EPSON

PORTABLE COMPUTER

HX-20

OPERATION MANUAL

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FOREWORD

Congratulations on your decision to purchase an EPSON HX-20 Portable Computer.

Your HX-20 is a compact (A4 size), yet powerful battery-operated portable computer designed to meet the computing needs of post-industrial society. The HX-20's unique mix of the portability of a pocket computer and the functions of a desktop personal computer is made possible by its state-of-the-art miniaturisation and consumer-oriented design.

The HX-20 is a well-balanced, general purpose computer which will stimulate the creativity of the hobbyist while satisfying the demands of the business and engineering user. The HX-20's dual CPUs enhance I/O processing, for excellent expandability and communications capability.

Please read this manual carefully and operate the computer correctly so that your HX-20 can display its functions to the maximum extent.

— CAUTION —

The AC voltage of the power supply available varies from country to country. Therefore, when using your HX-20 with an AC adapter, please use an AC adapter suitable for the voltage of your country.

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1.2 HX-20 Components

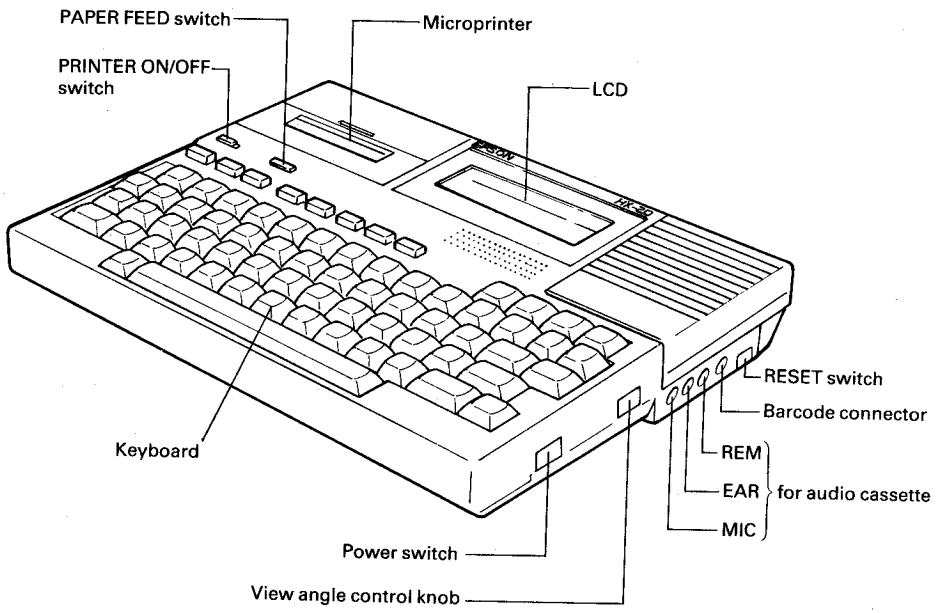


Fig. 1-2 Names of HX-20 Components

POWER switch: Used to turn ON and OFF the power supply of the HX-20.

VIEW angle control knob: Used to adjust the view angle of LCD.

The following connectors are for interfacing an external audio cassette to the HX-20.

MIC (microphone): Signal line for data write
EAR (earphone): Signal line for data read
REM (remote): Signal line for motor control of the cassette recorder.
Barcode connector: An interface connector for connection of a barcode reader to the HX-20.
RESET switch: Used to reset the hardware of the HX-20.

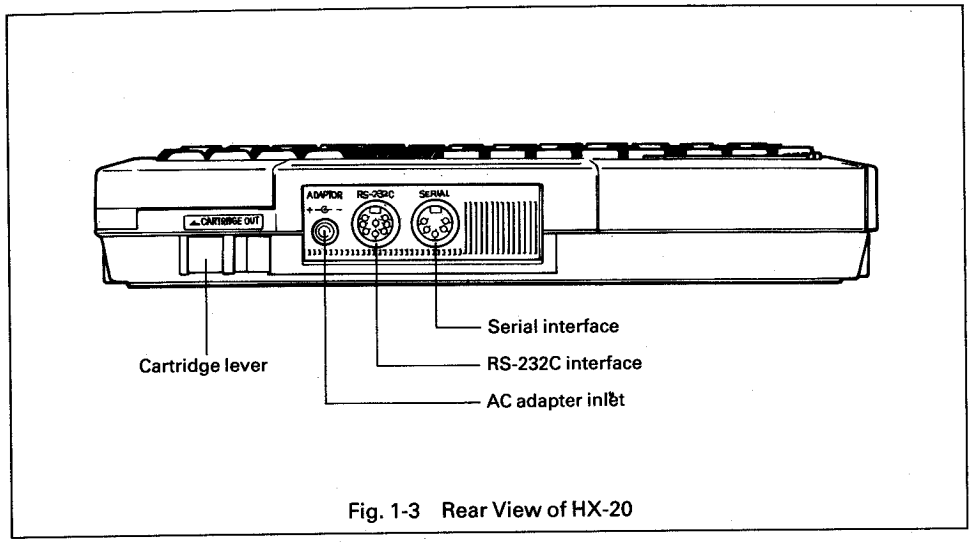


Fig. 1-3 Rear View of HX-20

Cartridge lever: Used to allow the dismounting of an optional unit (ROM cartridge or microcassette) from the HX-20. To remove the optional unit, push the lever to the left.

RS-232C interface connector: Used to connect a printer, acoustic coupler or another HX-20 to the HX-20.

AC adapter inlet: Used to connect the AC adapter for battery charging.

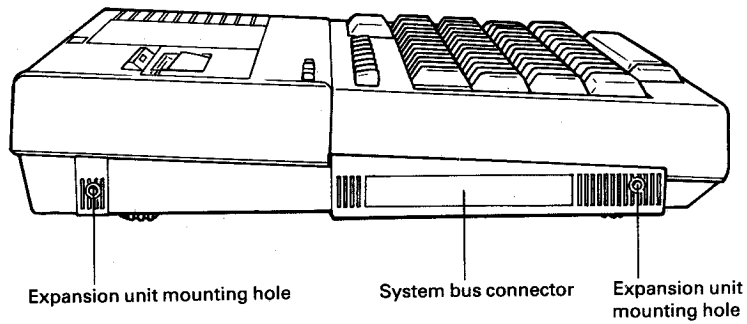


Fig. 1-4 Side View of HX-20

Expansion unit mounting holes: Two screw (M3) mounting holes are provided to secure the expansion unit.

System bus connector: Used to connect the expansion unit to the HX-20.

1.3 Setting the Roll Paper

STEP 1

Remove the new roll paper supplied as an accessory from the vinyl cover and pull out the leading edge of the paper as shown in Fig. 1-5. To reuse a roll which has already been cut, recut the leading edge of the roll cleanly at a right angle as shown in Fig. 1-5.

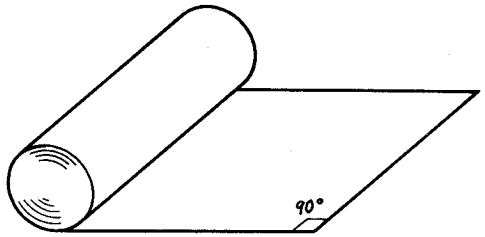
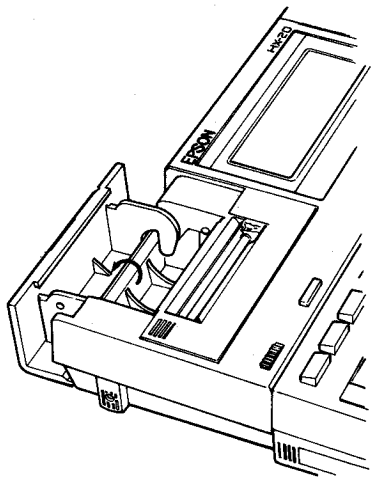


Fig. 1-5 Cutting Paper Edge

STEP 2

Open the paper cover behind the built-in microprinter by pushing the cover back with your fingers.



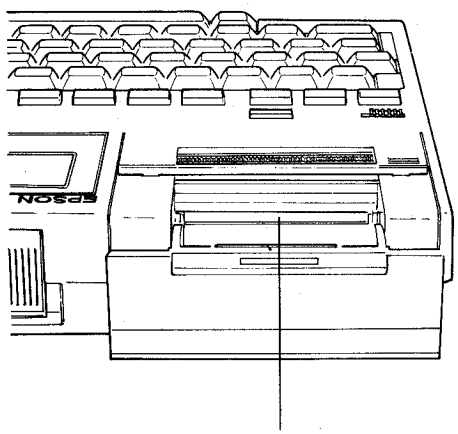


Fig. 1-6 Paper Inlet Cover

STEP 3

First, turn the power switch ON. Then turn the printer switch ON and insert the leading edge of the roll into the paper inlet. Keep on pressing the PAPER FEED button and the paper will automatically feed into the printer and emerge from the top of the printer in about 15 seconds.

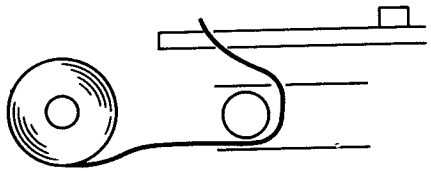


Fig. 1-7 Paper Feeding Course

1.4 Setting the Ribbon Cassette

Press the upper left-hand corner of the printer cover (where "PUSH" is inscribed) gently with your finger to remove the cover. Place the ribbon cassette in the position indicated by the dotted line in Fig. 1-9. Then, press both edges of the cartridge gently with your finger to secure the ribbon cassette.

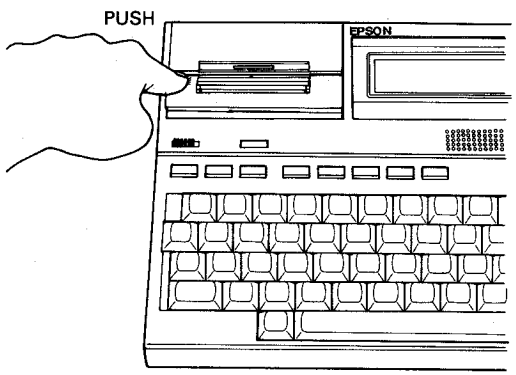


Fig. 1-8 Ribbon Cassette Setting

After mounting the ribbon cassette, check that the printing paper and the inked ribbon are correctly positioned as shown in Fig. 1-9. Be sure that the inked ribbon is not twisted and is free from creasing.

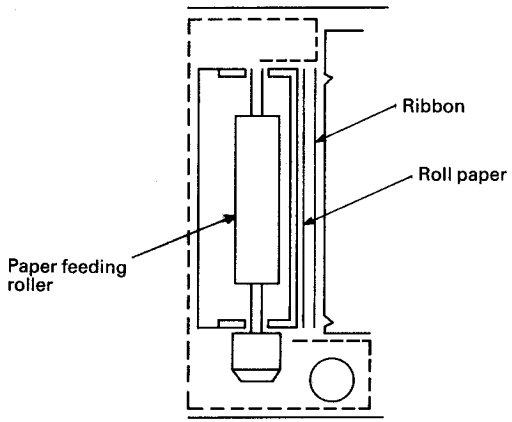


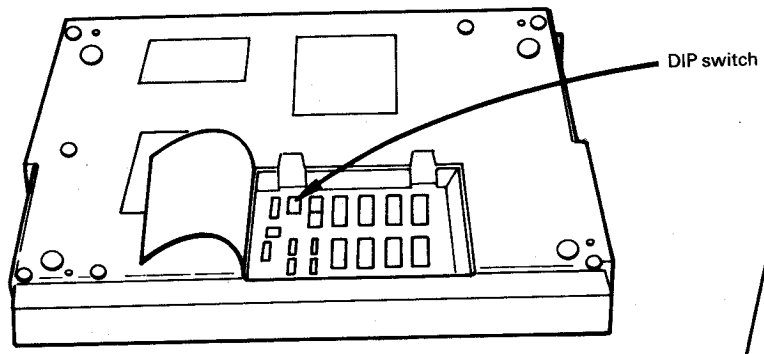
Fig. 1-9 Positions of Paper and Inked Ribbon

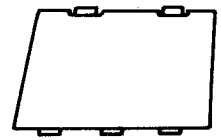
2. DIP SWITCH SETTING

Your HX-20 is equipped with a 4-pin DIP switch in order to meet user's specific requirements.

To gain access to the DIP switch, observe the following procedure.

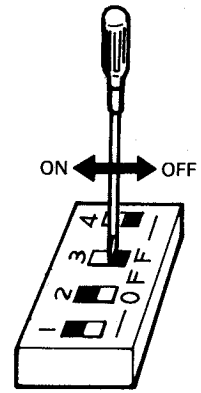
1. Turn the power OFF.
2. Turn the HX-20 upside down on a soft surface.
3. Open the lid located at the lower right-hand of the HX-20.
4. Position your HX-20 as follows:





Lid

5. Set these DIP switch pins. (Switch pins set to the left are ON, those set to the right are OFF. See figure below.)

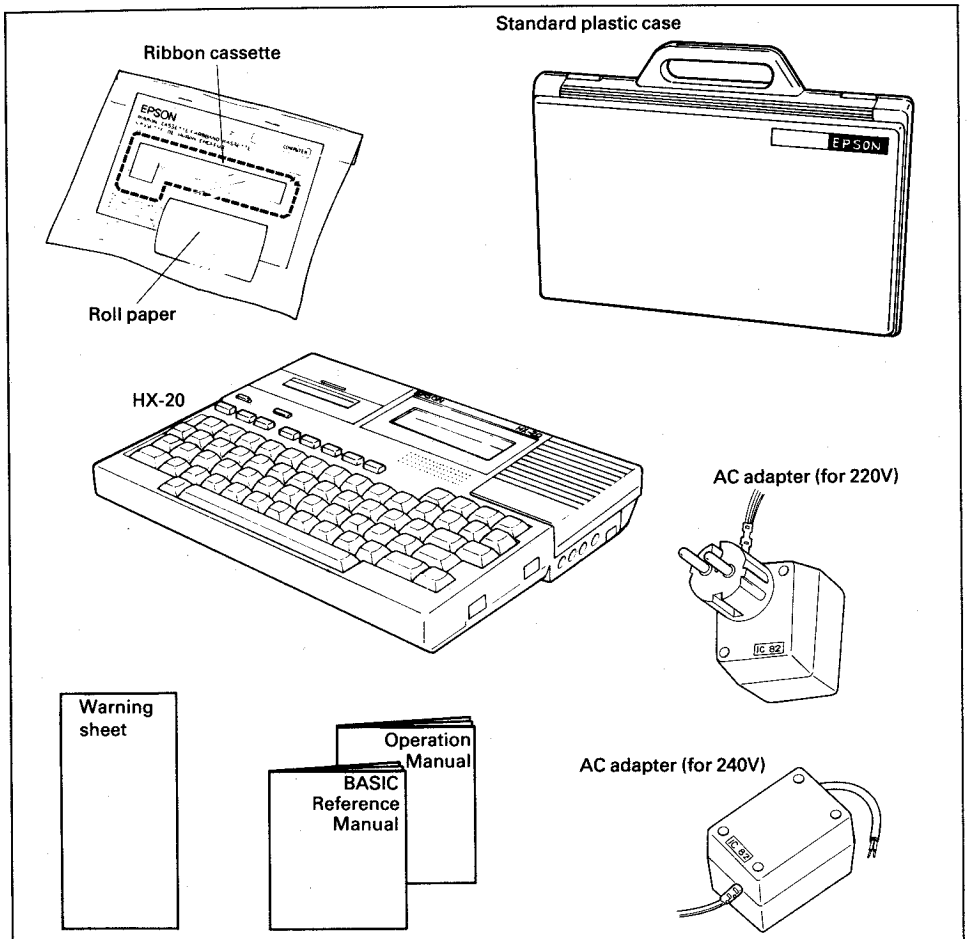


NOTE:
DIP SW pin No.4 is set to OFF at factory. Character set is selectable regardless of its ON/OFF position.
To use Disk Drive Unit, set the SW pin No. 4 to ON.

1. BEFORE OPERATION

1.1 Unpacking

Upon unpacking, please make sure that everything shown in Fig. 1-1 is in the carton box. If you notice any of the listed contents missing or damaged, contact the store where you purchased your HX-20.

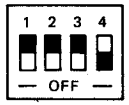


NOTES:
1. It is recommended that all packing materials be saved in case the HX-20 requires reshipment in the future.
2. To customers using the 240V AC adapter: Please purchase a commercially available plug and attach it to your AC adapter.

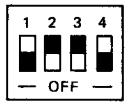
Fig. 1-1 Contents of Carton Box

By changing the DIP switch setting as shown below, you can select 8 different character sets.

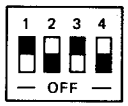
USASCII



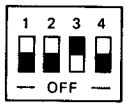
France



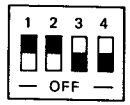
Germany



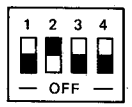
England



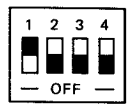
Denmark



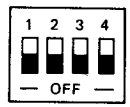
Sweden



Italy



Spain



International character sets are shown below:

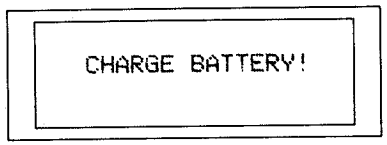
Country / Dec.code	U.S.A.	France	Germany	England	Denmark	Sweden	Italy	Spain
35 (23)	#	#	#	£	#	#	#	Pt
36 (24)	$	$	$	$	$	¤	$	$
64 (40)	@	à	§	@	@	É	@	@
91 (5B)	[	°	Ä	[	Æ	Ä	°	í
92 (5C)	\	ç	Ö	\	Ø	Ö	\	Ñ
93 (5D)	]	§	Ü	]	Å	Å	é	¿
94 (5E)	^	^	^	^	^	Ü	^	^
96 (60)	`	`	`	`	`	é	ù	`
123 (7B)	{	é	ä	{	æ	ä	à	¨
124 (7C)	¦	ù	ö	¦	ø	ö	ò	ñ
125 (7D)	}	è	ü	}	å	å	è	}
126 (7E)	~	¨	ß	~	~	ü	ì	~

NOTE: Numbers in parentheses are hexadecimal codes.

You can also select each character set by software. (See POKE in the BASIC Reference Manual for details.)

3. BUILT-IN BATTERY

Your HX-20 is powered by a built-in rechargeable Ni-Cd battery. When the battery discharges and its output voltage falls below the specified value, the message "**CHARGE BATTERY!**" will appear on the LCD screen. This message flashes 60 times and then causes the power supply of the HX-20 to turn off automatically. In this state, all operations of the HX-20 are put in the halt state. Recharge the battery as soon as possible, noting the following. The built-in battery can be charged before the "**CHARGE BATTERY!**" message is displayed. However, charging it repeatedly for long periods of time will overcharge it and shorten its service life. Pay careful attention to the charging time of the battery. You can, of course, use the HX-20 while the batteries are being charged.



3.1 Specifications of Built-in Battery

(1) Battery voltage
- (a) Operating : 4.5 to 6.0V
- (b) Data retention : 4.0 to 6.0V
- (c) Low voltage detection : 4.5V

(2) Battery capacity
The effective output capacity in the fully charged state is approx. 1,000 mAH. (The effective output capacity refers to the battery capacity to sustain operation until the message "CHARGE BATTERY!" will be displayed.)

(3) Battery life
The service life of the battery is influenced by such operating conditions as ambient operating temperature, charging method (length and timing of charging), etc. However, the rated service life of the built-in battery is three years and it is recommended that you replace the battery soon after the expiration of this period. Also, replace the battery if you notice that, even though it has been fully charged, the time duration you can operate the HX-20 is getting shorter.

(4) Replacing the battery

If your programmes are stored in the RAM, save them to a microcassette or audio cassette file before replacing the battery. When you replace the battery, be sure to disconnect the AC adapter.

NOTES:

1. *If the battery is removed when the AC adapter is connected to the HX-20, a voltage exceeding the rated supply voltage will be applied to the HX-20. This excess voltage will result in shortening of the service life of the circuit elements and may, in some cases, damage the circuit elements.*
2. *Removing the built-in battery causes the loss of the programmes stored in the RAM.*

Replace the battery according to the following procedure.

1. Save the programmes stored in the RAM to a cassette tape file or its equivalent.
2. Disconnect the AC adapter from the HX-20.
3. Remove the bottom housing of the HX-20 by loosening the seven screws and disconnecting the FPC cable for the plug-in option ROM cartridge.
4. Loosen the screw securing the battery holder and remove the battery holder containing the old battery from the battery compartment.
5. Disconnect the battery connector on the control circuit board.
6. Remove the old battery from the battery holder and insert the new battery into the battery holder.

NOTE:

Mount the battery holder with the new battery in the order of steps 4, 5 and 3 above except that the mounting procedure is the exact reverse of the disassembly procedure.

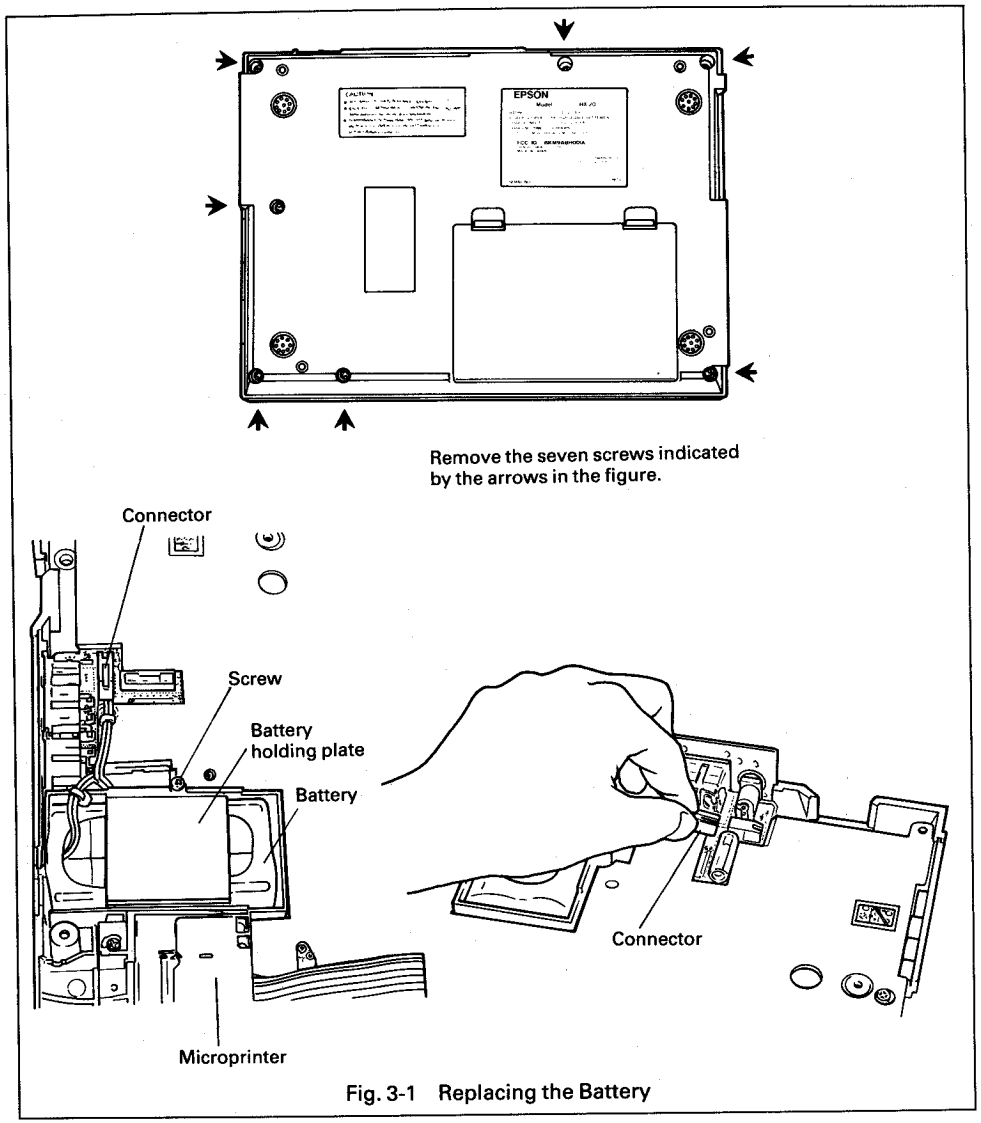


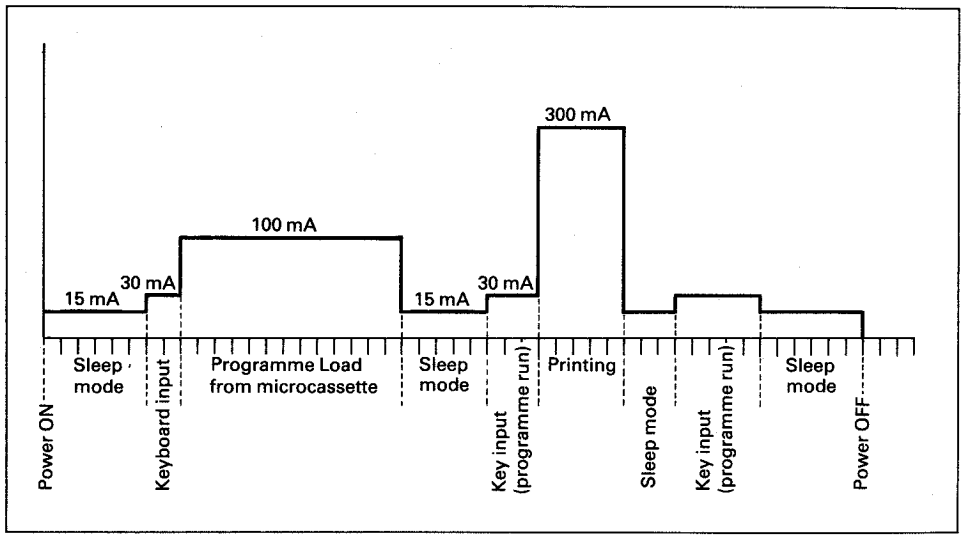
Fig. 3-1 Replacing the Battery

(5) Charging characteristics
When the AC adapter is used, the battery can be charged at the rate of approx. 125 mAH. Thus, the battery capacity of approx. 1,000 mAH can be realised by charging for 8 hours (125 mAH×8H).

(6) How to determine the charging time
(a) When the message "CHARGE BATTERY!" appears on the LCD screen, charge the battery for eight hours.
(b) Determine the required charging time by using the following formula if the batttery is to be charged before the "CHARGE BATTERY!" display appears.

$$\text{Charging time} = \frac{\text{Current consumption (mAH)}}{125\ \text{(mAH)}}$$

Determine the current consumption based on the product of the operation mode of the HX-20 by its operating time. (See (5) Charging characteristics.)
[Example]



With each division on the above scale taken as 1 minute.

1. 15×6/60
2. 30×2/60
3. 100×13/60
4. 15×5/60
5. 30×3/60
6. 300×5/60
7. 15×3/60
8. 30×5/60
9. 15×6/60

$$\text{Charging time } X = \frac{56.7}{125}\ \text{(hours)}$$

$X = 0.45$ hours

1, 4, 7, 9	$15 \times \frac{20}{60}$	= 5.0 mAH
2, 5, 8	$30 \times \frac{10}{60}$	= 5.0 mAH
3	$100 \times \frac{13}{60}$	= 21.7 mAH
6	$300 \times \frac{5}{60}$	= 25.0 mAH

Current consumption 56.7 mAH total

3.2 Charging the Built-in Battery

STEP 1

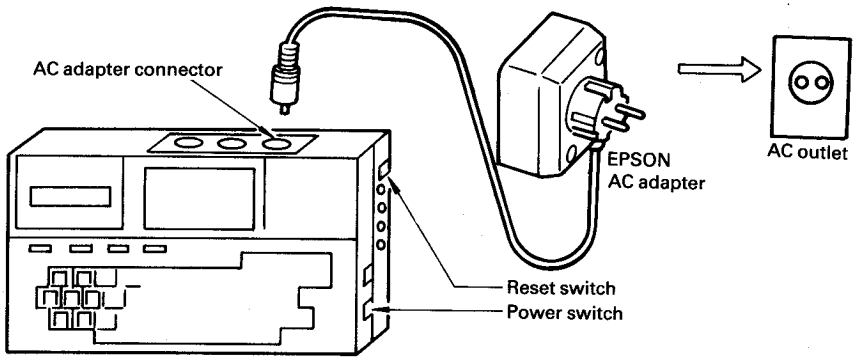
Turn the power switch OFF and check that the LCD display is extinguished. If the display is not extinguished, press the RESET switch.

STEP 2

Plug the AC Adapter (included as an accessory) into an AC outlet and insert the plug of the adapter into the AC adapter connector of the HX-20. The battery will be fully charged in about 8 hours. If you continue to charge the battery after it has reached the fully charged state, it will be overcharged and its service life will be shortened. (During charging, the battery will become slightly warm. This is normal and should not cause concern.)

CAUTIONS

- *Use the exclusive AC adapter for charging. After the battery is fully charged, unplug the adapter from the AC outlet and the adapter connector of the HX-20 and store it.*
- *If you notice an abnormal rise in the temperature of the battery, stop the charging immediately.*
- *Charge the battery in the normal operating temperature range (between 5°C and 35°C).*
- *Avoid continuous use of the HX-20 with the AC adapter connected. Continuous charging of the battery will result in overcharging. Overcharging can shorten the service life of the battery and, in some cases, can cause damage to the battery.*
- *If you leave the battery in a completely discharged state, its service life will be shortened. When you see the "**CHARGE BATTERY!**" message, stop operating the HX-20 and charge the battery as soon as possible.*



Note: To customers using the 240V AC adapter: Please purchase a commercially available plug and attach to your AC adapter.

Fig. 3.2 Connecting AC Adapter for Battery Charging

3.3 Hints on Use of AC Adapter

- Be sure to use the special EPSON AC adapter supplied as an accessory.
- If you use an adapter other than the special EPSON adapter, deterioration of the battery and the internal circuit elements may result as well as damage to the circuit components.
- Use an AC outlet of the voltage rating specified on the AC adapter.
- Do not connect the AC adapter when the battery is not in the HX-20. Excess voltage will occur in the HX-20, causing deterioration of, or even damage to, the circuit elements.
- When the adapter is not in use, unplug it from the AC outlet and the adapter connector of the HX-20 and store it safely.
- Do not connect the AC adapter to any equipment other than the HX-20 as the difference in voltage or current capacity may damage the connected equipment or the AC adapter.

3.4 Monitoring the Battery Voltage

The HX-20 constantly monitors the battery voltage from the time the power switch is turned on through its operation. When the battery discharges and its output voltage falls below the specified voltage (approx. 4.5V), the message "CHARGE BATTERY!" will be immediately displayed on the LCD screen.
This message will flash 60 times and then cause the power supply of the HX-20 to automatically turn off to protect the programmes from possible data loss or destruction.

- In this state, programme execution will stop and you cannot operate the HX-20.
  Countermeasures:
  Turn the power switch off at once and charge the battery with the exclusive AC adapter.
  If you leave the battery in an uncharged state, the programmes stored in the RAM may be lost.

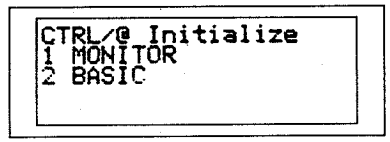
4. BASIC OPERATION OF HX-20

In this chapter, the basic operating procedures for using the HX-20 are explained.

4.1 Power Application

(1) Applying power to peripheral equipment
Be sure to check the peripheral device for proper connection before applying power to the HX-20. First, turn on the power switch of the peripheral device.

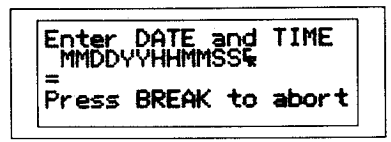
(2) Applying power to the HX-20
Next, turn on the power switch of the HX-20. You will hear the pip sounds issued by the built-in piezoelectric speaker and see the following menu information on the LCD screen.



4.2 Selecting a System Programme from the Menu

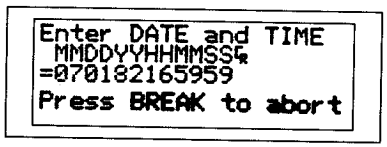
4.2.1 System initialisation

One of the features of the HX-20 is that the contents of the memory will not be lost when the power is turned OFF. Therefore, you must clear any unnecessary data still remaining in the memory. You can do this by following the instruction message "CTRL/@ Initialize" displayed at the top of the menu display. Press @ key, while holding down the CTRL key, and the following message will appear on the LCD and the HX-20 will enter a wait state for your key input.

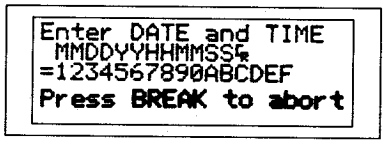


Then, you must set the current date and time by entering month, day, year, hours, minutes, and seconds from the keyboard as indicated by the message "MMDDYYHHMMSS" below the message "Enter DATE and TIME". "CR" stands for "Carriage Return", indicating that you must press the RETURN key.

For example, if the current date and time are July 1, 1982 and 4:59:59 P.M.,



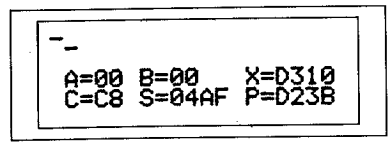
you must input the date and time as shown above, using the numeric keys from 1 to 0 at the top rows of the full keyboard. Input of the data and time information is completed when you finally press the RETURN key.
The HX-20 then clears the entire memory contents, and sets the necessary variables to predetermined values (i.e., default values), and returns to the menu display. (This state is called "Cold start".) The date and time you just entered are written into the internal calculator clock of the HX-20. So, you are no longer required to set the date and time again.



If you have made a mistake in data input, press the INS DEL key at the rightmost position above the top row of the full keyboard to clear all the previous data entry. You can now enter the correct data again.
The system initialisation is a very important, yet risky procedure. As mentioned earlier, if important data have been stored in the memory, special attention must be paid since the system initialisation will clear all the memory contents.
If you input "CTRL/@" by mistake, press the BREAK key immediately but without haste and the HX-20 will return to the initial menu display. Also, note that if you press the RETURN key after input of 12 or more characters, the HX-20 will be initialised. Remember, if you press the MENU key instead of the BREAK key, the HX-20 will also return to the menu display.

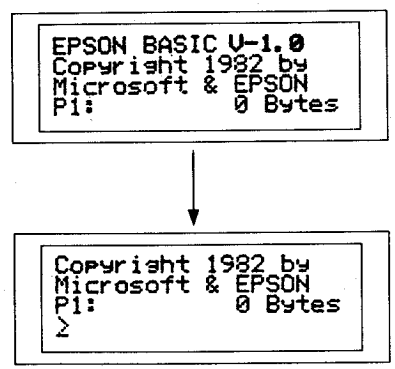
4.2.2 Branching to MONITOR

With the HX-20, you can write programmes or check the memory contents under the system monitor which controls the system. If you select "1" on the menu display, control is transferred to the system monitor. To be more specific, if you press the numeric key 1 at the leftmost position on the first row of the keyboard, the HX-20 will display the following messages and wait for command input. (For details, refer to Chapter 9, HOW TO USE THE MONITOR.)



4.2.3 Branching to BASIC

In addition to the system monitor, the HX-20 is provided with BASIC. In other words, using a programming language called "BASIC", you can write programmes and execute them. To start-up BASIC, you must select "2" from the menu display by pressing the numeric key 2 in the same manner as explained in the previous section. The menu will then disappear from the LCD screen and change to the following messages. The mark "≥" appearing at the lower left-hand corner of the LCD is called a "prompt sign" and indicates that the HX-20 is in a wait state for your input of a BASIC command. (This state is referred to as BASIC being returned to "command level". For details, refer to the BASIC Reference Manual.)



5. KEYBOARD

In order to make full use of the HX-20's compact keyboard, data entry from the keyboard can be made as follows.

5.1 Selecting Key Input Mode

(1) Uppercase mode
When the power switch is turned ON, the HX-20 keyboard is always in this mode. The characters which you can input in this mode are uppercase letters, numbers and special symbols. To enter lowercase letters in this mode, the desired letter key must be input while holding down the SHIFT key.

(2) Numeric key mode
This mode is selected by pressing the NUM key. Since only numeric keys are operable in this mode, only numeric data entry can be performed. Numeric keys 0 to 6 arranged like a numeric pad on the center right of keyboard, as well as numeric keys 0 to 9 at the top of the keyboard, are available. The symbols +, −, *, /, ., , and ? can also be input in this mode. (For details, refer to the key assignments for each mode in Section 5.2.) To release this mode, depress the NUM key a second time.

(3) Input of graphic characters
Graphic characters can be input while the GRPH key is being pressed when in uppercase mode or in lowercase mode. (For details, refer to the key assignments for each mode in Section 5.2.) By releasing this key, the HX-20 returns to uppercase mode or lowercase mode.

(4) Lowercase mode
This mode is selected by pressing the CAPS LOCK key located at the bottom left of the keyboard next to the space bar. In this mode, characters are input as lowercase letters, and symbols are input just the same as in uppercase mode. To return to uppercase mode, press the CAPS LOCK key a second time.

(5) Examples of key input
The following are specific examples of how to input characters and symbols from the keyboard.

Example 1) When 2 key is used.

Character input	Procedure
2	Press the 2 key alone.
"	Press the 2 key while holding down the SHIFT key.

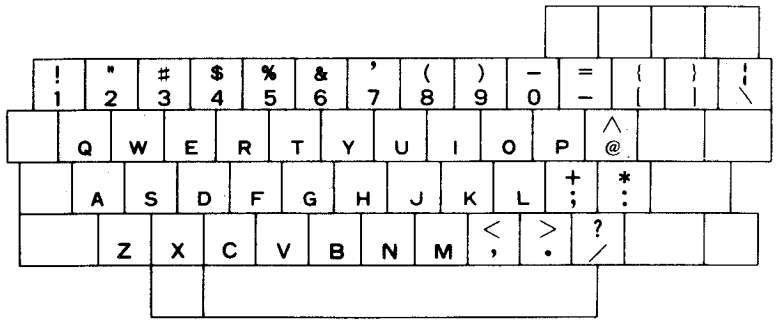
Example 2) When M key is used

Character input	Procedure
M	Press the M key alone.
m	Press the M key while holding down the SHIFT key.
♯	Press the M key while holding down the GRPH key.
0	Press the NUM key and then the M key.

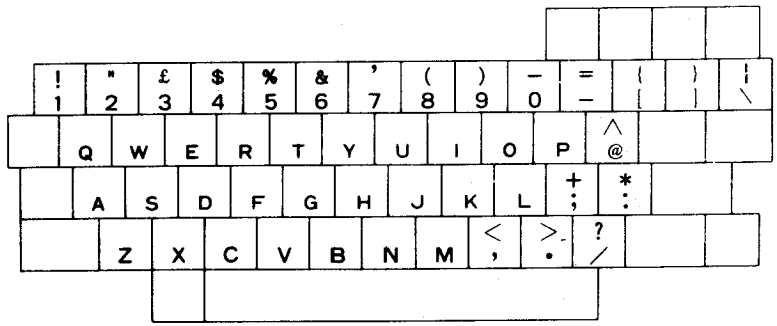
5.2 Key Assignments

(1) Uppercase mode and Lowercase mode

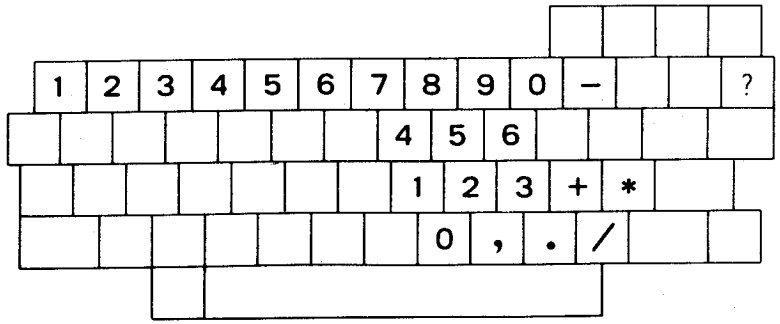
USASCII



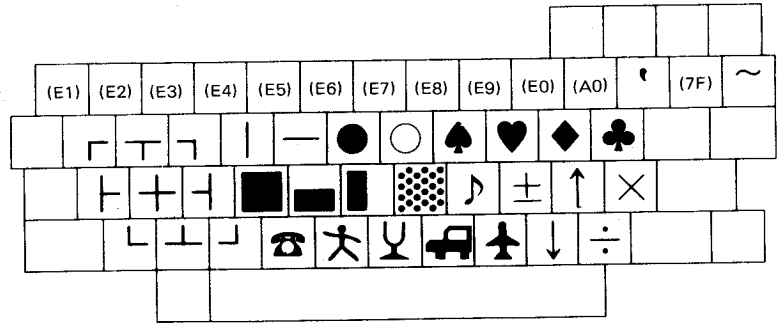
England



(2) Numeric key mode



(3) Graphic characters



NOTE:
E0 through E9, A0 and 7F shown in parentheses in the above figure are character codes in hexadecimal numbers and can be input by pressing the corresponding keys while holding down the GRPH key. The character codes for ‘ and ~ are 60 and 7E, respectively. (See Chapter 8, "Definition of Graphic Patterns".)

5.3 Special Keys

5.3.1 Input from special keys

When BASIC is started up, the HX-20 accepts inputs from the following keys and the space bar in any mode. (Refer to the BASIC Reference Manual.)

[ ], [ ], [HOME CLR], [SC : RN], [INS DEL], [TAB], [RETURN], [PF 1] – [PF 5], [MENU], [BREAK], [PAUSE]

5.3.2 Special key codes

Each function key code consists of 2 bytes as shown below.

F1 : FE, F1
F2 : FE, F2
F3 : FE, F3

↓

F10: FE, FA

[BREAK] and [PAUSE] do not have any character code.
The character code for [MENU] is FC.

5.4 Key Input

5.4.1 Auto-repeat function

All the keys of the HX-20 except the following have an auto-repeat function which is convenient for continuous input.

[MENU], [BREAK], [PAUSE], [PF1] – [PF5]
[SHIFT], [CTRL], [CAPS LOCK], [GRPH], [NUM]

5.4.2 Key input buffer

The HX-20 is equipped with an 8-byte buffer (for 8 characters) to facilitate your key input operations.

6. USING CASSETTE TAPES

6.1 External Cassette

The HX-20 is provided as standard equipment with an interface for an external audio cassette to be used as an auxiliary memory. Therefore, by using the optional interface cable (cable set #702) for audio cassette, you can write and read programmes and data to and from the external audio cassette. This chapter explains these procedures, using BASIC. (For detailed information about the BASIC Commands and Statements, refer to the BASIC Reference Manual.)

6.1.1 Interfacing with the HX-20

Your HX-20 must be set in the following conditions when you want to save the programmes stored in the memory of the HX-20 to the external audio cassette or to load programmes from the audio cassette into the memory of the HX-20.

(1) MIC (microphone) jack. This is an output line from the HX-20. The MIC jack must be connected to the MIC (input) terminal of the external audio cassette.
(2) EAR (earphone) jack. This is an input line to the HX-20. The EAR jack must be connected to the EAR (output) terminal of the external audio cassette.
(3) REM (remote) jack. This is a line to remotely control the motor of the external audio cassette. The REM jack should be connected to the REM terminal of the cassette tape recorder, if applicable.

6.2 Saving, Checking and Loading of Programmes

6.2.1 Confirmation before Programme Save or Load operation

You must check if the external audio cassette connects with the HX-20 in the following conditions before you start to save the programmes stored in the memory of the HX-20 to an audio cassette or to load programmes from the audio cassette into the memory of the HX-20.

(1) BASIC is under execution.
(2) BASIC is at command level.
(3) Programmes to be saved exist in the memory, or the programme area into which a programme is to be loaded has been logged in.
(4) Some tape recorders are not equipped with FF function. In this case, either disconnect the REM terminal and operate the recorder manually or use the BASIC command MOTOR ON/OFF to operate the recorder.

6.2.2 Programme Save operation

Transferring a programme from the memory of the HX-20 to the external memory is referred to as "Programme Save".

Operation at HX-20	Operation at External Audio Cassette
STEP 1 Place the HX-20 in the conditions described in paragraph 6.2.1.	
	STEP 2 Check that the interface cable is properly connected between the HX-20 and the audio cassette tape recorder and insert a cassette tape in the audio cassette recorder. Rewind the tape all the way to its beginning (BOT position).
	STEP 3 Reset the counter of the audio cassette tape recorder to 0.
	STEP 4 Push the PLAYBACK or FF button of the tape recorder and advance the tape slightly forward. Make a written record of the tape counter reading on the index card contained in the cassette. (Since most audio cassette tapes cannot be recorded from the very beginning, you must wind the tape forward past those sections.)
	STEP 5 When a tape recorder is connected to the HX-20 via the REM terminal, it cannot be operated simply by pushing the PLAYBACK button. This button should remain in the locked position for the duration of the Save or Load operation.
	STEP 6 Set the recording level to a desired value. It will vary from one tape recorder to another. However, as a rule, a recording level slightly higher than normal is recommended.

Operation at HX-20	Operation at External Audio Cassette
	STEP 7 If the tape recorder is connected to the HX-20 via the REM terminal, set to record. If the REM terminal is not connected, execute **STEP 8** before operating PLAYBACK and RECORD buttons.
STEP 8 Name the programme which you wish to save. In this example, the name "PROG" is used. `SAVE"CAS1:PROG"_` Input the programme statement as shown above and press **RETURN** key.	
	STEP 9 Then, check if the tape recorder begins recording (i.e., Programme Save operation).

STEP 10
 	
Confirm that the prompt sign ">" is displayed on the LCD, indicating that the HX-20 has returned to command level. Programme Save operation is now complete.
 	
`SAVE"CAS1:PROG"`
`>`	

	STEP 11 When the REM terminal is connected for remote motor control, the tape will stop automatically upon completion of **STEP 10**, but will not when the REM terminal is not connected. In either case, push the STOP button of the tape recorder.

STEP 12

Check the tape counter value when the tape has stopped and enter the reading on the index card, together with the programme name. This is the complete procedure for Programme Save.

6.2.3 Programme Save Check operation

STEP 1

Rewind the tape to the tape counter reading at which Programme Save began.

STEP 2

Adjust the playback level. (Playback level differs depending upon the tape recorder.)

STEP 3

Push the PLAYBACK button. If your tape recorder has no REM terminal, execute **STEP 4** before pushing the PLAYBACK button.

STEP 4

```
LOAD?"CAS1:PROG"_
```

Input the programme statement as shown above and press the RETURN key. The message "Searching" appears on the LCD.


```
LOAD?"CAS1:PROG"
Searching
```

When the target programme is found, the following message will be displayed.

```
Searching
Found: PROG
-
```

When the programme check is completed, the prompt sign ">" will be displayed and BASIC will return to command level.

```
Searching
Found: PROG
>
```

STEP 5

When the REM terminal is connected for remote motor control, the tape will stop upon completion of **STEP 4**, but will not when the REM terminal is not connected. In either case, push the STOP button of the tape recorder.

NOTE:
*The tape counter value at this time will be smaller than the tape counter value in **STEP 12** of the Save operation. This is because at the end of the file (when ">" is displayed) there are two marks and a tape feed of approx. 5 sec. At this time, the tape has stopped after the first end mark.*
*When performing the next Save, wind the tape forward to the tape counter value in **STEP 12**.*

This completes the procedure for checking that the saved programme has been correctly written into the cassette tape.

- If the saved programme name cannot be found or an I/O error occurs, return to **STEP 1** and repeat the entire procedure. In doing so, pay special attention to the adjustment of playback level in **STEP 2**.

- If the programme check still fails after several attempts to find the saved programme, it means that the programme has not been correctly saved to the cassette tape. If this happens, perform Programme Save a second time, carefully re-adjusting the recording level. It is recommended that the same external audio cassette recorder be used for both recording and playback and that a written record be kept of the recording and playback level settings. The procedure mentioned does not compare the programme contents on the tape with those in the memory of the HX-20. It only checks whether or not the programme written is available.

6.2.4 Programme Load

Transferring programmes from an external storage to the memory of the HX-20 is referred to as "Programme Load".

Operation at the HX-20	Operation at External Audio Cassette
STEP 1 Place the HX-20 in the conditions described in paragraph 6.2.1. (Example 1) Turn on the power switch of the HX-20 and branch to BASIC. Login the programme area into which you wish to load a programme from the cassette tape. (Example 2) If a programme is being executed in the target programme area, press the BREAK key and return BASIC to command level. ***NOTE:*** *If a programme already named exists in the target programme area into which the programme on the tape is to be loaded, that programme area is protected and execution of commands such as LOAD, NEW, etc., will become impossible. To cancel this protection input TITLE "" and press the* RETURN *key.*	**STEP 2** Wind the cassettte tape to the tape counter value at which the programme begins. Adjust the playback level as you did in the Programme Check operation. **STEP 3** If the REM terminal is used, press the PLAYBACK button of the tape recorder. If REM terminal is not used, push the PLAYBACK button after completion of **STEP 4**.

STEP 4

To load a programme with the name "PROG", input the following programme statement and press the RETURN key.

```
LOAD?"CAS1:PROG"_
```

STEP 5

Check that the tape recorder has started playback (Programme Load starts).

STEP 6

Simultaneously with the start of playback in STEP 5, the message "Searching" appears on the LCD screen.

```
LOAD?"CAS1:PROG"
Searching
```

When the target programme is found, the following message will be displayed.

```
Searching
Found: PROG
-
```


STEP 7

When the Programme Load operation has been completed, the prompt sign is displayed and the HX-20 returns to command level.

```
Searching
Found: PROG
>
```

STEP 8

If the REM terminal is connected for remote motor control, the tape will stop automatically upon completion of **STEP 6**, but if the REM terminal is not connected, the tape will not stop. In either case, push the STOP button of the tape recorder.

NOTE:

Before performing the next Save operation, wind the cassette tape slightly forward. (This is because the data end mark remains on the cassette tape even after the Programme Load operation has been completed.)

This completes the execution of the Programme Load operation.

- If the programme name cannot be found or an I/O error occurs, return to **STEP 1** and repeat the entire procedure, carefully re-adjusting the playback level as described in **STEP 2**.
- If the Programme Load still fails after several attempts to find the programme name, refer to Section 6.5, If There Are Problems Reading a Cassette, and retry from **STEP 1**.

6.3 The Microcassette Drive

Your HX-20 can also use a microcassette drive available as an option.
The microcassette drive operations such as REW (Rewind), FF (Fast Forward) as well as Programme Save, Load and Check can all be controlled under BASIC.
This chapter explains the basic operations of the microcassette.

6.3.1 Manual mode operation

The procedure for manual mode operation of the microcassette is described below.

STEP 1

Insert a microcassette as follows. Open the cassette holder by operating the eject lever of the microcassette drive.
Place the microcassette tape in the drive with the open side of the tape facing you and close the holder.

STEP 2

Press the PF1 key while holding down the CTRL key to cause the tape counter value to be displayed in the upper right-hand corner of the LCD screen. The tape counter value displayed will be in the range of −32767 to 32767.

STEP 3

When the microcassette drive enters manual mode, its operations can be controlled by the following keys.

(1) PF1 : Fast forward (FF)
Fast forwards the tape.
(2) PF2 : Slow forward
Advances the tape at about half the speed of the fast forward.
(3) PF3 : STOP
Stops the tape rewind, fast forward or slow forward operation.
(4) PF4 : Rewind
Rewinds the tape at the same speed as fast forward.
(5) PF5 : End of manual mode operation
Causes the cassette to escape from manual mode and return to the original state.
(6) PF6 : Reset
The tape counter will be reset to 00000 when PF6 is input by pressing the PF1 key while holding down the SHIFT key.

6.3.2 Cautions for manual mode operation

(1) While the microcassette is in manual mode, the built-in microprinter will not operate.
(2) Do not employ manual mode operation while write or read operation into the microcassette tape is being performed under software control (i.e., when CAS0: is OPENed at BASIC start-up).
(3) Manual operations should be performed when BASIC or MONITOR are at command level.

6.3.3 Saving, checking, and loading of programmes

Basically, these operations are the same as Programme Save, Check, and Load operations of the external audio cassette tape. Note, however, the following differences. (For details of BASIC commands and statements, refer to the BASIC Reference Manual.)

(1) Programme Save operation
Set the tape in the microcassette drive.
When you do this, BASIC must have been started up and be at command level.

STEP 1

LOGIN the programme area which contains the programme to be saved.

STEP 2

Input a WIND command and press the RETURN key, and the tape will be rewound and the tape counter value will be reset to 00000.

STEP 3

To name the programme, input following programme statement and press the RETURN key. The tape begins to move, indicating that Save has started. At this time, the LED indicator on the microcassette drive lights.
NOTE:
The LED may go out before the prompt sign (">") is displayed. However, this does not mean that Programme Save has been completed.

```
SAVE"CAS0:ABC"_
```

The tape will run for a while and then the prompt sign "≥" will appear on the LCD screen.

```
SAVE"CAS0:ABC"
≥
```

This means that the Programme Save operation has been completed. Check the tape counter value and write down the programme name and the tape counter value on the index card contained in the cassette. (e.g., 0–123 "ABC")

- You can find the tape counter value by either of the following 2 methods.

(a) Using BASIC

Input the programme statement "PRINT TAPCNT" and press the **RETURN** key. The counter value will then be displayed.

```
SAVE"CAS0:ABC"
PRINT TAPCNT_
```

(b) Using manual mode operation

Press the **PF1** key while holding down the **CTRL** key. The counter value will be displayed in the upper right-hand corner of the LCD screen.

(2) Programme Check operation

STEP 1

Rewind the tape to the tape counter value at which Save began.

- Input a WIND 0 command and press the **RETURN** key.
- Rewind the tape by manual mode operation.

```
LOAD?"CAS0:ABC"_
```


STEP 2

Input the following programme statement and press the **RETURN** key.

```
LOAD?"CAS0:ABC"
Searching
```

The message "Searching" will appear on the LCD screen and programme search begins.

```
Searching
Found: ABC
_
```

When the programme is found, the Programme Check operation starts.

STEP 3

The prompt sign will be displayed on the LCD screen and the tape will stop. The Programme Check operation is now completed.

```
Searching
Found: ABC
≥
```

STEP 4

Advance the tape up to the tape counter value at which the Programme Save was terminated. For instance, if Programme Save was completed at tape counter value 123, input a WIND123 command and press the **RETURN** key. This is done to clearly distinguish the programme previously saved from the programme to be saved next.

(3) Programme Load operation

STEP 1

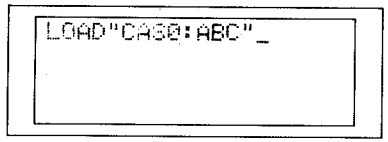
Input a WIND command and press the **RETURN** key.

STEP 2

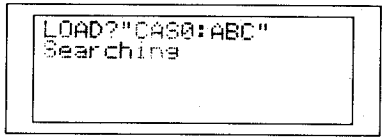
Wind the tape forward to the tape counter value at which the programme to be loaded begins. For example, if the target programme on the tape begins at tape counter value 123, input a WIND123 command and press the **RETURN** key.

STEP 3

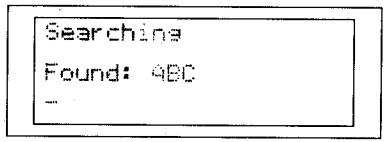
When the prompt sign ">" is displayed on the LCD screen, input the following programme statement and press the **RETURN** key.



Then, programme search begins.

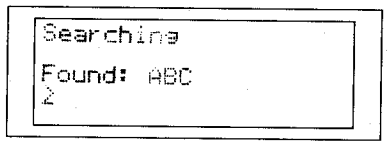


When the programme is found, the following message will be displayed.



STEP 4

The prompt sign ">" is then displayed and the microcassette drive stops, indicating that the Programme Load operation has been completed.



If an I/O error occurs while loading the programme or the programme name cannot be found, return to STEP 2 and repeat the procedure. If the programme loading is still not performed, refer to Section 6.5, If There Are Problems Reading a Cassette.

NOTE:

Before replacing a microcassette tape, always input a WIND command and press the **RETURN** *key to rewind the tape. By so doing, you need not execute a WIND command at the beginning of subsequent Save, Check, or Load operation.*

There may be some error in the tape counter value due to tape elasticity and digital conversion. It is therefore a good practice to leave gaps between files and to start reading before the file start position.

6.4 Write and Read Format for Data

Files stored in a tape are divided into units of a certain fixed length. These units are called blocks and there are three different types of blocks. The 80-byte block at the top of the file is called the header and contains the filename, date of file creation and other data pertinent to the file. Next are the data blocks, each of which is 256 bytes long. As the data is divided into units of 256 bytes, the number of data blocks is determined by the number of bytes of data. Finally, there is the 80-byte EOF (End of file) block which signifies that the file has been read to its end. In order to improve the reliability of the data and file-related information written into the file, each block is written twice.

The speed of data write by BASIC commands SAVE and SAVEM is approx. 64 char/sec. The header block and EOF block each require approx. 8 seconds to write.

6.5 If There Are Problems Reading a Cassette

If the data file cannot be correctly read from the cassette, use the following procedures to obtain a correct data read.

(1) When using the built-in microcassette to read a file written by the microcassette drive.

For data that was originally written into the file using the built-in microcassette, change the data of bits 2 and 3 of address 7E(hex) to 0. (Refer to 9.5 (1) S command for details concerning how to change data.)

1) Call the Monitor.
2) Use the S command to display and change the contents of address 7E (hex). Change the LSD (least significant, or rightmost, digit) of the data displayed according to the following table.

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

NOTE:

There is no need to change the LSD if it is already 0, 1, 2 or 3.

(2) When using the built-in microcassette to read data written by the external cassette.

For data that was originally written by an external audio cassette, change bits 2 and 3 of the data stored in address 7E(hex) to 0. (Use the same procedure as described above for the microcassette.)
If, even after you have executed the above procedure, you are still unable to obtain a correct read from the cassette, change bit 2 to 0 and bit 3 to 1, following the procedure described below.

1) Call the Monitor command S to display and change the contents of address 7E(hex). (As the procedure is essentially the same as for the microcassette, refer to the description above.)
2) Change the LSD of the data displayed by the S command according to the following table.

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

NOTE:
There is no need to change the LSD if it is already 8, 9, A or B.

If neither of the above procedures produces successful results, change the data of both bits 2 and 3 to 1.

1) Call the Monitor S command to change the contents of address 7E(hex).

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

NOTE:
There is no need to change the LSD if it is already C, D, E or F.

(3) Read data using an external audio cassette

If you cannot obtain a correct data read from a cassette (data written using either the built-in microcassette or an external cassette) using an external cassette unit, change bits 0 and 1 of the contents of address 7E(hex) to 0.

1) Display and change the contents of 7E(hex) using the monitor S command. (Refer to the procedure for the microcassete or to 9.5 (1), S command.)
2) Change the LSD of the data displayed by the S command according to the following table.

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

NOTE:
There is no need to change the LSD if it is already 0, 4, 8 or C.

If, even after you have performed the above changes, you still cannot obtain correct data read, change bit 0 to 0 and bit 1 of address 7E(hex) to 1.

1) Call the Monitor command S to confirm and change the contents of 7E(hex). (Refer to the example for the microcassette or to 9.5 (1), S command.)
2) Change the LSD of the data displayed by the S command according to the following table.

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

NOTE:
There is no need to change the LSD if it is already 2, 6, A or E.

If, even after you have performed the above changes, you still cannot obtain satisfactory data read, change both bits 1 and 0 of the contents of address 7E(hex) to 1.

1) Call the monitor command S to confirm and change the contents of 7E(hex).
2) Change the LSD of the data displayed by the S command according to the following table.

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.

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.