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RENESAS

User's Manual

IE-78000-R

IN-CIRCUIT EMULATOR

Document No. U11376EJ7V1UM00 (7th edition)
(Previous No. EEU-1398)
Date Published May 1997 N

Phase-out/Discontinued

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M7A 96.10

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- Availability of related technical literature
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Chapter 1

Overview

The IE-78000-R in-circuit emulator is a development tool to efficiently debug the hardware and software of an application system using 78K/0 series products when combined with the optional emulation board.

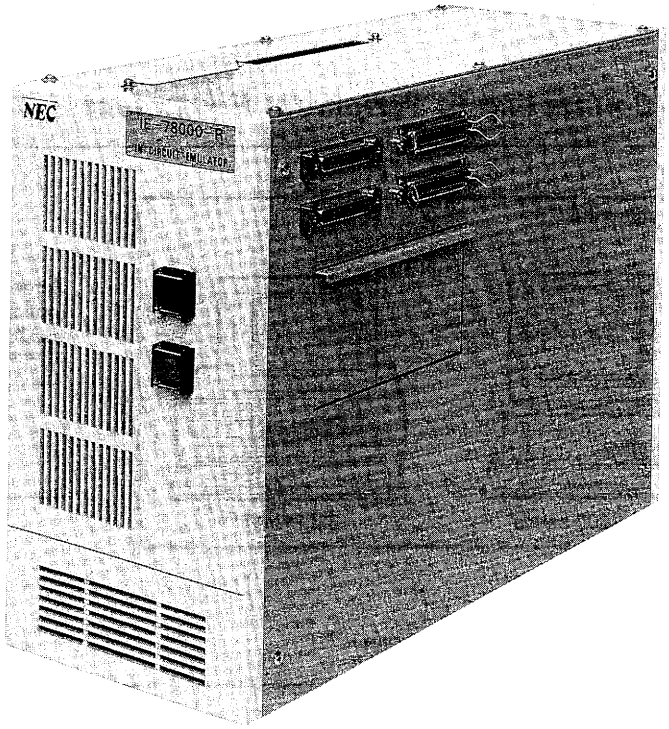
Organization of this chapter

1.1 Features

The IE-78000-R is superior because it:

- Enables real-time execution and real-time trace.
- Has many break and trace functions.
- Can output the contents of the tracer without stopping the emulation CPU.
- Can search data in the real-time tracer.
- Can perform symbolic debugging.
- Can perform online assembling and disassembling.
- Can input 8-bit trace data using the external sense clips.
- Can output access event triggers using external sense clips.
- Can output 8-bit data at a specified address in real time using external sense clips.
- Contains emulation memory (49 bits x 2K steps).
- Is available for any package using an optional emulation probe.
- Can be used as an emulator for other 78K-series by replacing the emulation board with the optional one.
- Can download load module, object, and symbol files at high speed using a parallel interface. (Ten times faster than downloading using the RS-232-C interface)

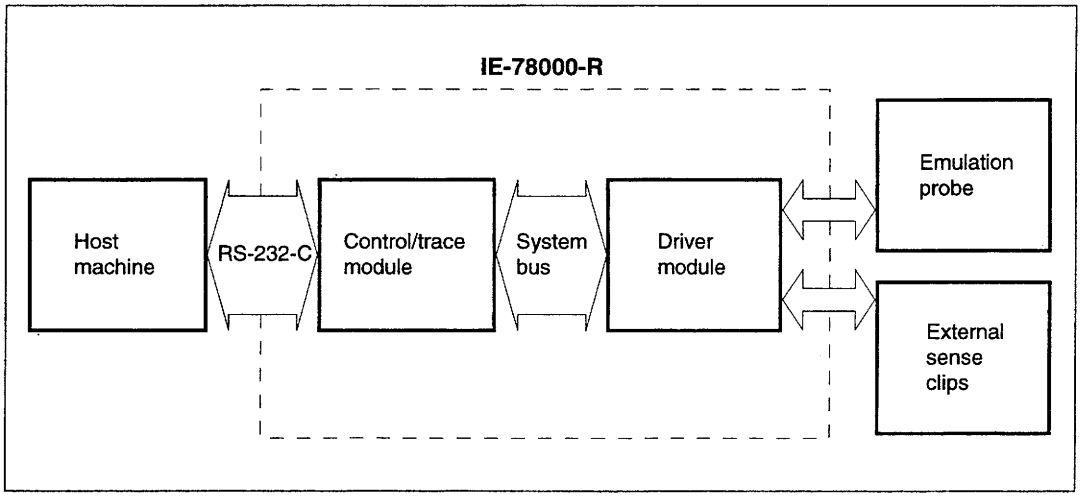
Photo 1-1. IE-78000-R



1.2 Hardware Configuration

Figure 1-1 shows the basic hardware configuration of the IE-78000-R.

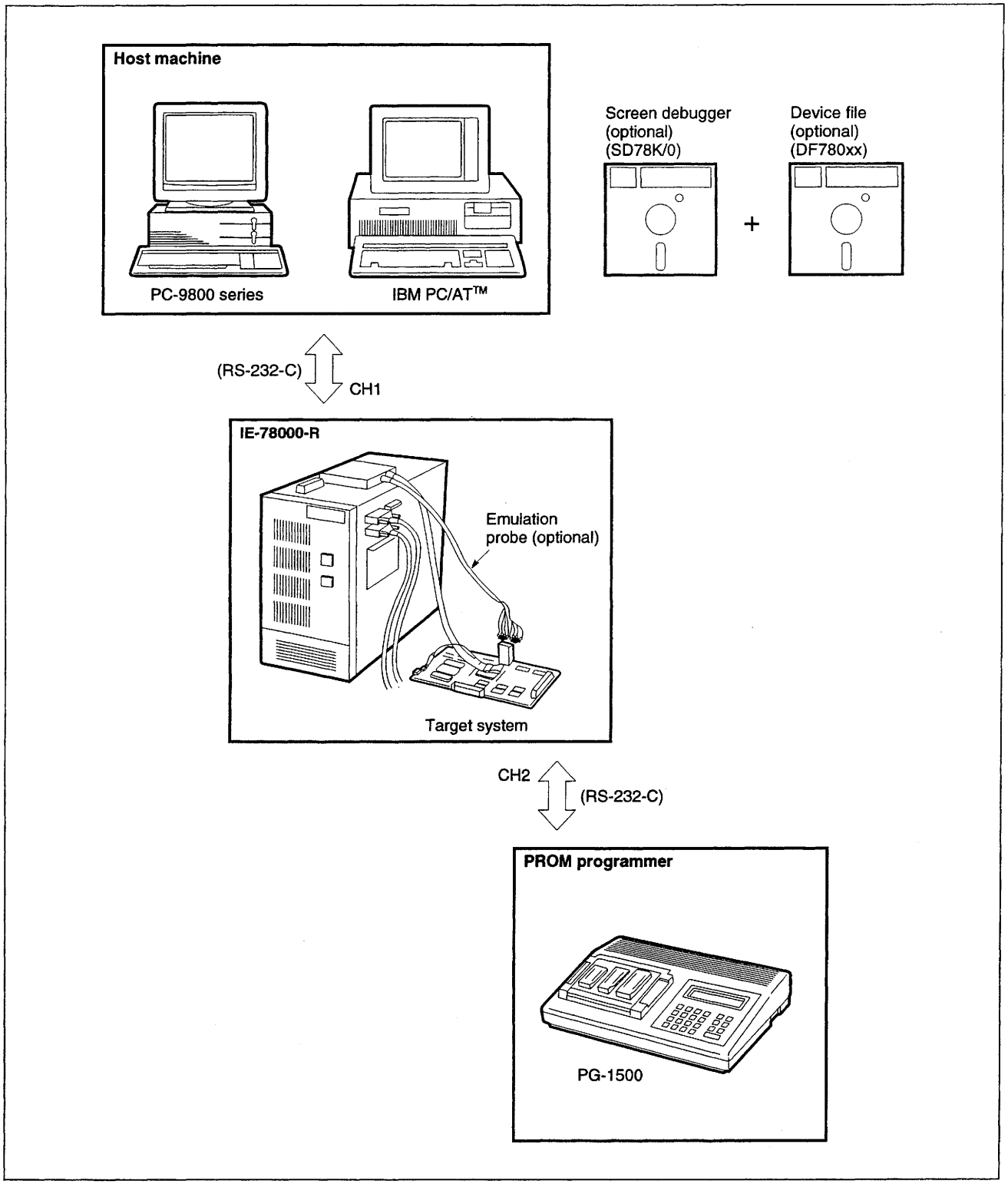
Figure 1-1. IE-78000-R Hardware Configuration



1.3 System Configuration

The IE-78000-R is connected to peripheral equipment to configure the system.

Figure 1-2. Connecting to Peripheral Equipment



1.4 Procedure for Setting up the System

Configure the system as follows:

<1> **Mount the monitor ROM supplied with the optional screen debugger on the control/trace board.** (See the procedure of mounting on the next page.)

<2> **Connect the emulation board.** (Refer to **the emulation board user's manual**.)

Connect the optional emulation board for the target device to the break board and secure them with screws.

<3> **Set the user clock.** (See **Chapter 3** when the user clock is set.)

When using the user clock, mount the clock on the break board of the IE-78000-R or the optional emulation board using a component block.

<4> **Connect the emulation board to the connector board.** (Refer to **the emulation board user's manual**.)

Connect the connector board attached to the optional emulation probe to the emulation board (optional).

<5> **Connect the cables supplied with the IE-78000-R.** (See **Chapter 2**.)

Connect the power cable and interface cable.

<6> **Connect the peripheral equipment to the IE-78000-R.** (See **Chapter 4**.)

- Host machine (PC-9800 series or IBM PC/AT)
- PROM programmer (if necessary)
- Printer (if necessary)

<7> **Connect the target system.** (See **Chapter 5**.)

Connect the target system to the emulation probe (optional).

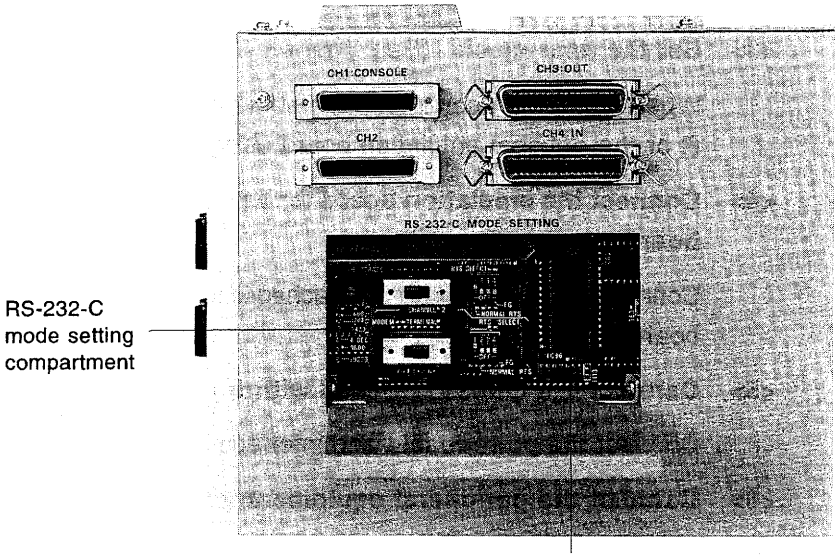
Remark For efficiency, it is recommended that steps **<2>**, **<3>**, and **<4>** be performed at a time because these procedures are done with the upper cover of the IE-78000-R open.

- **Mounting monitor ROM on the control/trace board**

<Procedure>

<1> Open the cover of the RS-232-C mode setting compartment on a side of the IE-78000-R.

Photo 1-2. RS-232-C Mode Setting Compartment

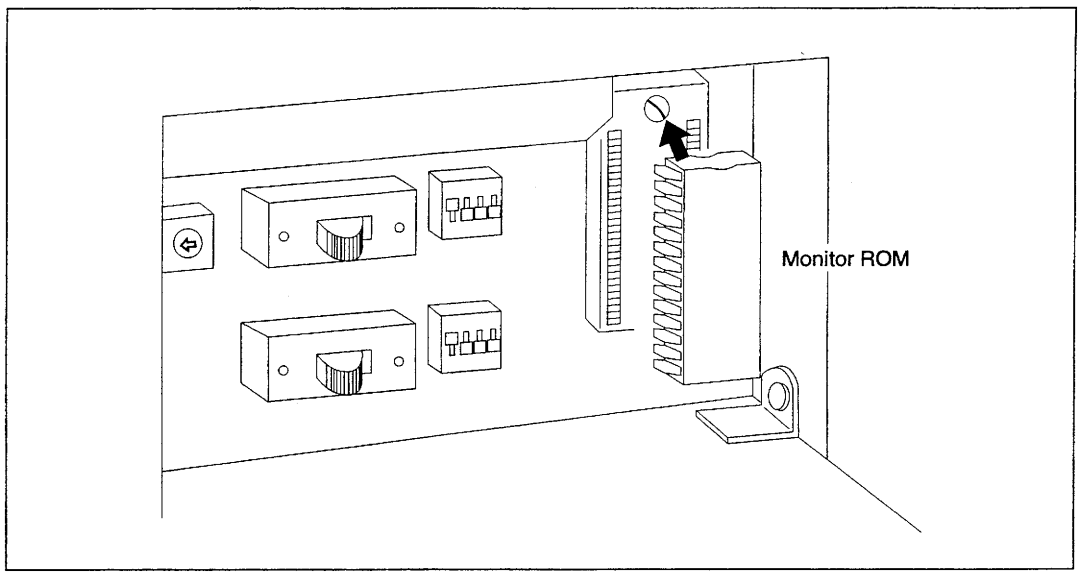


<2> To loosen the screws on the upper part of the socket, turn them counterclockwise with a flat-blade screwdriver.

<3> Next, mount the monitor ROM (S78K0/IC86/Vx.x) supplied with the optional screen debugger on IC86.

Caution **If the ROM is inserted in the wrong direction, it is damaged. Insert the ROM to the socket with the round notch facing up.**

Figure 1-3. Mounting Monitor ROM



<4> Turn the screws of the upper part of the socket clockwise with the screwdriver to tighten.

<5> Close the cover of the RS-232-C mode setting compartment on a side of the IE-78000-R.

1.5 Target Devices

The IE-78000-R can emulate the all products of the 78K/0 series by incorporating the optional emulation board.

* *Table 1-1. Emulation Board and Its Target Device*

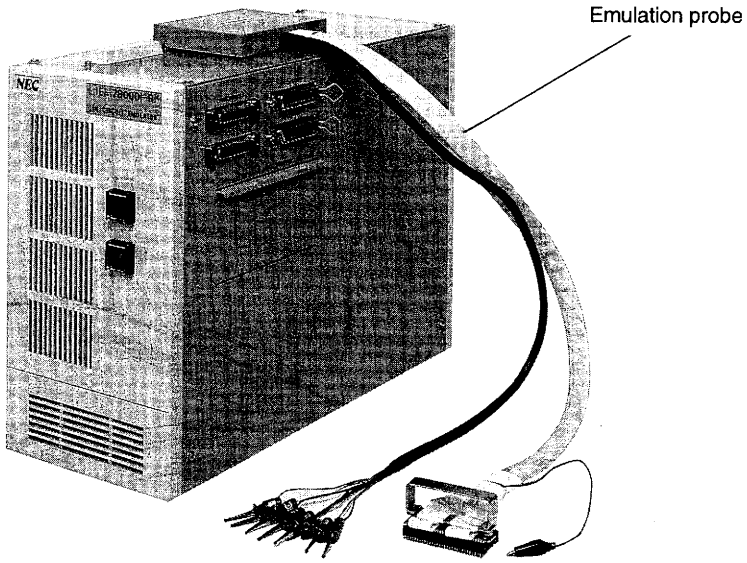
Emulation board	Target device	
IE-78014-R-EM	μPD78002 sub-series	μPD78001B, μPD78002B, μPD78001B(A), μPD78002B(A)
	μPD78002Y sub-series	μPD78001BY, μPD78002BY
	μPD78014 sub-series	μPD78011B, μPD78012B, μPD78013, μPD78014, μPD78P014, μPD78011B(A), μPD78012B(A), μPD78013(A), μPD78014(A)
	μPD78014Y sub-series	μPD78011BY, μPD78012BY, μPD78013Y, μPD78014Y, μPD78P014Y
IE-78014-R-EM-A	μPD78018F sub-series	μPD78011F(Note), μPD78012F(Note), μPD78013F(Note), μPD78014F(Note), μPD78015F(Note), μPD78016F(Note), μPD78018F(Note), μPD78P018F(Note)
	μPD78018FY sub-series	μPD78011FY(Note), μPD78012FY(Note), μPD78013FY(Note), μPD78014FY(Note), μPD78015FY(Note), μPD78016FY(Note), μPD78018FY(Note), μPD78P018FY(Note)
IE-78044-R-EM	μPD78024 sub-series	μPD78023, μPD78024, μPD78P024(Note)
	μPD78044 sub-series	μPD78042, μPD78043, μPD78044, μPD78P044
	μPD78044A sub-series	μPD78042A, μPD78043A, μPD78044A, μPD78045A, μPD78P048A(Note)
IE-78064-R-EM	μPD78054 sub-series	μPD78052, μPD78053, μPD78054, μPD78P054, μPD78055, μPD78056, μPD78058, μPD78P058
	μPD78054Y sub-series	μPD78052Y, μPD78053Y, μPD78054Y, μPD78055Y, μPD78056Y, μPD78058Y(Note), μPD78P054Y(Note), μPD78P058Y(Note)
	μPD78064 sub-series	μPD78062, μPD78063, μPD78064, μPD78P064
	μPD78064Y sub-series	μPD78062Y(Note), μPD78063Y(Note), μPD78064Y(Note), μPD78P064Y(Note)
IE-78078-R-EM	μPD78078 sub-series	μPD78074(Note), μPD78075(Note), μPD78076, μPD78078(Note), μPD78P078(Note)
	μPD78078Y sub-series	μPD78074Y(Note), μPD78075Y(Note), μPD78076Y(Note), μPD78078Y(Note), μPD78P078Y(Note)
	μPD78083 sub-series	μPD78081(Note), μPD78082(Note), μPD78P083(Note)
IE-78098-R-EM	μPD78098 sub-series	μPD78094, μPD78095, μPD78096, μPD78098A(Note), μPD78P098A(Note)
IE-780208-R-EM	μPD780208 sub-series	μPD780204(Note), μPD780205(Note), μPD78P0208(Note)

(Note) Under development

1.6 Emulation Probes

In addition to the IE-78000-R, the emulation probe must be purchased separately. When ordering, specify the correct type according to the package of the target device.

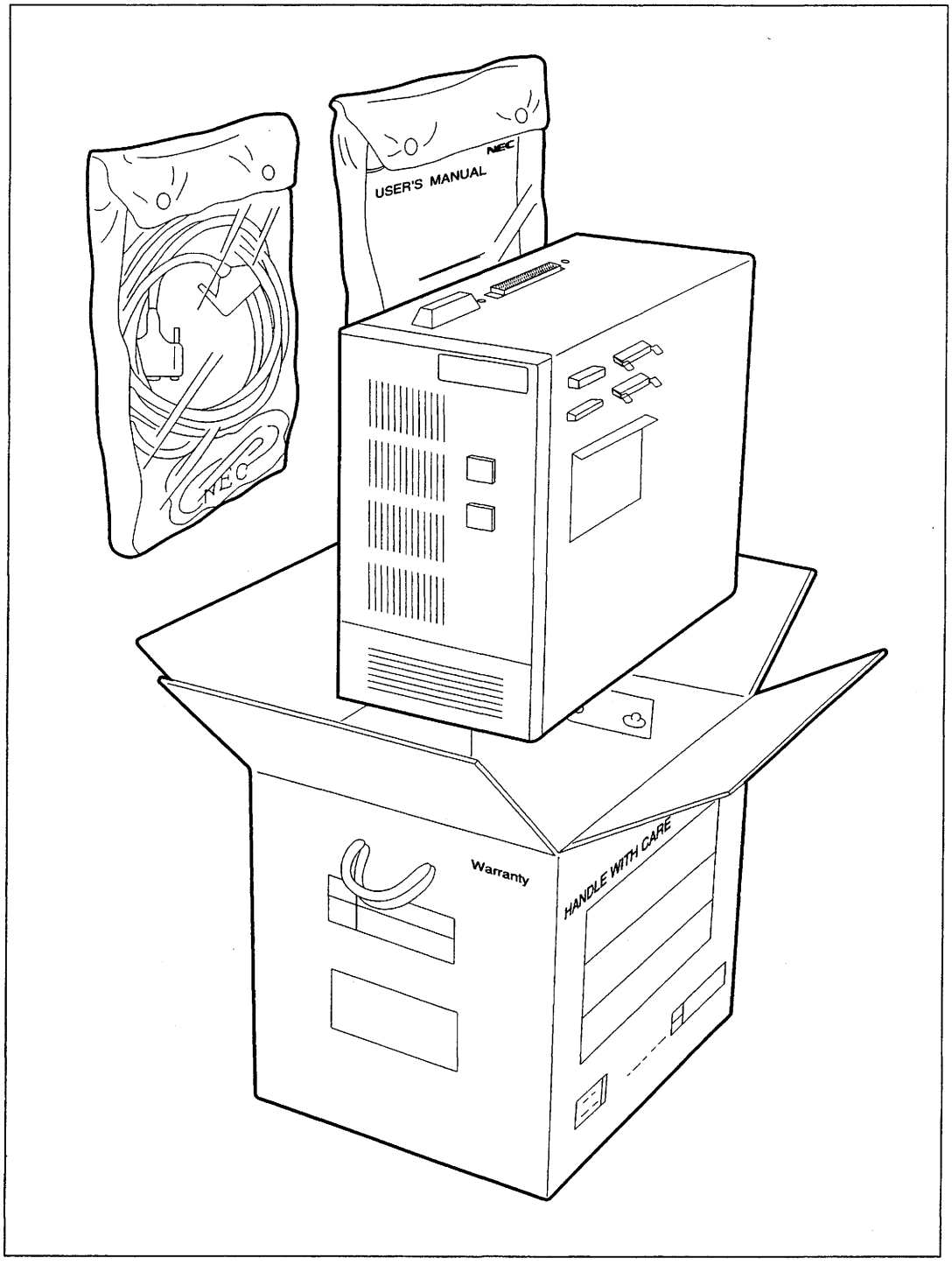
Photo 1-3. Emulation Probe



1.7 Checking the Contents of the Package

The IE-78000-R main unit and accessory bags are packed in a box. Two boards are installed in the main unit. In the accessory bags, this manual, cables, component blocks, and other accessories are packed. Check the contents of the package according to this section. Contact an NEC salesperson or authorized dealers if anything is missing or broken.

Figure 1-4. Checking the Contents of the Package



(1) Checking the boards

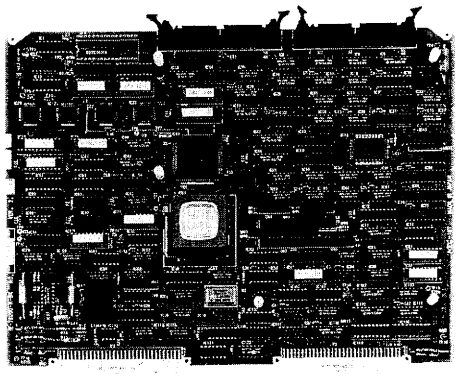
Two boards are installed in the IE-78000-R. Remove the six screws from the top of the main unit, open the cover, and check them.

(a) Break board: 1

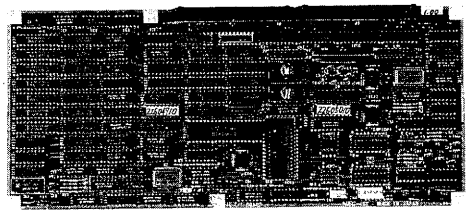
(b) Control/trace board (fixed in the IE-78000-R): 1

Photo 1-4. Boards

(a) Break board



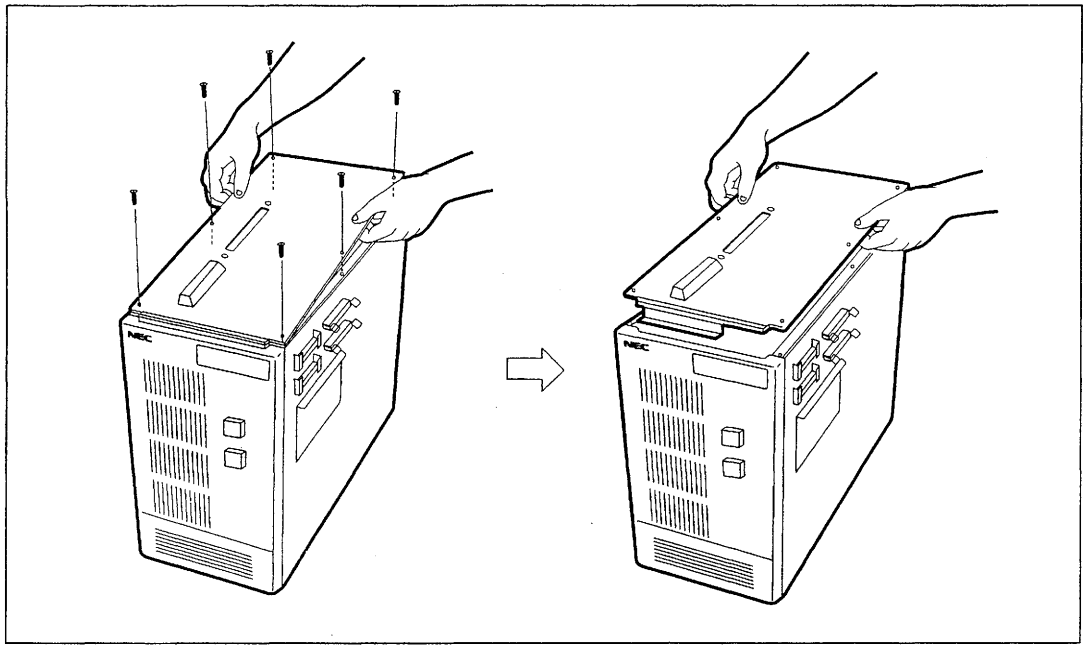
(b) Control/trace board



<Procedure>

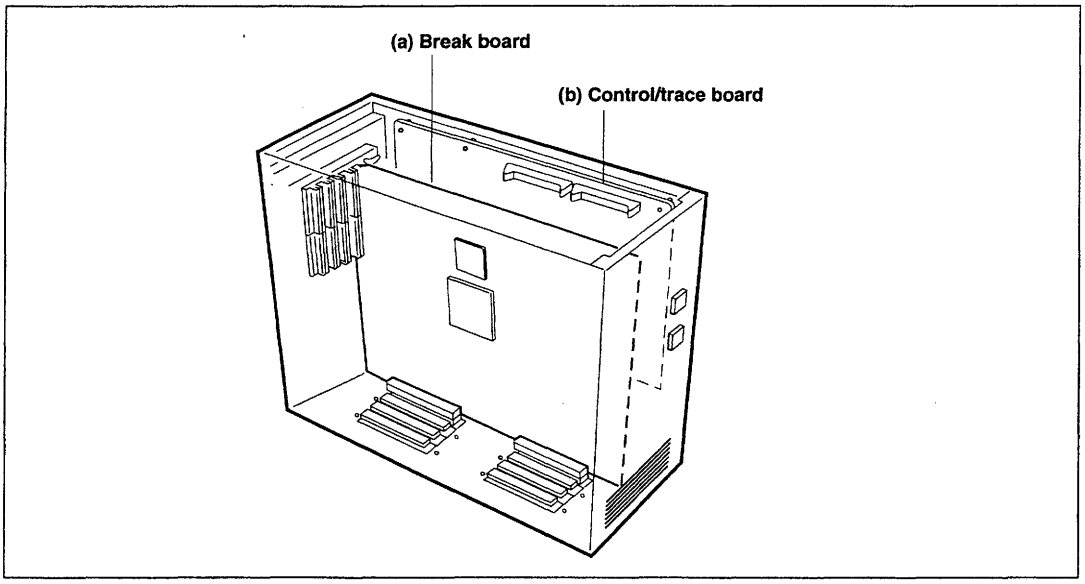
<1> Remove the six screws from the top of the main unit and open the cover.

Figure 1-5. Top View of the Main Unit



<2> Confirm that the boards are installed as follows.

Figure 1-6. Location of the Boards



Caution **After checking boards, take the break board, and secure the optional emulation board with screws. (Refer to the emulation board user's manual.)**

(2) Checking the accessories

Two accessory bags are packed in the box. Confirm that the following accessories are packed. (See **Photo 1-5**.)

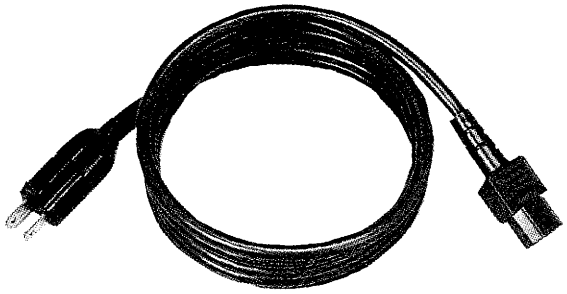
(a)	User's Manual (this manual):	1
(b)	100-VAC power cable with an AC adapter:	1
(c)	200-VAC power cable(Note 1):	1
(d)	RS-232-C interface cable:	1
(e)	Ground lead:	1
(f)	Spare fuse:	1
(g)	14-pin component block(Note 2):	2
(h)	Accessory list:	1
(i)	Warranty:	1
(j)	Packing list:	1

(Note 1) The IE-78000-R operates on either 100 VAC or 200 VAC. Use the proper power cable according to the line voltage.

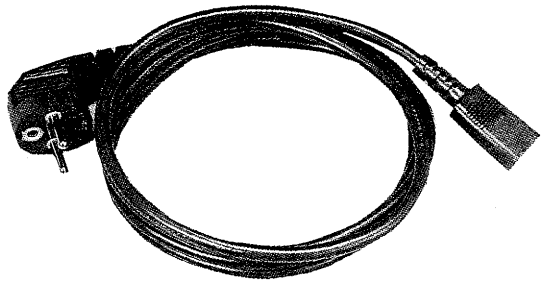
(Note 2) The component blocks are used when setting the user clock, if necessary.

Photo 1-5. Accessories

(b) 100-VAC power cable

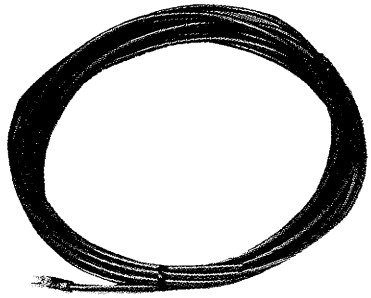


(c) 200-VAC power cable

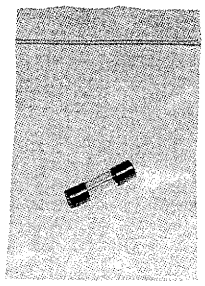


(d) RS-232-C interface cable

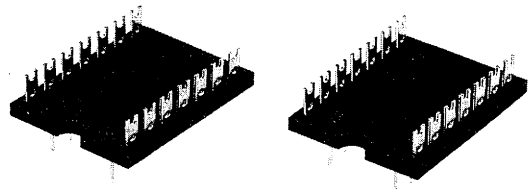
(e) Ground lead



(f) Spare fuse



(g) 14-pin component block(Note)



(Note) The provided component blocks have covers.

Chapter 2

Nomenclature and Function of Each Part

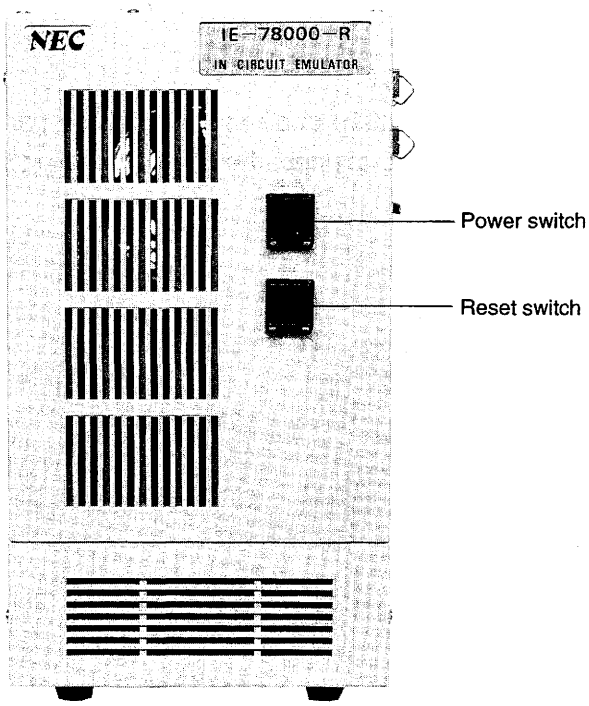
This chapter explains the nomenclature and function of each part of the IE-78000-R, how to set the switches, and how to connect the cables supplied with the IE-78000-R.

Organization of this chapter

2.1 Nomenclature and Function of Each Part of the Main Unit

(1) Front

Photo 2-1. Front View of the IE-78000-R



- **Power switch**

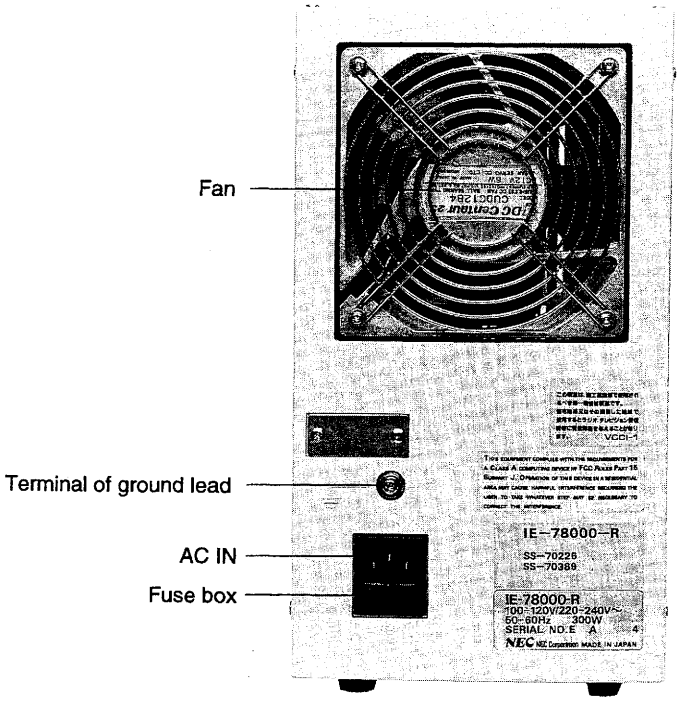
  Turns the power on and off.

- **Reset switch**

  Resets the IE-78000-R.

(2) Rear

Photo 2-2. Rear View of the IE-78000-R



- **Fan**

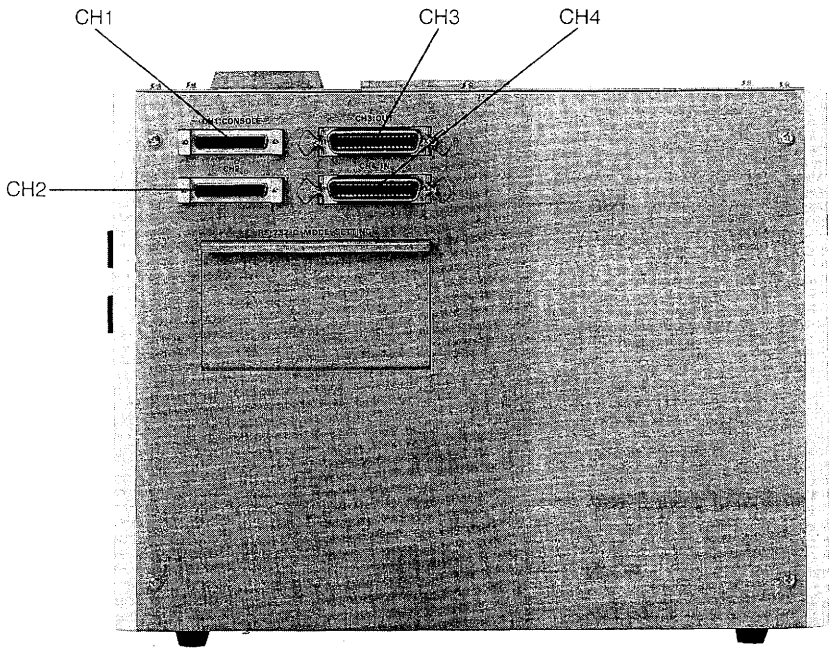
  Cools the inside of the cabinet.

- **AC IN**

  Supplies power by connecting the power cable to it.

(3) Side

Photo 2-3. Right Side of the IE-78000-R (1)



- **CH1 (I/O)**

  Used for connecting the host machine using the RS-232-C interface cable.

- **CH2 (I/O)**

  Used for connecting a PROM programmer (PG-1500) using the RS-232-C interface cable.

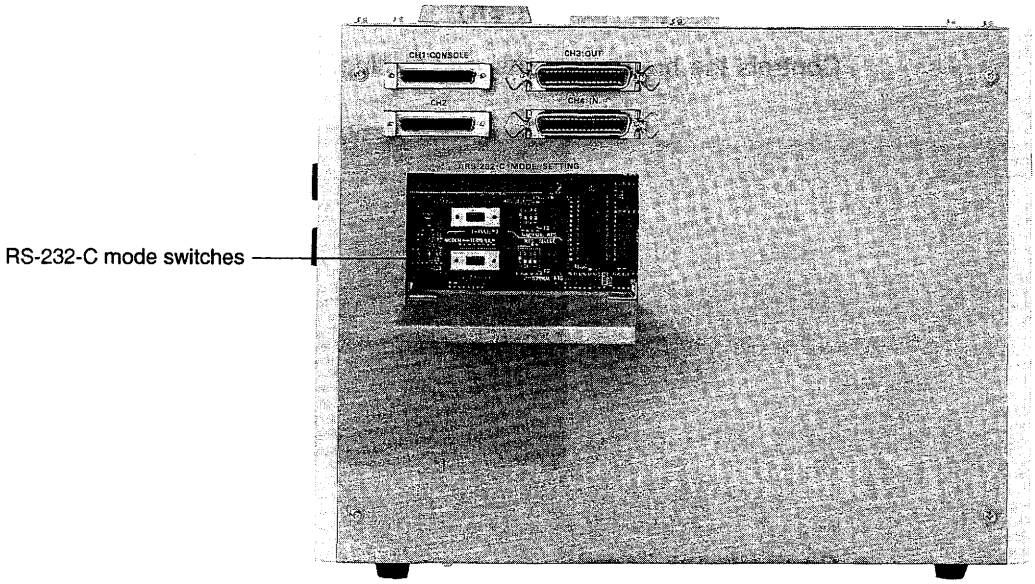
- **CH3 (output only)**

  Used for outputting data input in CH4 as is (through the output terminal).

- **CH4 (input only)**

  Used to execute high-speed download from the host machine using a parallel interface cable.

Photo 2-4. Right Side of the IE-78000-R (2)



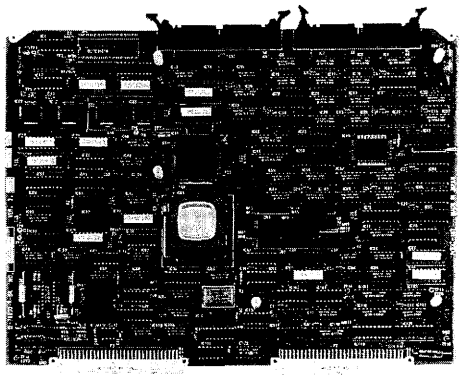
- **RS-232-C mode switches**

  Used for switching the modem/terminal mode, selecting RTS/FG, and setting the baud rate.

(4) Boards

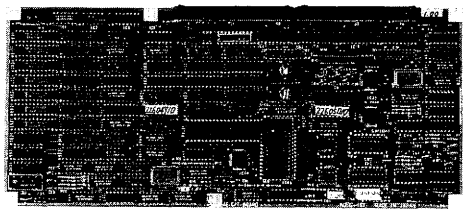
- **Break board (IE-78000-R-BK)**

  Controls the breaks, events, and tracing.



- **Control/trace board**

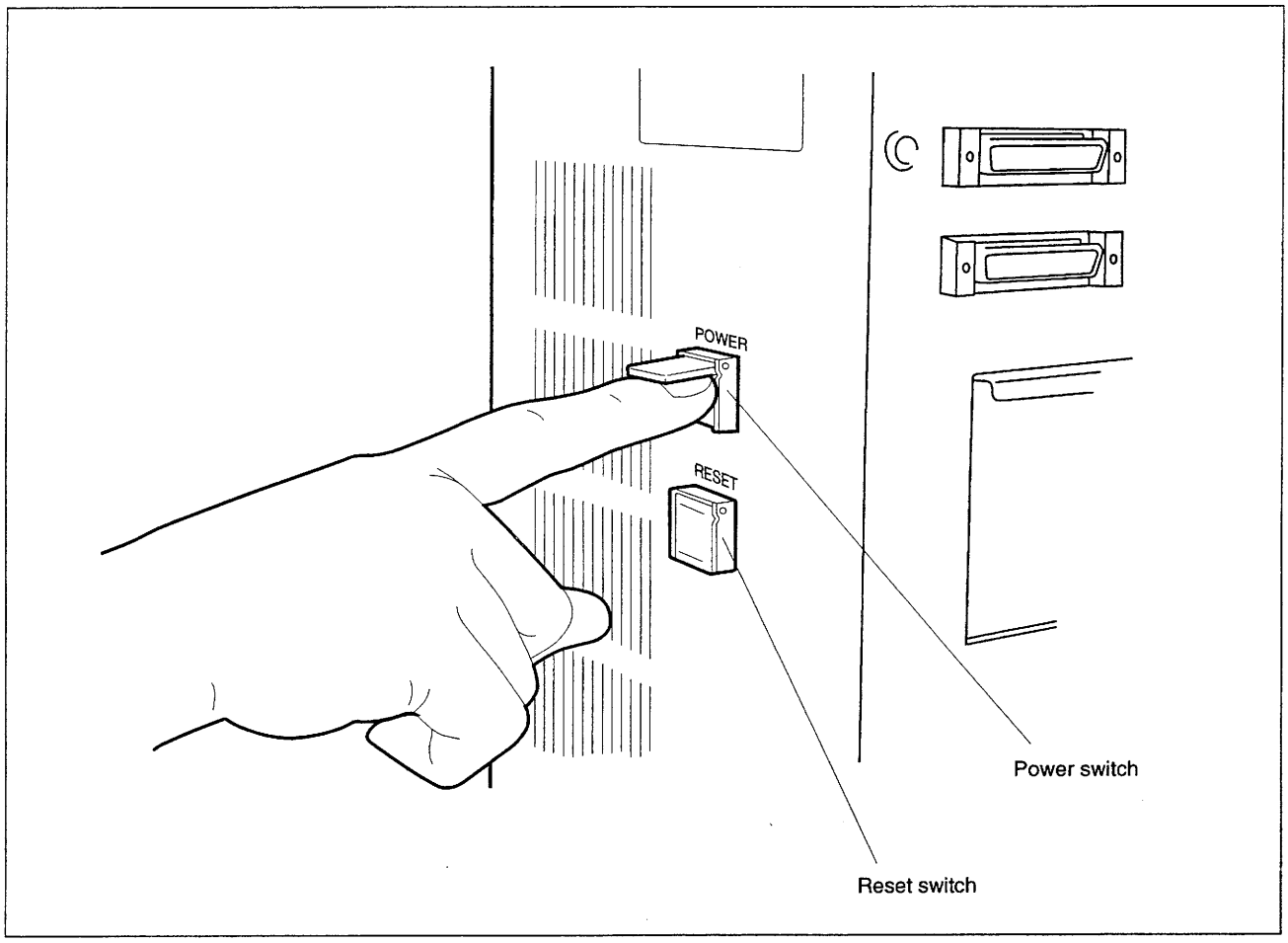
  Controls the entire IE-78000-R.



2.2 Setting the Switches

(1) Power switch and reset switch

Figure 2-1. Power Switch and Reset Switch



- **Power switch**
  - This is a pushbutton switch.
  - Setting

    Power-on: Press this switch once. The power-on LED goes on.

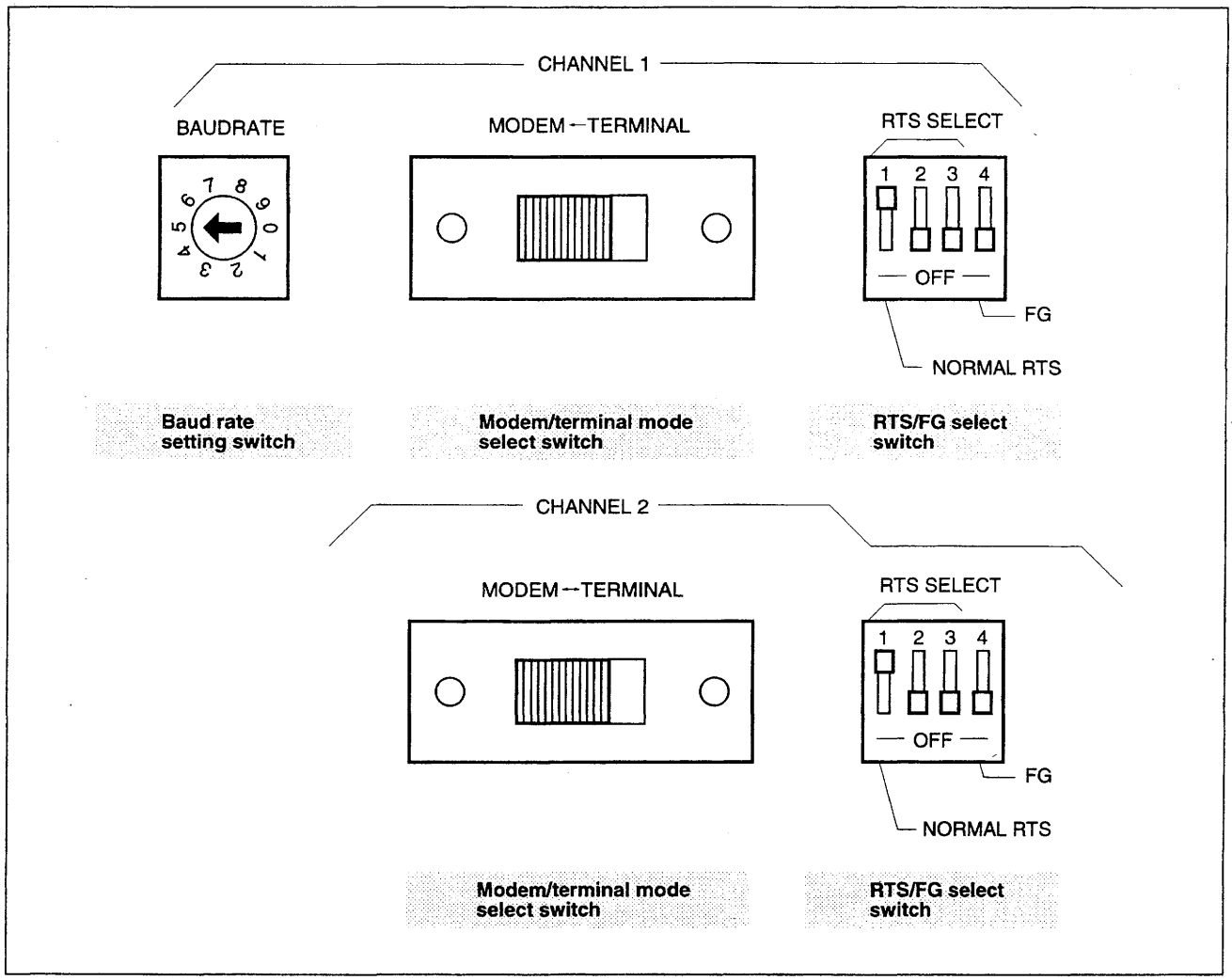
    Power-off: Press this switch once. The LED goes off.
- **Reset switch**
  - This is a pushbutton switch.
  - Setting

    Reset: Press this switch once to reset the IE-78000-R.

(2) RS-232-C mode switches

Open the RS-232-C mode switch cover on the right side of the main unit. (See **Figure 2-2.**) The setting modes depend on each of the peripheral equipment. For details, see **Chapter 4**.

Figure 2-2. RS-232-C Mode Switches



- **Modem/terminal mode select switch** (channels 1 and 2)
  - This is a slide switch.
  - This switch is factory-set to the modem mode.
  - Setting

    Modem mode: Slide the switch from right to left.

    Terminal mode: Slide the switch from left to right.

- **RTS/FG select switch** (channels 1 and 2)
  - This is a DIP switch.
  - This switch consists of switches 1 to 4.
  - Slide the switches upward to set them to ON. Slide the switches downward to set them to OFF.
  - The switches are factory-set as follows:

    1: ON

    2 and 3: OFF

    4: OFF
  - Setting

    To select RTS: Set switches 1 to 3 as follows:

    1: ON

    2 and 3: OFF

    To put the FG in the open state: Set switch 4 to OFF.

- **Baud rate setting switch** (channel 1)
  - This is a micro DIP switch.
  - This switch has 10 positions (0 to 9).
  - Turn the switch clockwise or counterclockwise to set the baud rate.
  - This switch is factory-set to position 5 (9600 bps).
  - Setting

    9600 bps: Set the switch to position 5.

Cautions 1. This switch is used to set the baud rate of channel 1. To set the baud rate of channel 2, use a software command. For details, see Section 4.5 and refer to MOD command in *User's Manual: Reference* that comes with the optional screen debugger.

2. Position 7, which corresponds to 0 bps, must not be used.

2.3 Connecting the Cables Supplied with the IE-78000-R

- **Location**

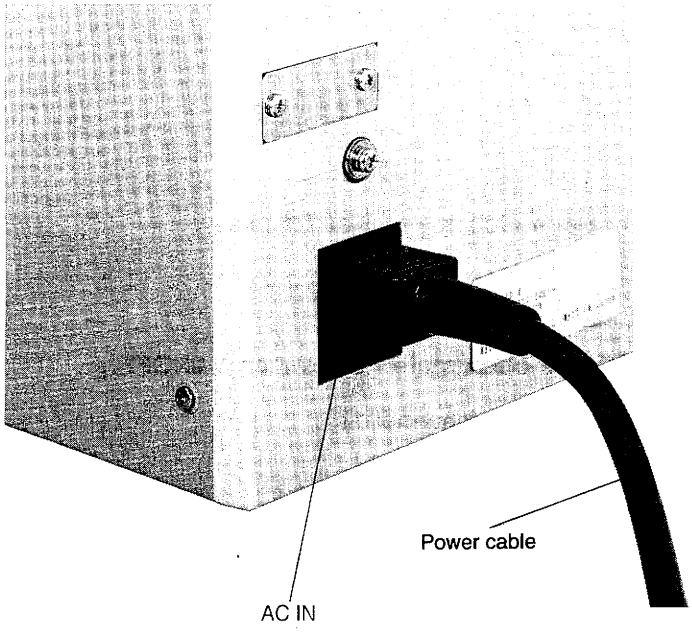
Install the IE-78000-R in a place satisfying the following conditions:

- A place which is free from dust
- Where no obstructions are placed near the air intake

(1) Power cable

Connect the power cable to the AC IN jack on the rear of the IE-78000-R main unit.

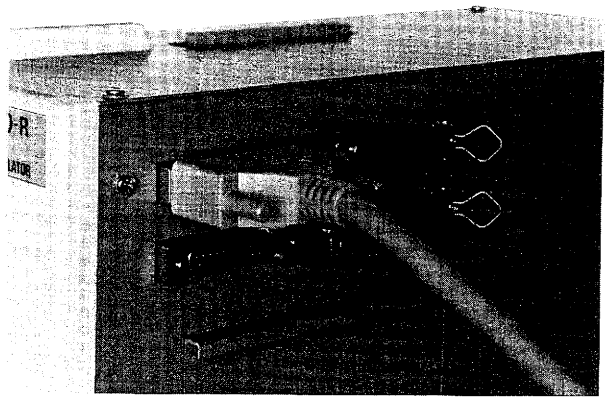
Photo 2-5. Connecting the Power Cable



(2) RS-232-C interface cable

Connect the RS-232-C interface cable to the CH1 or CH2 serial interface port on the right side of the IE-78000-R main unit.

Photo 2-6. Connecting the RS-232-C Interface Cable



(3) Parallel interface cable

Connect a parallel interface cable to the CH3 or CH4 parallel interface port on the right side of the IE-78000-R main unit.

Photo 2-7. Connecting a Parallel Interface Cable

[MEMO]

Phase-out/Discontinued

Chapter 3

Clock Setting

This chapter describes the setting of the main system clock and subsystem clock.

Organization of this chapter

3.1 Outline of Clock Setting

The main system clock to be used for debugging can be selected from (1) to (3), below. The subsystem clock can be selected from (2) and (3).

(1) Clock provided on the board(Note)

(2) Clock mounted by the user

(3) External clock

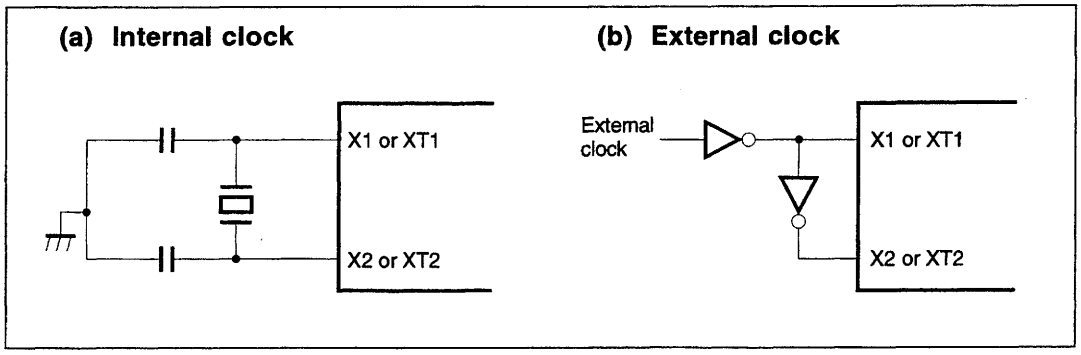
(Note) Break board or emulation board

When an internal clock is provided in the target system, select the clock provided on the board (1) or that mounted by the user (2). An internal clock is a clock generated by an oscillation circuit in the target device, with a resonator connected. **Figure 3-1 (a)** shows the external circuit for an internal clock. The resonator provided by the target system is, however, not used during emulation. The clock mounted on the break board or emulation board installed in the IE-78000-R is used instead.

When an external clock is configured in the target system, select the external clock (3). An external clock is a clock that is externally supplied to the target device. When an external clock is used, the oscillation circuit in the target device is not used. **Figure 3-1 (b)** shows the external circuit for an external clock.

Caution No oscillator for the subsystem clock is provided on the break or emulation board. To use the subsystem clock, therefore, the user must mount a clock on the break board or use an external clock.

Figure 3-1. External Circuit for System Clock Oscillator



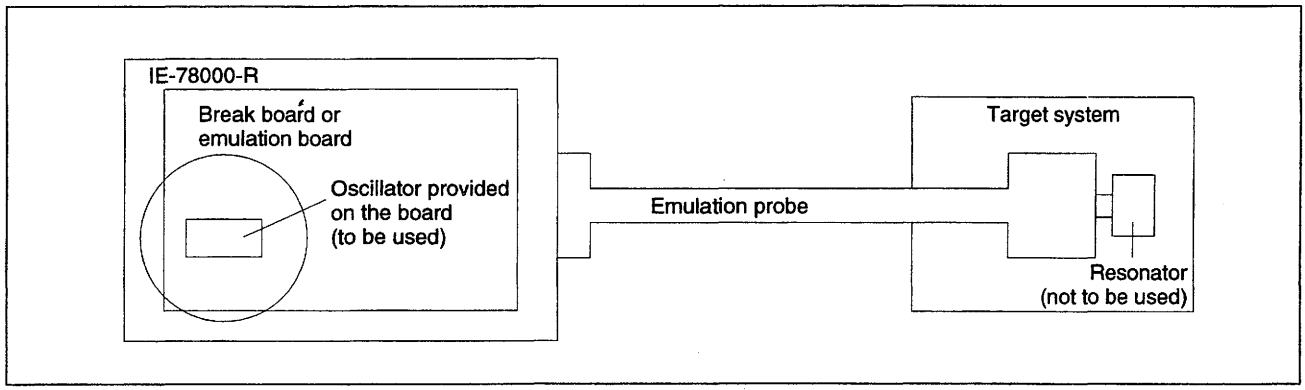
(1) Clock provided on the board

A crystal oscillator is provided on the break or emulation board. The frequency of the oscillator varies with the target device.

Table 3-1. Main System Clock Frequency *

Target device	Clock frequency	Mounted on
μPD78002 sub-series	8.38 MHz	Break board
μPD78002Y sub-series		
μPD78014 sub-series		
μPD78014Y sub-series		
μPD78018F sub-series		
μPD78018FY sub-series		
μPD78024 sub-series	4.19 MHz	
μPD78044 sub-series		
μPD78044A sub-series		
μPD780208 sub-series		
μPD78054 sub-series	5.0 MHz	Emulation board
μPD78054Y sub-series		
μPD78064 sub-series		
μPD78064Y sub-series		
μPD78078 sub-series		
μPD78078Y sub-series		
μPD78083 sub-series		
μPD78098 sub-series	6.0 MHz	

Figure 3-2. When Using the Clock Provided on the Board



Remark The clock output by the oscillator (indicated by the circle in the figure) on the board is used.

(2) Clock mounted by the user

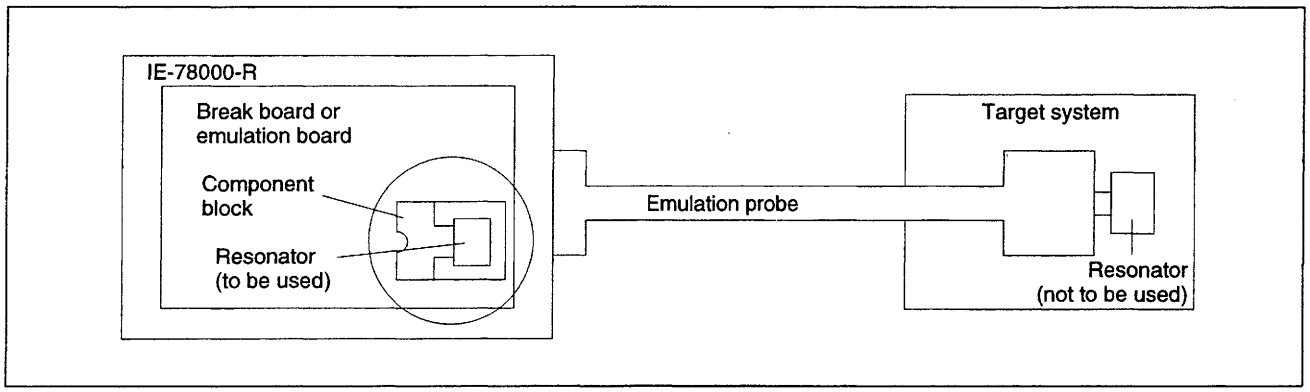
The user can mount a clock on a break or emulation board, to suit the user's system specifications.

Mount a resonator on a component block, then mount the component block on the break or emulation board. This is useful when debugging the system at a frequency other than that of the clock that is already mounted on the board. Whether a clock needs to be mounted on the break board or emulation board depends on the target device.

* ***Table 3-2. User Clock Setting***

<table>
<tr><th rowspan="2">Target device</th><th colspan="2">Main system clock</th><th colspan="2">Subsystem clock</th></tr>
<tr><th>X1 (MAIN) socket on break board</th><th>X1 (USRCLK) socket on emulation board</th><th>X2 (SUB) socket on break board</th><th>Emulation board</th></tr>
<tr><td>μPD78002 sub-series</td><td rowspan="6">Configure an oscillation circuit.</td><td rowspan="6">No setting is required.</td><td rowspan="14">Configure an oscillation circuit.</td><td rowspan="14">No setting is required.</td></tr>
<tr><td>μPD78002Y sub-series</td></tr>
<tr><td>μPD78014 sub-series</td></tr>
<tr><td>μPD78014Y sub-series</td></tr>
<tr><td>μPD78018F sub-series</td></tr>
<tr><td>μPD78018FY sub-series</td></tr>
<tr><td>μPD78024 sub-series</td><td rowspan="13">Short pins 6 and 8.</td><td rowspan="13">Configure an oscillation circuit.</td></tr>
<tr><td>μPD78044 sub-series</td></tr>
<tr><td>μPD78044A sub-series</td></tr>
<tr><td>μPD780208 sub-series</td></tr>
<tr><td>μPD78054 sub-series</td></tr>
<tr><td>μPD78054Y sub-series</td></tr>
<tr><td>μPD78064 sub-series</td></tr>
<tr><td>μPD78064Y sub-series</td></tr>
<tr><td>μPD78078 sub-series</td></tr>
<tr><td>μPD78078Y sub-series</td></tr>
<tr><td>μPD78083 sub-series</td><td>No setting is required.</td></tr>
<tr><td>μPD78098 sub-series</td><td>Configure an oscillation circuit.</td></tr>
</table>

Figure 3-3. When Using the Clock Mounted by the User

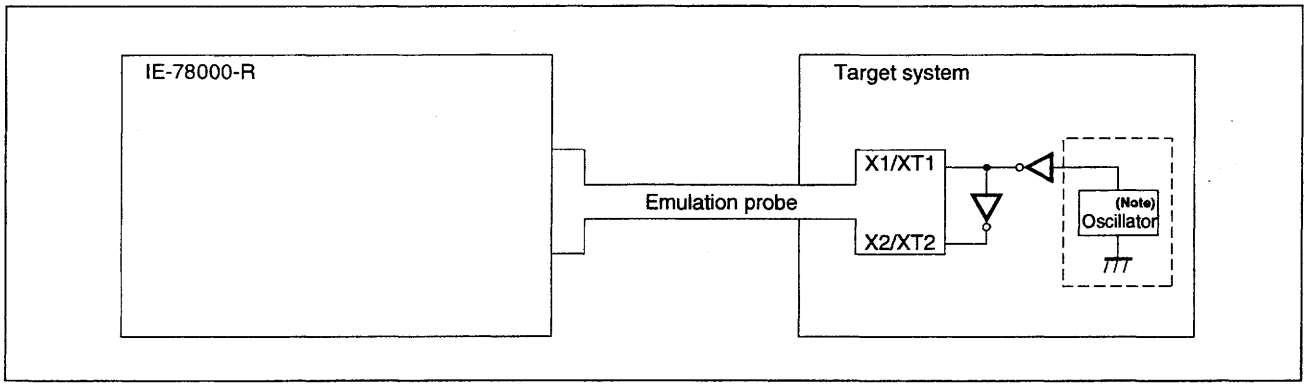


Remark The clock output by the resonator (indicated by the circle in the figure) on the board is used.

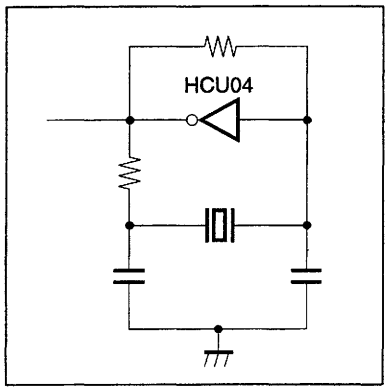
(3) External clock

An external clock in the target system can be used via the emulation probe.

Figure 3-4. When Using an External Clock



(Note) The following shows an example of the circuit enclosed with broken lines in the above figure:



Remark The clock output by the external oscillator in the target system is used.

Settings necessary for the main system clock

The following tables list the settings necessary for the main system clock for each emulation board.

* **(1) For the IE-78014-R-EM and IE-78014-R-EM-A**

Main system clock frequency to be used		X1 (MAIN) socket on IE-78000-R-BK	IE-78014-R-EM IE-78014-R-EM-A	Clock setting for screen debugger
When using the clock provided on the break board	8.38 MHz	Short pins 6 and 8.	No setting is required.	IE
When using the clock mounted by the user	Other than 8.38 MHz	Configure an oscillation circuit.		USER
When using an external clock		Short pins 6 and 8.		

* **(2) For the IE-78044-R-EM and IE-780208-R-EM**

Main system clock frequency to be used		X1 (MAIN) socket on IE-78000-R-BK	IE-78044-R-EM, IE-780208-R-EM		Clock setting for screen debugger
			X1 (USRCLK) socket	JP1	
When using the clock provided on the break board	4.19 MHz	Short pins 6 and 8.	Short pins 6 and 8.	Short pins 2 and 3 (Fx x 2 side).	IE
When using the clock mounted by the user	Other than 4.19 MHz		Configure an oscillation circuit.		USER
When using an external clock			Short pins 6 and 8.		

* **(3) For the IE-78064-R-EM and IE-78078-R-EM**

Main system clock frequency to be used		X1 (MAIN) socket on IE-78000-R-BK	IE-78064-R-EM, IE-78078-R-EM		Clock setting for screen debugger
			X1 (USRCLK) socket	JP1	
When using the clock provided on the emulation board	5.0 MHz	Short pins 6 and 8.	Short pins 6 and 8.	Short pins 1 and 2 (AUTO).	IE
When using the clock mounted by the user	Other than 5.0 MHz		Configure an oscillation circuit.		USER
When using an external clock			Short pins 6 and 8.		

(4) For the IE-78098-R-EM

Main system clock frequency to be used		X1 (MAIN) socket on IE-78000-R-BK	IE-78098-R-EM		Clock setting for screen debugger
			X1 (USRCLK) socket	JP1	
When using the clock provided on the emulation board	6.0 MHz	Short pins 6 and 8.	Short pins 6 and 8.	Short pins 1 and 2 (AUTO).	IE
When using the clock mounted by the user	Other than 6.0 MHz		Configure an oscillation circuit.		USER
When using an external clock			Short pins 6 and 8.		

Caution Turn off the power to the IE-78000-R before setting JP1 to switch between the clock on the emulation board and that in the socket.

Remark

Board	Factory setting for main system clock	Compatible screen debugger versions
IE-78014-R-EM	Using the clock provided on the break board	Ver. 1.2 or above
IE-78014-R-EM-A		Ver. 2.0 or above
IE-78044-R-EM		
IE-780208-R-EM		
IE-78064-R-EM	Using the clock provided on the emulation board	
IE-78078-R-EM		
IE-78098-R-EM		

3.2 Setting the Main System Clock

3.2.1 When Using the Clock Provided on the Board

A component block, wired as shown in Figure 3-5, is factory-mounted in a socket on the board (X1 (MAIN) socket on the break board or X1 (USRCLK) socket on the emulation board). When the component block is to be used as shipped, no hardware setting is necessary. When, however, the user prepares a component block to, for example, change from one clock source to another, or if the wired component block is lost, connect the component block as described below.

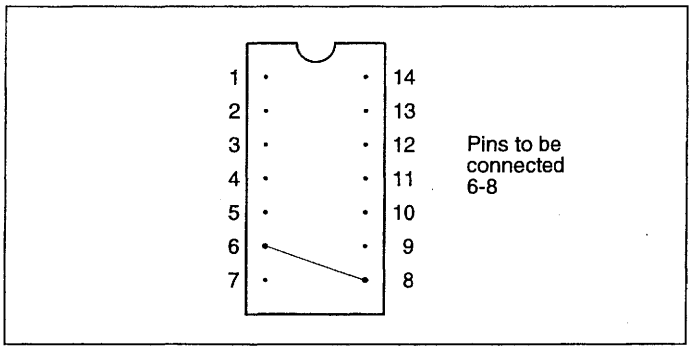
When starting the screen debugger (SD78K/0), select IE (thus selecting the clock in the emulator) as the clock setting on the initial setting screen or configuration panel.

- **Necessary parts and tools**
  - Component block (supplied with the IE-78000-R)
  - Lead wire
  - Soldering tools

<Procedure>

<1> Solder a lead wire to the component block as shown below.

Figure 3-5. Lead Wire Connection (for the Main System Clock, When the Clock Provided on the Board Is Used)



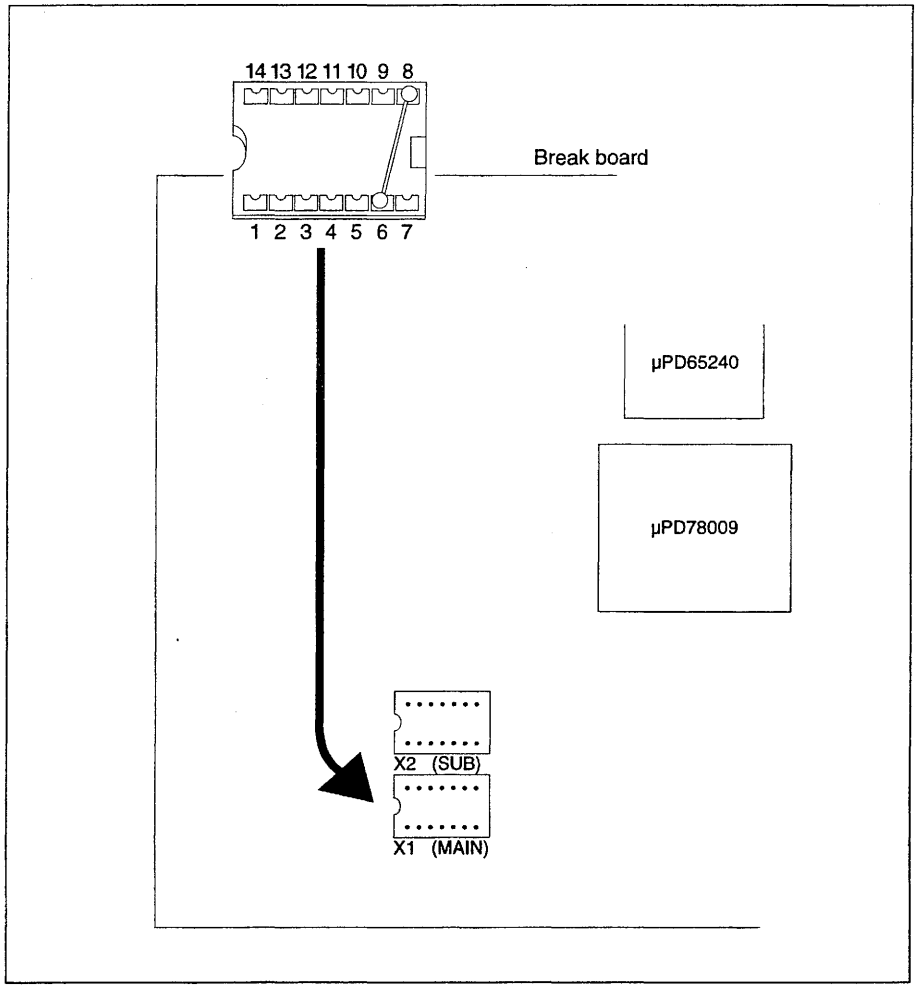
<2> Prepare the break board or emulation board.

<3> Mount the component block in the following socket on the board:

- For the break board : X1 (MAIN) socket
- For the emulation board : X1 (USRCLK) socket

When mounting the component block, pay particular attention to the orientation of pin 1.

Figure 3-6. Mounting Location of Component Block (for the Main System Clock, When the Clock Provided on the Board Is Used)



Caution This figure shows the break board. When using the emulation board, mount the component block in the X1 (USRCLK) socket.

<4> Install the emulation and break boards in the IE-78000-R.

3.2.2 When Using the Clock Mounted by the User

The socket in which the wired component block will be mounted varies with the emulation board to be used.

Table 3-3. Socket for Mounting the Component Block

Emulation board to be used	Socket for mounting the component block
IE-78014-R-EM IE-78014-R-EM-A	X1 (MAIN) socket on the break board
IE-78044-R-EM IE-78064-R-EM IE-78078-R-EM IE-78098-R-EM IE-780208-R-EM	X1 (USRCLK) socket on the emulation board

Either of procedure (1) or (2) should be followed, depending on the clock source to be used.

When starting the screen debugger, select USER (thus selecting the user clock) as the clock setting on the initial setting screen or configuration panel.

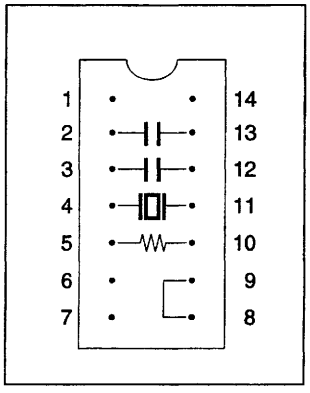
(1) When using a ceramic resonator or crystal

- **Necessary parts and tools**
  - Component block (supplied with the IE-78000-R)
  - Ceramic resonator or crystal
  - Resistor Rx
  - Capacitor CA
  - Capacitor CB
  - Soldering tools

<Procedure>

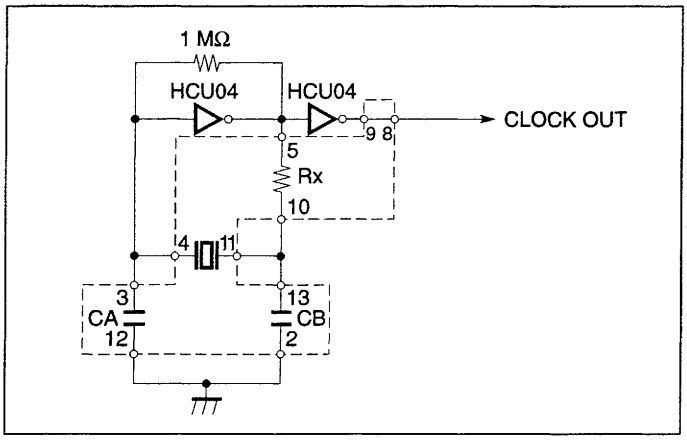
<1> Solder the ceramic resonator or crystal on the component block, as well as resistor Rx, capacitor CA, and CB, corresponding to the oscillation frequency, as shown below.

Component block



Pins	Connection
2-13	Capacitor CB
3-12	Capacitor CA
4-11	Ceramic resonator or crystal
5-10	Resistor Rx
8-9	Jumper

Circuit diagram



Remark The section enclosed in broken lines is mounted on the component block.

<2> Prepare the break board or emulation board.

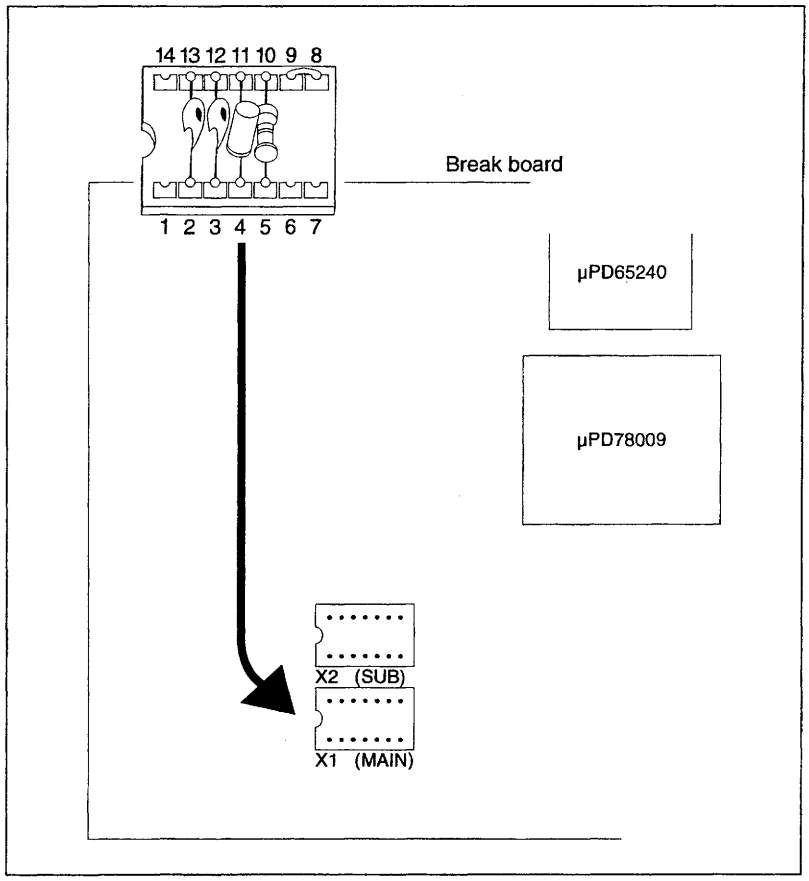
<3> Remove the external clock component block from the following socket on the board:

- For the break board : X1 (MAIN) socket
- For the emulation board : X1 (USRCLK) socket

<4> Mount the component block wired in step 1 on the MAIN or USRCLK socket. Pay particular attention to the orientation of pin 1.

Phase-out/Discontinued

Figure 3-7. Mounting Location of Component Block (for the Main System Clock, When the Clock Mounted by the User Is Used)

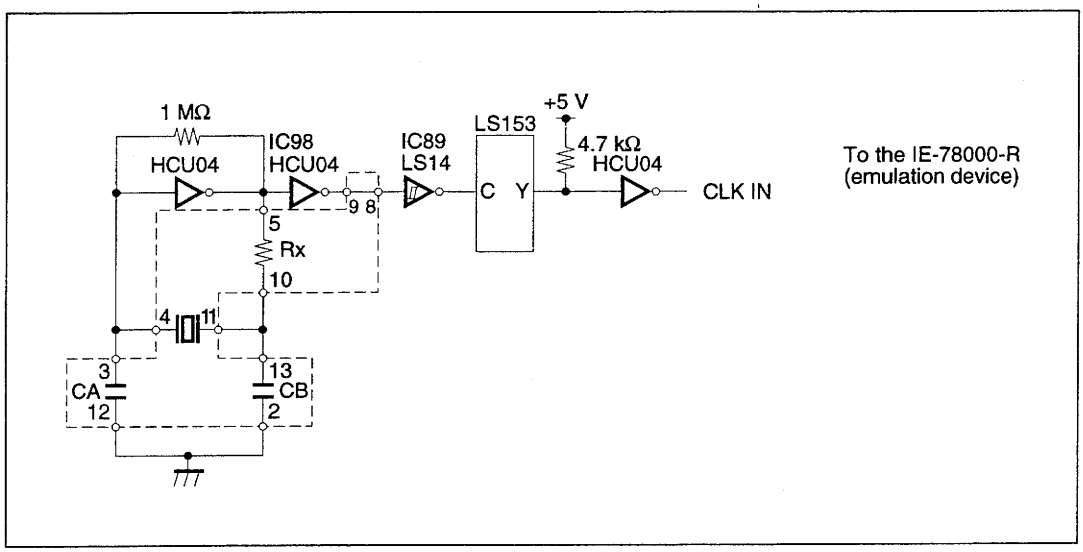


Caution **This figure shows the break board. When using the emulation board, mount the component block in the X1 (USRCLK) socket.**

<5> Install the emulation and break boards in the IE-78000-R.

Following the above procedure produces the following circuit, which supplies the clock generated by the mounted resonator to the emulation device.

Circuit on the break board

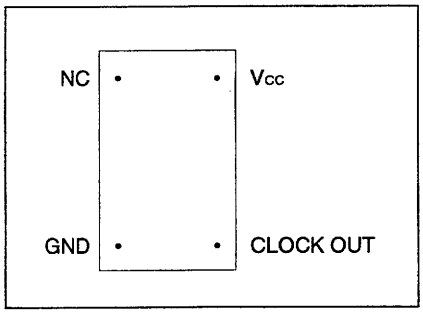


Remarks 1. The section enclosed in broken lines is mounted on the component block.
2. For details of the circuit on the emulation board, refer to **the user's manual for each emulation board**.

(2) When using a crystal oscillator

- **Necessary parts**
  - Crystal oscillator (having the pin configuration shown in Figure 3-8)

Figure 3-8. Crystal Oscillator (for the Main System Clock, When the Clock Mounted by the User Is Used)



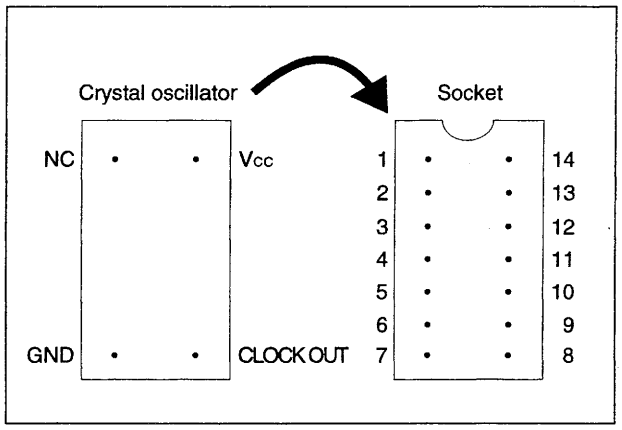
<Procedure>

<1> Prepare the break board or emulation board.

<2> Remove the external clock component block from the following socket:

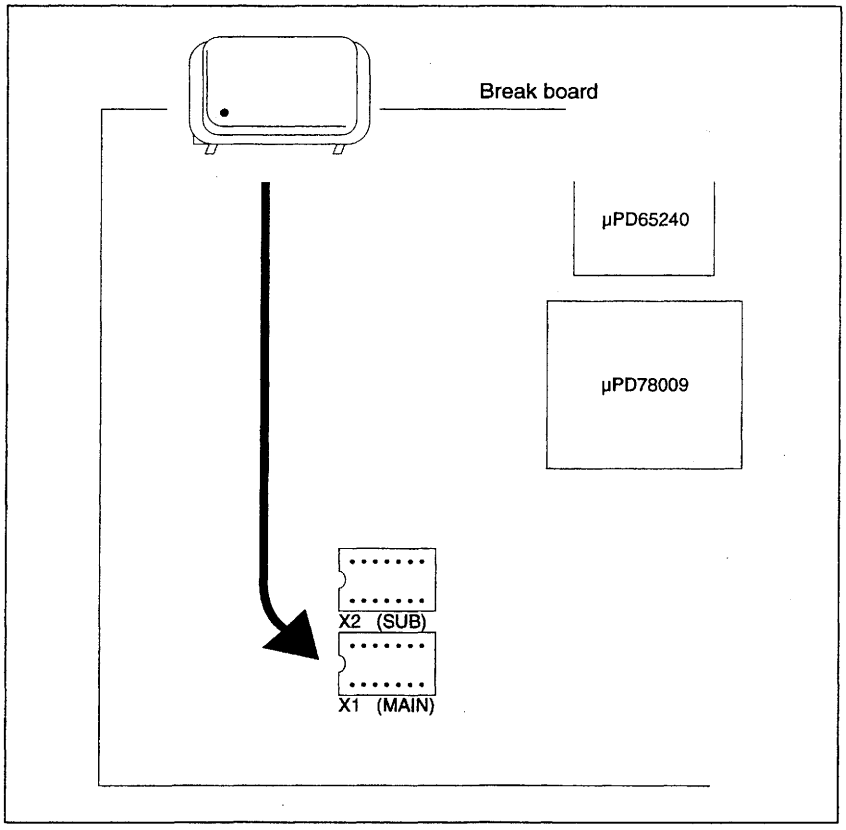
- On the break board : X1 (MAIN) socket
- On the emulation board : X1 (USRCLK) socket

<3> Mount the crystal oscillator in the MAIN or USRCLK socket. The pin correspondence is as follows:



Crystal oscillator	Socket
NC	1
GND	7
CLOCK OUT	8
Vcc	14

Figure 3-9. Mounting Location of Crystal Oscillator (for the Main System Clock, When the Clock Mounted by the User Is Used)

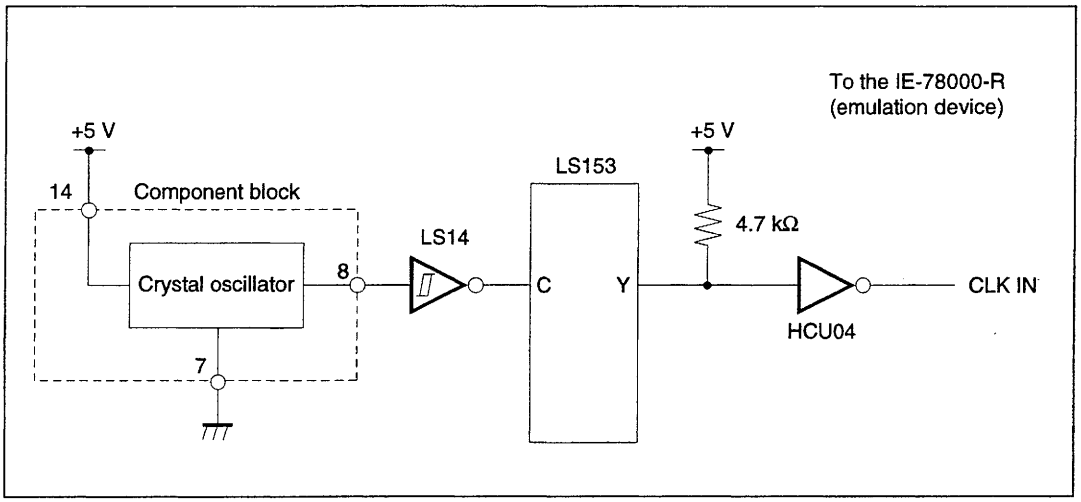


Caution **This figure shows the break board. When using the emulation board, mount the component block in the X1 (USRCLK) socket of the emulation board.**

<4> Install the emulation and break boards in the IE-78000-R.

Following the above procedure produces the following circuit, which supplies the clock generated from the mounted oscillator to the emulation device.

Circuit on the break board



Remark For details of the circuit on the emulation board, refer to **the user's manual for each emulation board.**

3.2.3 When Using an External Clock

A component block, wired as shown in Figure 3-10, is factory-mounted in a socket on the board (X1 (MAIN) socket on the break board or X1 (USRCLK) socket on the emulation board). When the component block is to be used as shipped, no hardware setting is necessary. When, however, the user prepares a component block to, for example, change from one clock source to another, or if the wired component block is lost, connect the component block as described below.

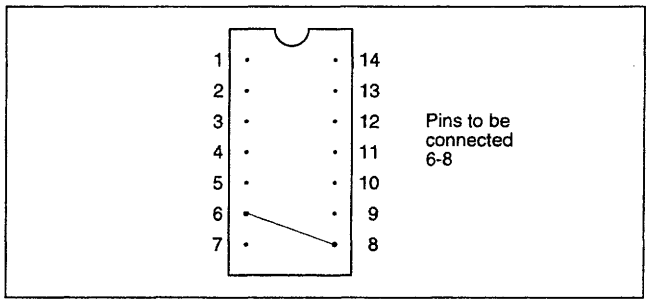
When starting the screen debugger, select USER (thus selecting the user clock) as the clock setting on the initial setting screen or configuration panel.

- **Necessary parts and tools**
  - Component block (supplied with the IE-78000-R)
  - Lead wire
  - Soldering tools

<Procedure>

<1> Solder a lead wire to the component block as shown below.

Figure 3-10. Lead Wire Connection (for the Main System Clock, When the External Clock Is Used)



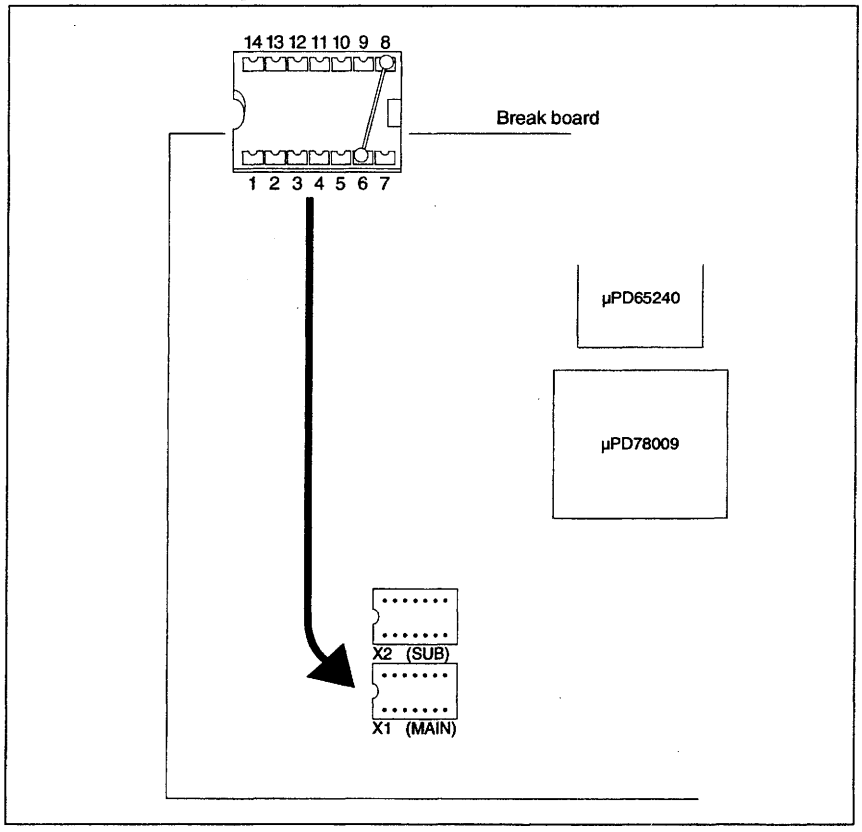
<2> Prepare the break board or emulation board.

<3> Mount the component block in the following socket on the board:

- For the break board : X1 (MAIN) socket
- For the emulation board : X1 (USRCLK) socket

When mounting the component block, pay particular attention to the orientation of pin 1.

Figure 3-11. Mounting Location of Component Block (for the Main System Clock, When the External Clock Is Used)

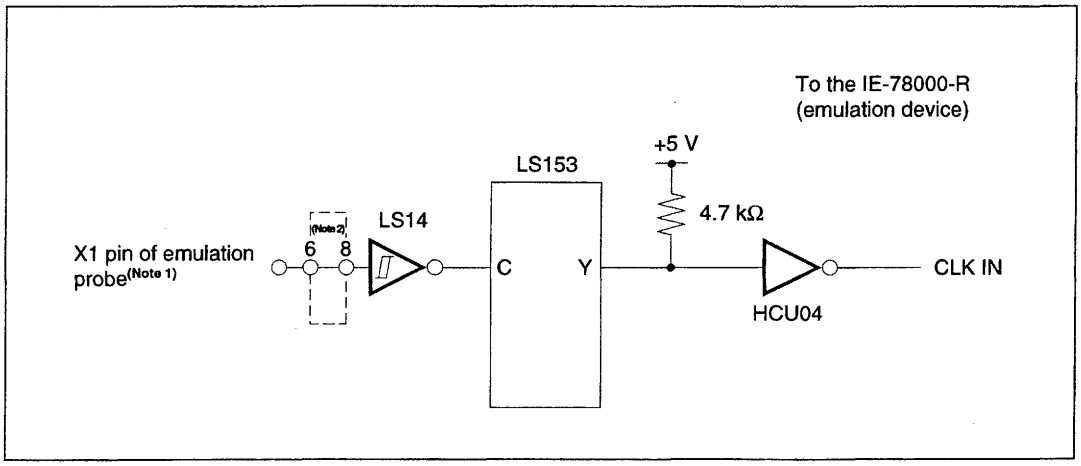


Caution This figure shows the break board. When using the emulation board, mount the component block in the X1 (USRCLK) socket.

<4> Install the emulation and break boards in the IE-78000-R.

Following the above procedure produces the following circuit, which supplies the clock signal from the target system to the emulation device.

Circuit on the break board



(Note 1) Pin name of target device
(Note 2) Pin numbers of component block

Remarks 1. The section enclosed in broken lines is mounted on the component block.
2. For details of the circuit on the emulation board, refer to **the user's manual for each emulation board**.

3.3 Setting the Subsystem Clock

3.3.1 When Using the Clock Mounted by the User

Either procedure (1) or (2), below, should be followed depending on the clock source to be used.

No setting is required for the screen debugger.

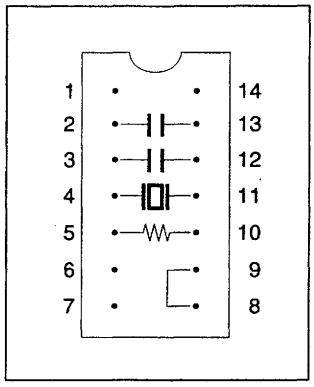
(1) When using a crystal

- **Necessary parts and tools**
  - Component block (supplied with the IE-78000-R)
  - Crystal
  - Resistor Rx
  - Capacitor CA
  - Capacitor CB
  - Soldering tools

<Procedure>

<1> Solder the crystal to the component block, as well as resistor Rx, capacitor CA, and CB, corresponding to the oscillation frequency, as shown below.

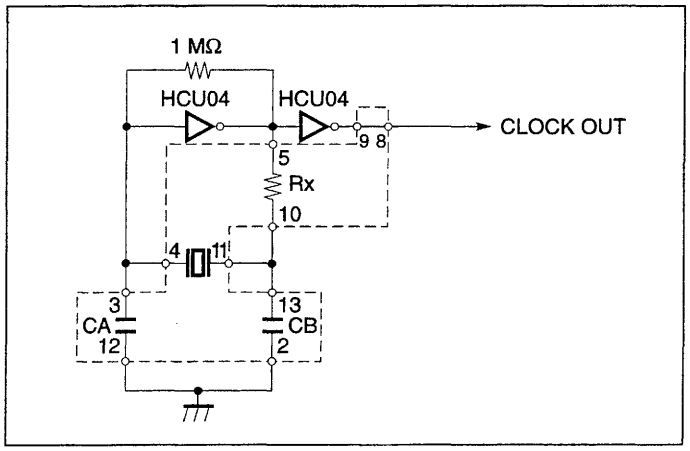
Component block



Pins	Connection	Standard value(Note)
2-13	Capacitor CB	33 pF
3-12	Capacitor CA	15 pF
4-11	Crystal	32.768 kHz
5-10	Resistor Rx	330 kΩ
8-9	Jumper	—

(Note) The above table lists only typical values. The circuit constants may vary with the crystal being used. If the crystal fails to oscillate, contact the manufacturer of the crystal.

Circuit diagram



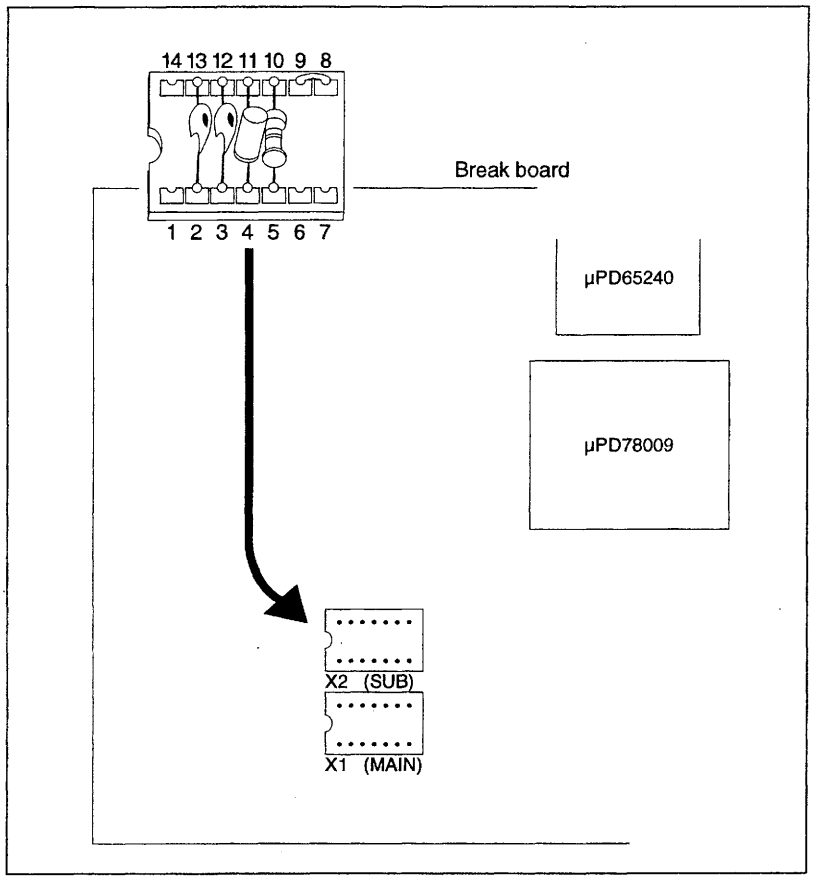
Remark The section enclosed in broken lines is mounted on the component block.

<2> Prepare the break board connected to the emulation board.

<3> Remove the component block for an external clock from the SUB socket.

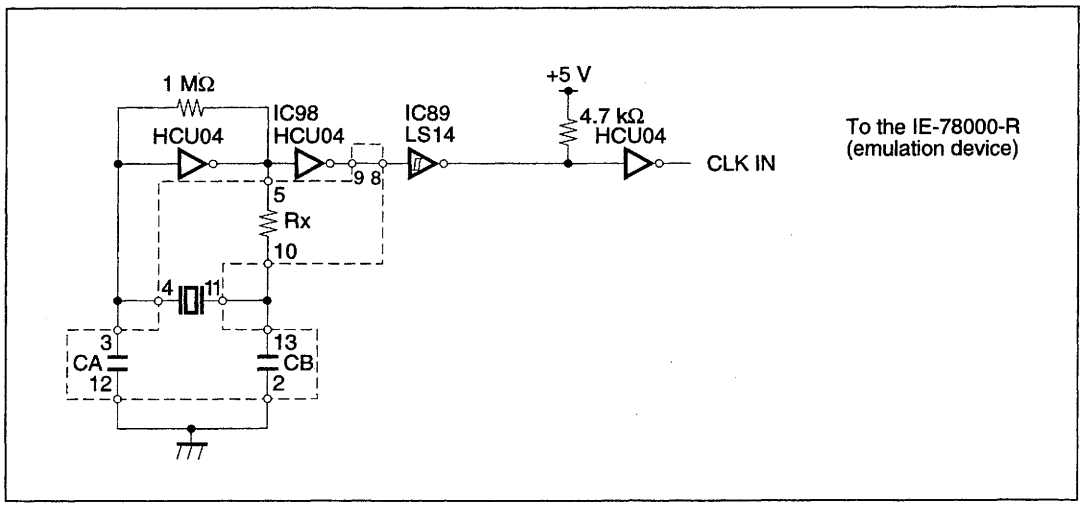
<4> Mount the component block, wired in step 1, in the SUB socket. Pay particular attention to the orientation of pin 1.

Figure 3-12. Mounting Location of Component Block (for the Subsystem Clock, When the Clock Mounted by the User Is Used)



<5> Install the emulation and break boards in the IE-78000-R.

Following the above procedure produces the following circuit, which supplies the clock generated from the mounted crystal to the emulation device.

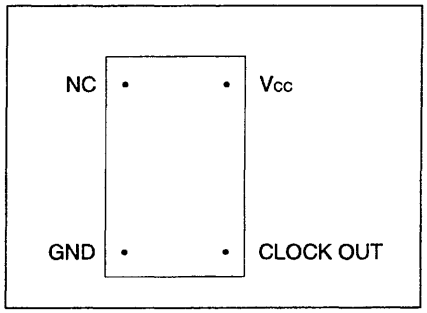


Remark The section enclosed in broken lines is mounted on the component block.

(2) When using a crystal oscillator

- **Necessary parts**
  - Crystal oscillator (having the pin configuration shown in Figure 3-13)

Figure 3-13. Crystal Oscillator (for the Subsystem Clock, When the Clock Mounted by the User Is Used)

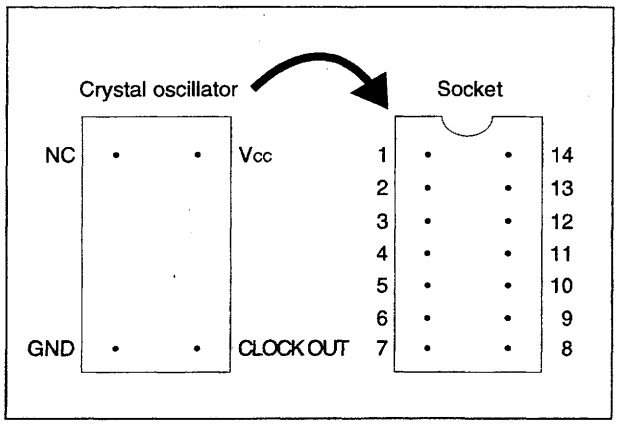


<Procedure>

<1> Prepare the break board connected to the emulation board.

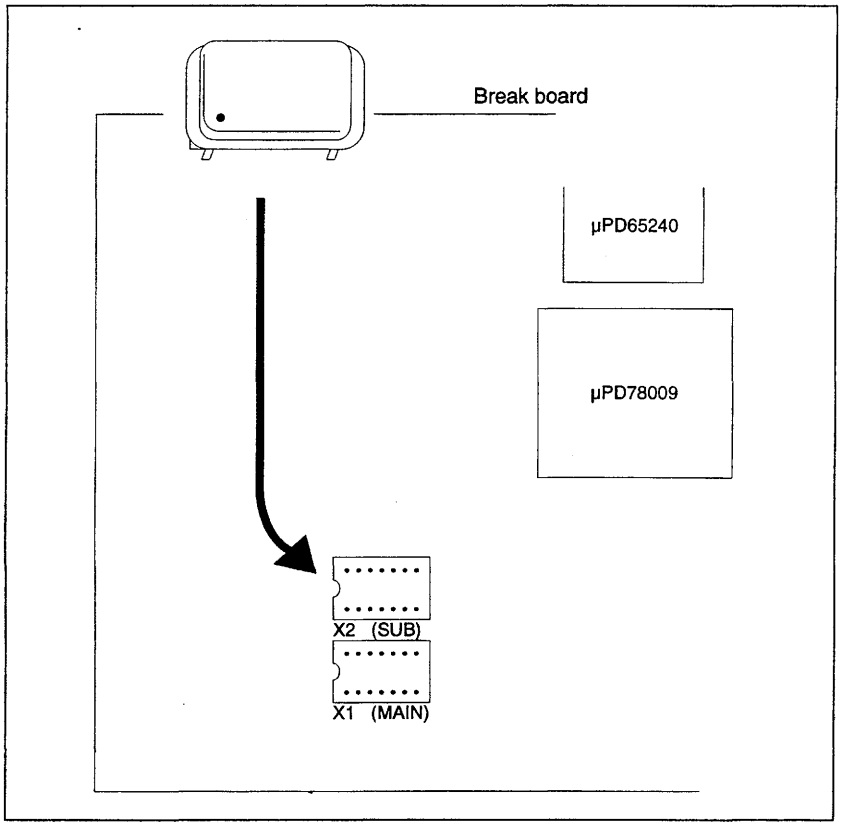
<2> Remove the external clock component block from the SUB socket.

<3> Mount the crystal oscillator in the SUB socket. The pin correspondence is as follows:



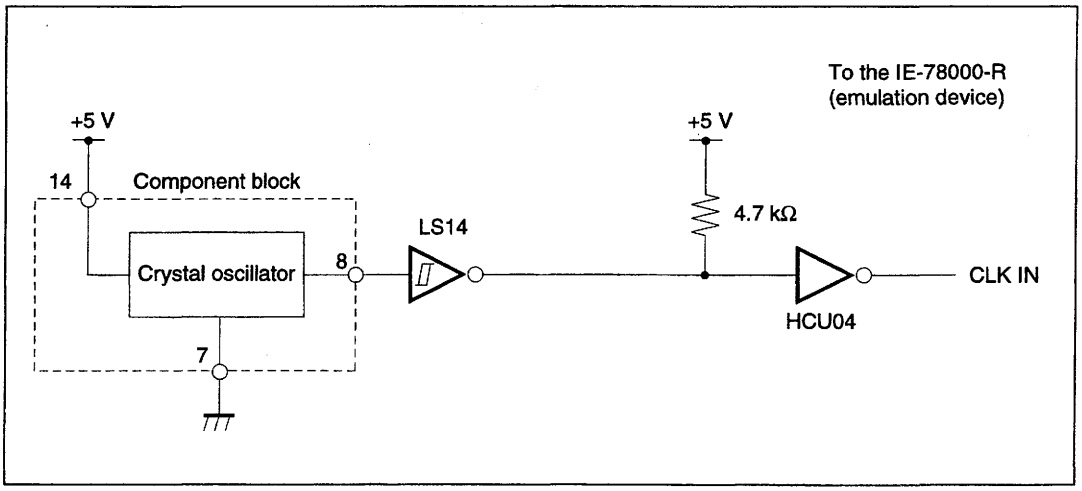
Crystal oscillator	Socket
NC	1
GND	7
CLOCK OUT	8
Vcc	14

Figure 3-14. Mounting Location of Crystal Oscillator (for the Subsystem Clock, When the Clock Mounted by the User Is Used)



<4> Install the emulation and break boards in the IE-78000-R.

Following the above procedure produces the following circuit, which supplies the clock generated from the mounted oscillator to the emulation device.



3.3.2 When Using an External Clock

A component block, wired as shown in Figure 3-15, is factory-mounted in the X2 (SUB) socket on the break board. When the component block is to be used as shipped, no hardware setting is necessary. When, however, the user prepares a component block to, for example, change from one clock source to another, or if the wired component block is lost, connect the component block as described below.

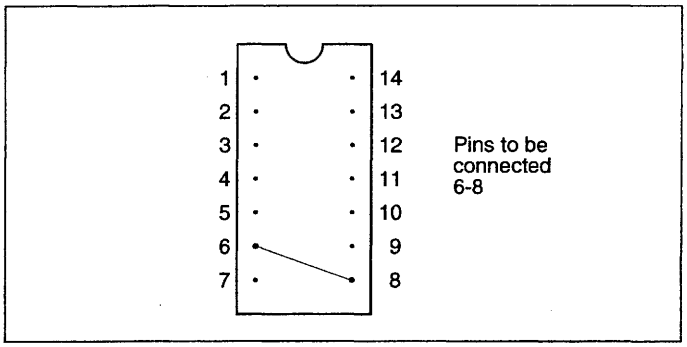
No setting is required for the screen debugger.

- **Necessary parts and tools**
  - Component block (supplied with the IE-78000-R)
  - Lead wire
  - Soldering tools

<Procedure>

<1> Solder a lead wire to the component block as shown below.

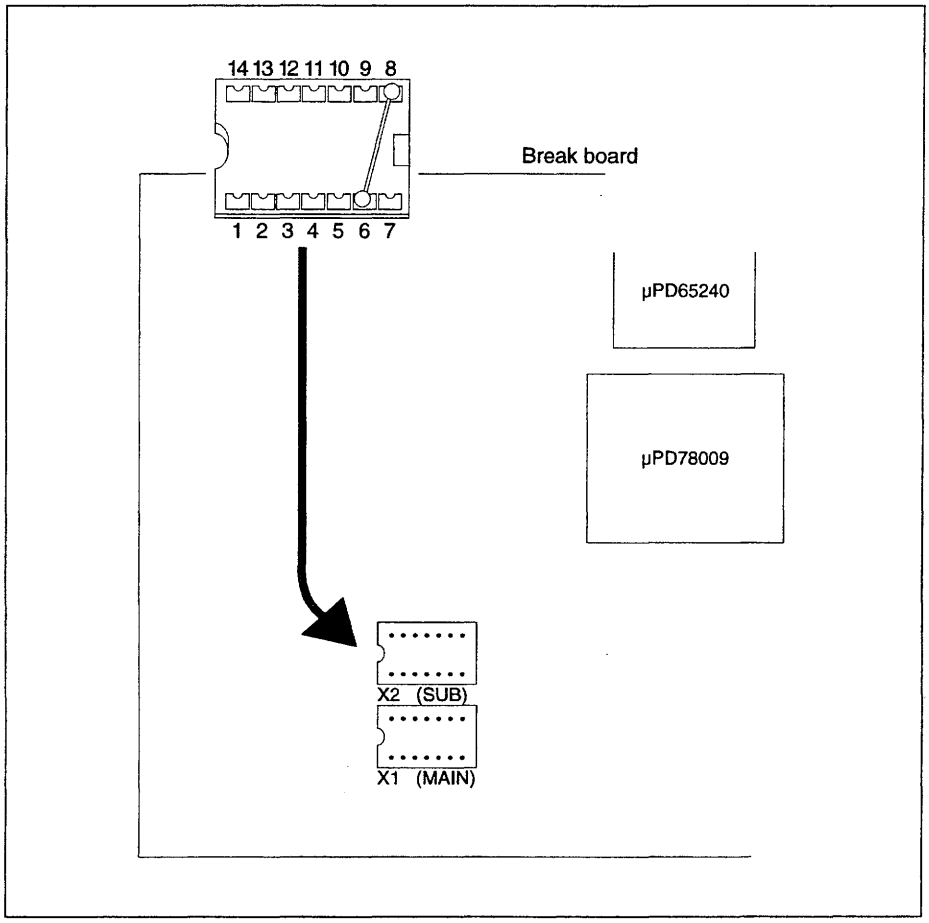
Figure 3-15. Lead Wire Connection (for the Subsystem Clock, When the External Clock Is Used)



<2> Prepare the break board connected to the emulation board.

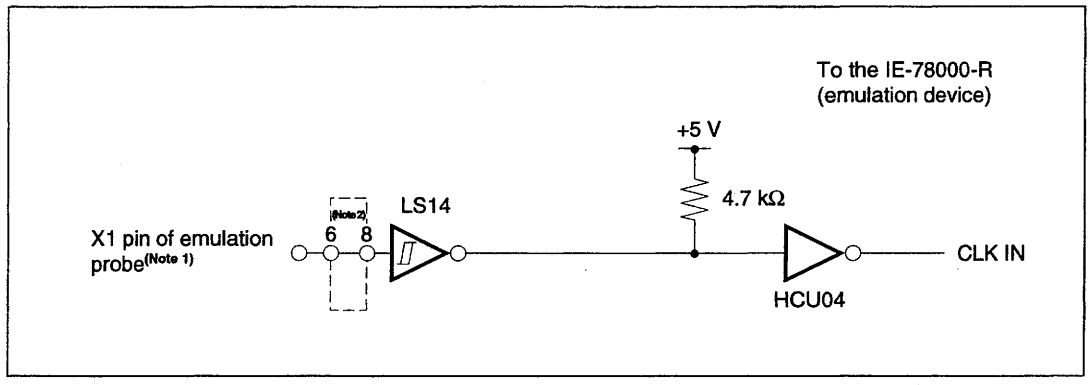
<3> Mount the component block in the SUB socket of the break board. Pay particular attention to the orientation of pin 1.

Figure 3-16. Mounting Location of Component Block (for the Subsystem Clock, When the External Clock Is Used)



<4> Install the emulation and break boards in the IE-78000-R.

Following the above procedure produces the following circuit, which supplies the clock signal from the target system to the emulation device.



(Note 1) Pin name of target device
(Note 2) Pin numbers of component block

Remark The section enclosed in broken lines is mounted on the component block.

Chapter 4

Connecting Peripheral Equipment

The IE-78000-R can debug and program the target device after the peripheral equipment has been connected and the system has been configured. This chapter explains how to connect the peripheral equipment to the IE-78000-R and how to set each device. Read this chapter before connecting the peripheral equipment.

For the procedure for setting up the system, see **Section 1.4**. For details of activating the system, refer to *User's Manual: Tutorial* that comes with the optional screen debugger.

Organization of this chapter

4.1 Peripheral Equipment

The following two types of peripheral equipment can be connected to the IE-78000-R:

- Host machine
- PROM programmer

(1) Host machine

- **PC-9800 series**

  For the PC-9800 series, the optional IE-78000-R screen debugger and device file can be run under MS-DOS™ to provide a consistent development environment for software development through total evaluation, including the hardware.

- **IBM PC/AT**

  For the IBM PC/AT, the optional IE-78000-R screen debugger and device file can be run under PC DOS™ to provide a consistent development environment for software development through total evaluation, including the hardware.

(2) PROM programmer

- **PG-1500**

  The PG-1500 is a PROM programmer for typical 256K- to 4M-bit PROMs. It can also program PROMs built in NEC's single-chip microcomputers using the optional PROM programmer adapter.

  The PG-1500 has key panel switches and a serial interface, so it can operate as a stand-alone PROM programmer. It can also operate as a remote PROM programmer through a host machine connected to the serial interface.

  Use an RS-232-C interface cable available on the market to connect the PG-1500 to the IE-78000-R.

4.2 IE-78000-R Interfaces

The IE-78000-R is connected to peripheral equipment via serial interfaces (channels 1 and 2) and/or parallel interfaces (channels 3 and 4).

(1) Serial interfaces (channels 1 and 2)

Channels 1 and 2 are used according to the peripheral equipment to be connected as follows:

Serial interface	Peripheral equipment to be connected
Channel 1 (I/O)	PC-9800 series
	IBM PC/AT
Channel 2 (I/O)	PG-1500

Table 4-1 outlines the functions of channel 1. Table 4-2 outlines the functions of channel 2. For details, see **Chapter 6**.

Table 4-1. Function Outline of Channel 1

Item		Setting	Set by(Note)
Mode selection		Terminal/modem mode	H
Baud rate (bps)		300, 600, 1200, 2400, 4800, 9600, 19200	H
Handshaking		Hardware (1 character) and software (flow control) handshaking	Fixed
Character specifications	Character length	8 bits The most significant bit (MSB) is set to 0 if output and is ignored if input.	Fixed
	Parity bit	None	Fixed
	Stop bit length	2 bits	Fixed

(Note) H: Switches (Hardware)

Table 4-2. Function Outline of Channel 2

Item		Setting	Set by(Note)
Mode selection		Terminal/modem mode	H
Baud rate (bps)		300, 600, 1200, 2400, 4800, 9600, 19200	S
Handshaking		Hardware (1 character) or software (flow control) handshaking	S
Character specifications	Character length	7 or 8 bits When the 8-bit length is specified, the most significant bit (MSB) must be 0 if output and is ignored if input.	S
	Parity bit	Even parity/odd parity/none	S
	Stop bit length	1 bit/2 bits	S

(Note) H: Switches (Hardware) S: Software

(2) Parallel interfaces (channels 3 and 4)

Channel 3 is an output-only channel, and channel 4 is an input-only channel. For details of the functions of channels 3 and 4, see **Chapter 7**.

Parallel interface	Peripheral equipment to be connected
Channel 3 (output only)	Printer
Channel 4 (input only)	PC-9800 series
	IBM PC/AT

4.3 Connecting a PC-9800 Series Computer

- **Outline of connection**

  <1> Turn off the power.

  <2> Set channel 1 of the IE-78000-R.

  <3> Connect the PC-9800 series computer to the IE-78000-R with the cable.

  <4> Turn on the power.

(1) Turning off the power

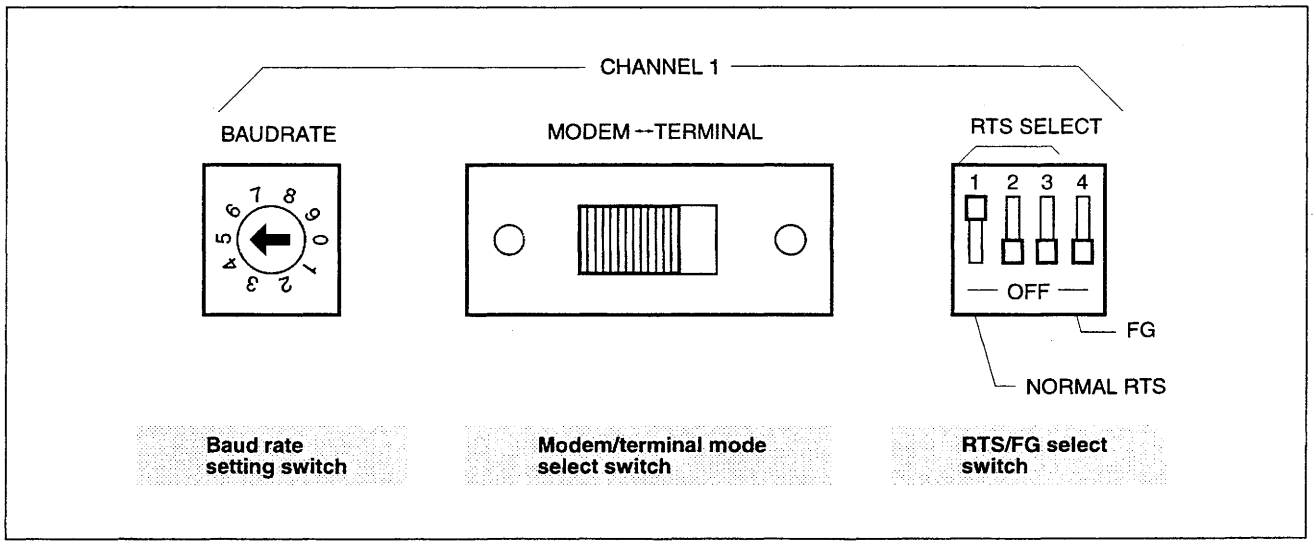
Check whether the power to the IE-78000-R and PC-9800 series computer is off. If the power is on, turn off the power first.

(2) Setting channel 1 of the IE-78000-R

Table 4-3. Setting Channel 1

Item	Setting
Mode selection	Modem mode
Baud rate	9600 bps
Frame ground	Switch 4: OFF
RTS selection	Switch 1: ON, Switches 2 and 3: OFF

Figure 4-1. Setting Channel 1



<Procedure>

<1> Open the RS-232-C mode switch cover on the right side of the IE-78000-R.

<2> Slide the modem/terminal mode select switch (CH1) from right to left to set channel 1 to the modem mode.

<3> Turn the baud rate setting switch (CH1) clockwise or counterclockwise and set the switch to position 5 to set the baud rate to 9600 bps.

<4> To set the frame ground, slide switch 4 of the RTS/FG select switch (CH1) downward (OFF: FG and SG are open).

<5> To set RTS, set switches 1 to 3 of the RTS/FG select switch (CH1) as follows:

1: ON (upward)

2: OFF (downward)

3: OFF (downward)

(3) Connecting the PC-9800 series computer to the IE-78000-R with the cable

<Procedure>

<1> Connect the standard RS-232-C channel on the rear of the main unit of the PC-9800 series computer to the CH1 serial interface port above the RS-232-C mode switches of the IE-78000-R with the cable supplied with the IE-78000-R.

<2> For a parallel interface, connect the printer connector on the rear of the main unit of the PC-9800 series computer to the CH4 parallel interface port of the IE-78000-R with the printer cable for the PC-9800 series.

Table 4-4. Cable Connection

IE-78000-R	Cable to be used	PC-9800 series
CH1	RS-232-C cable	Standard RS-232-C channel
CH4	Printer cable	Printer connector

(4) Turning on the power

Turn on the power in the following sequence. Turn off the power by reversing the power-on sequence. Turn on and off the power for ordinary operations using the same sequence.

<Procedure>

- **Power-on sequence**

  <1> Turn on the power switch of the PC-9800 series computer.

  <2> Turn on the power switch of the IE-78000-R.

- **Power-off sequence**

  <1> Turn off the power switch of the IE-78000-R.

  <2> Turn off the power switch of the PC-9800 series computer.

4.4 Connecting an IBM PC/AT Computer

- **Outline of connection**

  <1> Turn off the power.

  <2> Set channel 1 of the IE-78000-R.

  <3> Set the asynchronous communication adapter of the IBM PC/AT computer.

  <4> Connect the IBM PC/AT computer to the IE-78000-R with the cable.

  <5> Turn on the power.

(1) Turning off the power

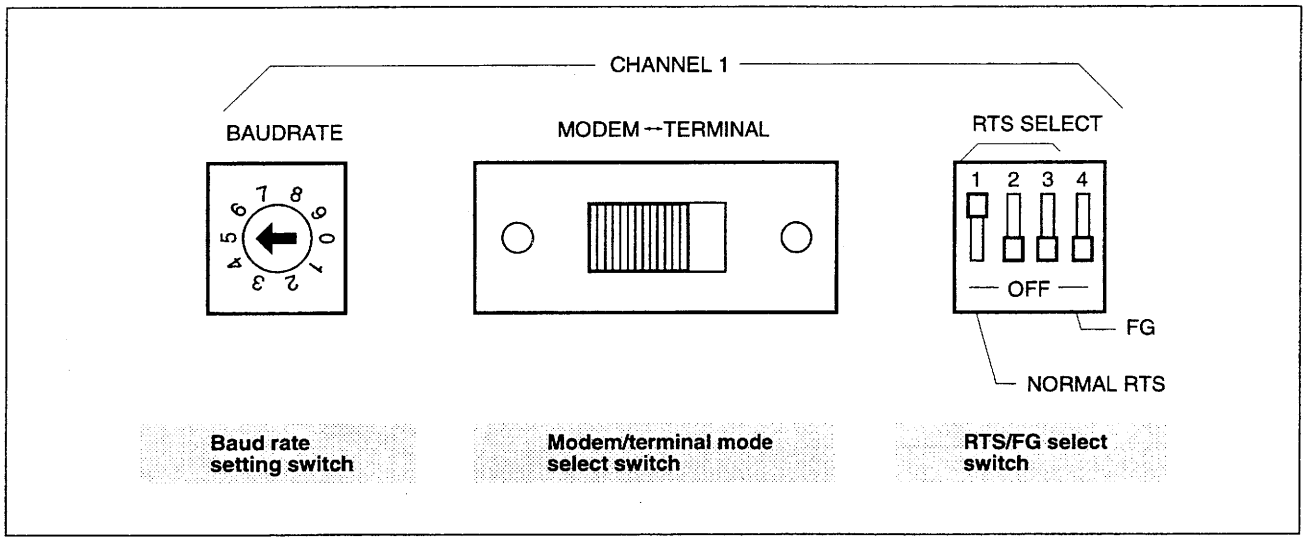
Check whether the power to the IE-78000-R and IBM PC/AT computer is off. If the power is on, turn off the power first.

(2) Setting channel 1 of the IE-78000-R

Table 4-5. Setting Channel 1

Item	Setting
Mode selection	Modem mode
Baud rate	9600 bps
Frame ground	Switch 4: OFF
RTS selection	Switch 1: ON, Switches 2 and 3: OFF

Figure 4-2. Setting Channel 1



<Procedure>

<1> Open the RS-232-C mode switch cover on the right side of the IE-78000-R.

<2> Slide the modem/terminal mode select switch (CH1) from right to left to set channel 1 to the modem mode.

<3> Turn the baud rate setting switch (CH1) clockwise or counterclockwise and set the switch to position 5 to set the baud rate to 9600 bps.

<4> To set the frame ground, slide switch 4 of the RTS/FG select switch (CH1) downward (OFF: FG and SG are open).

<5> To set RTS, set switches 1 to 3 of the RTS/FG select switch (CH1) as follows:

1: ON (upward)

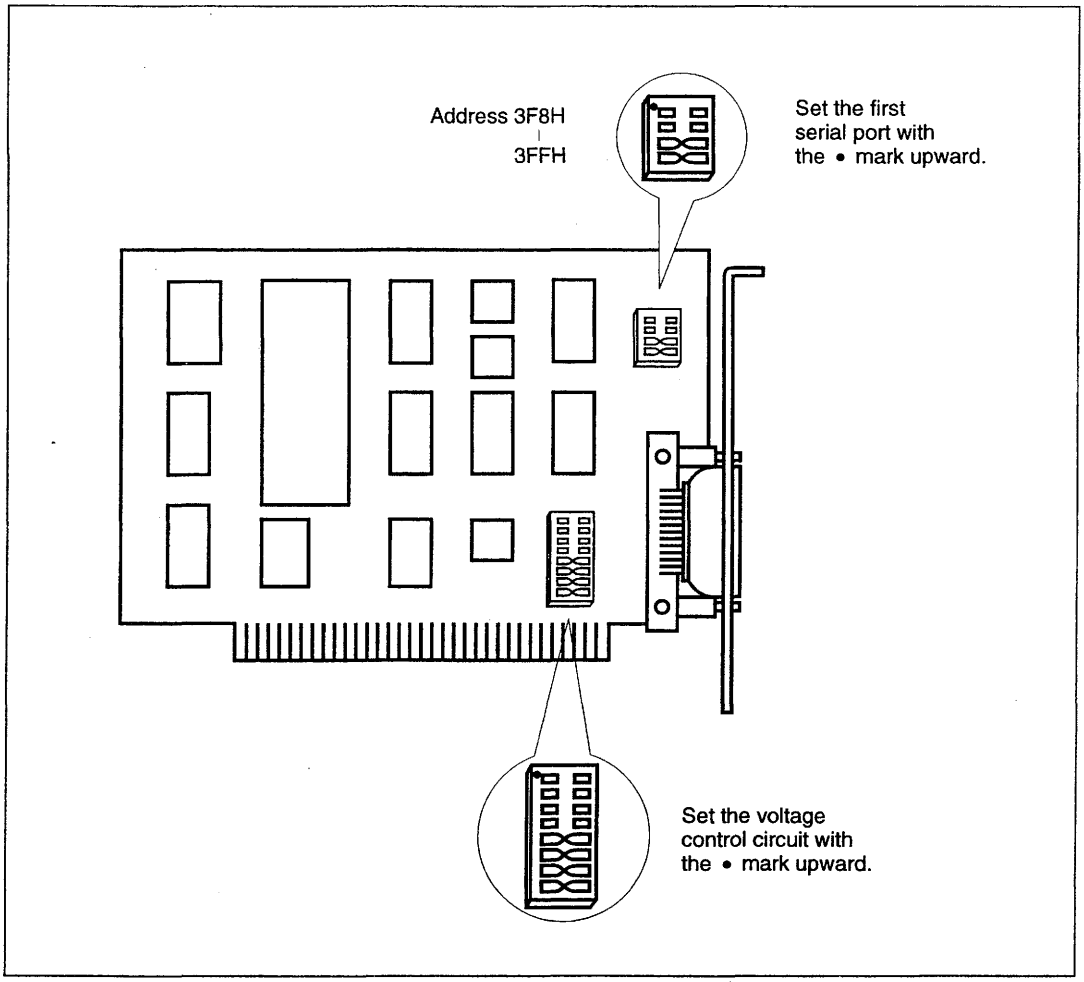
2: OFF (downward)

3: OFF (downward)

(3) Setting the asynchronous communication adapter of the IBM PC/AT computer

Set the asynchronous communication adapter in the IBM PC/AT computer as shown in Figure 4-3. The screen debugger (SD78K/0) supports only the first serial port (No. 0).

Figure 4-3. Setting the Asynchronous Communication Adapter

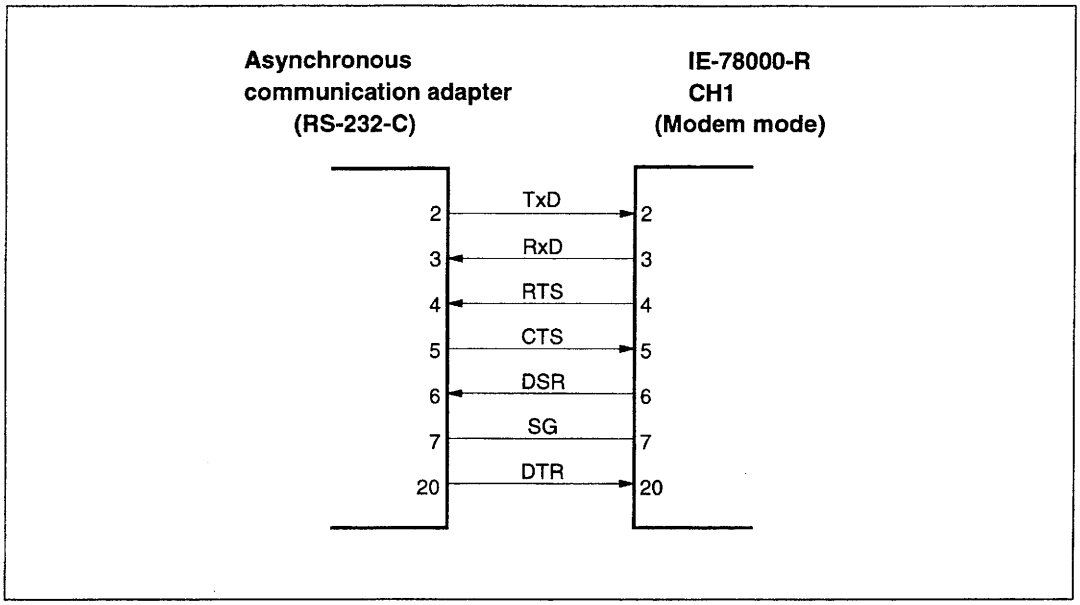


(4) Connecting the IBM PC/AT computer to the IE-78000-R with the cable

<Procedure>

<1> Connect the RS-232-C channel of the asynchronous communication adapter, which is an IBM PC/AT option, to the CH1 serial interface port of the IE-78000-R with an RS-232-C cable for the IBM PC/AT.

Figure 4-4. Connecting the IBM PC/AT Computer with an RS-232-C Cable



<2> For a parallel interface, connect the printer connector on the rear of the main unit of the IBM PC/AT computer to the CH4 parallel interface port of the IE-78000-R with a printer cable for the IBM PC/AT.

Table 4-6. Cable Connection

IE-78000-R	Cable to be used	IBM PC/AT
CH1	RS-232-C cable	RS-232-C channel of the asynchronous communication adapter
CH4	Printer cable	Printer connector

(5) Turning on the power

Turn on the power in the following sequence. Turn off the power by reversing the power-on sequence. Turn on and off the power for ordinary operations using the same sequence.

<Procedure>

- **Power-on sequence**

  <1> Turn on the power switch of the IBM PC/AT computer.

  <2> Turn on the power switch of the IE-78000-R.

- **Power-off sequence**

  <1> Turn off the power switch of the IE-78000-R.

  <2> Turn off the power switch of the IBM PC/AT computer.

4.5 Connecting the PG-1500

- **Outline of connection**

<1> Turn off the power.

<2> Set channel 2 of the IE-78000-R.

<3> Connect the PG-1500 to the IE-78000-R with the cable.

<4> Turn on the power to the PG-1500.

<5> Set the function mode of the PG-1500.

<6> Turn on the power to the IE-78000-R.

(1) Turning off the power

Check whether the power to the IE-78000-R and PG-1500 is off. If the power is on, turn off the power first.

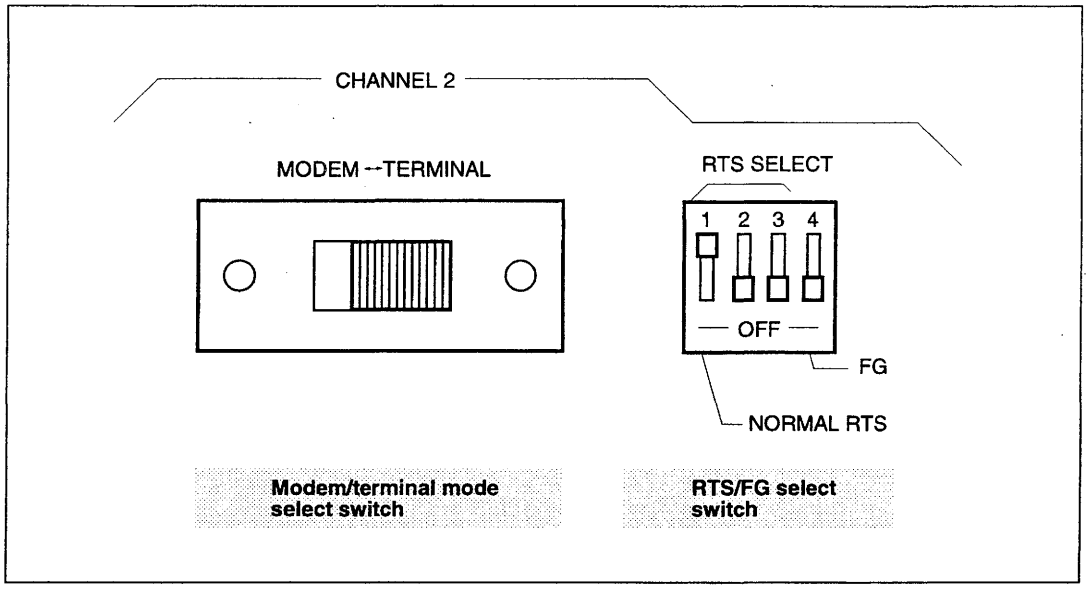
(2) Setting channel 2 of the IE-78000-R

Some settings of channel 2 of the IE-78000-R are set by RS-232-C mode switches on the main unit when the power is off. Some settings are set by executing the MOD command when the IE-78000-R is active. The following shows setting by the RS-232-C mode switches on the main unit.

Table 4-7. Setting Channel 2

Item	Setting
Mode selection	Terminal mode
Frame ground	Switch 4: OFF
RTS selection	Switch 1: ON, Switches 2 and 3: OFF

Figure 4-5. Setting Channel 2



<Procedure>

<1> Open the RS-232-C mode switch cover on the right side of the IE-78000-R main unit.

<2> Slide the modem/terminal mode select switch (CH2) from left to right to set channel 2 to the terminal mode.

<3> Slide switch 4 of the RTS/FG select switch (CH2) downward (OFF: FG and SG are open).

<4> To set RTS, set switches 1 to 3 of the RTS/FG select switch (CH2) as follows:

1: ON (upward)

2: OFF (downward)

3: OFF (downward)

Remark Setting channel 2 by the MOD command
Use the MOD command to set the handshaking, baud rate, and character specifications of channel 2. For details, refer to **MOD command** in *User's Manual: Reference* that comes with the optional screen debugger.

Table 4-8. Setting Channel 2 by the MOD Command

Item		Setting	Set by
Handshaking		1 character	MOD command
Baud rate		9600 bps	
Character specifications	Character length	8 bits	
	Parity bit	None	
	Stop bit length	2 bits	

(3) Connecting the PG-1500 to the IE-78000-R with the cable

Connect the serial interface connector at the right on the PG-1500 rear panel to the CH2 serial interface port of the IE-78000-R. Use an RS-232-C interface cable available on the market for connection.

Table 4-9. Cable Connection

IE-78000-R	Cable to be used	PG-1500
CH2	RS-232-C interface cable available on the market	Serial interface connector

(4) Turning on the power to the PG-1500

Turn on the power switch on the right side of the PG-1500 main unit.

(5) Setting the function mode of the PG-1500

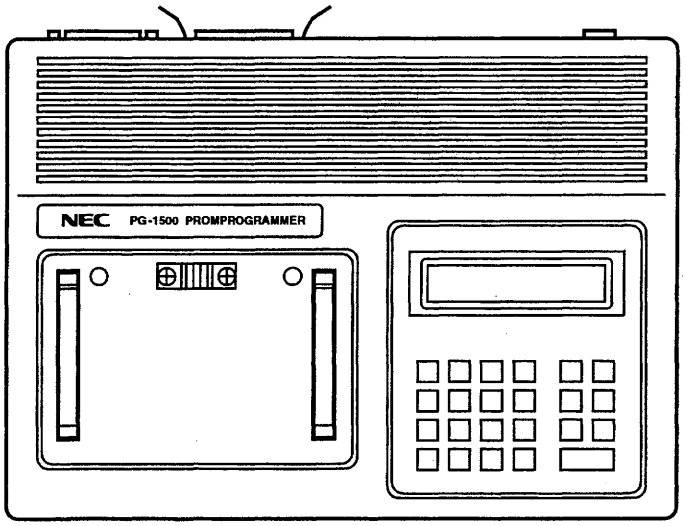
Set the PG-1500 with the key switches on the front panel. For details, refer to *PG-1500 User's Manual*.

Table 4-10. Setting the PG-1500

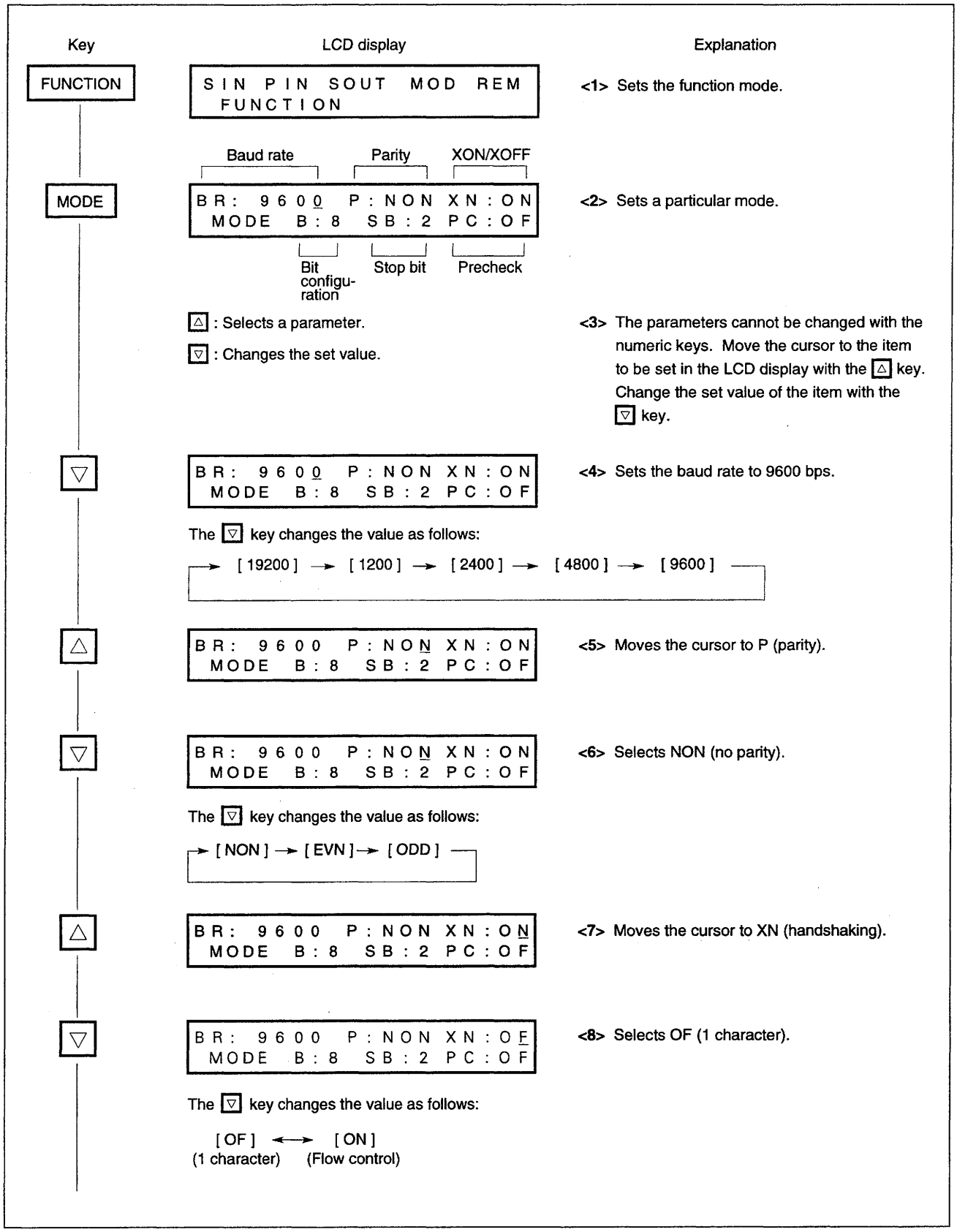
Item	Setting	LCD display
Baud rate	9600 bps	BR: 9600
Parity bit	None	P: NON
Handshaking	1 character	XN: OF
Character length	8 bits	B: 8
Stop bit length	2 bits	SB: 2
Precheck(Note)	None	PC: OF

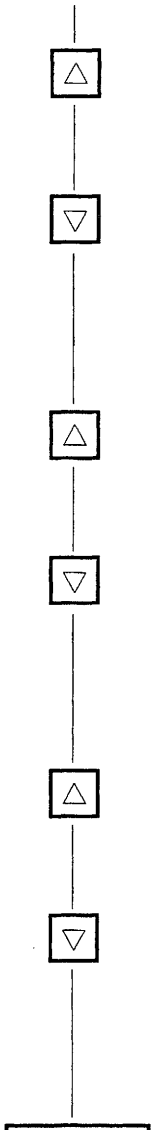
(Note) Function which prechecks if the device is correctly installed. Available only when the general-purpose PROM is used.

Figure 4-6. PG-1500 Front Panel



<Procedure>






```
BR: 9600  P:NON XN:OF
 MODE  B:8  SB:2 PC:OF
```

<9> Moves the cursor to B (bit configuration).

```
BR: 9600  P:NON XN:OF
 MODE  B:8  SB:2 PC:OF
```

<10> Selects 8 (8 bits).

The ▽ key changes the value as follows:

[8] ⟷ [7]

```
BR: 9600  P:NON XN:ON
 MODE  B:   SB:2 PC:OF
```

<11> Moves the cursor to SB (stop bit length).

```
BR: 9600  P:NON XN:OF
 MODE  B:8  SB:2 PC:OF
```

<12> Selects 2 (2 bits).

The ▽ key changes the value as follows:

[2] ⟷ [1]

```
BR: 9600  P:NON XN:ON
 MODE  B:8  SB:2 PC:OF
```

<13> Moves the cursor to PC (precheck).

```
BR: 9600  P:NON XN:OF
 MODE  B:8  SB:2 PC:OF
```

<14> Selects OF (no check).

The ▽ key changes the value as follows:

[OF] ⟷ [ON]

```
DEVICE EDIT FUNCTN
IDLE              V◆.◆
```

<15> All items have been set, and the system enters the idle state.

Caution **The set values are not changed unless the SET/START key is pressed. Press the SET/START key to write the set values in NV-RAM in the PG-1500.**

(6) Turning on the power to the IE-78000-R

Turn on the power switch on the front of the IE-78000-R main unit.

Remark The ordinary power-on/off sequence is as follows.

- **Power-on sequence**

  <1> Turn on the power switch of the PG-1500.

  <2> Press the FUNCTION key then the REMOTE key on the PG-1500 front panel.

  <3> Turn on the power switch of the IE-78000-R.

- **Power-off sequence**

  <1> Turn off the power switch of the PG-1500.

  <2> Turn off the power switch of the IE-78000-R.

[MEMO]

Phase-out/Discontinued

Chapter 5

Connecting the Target System

This chapter explains how to connect the target system using the target device to the emulation probe connected to the IE-78000-R. It also explains the handling of latch-up. Be sure to read this chapter before connecting the target system.

Refer to the emulation board user's manual for connecting the IE-78000-R to the emulation probe.

Organization of this chapter

5.1 Connecting the Target System

- **Before connection**
  - When the user clock is used

    See **Chapter 3**.
  - When the emulation probe has not been connected

    Refer to **the emulation board user's manual**.
- **Outline of connection**

  <1> Connect the target system to the emulation probe.

  <2> Connect the target system to the external sense clips.

(1) Connecting the target system to the emulation probe

The following outlines how to connect the target system to the emulation probe. For the details of connection, refer to **the emulation board user's manual**.

<Procedure>

<1> Connect the ground clip of the emulation probe to GND (signal ground) in the CPU socket of the target system. If the ground clip is not connected, the IE-78000-R may be destroyed by static electricity.

<2> Insert the tip of the emulation probe main unit into the CPU socket of the target system with the first-pin mark of the emulation probe aligned with the first pin of the CPU socket. Do not break or bend the pins of the emulation probe.

(2) Connecting the target system to the external sense clips

The IE-78000-R can trace the bus cycle of the target device in real time. It can also trace any eight signal lines in real time using the external sense function. Therefore, eight external sense clips are provided.

Cautions 1. Connect the external sense clips only to the signal lines compatible with the TTL. If a sense clip is connected to another signal line, the IE-78000-R cannot correctly detect the high or low level of the signal. This may destroy the sensor of the IE-78000-R main unit, depending on the voltage level.

2. Connect the external sense clips to V_{DD} through the pull-up resistor (about 3.3 kΩ) when using them as the outputs of the external data (event panel of the screen debugger). This is not necessary when using the external sense clips as the trigger outputs.

3. Use an IC clip for connecting the external sense clips.

<Procedure>

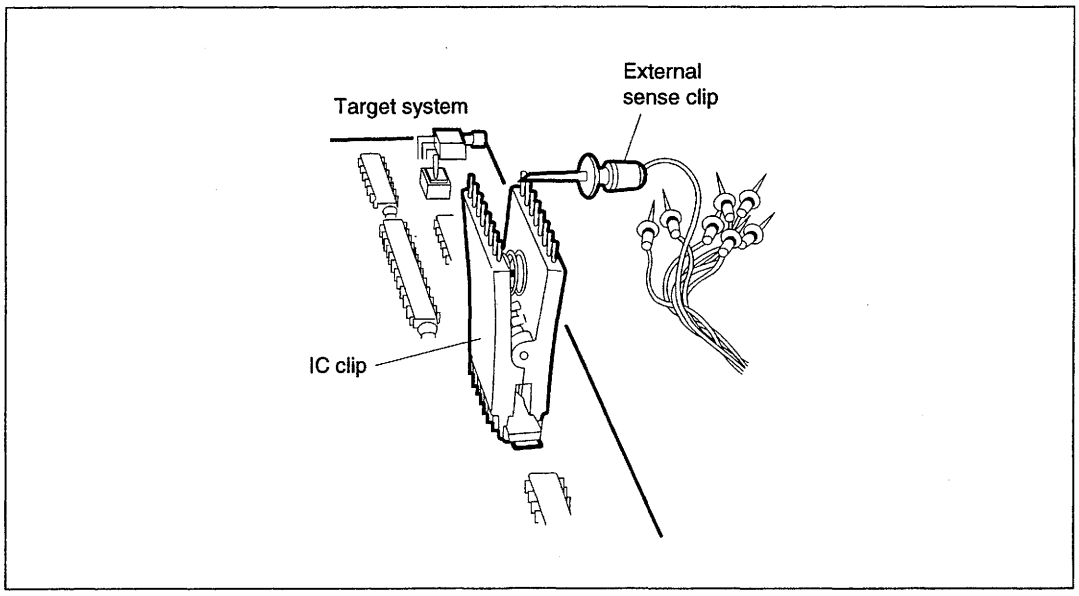
<1> Turn off the power to the IE-78000-R.

<2> Turn off the power to the target system.

<3> Set an IC clip at the IC to be traced in the target system.

<4> Connect the external sense clips to the IC clip.

Figure 5-1. Connecting the External Sense Clips



5.2 Power-on/Power-off Sequence

Turn on and off the power in the following sequence after connecting the target system. For details of the activation and termination of the IE-78000-R, refer to *User's Manual: Tutorial* that comes with the optional screen debugger.

Caution **Turn on and off the power in the correct sequence, otherwise the IE-78000-R may operate abnormally or may be destroyed.**

<Procedure>

- **Power-on sequence**

(1) Using PC-9800 series as host machine

<1> Turn on the power to the host machine.

<2> Turn on the power to the IE-78000-R.

<3> Execute the batch file shipped with the screen debugger.

<4> The following message appears.

```
IE connection confirmed
```

<5> The system then asks the target device series name.

Input the target CPU series name. The CPU series names depend on the target devices as shown in Table 5-1.

```
Specify CPU series name. ____ series
```

Table 5-1. Target Device and CPU Series Names *

Target device	CPU series name
μPD78001B, μPD78002B, μPD78001B(A), μPD78002B(A), μPD78001BY, μPD78002BY	78002
μPD78011B, μPD78012B, μPD78013, μPD78014, μPD78P014, μPD78011B(A), μPD78012B(A), μPD78013(A), μPD78014(A), μPD78011BY, μPD78012BY, μPD78013Y, μPD78014Y, μPD78P014Y	78014
μPD78011F(Note), μPD78012F(Note), μPD78013F(Note), μPD78014F(Note), μPD78015F(Note), μPD78016F(Note), μPD78018F(Note), μPD78P018F(Note), μPD78011FY(Note), μPD78012FY(Note), μPD78013FY(Note), μPD78014FY(Note), μPD78015FY(Note), μPD78016FY(Note), μPD78018FY(Note), μPD78P018FY(Note)	78018
μPD78023, μPD78024, μPD78P024(Note)	78024
μPD78042, μPD78043, μPD78044, μPD78P044	78044
μPD78042A, μPD78043A, μPD78044A, μPD78045A, μPD78P048A(Note)	78048
μPD78052, μPD78053, μPD78054, μPD78P054, μPD78052Y, μPD78053Y, μPD78054Y, μPD78P054Y(Note)	78054
μPD78055, μPD78056, μPD78058, μPD78P058, μPD78055Y, μPD78056Y, μPD78058Y, μPD78P058Y(Note)	78058
μPD78062, μPD78063, μPD78064, μPD78P064, μPD78062Y(Note), μPD78063Y(Note), μPD78064Y(Note), μPD78P064Y(Note)	78064
μPD78074(Note), μPD78075(Note), μPD78076, μPD78078(Note), μPD78P078(Note), μPD78074Y(Note), μPD78075Y(Note), μPD78076Y(Note), μPD78078Y(Note), μPD78P078Y(Note)	78078
μPD78081(Note), μPD78082(Note), μPD78P083(Note)	78083
μPD78094, μPD78095, μPD78096, μPD78098A(Note), μPD78P098A(Note)	78098
μPD780204(Note), μPD780205(Note), μPD78P0208(Note)	780208

(Note) Under development

<6> The system then asks whether or not to use the target system.

If the target system is used, input **y**. If the target system is not used, input **n**.

```
Use target? (y/n)
```

<7> If **y** is input in **<6>**, check that the target system is turned on.

Input **y** after turning on the target system(**Notes 1, 2**). If **y** is input in **<6>** by mistake, input **n** to return to **<6>**.

```
Check that target is turned on. (y/n)
```

(Note 1) The power supply voltages (V_{DD}) of the target system depend on the emulation boards.

For the IE-78014-R-EM: 5.0 V
For the IE-78044-R-EM: 5.0 V
* For the IE-780208-R-EM: 5.0 V
* For the IE-78014-R-EM-A: 3.0 to 6.0 V
For the IE-78064-R-EM: 3.0 to 6.0 V
* For the IE-78078-R-EM: 3.0 to 6.0 V
For the IE-78098-R-EM: 3.0 to 6.0 V

(Note 2) Mount the connector board attached to the emulation probe to the emulation board to debug the device connected to the target system. For mounting, refer to each emulation board user's manual.

Caution Turning on the power of the target system before <6> may damage the target system. Be sure that the power is turned off when connecting the target system.

(2) Using IBM PC/AT as host machine

<1> Turn on the power to the host machine.

<2> Turn on the power to the IE-78000-R.

<3> Execute the batch file shipped with the screen debugger.

<4> The following message appears.

```
Confirmed SD's connection with IE.
```

<5> The system then asks the target device series name.

Input the target CPU series name. (See **Table 5-1**.)

```
Specify CPU series name. _____ series
```

<6> The system then asks whether or not to use the target system.

If the target system is used, input **Y**. If the target system is not used , input **N**.

```
Do you connect Target System? (Y/N)
```

<7> If **Y** is input in **<6>**, check that the target system is turned on.

Input **Y** after turning on the target system(**Notes 1, 2**). If **Y** is input in **<6>** by mistake, input **N** to return to **<6>**.

```
Has Target System been turned on? (Y/N)
```

(Note 1) The power supply voltages (V_{DD}) of the target system depend on the emulation boards.

For the IE-78014-R-EM: 5.0 V
For the IE-78044-R-EM: 5.0 V
For the IE-780208-R-EM: 5.0 V *
For the IE-78014-R-EM-A: 3.0 to 6.0 V *
For the IE-78064-R-EM: 3.0 to 6.0 V
For the IE-78078-R-EM: 3.0 to 6.0 V *
For the IE-78098-R-EM: 3.0 to 6.0 V

(Note 2) Mount the connector board attached to the emulation probe to the emulation board to debug the device connected to the target system. For mounting, refer to each emulation board user's manual.

Caution Turning on the power of the target system before <6> may damage the target system. Be sure that the power is turned off when connecting the target system.

- **Power-off sequence**

<1> Turn off the power to the target system.

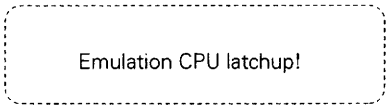
<2> Turn off the power to the IE-78000-R.

5.3 Handling Latch-up

If latch-up occurs in the emulation device, interface driver, and neighboring CMOS around the emulation device in the IE-78000-R, turn off the power immediately.

- The IE-78000-R detects latch-up, and the power to the following devices is automatically turned off.
  - Emulation device
  - Interface driver
  - Neighboring CMOSs around the emulation device
  - Other CMOSs
- The latch-up warning circuit in the IE-78000-R operates, and the following message appears on the display.

(1) For PC-9800 series



(2) For IBM PC/AT

<1> Turn off the power to the target system.

<2> Turn off the power to the IE-78000-R.

Chapter 6

Functions of Channels 1 and 2

This chapter details the functions of channels 1 and 2 of the IE-78000-R.

Channels 1 and 2 are serial interfaces provided for the host machine and the PROM programmer respectively.

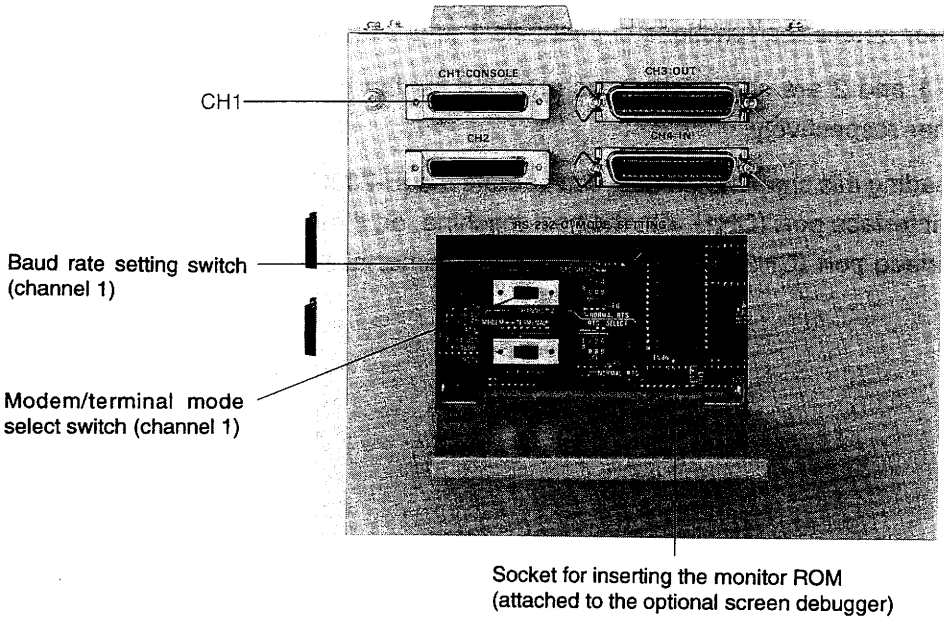
Without reading this chapter, the user can operate the IE-78000-R correctly by connecting the serial interface port (CH1) with the host machine, or, if necessary, by connecting the serial interface port (CH2) with the PROM programmer according to **Chapter 4**.

Organization of this chapter

6.1 Channel 1 Functions

Channel 1 is a serial interface for the host machine. It is based on RS-232-C. The RS-232-C mode switches on the right side of the IE-78000-R main unit contain channel 1 mode setting switches (CHANNEL 1). A serial interface port (CH1) is provided above the switches.

Photo 6-1. Channel 1



Channel 1 has the functions (1) to (5) below to control the RS-232-C interface. With these functions, channel 1 transfers control data between the IE-78000-R and the host machine, and loads files such as object files.

(1) to (3) below can be set with the CHANNEL 1 switches. However, the setting values of (4) and (5) are fixed, and cannot be modified.

(1) Mode switching

Setting item	Setting	Switch
Mode switching	Modem mode and terminal mode	Modem/terminal mode select switch

(2) RTS and FG setting

Setting item	Setting	Switch
RTS, FG	1: On, 2 to 4: Off	RTS/FG select switch

(3) Baud rate selection

Setting item	Setting	Switch
Baud rate	9600 bps	Baud rate setting switch

(4) Handshaking

Setting item	Setting	Switch
Handshaking	Hardware handshaking used together with software handshaking	Fixed

(5) Character specification

Setting item	Setting	Switch
Character length	8 bits (with the most significant bit set always to 0 for output and ignored for input)	Fixed
Parity bit	None	
Stop bit length	2 bits	

(1) Mode switching

The modem/terminal mode select switch is used for mode switching between the terminal mode and modem mode. The terminal mode is set by sliding the switch from left to right. The modem mode is set by sliding the switch from right to left. The modem mode must be set for connection with the host machine.

Figure 6-1. Modem/Terminal Mode Select Switch (Channel 1)

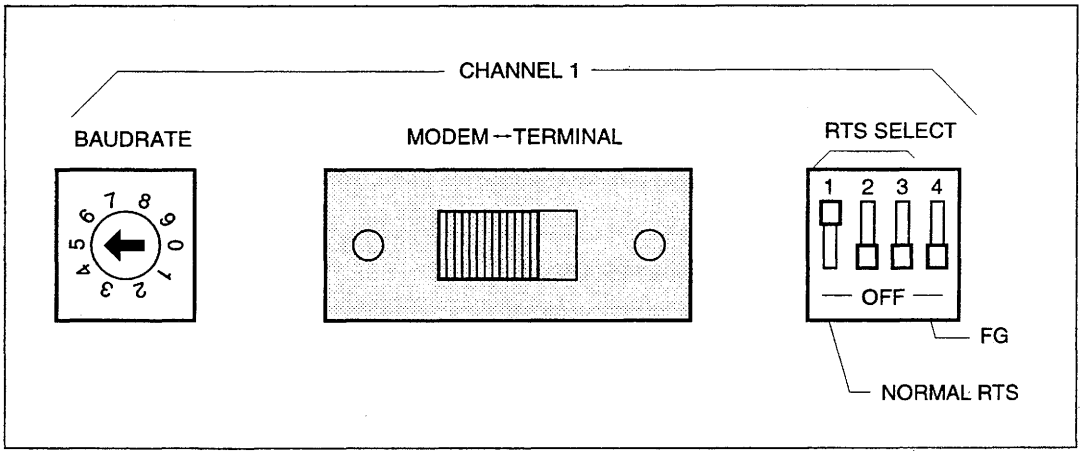
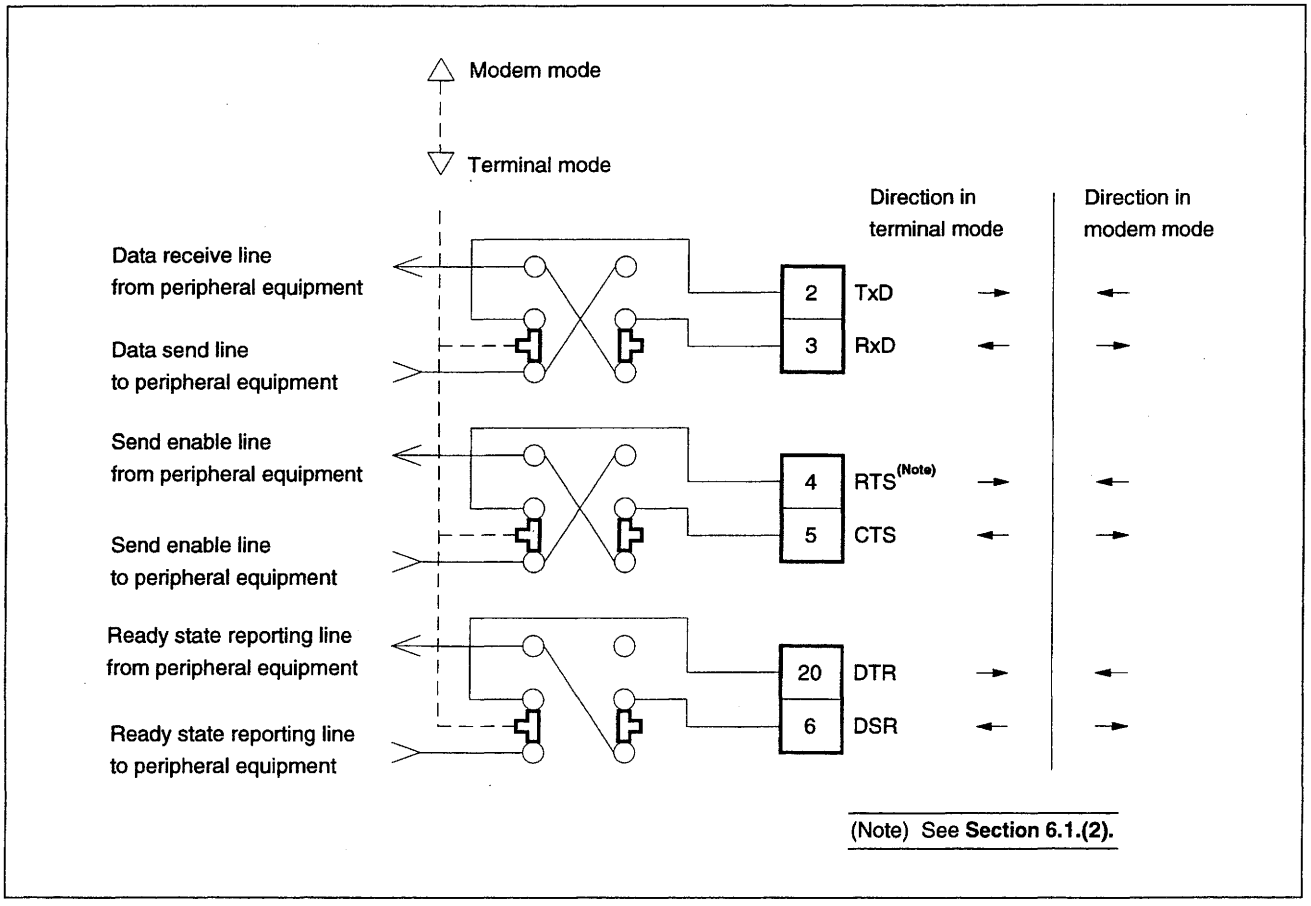


Figure 6-2. Circuit Diagram of Modem/Terminal Mode Select Switch (Channel 1)



(2) RTS and FG setting

The RTS/FG select switch is used for RTS and FG setting. The switch is on when it is set to the upper position. The switch is off when it is set to the lower position. (See **Table 6-1**, **Figure 6-3**, and **Figure 6-4**.)

- **RTS setting**

  Switches 1 to 3 of the RTS/FG select switch are used for RTS setting. Setting these switches determines which pin (pin 4, 11, or 21) of the RS-232-C interface cable is to be connected to the RTS signal line. RTS is usually connected to pin 4 of the RS-232-C interface. RTS must always be connected to RTS N (Switch 1: ON, Switches 2 and 3: OFF) except in special cases.

- **FG setting**

  Switch 4 of the RTS/FG select switch is used to determine whether FG (Frame Ground) and SG (Signal Ground) are to be connected or open. Usually, FG and SG must be set open.

Table 6-1. RTS and FG Setting (Channel 1)

	RTS and FG setting				
RTS name	1	2	3	4	Device connected
RTS N	ON	OFF	OFF	OFF	Host machine
RTS P	OFF	ON	OFF	OFF	Not to be set
RTS D	OFF	OFF	ON	OFF	

Figure 6-3. RTS/FG Select Switch (Channel 1)

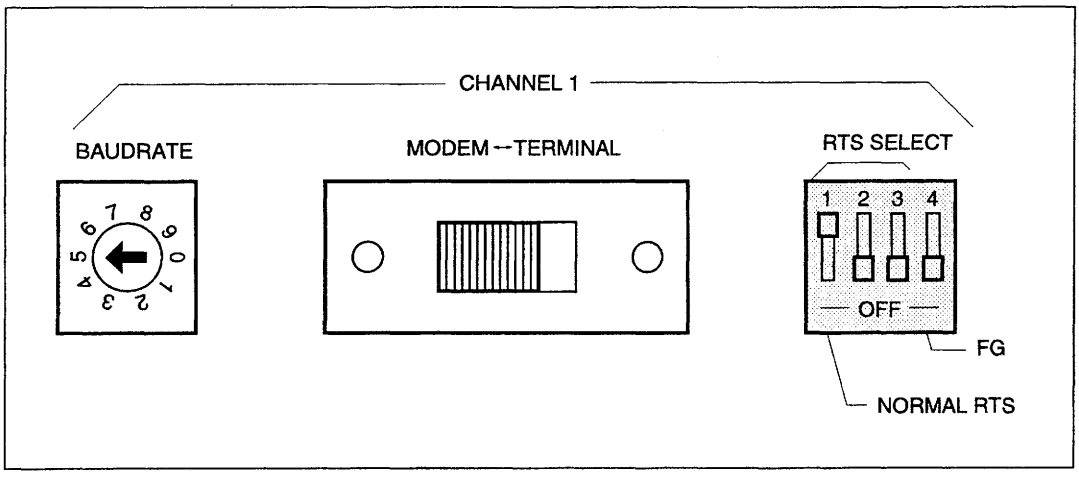
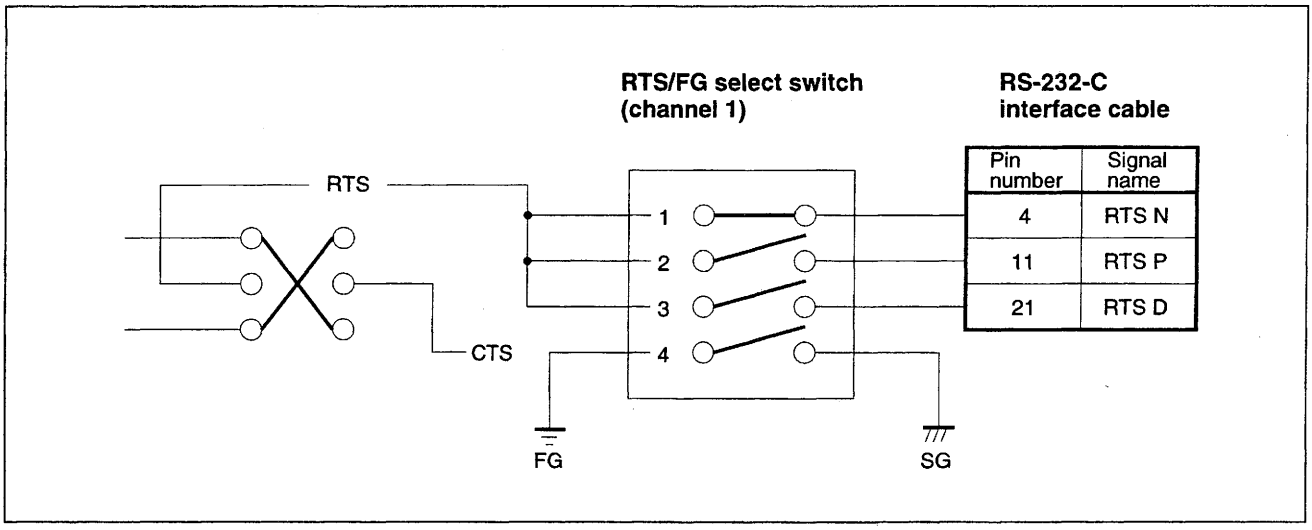


Figure 6-4. Circuit Diagram of RTS/FG Select Switch (Channel 1)



(3) Baud rate selection

The baud rate of the connected host machine needs to be set to match that of the IE-78000-R. A baud rate is selected using the micro DIP switch for baud rate setting (for channel 1).

Figure 6-5. Baud Rate Setting Switch (Channel 1)

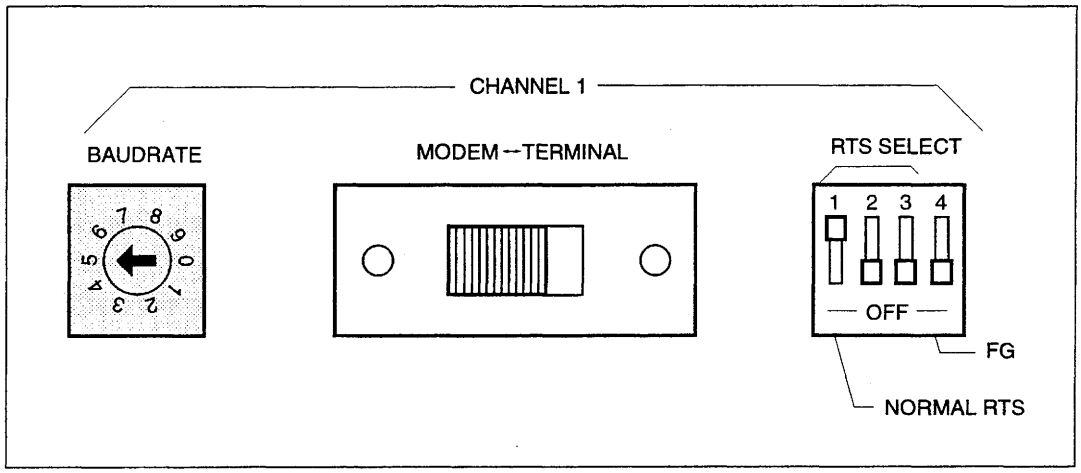


Table 6-2. Baud Rate Setting

Switch	Baud rate (bps)	Switch	Baud rate (bps)
0	300	5	9600
1	600	6	19200
2	1200	7(Note)	0
3	2400	8	300
4	4800	9	600

(Note) Do not select this position. Pulses required for data transfer are not generated when this position is selected.

(4) Handshaking

Hardware handshaking is performed by connecting the RTS, CTS, DSR, and DTR handshake signals. When these signals are not connected, software handshaking is performed. With channel 1, hardware handshaking and software handshaking are usually performed at the same time to transfer data.

In hardware handshaking, data is transferred one byte at a time using the handshake signals. This mode is called single-character handshaking. Software handshaking does not allow byte-by-byte handshaking, but allows block-by-block handshaking. This is called flow control.

With the IE-78000-R, an automatic hardware adjustment is made by using each handshake signal to prevent data overlapping in handshaking. When the buffer is full, for example, the CTS signal is controlled to stop data transfer completely. So no data is lost as long as the handshake signals are connected. When handshake signals are not connected, only software handshaking is performed, and data can be lost.

Hardware handshaking and software handshaking are explained below by using **modem mode** operation as an example.

- **Hardware handshaking (in the modem mode)**

  With the IE-78000-R, the μPD71051 is used for the RS-232-C interface. The signal output on the RxRDY pin of the μPD71051 is inverted for output onto the CTS line. When the receive buffer receives data from the RS-232-C interface, 1 appears on the RxRDY pin, and when the CPU in the IE-78000-R receives data from the buffer, 0 appears on the RxRDY pin (single-character handshaking). Thus CTS is controlled to prevent the terminal from sending the next data before the receive buffer becomes available.

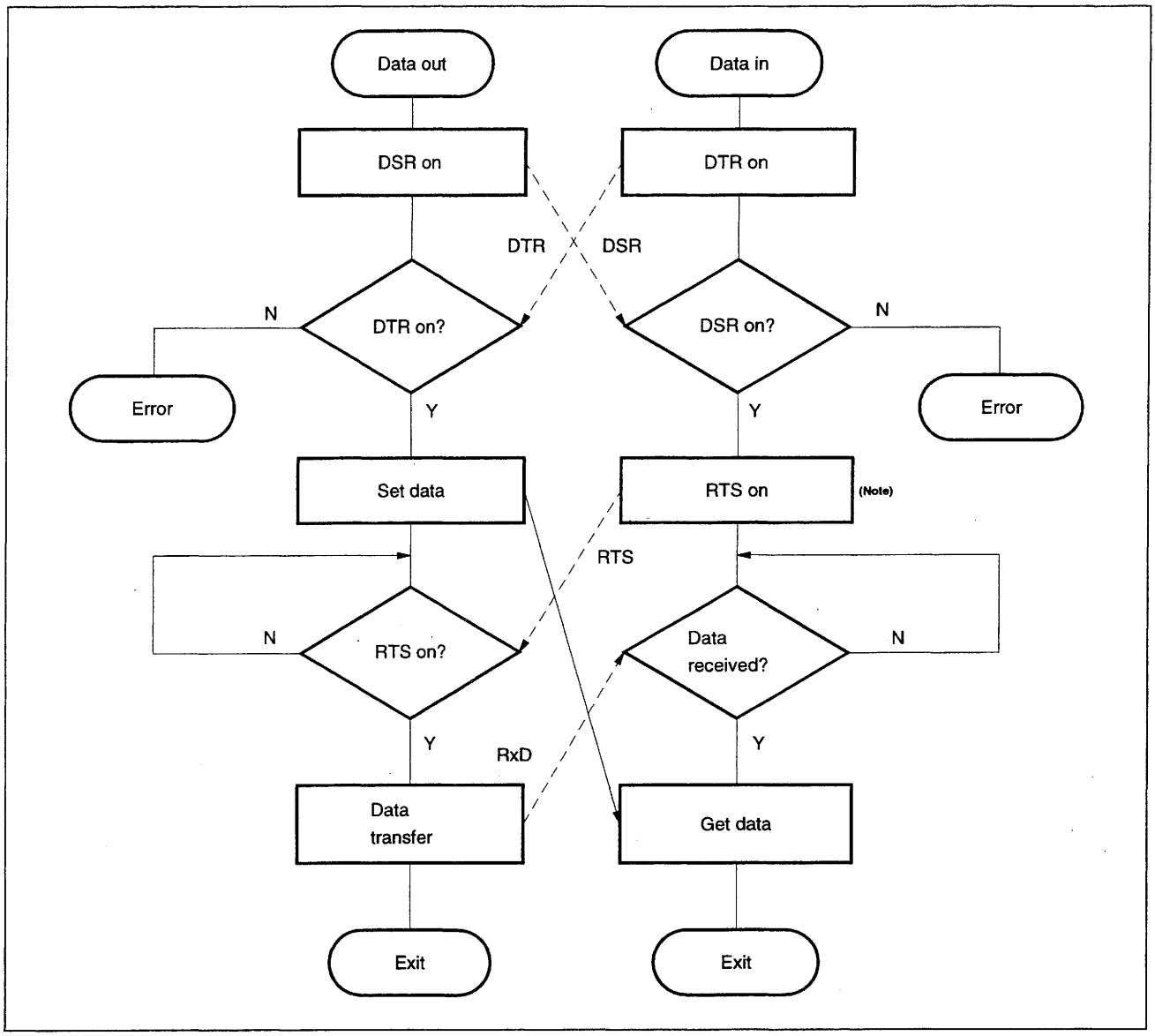
  - **Data transmission**

    When both RTS and DTR are active, the host machine is assumed to be ready to receive data, and data is sent onto the RxD line.

  - **Data reception**

    DSR must always be active. When the IE-78000-R is not ready to receive data, CTS is to be inactive. When the IE-78000-R is ready to receive data, CTS is to be made active. Then data is received from the TxD line.

Figure 6-6. Data Transfer from Modem to Terminal (Hardware Handshaking)



Remark ◄------- : Handshake line, ◄——— : Flow of data

(Note) RTS is set on as a pulse signal.

<1> DSR is set on when power is turned on.

<2> The DTR pin is checked. When DTR is off, an error results. When DTR is on, processing proceeds to the next step.

<3> Transfer data is set.

<4> Data transfer is not started until RTS is set on. Transfer is started when RTS is set on.

<5> Data is transferred.

<1> DTR is set on when power is turned on.

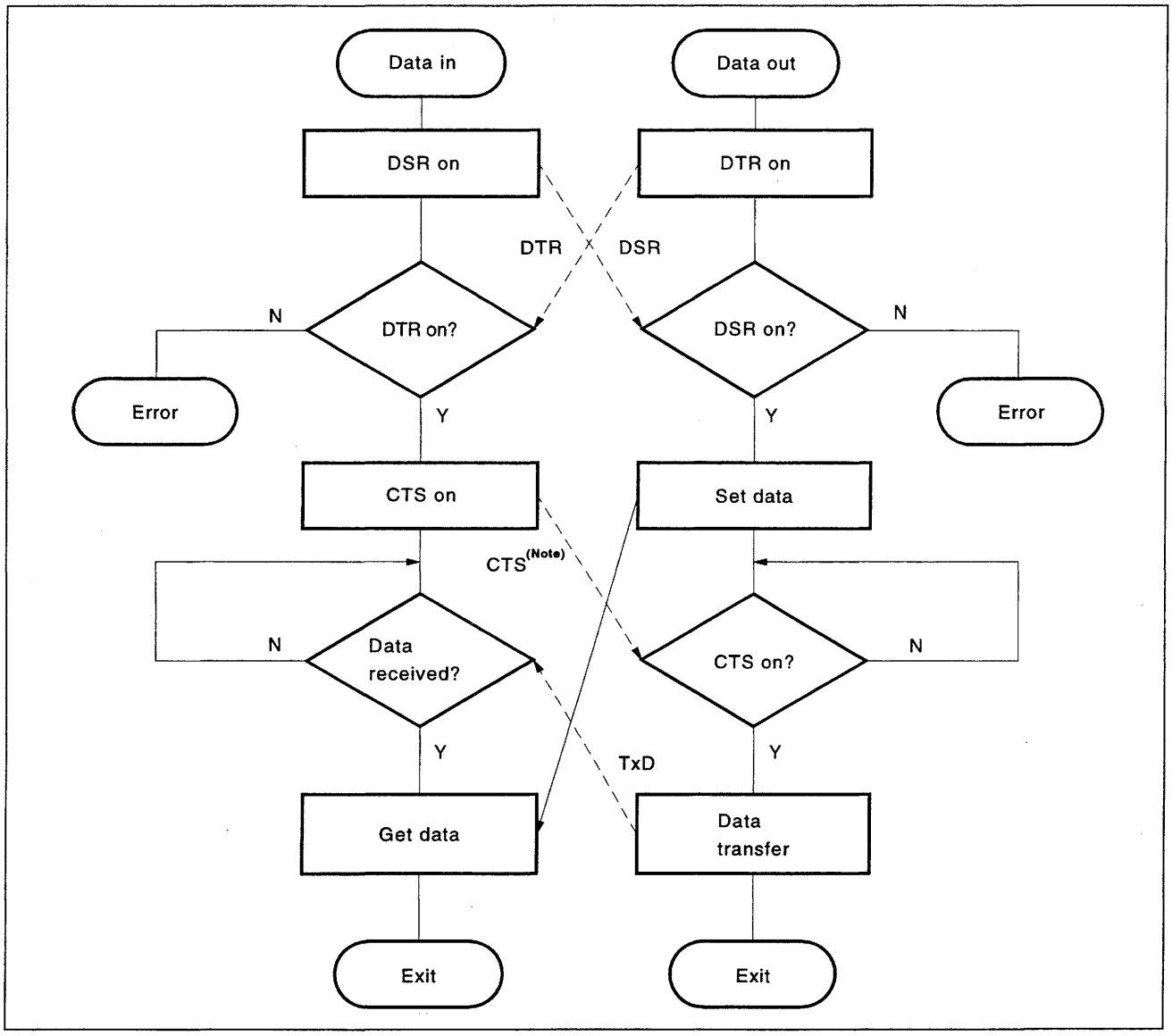
<2> The DSR pin is checked. When DSR is off, an error results. When DSR is on, processing proceeds to the next step.

<3> RTS is set on to allow an peripheral equipment to transfer data.

<4> Polling is performed to check whether data reception is completed.

<5> Data is taken in.

Figure 6-7. Data Transfer from Terminal to Modem (Hardware Handshaking)



Remark ◄------- : Handshake line, ◄——— : Flow of data

(Note) CTS is set on as a pulse signal.

<1> DSR is set on when power is turned on.

<2> The DTR pin is checked. When DTR is off, an error results. When DTR is on, processing proceeds to the next step.

<3> CTS is set on to allow an peripheral equipment to transfer data.

<4> Polling is performed to check whether data reception is completed.

<5> Data is taken in.

<1> DTR is set on when power is turned on.

<2> The DSR pin is checked. When DSR is off, an error results. When DSR is on, processing proceeds to the next step.

<3> Transfer data is set.

<4> Data transfer is not started until CTS is set on. Transfer is started when CTS is set on.

<5> Data is transferred.

- **Software handshaking (in the modem mode)**

  Software handshaking does not allow byte-by-byte handshaking, but allows block-by-block handshaking (flow control).

  - **Data transmission**

    Basically, the IE-78000-R always assumes that the host machine can receive data, and send data onto the RxD line. However, when Ctrl-S is sent from the host machine on the TxD line, data transfer is suspended. With channel 1 of the IE-78000-R, four to five characters are sent after Ctrl-S is received, then data transfer is stopped.

    When Ctrl-Q is sent from the host machine on the TxD line during transfer suspension, data transfer is resumed.

  - **Data reception**

    Basically, the IE-78000-R always receives data. Data is received using interrupts. Received data is loaded into a 128-byte buffer. When the buffer is loaded with data up to 50 percent of the buffer capacity, Ctrl-S is sent onto the RxD line to request the host machine to suspend data transmission. When data is transmitted after the request is issued, the data is received and loaded into the buffer. Then the CPU of the IE-78000-R takes in the data held in the buffer. When the data in the buffer is reduced to 35 percent of the buffer capacity, Ctrl-Q is sent onto the RxD line to request the host machine to resume data transfer.

    So if a host machine that sends at least 64 bytes after receiving Ctrl-S is connected to channel 1, data can be lost.

(5) Character specification

The character specification for data transmission is described below.

- **Character length**

  A fixed character length of eight bits is used. When the IE-78000-R sends data, the most significant bit (MSB) is always 0. When the IE-78000-R receives data, the most significant bit is ignored: it is always assumed to be 0.

- **Parity bit**

  No parity bit is used.

- **Stop bit length**

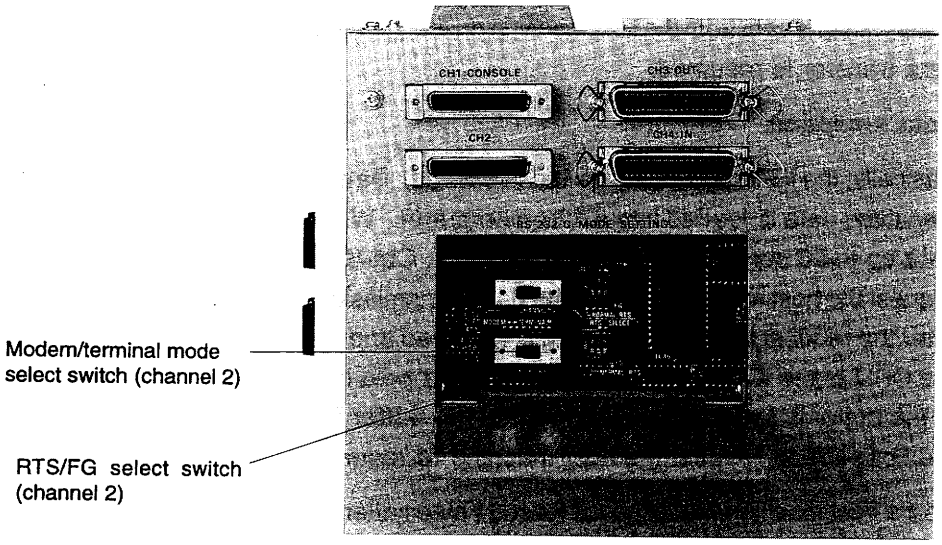
  A fixed stop bit length of two bits is used.

Phase-out/Discontinued

6.2 Channel 2 Functions

Channel 2 is a serial interface for a PROM programmer. It is based on RS-232-C. The RS-232-C mode switches on the right side of the IE-78000-R main unit contain channel 2 mode setting switches (CHANNEL 2). A serial interface port (CH2) is provided above the switches.

Photo 6-2. Channel 2



Channel 2 has the functions (1) to (5) below to control the RS-232-C interface. With these functions, channel 2 transfers control data between the IE-78000-R and a PROM programmer, and loads files.

All items below except (1) for mode switching (between terminal and modem) and (2) for RTS and FG setting can be set with the MOD command. The initial state is set to a baud rate of 9600 baud, single-character handshaking, a character length of eight bits, without parity, and a stop bit length of two bits.

(1) Mode switching

Setting item	Setting	Switch
Mode switching	Modem mode or terminal mode	Modem/terminal mode select switch

(2) RTS and FG setting

Setting item	Setting	Switch
RTS, FG	1: On, 2 to 4: Off	RTS/FG select switch

(3) Baud rate selection

Setting item	Setting	Switch
Baud rate	9600 bps	MOD command

(4) Handshaking

Setting item	Setting	Switch
Handshaking	Hardware handshaking or software handshaking	MOD command

(5) Character specification

Setting item	Setting	Switch
Character length	7 or 8 bits (with the most significant bit set always to 0 for output and ignored for input)	MOD command
Parity bit	Even parity/odd parity/without parity	
Stop bit length	1 bit or 2 bits	

Remark MOD command
The MOD command can be set as a single command line at the time of command input. For details, refer to **MOD command** in *User's Manual: Reference* that comes with the optional screen debugger.

- **Input format**

```
MOD [MODE = { CHAR | FLOW }] [BAUD = { 19200 | 9600 | 4800 | 2400 | 1200 | 600 | 300 }] [LONG = { 7 | 8 }] [PAR = { NON | EVEN | ODD }] [STOP = { 1 | 2 }]
```

- **Operands**

  MODE: Handshaking mode

  BAUD: Baud rate

  LONG: Character length

  PAR: Parity bit

  STOP: Stop bit

- **System operation mode**

  Executable when "TRACE" is not displayed in the status display stage.

- **Example of command setting on a single line**

```
CMD : MOD MODE = CHAR BAUD = 9600 LONG = 8 PAR = NON STOP = 2 ↵   ← Set on one line
CMD : ■
```

(1) Mode switching

The modem/terminal mode select switch provided as one of the RS-232-C mode switches on the right side of the main unit is used for mode switching between the terminal mode and modem mode (See **Figure 6-8**). The modem mode is set by sliding the switch from right to left. The terminal mode is set by sliding the switch from left to right.

Figure 6-8. Modem/Terminal Mode Select Switch (Channel 2)

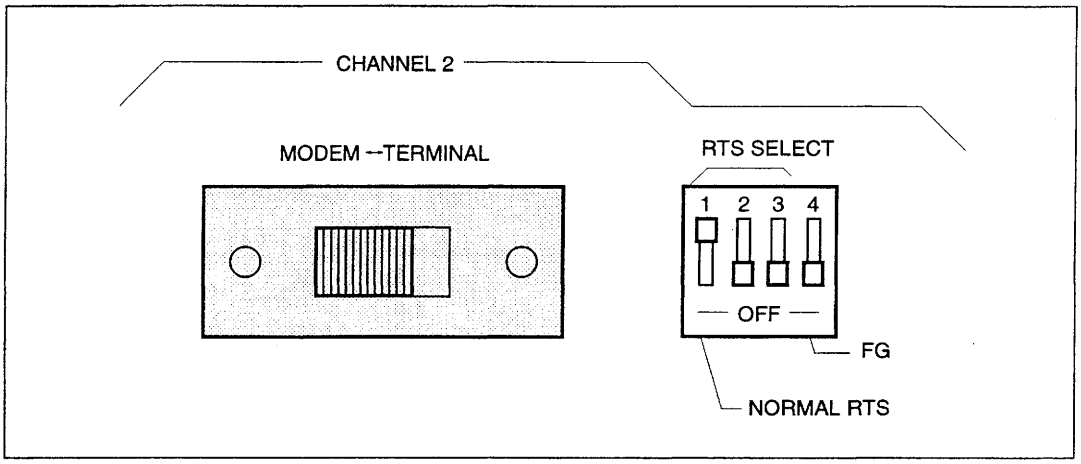
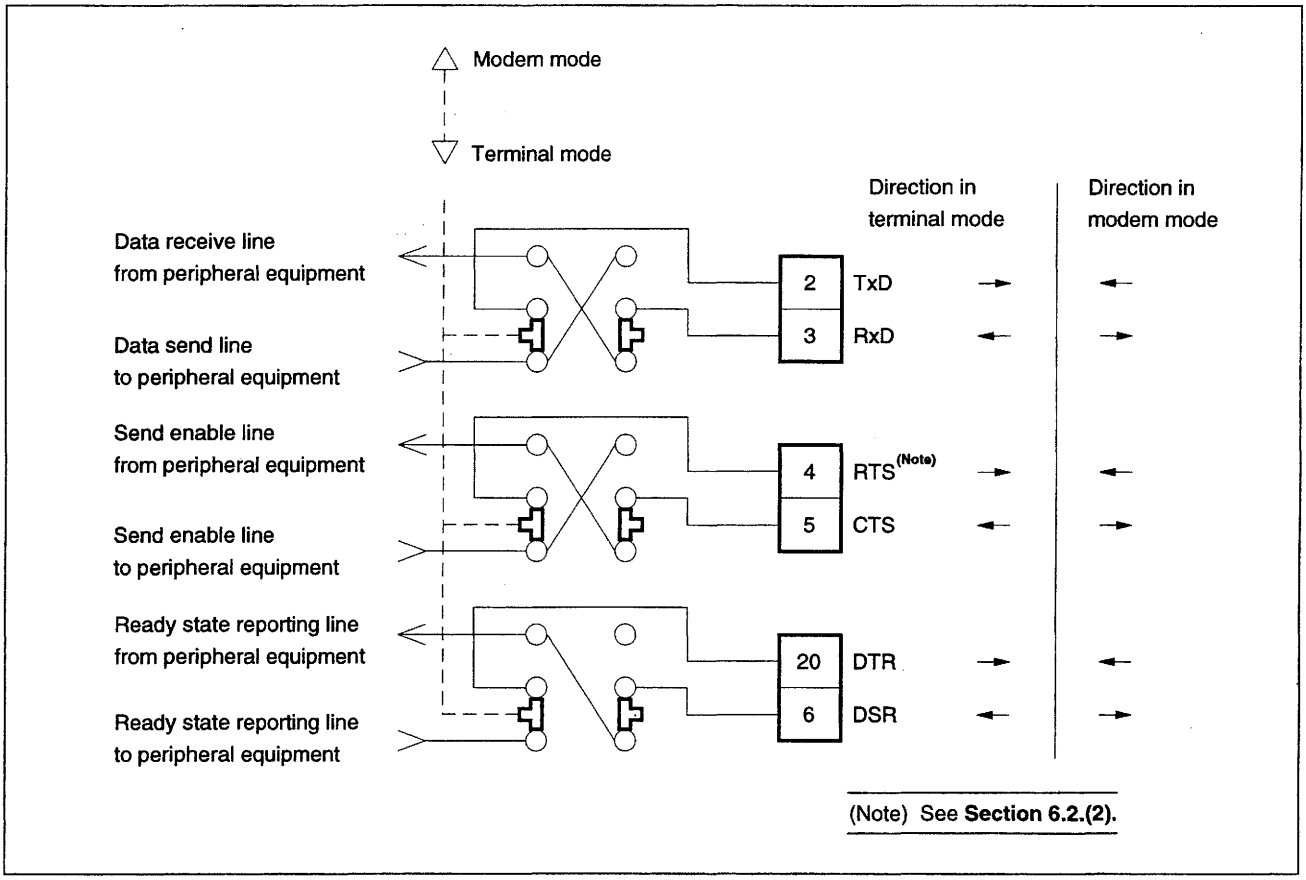


Figure 6-9. Circuit Diagram of Modem/Terminal Mode Select Switch (Channel 2)

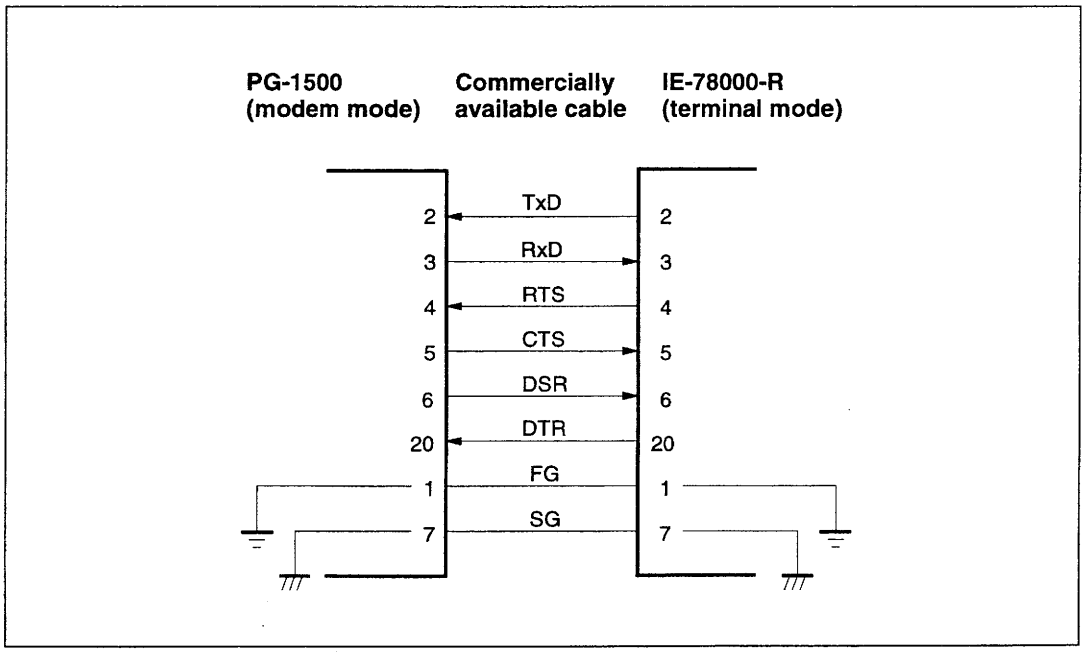


An example of mode setting is explained below. In the example, a PROM programmer (PG-1500) is connected.

- **PG-1500**

  The PG-1500 is a device that has the modem mode interface. To connect the PG-1500, a commercially available cable consisting of pairs of signal lines should be used. The IE-78000-R must be set to the terminal mode by sliding the switch from left to right.

Figure 6-10. PG-1500 Connection (When Commercially Available Cable Consisting of Pairs of Signal Lines Is Used)



(2) RTS and FG setting

The RTS/FG select switch is used for RTS and FG setting. The switch is on when it is set to the upper position. The switch is off when it is set to the lower position. (See **Table 6-3**, **Figure 6-11** and **Figure 6-12**.)

- **RTS setting**

  Switches 1 to 3 of the RTS/FG select switch are used for RTS setting. Setting these switches determines which pin (pin 4, 11, or 21) of the RS-232-C interface cable is to be connected to the RTS signal line. RTS is usually connected to pin 4 of the RS-232-C interface. RTS must always be connected to RTS N (Switch 1: ON, Switches 2 and 3: OFF) except in special cases.

- **FG setting**

  Switch 4 of the RTS/FG select switch is used to determine whether FG (Frame Ground) and SG (Signal Ground) are to be connected or open. Usually, FG and SG must be set open.

Table 6-3. RTS and FG Setting (Channel 2)

	RTS and FG setting				
RTS name	1	2	3	4	Device connected
RTS N	ON	OFF	OFF	OFF	PROM programmer
RTS P	OFF	ON	OFF	OFF	Not to be set
RTS D	OFF	OFF	ON	OFF	

Figure 6-11. RTS/FG Select Switch (Channel 2)

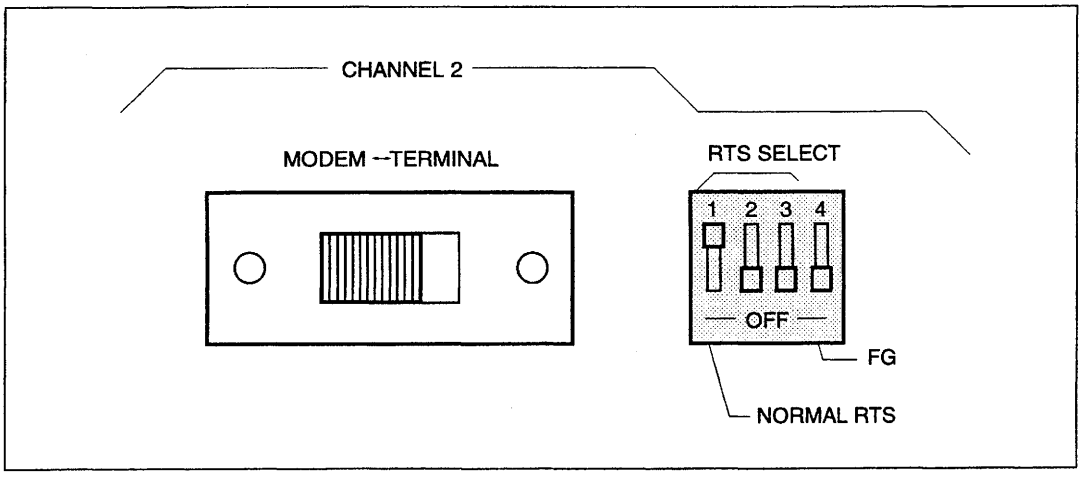
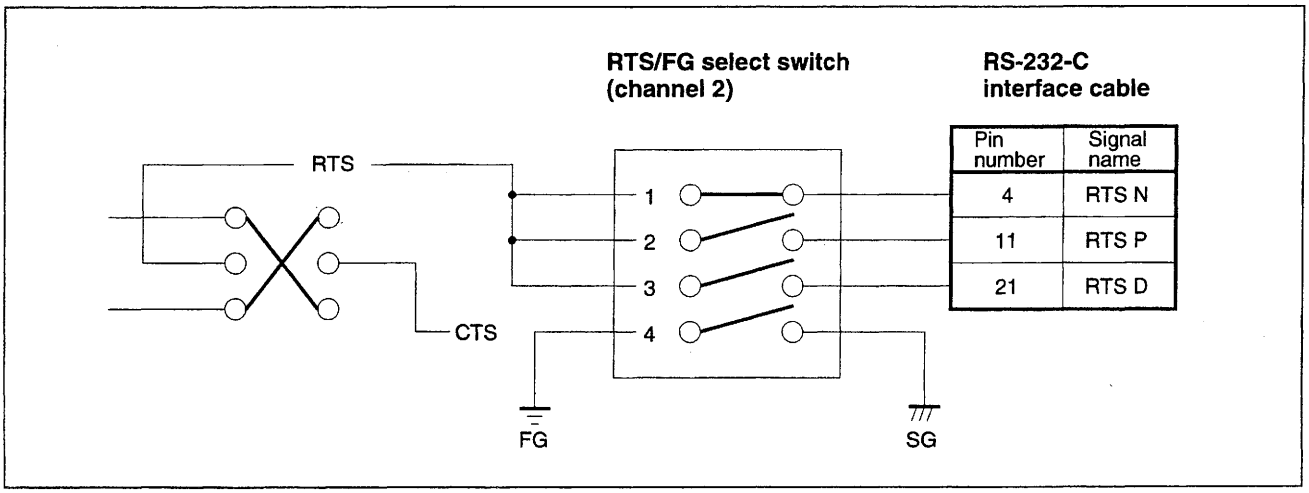


Figure 6-12. Circuit Diagram of RTS/FG Select Switch (Channel 2)



(3) Baud rate selection

The baud rate of the connected PROM programmer needs to be set to match that of the IE-78000-R. A baud rate is selected using the MOD command. This command is entered from the host machine connected to channel 1 of the IE-78000-R.

(4) Handshaking

Hardware handshaking is performed by connecting the RTS, CTS, DSR, and DTR handshake signals. When these signals are not connected, software handshaking is performed. With channel 2, either hardware handshaking or software handshaking is usually performed to transfer data. The MOD command is used for handshake setting.

In hardware handshaking, data is transferred one byte at a time using the handshake signals (single-character handshaking). Software handshaking does not allow byte-by-byte handshaking, but allows block-by-block handshaking. This is called flow control.

Note that when the hardware handshake mode (single-character handshaking: CHAR) is selected, **the handshake signals must be connected**. Since no buffer is used, normal handshaking is not performed when hardware handshaking is selected without connecting the handshake signals.

When the software handshake mode (flow control: FLOW) is selected, a 96-byte buffer for storing serial data is available. However, some data can be lost, depending on the situation.

Hardware handshaking and software handshaking are explained below by using **modem mode** operation as an example.

- **Hardware handshaking (in the modem mode)**

  With the IE-78000-R, the μPD71051 is used for the RS-232-C interface. The signal output on the RxRDY pin of the μPD71051 is inverted for output onto the CTS line. When the receive buffer receives data from the RS-232-C interface, **1** appears on the RxRDY pin, and when the CPU in the IE-78000-R receives data from the buffer, 0 appears on the RxRDY pin (single-character handshaking).

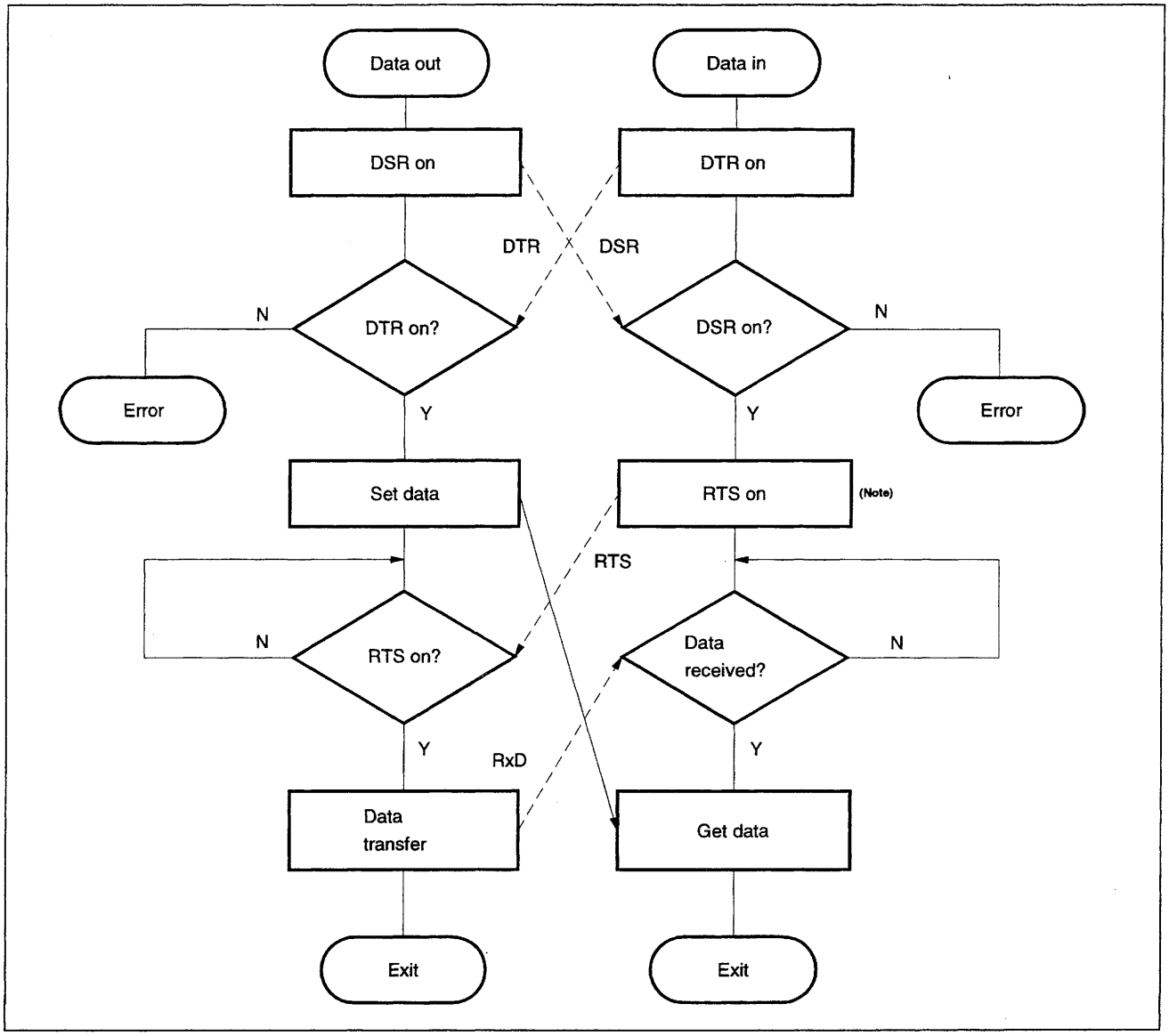
  - **Data transmission**

    When both RTS and DTR are active, the PROM programmer is assumed to be ready to receive data, and data is sent onto the RxD line.

  - **Data reception**

    DSR must always be active. When the IE-78000-R is not ready to receive data, CTS is to be inactive. When the IE-78000-R is ready to receive data, CTS is to be made active. Then data is received from the TxD line.

Figure 6-13. Data Transfer from Modem to Terminal (Hardware Handshaking)



Remark ◄------- : Handshake line, ◄——— : Flow of data

(Note) RTS is set on as a pulse signal.

<1> DSR is set on when power is turned on.

<2> The DTR pin is checked. When DTR is off, an error results. When DTR is on, processing proceeds to the next step.

<3> Transfer data is set.

<4> Data transfer is not started until RTS is set on. Transfer is started when RTS is set on.

<5> Data is transferred.

<1> DTR is set on when power is turned on.

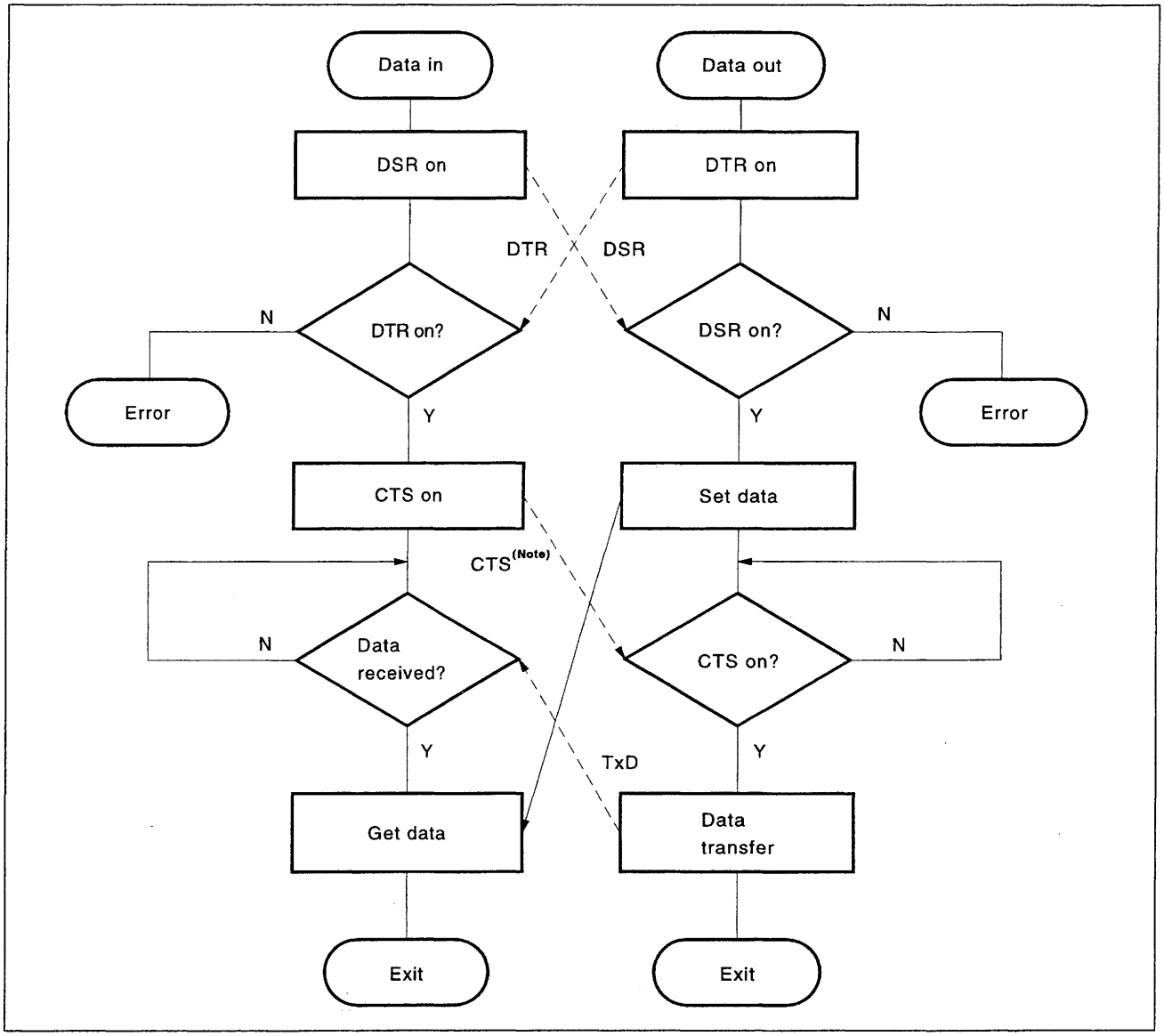
<2> The DSR pin is checked. When DSR is off, an error results. When DSR is on, processing proceeds to the next step.

<3> RTS is set on to allow an peripheral equipment to transfer data.

<4> Polling is performed to check whether data reception is completed.

<5> Data is taken in.

Figure 6-14. Data Transfer from Terminal to Modem (Hardware Handshaking)



Remark ◄------- : Handshake line, ◄——— : Flow of data

(Note) CTS is set on as a pulse signal.

<1> DSR is set on when power is turned on.

<2> The DTR pin is checked. When DTR is off, an error results. When DTR is on, processing proceeds to the next step.

<3> CTS is set on to allow an peripheral equipment to transfer data.

<4> Polling is performed to check whether data reception is completed.

<5> Data is taken in.

<1> DTR is set on when power is turned on.

<2> The DSR pin is checked. When DSR is off, an error results. When DSR is on, processing proceeds to the next step.

<3> Transfer data is set.

<4> Data transfer is not started until CTS is set on. Transfer is started when CTS is set on.

<5> Data is transferred.

- **Software handshaking (in the modem mode)**

  Software handshaking does not allow byte-by-byte handshaking, but allows block-by-block handshaking (flow control).

  - **Data transmission**

    Basically, the IE-78000-R always assumes that the PROM programmer can receive data, and send data onto the RxD line. However, when Ctrl-S is sent from the PROM programmer on the TxD line, data transfer is suspended. With channel 2 of the IE-78000-R, four to five characters are sent after Ctrl-S is received, then data transfer is stopped.

    When Ctrl-Q is sent from the PROM programmer on the TxD line during transfer suspension, data transfer is resumed.

  - **Data reception**

    Basically, the IE-78000-R always receives data. Data is received using interrupts. Received data is loaded into a 96-byte buffer. When the buffer is loaded with data up to 50 percent of the buffer capacity, Ctrl-S is sent onto the RxD line to request the PROM programmer to suspend data transmission. When data is transmitted after the request is issued, the data is received and loaded into the buffer. Then the CPU of the IE-78000-R takes in the data held in the buffer. When the data in the buffer is reduced to 35 percent of the buffer capacity, Ctrl-Q is sent onto the RxD line to request the PROM programmer to resume data transfer.

    So if a PROM programmer that sends at least 48 bytes after receiving Ctrl-S is connected to channel 2, data can be lost.

(5) Character specification

The character specification for data transmission is described below.

- **Character length**

  A character length of seven bits or eight bits must be selected using the MOD command. When the 8-bit length is selected, the most significant bit (MSB) of data output from the IE-78000-R is always 0. The most significant bit of data received by the IE-78000-R is ignored: it is always assumed to be 0.

- **Parity bit**

  The MOD command is used to select even parity, odd parity, or without parity.

- **Stop bit length**

  The MOD command is used to select a stop bit length of one bit or two bits.

Phase-out/Discontinued

Chapter 7

Functions of Channels 3 and 4

This chapter details channels 3 and 4 of the IE-78000-R. Read this chapter when detailed information about channels 3 and 4 is required.

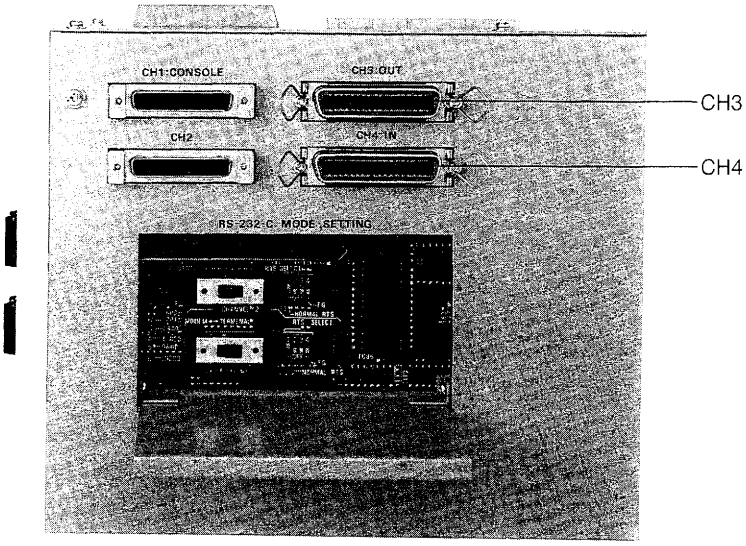
Organization of this chapter

7.1 Functions of Channels 3 and 4

Channels 3 and 4 are 8-bit parallel interfaces. Parallel interface ports (CH3 and CH4) are provided above the RS-232-C mode switches on the side of the IE-78000-R main unit. The TTL level is used for all input data and interface control signals. In addition, the interface circuitry conforms to Centronics.

Channel 3, when connected to a printer, can output data from channel 4 to the printer in through output mode. Channel 4 is used for connection to a host machine, and can download files such as object files at high speed.

Photo 7-1. Parallel Interface Ports (CH3 and CH4)



(1) High-speed download

With the IE-78000-R, two download methods are used. When channel 4 is used, high-speed download is possible.

Load mode	Description	Selection method
High-speed download	Parallel interface output of host machine is downloaded to parallel interface input (channel 4) of IE-78000-R.	<1> Select high-speed download mode in the initial setting screen at activation of the screen debugger. <2> Open the load panel for loading.
Normal download	RS-232-C interface output of host machine is downloaded to RS-232-C interface input (channel 1) of IE-78000-R.	Open the load panel for loading. (Do not select high-speed download mode at activation of the screen debugger.)

- **Executing high-speed download**

<1> The following message appears in setting high-speed download mode on the initial setting screen of the screen debugger.

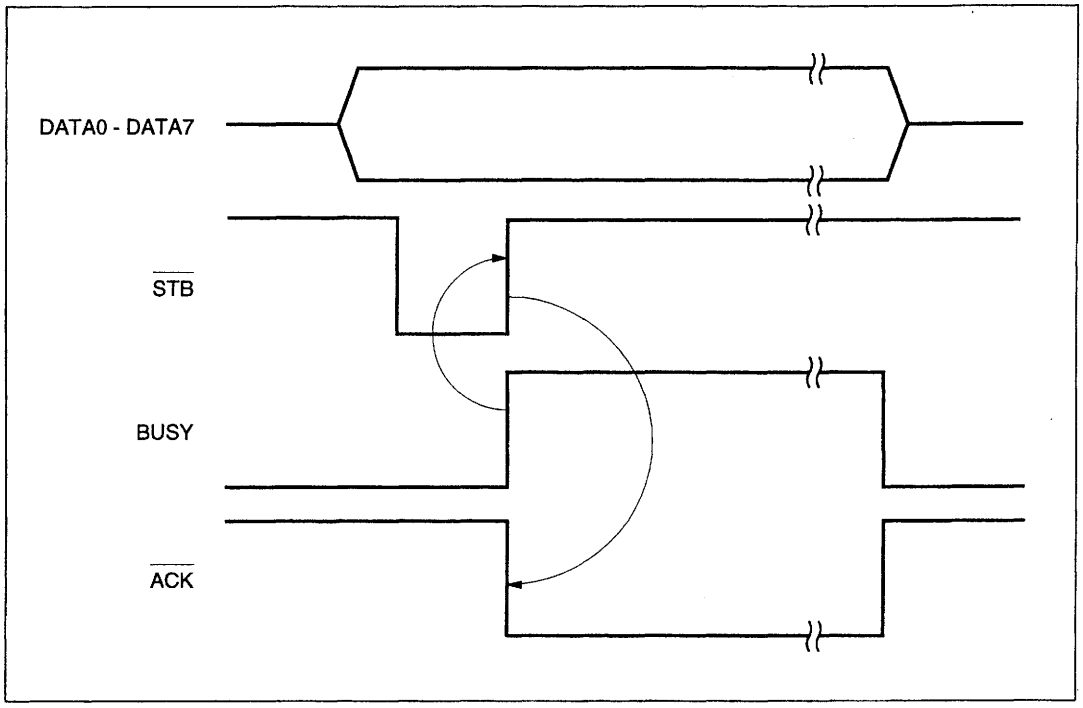
```
High-speed download mode ?   [yes, no]
```

<2> Type yes ↵ to select the high-speed download mode. Then the following files can be downloaded from the host machine at high speed through the parallel interface.

When selecting yes, make sure that CH4 is connected to the host machine.

- Load module file
- Object file
- Symbol file
- Debugging environment file
- Device file

Figure 7-1. Timing of High-Speed Download Mode



(2) Through output

For through output from channel 4 to channel 3, download operation must be performed by means other than the LOD command. For example, when the PRINT command of MS-DOS is used for list output, the printer connected with channel 3 can be used for output without reconnecting the printer to the PC-9800.

When the parallel interface is already used (for example, for list output) at the time of VRY command execution, download operation is performed through serial interface channel 1.

7.2 Signal Lines and Circuit Diagram of Parallel Interface (CH3 and CH4)

The input signals, port pin allocation, and circuit diagram of the parallel interface (CH3 and CH4) are described below.

Table 7-1. Parallel Interface Signals

Pin number	Signal name	Direction CH3	Direction CH4	Function
1	$\overline{STB}$	Output	Input	Strobe pulse signal for reading data
2	DATA0	Output	Input	Parallel data 0
3	DATA1	Output	Input	Parallel data 1
4	DATA2	Output	Input	Parallel data 2
5	DATA3	Output	Input	Parallel data 3
6	DATA4	Output	Input	Parallel data 4
7	DATA5	Output	Input	Parallel data 5
8	DATA6	Output	Input	Parallel data 6
9	DATA7	Output	Input	Parallel data 7
10	$\overline{ACK}$	Input	Output	Output upon completion of data input
11	BUSY	Input	Output	Signal for reporting that data cannot be received
19-30 33	GND	–	–	Signal ground
12	PE	–	Input	Not used (+5 V, pulled up with 3.3 kΩ resistor)
32	$\overline{ERROR}$	–	Input	Not used (+5 V, pulled up with 3.3 kΩ resistor)

Figure 7-2. Pin Allocation of Parallel Interface Port (CH3 and CH4)

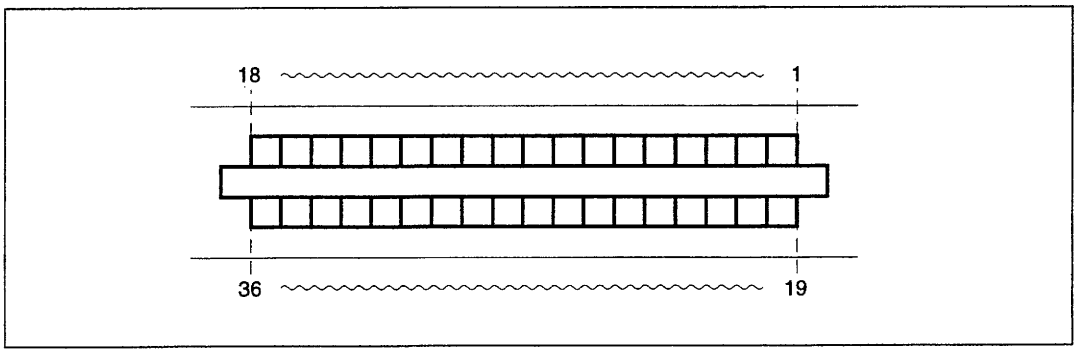
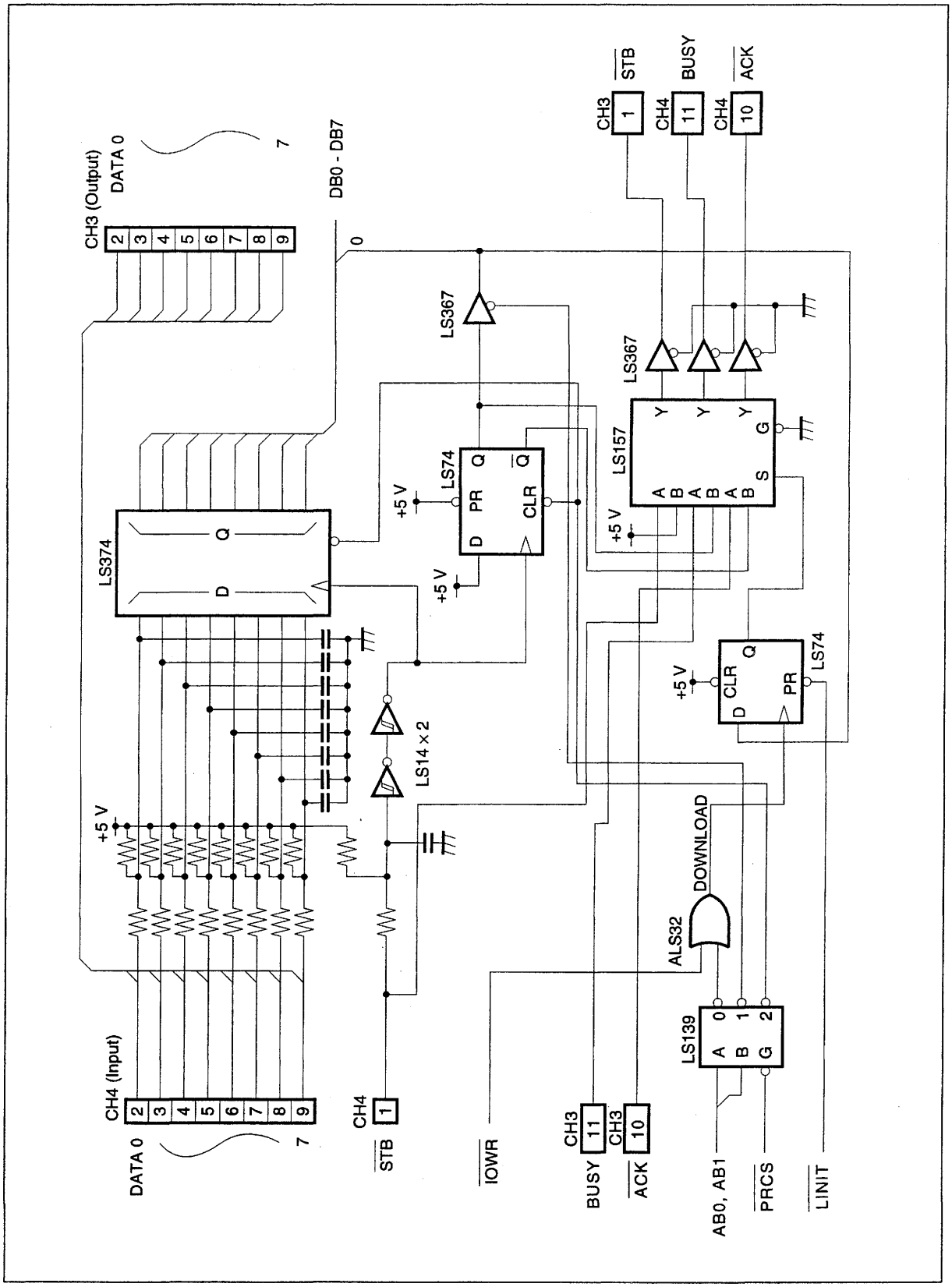


Figure 7-3. Circuit Diagram of Parallel Interface



Phase-out/Discontinued

Appendix A

Specifications

This appendix describes the IE-78000-R specifications. The specifications are divided into two categories: product specifications (including outside dimensions and electric specifications) and debugger specifications.

- **Product specifications**

Outside dimensions	Depth: 370 mm
	Width: 160 mm
	Height: 283 mm
Weight	8.5 kg
Input voltage	85 to 132 VAC or 170 to 265 VAC (automatic input switching)
Current	100 VAC
	50/60 Hz
	3 A
Operating temperature	0°C to 50°C
Storage temperature	–20°C to +60°C
Ambient humidity	20% to 80% RH

- **Basic debugger specifications**
  - **Applicable device**
    - All devices of the 78K/0 series (The emulation board corresponding to the device is needed.)
  - **Operating frequency** Up to 10 MHz (Factory-set: 8.38 MHz)
  - **Clock supply** Crystal oscillator in IE-78000-R (Clocks can be supplied from the target system.)
  - **Memory**
    - Alternate memory capacity

      Internal ROM
      Expansion memory } 64 KB
      Internal RAM

    - Mapping unit

      Internal ROM: In units of 8K bytes
      Expansion memory: In units of 4K bytes
      Internal RAM: In units of 128 bytes

- **Event detection**
  - Access detection: 4 points (address/data/status/external signal level)
  - Program execution detection: 7-point parallel (address/external signal level)
    4-level sequential (address/external signal level)
  - External signal level: 8 bits (Set by ANDing access detection and program execution detection)
  - Number of event occurred: 1 to 255

- **Break function and cause of break**
  - Event detection: Access detection: Address
    Data
    Status
    External signal data
    Fetch detection: 4-point parallel fetch
    4-level sequential fetch
  - Fail-safe breaks: Manual break
    Non-map break
    Write-protect break
    SFR illegal access break
    System stack overflow break
    User stack overflow break
- **Real-time trace**
  - Cause of trace Total trace or triggered by event detection
  - Trace capacity 49 bits x 2K steps
  - Trace contents Fetch bus (16 bits), access bus (16 bits), data (8 bits), status (9 types), external sense data (8 bits)
- **Command functions**
  - Online assembling, disassembling
  - Memory/register/SFR manipulation
  - Event/trace condition setting
  - Mapping
  - Reset
  - Emulation start/stop
  - Symbolic debugging
  - Object/symbol/debugging environment load and save
  - Console redirection, help command, PGM mode, history
  - Line edit

- **Target interface**
  - Emulation probe (optional)
  - The power supply voltages (V_{DD}) of the target system depend on the emulation boards.

    For the IE-78014-R-EM: 5.0 V

    For the IE-78044-R-EM: 5.0 V

    For the IE-780208-R-EM: 5.0 V *

    For the IE-78014-R-EM-A: 3.0 to 6.0 V *

    For the IE-78064-R-EM: 3.0 to 6.0 V

    For the IE-78078-R-EM: 3.0 to 6.0 V *

    For the IE-78098-R-EM: 3.0 to 6.0 V
- **External interface**
  - RS-232-C CH1: For host machine
    CH2: For PROM programmer
  - Parallel interface CH3: For parallel output and printer
    CH4: For parallel input and high-speed download
- **Host machine** PC-9800 series
  IBM PC/AT
- **Screen debugger**
  - SD78K/0: For MS-DOS (optional)
    For PC DOS (optional)
- **Device file**
  - DF780xx: For MS-DOS (optional)
    For PC DOS (optional)
- **Language processing program**
  - Relocatable assembler RA78K/0: For MS-DOS (optional)
    For PC DOS (optional)
  - C compiler CC78K/0: For MS-DOS (optional)
    For PC DOS (optional)
  - C compiler library source file CC78K/0-L: For MS-DOS (optional)
    For PC DOS (optional)

- **Others**
  - Support of stand-by functions
  - Built-in latch-up protection circuit
  - Trace display and event detection setting modification during emulation CPU operation.

Phase-out/Discontinued

Appendix B

Block Diagrams

This appendix provides the block diagrams of the control/trace module and driver module, which represent key functions of the IE-78000-R.

(1) Control/trace module block

- **Driver control**

  This is an interface with the driver module.

- **Trace RAM**

  A 14K-byte trace RAM is contained, and the RAM can hold the latest trace data (for 2047 steps) up to an event detection point.

- **Memory bank selector**

  The memory bank selector enables selection from ROM, DRAM, and trace RAM by means of bank switching.

- **Serial interface**

  Two RS-232-C interface channels are used.

- **Parallel interface**

  Two interface channels are used: a centronics interface channel for high-speed download and a channel for through output.

- **I/O selector**

  The I/O selector enables selection from the serial interface, parallel interface, and driver control by means of bank switching.

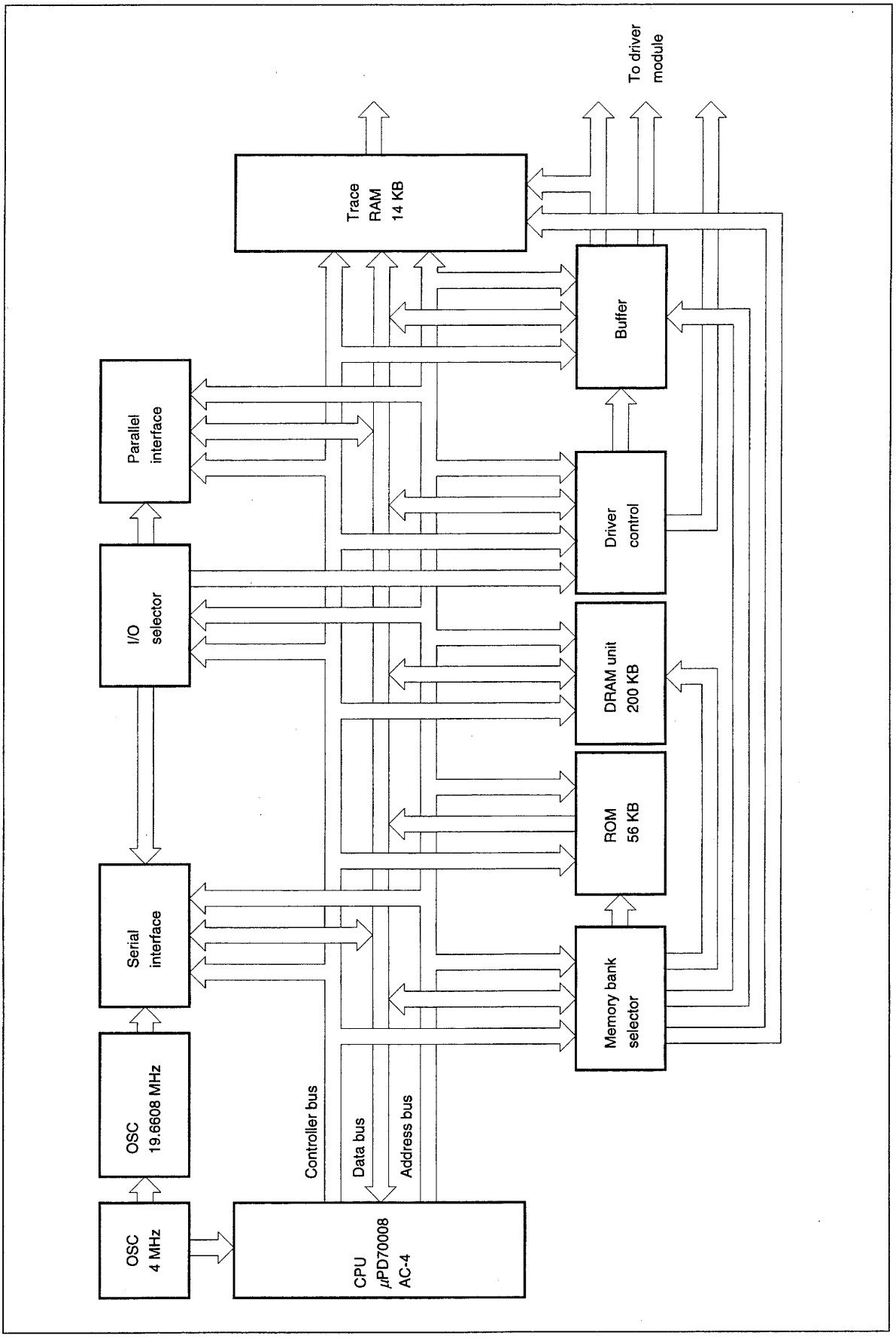
- **DRAM unit**

  A 192K-byte work area is available for symbols, and an 8K-byte work area is available for programs in a 200K-byte memory.

- **ROM**

  A 56K-byte ROM is available which contains a program for activating the IE-78000-R.

Figure B-1. Block Diagram of Control/Trace Module



(2) Driver module block

- **Event control**

  This controls a wide variety of event detection functions available with the IE-78000-R.

- **Break control**

  This controls a wide variety of break functions provided by the IE-78000-R. Many different break conditions can be set by a combination of event conditions.

- **Trace control**

  This controls trace conditions. The IE-78000-R has a trace function with a capacity of 2K bytes by 49 bits for storing CPU execution status. Many different trace conditions can be set by a combination of event conditions.

- **Latch-up**

  When a latch-up occurs with an emulation device or peripheral CMOS-TTL, this section removes power from the emulation device, CMOS around the emulation device, and TTL preceding the CMOS.

- **Alternate memory**

  This memory is used to control basic operations at the break of emulation device.

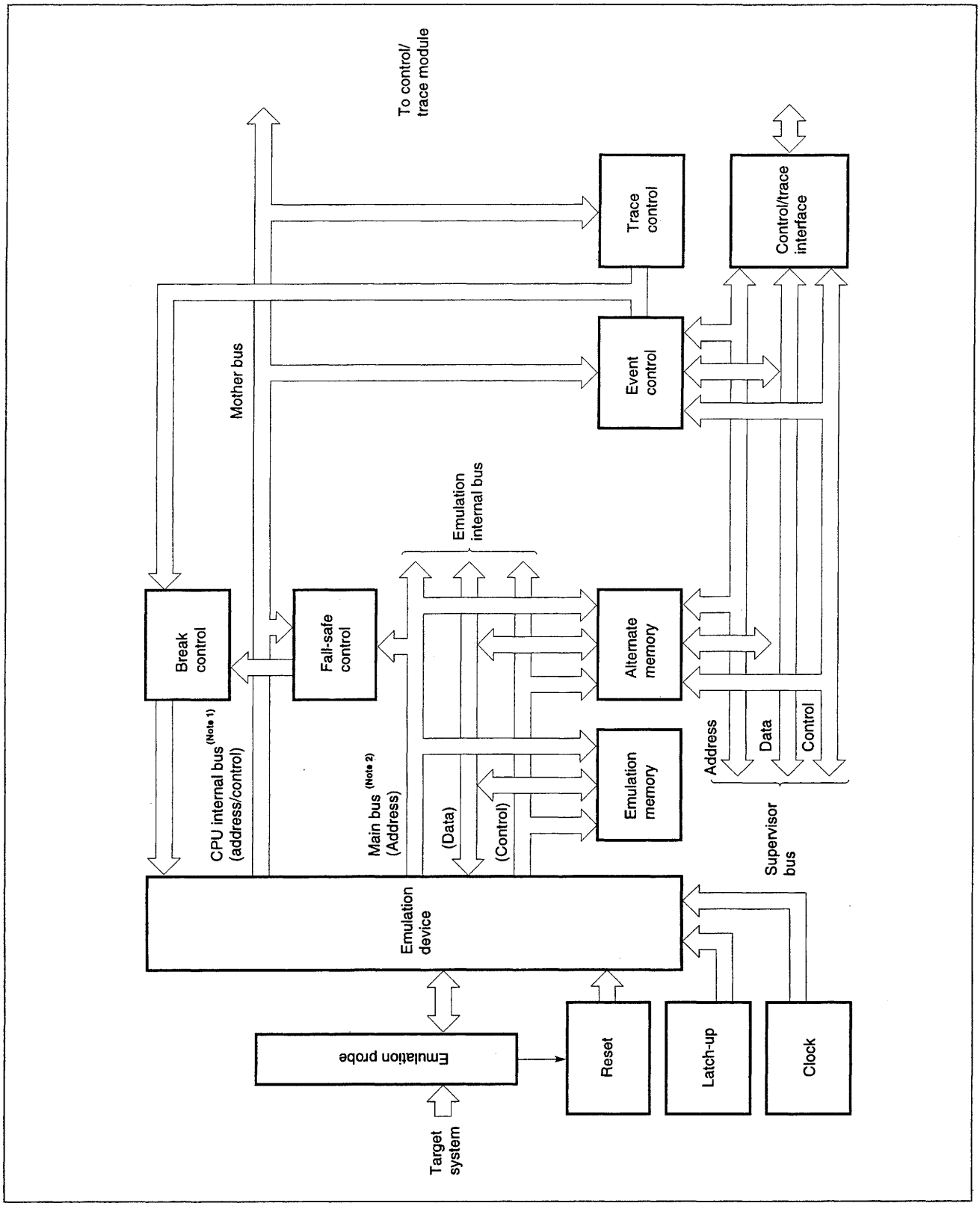
- **Emulation memory**

  This memory is a 64K-byte alternate memory that can be accessed by the target device. Even when a target system is not completed yet, software can be debugged by using this memory. By using the mapping function, memory from 0 to 64K bytes can be allocated in units of 8K bytes to internal ROM, and 4K bytes to user memory.

- **Fail-safe control**

  This circuit protects memory and an SFR read-only area.

Figure B-2. Block Diagram of Driver Module



(Note 1) CPU internal bus: Bus for accessing data in the CPU internal RAM and SFR
(Note 2) Main bus: Bus for fetching programs into and accessing data in the internal ROM or expansion memory

[MEMO]

Phase-out/Discontinued

Appendix C

Setting of Jumpers on Control Trace Board

This appendix explains the factory-set control/trace board jumper setting. Usually, the user need not modify the setting.

(1) Jumper setting

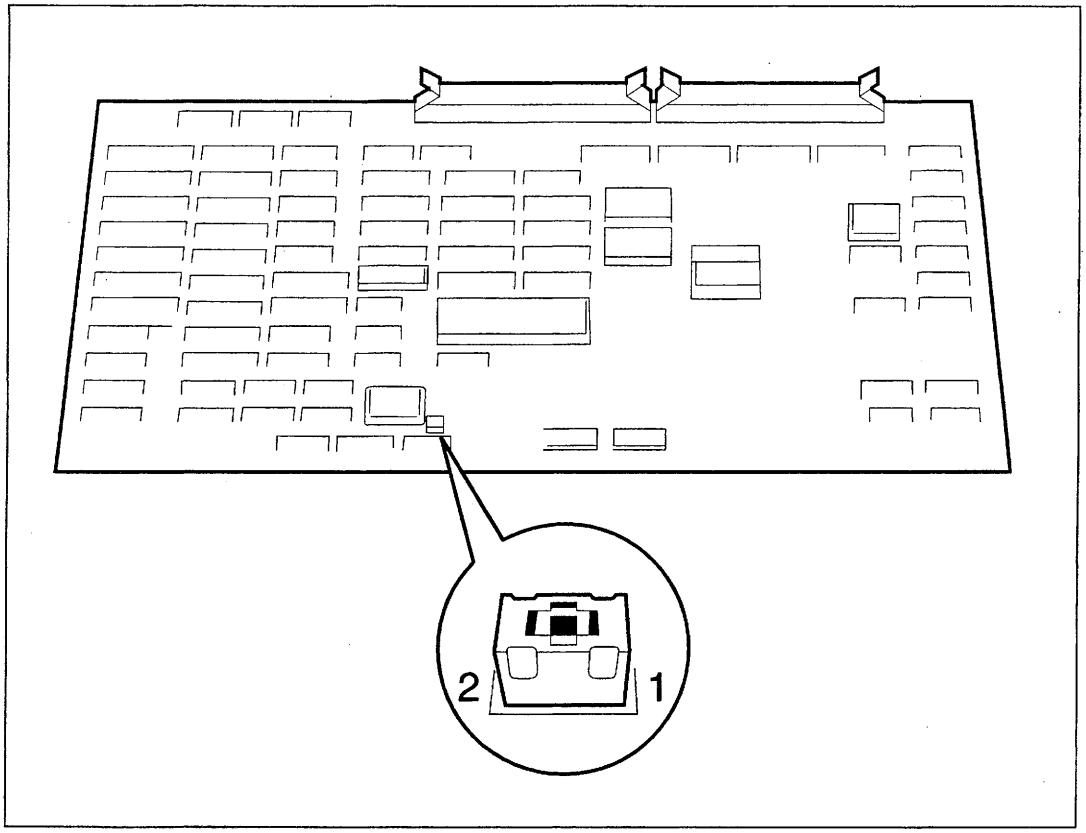
The jumper of the control/trace board is factory-set as described below.

Table C-1. Jumper Setting (Factory-Set)

Board	Jumper No.	Setting
Control/trace board	JP1	1-2 connected

Caution **If the jumper is set differently from the factory setting, abnormal operation results. Usual operation requires no change to the setting. So the factory-set jumper must not be changed.**

Figure C-1. Jumper Location on Control/Trace Board



(2) Control/trace board connection

The control/trace board can be installed and removed by using the procedure described below.

<Procedure>

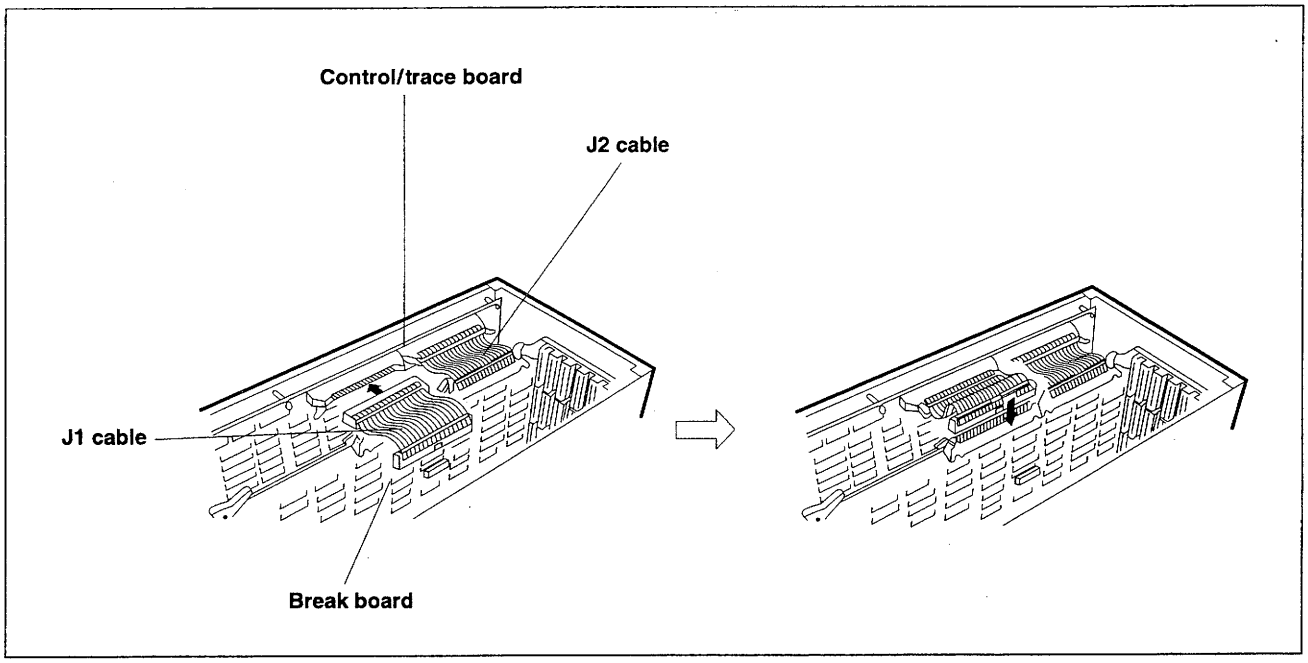
<1> Remove the six screws from the top of the IE-78000-R main unit to open the cover.

<2> Disconnect the J1 and J2 cables connecting the break board with the control/trace board.

<3> Pull the card pullers located on both ends of the board toward you and pull out all boards from the slots.

<4> To reconnect the J1 and J2 cables, make connections as shown in Figure C-2.

Figure C-2. J1 and J2 Cable Connection Diagram



[MEMO]

Phase-out/Discontinued

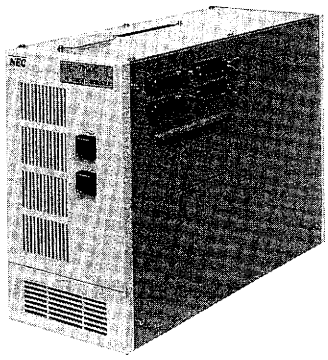
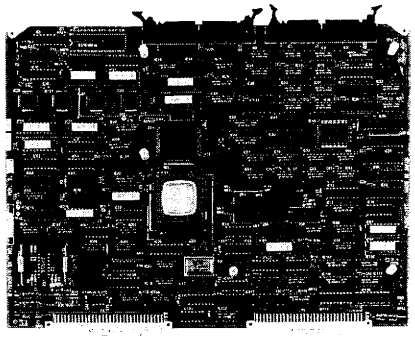
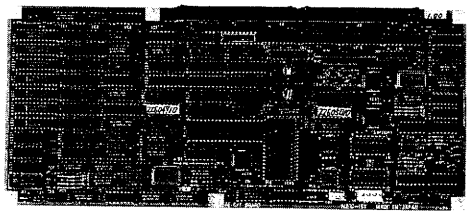
Appendix D

System Configuration

This appendix shows the system configuration of the IE-78000-R.

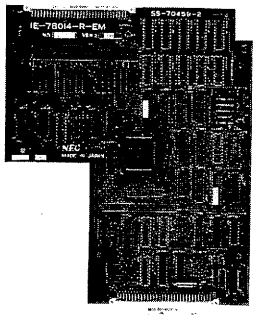
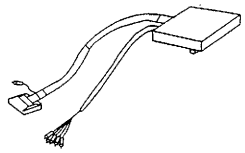
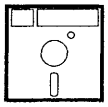
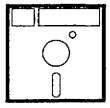
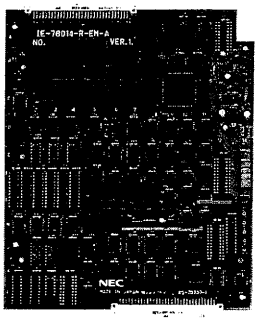
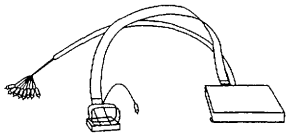
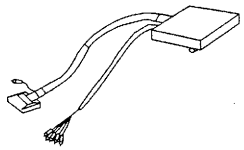
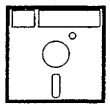
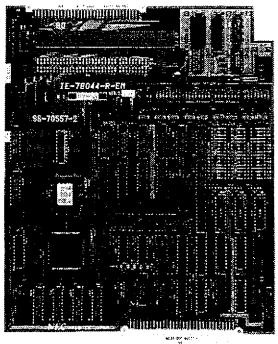
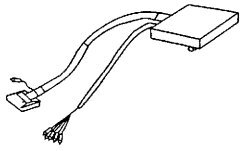
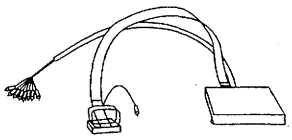
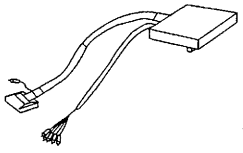
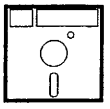
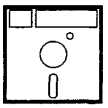
Phase-out/Discontinued

Table D-1. System Configuration of the IE-78000-R (1/6)

Target device	Cabinet and control/trace board	Break board
μPD78002 sub-series μPD78002Y sub-series	 78K series common cabinet (internal power supply)	 IE-78000-R-BK (78K/0 series common break board)
μPD78014 sub-series μPD78014Y sub-series		
* μPD78018F sub-series μPD78018FY sub-series		
μPD78024 sub-series	 IE-78000-R-CS-A (78K series common control/trace board)	
* μPD78044 sub-series μPD78044A sub-series		

Phase-out/Discontinued

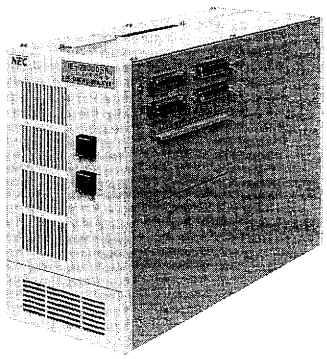
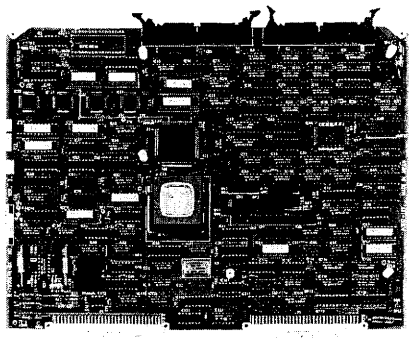
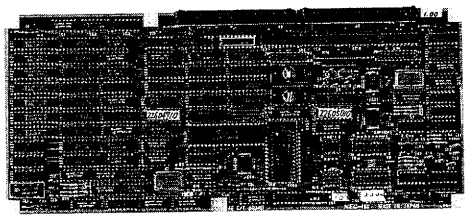
Table D-1. System Configuration of the IE-78000-R (2/6)

Emulation board (optional)	Emulation probe (optional)	Screen debugger (optional)	Device file (optional)
 IE-78014-R-EM	 (Add-on product: EV-9200GC-64 (one)) EP-78240GC-R	 SD78K0 (with ROM)	 DF78002
 IE-78014-R-EM-A	 EP-78240CW-R  (Add-on product: EV-9500GK-64 (one)) EP-78012GK-R(Note)		 DF78014
 IE-78044-R-EM	 (Add-on product: EV-9200G-64 (one)) EP-78024GF-R  EP-78024CW-R  (Add-on product: EV-9200G-80 (one)) EP-78130GF-R		 DF78024  DF78044 *

(Note) Corresponds to the μPD78018F sub-series only. *

Phase-out/Discontinued

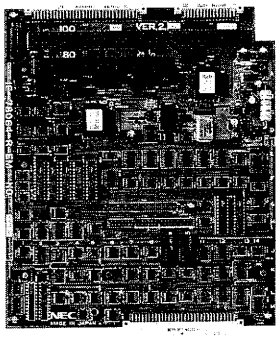
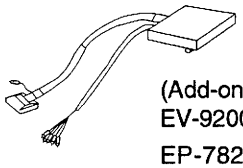
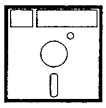
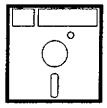
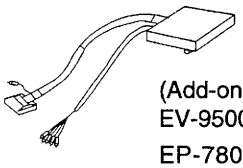
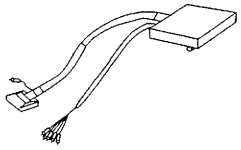
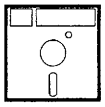
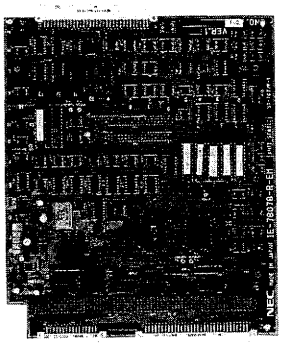
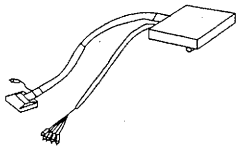
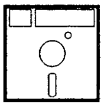
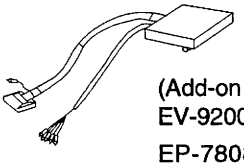
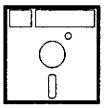
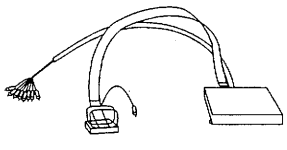
Table D-1. System Configuration of the IE-78000-R (3/6)

Target device	Cabinet and control/trace board	Break board
* μPD78054 sub-series μPD78054Y sub-series	 78K series common cabinet (internal power supply)	 IE-78000-R-BK (78K/0 series common break board)
* μPD78064 sub-series μPD78064Y sub-series		
* μPD78078 sub-series μPD78078Y sub-series	 IE-78000-R-CS-A (78K series common control/trace board)	
* μPD78083 sub-series		

* **Caution The μPD78064Y, μPD78078Y, and μPD78083 sub-series are under development.**

Phase-out/Discontinued

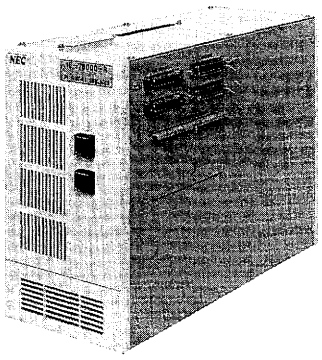
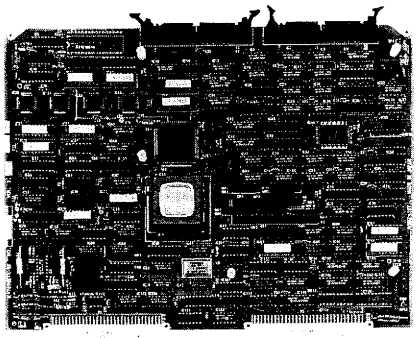
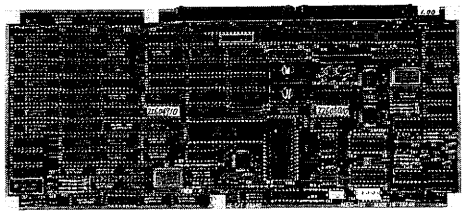
Table D-1. System Configuration of the IE-78000-R (4/6)

Emulation board (optional)	Emulation probe (optional)	Screen debugger (optional)	Device file (optional)	
 IE-78064-R-EM	 (Add-on product: EV-9200GC-80 (one)) EP-78230GC-R	 SD78K0 (with ROM)	 DF78054	*
	 (Add-on product: EV-9500GK-80 (one)) EP-78054GK-R			
	 (Add-on product: EV-9500GC-100 (one)) EP-78064GF-R		 DF78064	*
 IE-78078-R-EM	 (Add-on product: EV-9200GF-100 (one)) EP-78064GF-R		 DF78078	*
	 (Add-on product: EV-9200G-44 (one)) EP-78083GB-R		 DF78083	*
	 EP-78083CU-R			

Caution **The EP-78083GB-R, EP-78083CU-R, DF78078, and DF78083 are under development.**

Phase-out/Discontinued

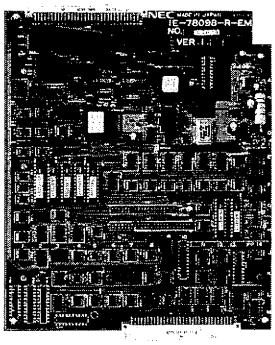
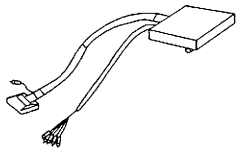
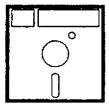
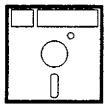
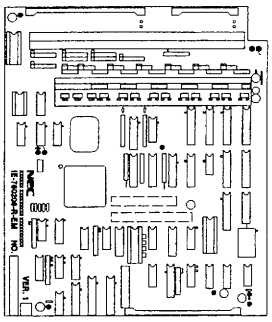
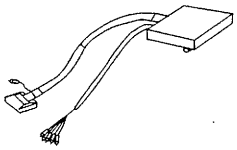
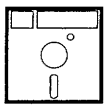
Table D-1. System Configuration of the IE-78000-R (5/6)

Target device	Cabinet and control/trace board	Break board
μPD78098 sub-series	 78K series common cabinet (internal power supply)	 IE-78000-R-BK (78K/0 series common break board)
* μPD780208 sub-series	 IE-78000-R-CS-A (78K series common control/trace board)	

Caution The μPD780208 sub-series are under development.

Phase-out/Discontinued

Table D-1. System Configuration of the IE-78000-R (6/6)

Emulation board (optional)	Emulation probe (optional)	Screen debugger (optional)	Device file (optional)
 IE-78098-R-EM	 (Add-on product: EV-9200GC-80 (one)) EP-78230GC-R	 SD78K0 (with ROM)	 DF78098
 IE-780208-R-EM	 (Add-on product: EV-9200GF-100 (one)) EP-78064GF-R		 DF780208 *

Caution The DF780208 is under development.

[MEMO]

Phase-out/Discontinued

Appendix E

Revision History

The revision is shown below. The chapters appearing in the revised-chapter column indicate those of the corresponding edition.

Edition	Major changes	Revised chapter
Fifth	The description of the host machine IBM PC/AT has been added.	Throughout
	The following target devices have been added: • μPD78023, μPD78024, μPD78P024 • μPD78055, μPD78056, μPD78058, μPD78P058 • μPD78094, μPD78095, μPD78096, μPD78P098	
	The example of the oscillation circuit has been added in **Figure 3-4**.	Chapter 3
	The description of setting **for the screen debugger Ver. 2.0 below** (the fourth edition) has been deleted from the table of **Section 3.1 (3)**.	
	Table 3-3 has been added in **Section 3.2.2**.	
	The standard values of the capacitor, crystal, and resistor have been added in **Section 3.3.1 (1)**.	
Sixth	The following emulation boards have been added: • IE-78014-R-EM-A • IE-78078-R-EM • IE-780208-EM	Throughout
	The following target devices have been added: • μPD78001B(A), μPD78002B(A), μPD78011B(A), μPD78012B(A), μPD78013(A), μPD78014(A) • μPD78011F, μPD78012F, μPD78013F, μPD78014F, μPD78015F, μPD78016F, μPD78018F, μPD78P018F • μPD78011FY, μPD78012FY, μPD78013FY, μPD78014FY, μPD78015FY, μPD78016FY, μPD78018FY, μPD78P018FY • μPD78042A, μPD78043A, μPD78044A, μPD78045A, μPD78P048A • μPD78052Y, μPD78053Y, μPD78054Y, μPD78P054Y, μPD78055Y, μPD78056Y, μPD78058Y, μPD78P058Y • μPD78062Y, μPD78063Y, μPD78064Y, μPD78P064Y • μPD78074, μPD78075, μPD78076, μPD780748, μPD78P078, μPD78076Y, μPD78078Y, μPD78P078Y • μPD78081, μPD78082, μPD78P083 • μPD78094, μPD78095, μPD78096, μPD78098A, μPD78P098A • μPD780204, μPD780205, μPD78P0208	

E

Edition	Major changes	Revised chapter
Sixth	In **Section 3.1**, settings necessary for the main system clock has been modified.	Chapter 3
	Table 3-3 has been added in **Section 3.2.2.**	
	Appendix E has been added.	

Phase-out/Discontinued

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