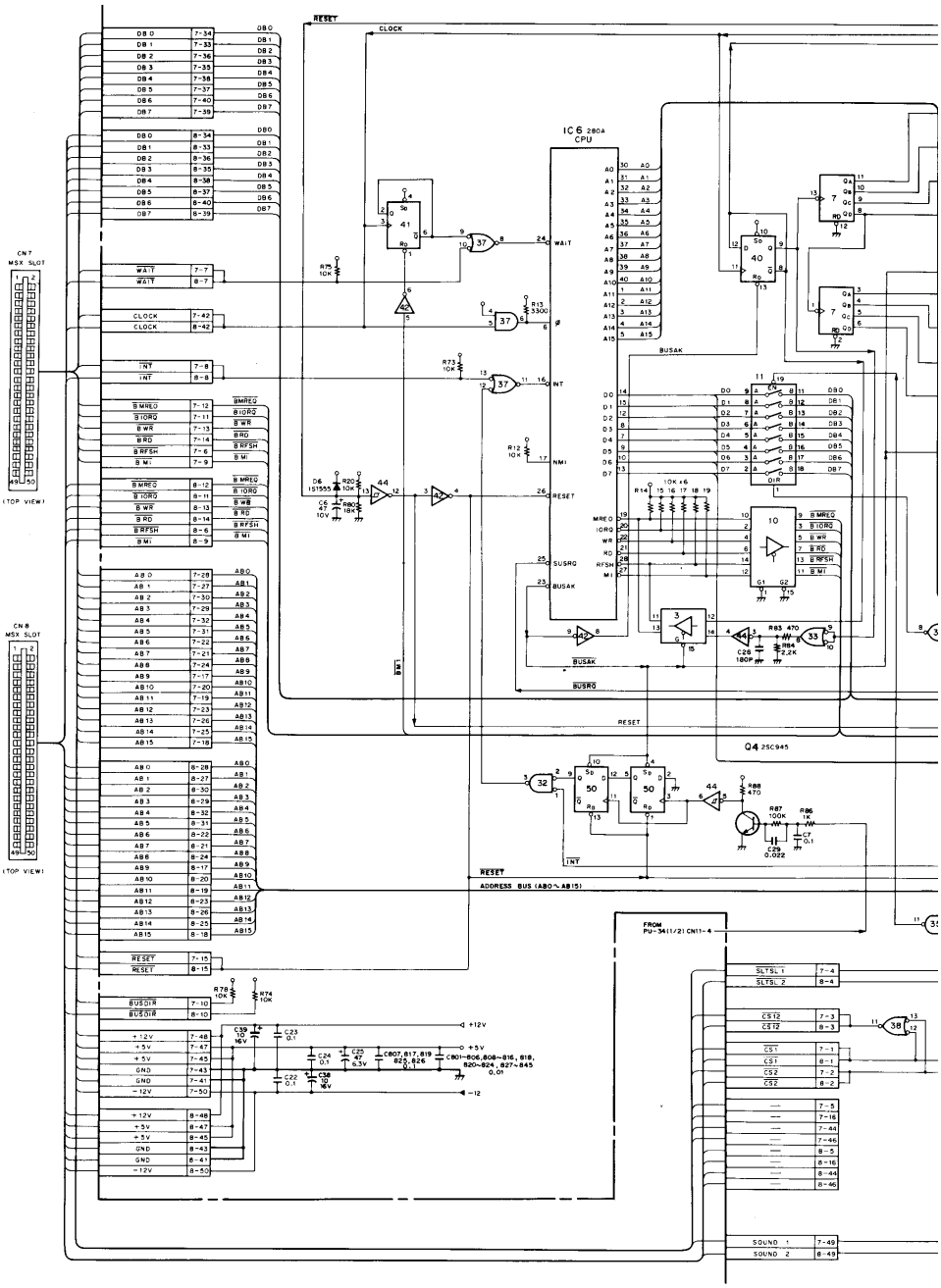
ut is COMPONENT SIDE.
ut is SOLDERING SIDE.

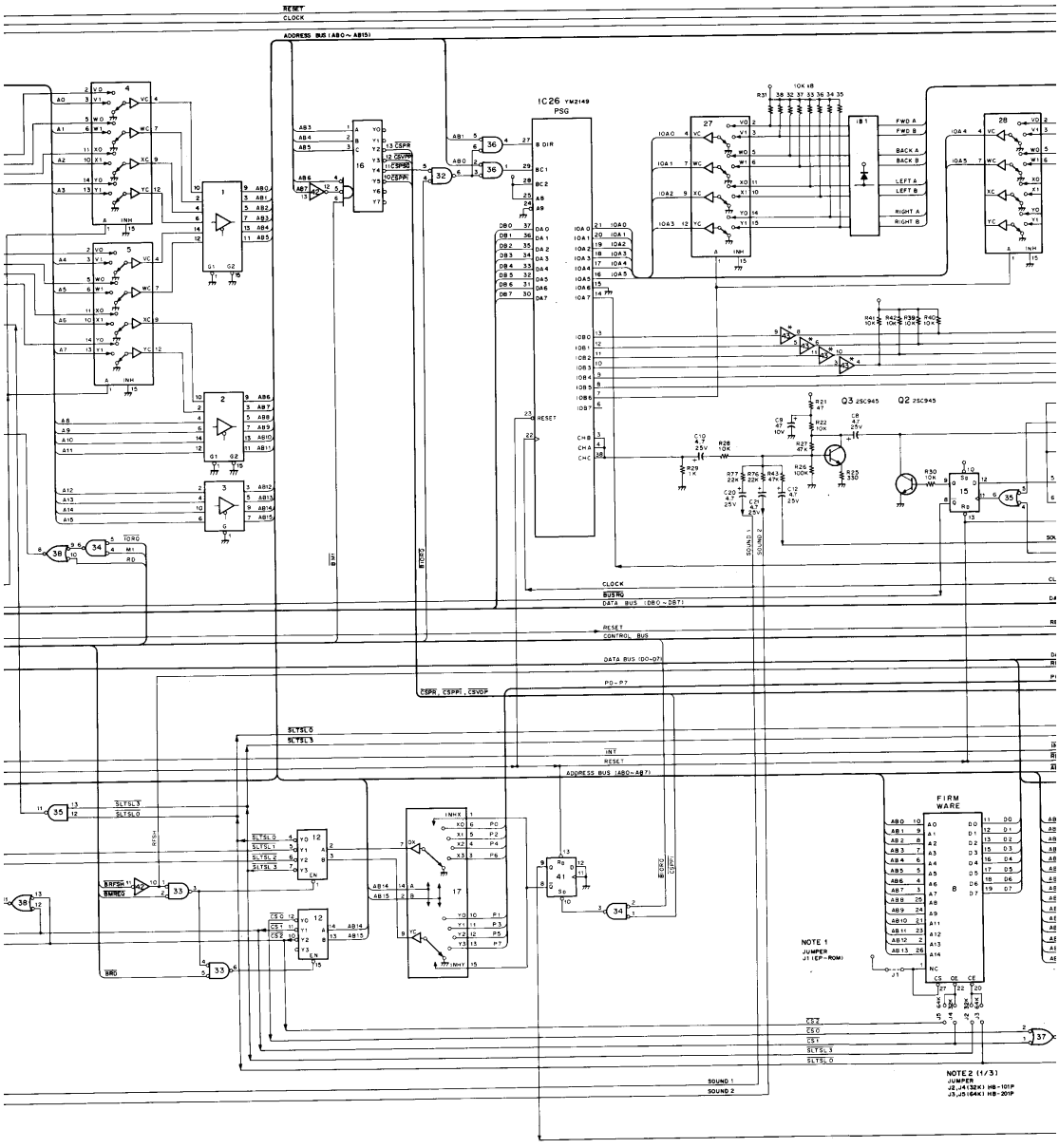
PU-34 – COMPONENT SIDE –

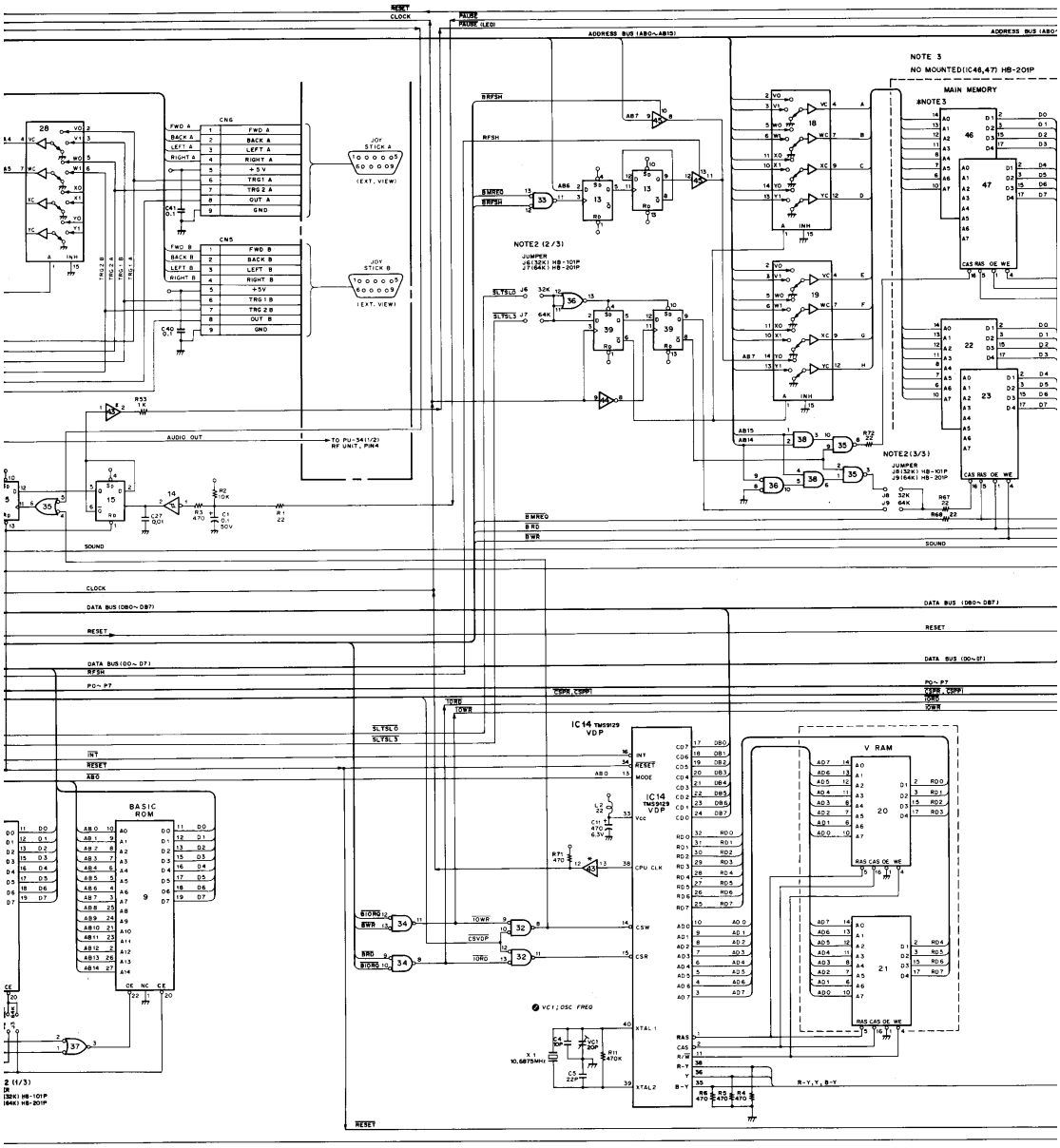
1-615-998-11
HB-101P/201P(AE/E)

C1	A-4	C821	C-5	IC10	D-5	Q1	A-2	R57	B-3
C3	E-2	C822	C-5	IC11	D-5	Q2	D-3	R58	B-3
C4	E-4	C823	D-5	IC12	C-5	Q3	D-3	R59	B-3
C5	E-4	C824	D-5	IC13	C-6	Q4	E-2	R60	B-3
C6	A-4	C825	E-5	IC14	E-4			R61	B-3
C7	E-2	C826	E-5	IC15	B-4	R1	A-5	R62	B-3
C8	D-3	C827	A-6	IC16	B-5	R2	A-4	R63	B-3
C9	D-3	C828	A-6	IC17	E-6	R3	A-5	R64	B-3
C10	D-3	C829	B-6	IC18	B-4	R4	E-3	R65	B-2
C11	E-4	C830	B-6	IC19	B-5	R5	E-3	R66	A-2
C12	E-3	C831	B-6	IC20	E-5	R6	E-3	R67	B-5
C13	A-3	C832	C-6	IC21	E-5	R7	D-1	R68	A-5
C14	C-1	C833	C-6	IC22	A-5	R8	C-1	R69	B-3
C15	B-3	C834	D-6	IC23	B-5	R9	C-1	R70	B-4
C16	B-3	C835	F-6	IC24	B-5	R11	E-3	R71	A-6
C17	B-2	C836	B-6	IC25	B-3	R12	D-5	R72	B-5
C18	B-1	C837	B-6	IC26	E-4	R13	C-5	R73	D-2
C19	A-1	C838	B-6	IC27	E-2	R14	D-6	R74	D-2
C20	D-3	C839	C-6	IC28	E-3	R15	D-5	R75	D-2
C21	D-3	C840	C-6	IC29	F-4	R16	D-5	R76	D-3
C22	B-3	C841	D-6	IC30	E-6	R17	D-6	R77	D-3
C23	B-3	C842	D-6	IC31	B-3	R18	D-5	R78	D-2
C24	A-1	C843	D-6	IC32	D-6	R19	D-5	R79	F-5
C25	C-2	C844	E-6	IC33	B-5	R20	A-4	R80	A-2
C26	A-1	C845	E-6	IC34	D-6	R21	D-3	R81	D-4
C27	A-3			IC35	B-6	R22	D-3	R82	E-5
C28	A-5	CN1	C-1	IC36	B-6	R23	D-1	R83	A-5
C29	E-2	CN2	E-1	IC37	C-5	R24	D-1	R84	A-5
C30	A-2	CN3	A-1	IC38	D-6	R25	D-3	R85	E-2
C31	A-3	CN4	B-1	IC39	B-6	R26	D-3	R86	E-2
C32	A-3	CN5	F-1	IC40	A-6	R27	D-3	R87	E-2
C33	A-3	CN6	F-3	IC41	E-6	R28	E-3	R88	E-2
C34	A-3	CN7	C-2	IC42	C-6	R29	D-3		
C35	A-3	CN8	C-1	IC43	E-3	R30	D-3	RY101	B-2
C36	A-4	CN9	F-4	IC44	A-5	R31	F-2		
C37	A-4	CN10	E-3	IC45	B-4	R32	F-2	VC1	E-4
C38	B-2	CN12	E-1	IC46	A-5	R33	F-2		
C39	C-2	CN11	E-2	IC47	B-5	R34	F-2	X1	E-3
C40	F-1	CN13	A-2	IC48	A-4	R35	F-2		
C41	F-2	CN14	A-1	IC49	A-4	R36	F-2		
C801	B-3			IC50	A-6	R37	F-2		
C802	C-3	D1	A-2			R38	F-2		
C803	D-3	D2	A-2	IB1	F-2	R39	F-3		
C804	E-2	D3	A-2			R40	F-3		
C805	E-3	D4	A-3	J1	D-3	R41	E-2		
C806	E-3	D5	A-4	J2	B-5	R42	E-2		
C807	D-3	D6	A-4	J3	B-5	R43	E-3		
C808	B-4	D7	B-3	J4	C-3	R44	F-5		
C809	B-4	D8	B-3	J5	C-3	R45	F-4		
C810	B-4	D9	B-2	J6	B-6	R46	F-4		
C811	C-4			J7	B-6	R47	F-4		
C812	C-4	IC1	C-4	J8	B-5	R48	F-4		
C813	D-4	IC2	C-4	J9	C-6	R49	F-4		
C814	F-3	IC3	D-4			R50	F-4		
C815	F-5	IC4	C-5	L1	D-2	R51	F-4		
C816	A-5	IC5	D-5	L2	E-4	R52	F-4		
C817	A-5	IC6	D-4	L4	B-1	R53	F-5		
C818	B-5	IC7	C-5			R54	C-1		
C819	B-5	IC8	C-3	PS1	A-4	R55	C-1		
C820	B-5	IC9	C-3			R56	C-1		

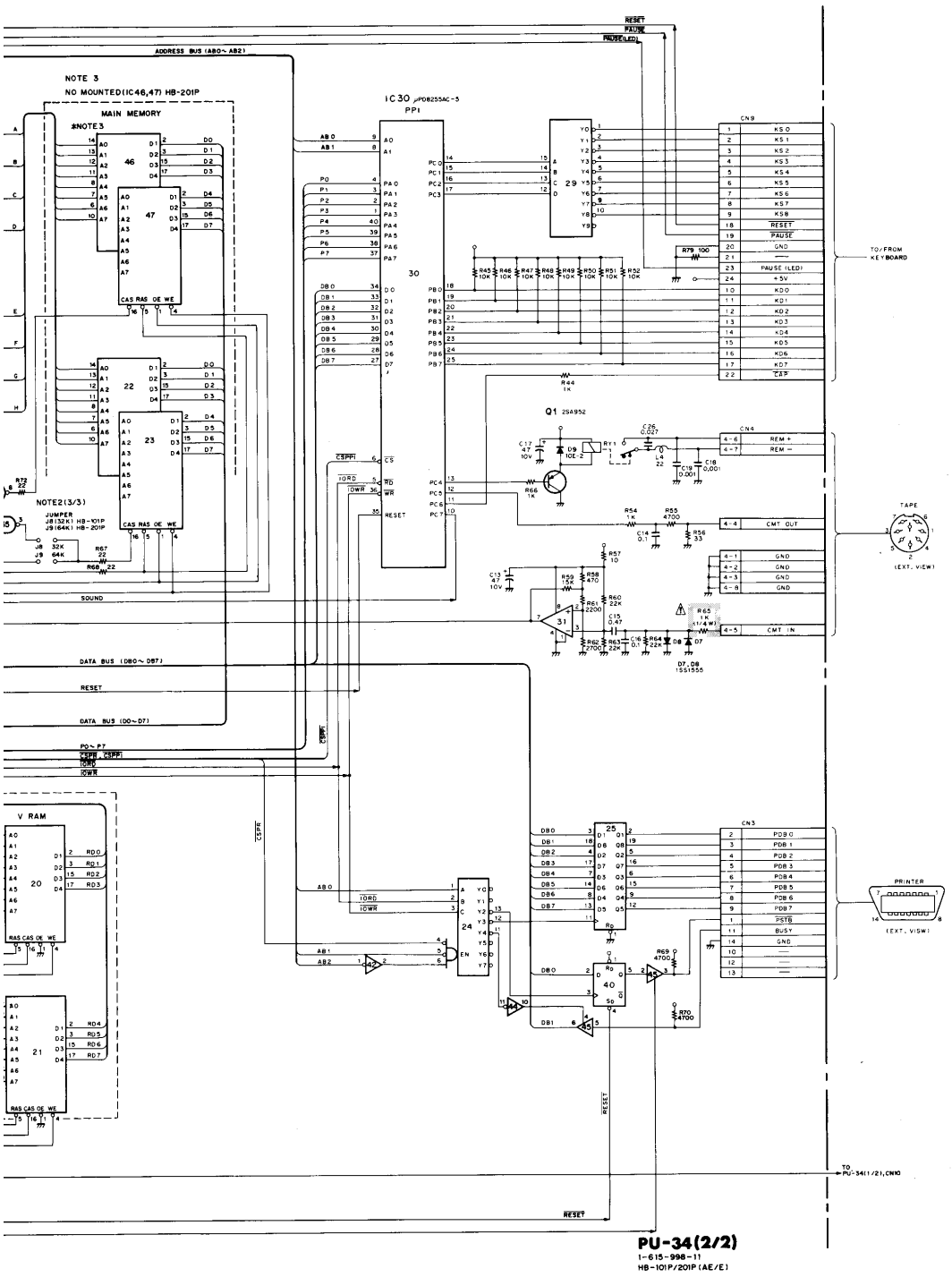
REF.NO.	TYPE NO.	PIN NO.			
		+12V	+5V	GND	-12V
IC1	SN74LS367AN,HD74LS367AP		16	8	
IC2	SN74LS367AN,HD74LS367AP		16	8	
IC3	SN74LS367AN,HD74LS367AP		16	8	
IC4	SN74LS157N,MB74LS157		16	8	
IC5	SN74LS157N,MB74LS157		16	8	
IC6	LH0080A,uPD780C-1		11	29	
IC7	SN74LS393N,MB74LS393		14	7	
IC8	MSM38128A-F6RS(101P)		28	14	
	TMM23128P-8712(201P)		28	14	
IC9	MSM38256-78RS		28	14	
IC10	SN74LS367AN,HD74LS367AP		16	8	
IC11	SN74LS645N,HD74LS645P		20	10	
IC12	SN74LS139N,MB74LS139		16	8	
IC13	SN74LS74AN,MB74LS74A		14	7	
IC14	TMS9129NL		33	12	
IC15	SN74LS74AN,MB74LS74A		14	7	
IC16	SN74LS138N,HD74LS138P		16	8	
IC17	SN74LS153N,MB74LS153		16	8	
IC18	SN74LS157N,MB74LS157		16	8	
IC19	SN74LS157N,MB74LS157		16	8	
IC20	TMS4416-15NL		9	18	
IC21	TMS4416-15NL		9	18	
IC22	TMS4416-15NL(101P)		9	18	
	uPD41254C-15(201P)		9	18	
IC23	TMS4416-15NL(101P)		9	18	
	uPD41254C-15(201P)		9	18	
IC24	SN74LS138N,HD74LS138P		16	8	
IC25	SN74LS273N,HD74LS273P		20	10	
IC26	YM-2149		40	1	
IC27	SN74LS157N		16	8	
IC28	SN74LS157N		16	8	
IC29	SN74LS145N,SN74LS145N-R		16	8	
IC30	uPD8255AC-5		26	7	
IC31	uPC311C		8	1	
IC32	SN74LS32N,MB74LS32		14	7	
IC33	SN74LS32N,MB74LS32		14	7	
IC34	SN74LS32N,MB74LS32		14	7	
IC35	SN74LS00N,HD74LS00P		14	7	
IC36	SN74LS02N,MB74LS02		14	7	
IC37	SN74LS08N,MB74LS08		14	7	
IC38	SN74LS08N,MB74LS08		14	7	
IC39	SN74LS74AN,MB74LS74A		14	7	
IC40	SN74LS74AN,MB74LS74A		14	7	
IC41	SN74LS74AN,MB74LS74A		14	7	
IC42	SN74LS04N,MB74LS04		14	7	
IC43	SN7407N		14	7	
IC44	SN74LS14N,MB74LS14		14	7	
IC45	SN74LS126AN,MB74LS126A		14	7	
IC46	TMS4416-15NL(101P)		9	18	
IC47	TMS4416-15NL(101P)		9	18	
IC48	uPC78L12	2		3	
IC49	NJM79L12A			1	3
IC50	SN74LS74AN,MB74LS74A		14	7	


IC 6 280A CPU
RESET
CLOCK
WAIT
INT
NMI
BUSAK
BUSRQ
SUSRQ
RESET
ADDRESS BUS (AB0~AB15)
Q4 2SC945
FROM PU-34(1/2) CN1~4
CN7 MSX SLOT
CN8 MSX SLOT
(TOP VIEW)
+12V
+5V
GND
-12V

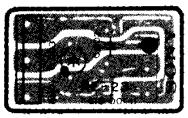

RESET
CLOCK
ADDRESS BUS (AB0 ~ AB15)
1C26 YM2149
PSG
FWD A
FWD B
BACK A
BACK B
LEFT A
LEFT B
RIGHT A
RIGHT B
Q3 2SC945
Q2 2SC945
CLOCK
BUSRQ
DATA BUS (DB0 ~ DB7)
RESET
CONTROL BUS
DATA BUS (D0-D7)
INT
RESET
ADDRESS BUS (AB0~AB7)
FIRM WARE
NOTE 1
JUMPER
J1 (EP-ROM)
NOTE 2 (1/3)
JUMPER
J2,J4(32K) HB-101P
J3,J5(64K) HB-201P
SOUND 1
SOUND 2


RESET
CLOCK
PAUSE
PAUSE (LED)
ADDRESS BUS (A00~A15)
NOTE 3
NO MOUNTED(IC46,47) HB-201P
MAIN MEMORY
#NOTE3
CN6
CN5
FWD A
BACK A
LEFT A
RIGHT A
+5V
TRG1 A
TRG 2 A
OUT A
GND
FWD B
BACK B
LEFT B
RIGHT B
+5V
TRG 1 B
TRG 2 B
OUT B
GND
JOY STICK A
JOY STICK B
(EXT. VIEW)
AUDIO OUT
TO PU-34(1/2) RF UNIT, PIN4
NOTE2 (2/3)
JUMPER
J6(32K) HB-101P
J7(64K) HB-201P
NOTE2(3/3)
J8 32K
J9 64K
SOUND
CLOCK
DATA BUS (D0~D7)
RESET
RFSH
P0~P7
INT
A00
BASIC ROM
IC14 TMS9129 VDP
V RAM
SLTSL0
SLTSL3
IORQ
IOWR
BWR
BRD
CSVDP
CPU CLK
CSW
CSR
XTAL1
XTAL2
RAS
CAS
R/W
R-Y
Y
B-Y
R-Y, Y, B-Y
OE NC CE

PU-34 (2/2)

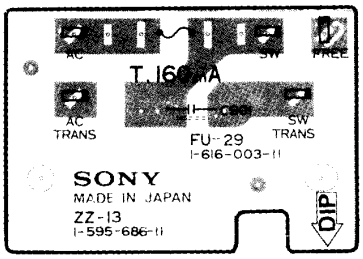

NOTE 3
NO MOUNTED(IC46,47) HB-201P
MAIN MEMORY
*NOTE3
NOTE2(3/3)
JUMPER
J8(32K) HB-101P
J9(64K) HB-201P
IC30 μPD8255AC-5
PPI
Q1 2SA952
CN9
CN4
CN3
TAPE
PRINTER
V RAM
SOUND
DATA BUS (DB0~DB7)
RESET
DATA BUS (D0~D7)
TO/FROM KEYBOARD
CMT OUT
CMT IN
GND
BUSY
TO PU-34(1/2),CN10
PU-34(2/2)
1-615-998-11
HB-101P/201P(AE/E)

5-3. FU-29, RE-23 BOARD



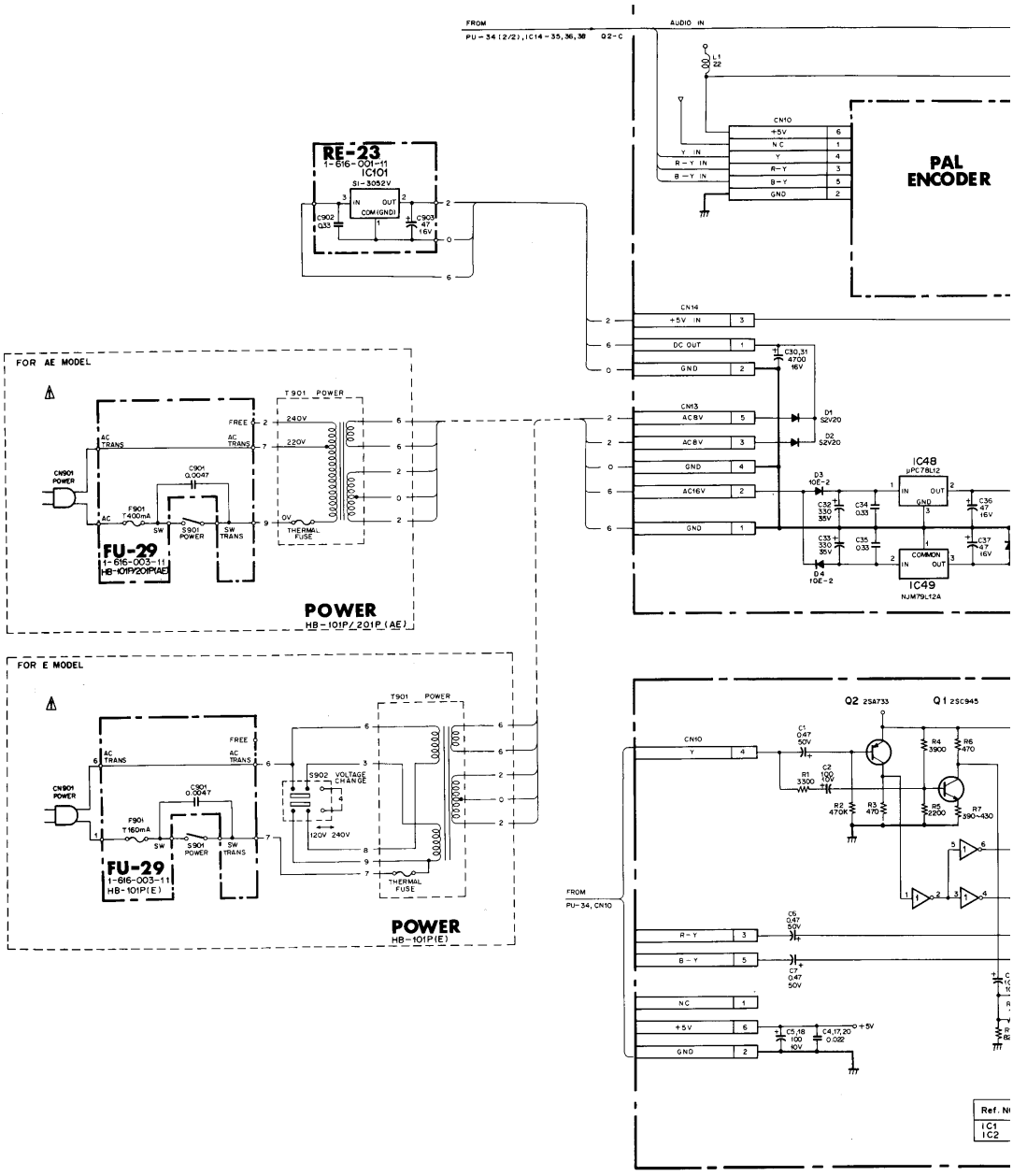
RE-23 – COMPONENT SIDE –

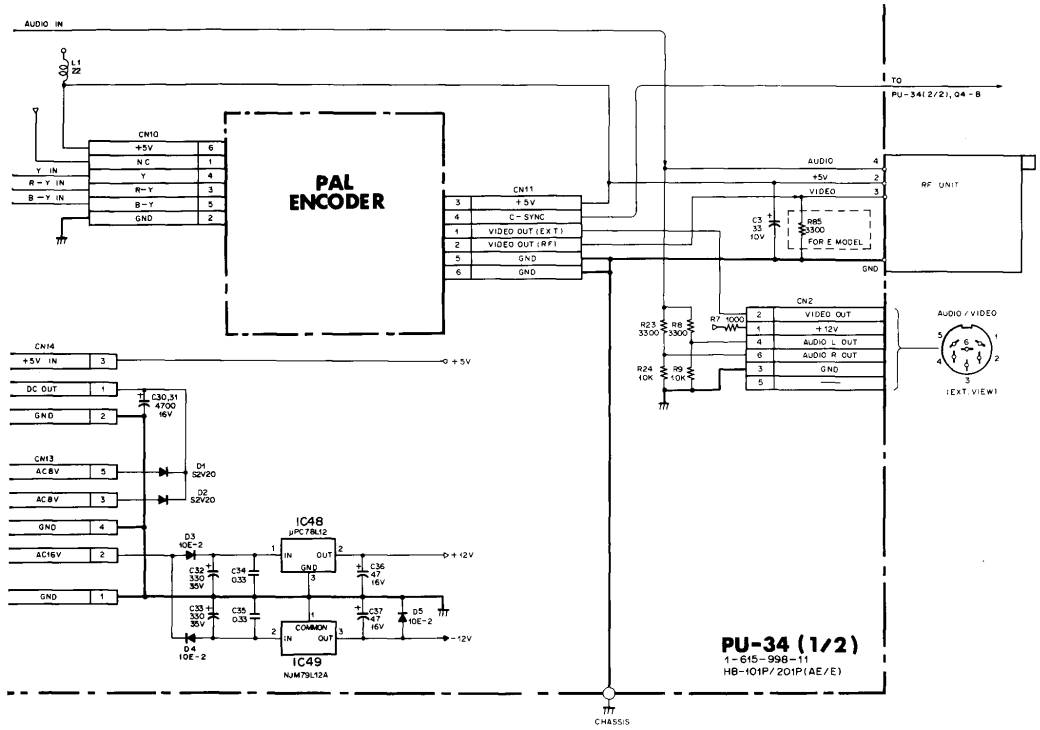
1-616-001-11
HB-101P/201P(AE/E)

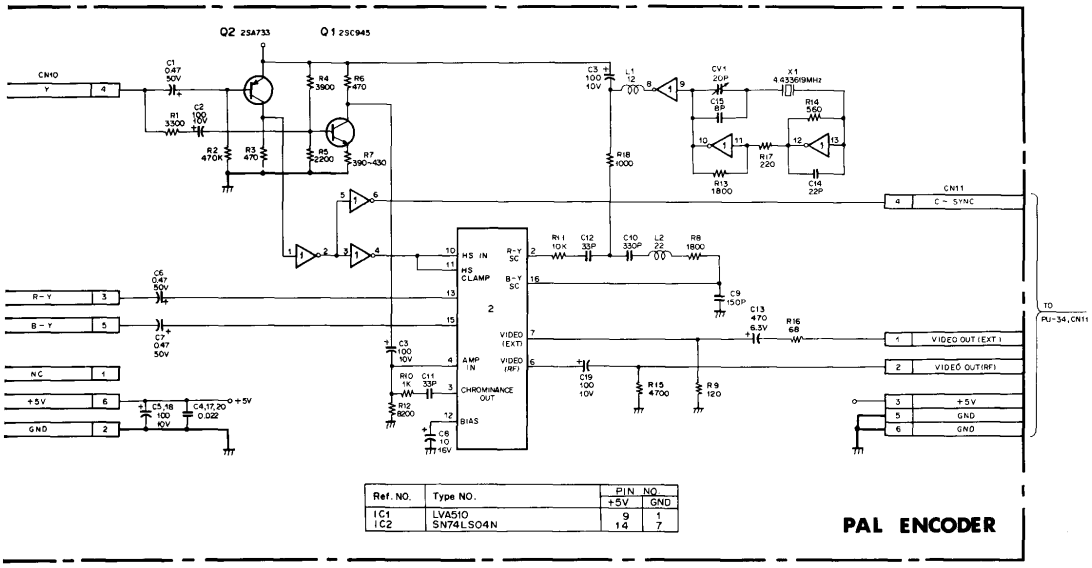


FU-29 – COMPONENT SIDE –

1-616-003-11
HB-101P/201P(AE/E)

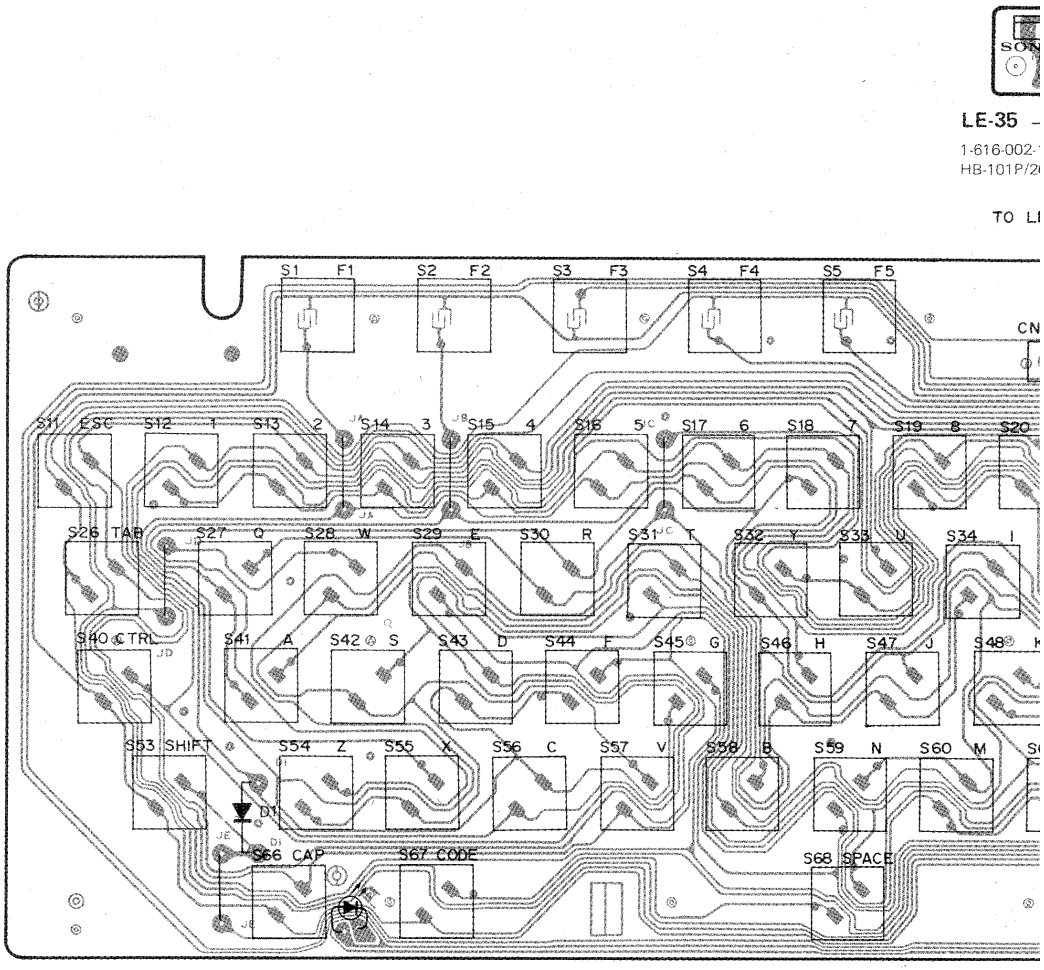

FROM
PU-34 (2/2), IC14-35,36,38
Q2-C
AUDIO IN
L1
22
CN10
+5V
N.C
Y
R-Y
B-Y
GND
Y IN
R-Y IN
B-Y IN
PAL ENCODER
RE-23
1-616-001-11
IC101
SI-3052V
IN
OUT
COM (GND)
C902
0.33
C903
47
16V
FOR AE MODEL
T901 POWER
FREE
AC TRANS
240V
220V
0V
THERMAL FUSE
CN901
POWER
AC
F901
T400mA
SW
S901
POWER
SW TRANS
FU-29
1-616-003-11
HB-101P/201P(AE)
POWER
HB-101P/201P(AE)
CN14
+5V IN
DC OUT
GND
C30,31
4700
16V
CN13
AC8V
AC16V
D1
S2V20
D2
S2V20
D3
1QE-2
D4
1QE-2
IC48
μPC78L12
IN
OUT
GND
C32
330
35V
C33
330
35V
C34
0.33
C35
0.33
C36
47
16V
C37
47
16V
COMMON
IC49
NJM79L12A
FOR E MODEL
T901 POWER
FREE
AC TRANS
S902 VOLTAGE CHANGE
120V 240V
C901
0.0047
F901
T160mA
S901
POWER
SW TRANS
THERMAL FUSE
FU-29
1-616-003-11
HB-101P(E)
POWER
HB-101P(E)
Q2 2SA733
Q1 2SC945
CN10
Y
C1
0.47
50V
C2
100
10V
R1
3300
R2
470K
R3
470
R4
3900
R5
2200
R6
470
R7
390~430
FROM
PU-34, CN10
R-Y
B-Y
C6
0.47
50V
C7
0.47
50V
NC
+5V
GND
C5,16
100
10V
C4,17,20
0.022
+5V
Ref. N
IC1
IC2





Ref. NO.	Type NO.	PIN NO. +5V	PIN NO. GND
IC1	LVA510	9	1
IC2	SN74LS04N	14	7

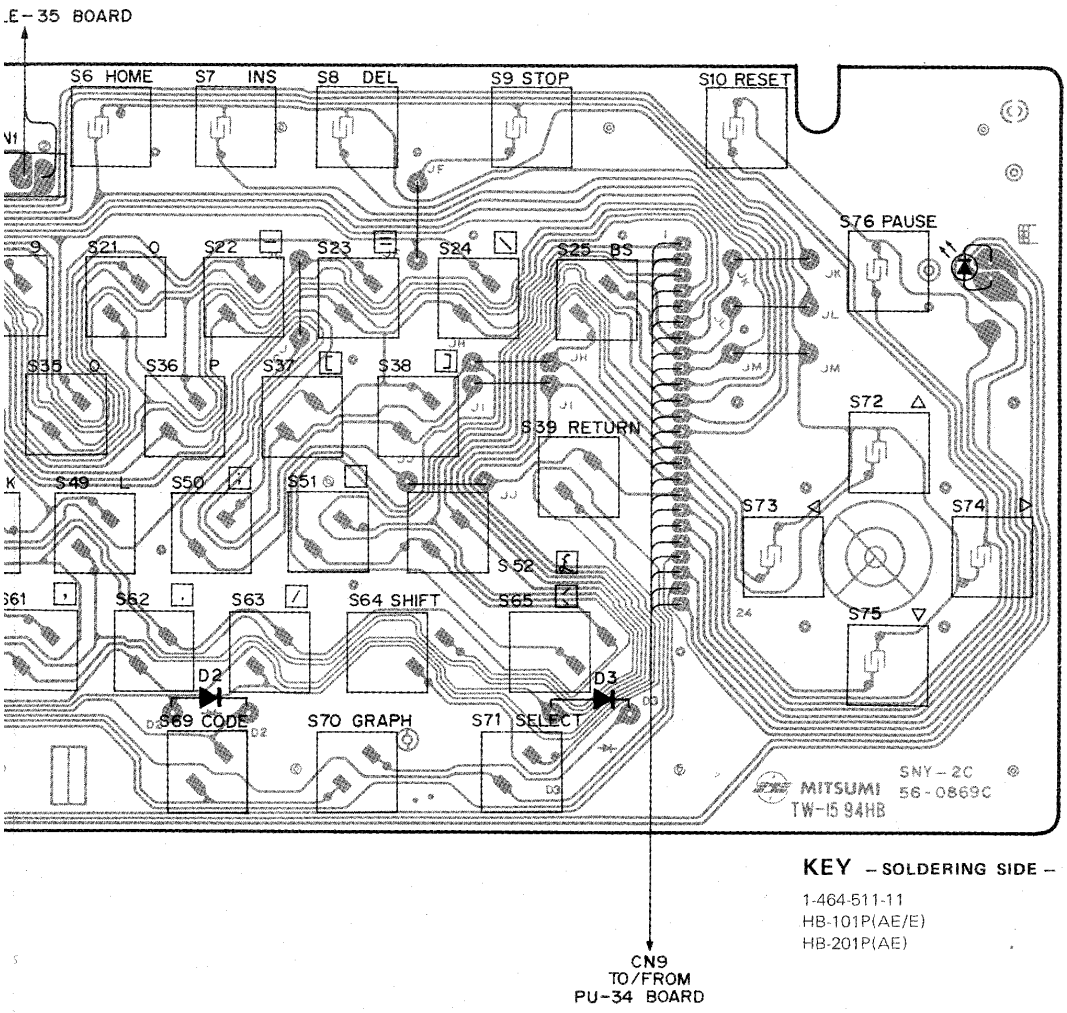
5-4. LE-35, KEY BOARD



LE-35, KEY

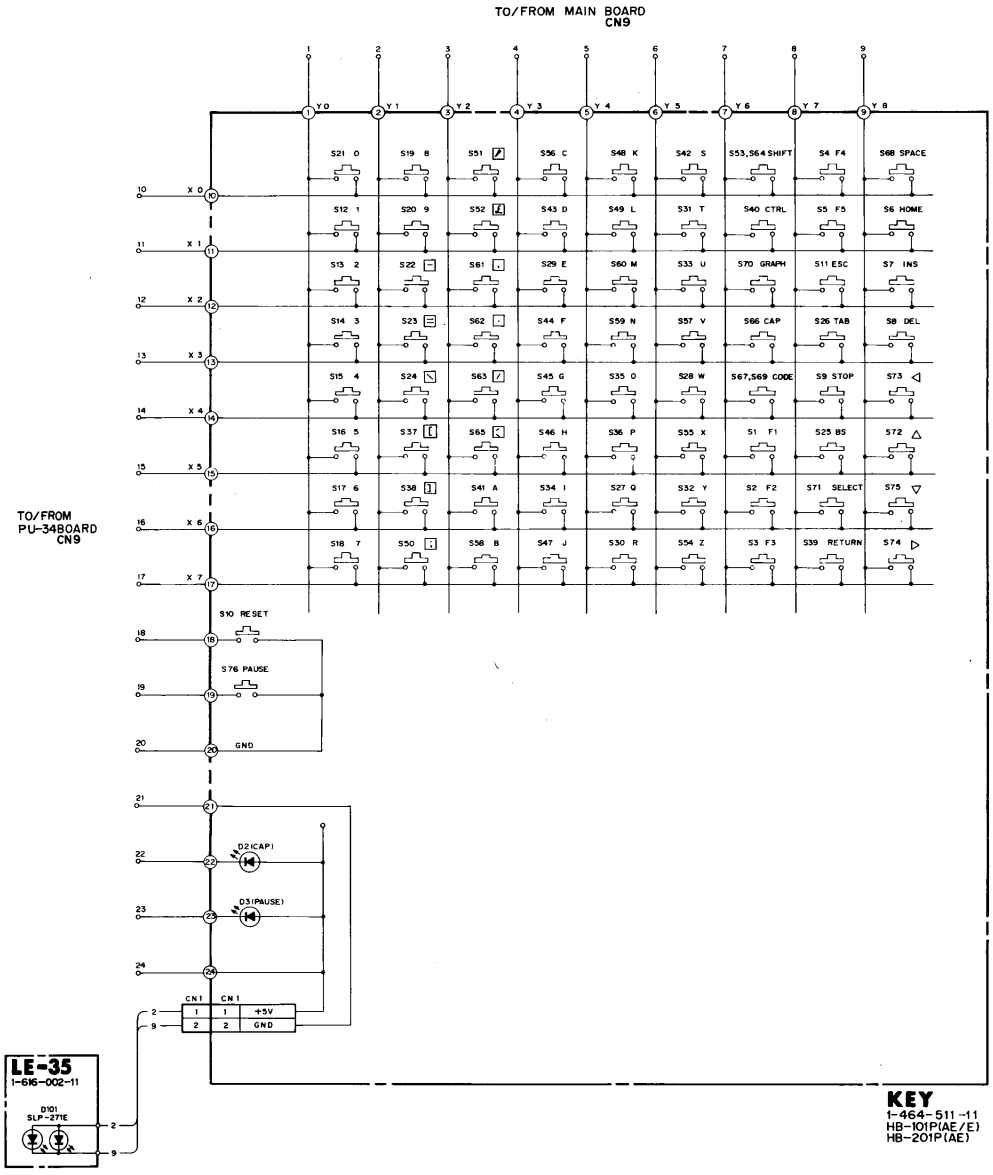
– COMPONENT SIDE –

-11
201P(AE/E)



KEY – SOLDERING SIDE –

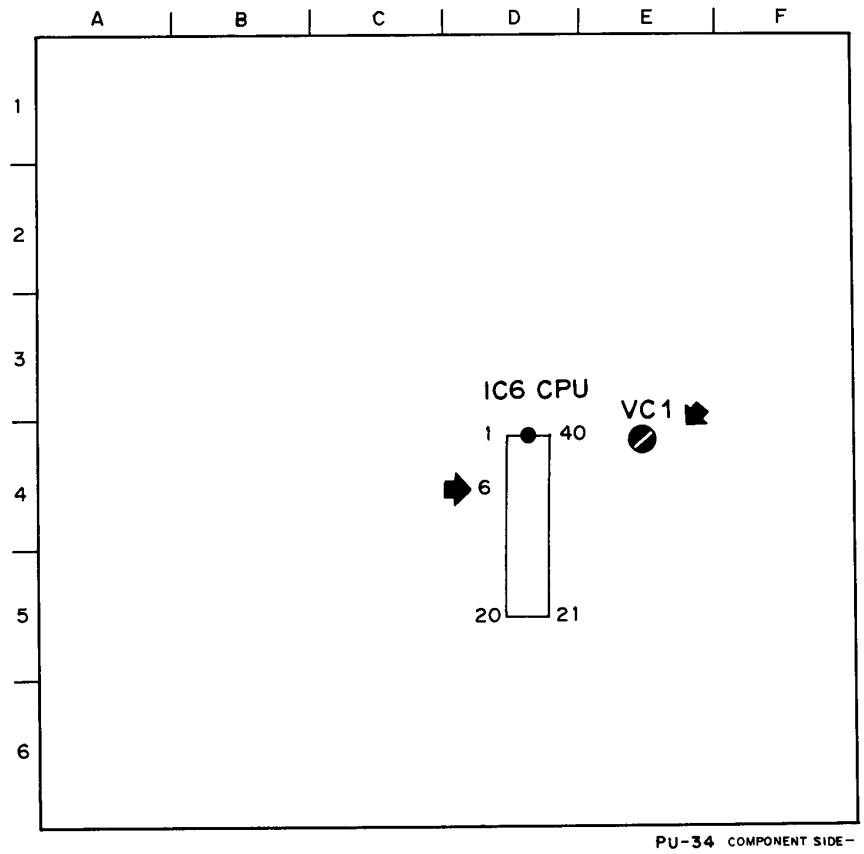
1-464-511-11
HB-101P(AE/E)
HB-201P(AE)


TO/FROM MAIN BOARD
CN9
TO/FROM
PU-348BOARD
CN9
S10 RESET
S76 PAUSE
GND
D2(CAP)
D3(PAUSE)
CN1
+5V
GND
LE-35
1-616-002-11
D101
SLP-271E
KEY
1-464-511-11
HB-101P(AE/E)
HB-201P(AE)

CHAPTER 6
ALIGNMENT

6-1. CLOCK FREQUENCY ADJUSTMENT

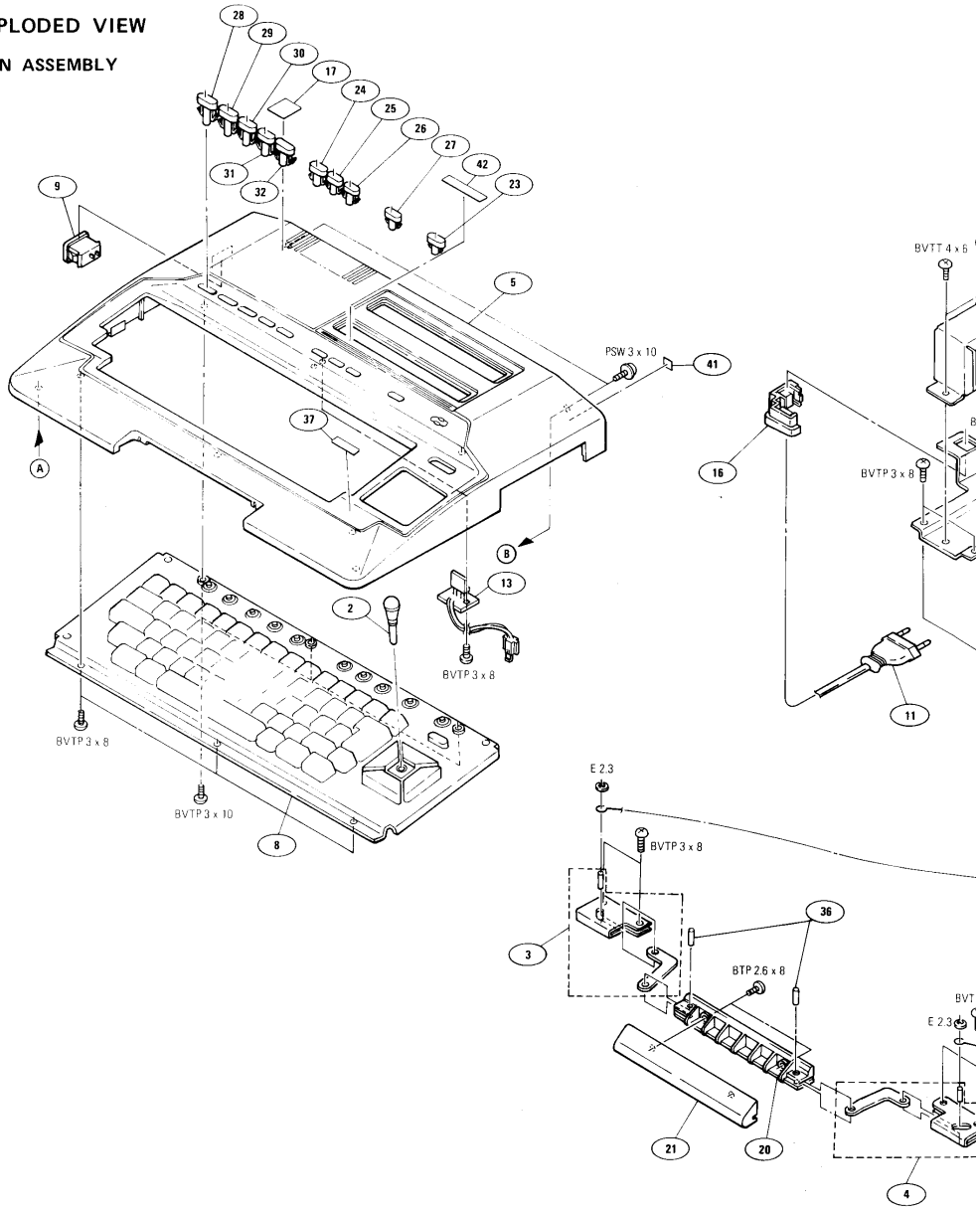
1 Power supply turns ON.
2 Connect the frequency counter to pin 6 (ϕ) of IC6 (CPU) on PU-34 board.
3 Adjust with VC1 so that the frequency of pin 6 of IC6 becomes 3.562500 MHz ± 10 Hz.



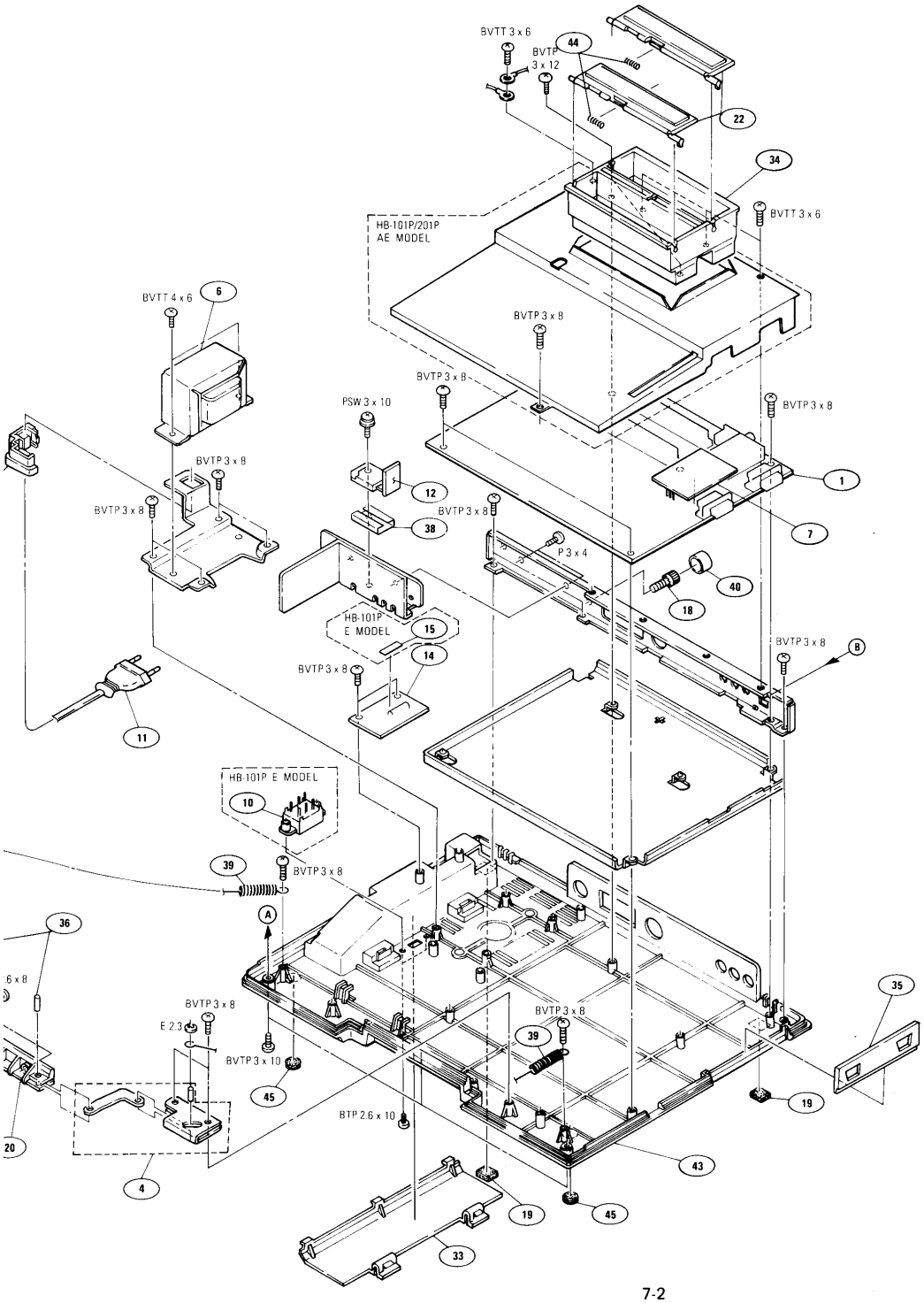
CHAPTER 7
REPAIR PARTS AND FIXTURE

7-1. EXPLODED VIEW

7-1-1. MAIN ASSEMBLY



MAIN MAIN


BVTT 3 x 6
BVTP 3 x 12
44
22
34
BVTT 3 x 6
HB-101P/201P AE MODEL
BVTP 3 x 8
BVTT 4 x 6
6
PSW 3 x 10
BVTP 3 x 8
BVTP 3 x 8
BVTP 3 x 8
12
1
BVTP 3 x 8
38
7
P 3 x 4
40
18
HB-101P E MODEL
15
14
BVTP 3 x 8
8
BVTP 3 x 8
11
HB-101P E MODEL
10
39
BVTP 3 x 8
A
36
BVTP 3 x 8
E 2.3
BVTP 3 x 10
45
BVTP 3 x 8
39
35
19
BTP 2.6 x 10
43
20
4
19
45
33

No.	Parts No.	Description
1	A-8080-082-A	MOUNTED CB, PU-34 (1) (101P E)
	A-8080-085-A	MOUNTED CB, PU-34 (2) (101P AE)
	A-8080-090-A	MOUNTED CB, PU-34 (3) (201P AE)
2	**X-4605-404-1**	**STICK ASSY**
3	X-4605-409-2	ARM (LEFT) ASSY, HANDLE
4	X-4605-410-2	ARM (RIGHT) ASSY, HANDLE
5	**X-4605-414-1**	**ESCUTCHEON ASSY, KEYBOARD (LIGHT GRAY) (201P AE)**
	X-4605-415-1	**ESCUTCHEON ASSY, KEYBOARD (BLACK) (201P AE)**
	X-4605-416-1	**ESCUTCHEON ASSY, KEYBOARD (LIGHT GRAY) (101P AE/E)**
	X-4605-417-1	**ESCUTCHEON ASSY, KEYBOARD (BLACK) (101P AE/E)**
⚠ **6**	**1-448-228-11**	**TRANSFORMER, POWER (101P E)**
	1-448-229-11	**TRANSFORMER, POWER (101P/201P AE)**
7	**1-464-507-11**	**ENCODER, PAL**
8	1-464-511-11	KEYBOARD UNIT
⚠ **9**	**1-553-575-21**	**SWITCH, SEESAW**
⚠ **10**	**1-554-752-21**	**SWITCH, VOLTAGE CHANGE (101P E)**
⚠ **11**	**1-555-735-00**	**CORD, POWER (101P E)**
	1-558-109-11	**CORD, POWER (101P/201P AE)**
12	1-616-001-11	PC BOARD, RE-23
13	1-616-002-11	PC BOARD, LE-35
14	1-616-003-11	PC BOARD, FU-29
15	3-701-948-10	LABEL, FUSE (101P E)
⚠ **16**	**3-703-244-00**	**BUSHING, CORD (101P/201P AE)**
	3-703-571-00	**BUSHING (S), CORD (101P E)**
17	**3-703-707-01**	**STICKER, SONY SYMBOL (21)**
18	**3-706-165-00**	**SCREW**
19	**4-605-401-01**	**FELT, SQUARE**
20	**4-605-408-21**	**HANDLE (BLACK)**
	4-605-408-32	**HANDLE (LIGHT GRAY)**
21	**4-605-409-23**	**COVER, HANDLE (BLACK)**
	4-605-409-32	**COVER, HANDLE (LIGHT GRAY)**
22	**4-605-410-22**	**LID, CARTRIDGE (BLACK)**
	4-605-410-32	**LID, CARTRIDGE (LIGHT GRAY)**
23	**4-605-411-01**	**BUTTON, RESET**
24	**4-605-412-01**	**BUTTON, HOME**
25	**4-605-412-11**	**BUTTON, INS**
26	**4-605-412-21**	**BUTTON, DEL**
27	**4-605-412-31**	**BUTTON, STOP**
28	**4-605-413-01**	**BUTTON, F1.F6**
29	**4-605-413-11**	**BUTTON, F2.F7**
30	**4-605-413-21**	**BUTTON, F3.F8**

No.	Parts No.	Description
31	**4-605-413-31**	**BUTTON, F4.F9**
32	**4-605-413-41**	**BUTTON, F5.F10**
33	**4-605-416-22**	**LID, AC CORD (BLACK)**
	4-605-416-32	**LID, AC CORD (LIGHT GRAY)**
34	**4-605-417-01**	**HOLDER, CARTRIDGE**
35	**4-605-424-22**	**PLATE, BLIND, CONTROLLER (BLACK)**
	4-605-424-32	**PLATE, BLIND, CONTROLLER (LIGHT GRAY)**
36	**4-605-433-01**	**SHAFT, HANDLE ARM**
37	**4-605-440-01**	**SEAL, HIT BIT**
38	**4-605-453-01**	**SHEET, RADIATION**
39	**4-605-459-01**	**SPRING, TENSION**
40	**4-605-460-01**	**THERMO KILLER**
41	4-605-467-02	LABEL, ADJUSTMENT, RF (101P/201P AE)
42	4-605-468-01	LABEL (S), CAUTION
43	**4-605-469-01**	**CABINET, LOWER (LIGHT GRAY) (101P/201P AE)**
	4-605-469-11	**CABINET, LOWER (BLACK) (101P/201P AE)**
	4-605-469-21	**CABINET, LOWER (LIGHT GRAY) (101P E)**
	4-605-469-31	**CABINET, LOWER (BLACK) (101P E)**
44	**4-605-615-01**	**SPRING**
45	**4-860-711-01**	**FELT**

NOTE:

1. **The shaded and ⚠ -marked components are critical to safety. Replace only with same components as specified.**
2. Parts printed in Bold-Face type are normally stocked for replacement purposes. The remaining parts shown in this manual 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.
3. Item with no part number and/or no description are not stocked because they are seldom required for routine service.

No.	Parts No.	Description
51	**4-605-405-01**	**SPRING,COMPRESSION**
52	**4-605-425-01**	**CONTROLLER**
53	**4-605-428-01**	**HOLDER,CONTROLLER**
54	**9-985-392-01**	**SPRING C,COMPRESSION**
55	**9-985-394-01**	**GUIDE CHIP SNY**
56	**9-985-395-01**	**GUIDE CHIP,C-624**
57	9-985-396-01	CRANK SHAFT,U
58	9-985-397-01	CRANK SHAFT,U
59	**9-985-398-01**	**CRICK RUBBER,MS**
60	**9-985-403-01**	**CURSOR KEY**
61	**9-985-404-01**	**PAUSE KEY ASSY**
62	**9-987-078-01**	**KEYTOP(1) E**
63	**9-987-079-01**	**KEYTOP(1) W**
64	**9-987-080-01**	**KEYTOP(1) Q**
65	**9-987-081-01**	**KEYTOP(3) TAB**
66	**9-987-082-01**	**KEYTOP(2) BS**
67	**9-987-083-01**	**KEYTOP(1) **
68	**9-987-084-01**	**KEYTOP(1) =**
69	**9-987-085-01**	**KEYTOP(1) —**
70	**9-987-086-01**	**KEYTOP(1) 0**
71	**9-985-087-01**	**KEYTOP(1) 9**
72	**9-987-088-01**	**KEYTOP(1) 8**
73	**9-987-089-01**	**KEYTOP(1) 7**
74	**9-987-090-01**	**KEYTOP(1) 6**
75	**9-987-091-01**	**KEYTOP(1) 5**
76	**9-987-092-01**	**KEYTOP(1) 4**
77	**9-987-093-01**	**KEYTOP(1) 3**
78	**9-987-094-01**	**KEYTOP(1) 2**
79	**9-987-095-01**	**KEYTOP(1) 1**
80	**9-987-096-01**	**KEYTOP(2) ESC**
81	**9-987-097-01**	**KEYTOP(4) SELECT**
82	**9-987-098-01**	**KEYTOP(4) CODE(LEFT)**
83	**9-987-099-01**	**KEYTOP(2) CODE(RIGHT)**
84	**9-987-100-01**	**SPACE KEY ASSY**
85	**9-987-101-01**	**CAP KEY ASSY**
86	**9-987-102-01**	**GRAPH KEY ASSY**
87	**9-987-103-01**	**RETURN KEY ASSY**
88	**9-987-104-01**	**SHIFT KEY ASSY**
89	**9-987-105-01**	**CTRL KEY ASSY**
90	**9-987-106-01**	**SPRING CM,COMPRESSION**
91	9-987-108-01	PC BOARD
92	**9-987-110-01**	**CONTACT ASSY,KKR-2**
93	**9-987-111-01**	**KEYTOP(1) :**
94	**9-987-112-01**	**KEYTOP(1) /**
95	**9-987-113-01**	**KEYTOP(1) .**
96	**9-987-114-01**	**KEYTOP(1) ,**
97	**9-987-115-01**	**KEYTOP(1) M**
98	**9-987-116-01**	**KEYTOP(1) N**
99	**9-987-117-01**	**KEYTOP(1) B**
100	**9-987-118-01**	**KEYTOP(1) V**
101	**9-985-119-01**	**KEYTOP(1) C**
102	**9-987-120-01**	**KEYTOP(1) X**
103	**9-987-121-01**	**KEYTOP(1) Z**
104	**9-987-122-01**	**KEYTOP(1) £**
105	**9-987-123-01**	**KEYTOP(1) '**
106	**9-987-124-01**	**KEYTOP(1) ;**
107	**9-987-125-01**	**KEYTOP(1) L**
108	**9-987-126-01**	**KEYTOP(1) K**
109	**9-987-127-01**	**KEYTOP(1) J**
110	**9-987-128-01**	**KEYTOP(1) H**
111	**9-987-129-01**	**KEYTOP(1) G**
112	**9-987-130-01**	**KEYTOP(1) F**
113	**9-987-131-01**	**KEYTOP(1) D**
114	**9-987-132-01**	**KEYTOP(1) S**
115	**9-987-133-01**	**KEYTOP(1) A**
116	**9-987-134-01**	**KEYTOP(1)]**
117	**9-987-135-01**	**KEYTOP(1) [**
118	**9-987-136-01**	**KEYTOP(1) P**
119	**9-987-137-01**	**KEYTOP(1) O**
120	**9-987-138-01**	**KEYTOP(1) I**
121	**9-987-139-01**	**KEYTOP(1) U**
122	**9-987-140-01**	**KEYTOP(1) Y**
123	**9-987-141-01**	**KEYTOP(1) T**
124	**9-987-142-01**	**KEYTOP(1) R**

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7-2. ELECTRICAL PARTS LIST

7-2-1. PU-34 BOARD

Ref. No.	Parts No.	Description
	A-8080-082-A	MOUNTED CB,PU-34(1) (101P E)
	A-8080-085-A	MOUNTED CB,PU-34(2) (101P AE)
	A-8080-090-A	MOUNTED CB,PU-34(3) (201P AE)
	1-464-384-11	**MODULATOR, RF(UE) (101P E)**
	1-464-490-11	**MODULATOR, RF(MDG-UE3602) (101P/201P AE)**
	1-464-507-11	**ENCODER, PAL**
	1-526-722-00	SOCKET, IC 40P
C1	**1-123-607-00**	**ELECT 0.1 20% 50V**
C3	**1-123-318-00**	**ELECT 33 20% 16V**
C4	**1-102-508-00**	**CERAMIC 10P 0.5P 50V**
C5	**1-102-959-00**	**CERAMIC 22P 5% 50V**
C6	**1-123-306-00**	**ELECT 4.7 20% 10V**
C7	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C8	**1-123-369-00**	**ELECT 4.7 20% 50V**
C9	**1-123-306-00**	**ELECT 47 20% 10V**
C10	**1-123-369-00**	**ELECT 4.7 20% 63V**
C11	**1-123-298-00**	**ELECT 470 20% 6.3V**
C12	**1-123-369-00**	**ELECT 4.7 20% 63V**
C13	**1-123-306-00**	**ELECT 47 20% 10V**
C14	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C15	**1-136-173-00**	**FILM 0.47 5% 50V**
C16	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C15	**1-136-173-00**	**FILM 0.47 5% 50V**
C16	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C17	**1-123-306-00**	**ELECT 47 20% 10V**
C18	**1-102-074-00**	**CERAMIC 0.001 10% 50V**
C19	**1-102-074-00**	**CERAMIC 0.001 10% 50V**
C20	**1-123-369-00**	**ELECT 4.7 20% 63V**
C21	**1-123-369-00**	**ELECT 4.7 20% 63V**
C22	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C23	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C24	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C25	**1-123-306-00**	**ELECT 47 20% 10V**
C26	**1-101-005-00**	**CERAMIC 0.022 50V**
C27	**1-101-004-00**	**CERAMIC 0.01 50V**
C28	**1-102-109-00**	**CERAMIC 180P 10% 50V**
C29	**1-108-587-00**	**MYLAR 0.022 5% 50V**
C30	**1-124-594-11**	**ELECT 0.0047 20% 16V**
C31	**1-124-594-11**	**ELECT 0.0047 20% 16V**
C32	**1-123-362-00**	**ELECT 330 20% 50V**
C33	**1-123-362-00**	**ELECT 330 20% 50V**
C34	**1-136-171-00**	**FILM 0.33 5% 50V**
C35	**1-136-171-00**	**FILM 0.33 5% 50V**
C36	**1-123-332-00**	**ELECT 47 20% 25V**
C37	**1-123-332-00**	**ELECT 47 20% 25V**
C38	**1-123-356-00**	**ELECT 10 20% 50V**
C39	**1-123-356-00**	**ELECT 10 20% 50V**
C801	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C802	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C803	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C804	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C805	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C806	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C807	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C808	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C809	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C810	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C811	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C812	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C813	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C814	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C815	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C816	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C817	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C818	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C819	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C820	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C821	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C822	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C823	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C824	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C825	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C826	**1-161-974-00**	**CERAMIC 0.1 20% 16V**
C827	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C828	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C829	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C830	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C831	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C832	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C833	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C834	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C835	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C836	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C837	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C838	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C839	**1-162-113-00**	**CERAMIC 0.01 30% 16V**
C840	**1-162-113-00**	**CERAMIC 0.01 30% 16V**

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Ref. No.	Parts No.	Description
C841	1-162-113-00	CERAMIC 0.01 30% 16V
C842	1-162-113-00	CERAMIC 0.01 30% 16V
C843	1-162-113-00	CERAMIC 0.01 30% 16V
C844	1-162-113-00	CERAMIC 0.01 30% 16V
C845	1-162-113-00	CERAMIC 0.01 30% 16V
CN2	1-562-121-11	DIN 6P
CN3	1-564-373-22	14P (PRINTER)
CN4	1-561-468-00	DIN 8P (CASSETT)
CN5	1-564-372-00	9P (JOYSTICK B)
CN6	1-564-372-00	9P (JOYSTICK A)
CN7	1-562-383-00	50P (SLOT1)
CN8	1-562-383-00	50P (SLOT2)
CN9	1-562-678-11	24P (KEYBOARD)
CN13	1-564-242-00	5P
CN14	1-564-104-11	3P
D1	8-719-911-55	U05G
D2	8-719-911-55	U05G
D3	8-719-200-02	10E2
D4	8-719-200-02	10E2
D6	8-719-815-55	1S1555
D7	8-719-815-55	1S1555
D8	8-719-815-55	1S1555
D9	8-719-200-02	10E2
IC1	8-759-903-67	SN74LS367AN
IC2	8-759-903-67	SN74LS367AN
IC3	8-759-903-67	SN74LS367AN
IC4	8-759-901-57	SN74LS157N
IC5	8-759-901-57	SN74LS157N
IC6	8-759-916-80	LH0080A
IC7	8-759-903-93	SN74LS393N
IC8	8-759-922-31	MSM38128A-F6RS (101P AE/E)
	8-759-206-19	TMM23128P-8712 (201P AE)
IC9	8-759-922-70	MSM38256-78RS
IC10	8-759-903-67	SN74LS367AN
IC11	8-759-906-45	SN74LS645N
IC12	8-759-901-39	SN74LS139N
IC13	8-759-900-74	SN74LS74AN
IC14	8-759-920-31	TMS9129NL
IC15	8-759-900-74	SN74LS74AN

Ref. No.	Parts No.	Description
IC16	8-759-901-38	SN74LS138N
IC17	8-759-901-53	SN74LS153N
IC18	8-759-901-57	SN74LS157N
IC19	8-759-901-57	SN74LS157N
IC20	8-759-909-04	TMS4416-15NL
IC21	8-759-909-04	TMS4416-15NL
IC22	8-759-909-04	TMS4416-15NL (101P AE/E)
	8-759-103-98	μPD41254C-15 (201P AE)
IC23	8-759-909-04	TMS4416-15NL (101P AE/E)
	8-759-103-98	μPD41254C-15 (201P AE)
IC24	8-759-901-38	SN74LS138N
IC25	8-759-902-73	SN74LS273N
IC26	8-759-911-36	YM-2149
IC27	8-759-901-57	SN74LS157N
IC28	8-759-901-57	SN74LS157N
IC29	8-759-901-45	SN74LS145N
IC30	8-759-182-55	μPD8255AC5
IC31	8-759-131-11	μPC311C
IC32	8-759-900-32	SN74LS32N
IC33	8-759-900-32	SN74LS32N
IC34	8-759-900-32	SN74LS32N
IC35	8-759-900-00	SN74LS00N
IC36	8-759-900-02	SN74LS02N
IC37	8-759-900-08	SN74LS08N
IC38	8-759-900-08	SN74LS08N
IC39	8-759-900-74	SN74LS74AN
IC40	8-759-900-74	SN74LS74AN
IC41	8-759-900-74	SN74LS74AN
IC42	8-759-900-04	SN74LS04N
IC43	8-759-974-07	SN7407N
IC44	8-759-900-14	SN74LS14N
IC45	8-759-901-26	SN74LS126AN
IC46	8-759-909-04	TMS4416-15NL (101P AE/E)
IC47	8-759-909-04	TMS4416-15NL (101P AE/E)
IC48	8-759-178-12	μPC78L12
IC49	8-759-700-69	NJM79L12A
IC50	8-759-900-74	SN74LS74AN
L1	1-408-413-00	22
L2	1-408-413-00	22
L4	1-408-413-00	22

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Ref. No.	Parts No.	Description
Q1	8-729-195-23	2SA952
Q2	8-729-663-47	2SC1364
Q3	8-729-663-47	2SC1364
Q4	8-729-663-47	2SC1364
R1	1-247-791-00	CARBON 22 5% 1/6W
R2	1-247-855-00	CARBON 10K 5% 1/6W
R3	1-247-823-00	CARBON 470 5% 1/6W
R4	1-247-823-00	CARBON 470 5% 1/6W
R5	1-247-823-00	CARBON 470 5% 1/6W
R6	1-247-823-00	CARBON 470 5% 1/6W
R7	1-247-831-00	CARBON 1K 5% 1/6W
R8	1-247-843-00	CARBON 3.3K 5% 1/6W
R9	1-247-855-00	CARBON 10K 5% 1/6W
R11	1-247-895-00	CARBON 470K 5% 1/6W
R12	1-247-855-00	CARBON 10K 5% 1/6W
R13	1-247-843-00	CARBON 3.3K 5% 1/6W
R14	1-247-855-00	CARBON 10K 5% 1/6W
R15	1-247-855-00	CARBON 10K 5% 1/6W
R16	1-247-855-00	CARBON 10K 5% 1/6W
R17	1-247-855-00	CARBON 10K 5% 1/6W
R18	1-247-855-00	CARBON 10K 5% 1/6W
R19	1-247-855-00	CARBON 10K 5% 1/6W
R20	1-247-855-00	CARBON 10K 5% 1/6W
R21	1-247-799-00	CARBON 47 5% 1/6W
R22	1-247-855-00	CARBON 10K 5% 1/6W
R23	1-247-843-00	CARBON 3.3K 5% 1/6W
R24	1-247-855-00	CARBON 10K 5% 1/6W
R25	1-247-819-00	CARBON 330 5% 1/6W
R26	1-247-879-00	CARBON 100K 5% 1/6W
R27	1-247-871-00	CARBON 47K 5% 1/6W
R28	1-247-855-00	CARBON 10K 5% 1/6W
R29	1-247-831-00	CARBON 1K 5% 1/6W
R30	1-247-855-00	CARBON 10K 5% 1/6W
R31	1-247-855-00	CARBON 10K 5% 1/6W
R32	1-247-855-00	CARBON 10K 5% 1/6W
R33	1-247-855-00	CARBON 10K 5% 1/6W
R34	1-247-855-00	CARBON 10K 5% 1/6W
R35	1-247-855-00	CARBON 10K 5% 1/6W
R36	1-247-855-00	CARBON 10K 5% 1/6W
R37	1-247-855-00	CARBON 10K 5% 1/6W
R38	1-247-855-00	CARBON 10K 5% 1/6W
R39	1-247-855-00	CARBON 10K 5% 1/6W
R40	1-247-855-00	CARBON 10K 5% 1/6W
R41	1-247-855-00	CARBON 10K 5% 1/6W
R42	1-247-855-00	CARBON 10K 5% 1/6W
R43	1-247-871-00	CARBON 47K 5% 1/6W
R44	1-247-831-00	CARBON 1K 5% 1/6W
R45	1-247-855-00	CARBON 10K 5% 1/6W
R46	1-247-855-00	CARBON 10K 5% 1/6W
R47	1-247-855-00	CARBON 10K 5% 1/6W
R48	1-247-855-00	CARBON 10K 5% 1/6W
R49	1-247-855-00	CARBON 10K 5% 1/6W
R50	1-247-855-00	CARBON 10K 5% 1/6W
R51	1-247-855-00	CARBON 10K 5% 1/6W
R52	1-247-855-00	CARBON 10K 5% 1/6W
R53	1-247-831-00	CARBON 1K 5% 1/6W
R54	1-247-831-00	CARBON 1K 5% 1/6W
R55	1-247-847-00	CARBON 4.7K 5% 1/6W
R56	1-247-795-00	CARBON 33 5% 1/6W
R57	1-247-783-00	CARBON 10 5% 1/6W
R58	1-247-823-00	CARBON 470 5% 1/6W
R59	1-247-859-00	CARBON 15K 5% 1/6W
R60	1-247-863-00	CARBON 22K 5% 1/6W
R61	1-249-421-11	CARBON 2.2K 5% 1/6W
R62	1-247-841-00	CARBON 2.7K 5% 1/6W
R63	1-247-863-00	CARBON 22K 5% 1/6W
R64	1-247-863-00	CARBON 22K 5% 1/6W
R65	1-247-831-00	CARBON 1K 5% 1/6W
R66	1-247-831-00	CARBON 1K 5% 1/6W
R67	1-247-791-00	CARBON 22 5% 1/6W
R68	1-247-791-00	CARBON 22 5% 1/6W
R69	1-247-847-00	CARBON 4.7K 5% 1/6W
R70	1-247-847-00	CARBON 4.7K 5% 1/6W
R71	1-247-823-00	CARBON 470 5% 1/6W
R72	1-247-791-00	CARBON 22 5% 1/6W
R73	1-247-855-00	CARBON 10K 5% 1/6W
R74	1-247-855-00	CARBON 10K 5% 1/6W
R75	1-247-855-00	CARBON 10K 5% 1/6W
R76	1-247-863-00	CARBON 22K 5% 1/6W
R77	1-247-863-00	CARBON 22K 5% 1/6W
R78	1-247-855-00	CARBON 10K 5% 1/6W
R79	1-247-807-00	CARBON 100 5% 1/6W
R80	1-247-861-00	CARBON 18K 5% 1/6W
R81	1-247-791-00	CARBON 22 5% 1/6W
R82	1-247-791-00	CARBON 22 5% 1/6W
R83	1-247-823-00	CARBON 470 5% 1/6W
R84	1-249-421-11	CARBON 2.2K 5% 1/6W
R85	1-247-843-00	CARBON 3.3K 5% 1/6W(101P E)
R86	1-247-831-00	CARBON 1K 5% 1/6W

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Ref. No.	Parts No.	Description
R87	**1-247-855-00**	**CARBON 10K 5% 1/6W**
R88	**1-247-823-00**	**CARBON 470 5% 1/6W**
RY1	**1-515-520-00**	**RELAY**
VC1	**1-141-227-00**	**TRIMMER,CERAMIC 20P**
X1	**1-567-472-11**	**VIBRATOR, CRYSTAL 10.6875MHz**

7-2-2. FU-29 BOARD

	1-616-003-11	PC BOARD, FU-29
	1-533-162-00	**HOLDER, FUSE**
	3-701-948-10	LABEL, FUSE (101P E)
⚠**C901**	**1-161-953-00**	**CERAMIC 0.0047 20% 400V**
⚠**F901**	**1-532-612-00**	**TIME-LAG (101P/201P AE)**
	1-532-066-00	**TIME-LAG (101P E)**

Ref. No.	Parts No.	Description

7-2-3. LE-35 BOARD

	1-616-002-11	PC BOARD, LE-35
D101	**8-719-903-17**	**SLP271E**

7-2-4. RE-23 BOARD

	1-616-001-11	PC BOARD, RE-23
C902	**1-136-171-00**	**FILM 0.33 5% 50V**
C903	**1-123-332-00**	**ELECT 47 20% 25V**
IC101	**8-749-930-52**	**SI-3052V**

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Ref. No.	Parts No.	Description
7-2-5. FRAME		
	1-464-507-11	**ENCODER, PAL**
⚠**CN901**	**1-558-109-11**	**CORD, POWER (101P/201P AE)**
	1-555-735-00	**CORD, POWER (101P E)**
⚠**S901**	**1-553-575-21**	**SEESAW**
⚠**S902**	**1-554-752-21**	**VOLTAGE CHANGE (101P E)**
⚠**T901**	**1-448-229-11**	**POWER (101P/201P AE)**
	1-448-228-11	**POWER (101P E)**

7-3. PACKING MATERIAL AND ACCESSORY

Ref. No.	Parts No.	Description
	X-4605-404-1	**STICK ASSY**
	1-417-123-11	**SELECTOR, ANT**
	1-557-127-00	**CORD (WITH CONNECTOR)**
	1-557-585-11	**CORD, RF CONNECTION**
	3-760-161-11	MANUAL, INSTRUCTION (ENGLISH) (101P E/201P AE)
	3-760-161-41	MANUAL, INSTRUCTION (FRENCH, GERMAN, ITALIAN)(201P AE)
	3-760-161-51	MANUAL, INSTRUCTION (DUTCH, SWEDISH) (201P AE)
	3-760-161-61	MANUAL, INSTRUCTION (SPANISH) (101P/201P AE)
	3-795-898-12	MANUAL, INTRODUCTION TO MSX-BASIC (ENGLISH)(101P E)
	3-795-898-32	MANUAL, INTRODUCTION TO MSX-BASIC (FRENCH)(201P AE)
	3-795-898-42	MANUAL, INTRODUCTION TO MSX-BASIC (SPANISH)(101P AE)
	3-795-898-52	MANUAL, INTRODUCTION TO MSX-BASIC (GERMAN)(201P AE)
	3-795-898-62	MANUAL, INTRODUCTION TO MSX-BASIC (ITALIAN)(201P AE)
	3-795-898-72	MANUAL, INTRODUCTION TO MSX-BASIC (DUTCH)(201P AE)
	3-795-898-82	MANUAL, INTRODUCTION TO MSX-BASIC (SWEDISH)(201P AE)
	3-795-899-12	MANUAL, PROGRAMMING REFERENCE (ENGLISH)(101P E)
	3-795-899-31	MANUAL, PROGRAMMING REFERENCE (FRENCH)(201P AE)
	3-795-899-42	MANUAL, PROGRAMMING REFERENCE (SPANISH)(101P AE)
	3-795-899-52	MANUAL, PROGRAMMING REFERENCE (GERMAN)(201P AE)
	3-795-899-61	MANUAL, PROGRAMMING REFERENCE (ITALIAN)(201P AE)
	3-795-899-72	MANUAL, PROGRAMMING REFERENCE (DUTCH)(201P AE)
	3-795-899-81	MANUAL, PROGRAMMING REFERENCE (SWEDISH)(201P AE)
	3-795-966-11	MANUAL, HOW TO USE THE PERSONAL DATA BANK (ENGLISH) (101P E/201P AE)
	3-795-966-41	MANUAL, HOW TO USE THE PERSONAL DATA BANK (FRENCH, GERMAN, ITALIAN)(201P AE)
	3-795-966-51	MANUAL, HOW TO USE THE PERSONAL DATA BANK (DUTCH, SWEDISH)(201P AE)
	3-795-966-61	MANUAL, HOW TO USE THE PERSONAL DATA BANK (SPANISH) (201P AE)
	4-605-140-01	**SHEET, PROTECTION**
	4-605-472-01	INDIVIDUAL CARTON (101P AE/E)
	4-605-473-01	INDIVIDUAL CARTON (201P AE)
	4-605-474-01	CUSHION (LEFT)
	4-605-475-01	CUSHION (RIGHT)
	4-605-476-01	**CASE, ACCESSORY**

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