If the LSD is,	change it to	If the LSD is,	change it to
0	3	1	3
2	3	4	7
5	7	6	7
8	B	9	B
A	B	C	F
D	F	E	F

NOTE:
There is no need to change the LSD if it is already 3, 7, B or F.

6.6 Interchangeability of the Built-in Microcassette with an External Cassette

Since the bit rate and data format of the microcassette and an external cassette are the same, data can be read irrespective of the device on which it was written. However, depending on the type of tape used and the configuration of the microcassette, there may be cases when a programme cannot be read.

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7. HOW TO USE THE MICROPRINTER

Your HX-20 is equipped with two switches and two keys which are related to the manual mode operation of the built-in microprinter: PRINTER ON/OFF, PAPER FEED and CTRL + PF2.

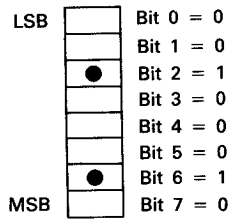
(1) PRINTER ON/OFF switch
This switch controls the output to the built-in microprinter. Data will be output to the microprinter when the switch is set to the "ON" position, and the microprinter will not operate when the switch is set to the "OFF" position. (When this switch is in the OFF position, data will not be output to the microprinter even if a statement such as LPRINT "ABC" RETURN is executed in BASIC.)

(2) PAPER FEED switch
Press this switch to feed the paper. Paper feed will continue while this switch is being pressed. When the PRINTER ON/OFF switch is in the "OFF" position, the paper will not feed into the printer even if the PAPER FEED switch is pressed.

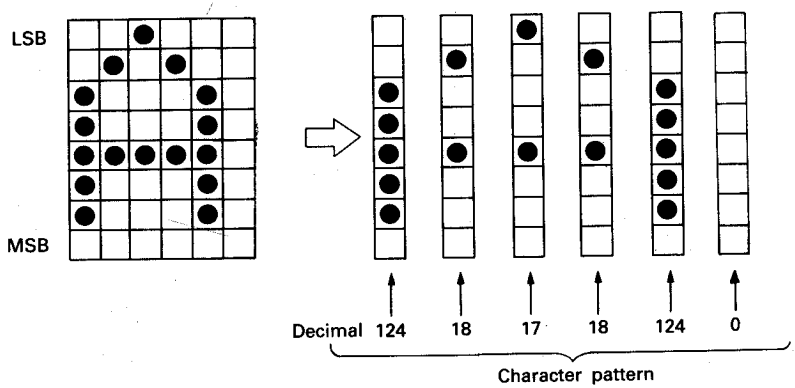
(3) CTRL and PF2 keys
Press the PF2 key while holding down the CTRL key to output the entire contents of the LCD screen on the microprinter. This screen copy function may not be executed when either the external audio cassette or the microcassette is being operated. When the Printer ON/OFF switch is in the "OFF" position, the contents of the LCD screen cannot be copied on the printer.
NOTE:
If an operation to output data on the built-in microprinter using a BASIC programme is executed while data is being input to the RS-232C port, data input to the RS-232C port will be interrupted during the printing operation causing the data in the RS-232C port to be lost.

8. DEFINITION OF GRAPHIC PATTERNS

Character patterns can be defined freely by the user into the codes 224 through 255 (dec). In the following example, ● denotes a bit with logic 1 and a blank denotes a bit with logic 0. Only bits with logic 1 will be printed as dots. The LSB of the data corresponds to the uppermost dot position.



This data can be expressed as binary 01000100, 44(hex) or 68(dec).
In Appendix C, the lower four bits are listed in the column at the side and the upper four bits in the row at the top of the Character Code Table. For example, the character pattern for the letter "A" is formed in the following manner.



The 6-byte data shown above are sent in the following order: 124, 18, 17, 18, 124 and 0 (decimal).
User-defined character patterns are stored in the memory starting from address 11E(hex). Data stored in code 224 are sent first and data stored in code 255, last.

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[Example]

Address		(Decimal)
011E	←	16
011F	←	0
1000	←	124
1001	←	18
1002	←	17
1003	←	18
1004	←	124
1005	←	0
1006	←	127
1007	←	73
1008	←	73
1009	←	73
100A	←	54
100B	←	0

Assume that two character patterns (two 6-byte data) are stored in the addresses shown on the left. When you press numeric key **0** while holding down the **GRPH** key, letter "A" is displayed. Press numeric key **1** while holding down the **GRPH** key and letter "B" will be displayed.

(Pay attention to the bottom address of memory set by a MEMSET command in BASIC.)

Programme example in BASIC:

```
10 REM Defined Character
20 MEMSET &H1010
30 POKE &H011E,16
40 POKE &H011F,0
50 POKE &H1000,124
60 POKE &H1001,18
70 POKE &H1002,17
80 POKE &H1003,18
90 POKE &H1004,124
100 POKE &H1005,0
110 POKE &H1006,127
120 POKE &H1007,73
130 POKE &H1008,73
140 POKE &H1009,73
150 POKE &H100A,54
160 POKE &H100B,0
170 END

RUN_
```

Press **GRPH** and **0** key. A_

Press **GRPH** and **1** key. B_

To call user-defined characters using the keyboard, the following modes are used.

(1) Control key mode

The following keys corresponding to 00 through 1F and E1 through FF (except FC and FE) can be input while holding down the **CTRL** key. For example, for E1, press the **1** key while holding down the **CTRL** and **SHIFT** keys.

00 (00)	@	10 (16)	P
01 (01)	A	11 (17)	Q
02 (02)	B	12 (18)	R
03 (03)	C	13 (19)	S
04 (04)	D	14 (20)	T
05 (05)	E	15 (21)	U
06 (06)	F	16 (22)	V
07 (07)	G	17 (23)	W
08 (08)	H	18 (24)	X
09 (09)	I	19 (25)	Y
0A (10)	J	1A (26)	Z
0B (11)	K	1B (27)	[
0C (12)	L	1C (28)	¥
0D (13)	M	1D (29)	]
0E (14)	N	1E (30)	^
0F (15)	O	1F (31)	_

E0 (224)		F0 (240)	0
E1 (225)	!	F1 (241)	1
E2 (226)	"	F2 (242)	2
E3 (227)	#[£]	F3 (243)	3
E4 (228)	$	F4 (244)	4
E5 (229)	%	F5 (245)	5
E6 (230)	&	F6 (246)	6
E7 (231)	'	F7 (247)	7
E8 (232)	(	F8 (248)	8
E9 (233)	)	F9 (249)	9
EA (234)	*	FA (250)	:
EB (235)	+	FB (251)	;
EC (236)	,	FC (252)	
ED (237)	-	FD (253)	=
EE (238)	.	FE (254)	
EF (239)	/	FF (255)	?

NOTE:
Numbers in parentheses are decimal codes and the character in brackets is available on the English Keyboard.

(2) Graphic mode

The numeric keys **0** through **9** while holding down the **GRPH** key correspond to E0 through E9.

E0 (224)	0
E1 (225)	1
E2 (226)	2
E3 (227)	3
E4 (228)	4
E5 (229)	5
E6 (230)	6
E7 (231)	7
E8 (232)	8
E9 (233)	9

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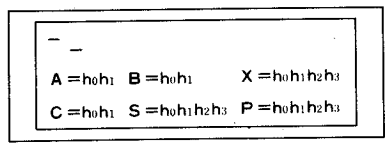
9. HOW TO USE THE MONITOR

9.1 Running the Monitor

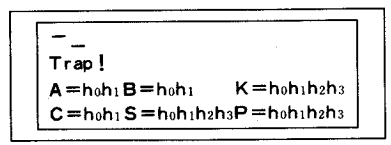
You can run the Monitor in the following three cases.
(1) When you select the monitor from the menu display.
(2) When a MON command is executed in BASIC. (MON **RETURN**.)
(3) When a trap interrupt is generated due to programme overrun.

9.2 Monitor Display

The display of data by the monitor is always on the physical screen. During the data display by the monitor, the virtual screen data used by BASIC is retained. When the HX-20 enters Monitor mode under condition (1) or (2) described in Section 9.1 above, the monitor display is as follows.



A, B, X, C, S, and P show the contents of the accumulator A, accumulator B, Index register, condition code register, stack pointer and programme counter, respectively. h_0h_1 represents a value in two-digit hex numbers and $h_0h_1h_2h_3$, a value in four-digit hex numbers. The "–" sign at the top line on the screen is a prompt sign, indicating that you can enter a command from the position of the cursor.
When the HX-20 enters Monitor mode under condition (3) described in Section 9.1 above, the message "Trap!" will appear on the second line of the screen as shown below.



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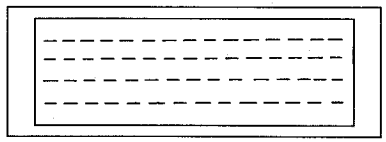
9.3 Types of Commands

In the Monitor, there are 10 types of commands.

(1) **S** (Set) : Displays and changes the contents of the memory.
(2) **D** (Dump) : Displays the contents of the memory.
(3) **G** (Go) : Executes a programme.
(4) **X** (Examine) : Displays and changes the content of each register.
(5) **R** (Read) : Loads a programme or data into the memory from an external storage.
(6) **W** (Write) : Saves the contents of the memory to an external storage.
(7) **V** (Verify) : Verifies the data output to an external storage.
(8) **A** (Address) : Specifies the range of the memory space when loading from an external storage or saving data to an external storage.
(9) **K** (Key) : Specifies the data for automatic key input when the power switch is turned on.
(10) **B** (Back) : Returns control to the procedure by which the monitor was called.

9.4 Command Input

Monitor commands can be input at any column between the 2nd and the 20th column following the prompt sign (–) at the leftmost end of the first line. The first line where the prompt sign exists is called a "command line". The first character of the command line is significant as a command and each command may be followed by one or more arguments.



All the codes in the character code table except DEL code (&H08) are acceptable as key inputs at the command line. (When the INS DEL key is pressed, it is accepted as the INS DEL key. All other character codes are accepted as codes. However, there are some character codes which are not displayed. The DEL code moves the display back one character space. The space key is not ignored but is taken to indicate a space.)

9.5 Description of Each Monitor Command

(1) **S** (Set) command
This command is used to display and change the memory contents.

–Sa_{16} RETURN (a_{16} = address in hex numbers of 4 or less digits)

Following this command, you must enter the address of the memory containing the data to be changed in hexadecimal numbers of 4 or less digits. After you press the RETURN key, the current contents of memory are displayed and the cursor is positioned next to the memory contents being displayed.
To change the memory contents, you must input the new data in hex numbers and then press the RETURN key. The contents of memory will then be rewritten as specified, and the memory contents of the next address will be displayed for your rewriting if required. In this manner, you can change the memory contents continuously.

There are two methods to cancel the S command. One is to enter any character exclusive of hexadecimal numbers, comma (,) and space. In this method, use of slash (/) or full stop (.) is preferred. The other method is to input a new command in the position where the S command is displayed by moving the cursor back one position to the left with the INS DEL key.

[Example]
In this example, the contents of addresses 1000 (hex) through 1006 (hex) will be changed as follows.

Address	Contents before change	Contents after change
1000	00	02
1001	02	54
1002	3A	3A
1003	57	57
1004	84	00
1005	95	81
1006	23	

Input and display of data will be as follows. (Command line)

Input		Display
–S1000	RETURN	–S1000 00 _
	02 RETURN	–S1001 02 _
	54 RETURN	–S1002 3A _
	RETURN	–S1003 57 _
	RETURN	–S1004 84 _
	00 RETURN	–S1005 95 _
	81 RETURN	–S1006 23 _
	/ RETURN	–_

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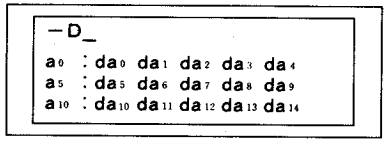
(2) **D** (Dump) command
This command is used to display the contents of the memory.

$-Da_{16}$ **RETURN** (a_{16} = address in hex numbers of 4 or less digits)

Following this command, you must enter the memory address containing the data to be displayed in hex numbers of 4 or less digits. After you press the **RETURN** key, 15 bytes of data starting from the specified address will be displayed in the following format.



a_0 indicates the specified address, which is displayed as a 4-digit hex number. Da_0 indicates the content of the specified number, displayed as a 2-digit hex number. If the address is not specified with the D command, the previously specified address +15(dec) will be assumed. Also, after the execution of the D command, "D" will remain on the screen followed by the cursor. Therefore, to display the content of the next address, press only the **RETURN** key.

NOTE:
Addresses 0000(hex) through 004D(hex) are for I/O ports. If you attempt to read/write any of these ports, an overrun may occur in the system. Therefore, if you specify any of these addresses, the message "Protected" will be displayed to disable the memory read/write operation.

(3) **G** (Go) command
This command sets the programme counter to a specified address value for programme execution from the address specified by the programme counter.

$-Ga_{16},b_{16}$ **RETURN** (a_{16},b_{16} = addresses in hex numbers of 4 or less digits.)
a_{16} indicates the execution starting address and b_{16} indicates the breakpoint address. A breakpoint refers to the point from which the HX-20 returns to the monitor mode agair after the execution of a programme has started. The HX-20 will return to the monitor mode before the address specified as a breakpoint is executed.

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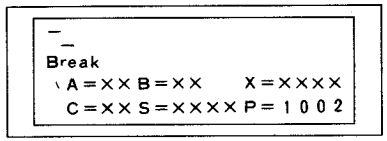
[Example]
With the contents of addresses 1000(hex) through 1003(hex) as shown below.

1000	01	("01" indicates NOP which is a machine
1001	01	language command instructing the HX-20 to
1002	01	do nothing but to proceed to the next
1003	01	instruction in sequence.)

If you input G1000,1002 and press the **RETURN** key, the following will be displayed.



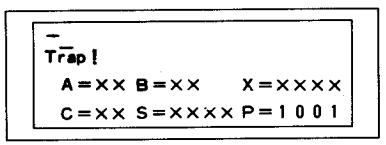
XX and XXXX are the predetermined values before the execution of the G command and P=1002 indicates that the next address to be executed is 1002(hex).

This is because the programme execution was started from address 1000(hex), continued until just before the execution of address 1002(hex) and the HX-20 entered monitor mode again.

- On Trap

The HX-20 will enter the monitor mode when a command which is not defined for the 6301 CPU is executed. Should this happen, the monitor will display the message "Trap!" on the 2nd line, and the values of the respective registers on the 3rd and the 4th lines.

[Example]
In the preceding example of the G command, if you execute G1000 **RETURN** by changing the content of address 1001(hex) from "01" (NOP) to "00" (which is not defined as a command), the following message is displayed, indicating that a trap interrupt is generated as a result of the execution of address 1001(hex).

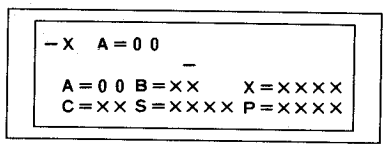


(4) **X** (Examine) command

This command is used to display and change the content of each register.

–X **RETURN**

After your input of X **RETURN**, the contents of the Accumulator A will be displayed on the command line.



You may now change the contents of the Accumulator A. To do so, you must enter the data in hex numbers and press the **RETURN** key. (If only the **RETURN** key is pressed, the value of the Accumulator A will not be changed.) You will know the change in the value of the Accumulator A by the value displayed on the third line. Next, the content of the Accumulator B will be displayed for possible data change. In this manner, you can change the contents of all the registers successively (from X to C, C to S, S to P, and back to A).

To cancel the X command, input any character exclusive of hexadecimal numbers, comma (,) and space, or enter a new command at the position where the X command is displayed.

(5) **R** (Read) command

This command is used to transfer data from an external storage such as a cassette or ROM cartridge to the memory of the HX-20.

–Rd,fn.ft **RETURN**, or
–Rd.fn.ft, R **RETURN**

"d" denotes the input device and "fn.ft" denote the name and type of the file to be loaded. You can use the following alphabetic characters to specify the input device.

M: Microcassette drive
C: External audio cassette
P: ROM cartridge

The data to be loaded must be in the format specified by a BASIC SAVEM command or a Monitor W command. Also, the A (Address) command of the Monitor must be executed prior to the execution of the command.

The values for T, L and O are specified by the A command and represent, respectively, the address information for the Top address, the Last address and the Offset value.

T (Top address) specifies the top address of the range of data for programme read and L (Last address), the last address of the range of available memory.

This address data is included in the data input by the R command and the programme is loaded into the memory of the HX-20 within this range. The range specified by T and L is reserved for programme load and data cannot be stored outside of this range. (If an attempt is made to store data outside of this range, the input processing will be forced to halt by Return Code 8C.) The offset value is the value added to the address data during programme load.

For example, if the data at address 1000(hex) is AA, when the Offset value is specified as 500(hex), this data will be loaded, not at 1000(hex) but at address 1500(hex), or 1000 + 500(hex).

E (Entry point) uses the value written into the file and will ignore any setting written for E in the A command. The value specifed as the Offset value will be added to the Entry point address.

If the R command is accepted, the LCD screen will be cleared and upon completion of the data transfer the message "OK" will be displayed on the second line. If the data transfer from the external storage fails, the message "Error" will be displayed.

If the R option is specified (by adding ",R" to the file type), execution of the programme loaded into the memory will start from the address specified as the starting address after the completion of the data transfer.

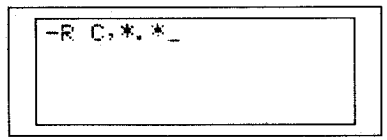
The value of the Accumulator A after execution is a return code. (Return code "00" indicates that the data transfer has been completed normally.)

• About filename and file type

A filename must be a string of 8 or less alphanumeric characters and a file type, a string of 3 alphanumeric characters. You can omit the file type. If you do so, a space is assumed as the file type. You cannot omit the filename. If the R option is used, the file type cannot be omitted. When "*" is used in a filename, any characters following the "*" will be accepted as the filename. This applies as well to the file type specification.

[Example]

If you want to load the first data file in an audio cassette, enter **R C,*.***.



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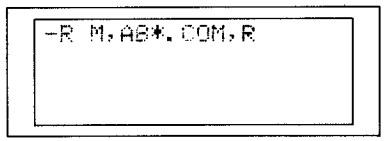
If you enter "R M,AB*.COM,R," the data file with the filename beginning with letters "AB" and file type "COM" will be loaded from the microcassette drive into the memory and the programme execution will start from the specified address after the completion of the data transfer.



(6) **W** (Write) command
This command is used to transfer data from the memory of the HX-20 to an external storage (cassette).

-Wd,fn.ft **RETURN**

"d" denotes the output device and "fn.ft" denotes the name and type of the file to be saved. The following alphabetic characters can be used to specify the device name.

M: Microcassette drive
C: External audio cassette

You must specify the range of memory space for data output using the A command of the Monitor prior to the execution of the W command.
For example, if you specify T (Top address) as 1000(hex) and L (Last address) as 2000(hex), the contents of memory from address 1000(hex) to address 2000(hex) will be output to the specified output device. If O (Offset value) is specified as 500(hex), the data written into the file will be the contents of memory from address 1500(hex) to 2500(hex) that is, address 1000 + 500(hex) to 2000 + 500(hex). Also, if E (Entry point) has been written into the file to indicate the execution starting address, the Offset value will be added to that address and output.
If the W command is accepted, the LCD screen will be cleared and the message "OK" will be displayed on the second line upon the completion of the data transfer to the external storage. If the data transfer fails, the message "Error" will be displayed.
The filename must be a string of 8 or less alphanumeric characters, and the file type, a string of 3 alphanumeric characters.
With the W command, the data output to the cassette are not verified after the completion of the data transfer. So, it is suggested that you perform data verification using the V command of the monitor.

(7) **V** (Verify) command
This command is used to verify that the data output to an external storage (cassette) are correct.

-Vd,fn.ft, **RETURN**

"d" denotes the output device and "fn.ft" denote the name and type of the file to be checked. The following alphabetic characters can be used to specify the device name.

M: Microcassette drive
C: External audio cassette

In verification, the data file in the cassette tape will not actually be compared with the contents of the memory. Only the error-detecting code (2-byte CRC) written into the cassette tape is checked.

Return codes for R, W, and V commands

00	Normal completion of data transfer
01	End of file: The file reached its end as a result of the data input.
80	Microcassette is not connected to the HX-20.
81	There are errors in inputting.
82	The specified file failed to be found (in external audio cassette or microcassette drive)
83	An incorrect data was input.
86	Data format error
8B	A file other than that specified was found.
8C	Data input was not in the specified range of memory space.
91	An error occurred during data output
99	An incorrect I/O device was specified.
A0	A ROM cartridge is not mounted.
A1	The specified file failed to be found. (ROM cartridge)
A4	An error in the header of the ROM cartridge.
A5	An error in the header address designation of the ROM cartridge.

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(8) **A** (Address) command

This command specifies the range of memory space within which data can be input by the R command, or output by the W command.

–A RETURN

The following four values can be specified as arguments with the A command.

T (Top address)
L (Last address)
O (Offset value)
E (Entry point)

With the W command, the values specified by the A command denote the following.

T: The top address of the data to be output to an external storage.
L: The last address of the data to be output to an external storage.
O: The offset value for the address value of the data to be output to an external storage.
The offset value is a value to be added to the address value and to be output as the resulting address value. For example, 1000(hex) is added as an offset value to the address value when the content of address 1000(hex) is to be output and then is output as if it were the data of address 2000(hex) and not as the data of address 1000(hex). The offset value is effective for the address value specified by T, L, or E.
E: The execution starting address if the data to be output is a programme. If the R option is specified with the R command, execution of the programme will begin from this address when the programme loading is completed.

With the R command, the value specified by the A command denote the following.

T: The top address of the range of memory space available for data input.
L: The last address of the range of memory space available for data input.
O: The offset value for the address value of the data to be input.

The purpose of specifying T and L is to check the top and bottom addresses of memory space allocated for data input for protection of the current memory contents from destruction.
With the R command the value E need not be specified by the A command. If you input –A* RETURN, all of the address values specified by the A command will be set to 0.
As for the data input and display, after you input –A RETURN, the message "–A T=XXXX _" will appear to show the current T value. The monitor will then wait for input. To change the T value, press the RETURN key following the input of the new value.

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```
-A T=XXXX _

A=81 B=6E    X=AB22
D=D8 S=3CEC  P=1001
```

If you do not wish to change the T value, just press the RETURN key. When the T value has been set, the values of L, O, E, T..... will be displayed and the monitor will be ready for your input. To cancel the A command, you can input any character exclusive of hex numbers, comma (,) and space, or input a new command at the position where the A command is displayed.
In the following examples, the contents of addresses 1000(hex) through 1FFF (hex) will be output from the memory to the microcassette drive (filename: DUMP. BIN), data will be input to addresses 2000(hex) through 2FFF(hex) of the memory from the microcassette drive and then the programme execution will start from address 2000(hex).

(Example 1)

	Key input	Display
STEP 1	–A RETURN	–A T =0000 _
	1000 RETURN	–A L =0000 _
	1FFF RETURN	–A O =0000 _
	1000 RETURN	–A E =0000 _
	1000 RETURN	–A T =1000 _
	/ RETURN	–
STEP 2	–W M, DUMP.BIN RETURN	
STEP 3	–A RETURN	–A T =1000 _
	2000 RETURN	–A L =1FFF _
	2FFF RETURN	–A O =1000 _
	0000 RETURN	–A E =1000 _
	/ RETURN	–
STEP 4	R M, DUMP.BIN,R RETURN	

(Example 2)

Key input	Display
STEP 1 A RETURN	–A T =0000_
1000 RETURN	–A L =0000_
1FFF RETURN	–A O =0000_
RETURN	–A E =0000_
/ RETURN	–A T =1000_
STEP 2 W M,DUMP.BIN RETURN	
STEP 3 A RETURN	–A T =1000_
2000 RETURN	–A L =1FFF_
2FFF RETURN	–A O =0000_
1000 RETURN	–A E =1000_
/ RETURN	–
STEP 4 –R M,DUMP.BIN, R RETURN	

In both examples 1 and 2, the contents of addresses 1000(hex) through 1FFF(hex) are saved to the microcassette drive and data are loaded into addresses 2000(hex) through 2FFF(hex) of the memory from the microcassette drive. However, they differ in the way of recording the address values on the tape.

(9) **K** (Key set) command

This command specifies the data for automatic key input when the power switch is turned ON. If this command is used to specify in advance the data to be input, when the power switch is turned ON, the data will be processed as if it were actually input from the keyboard.

The maximum length of the data string is 18 characters. However, function keys will count as two characters. RETURN counts as one character and is displayed as $_{CR}$ on the screen.

When you have finished inputting data, press @ key while holding down the CRTL key.

To cancel a previously input K command, input the following.

– K CTRL + @

If you do not wish the K command to be executed when the power switch is turned ON, turn on the power switch while holding down the BREAK key. Below is an example of an actual K command.

(1) –K2PRINT"HX-20"↵ press CTRL + @ key

```
A=00 B=00   X=D310
C=C8 S=04AF P=D23B
```

(2) Turn the power switch OFF.

(3) Turn the power switch ON.

(4)
```
P1:              0 Bytes
PRINT"HX-20"
HX-20
Ok
```

The above be displayed on the screen of the HX-20.

(5) When the power switch is turned ON, the data which you input in (1) is processed as if it were actually input from the keyboard.

- 2 immediately following K selects BASIC from the menu.
- Then, the BASIC command PRINT "HX-20" followed by RETURN is input.
- The above command is then executed and the characters HX-20 are displayed on the screen.

NOTE:
Depending on the DIP switch setting of your HX-20, different characters may be used instead of @. See Chapter 2, DIP Switch Setting.

(10) **B** (Back) command

This command returns control to the procedure by which the Monitor was called.

–B RETURN

With this command, the HX-20 will return from Monitor mode to the menu display when the Monitor was called by the menu, and to BASIC mode when called by BASIC.

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10. HARDWARE DESCRIPTION

10.1 Basic Configuration of the HX-20

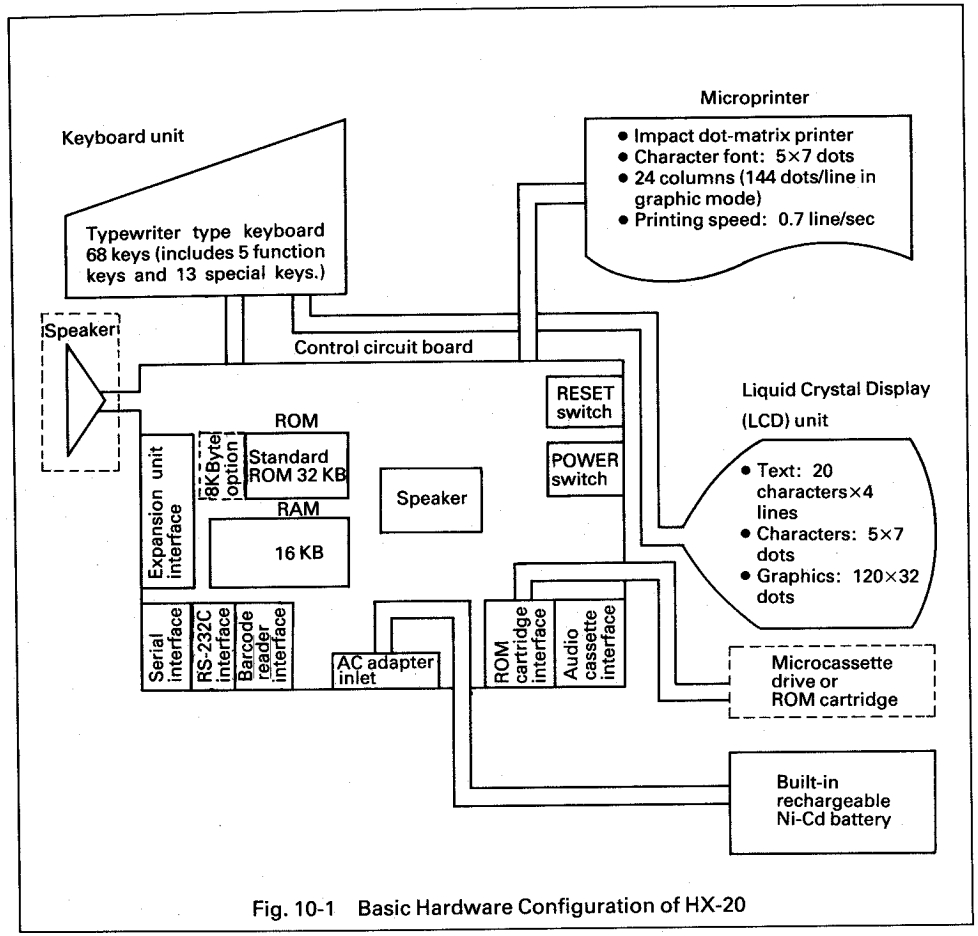

Fig. 10-1 Basic Hardware Configuration of HX-20

Your HX-20 comprises six major blocks as shown in the block diagram above; namely, a control circuit board, a keyboard unit, a microprinter, an LCD unit, a speaker, and a battery power supply. Each block is connected to the control circuit board and is neatly housed in the HX-20. The HX-20 is also equipped with an RS-232C interface, a serial interface and an expansion unit interface as standard equipment to permit system expansion through use of these interfaces.

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10.2 Relationship between CPUs and Input/Output Operations

The relationship between the CPUs and I/O operations is as illustrated below.

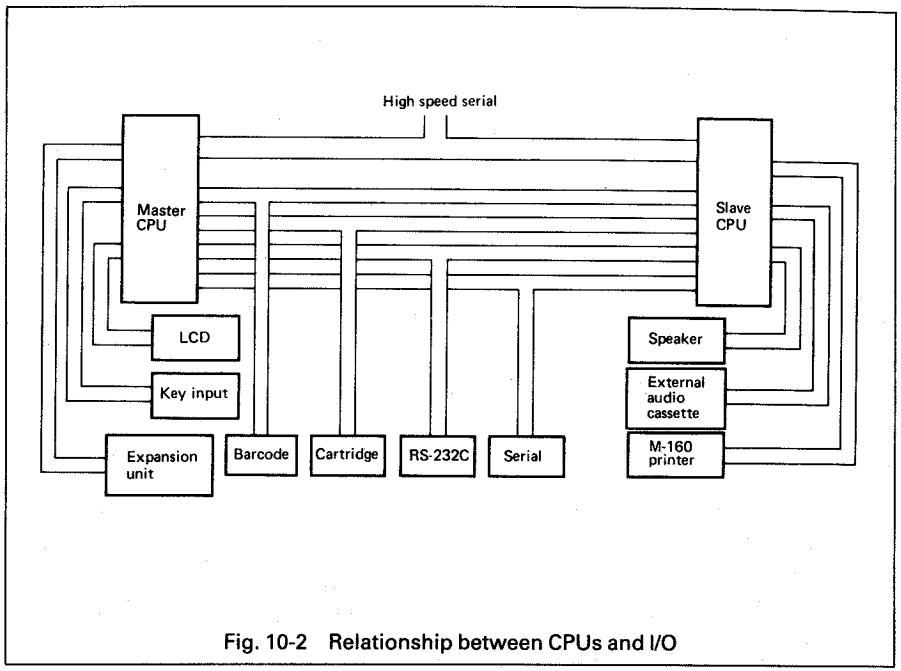
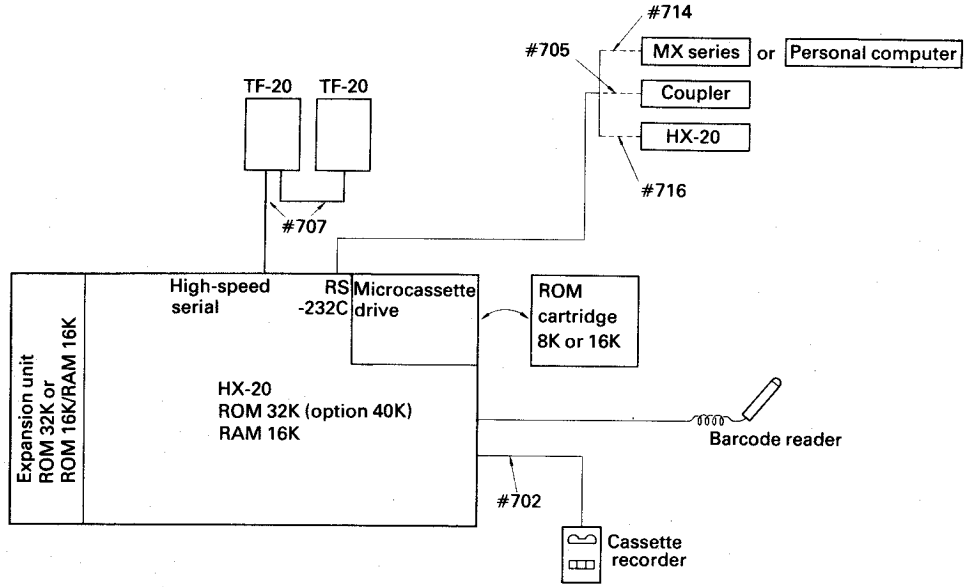


Fig. 10-2 Relationship between CPUs and I/O

10.3 Cable List of Interface Cables



Cable set	Connection between	Part number	Connector
#702	HX-20 and External audio cassette	Y201302000	Two 3.5 dia. plugs and two 2.5 dia. plug adapters
#705	HX-20 and Coupler	Y201305000	One 8-pin DIN connector and one DB-25 connector
#707	HX-20 and TF-20	Y201307000	One 5-pin DIN connector and one 6-pin DIN connector
#714	HX-20 and Terminal printer (MX series)	Y201309000	One 8-pin DIN connector and one DB-25 connector
#716	HX-20 and HX-20	Y201311000	Two 8-pin DIN connectors

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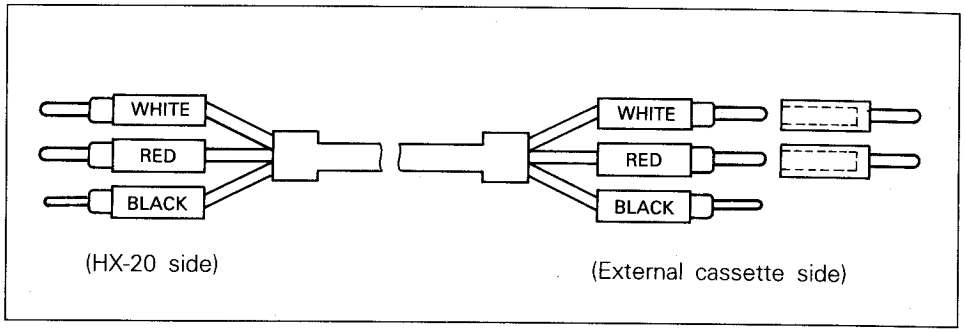
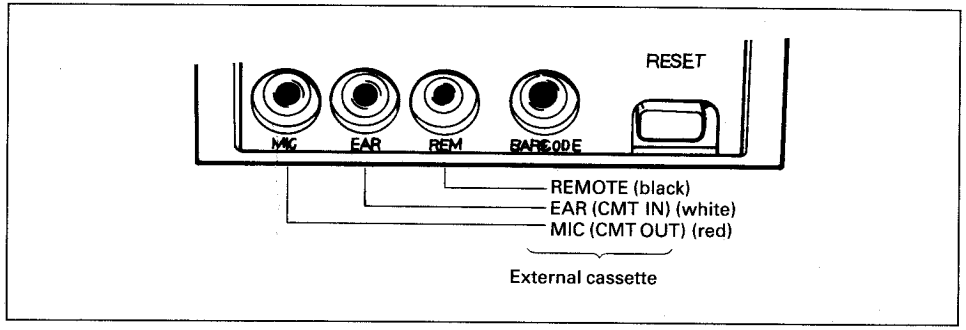
10.3.1 Interface cable description

(1) Cable set #702 with two 2.5 dia. jack adapters
1) Use: To connect the HX-20 to an external cassette tape recorder.
2) Plugs: 3.5 (white and red) and 2.5 dia. (black)

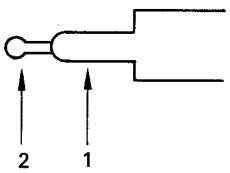


3) Connection
Connect the HX-20 to the external cassette tape recorder as shown below.

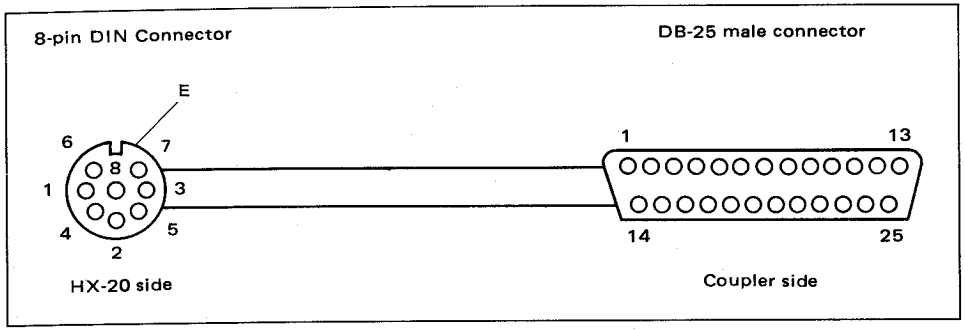


4) Signal names

	Pin No.	Signal name	Colour
HX-20 and Cassette	1	Ground	White
	2	Input	White
	1	Ground	Red
	2	Output	Red
	1	Remote	Black
	2	Remote	Black



(2) Cable set #705
1) Use: To connect the HX-20 to the acoustic coupler
2) Connectors: HX-20 side: 8-pin DIN connector
Coupler side: DB-25 connector



3) Connection
Plug the DIN connector into the RS-232C interface connector on the rear panel of the HX-20 and the DB-25 connector into the interface connector of the acoustic coupler. Then, tighten the two mounting screws with a screwdriver to secure the DB-25 connector to the acoustic coupler.

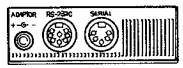
4) Signal names

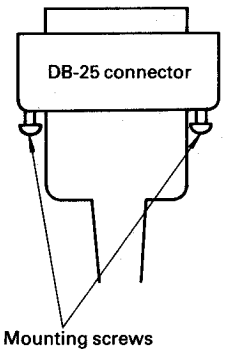
DB-25 connector

Pin No.	Signal name	Colour
1	CG	(Shield)
2	$\overline{TX}$	Red
3	$\overline{RX}$	Gray
4	RTS	Yellow
5	CTS	Green
6	DSR	Brown
7	GND	Black
8	CD	White
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20	DTR	Blue
21		
22		
23		
24		
25		

8-pin DIN connector

Pin No.	Signal name	Colour
1	GND	Black
2	$\overline{TX}$	Red
3	$\overline{RX}$	Gray
4	RTS	Yellow
5	CTS	Green
6	DSR	Brown
7	DTR	Blue
8	CD	White
E	CG	(Shield)





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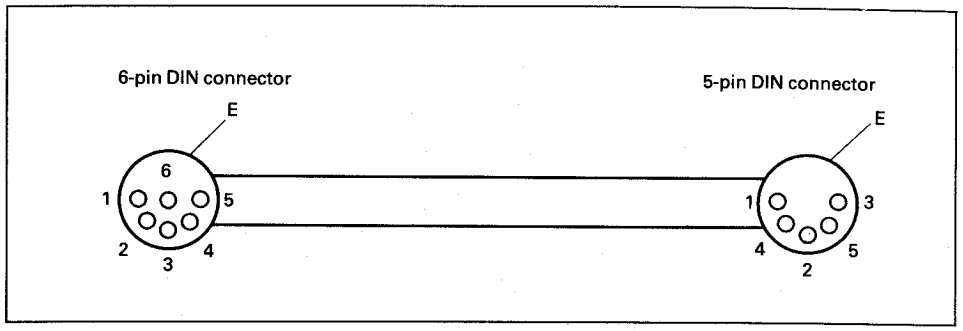
(3) Cable set #707

1) Use: To connect the HX-20 to the flexible disk unit.

2) Connectors:

5-pin DIN (HX-20) ↔ 6-pin DIN (Flexible disk unit)



3) Connection

Plug the DIN connectors on both sides into the corresponding interface connectors.

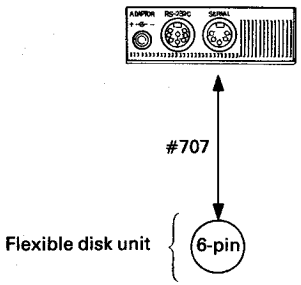
4) Signal names

6-pin DIN connector

Pin No.	Signal name	Colour
1	PRX	White
2	PIN	Green
3	PTX	Red
4	POUT	Yellow
5	SG (Signal ground)	Black
6	Unused	–
E	FG	(Shield)

5-pin DIN connector

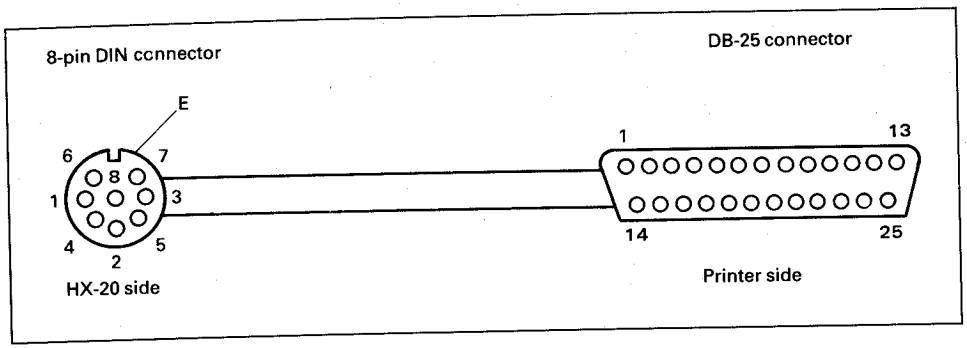
Pin No.	Signal name	Colour
1	SG (Signal ground)	Black
2	PTX	Red
3	PRX	White
4	POUT	Yellow
5	PIN	Green
E	FG	(Shield)



(4) Cable set #714

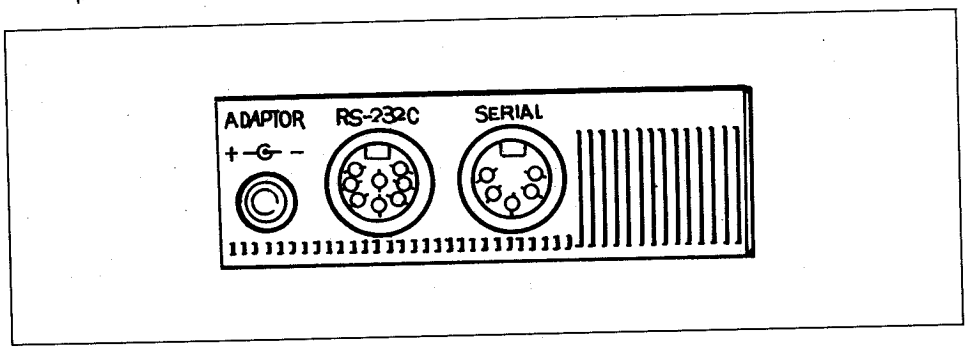
1) Use: To connect the HX-20 to the MX-series terminal printer

2) Connectors: HX-20 side: 8-pin DIN connector
Printer side: DB-25 connector



3) Connection

Plug the DIN connector into the RS-232C interface connector on the rear panel of the HX-20 and the DB-25 connector to the interface connector of the terminal printer.



4) Signal names

8-pin DIN connector

Pin No.	Signal name	Colour
1	GND (Signal ground)	Black
2	$\overline{TX}$	Red
3	$\overline{RX}$	White
4	RTS	Brown
5	CTS	Brown
6	DSR	Yellow
7	DTR	Green
8	CD	Blue
E	CG	(Shield)

DB-25 connector

Pin No.	Signal name	Colour
1	CG	(Shield)
2	$\overline{TX}$	White
3	$\overline{RX}$	Red
4		Blue
5		Blue
6	DSR	Green
7	GND	Black
8		Brown
9–19		
20	DTR	Yellow
21–25		

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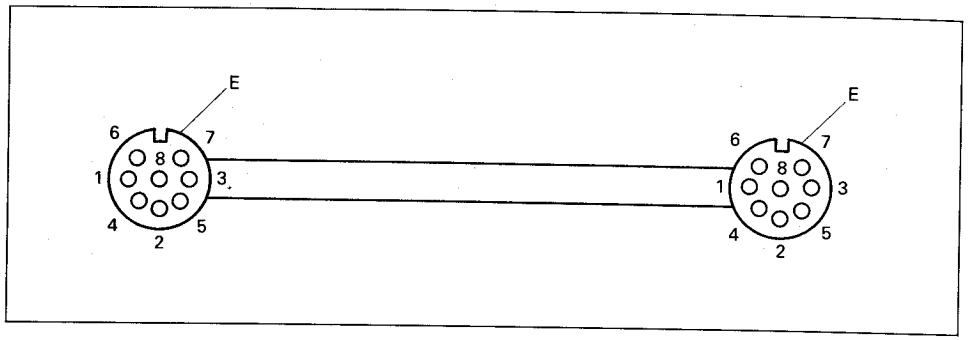
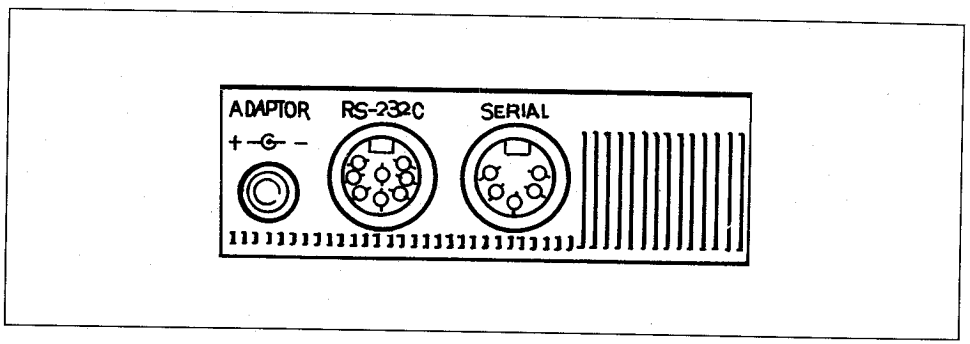
(5) Cable set #716
1) Use: To connect two HX-20 units through the RS-232C interface.
2) Connectors: Two 8-pin DIN connectors



3) Connection
Plug the DIN connectors into the RS-232C interface connector on the rear panel of each HX-20 unit.



4) Signal names

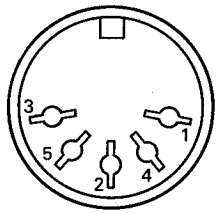
Pin No.	Signal name	Colour
1	GND (Signal ground)	Black
2	TXD	Red
3	RXD	White
4	RTS	Brown
5	CTS	Brown
6	DSR	Yellow
7	DTR	Green
8	CD	Blue
E	FG	(Shield)

Pin No.	Signal name	Colour
1	GND (Signal ground)	Black
2	TXD	White
3	RXD	Red
4	RTS	Blue
5	CTS	Blue
6	DSR	Green
7	DTR	Yellow
8	CD	Brown
E	FG	(Shield)

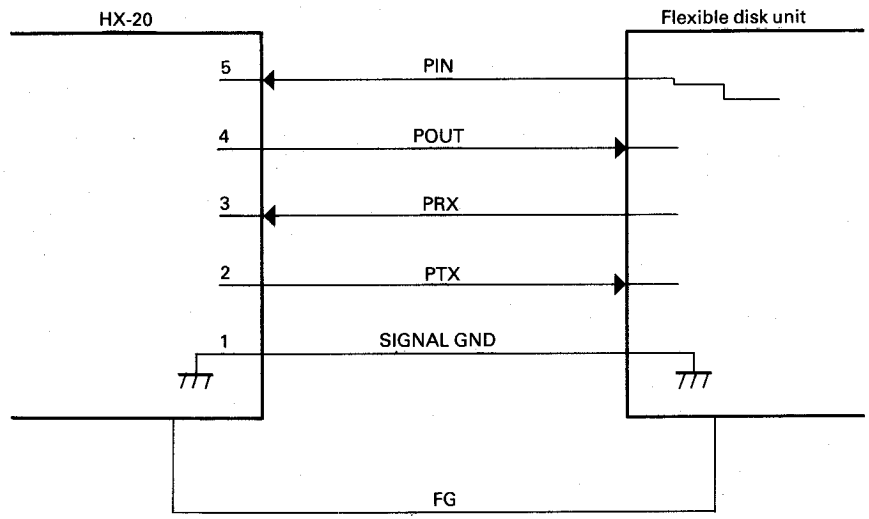
NOTE:
Pin Nos. 4 and 5 are connected to pin No. 8 at the other end of the connector.

10.3.2 Interface connector description

(1) Serial interface
1) Use: A high-speed serial interface connector for data transmission/reception between the HX-20 and the flexible disk unit.
2) Connector: 5-pin DIN, TCS 4450



Signal pin No.	Signal name	Direction of signal	Description
1	GND	–	Signal Ground
2	PTX	Out	Transmitted data
3	PRX	In	Received data
4	POUT	Out	Transmit mode
5	PIN	In	Receive mode
E	FG	–	Protective Ground



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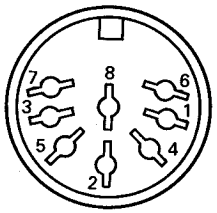
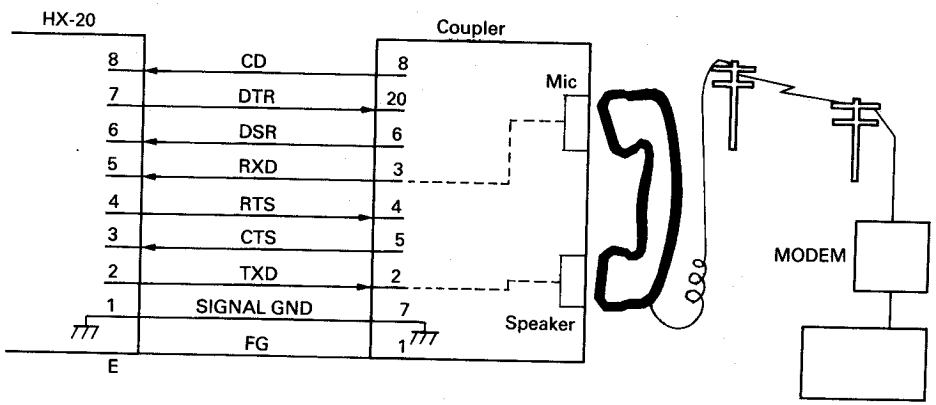
(2) RS-232C interface

1) Use: An interface connector for data transmission/reception between the HX-20 and the acoustic coupler or other external device.

2) Connector: 8-pin DIN, TCS4480



Signal pin No.	Signal name	Direction of signal	Description
1	GND	–	Signal Ground
2	TXD	Out	Transmitted data
3	RXD	In	Received data
4	RTS	Out	Request to send
5	CTS	In	Clear to send
6	DSR	In	Data set ready
7	DTR	Out	Data terminal ready
8	CD	In	Carrier detect
E	FG	–	Protective Ground



10.4 Specifications of the HX-20

(1) Outline dimensions and weight

1) Outline dimensions: 290 (W)×215 (D)×44 (H) mm

2) Weight: Approx. 1.7 kg

(2) Environmental requirements

1) Ambient temperature

- Operating : 5 to 35°C
- Storage : −20 to 60°C (below 30°C for extended storage)
- Charging : 5 to 35°C
- Data storage : −5 to 40°C

2) Humidity

- Operating : 10 to 80% (without condensation)
- Storage : 10 to 80% (without condensation)

3) Vibration

- Operating : 0.25G 55 Hz max.
- Non-operating : Must be free of any abnormality under the following test conditions.

	With HX-20 in unpacked state	With HX-20 in packed state
Amplitude	: 2 mm	2 mm
Frequency	: 1,000 CPM	600 to 1,300 CPM
Direction	: 3 directions (X, Y, Z)	Up and down
Time	: 30 min.	30 min.

4) Shock resistance

- Operating : 1G 1 ms max.
- Non-operating : Must be free of any abnormality under the following test conditions.

In unpacked state:
The HX-20 is placed on a 3-cm-thick flat board and is subjected to shock by dropping the HX-20 with one side of the unit lifted 10 cm above the flat board. This process is repeated five times.
In packed state:
The HX-20 is dropped from a height of 50 cm above a concrete surface. This process is repeated 3 times for each side of the container.

(3) Current consumption

The current consumption of the HX-20 varies depending on the method of its operation but the average current consumption is as follows.

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1) When the HX-20 is not connected with a peripheral device during programme running ..... 30 mAH
Non-operating state (but with the power switch turned ON) ..... 15 mAH
2) When the HX-20 is connected with any peripheral device
- Microprinter
  During printing (with character "K" printed for 24 columns) ..... 300 mAH
  During paper feeding ..... 100 mAH
- RS-232C ..... 100 mAH
- Microcassette drive
  During execution of WIND, LOAD, or SAVE ..... 100 mAH

(4) AC adapter
1) Power consumption : 8W
2) Insulation resistance : 10MΩ min. (between the chassis and AC power circuit)
3) Dielectric strength : 1,000V for 1 min. (between the chassis and AC power circuit)

11. MAINTENANCE

11.1 Operating Environments

(1) Avoid use or storage in extremely humid locations.
(2) Avoid use or storage in locations subject to extremely hot or cold temperatures, as well as to rapid temperature changes. (Also, do not use or store under direct sunlight or near heaters or coolers.)
(3) Avoid violent shocks or vibrations while in use or storage.

11.2 Handling

11.2.1 Storage and operating conditions

- When using your HX-20, place it on a flat surface such as a desk.
- Do not pile or stack things on top of the machine while in storage or during transportation.
- Do not apply any shocks to the HX-20, and avoid use when the HX-20 is partially dismounted, as the machine is made of precision electronic parts. Dust, static electricity, etc., may also cause the machine to malfunction.

11.2.2 Power supply

- Normally, operate your HX-20 on the built-in battery power supply (without connecting it to the AC adapter).
- Your HX-20 can also be used with the AC adapter connected. Please note that if you use the machine connected to the AC adapter continuously for a long time, the service life of the battery may be shortened due to overcharging.
- If your HX-20 is left unused for a long period, the built-in battery will be completely discharged. If this occurs, the programmes stored in the RAM may be lost and the battery may deteriorate. Therefore, occasionally turn on the power switch to check the battery for proper operation (by checking that the HX-20 operates normally or the message "CHARGE BATTERY !" does not appear).
- For details about how to charge the battery or to use the AC adapter, refer to Chapter 3 of this manual.

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11.2.3 Maintenance

- To clean the housing of your HX-20, wipe it gently with a dry soft cloth. Avoid use of alcohol or volatile solvents.
- If any optional units or interface cables are connected to your HX-20, check them occasionally for proper connection.

11.2.4 Consumables

- Use only the consumables (roll paper, ribbon cartridge, etc.) specified by EPSON.
- For replacement, refer to Chapter 1 of this manual.

11.2.5 Abnormalities

- Should any abnormality occur in your HX-20, turn off the power switch at once and press the RESET switch.
- For troubleshooting or repair, contact your nearest EPSON distributer.

11.2.6 Optional units

- Use only the options specified by EPSON.
  Use of other optional units may cause damage to your HX-20. To install the EPSON specified options, refer to the appropriate chapters of this manual.

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APPENDIX A Memory Map

The memory of the HX-20 is divided into the following areas.

Address	
0000 to 004D	I/O port
004E to 007F	RAM. This area is used by I/O routines as a flag and work area.
0080 to 00FF	RAM. This area is used as a work area for BASIC.
0100 to 04AF	RAM. This area is used by I/O routines as a work area and I/O buffer.
04B0 to 0A3F	RAM. This area is used as a work area for BASIC.
0A40 to 3FFF	RAM.
4000 to 5FFF	Not used.
6000 to 7FFF	ROM. (ROM 5) Option 8K byte ROM.
8000 to 9FFF	ROM. (ROM 4) BASIC interpreter.
A000 to BFFF	ROM. (ROM 3) BASIC interpreter.
C000 to DFFF	ROM. (ROM 2) C000 to CFFF is the BASIC interpreter and D000 to DFFF contains the Menu, Monitor and virtual screen routines.
E000 to FFFF	ROM. (ROM 1) I/O routines.

The ROM contains of the following vectors.

Address	
FFD0 to FFD1	Shows the address where the result of key scan is stored.
FFD2 to FFD3	Shows the address where the amount of data in the print buffer of the microprinter is stored. Amount of data is shown in units of one byte and can be in the range 0 to 24 (dec).
FFD4 to FFD5	Shows the address where the amount of data in the I/O buffer for the external cassette is stored. Data amount is in units of two bytes for both I and O and can be in the range 0 to 256.
FFD6 to FFD7	Shows the address where the amount of data in the I/O buffer for the built-in microcassette is stored. Data amount is in units of two bytes for both I and O and can be in the range of 0 to 256.
FFD8 to FFD9	Shows the address where the amount of data in the I/O buffer for the RS-232C port is stored. Data amount is shown in units of two bytes.
FFDA to FFDB	Shows the top address of the buffer for the physical screen of the LCD display. The size of the buffer is 80 bytes.
FFDC to FFDD	Shows the top address of the 260-byte I/O routine buffer.
FFDE to FFDF	Shows the address where the scroll speed data for the virtual screen is stored. The scroll speed data is shown in one byte and can have a value in the range 0 to 9.
FFE0 to FFE1	Shows the top address where the header data for the external cassette is stored.
FFE2 to FFE3	Shows the top address where the header data for the built-in microcassette is stored.

The RAM contains the following vectors.

Address	
011E, 011F	Shows the top address where the display patterns for character codes E0 to FF are stored.
012C, 012D	Shows the final address plus one where the RAM is installed.

The following I/O flags exist in memory area 004E to 00FF.

Address	
0078	Sets the BASIC and Menu programmes for cold start or warm start. Bits are assigned to each programme with logic 0 setting for cold start and logic 1 setting for warm start. This value does not change when the power is turned ON. When the HX-20 is cold started these bits are set to logic 0. Bit 0: Menu Bit 1 to Bit 5 } Unused Bit 6: BASIC application programmes Bit 7: BASIC interpreter
0079	Bits 0 through 2 indicate which of the plug-in options is currently connected to the HX-20. Bit 2 1 0 Value 0 0 0 ROM cartridge 0 0 1 Reserved 0 1 0 Nothing connected 0 1 1 Reserved 1 × × Microcassette (x: don't care.) Bits 3 through 6 are undefined. Bit 7: Sets whether the driver of the RS-232C port will be turned off when the BREAK key is pressed. 0 indicates that the driver will not be turned off and 1, that it will. Bit 7 is set for logic 0 when the power switch is turned ON. The other bits at this address are not changed.

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Address	
007E	Bits 0 and 1 set the mode of the external cassette. Bit 1 0 0 × Decided automatically 1 0 Normal mode 1 1 Reverse mode (×: don't care) Bits 2 and 3 set the mode of the built-in microcassette. Bit 3 2 0 × Decided automatically 1 0 Normal mode 1 1 Reverse mode (×: don't care) Bit 4: Shows the currently selected memory bank. 0 indicates bank 0 and 1, bank 1. Bit 5: Shows the memory bank most recently chosen for use by the menu routine. Bit 6: Shows the memory bank in which the BASIC interpreter is located. Bit 7: The value of this bit determines whether or not addresses 0000 through 004D can accessed by BASIC commands POKE and PEEK and Monitor commands S and D. 0: cannot be accessed. 1: can be accessed.
007F	The bits at this address are used to force set the switches. The actual settings of the switches will be ignored and the setting will be from software. Bits 0 through 4 concern the setting of the DIP switches. Bit 0: Sets DIP switch 1 (0: OFF, 1: ON) Bit 1: Sets DIP switch 2 Bit 2: Sets DIP switch 3 Bit 3: Sets DIP switch 4 Bit 4: Determines whether the actual settings of the DIP switches will be used or not. Logic 0 indicates that the actual DIP switch setting will be used and logic 1, that the settings of bits 0 through 3 will be used. Bits 5 and 7 control the printer ON/OFF switch. Bit 5: Determines whether the value of bit 7 will control the printer or not. Logic 0 indicates the actual setting of the Printer ON/OFF switch and logic 1, that bit 7 will control the function. Bit 7: Turns the printer ON and OFF. (0: OFF, 1: ON) Bits 4 and 5 are set to logic 0 when the power switch is turned ON. The settings of the other bits do not change.

APPENDIX B
RS-232C Serial Communication

The HX-20 uses asynchronous serial communication as described below.

(1) With asynchronous data transmission, a start bit (0) is attached to the beginning of the send data to indicate that transmission has begun. As shown in Fig. B-1, the line level is held to "1" when no data is present; the beginning of data transmission is indicated by the dropping of the line level to "0".
This is followed by the bits of the send byte, starting from the least significant bit (LSB), and terminating with a stop bit ("1"). The stop bit indicates that transmission of one character has been completed. Stop bits may be either 1 or 2 bits in length.
The duration of each bit depends on the bit rate.
For example, if the bit rate is 300bps (bits per second), the duration of each bit is 3.3 msec.

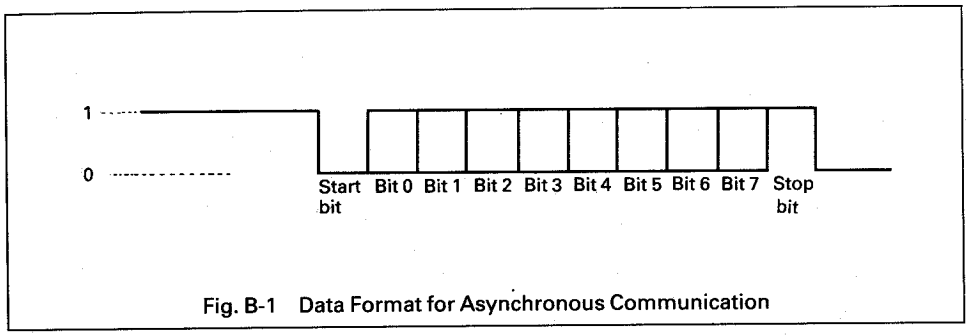

Fig. B-1 Data Format for Asynchronous Communication

Thus, the hex number 3A would be transmitted at 300bps as the 8-bit word shown in Fig. B-2.

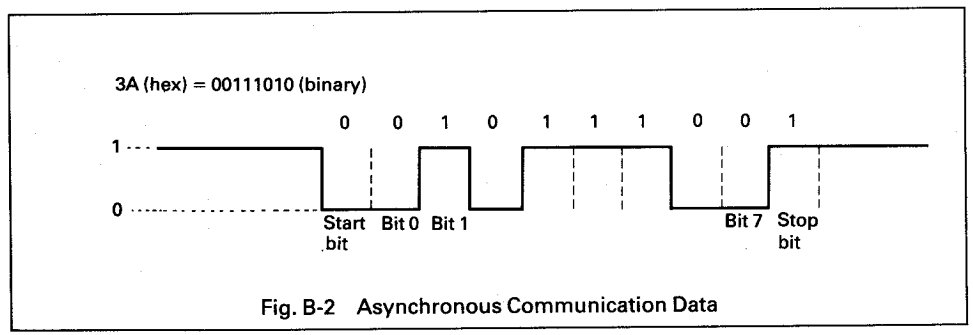

Fig. B-2 Asynchronous Communication Data

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Actually, −8V (−3 to −15V) is output when the line level is "1" and +8V (+3 to +15V) is output when it is "0". Therefore, the relationship between the bit states and the line voltages is as shown below.

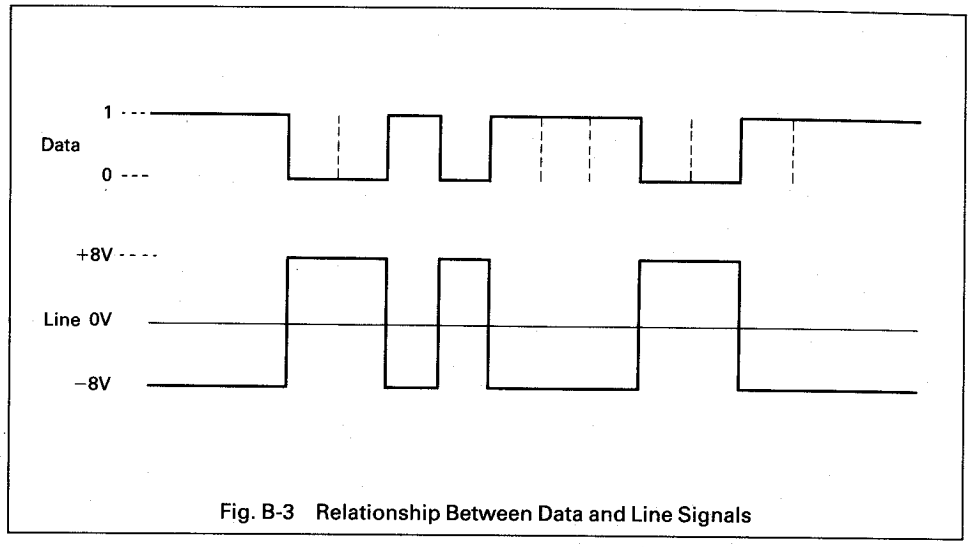

Fig. B-3 Relationship Between Data and Line Signals

(2) Restrictions on Serial Communications with the HX-20
Because the HX-20 is designed to conserve the charge in its battery, current is normally applied to the serial line only when communication is actually being performed. Therefore, the signal is unstable for a certain period of time while the voltage rises at the beginning of communcation. This is shown in Fig. B-4.

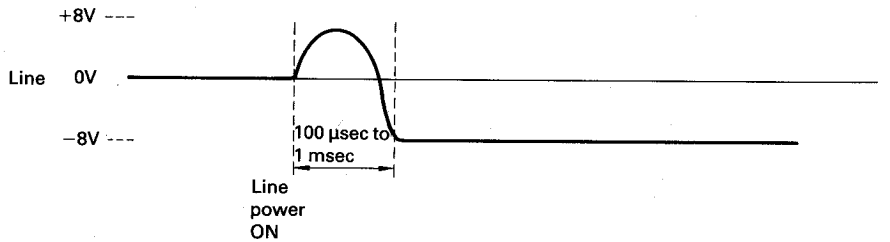

Fig. B-4 Line Voltage at the Beginning of Communication

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When the RS-232C is used to transmit data serially, TXD rises as shown in Fig. B-5. This may result in incorrect reception by the receiving side depending on the bit rate and other conditions.

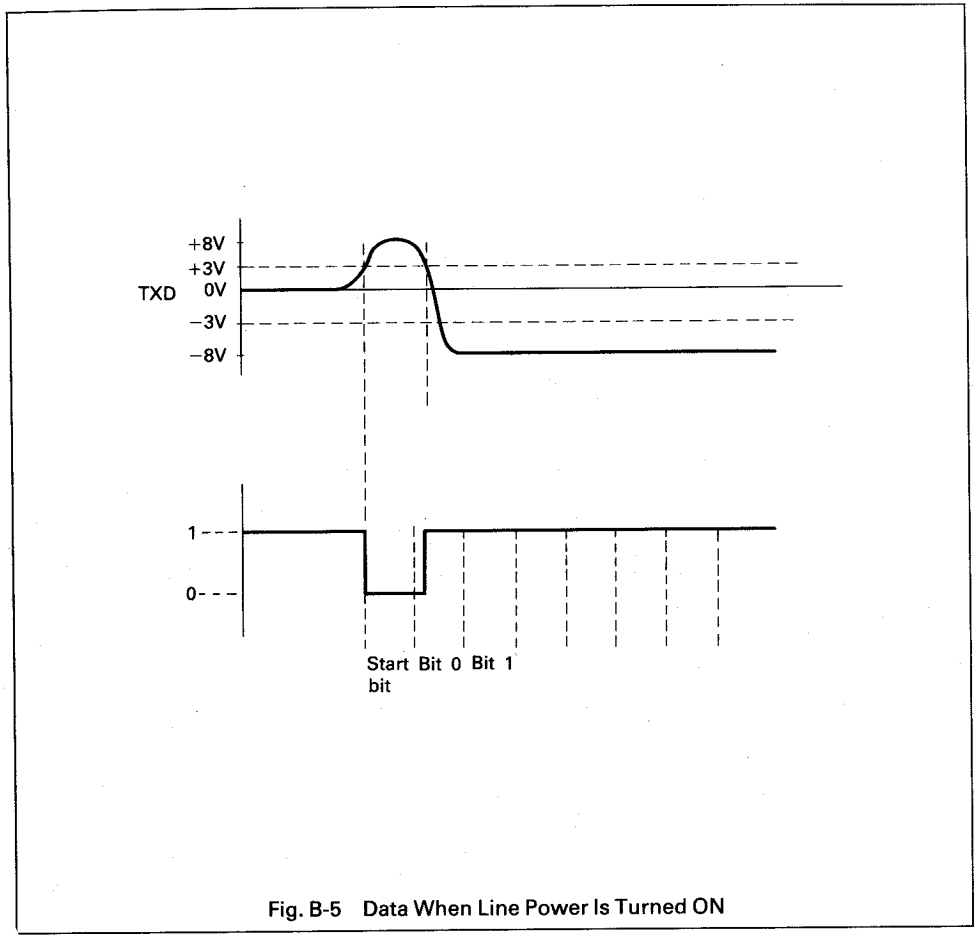

Fig. B-5 Data When Line Power Is Turned ON

As a result, one incorrect bit may be received at the beginning of a data transmission when a programme list is serially output to the MX-80 by BASIC command LIST"COM0:". When programmes are transferred from one HX-20 to another (one using LIST"COM0:" and the other using LOAD"COM0:"), this incorrect bit can prevent the expected results from being obtained.

There are several countermeasures for this problem.
(1) Use a bit rate that is slow enough for the incorrect bit to be ignored.
(2) Apply current to the line ahead of time to avoid signal instability during voltage rise.
(3) Synchronise the receiving and sending sides.

The sequence for applying current ahead of time is as follows.

Sending side	Receiving side
(1) OPEN "I", #1, "COM0:(28N2B)" (Line power ON)	
(2) WIDTH "COM0:",255	
	(3) LOAD"COM0:(28N2B)" (Start programme reception)
(4) LIST "COM0:(28N2B)" (Start programme transmission)	
(5) CLOSE #1	

A procedure which can be used to synchronise the sending and receiving sides is shown in Example 1.

The sending side sends the character "A" (synchronisation character), then the receiving side responds with "A" when the synchronisation character is received. The sending side begins transmission after it receives the synchonisation character from the receiving side.

[Example 1] Opening for Data Transfer

Sending side	Receiving side
10 OPEN "I",#1,"COM0:(68N2B)"	10 OPEN "O",#2,"COM0:(68N2B)"
20 OPEN "O",#2,"COM0:(68N2B)"	20 OPEN "I",#1,"COM0:(68N2B)"
30 PRINT #2,"A";	30 IF LOF(1)=0 THEN 30
40 FOR I=1 TO 300: NEXT I	40 A$=INPUT$(LOF(1),1)
50 IF LOF(1)=0 THEN 30	50 IF A$<>"A" THEN 30
60 A$=INPUT$ (LOF(1),1)	60 PRINT #2,"A";
70 IF A$<>"A" THEN 30	

Another method is to have both the sending and receiving sides check one another's status before beginning data communication. This is shown in Example 2.

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[Example 2]

Sending side	Receiving side
10 OPEN "I",#1,"COM0:(68N2B)"	10 OPEN "O",#2,"COM0:(68N2B)"
20 A$=INPUT$(1) (Waits for key input)	20 A$=INPUT$(1) (Waits for key input)
30 OPEN "O",#2,"COM0:(68N2B)"	30 OPEN "I",#1,"COM0:(68N2B)"

Here, the data transfer begins after a key has been pressed on both the sending and receiving sides.
Voltage fluctuation when power is first applied to the line can affect the RTS and DTR control lines in a similar manner.

All operations of the slave CPU are controlled by commands from the master CPU. For this reason, some operations cannot be performed simultaneously. For example, data input through the RS-232C port will be interrupted if data is output to the printer.

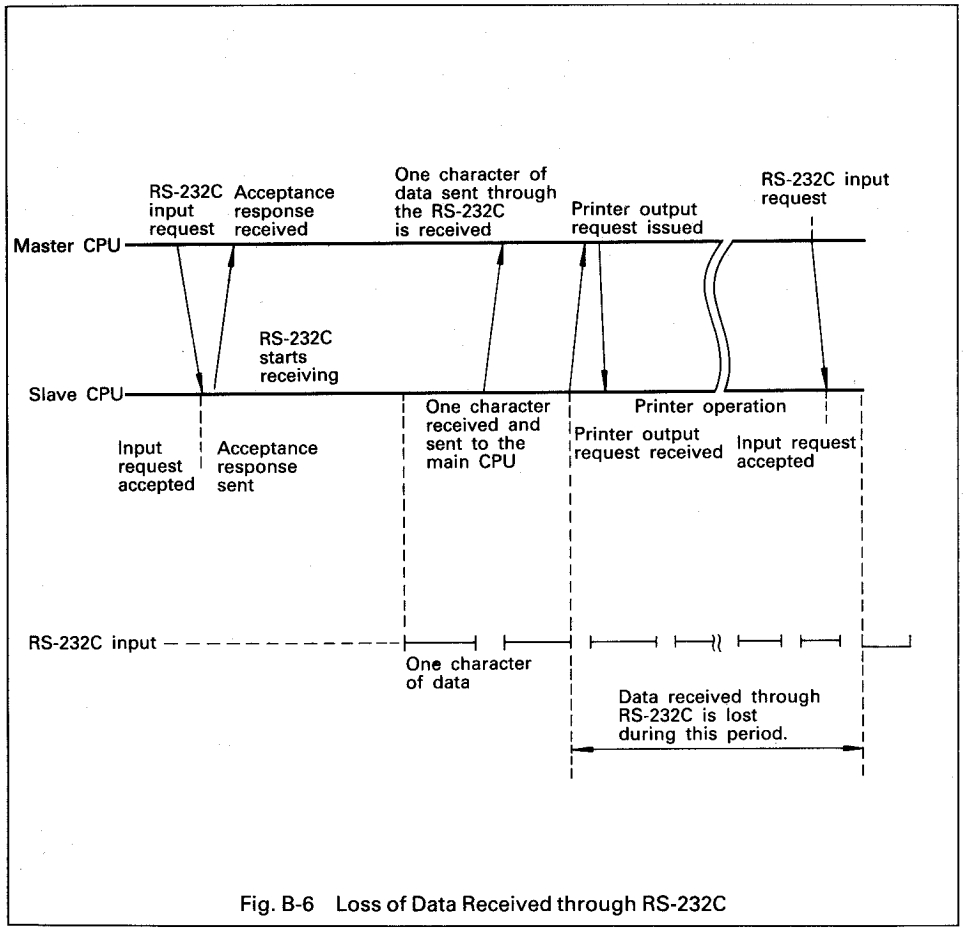

Fig. B-6 Loss of Data Received through RS-232C

Table B-1 Simultaneous I/O operations

Item number	Master CPU			Slave CPU
	Master CPU interrupt			
1	Keyboard input interrupt	Battery voltage interrupt, etc.	Microcassette input	
2			Microcassette output	
3			External cassette input	
4			External cassette output	
5			LCD (input)	Speaker output
6			LCD (input)	Printer output
7			LCD (input)	RS-232C input
8			RS-232C output	Speaker output
9			RS-232C output	Printer output
10			RS-232C output	RS-232C input
11			High-speed serial operation	Not operational

Simultaneous I/O operations which are possible are shown in Table B-1. Those combinations which are possible are shown on the same line. For example, during input from the microcassette drive (line 1 in the table), both the master and the slave CPUs are occupied. Therefore, operations such as output to the speaker are not possible, although input from the keyboard is accepted.

On line 11 of the table, the slave CPU does not operate during high-speed serial communication because this mode is used for exchange of data with the master CPU; i.e., the link between the master CPU and the slave CPU is severed during high-speed serial communication. (However, if a command is issued to the slave CPU to sound the speaker, say, for 10 seconds, high-speed serial communication can be started while the speaker is sounding.) With the standard I/O routines provided, sounding the speaker after RS-232C has been opened for input using BASIC COM0: statements will cause the input to be interrupted.

However, RS-232C input automatically resumes after the specified operation has been completed.

APPENDIX C Character Code Tables

1. USASCII

Hex. No.	Binary No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Hex. No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	▒ 128	▒ 144	▒ 160	▒ 176	▒ 192	▒ 208	▒ 224	▒ 240
1	0001	1	17	! 33	1 49	A 65	Q 81	a 97	q 113	▒ 129	▒ 145	▒ 161	▒ 177	▒ 193	▒ 209	▒ 225	▒ 241
2	0010	2	18	" 34	2 50	B 66	R 82	b 98	r 114	▒ 130	▒ 146	▒ 162	▒ 178	▒ 194	▒ 210	▒ 226	▒ 242
3	0011	3	19	# 35	3 51	C 67	S 83	c 99	s 115	▒ 131	▒ 147	▒ 163	▒ 179	▒ 195	▒ 211	▒ 227	▒ 243
4	0100	4	20	$ 36	4 52	D 68	T 84	d 100	t 116	▒ 132	▒ 148	▒ 164	▒ 180	▒ 196	▒ 212	▒ 228	▒ 244
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117	▒ 133	▒ 149	▒ 165	▒ 181	▒ 197	▒ 213	▒ 229	▒ 245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	▒ 134	▒ 150	▒ 166	▒ 182	▒ 198	▒ 214	▒ 230	▒ 246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	▒ 135	▒ 151	▒ 167	▒ 183	▒ 199	▒ 215	▒ 231	▒ 247
8	1000	8	24	(40	8 56	H 72	X 88	h 104	x 120	▒ 136	▒ 152	▒ 168	▒ 184	▒ 200	▒ 216	▒ 232	▒ 248
9	1001	9	25	) 41	9 57	I 73	Y 89	i 105	y 121	▒ 137	▒ 153	▒ 169	▒ 185	▒ 201	▒ 217	▒ 233	▒ 249
A	1010	10	26	* 42	: 58	J 74	Z 90	j 106	z 122	▒ 138	▒ 154	▒ 170	▒ 186	▒ 202	▒ 218	▒ 234	▒ 250
B	1011	11	27	+ 43	; 59	K 75	[91	k 107	{ 123	▒ 139	▒ 155	▒ 171	▒ 187	▒ 203	▒ 219	▒ 235	▒ 251
C	1100	12	28	, 44	< 60	L 76	\ 92	l 108	| 124	▒ 140	▒ 156	▒ 172	▒ 188	▒ 204	▒ 220	▒ 236	▒ 252
D	1101	13	29	- 45	= 61	M 77	] 93	m 109	} 125	▒ 141	▒ 157	▒ 173	▒ 189	▒ 205	▒ 221	▒ 237	▒ 253
E	1110	14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	▒ 142	▒ 158	▒ 174	▒ 190	▒ 206	▒ 222	▒ 238	▒ 254
F	1111	15	31	/ 47	? 63	O 79	_ 95	o 111	▒ 127	▒ 143	▒ 159	▒ 175	▒ 191	▒ 207	▒ 223	▒ 239	▒ 255

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2. ENGLAND

Hex. No.	Binary No.	0 0000	1 0001	2 0010	3 0011	4 0100	5 0101	6 0110	7 0111	8 1000	9 1001	A 1010	B 1011	C 1100	D 1101	E 1110	F 1111
0	0000	0	16	SP 32	Ø 48	@ 64	P 80	‘ 96	p 112	┼ 128	○ 144	160	176	192	208	224	240
1	0001	1	17	! 33	1 49	A 65	Q 81	a 97	q 113	┴ 129	♠ 145	161	177	193	209	225	241
2	0010	2	18	" 34	2 50	B 66	R 82	b 98	r 114	┬ 130	♥ 146	162	178	194	210	226	242
3	0011	3	19	£ 35	3 51	C 67	S 83	c 99	s 115	┤ 131	♦ 147	163	179	195	211	227	243
4	0100	4	20	$ 36	4 52	D 68	T 84	d 100	t 116	├ 132	♣ 148	164	180	196	212	228	244
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117	─ 133	♪ 149	165	181	197	213	229	245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	│ 134	ª 150	166	182	198	214	230	246
7	0111	7	23	’ 39	7 55	G 71	W 87	g 103	w 119	┌ 135	↑ 151	167	183	199	215	231	247
8	1000	8	24	(40	8 56	H 72	X 88	h 104	x 120	┐ 136	◘ 152	168	184	200	216	232	248
9	1001	9	25	) 41	9 57	I 73	Y 89	i 105	y 121	└ 137	Y 153	169	185	201	217	233	249
A	1010	10	26	* 42	: 58	J 74	Z 90	j 106	z 122	┘ 138	→ 154	170	186	202	218	234	250
B	1011	11	27	+ 43	; 59	K 75	[91	k 107	{ 123	▒ 139	↑ 155	171	187	203	219	235	251
C	1100	12	28	, 44	< 60	L 76	\ 92	l 108	¦ 124	■ 140	↓ 156	172	188	204	220	236	252
D	1101	13	29	- 45	= 61	M 77	] 93	m 109	} 125	▬ 141	× 157	173	189	205	221	237	253
E	1110	14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	▌ 142	÷ 158	174	190	206	222	238	254
F	1111	15	31	/ 47	? 63	O 79	_ 95	o 111	127	● 143	± 159	175	191	207	223	239	255

3. FRANCE

Hex. No.	Binary No.	0 0000	1 0001	2 0010	3 0011	4 0100	5 0101	6 0110	7 0111	8 1000	9 1001	A 1010	B 1011	C 1100	D 1101	E 1110	F 1111
0	0000	0	16	SP 32	Ø 48	à 64	P 80	‘ 96	p 112	┼ 128	○ 144	160	176	192	208	224	240
1	0001	1	17	! 33	1 49	A 65	Q 81	a 97	q 113	┴ 129	♠ 145	161	177	193	209	225	241
2	0010	2	18	" 34	2 50	B 66	R 82	b 98	r 114	┬ 130	♥ 146	162	178	194	210	226	242
3	0011	3	19	# 35	3 51	C 67	S 83	c 99	s 115	┤ 131	♦ 147	163	179	195	211	227	243
4	0100	4	20	$ 36	4 52	D 68	T 84	d 100	t 116	├ 132	♣ 148	164	180	196	212	228	244
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117	─ 133	♪ 149	165	181	197	213	229	245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	│ 134	ª 150	166	182	198	214	230	246
7	0111	7	23	’ 39	7 55	G 71	W 87	g 103	w 119	┌ 135	↑ 151	167	183	199	215	231	247
8	1000	8	24	(40	8 56	H 72	X 88	h 104	x 120	┐ 136	◘ 152	168	184	200	216	232	248
9	1001	9	25	) 41	9 57	I 73	Y 89	i 105	y 121	└ 137	Y 153	169	185	201	217	233	249
A	1010	10	26	* 42	: 58	J 74	Z 90	j 106	z 122	┘ 138	→ 154	170	186	202	218	234	250
B	1011	11	27	+ 43	; 59	K 75	° 91	k 107	é 123	▒ 139	↑ 155	171	187	203	219	235	251
C	1100	12	28	, 44	< 60	L 76	ç 92	l 108	ù 124	■ 140	↓ 156	172	188	204	220	236	252
D	1101	13	29	- 45	= 61	M 77	§ 93	m 109	è 125	▬ 141	× 157	173	189	205	221	237	253
E	1110	14	30	. 46	> 62	N 78	^ 94	n 110	¨ 126	▌ 142	÷ 158	174	190	206	222	238	254
F	1111	15	31	/ 47	? 63	O 79	_ 95	o 111	127	● 143	± 159	175	191	207	223	239	255

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4. GERMANY

Hex. No.	Binary No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	0	16	SP 32	0 48	§ 64	P 80	' 96	p 112	+ 128	o 144	160	176	192	208	224	240
1	0001	1	17	! 33	1 49	A 65	Q 81	a 97	q 113	⊥ 129	♠ 145	161	177	193	209	225	241
2	0010	2	18	" 34	2 50	B 66	R 82	b 98	r 114	T 130	♥ 146	162	178	194	210	226	242
3	0011	3	19	# 35	3 51	C 67	S 83	c 99	s 115	┤ 131	♦ 147	163	179	195	211	227	243
4	0100	4	20	$ 36	4 52	D 68	T 84	d 100	t 116	├ 132	♣ 148	164	180	196	212	228	244
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117	─ 133	♪ 149	165	181	197	213	229	245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	│ 134	a 150	166	182	198	214	230	246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	┌ 135	♣ 151	167	183	199	215	231	247
8	1000	8	24	(40	8 56	H 72	X 88	h 104	x 120	┐ 136	♦ 152	168	184	200	216	232	248
9	1001	9	25	) 41	9 57	I 73	Y 89	i 105	y 121	└ 137	Y 153	169	185	201	217	233	249
A	1010	10	26	* 42	: 58	J 74	Z 90	j 106	z 122	┘ 138	↗ 154	170	186	202	218	234	250
B	1011	11	27	+ 43	; 59	K 75	Ä 91	k 107	ä 123	▒ 139	↑ 155	171	187	203	219	235	251
C	1100	12	28	, 44	< 60	L 76	Ö 92	l 108	ö 124	■ 140	↓ 156	172	188	204	220	236	252
D	1101	13	29	- 45	= 61	M 77	Ü 93	m 109	ü 125	▬ 141	× 157	173	189	205	221	237	253
E	1110	14	30	. 46	> 62	N 78	^ 94	n 110	ß 126	▌ 142	÷ 158	174	190	206	222	238	254
F	1111	15	31	/ 47	? 63	O 79	_ 95	o 111	127	● 143	± 159	175	191	207	223	239	255

5. DENMARK

Hex. No.	Binary No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	0	16	SP 32	0 48	@ 64	P 80	' 96	p 112	+ 128	o 144	160	176	192	208	224	240
1	0001	1	17	! 33	1 49	A 65	Q 81	a 97	q 113	⊥ 129	♠ 145	161	177	193	209	225	241
2	0010	2	18	" 34	2 50	B 66	R 82	b 98	r 114	T 130	♥ 146	162	178	194	210	226	242
3	0011	3	19	# 35	3 51	C 67	S 83	c 99	s 115	┤ 131	♦ 147	163	179	195	211	227	243
4	0100	4	20	$ 36	4 52	D 68	T 84	d 100	t 116	├ 132	♣ 148	164	180	196	212	228	244
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117	─ 133	♪ 149	165	181	197	213	229	245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	│ 134	a 150	166	182	198	214	230	246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	┌ 135	♣ 151	167	183	199	215	231	247
8	1000	8	24	(40	8 56	H 72	X 88	h 104	x 120	┐ 136	♦ 152	168	184	200	216	232	248
9	1001	9	25	) 41	9 57	I 73	Y 89	i 105	y 121	└ 137	Y 153	169	185	201	217	233	249
A	1010	10	26	* 42	: 58	J 74	Z 90	j 106	z 122	┘ 138	↗ 154	170	186	202	218	234	250
B	1011	11	27	+ 43	; 59	K 75	Æ 91	k 107	æ 123	▒ 139	↑ 155	171	187	203	219	235	251
C	1100	12	28	, 44	< 60	L 76	Ø 92	l 108	ø 124	■ 140	↓ 156	172	188	204	220	236	252
D	1101	13	29	- 45	= 61	M 77	Å 93	m 109	å 125	▬ 141	× 157	173	189	205	221	237	253
E	1110	14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	▌ 142	÷ 158	174	190	206	222	238	254
F	1111	15	31	/ 47	? 63	O 79	_ 95	o 111	127	● 143	± 159	175	191	207	223	239	255

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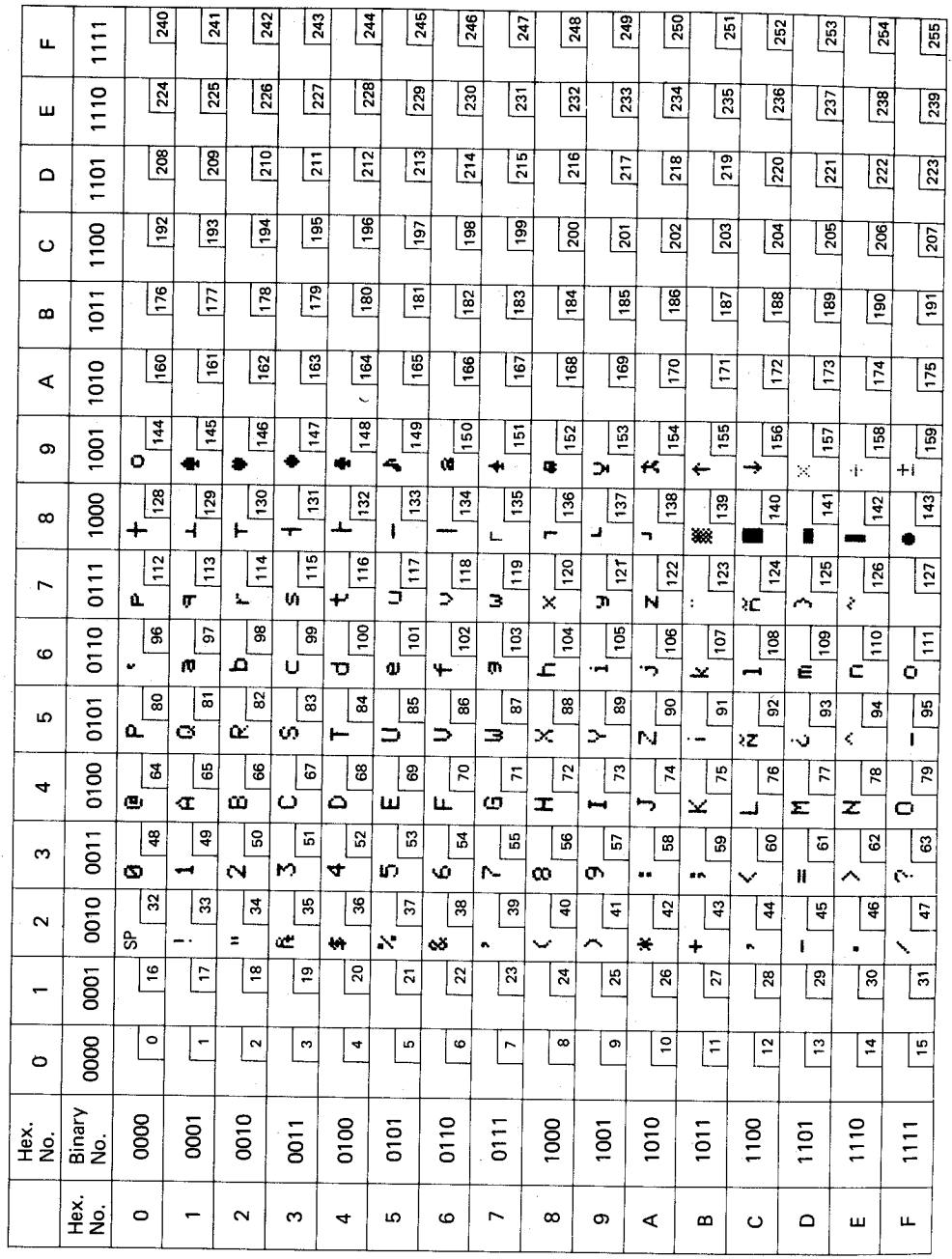
Hex. No.	Binary No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	0	16	SP 32	0 48	É 64	P 80	é 96	p 112	+ 128	o 144	160	176	192	208	224	240
1	0001	1	17	! 33	1 49	A 65	Q 81	a 97	q 113	⊥ 129	♠ 145	161	177	193	209	225	241
2	0010	2	18	" 34	2 50	B 66	R 82	b 98	r 114	T 130	♥ 146	162	178	194	210	226	242
3	0011	3	19	# 35	3 51	C 67	S 83	c 99	s 115	┤ 131	♦ 147	163	179	195	211	227	243
4	0100	4	20	¤ 36	4 52	D 68	T 84	d 100	t 116	├ 132	♣ 148	164	180	196	212	228	244
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117	─ 133	♪ 149	165	181	197	213	229	245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	│ 134	ä 150	166	182	198	214	230	246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	┌ 135	↨ 151	167	183	199	215	231	247
8	1000	8	24	(40	8 56	H 72	X 88	h 104	x 120	┐ 136	å 152	168	184	200	216	232	248
9	1001	9	25	) 41	9 57	I 73	Y 89	i 105	y 121	└ 137	Ö 153	169	185	201	217	233	249
A	1010	10	26	* 42	: 58	J 74	Z 90	j 106	z 122	┘ 138	Ü 154	170	186	202	218	234	250
B	1011	11	27	+ 43	; 59	K 75	Ä 91	k 107	ä 123	▓ 139	↑ 155	171	187	203	219	235	251
C	1100	12	28	, 44	< 60	L 76	Ö 92	l 108	ö 124	▌ 140	↓ 156	172	188	204	220	236	252
D	1101	13	29	- 45	= 61	M 77	Å 93	m 109	å 125	▬ 141	→ 157	173	189	205	221	237	253
E	1110	14	30	. 46	> 62	N 78	Ü 94	n 110	ü 126	▐ 142	← 158	174	190	206	222	238	254
F	1111	15	31	/ 47	? 63	O 79	_ 95	o 111	127	● 143	± 159	175	191	207	223	239	255

Hex. No.	Binary No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	0	16	SP 32	0 48	@ 64	P 80	ù 96	p 112	+ 128	o 144	160	176	192	208	224	240
1	0001	1	17	! 33	1 49	A 65	Q 81	a 97	q 113	⊥ 129	♠ 145	161	177	193	209	225	241
2	0010	2	18	" 34	2 50	B 66	R 82	b 98	r 114	T 130	♥ 146	162	178	194	210	226	242
3	0011	3	19	# 35	3 51	C 67	S 83	c 99	s 115	┤ 131	♦ 147	163	179	195	211	227	243
4	0100	4	20	$ 36	4 52	D 68	T 84	d 100	t 116	├ 132	♣ 148	164	180	196	212	228	244
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117	─ 133	♪ 149	165	181	197	213	229	245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	│ 134	ä 150	166	182	198	214	230	246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	┌ 135	↨ 151	167	183	199	215	231	247
8	1000	8	24	(40	8 56	H 72	X 88	h 104	x 120	┐ 136	å 152	168	184	200	216	232	248
9	1001	9	25	) 41	9 57	I 73	Y 89	i 105	y 121	└ 137	Ö 153	169	185	201	217	233	249
A	1010	10	26	* 42	: 58	J 74	Z 90	j 106	z 122	┘ 138	Ü 154	170	186	202	218	234	250
B	1011	11	27	+ 43	; 59	K 75	° 91	k 107	à 123	▓ 139	↑ 155	171	187	203	219	235	251
C	1100	12	28	, 44	< 60	L 76	\ 92	l 108	ò 124	▌ 140	↓ 156	172	188	204	220	236	252
D	1101	13	29	- 45	= 61	M 77	é 93	m 109	è 125	▬ 141	→ 157	173	189	205	221	237	253
E	1110	14	30	. 46	> 62	N 78	^ 94	n 110	ì 126	▐ 142	← 158	174	190	206	222	238	254
F	1111	15	31	/ 47	? 63	O 79	_ 95	o 111	127	● 143	± 159	175	191	207	223	239	255

8. SPAIN



Hex. No.	Binary No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0000	0	16	32 SP	48 0	64 @	80 P	96 `	112 p	128 Ç	144 É	160 á	176 ▒	192 └	208 ð	224 Ó	240 ≡
1	0001	1	17	33 !	49 1	65 A	81 Q	97 a	113 q	129 ü	145 æ	161 í	177 ▓	193 ┴	209 Ð	225 ß	241 ±
2	0010	2	18	34 "	50 2	66 B	82 R	98 b	114 r	130 é	146 Æ	162 ó	178 │	194 ┬	210 Ê	226 Ô	242 ‗
3	0011	3	19	35 #	51 3	67 C	83 S	99 c	115 s	131 â	147 ô	163 ú	179 ┤	195 ├	211 Ë	227 Ò	243 ¾
4	0100	4	20	36 $	52 4	68 D	84 T	100 d	116 t	132 ä	148 ö	164 ñ	180 ╡	196 ─	212 È	228 õ	244 ¶
5	0101	5	21	37 %	53 5	69 E	85 U	101 e	117 u	133 à	149 ò	165 Ñ	181 ╢	197 ┼	213 ı	229 Õ	245 §
6	0110	6	22	38 &	54 6	70 F	86 V	102 f	118 v	134 å	150 û	166 ª	182 ╖	198 ╞	214 Í	230 µ	246 ÷
7	0111	7	23	39 '	55 7	71 G	87 W	103 g	119 w	135 ç	151 ù	167 º	183 ╕	199 ╟	215 Î	231 þ	247 ¸
8	1000	8	24	40 (	56 8	72 H	88 X	104 h	120 x	136 ê	152 ÿ	168 ¿	184 ╣	200 ╚	216 Ï	232 Þ	248 °
9	1001	9	25	41)	57 9	73 I	89 Y	105 i	121 y	137 ë	153 Ö	169 ⌐	185 ║	201 ╔	217 ┘	233 Ú	249 ¨
A	1010	10	26	42 *	58 :	74 J	90 Z	106 j	122 z	138 è	154 Ü	170 ¬	186 ╗	202 ╩	218 ┌	234 Û	250 ·
B	1011	11	27	43 +	59 ;	75 K	91 [	107 k	123 {	139 ï	155 ¢	171 ½	187 ╝	203 ╦	219 █	235 Ù	251 ¹
C	1100	12	28	44 ,	60 <	76 L	92 Ñ	108 l	124 ñ	140 î	156 £	172 ¼	188 ╜	204 ╠	220 ▄	236 ý	252 ³
D	1101	13	29	45 -	61 =	77 M	93]	109 m	125 }	141 ì	157 ¥	173 ¡	189 ╛	205 ═	221 ¦	237 Ý	253 ²
E	1110	14	30	46 .	62 >	78 N	94 ^	110 n	126 ~	142 Ä	158 ₧	174 «	190 ┐	206 ╬	222 Ì	238 ¯	254 ■
F	1111	15	31	47 /	63 ?	79 O	95 _	111 o	127	143 Å	159 ƒ	175 »	191 └	207 ¤	223 ▀	239 ´	255

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