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RENESAS

USER'S MANUAL

Phase-out/Discontinued

IE-78240-R-A

IN-CIRCUIT EMULATOR

IE-78240-R-A
IE-78240-R-EM

Document No. EEU-1395C
(O. D. No. EEU-796C)
Date Published March 1994 P
Printed in Japan

USER'S MANUAL

NEC

Phase-out/Discontinued

IE-78240-R-A

IN-CIRCUIT EMULATOR

IE-78240-R-A
IE-78240-R-EM


Phase-out/Discontinued

This product is designed to be used in a commercial or industrial district. If it is used in a residential district or in an area in the vicinity of a residential district, radio and TV receivers in the district may be affected.
TV receivers in the district may be affected.
Use this product correctly by carefully reading its User's Manual.

Phase-out/Discontinued

CONTENTS UPDATED IN THIS EDITION

Page	Contents
Throughout	• IBM PC/AT as host machine has been added. • μPD78P244 as target device has been deleted.
p. 60	The programmable range for PG-1500 in "**(2) PROM programmer**" has been expanded to 4M bits from 1M bits.
p. 66	"**5.4 Connecting IBM PC/AT**" has been added.
p. 92	"**(2) Using IBM PC/AT as host machine**" has been added to "**6.2 Turning Power On/Off**.
p. 93	"**(2) IBM PC/AT**" has been added to "**6.3 Countermeasures against Latchup**".
p. 98	A part of "**Fig. 7-1 Equivalent Circuits of Port Pin Emulation Circuit (2/2)**" has been updated.

The mark ★ shows major revised points.

INTRODUCTION

Target Reader:

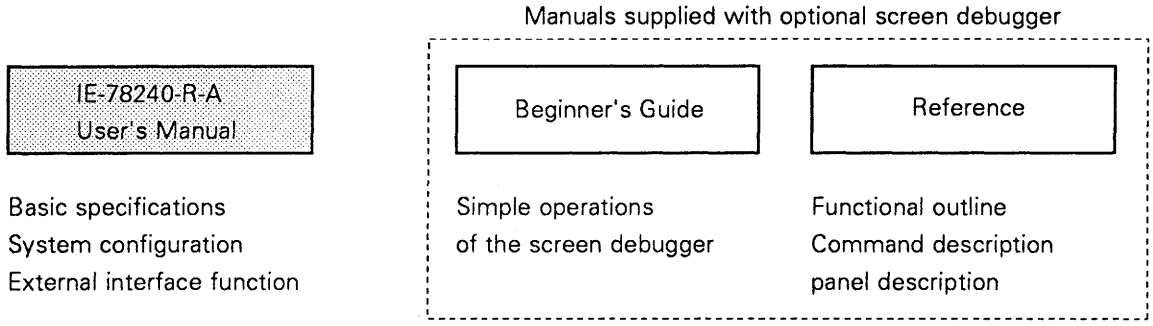
This manual is prepared for the engineers who debug a system emplying a 78K/II series 8-bit single-chip microcomputer by using IE-78240-R-A.

This manual is also intended for the engineers who upgrade a system so that it has functions equivalent to those of IE-78240-R-A by combining IE-78240-R-EM and other in-circuit emulators.

IE-78240-R-A can emulate the μPD78244 series, μPD78214 series or μPD78218A series microcomputer. It is therefore assumed that the readers of this manual are fairly familiar with the functions and applications of the μPD78244 series, μPD78214 series or μPD78218A series microcomputers and have knowledge of debuggers.

Configuration:

Only this manual is supplied with IE-78240-R-A.
For more information, refer to the two manuals (Introduction and Reference Manual) supplied with the optional screen debugger.



Appendix D of this manual describes the points to be noted to use IE-78240-R-A correctly. Be sure to read this appendix before using the In-Circuit Emulator.
For the latest information on this product, consult NEC.

How to Read:

- To understand the basic specifications, refer to **CHAPTER 1 GENERAL** and **CHAPTER 2 NAMES AND FUNCTIONS OF RESPECTIVE PARTS**.
- To upgrade your system by using IE-78240-R-EM, refer to **1.2 Hardware Configuration** and **3.3 Using IE-78240-R-EM**.
- To connect IE-78240-R-A to an external device, refer to **1.4 Setup Procedure**, **2.3 Connecting Accessory**, **CHAPTER 5 CONNECTING PERIPHERAL DEVICES**, and **CHAPTER 6 CONNECTING TARGET SYSTEM**.
- To change the development mode, refer to **3.1 Changing Development Mode**.
- To learn the difference between the target device and the target interface circuit for IE-78240-R-A, refer to **CHAPTER 7 TARGET INTERFACE CIRCUIT**.
- For a detailed functional description of the serial or parallel interface of IE-78240-R-A, refer to **CHAPTER 8 CHANNELS 1 AND 2 FUNCTIONS** or **CHAPTER 9 CHANNELS 3 AND 4 FUNCTIONS**.

Terminology:

The following terms are often used in this manual:

Term	Meaning
Emulation Device	Generical names of the devices, including the emulation CPU, that emulate the target device in the emulator.
Emulation CPU	The CPU that executes the program developed by the user in the emulator.
Target Device	The device to be emulated (such as μPD78244 series)
Target Program	The program to be debugged (developed by the user)
Target System	The system to be debugged (developed by the user), including the target program and the hardware developed by the user. In a narrow sense, only the hardware.

Legend:

- ***** : Footnote
- **Caution** : Information calling for your attention
- **Remarks** : Supplement

Phase-out/Discontinued

CONTENTS

CONTENTS OF PHOTOS

CONTENTS OF FIGURES (1/2)

CONTENTS OF FIGURES (2/2)

CONTENTS OF TABLES

CHAPTER 1 GENERAL

The IE-78240-R-A In-Circuit Emulator is a development tool that efficiently debugs the hardware and software of an application system using a microcomputer in NEC's μPD78244 series, μPD78214 series or μPD78218A series.

1.1 Features

The IE-78240-R-A features are as follows:

- O Emulates the μPD78244 series, μPD78214 series and μPD78218A series
  - Can emulate microcomputers of all packages when used with optional emulation probe
- O Real-time display and real-time trace
  - Many break and trace functions
  - Contents of real-time tracer can be viewed without stopping execution of emulation CPU
  - Contents of real-time tracer can be searched
  - 8-bit trace input through external sense clip
- O Symbolic debugging
- O On-line assemble/disassemble
- O Emulation memory: 64K bytes
- O Object files and symbol files can be downloaded through Centronics interface 10 times faster than through RS-232-C interface
- O Can also emulate other 78K series microcomputers, when optional emulation board is used
- O Coverage measuring function
- O Time and number of instructions measuring functions
- O Real-time display of internal RAM data

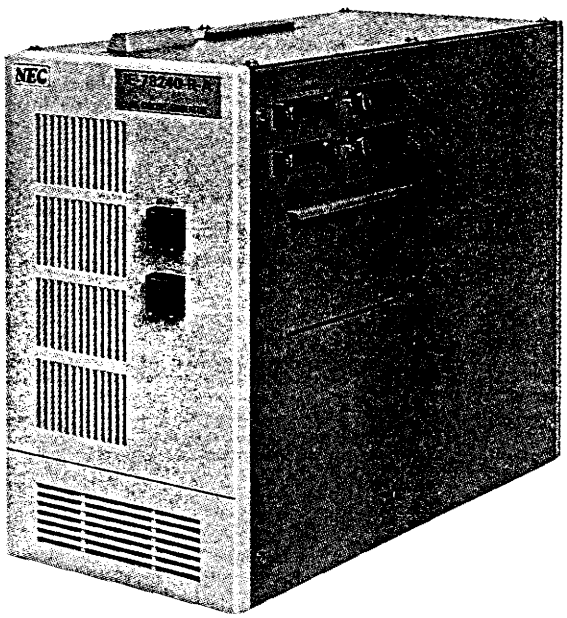


Photo 1-1 IE-78240-R-A

1.2 Hardware Configuration

1.2.1 E-78240-R-A configuration

The IE-78240-R-A consists of the following hardware (frame and boards):

- Frame
- Control/trace board
- Break board (IE-78200-R-BK)
- Emulation board (IE-78240-R-EM)

By replacing the break board and emulation board with optional boards, the emulator system can be upgraded so as to emulate the other microcomputers in the 78K series.

Remarks: "Upgrading" here means to modify the in-circuit emulator system by replacing the emulation board and break board of the emulator with new boards, so that the emulator can emulate the other devices.

1.2.2 Upgrading other model to IE-78240-R-A

If you already have an in-circuit emulator for the 75X series or 78K series, your emulator can be upgraded to have the functions equivalent to those of the IE-78240-R-A, by replacing the emulation board and break board of the emulator with those for the IE-78240-R-A.

Table 1-1 lists the boards necessary for upgrading.

The existing in-circuit emulators are divided into two types by frame classification: those having the group 1 and those having the groups 2 to 4.

Depending on the frame, the functions of the emulator, when it is upgraded, differ (for details, refer to 1.2.3).

As the control program of the in-circuit emulator, the IE-78240-R-A control program (screen debugger and device file) is necessary.

Table 1-1 Upgrading to IE-78240-R-A (1/3)

Your In-Circuit Emulator			Necessary Board and Software		
Series	In-circuit emulator	IE group No.		For μPD78214 series μPD78218A series	For μPD78244 series
75X	IE-75000-R IE-75001-R	4	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
78K/0	IE-78000-R	4	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
78K/I	IE-78112-R*	1	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
	IE-78130-R	4	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
	IE-78140-R	3	Board	IE-78240-R-EM	IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
78K/II	IE-78210-R*	1	Board	IE-78200-R-BK	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)

*: This product is no longer manufactured and thus is not available.

Table 1-1 Upgrading to IE-78240-R-A (2/3)

Your In-Circuit Emulator			Necessary Board and Software		
Series	In-circuit emulator	IE group No.		For μPD78214 series μPD78218A series	For μPD78244 series
78K/II	IE-78220-R*	1	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
	IE-78230-R*	4	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
	IE-78240-R*	2	Board	IE-78200-R-BK	IE-78200-R-BK
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
	IE-78230-R-A	3	Board	IE-78240-R-EM	IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
78K/III	IE-78310-R*	1	Board	IE-78200-R-BK IE-78240R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
	IE-78310A-R	1	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)

*: This product is no longer manufactured and thus is not available.

Table 1-1 Upgrading to IE-78240-R-A (3/3)

Your In-Circuit Emulator			Necessary Board and Software		
Series	In-circuit emulator	IE group No.		For μPD78214 series μPD78218A series	For μPD78244 series
78K/III	IE-78320-R*	4	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
	IE-78327-R	4	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
	IE-78330-R	4	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
	IE-78350-R	4	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)
78K/VI	IE-78600-R	4	Board	IE-78200-R-BK IE-78240-R-EM	IE-78200-R-BK IE-78240-R-EM
			Software	Screen debugger (SD78K2) Device file (DF78210)	Screen debugger (SD78K2) Device file (DF78240)

*: This product is no longer manufactured and thus is not available.

1.2.3 Functional difference between IE-78240-R-A and other in-circuit emulators using IE-78240-R-EM

The IE-78240-R-A and any other in-circuit emulators, whose functions are upgraded by using option boards such as IE-78240-R-EM, can be used in the same manner.

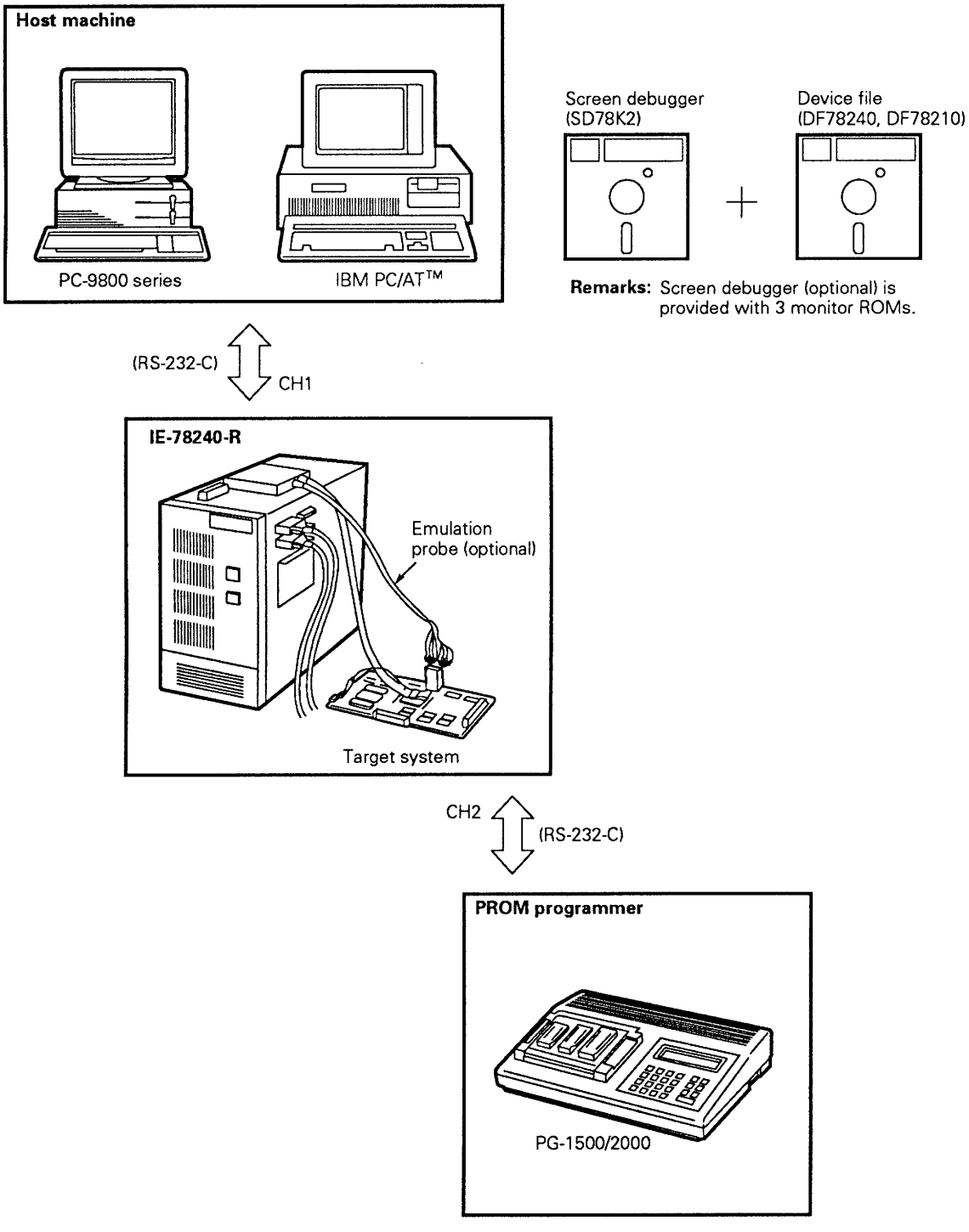
However, between the upgraded in-circuit emulators in the group 1 and those in the groups 2 to 4 (including the IE-78240-R-A), the following functional difference exists:

Table 1-2 Functional Difference

Function of in-circuit emulator \ In-circuit emulator	o Model in groups 2 to 4 o IE-78240-R-A	o Model in in group 1
Use of channels 3 and 4	Possible	Impossible

1.3 System Configuration

The IE-78240-R-A is connected with the following peripheral devices to constitute a system:



★ **Fig. 1-1 Connections with Peripheral Devices**

1.4 Setup Procedure

Set up the IE-78240-R-A in the following sequence:

① Mount the ROM supplied with the optional screen debuggers on the control/trace board (refer to the photograph on the next page).

② Change the development mode as necessary (refer to 3.1 Changing Development Mode).
Change the setting of the jumpers on the emulation boards installed in the IE-78240-R-A.

③ Set the user clock as necessary (refer to 3.2 Setting User Clock).
When using the user clock, mount a clock oscillator on the emulation board of the IE-78240-R-A by using a component block.

④ Connect the emulation probe to the IE-78240-R-A (refer to Chapter 4 Connecting Emulation Probe).
Connect the connector board of the optional emulation probe to the adapter board installed in the IE-78240-R-A.

⑤ Connect the accessory cables (refer to 2.3 Connecting Accessory Cables).
Connect the power cable and interface cable.

⑥ Connect the peripheral devices to the IE-78240-R-A (refer to Chapter 5 Connecting Peripheral Devices). ★

- Host machine
- PROM programmer (if necessary)
- Printer (if necessary)
- Device file (optional)
- Screen debugger (optional)

⑦ Connect the target system (refer to Chapter 6 Connecting Target System).
Connect the emulation probe and target system using a sense clip.

Remarks 1: Accomplish ② to ④ at the same time because all these operations are carried out with the top cover of the IE-78240-R-A opened.

2: When carrying out ② and ③, also refer to Chapter 4 Connecting Emulation Probe.

- Mounting monitor ROM on control/trace board

▷ Step

① Open the cover of the RS-232-C MODE SETTING compartment on a side of the IE-78240-R-A.

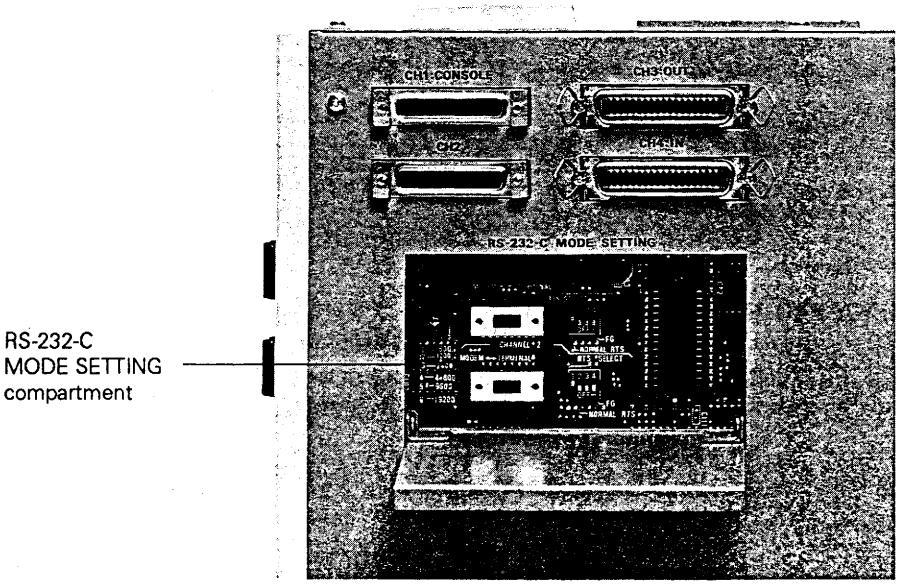


Photo 1-2 RS-232-C MODE SETTING Compartment

Phase-out/Discontinued

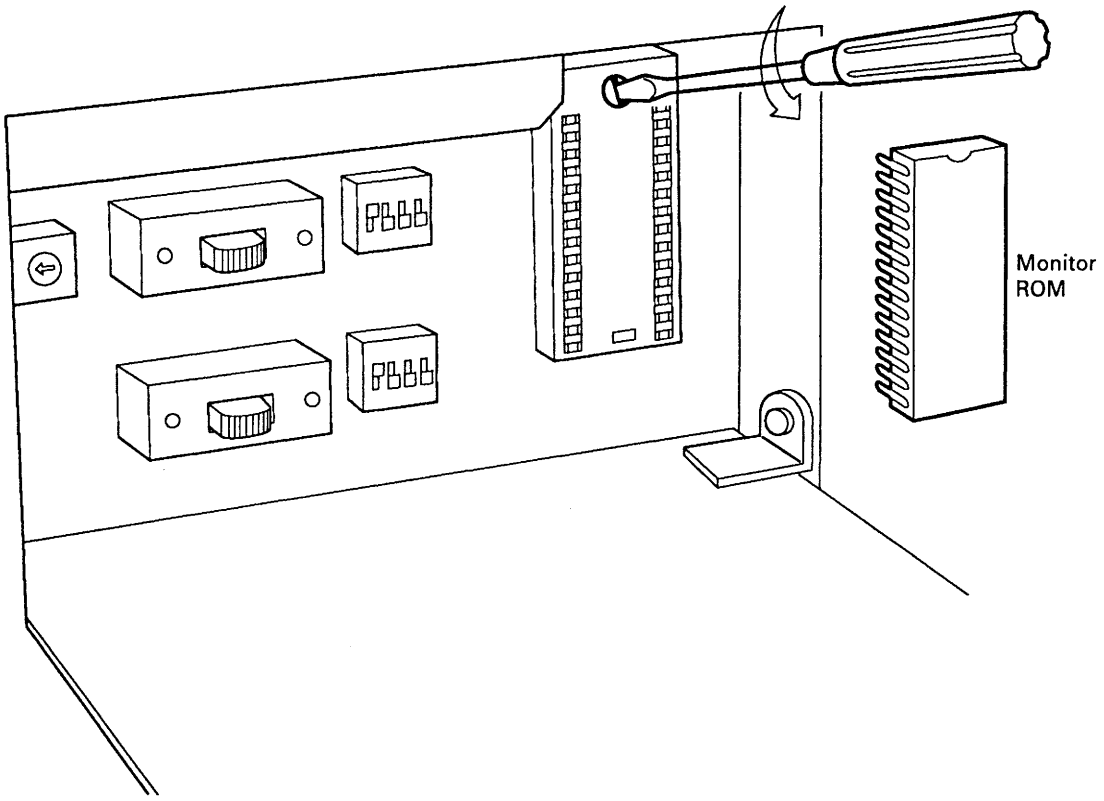


Fig. 1-2 Mounting Monitor ROM

② Next, mount the monitor ROM (A200/Vx.x/IC86) supplied with the optional screen debugger on IC86.

Caution: **If the ROM is inserted in the wrong direction, it is damaged. Insert the ROM in the correct direction as indicated on the board.**

Remarks: To set the user clock, refer to 3.2 Setting User Clock.

1.5 Target Devices

Table 1-3 below lists the development modes of the IE-78240-R-A and the devices the In-Circuit Emulator can emulate.

The IE-78240-R-A is intended to develop a system using a device in the μPD78244 series, but it can also be used to develop a system using a μPD78214 series device (refer to 3.1 Changing Development Mode).

Table 1-3 IE-78240-R-A Development Modes and Target Devices

	μPD78244 Series Development Mode	μPD78214 Series Development Mode
Target Device	μPD78243 μPD78244	μPD78210 μPD78212 μPD78213 μPD78214 μPD78P214 μPD78217A μPD78218A μPD78P218A

Phase-out/Discontinued

1.6 Emulation Probe

The emulation probe is optional. The following types of emulation probes are available. Select one according to the package of your target device (μPD78244 series, μPD78214 series and μPD78218A series):

Ordering code	
EP-78240GJ-R	(for 74-pin QFP package)
EP-78240GC-R	(for 64-pin QFP package)
EP-78240LP-R	(for 68-pin QFJ package)
EP-78240CW-R	(for 64-pin shrink package)
EP-78240GQ-R	(for 64-pin QUIP package)

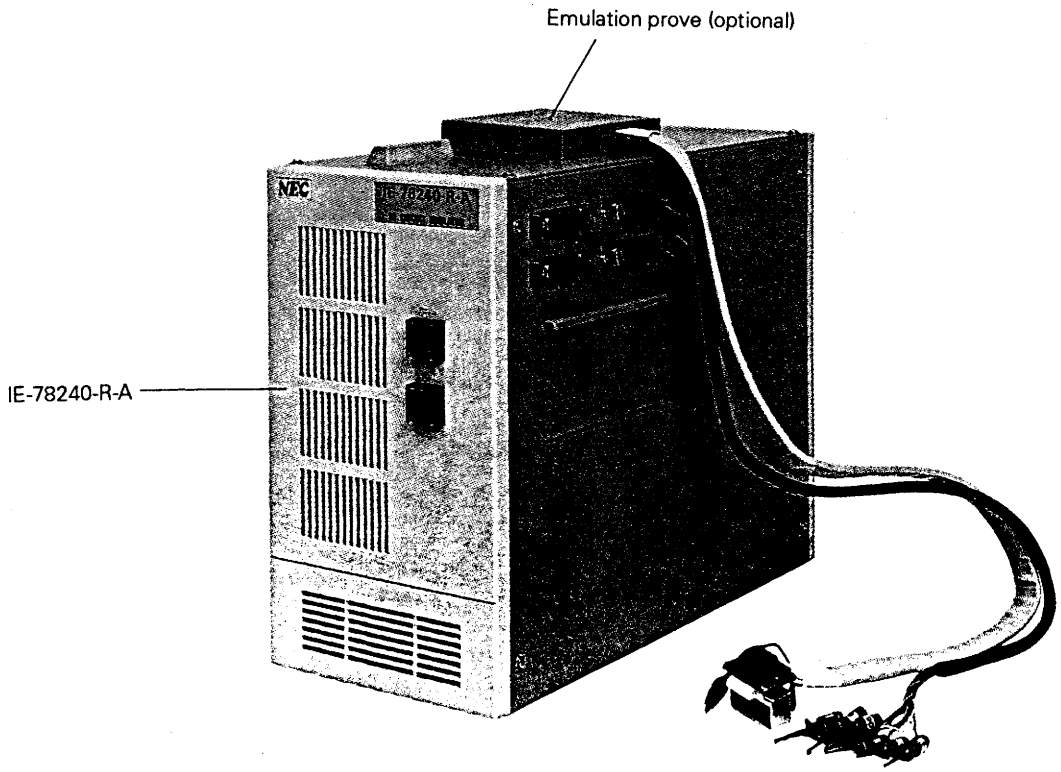


Photo 1-3 Emulation Probe

1.7 Unpacking

1.7.1 Contents of IE-78240-R-A carton box

The carton box of the IE-78240-R-A contains the main enclosure of the IE-78240-R-A and accessory bags. In the main enclosure, four boards are installed. The accessory bags contain accessories such as cables, and component blocks, in addition to this manual. When unpacking the IE-78240-R-A carton box, be sure to check whether or not all the accessories are contained. If some accessories are missing or damaged, notify NEC.

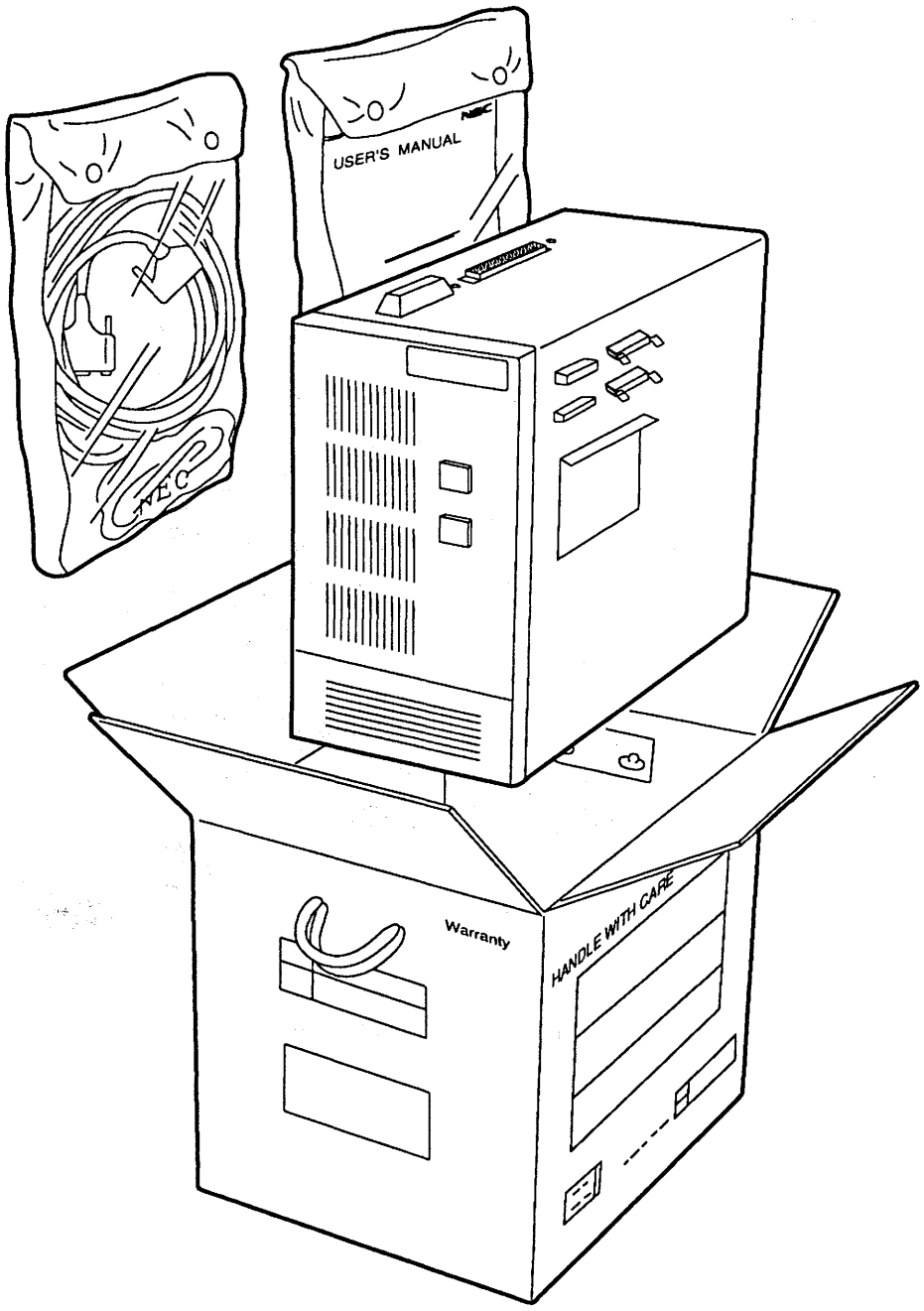


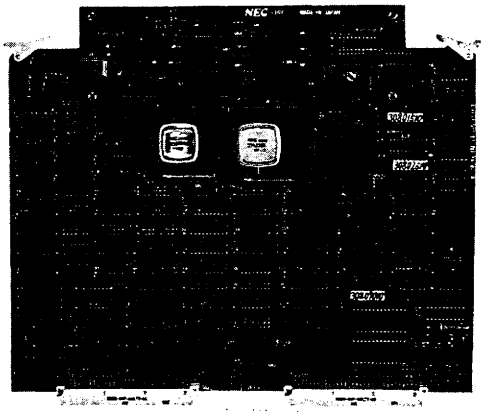
Fig. 1-3 Unpacking

(1) Checking boards

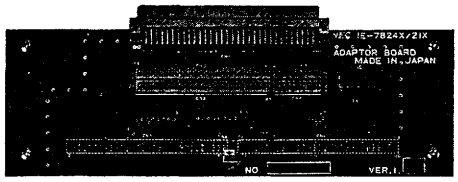
The following four boards are installed in the main enclosure of the IE-78240-R-A. Check to see all the boards are correctly installed by removing the screws (six places) on the top panel of the In-Circuit Emulator and the top panel.

	Qty
(a) Emulation board	1
(b) Adapter board	1
(c) Break board	1
(d) Control/trace board	1

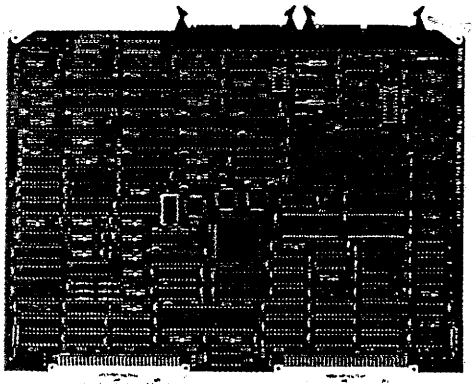
(a) Emulation board



(b) Adapter board



(c) Break board



(d) Control/trace board

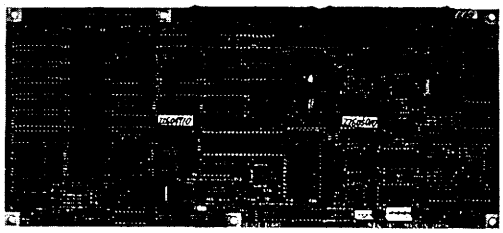


Photo 1-4 Boards

Remarks: The adapter board is screwed on the emulation board for shipment. The control/trace board is screwed to the frame of the IE-78240-R-A.

▷ **Step**

① Remove the six screws from the top cover of the In-Circuit Emulator and remove the cover.

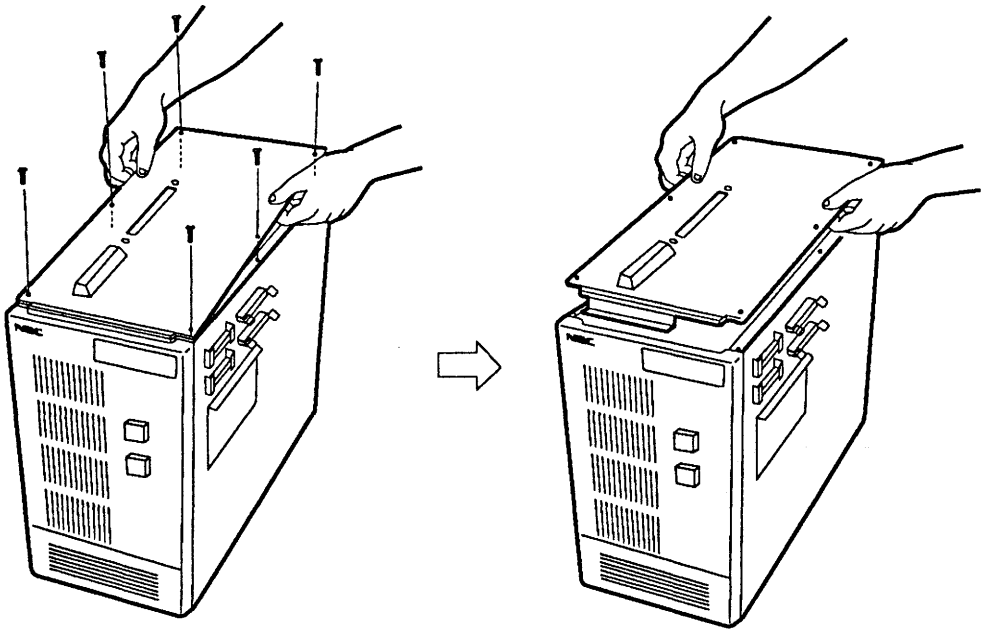


Fig. 1-4 Top Cover

② Confirm that the following boards are in the In-Circuit Emulator:

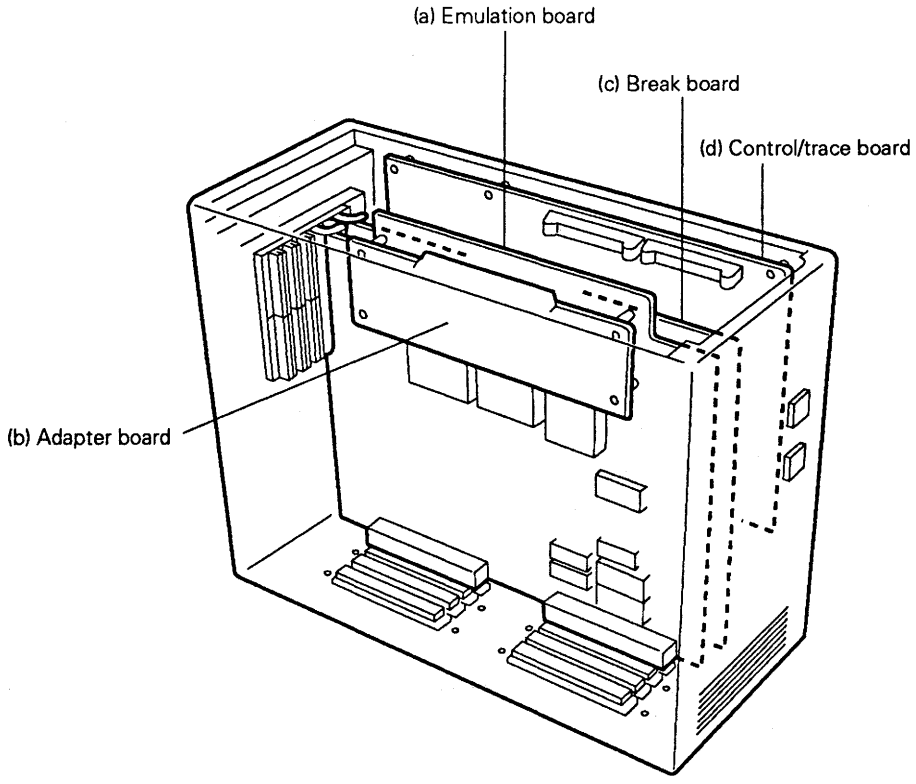


Fig. 1-5 Board Positions

(2) Checking accessories

The carton box contains two accessory bags. Confirm that the following accessories are contained in the bags (refer to Photo 1-5):

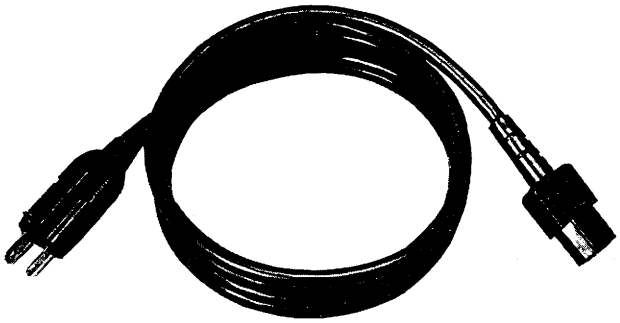
	Qty
(a) User's manual (this manual)	1
(b) AC 100 V power cable (w/AC adapter)	1
(c) AC 200 V power cable*1	1
(d) RS-232-C interface cable	1
(e) Ground lead cable	1
(f) Spare fuse	1
(g) 14-pin component block*2	2
(h) Accessory list	1
(i) Warranty	1
(j) Detailed packing list	1

***1**: Used when the IE-78240-R-A is used in a foreign country where a 200 V power cable may be necessary.

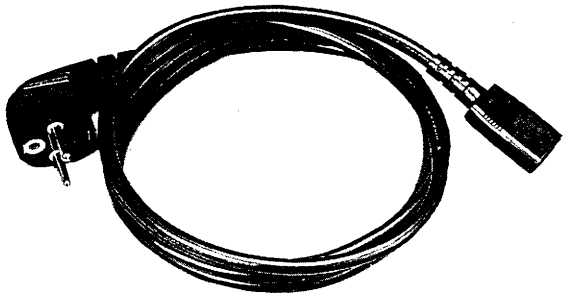
***2**: Used to set the user clock or when component blocks are necessary.

Phase-out/Discontinued

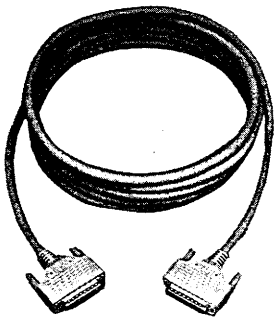
(b) AC 100 V power cable



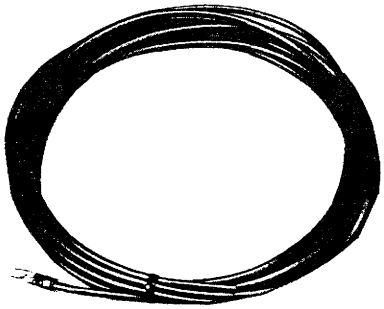
(c) AC 200 V power cable



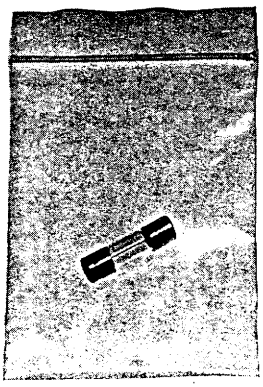
(d) RS-232-C interface cable



(e) Ground lead cable



(f) Spare fuse



(g) 14-pin component blocks

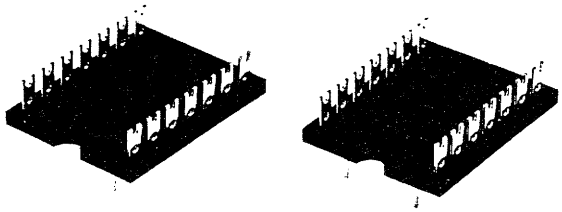


Photo 1-5 Accessories

1.7.2 Contents of IE-78240-R-EM's carton box

The IE-78240-R-EM is optionally available for upgrading the existing in-circuit emulator.

The carton box of the IE-78240-R-EM contains two boards (including the adapter board), three user's manuals, replacement ROM, and component blocks. When unpacking the IE-78240-R-EM carton box, confirm that these items are contained. If some accessories are missing or damaged, notify NEC.

(1) Checking boards

The carton box contains two boards: IE-78240-R-EM and adapter board

(a) IE-78240-R-EM (emulation board)

(b) Adapter board

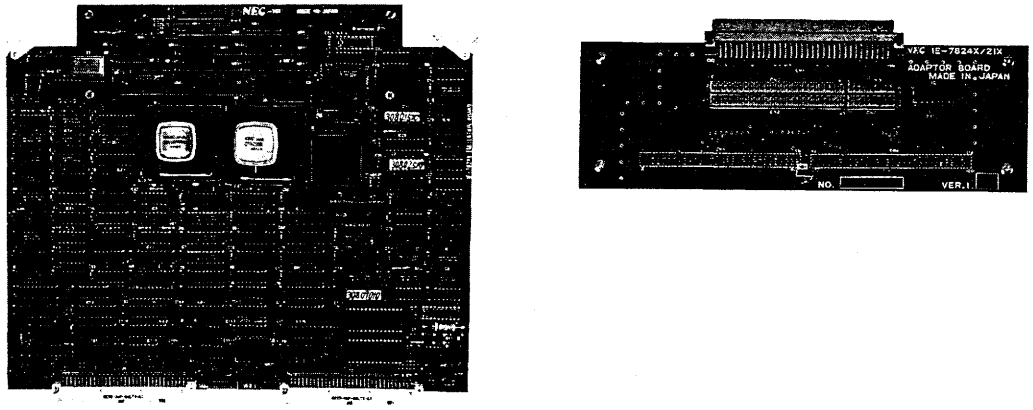


Photo 1-6 Boards

Remarks: The adapter board is attached to the IE-78240-R-EM (emulation board) with screws for shipment.

(2) Checking accessories

Open the accessory bag and confirm that the following accessories are contained:

		Qty
(a) IE-78240-R User's Manual (Hardware and Software)		2
(b) IE-78240-R-A User's Manual (This manual)		1
(c) ROM case		1
• Monitor ROM	(A240/Vx.x/IC86)	1
	(A210/Vx.x/IC86)	1
	(I240/Vx.x/IC49)	1
	(I240/Vx.x/IC56)	1
	(I210/Vx.x/IC49)	1
	(I210/Vx.x/IC56)	1
(d) 14-pin component block*		2
(e) Warranty		1
(f) Detailed packing list		1
(g) Accessory list		1

*: Used to set the user clock or when component blocks are necessary.

Remarks: When the other in-circuit emulator is upgraded to IE-78240-R-A, the six monitor ROMs (c) are not used. Use the monitor ROMs supplied with the optional screen debugger.

1.7.3 Contents of IE-78200-R-BK carton box

The IE-78200-R-BK can also be separately purchased for upgrading the incircuit emulator system.

Accessories (a) to (d) listed below come with the IE-78200-R-BK. Check that all of these accessories are contained in the package.

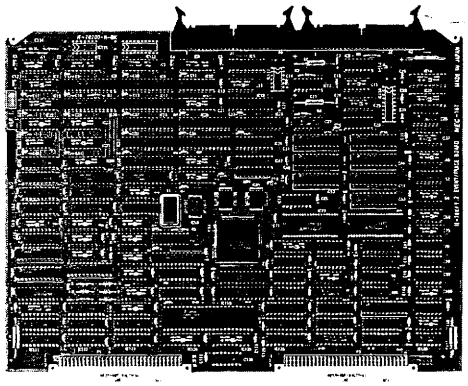


Photo 1-7 Break Board

If some accessories missing or damaged, notify NEC.

- Accessories

	Qty
(a) Installation manual	1
(b) Warranty	1
(c) Detailed packing list	1
(d) Accessory list	1

Phase-out/Discontinued

CHAPTER 2 NAMES AND FUNCTIONS OF RESPECTIVE PARTS

This chapter describes the IE-78240-R-A parts, their names, their functions, and how to set the switches and connect accessory cables.

2.1 Names and Functions of Main Enclosure

(1) Front view

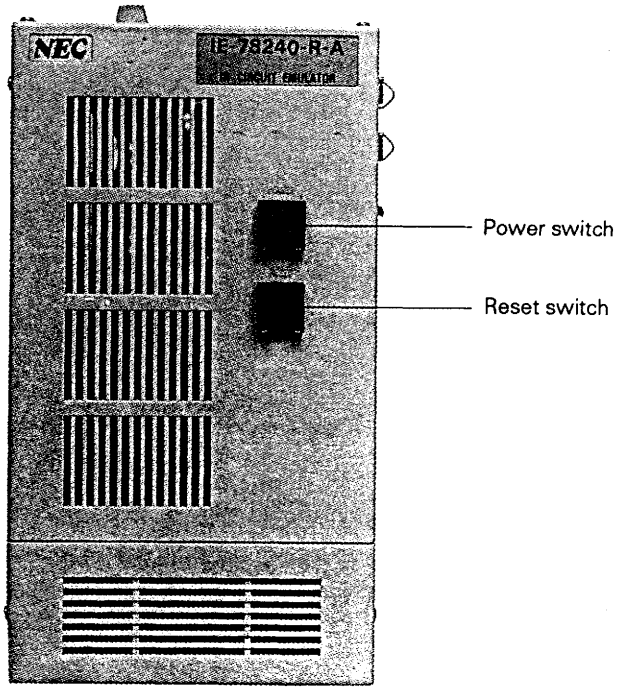


Photo 2-1 IE-78240-R-A Front View

- Power switch
  Turns power on/off.

- Reset switch
  Resets IE-78240-R-A.

(2) Rear view

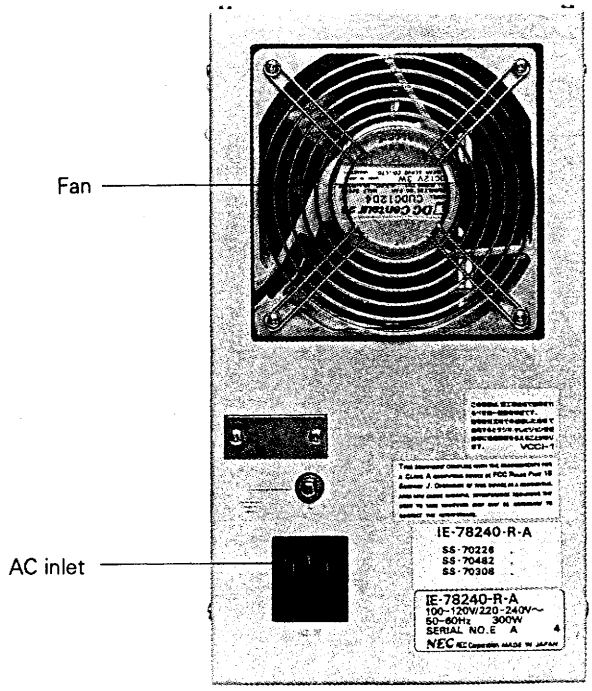


Photo 2-2 IE-78240-R-A Rear View

- Fan
  Cools the frame.

- AC inlet
  Supplies power through the power cable.

(3) Side view

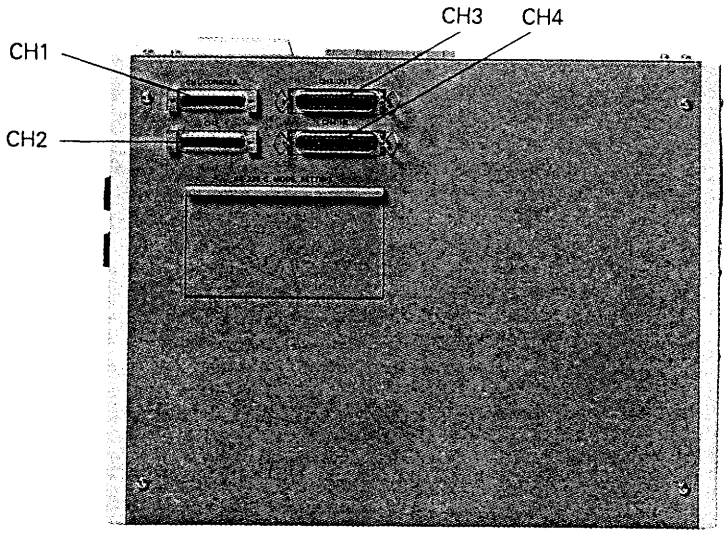


Photo 2-3 IE-78240-R-A Side View 1

- CH1 (input/output)
  Connects a host machine through an RS-232-C interface cable.

- CH2 (input/output)
  Connects a PROM programmer (PG series) through an RS-232-C interface cable.

- CH3 (output)
  Outputs data input to CH4 (through output pins).

- CH4 (input)
  Connects a host machine through a Centronics cable.

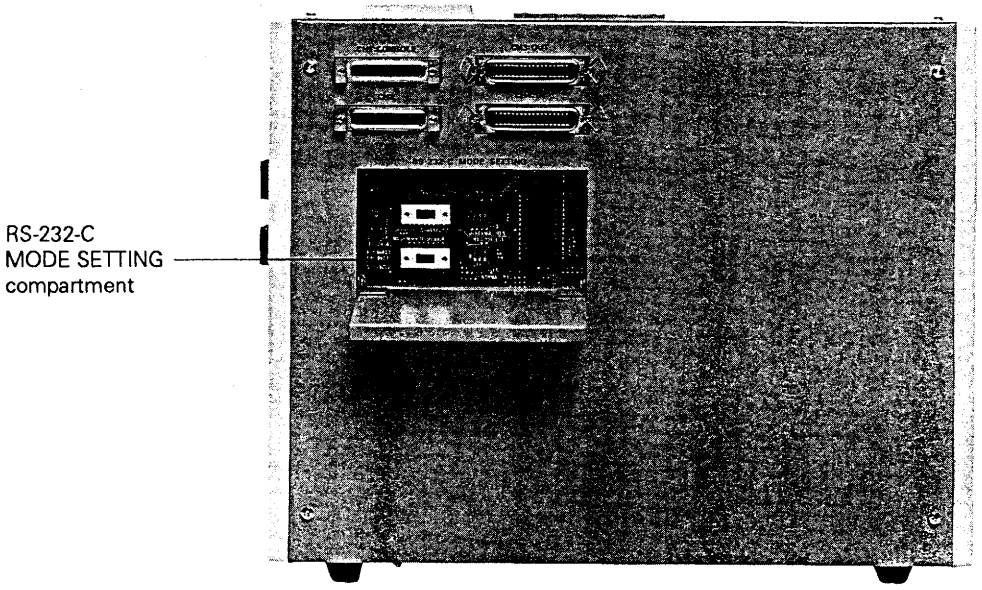
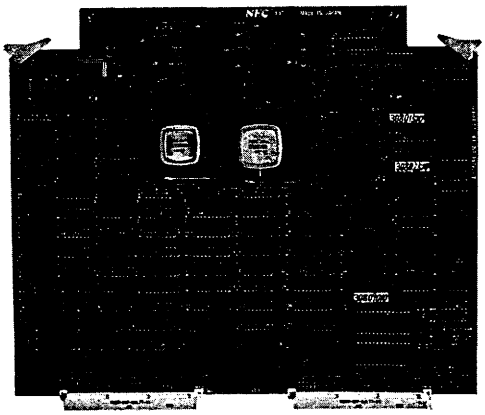


Photo 2-4 IE-78240-R-A Side View 2

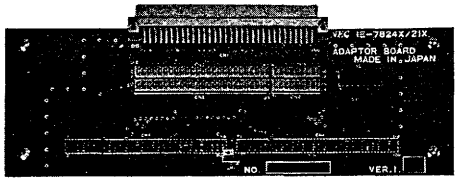
- RS-232-C MODE SETTING compartment
  Selects the modem or terminal mode, sets RTS and FG, and a baud rate.

(4) Boards

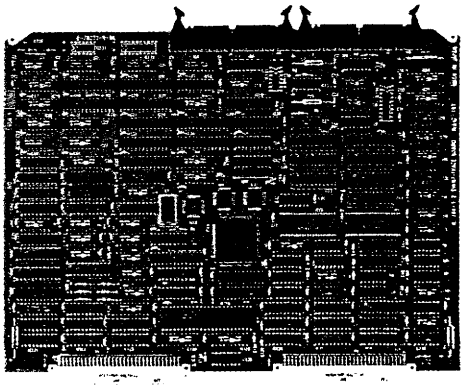
- Emulation board
  Emulates the target device.



- Adapter board
  Mounts a connector board supplied with the emulation probe when connecting the the probe.



- Break board
  Accomplishes break control, event control, and trace control.



- Control/trace board
  Controls IE-78240-R-A.

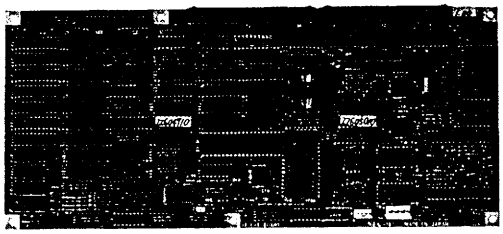


Photo 2-5 Boards

2.2 Switch Setting

(1) Power switch and reset switch

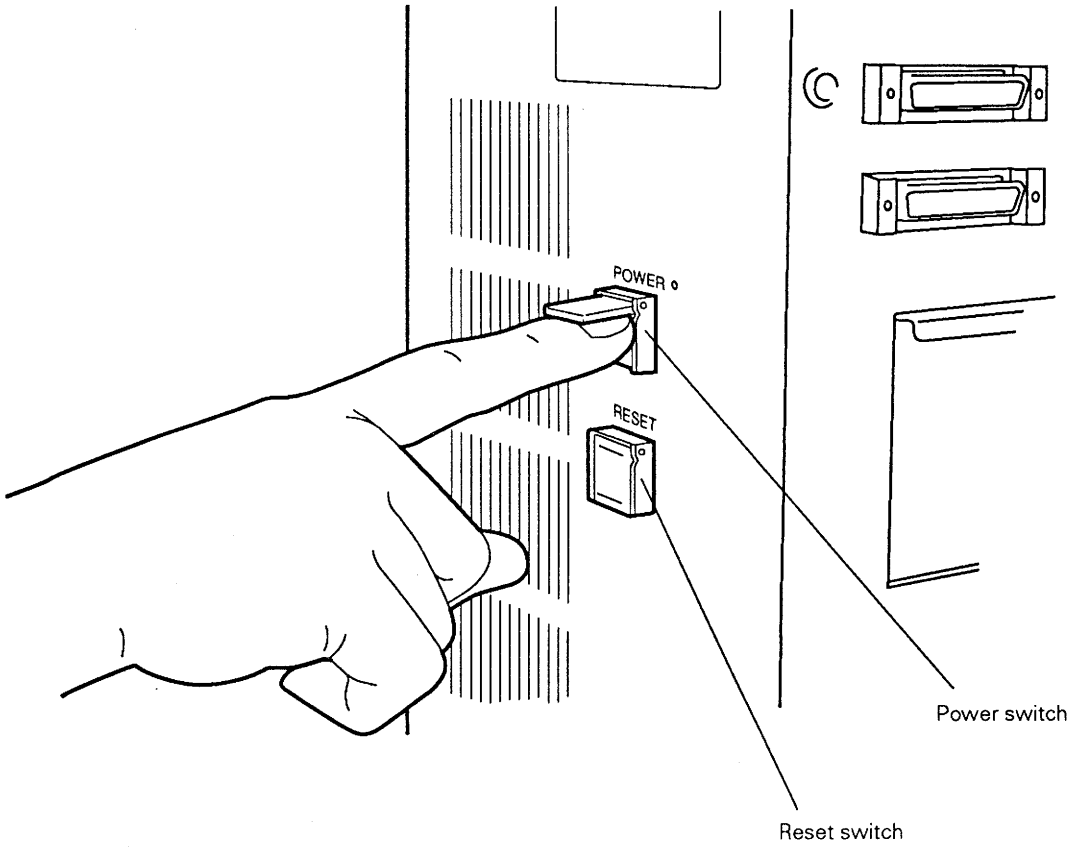


Fig. 2-1 Power Switch and Reset Switch

- Power switch
  The pushbutton power switch is on the IE-78240-R-A front panel.
  Press this switch to turn power on; the POWER LED indicator will light.
  Press the switch again to turn off power; the LED will go off.

- Reset switch
  The reset switch is located below the power switch.
  Press this switch to reset IE-78240-R-A.

(2) Switches in RS-232-C MODE SETTING compartment

Open the cover on the RS-232-C MODE SETTING compartment. The switches shown in Fig. 2-2 will be visible. The modes to be set by these switches differ, depending on the peripheral device to be used. For details, refer to Chapter 5 Connecting Peripheral Devices.

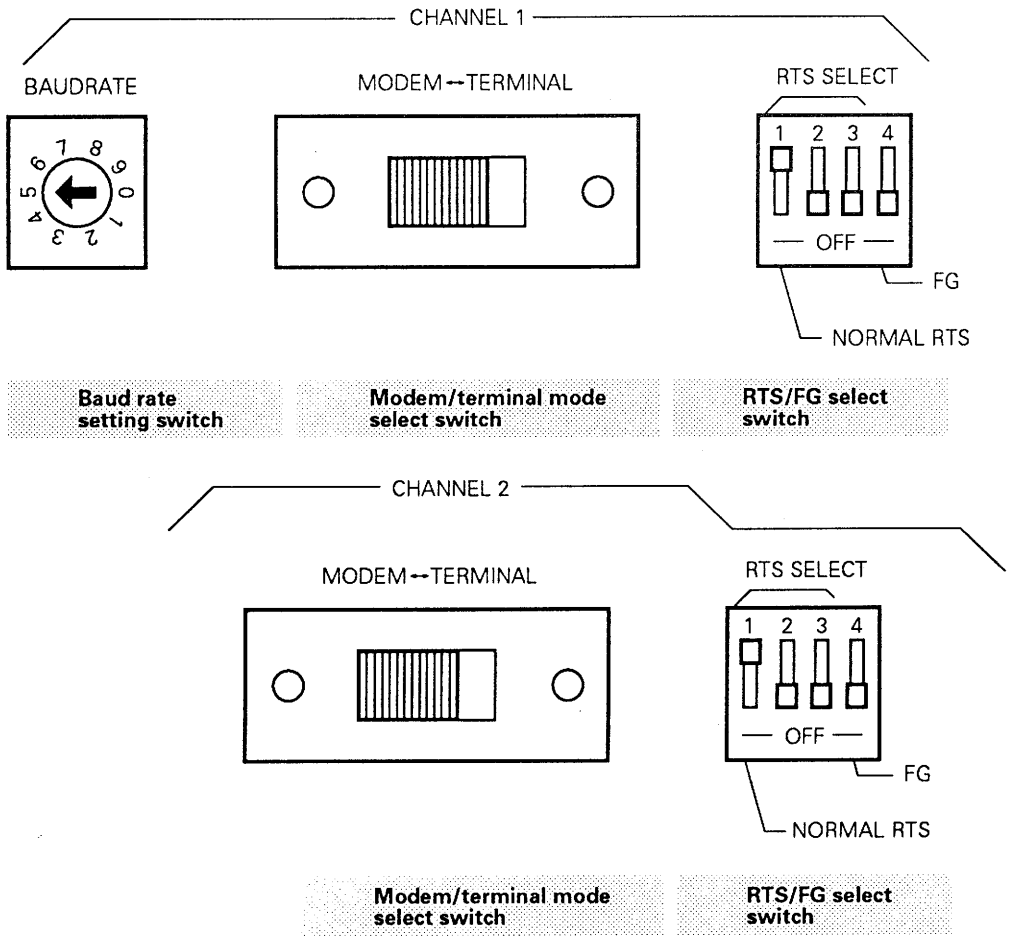


Fig. 2-2 Switches in RS-232-C Compartment

- Modem/terminal mode selector switches (CHANNEL 1 and CHANNEL 2)
  - Move these slide switches to the left to set the modem mode.
  - Move them to the right to set the terminal mode.
  - The modem mode is set as a factory-set condition for shipment.

- RTS/FG selector switches (CHANNEL 1 and CHANNEL 2)
  - To turn on each pin of these DIP switches, move the pin up; to turn it off, move the pin down.
  - RTS setting: Pins 1 to 3 of the DIP switches are used to specify to which pin of the RS-232-C interface cable the RTS is to be connected. As a factory-set condition, pin 1 is set to ON and pins 2 and 3 are set to OFF (RTS selected).
  - FG setting: Pin 4 of the DIP switches is used to determine whether FG (frame ground) and SG (signal ground) are connected or open. As a factory-set condition, this pin is set to OFF (FG and SG are open).

- Baud rate selector switch (CHANNEL 1)
  Turn this 10-position (0 through 9) micro DIP switch clockwise or counterclockwise to select the desired baud rate. As a factory-set condition, this switch is set to the 5 position (9,600 bps).

  Note: This switch is for channel 1. The baud rate for channel 2 is set by software (command). For details, refer to 5.5 Connecting PG-1500, 5.6 Connecting PG-2000, and the description of the MOD command in the User's Reference Manual supplied with the optional screen debugger.

2.3 Connecting Accessory Cables

- Installation location
  Install IE-78240-R-A at a location not subject to dust and dirt. Do not place any object in the IE-78240-R-A air inlet vicinity.

(1) Power cable

Insert the power cable to the AC inlet on the IE-78240-R-A rear surface, as shown below.

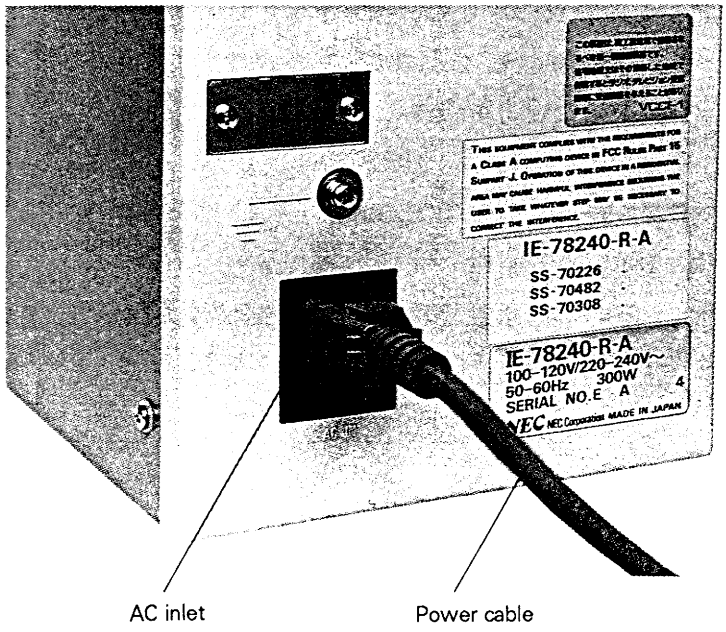


Photo 2-6 Connecting Power Cable

(2) RS-232-C interface cable

Insert the RS-232-C cable to serial interface port CH1 or CH2 on the IE-78240-R-A rear surface.

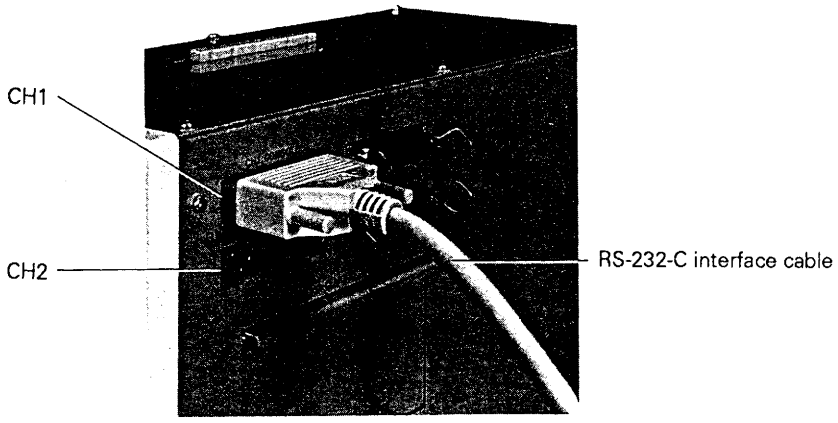


Photo 2-7 Connecting RS-232-C Interface Cable

(3) Parallel interface cable (not be with IE-78240-R-A)

Connect the parallel interface cable to parallel interface port CH3 or CH4 on a IE-78240-R-A side panel.

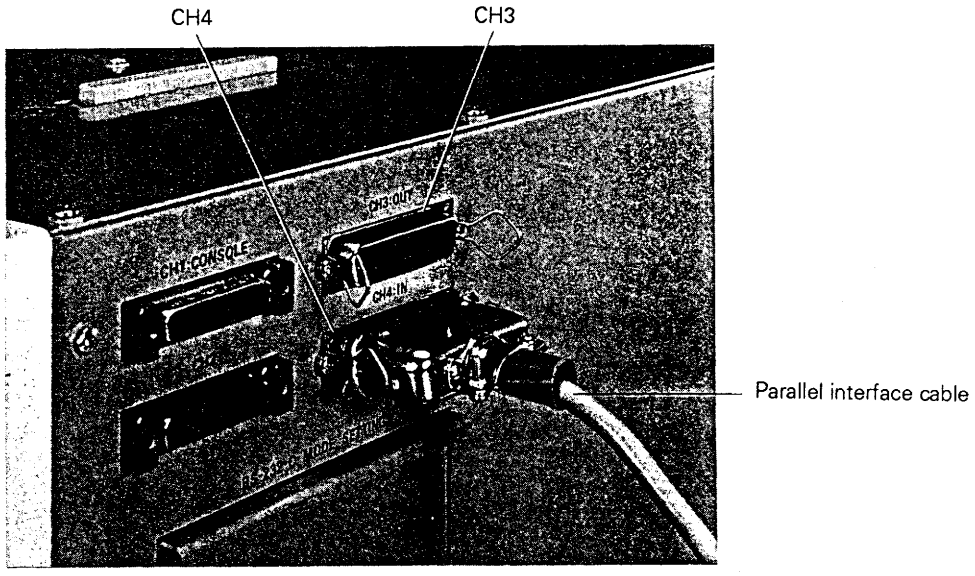


Photo 2-8 Connecting Parallel Interface Cable

Phase-out/Discontinued

CHAPTER 3 SETTING OF EMULATION BOARD

This chapter describes how to change the development mode of IE-78240-R-A and set the user clock.

3.1 Changing Development Mode

IE-78240-R-A is factory-set to develop a μPD78244 series microcomputer. To change the development mode (from μPD78244 series to μPD78214 series or vice versa), read this chapter through first. If the setting is wrong, IE-78240-R-A does not operate.

This chapter describes how to change the IE-78240-R-A setting, using an example in which the setting for development of a μPD78244 series microcomputer is changed to the setting for a μPD78214 series microcomputer. To change the setting the other way round, a similar procedure must be observed.

If IE-78240-R-EM is to be used to upgrade the system of some other in-circuit emulator, first refer to 3.3 Using IE-78240-R-EM.

3.1.1 Getting ready for change

To change the development mode (from μPD78244 series to μPD78214 series), the jumper settings and the device files must be changed, as shown in the following table:

Table 3-1 Changing Setting

Setting to be Changed	Setting to Develop μPD78244 Series (Factory-Set Condition)	Setting to Develop μPD78214 Series and μPD78218A Series
JP1 on the emulation board	5-4 shorted 6-3 shorted	Opened
Device file	DF78240	DF78210

The following tools are necessary:

- Device file (DF78210 = Optional)
- Phillips screwdriver

3.1.2 Setting changing sequence

■ Follow these steps to change the setting:

▷ Turn off power.

▷ Open the JP1 on the emulation board.

▷ Install the device file (DF78210) for the μPD78214 series to the screen debugger (for details, refer to the User's Manual - Introduction of the optional screen debugger).

Remarks: The same steps must be observed when the target device is changed from μPD78214 series de dvelopment mode to μPD78244 series mode.

Each of the above steps is described in detail next.

(1) Turn off power

If power is supplied to IE-78240-R-A, be sure to turn it off.

(2) Open the JP1 on the emulator board.

▷ **Step**

① Remove the six screws from the IE-78240-R-A top cover and remove the top cover.

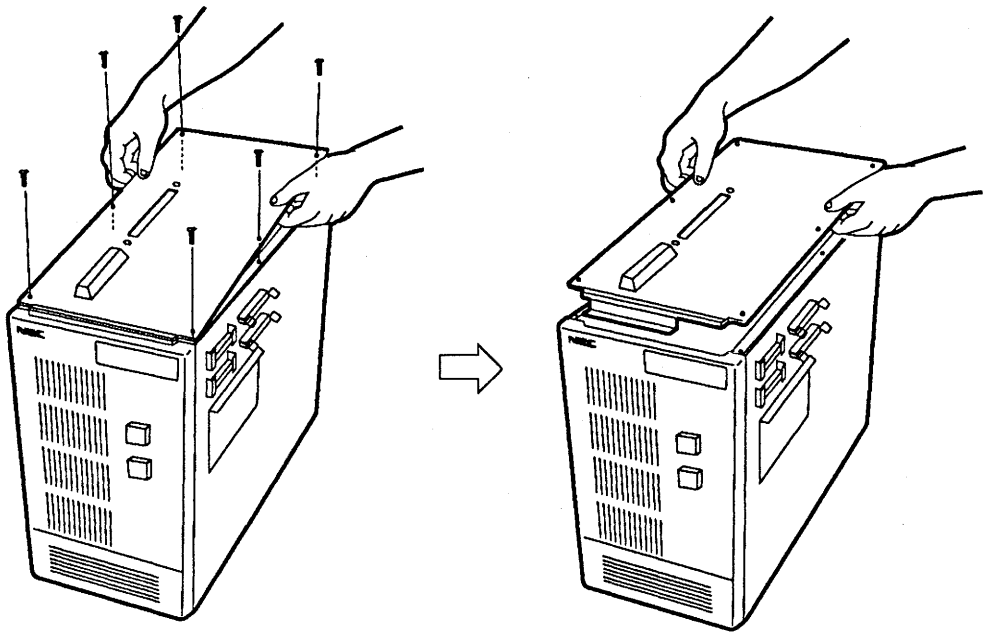


Fig. 3-1 Top Cover

② Pull the card pullers at both edges of the emulation board toward you, to pull out the emulation board. The adapter board is fixed on the emulation board.

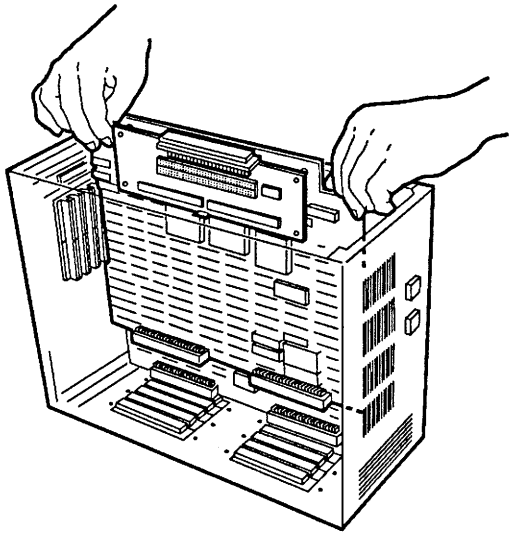


Fig. 3-2 Emulation Board and Adapter Board

③ The adapter board is fixed onto the emulation board. Remove the four screws from the adapter board to detach the adapter board from the emulation board.

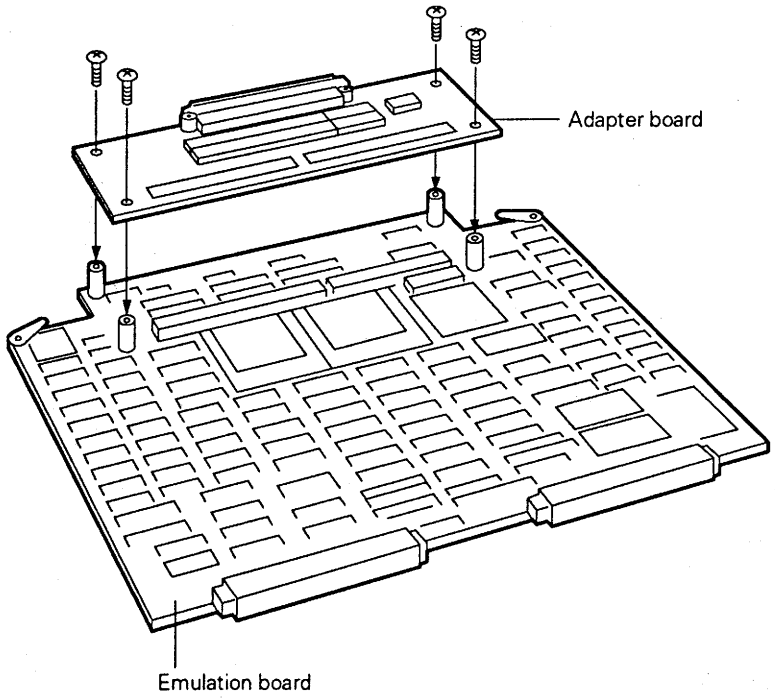


Fig. 3-3 Adapter Board and Screw Positions

④ Remove all short-pins from the JP1 on the emulation board.

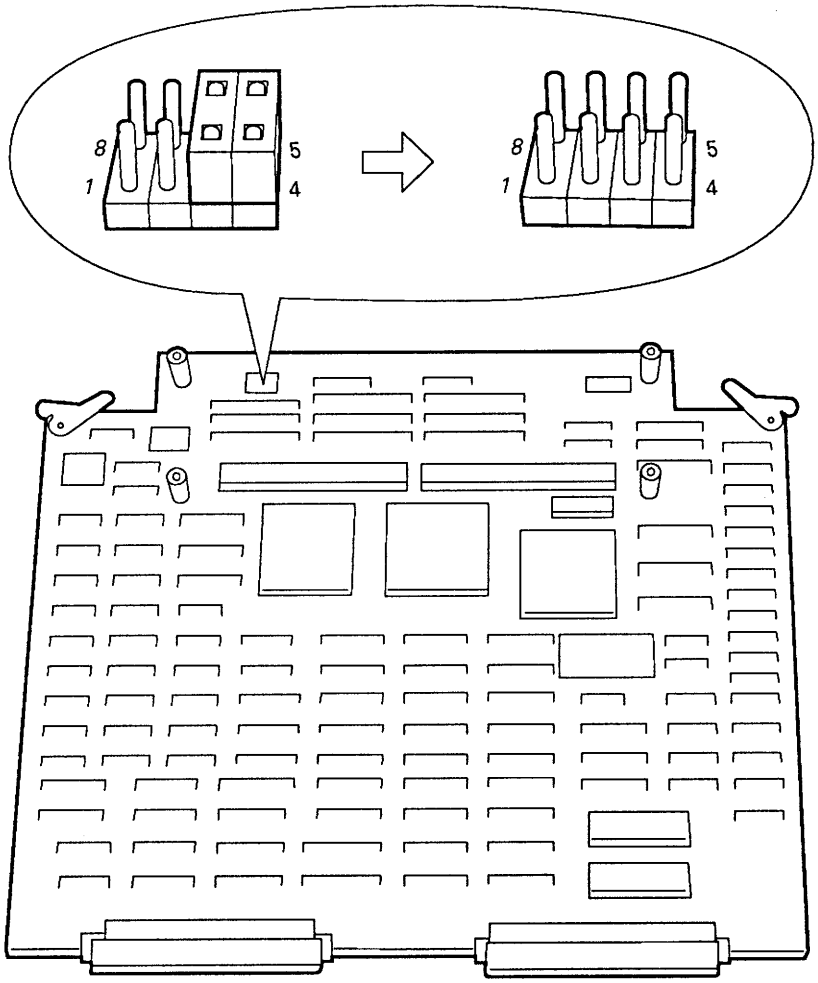


Fig. 3-4 Setting of JP1

Remarks: Setting of JP1

Target Device	Setting of JP1
μPD78244 series	5-4 shorted 6-3 shorted
μPD78214 series μPD78218A series	Open

3.2 Setting User Clock

When IE-78240-R-A is started, a clock (12 MHz: in-emulator clock) is created and supplied by the crystal oscillator located on the emulation board of the IE-78240-R-A.

The clock used on the target system (user clock) can also be supplied to IE-78240-R-A. In this case, mount an oscillator on the component block of the emulation board installed in IE-78240-R-A. To set the component block, be sure to read this Chapter.

Note: The crystal/ceramic resonator on the target system cannot be used for clock generation for the IE-78240-R-A.

3.2.1 Setting outline

Settings for component blocks differ, as shown in Table 3-2, depending on the type of clock connected across the X1 and X2 pins on the target system.

The emulation clock is set on the configuration panel of the screen debugger.

Table 3-2 Outline of Setting for Clock Supply

Target System Clock	Oscillation Frequency	Setting of Emulation Clock	Setting Component Block
Crystal/Ceramic Oscillation	12 MHz	IE (clock in emulator)	No need for setting
	Other than 12 MHz (4 MHz≦ fxx < 12 MHz)	USER (user clock)	Mount oscillator on component block
External Clock	12 MHz	USER (user clock)	No need for setting
	Other than 12 MHz (4 MHz≦ fxx < 12 MHz)	USER (user clock)	

Caution: If the component block for external clock is prepared by the user, the wiring for the component block must be changed, even when the external clock is used (refer to 3.2.4 Using external clock).

An example of setting the clock on the configuration panel is described next.

◉ When a 12-MHz oscillator is connected across the X1 and X2 pins, or when a 12-MHz clock is input to the pins.

◘ Select the in-emulator clock by setting the clock. The component blocks on the emulation board of IE-78240-R-A do not have to be manipulated.

◉ When an oscillator other than a 12-MHz oscillator is connected across the X1 and X2 pins.

◘ Mount an oscillator of the frequency to be used on the component block of the IE-78240-R-A emulation board and select USER for the clock setting (select the user clock).

◘ For how to mount the component blocks, refer to:

3.2.2 Using ceramic oscillator or crystal resonator

3.2.3 Using crystal resonator

- When an external clock other than 12 MHz, is input to pins X1 and X2.
- Select USER for the clock setting (select the user clock). The component block does not have to be set, because a component block wired to use the external clock is attached on the emulation board as a factory-set condition.
- However, if some other clock is to be used, or if the user prepares a component block because the original component block has been lost, refer to 3.2.4 Using external clock.

Remarks 1: Target system clock

- Crystal/ceramic oscillation
  In this mode, the clock is created by using the oscillator circuit in the CPU with an ocsillator connected to target system.
- External clock
  In this mode, a clock signal created by an external clock oscillator circuit is supplied to X1 and X2 pins for the target system, and the CPU internal oscillator circuit is not used.

2: fxx indicates the oscillation frequency for the oscillator connected to X1 and X2 pins.

3: For details on how to set the clock, refer to the descriptions of the configuration panel and CLK command in the User's Manual - Reference of the optional screen debugger.

3.2.2 Using ceramic/crystal resonator

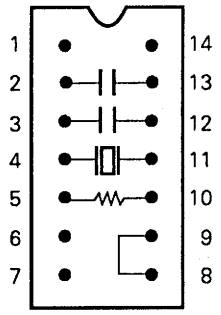
■ The following components and tools are necessary:

- Component blocks (two supplied with IE-78240-R-A)
- Ceramic oscillator or crystal resonator
- Resistor Rx
- Capacitor CA
- Capacitor CB
- Soldering tools
- Phillips screwdriver

▷ **Step**

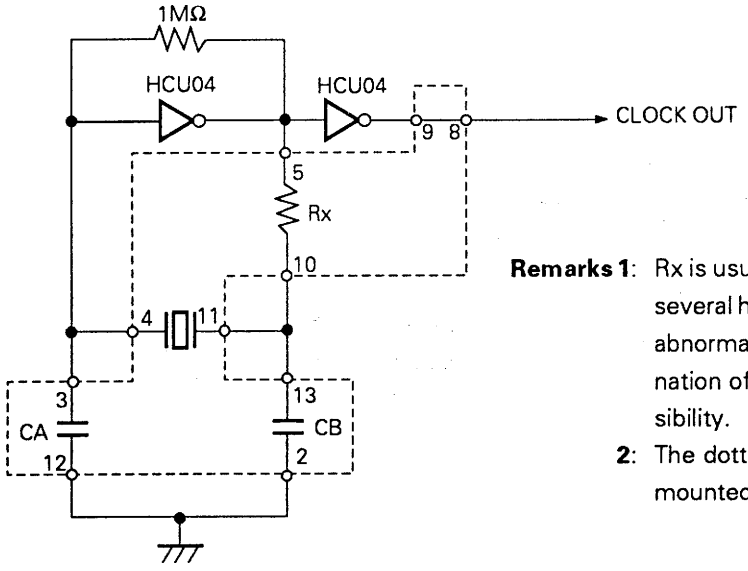
① Solder the ceramic oscillator or crystal resonator to be used on the component block, and resistor Rx and capacitors CA and CB, which match the frequency of the oscillator, as illustrated below.

Component block



Pin No.	Connection
2-13	Capacitor CB
3-12	Capacitor CA
4-11	Ceramic/crystal oscillator
5-10	Resistor Rx
8-9	Shorted

Circuit diagram



Remarks 1: Rx is usually 0 Ω (shorted). Connect a resistor of several hundred ohms as Rx in case oscillation is abnormal. In this case, evaluation and determination of the Rx value is the user's own responsibility.

2: The dotted lines indicate the components to be mounted on component platform.

② Turn off power to IE-78240-R-A.
③ Remove the six screws from the IE-78240-R-A top cover and remove the top cover.
④ Pull out the emulation board.
⑤ Remove the component block for external clock from the socket (OPCK) on the emulation board.
⑥ Mount the component block on the socket (OPCK) on the emulation board. At this time, match the mark indicating pin 1 and inscribed on the emulation board with the pin 1 mark on the component block.

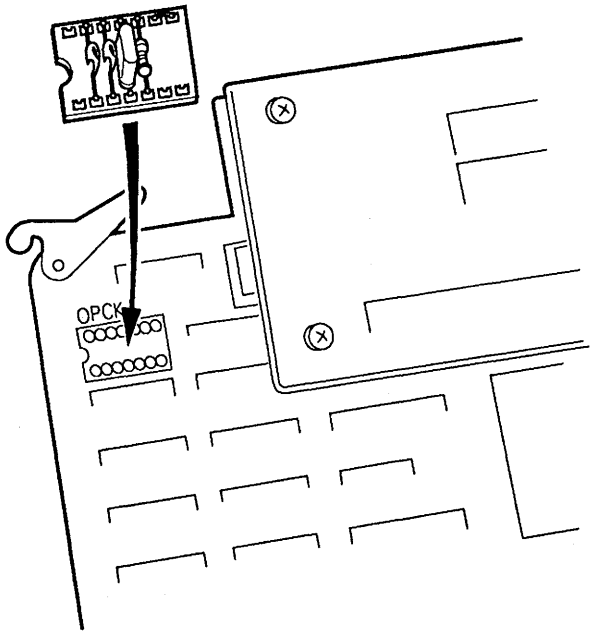
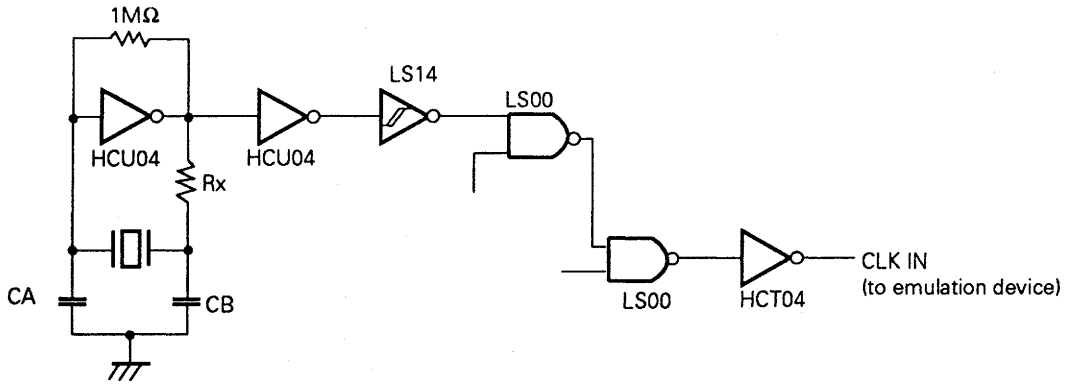


Fig. 3-5 Emulation Board Enlarged View

⑦ Re-insert the emulation board into IE-78240-R-A.
⑧ Turn on power to IE-78240-R-A.

The above steps configure the following circuit, and the oscillator mounted on the emulation board supplies a clock to the emulation device.



3.2.3 Using crystal resonator

■ The following components and tools are necessary:

- Crystal resonator (with pins arranged as shown in Fig. 3-6)
- Phillips screwdriver

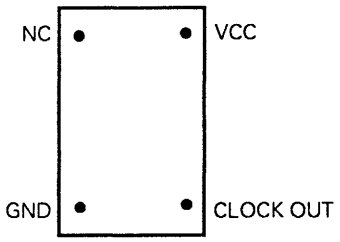
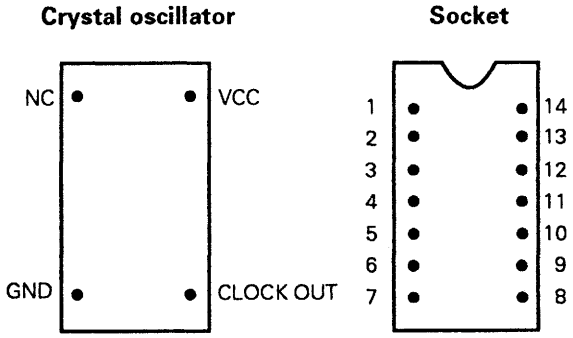


Fig. 3-6 Crystal Resonator (Top View)

▷ **Step**

① Turn off power to IE-78240-R-A.
② Remove the six screws from the IE-78240-R-A top cover and remove the top cover.
③ Pull out the emulation board.
④ Remove the external clock component block from the socket (OPCK) on the emulation board.
⑤ Mount a crystal resonator to the component block socket (OPCK) on the emulation board. At this time, the oscillator pins must be inserted into the correct pin holes in the socket, as shown in the following table.



Crystal Oscillator	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
Vcc	14

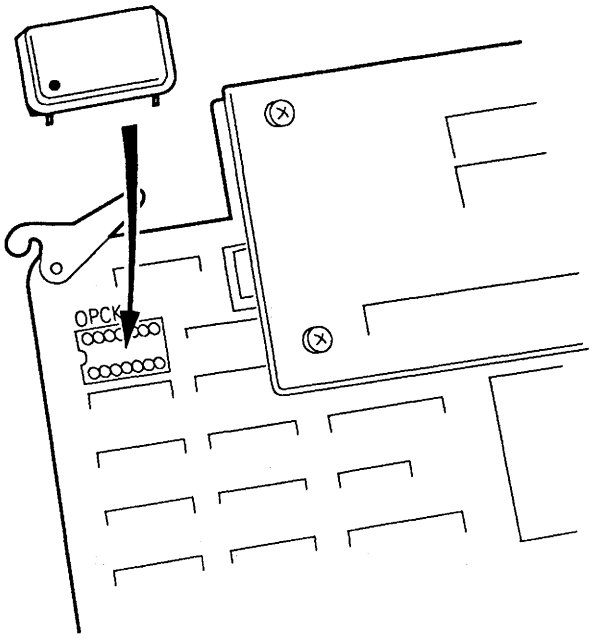
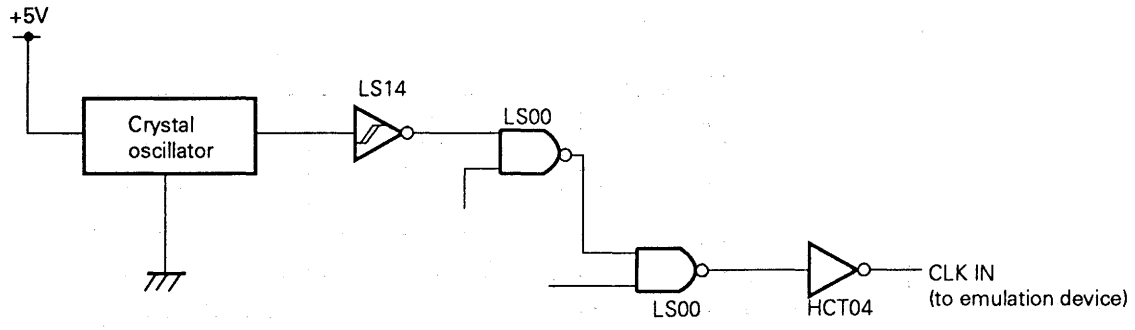


Fig. 3-7 Emulation Board Enlarged View

⑥ Re-insert the emulation board into IE-78240-R-A.

⑦ Turn on power to IE-78240-R-A.

The above steps are used to configure the following circuit, and the crystal resonator mounted on the emulation board supplies a clock to the emulation device.



3.2.4 Using external clock

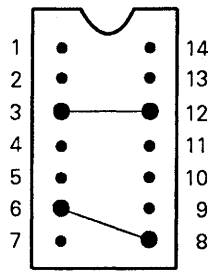
As a factory-set condition for shipment, component blocks wired as shown in Fig. 3-8 are mounted on the IE-78240-R-A emulation board. To modify the clock source, or to prepare component blocks of your own, because the supplied component blocks have been lost or damaged, follow the steps described below.

■ The following components and tools are necessary:

- Component block (two supplied with IE-78240-R-A)
- Lead wires
- Phillips screwdriver
- Soldering tools

▷ **Step**

① Solder the lead wires on the supplied component block as illustrated below.



Component block pin No.
3-12
6-8

Fig. 3-8 Lead Wiring

② Turn off power to IE-78240-R-A.
③ Remove the six screws from the IE-78240-R-A top cover and remove the top cover.
④ Pull out the emulation board.

⑤ Mount the component block on the socket (OPCK) on the emulation board. At this time, match the mark indicating pin 1 and inscribed on the emulation board with the pin 1 mark on the component block.

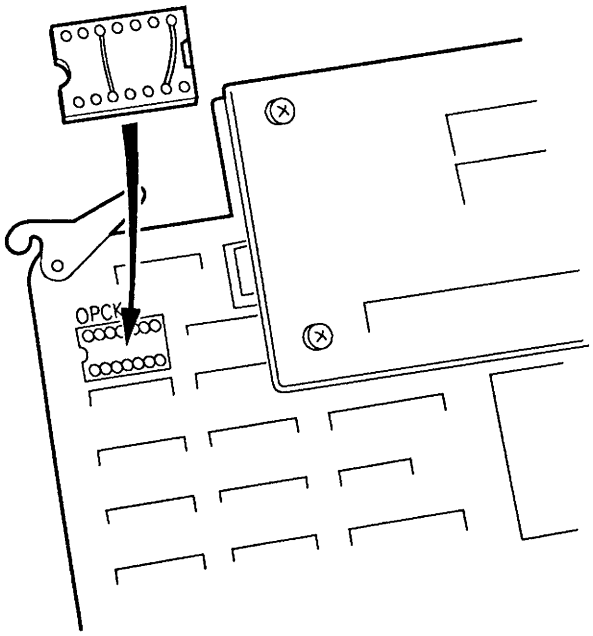
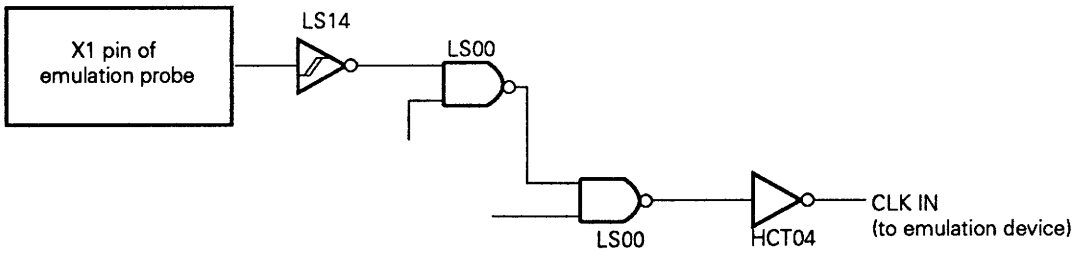


Fig. 3-9 Emulation Board Enlarged View

⑥ Re-insert the emulation board into IE-78240-R-A.

⑦ Turn on power to IE-78240-R-A.

The above steps are used to configure the following circuit, and the clock signal for the target system is supplied to the emulation device.



3.3 Using IE-78240-R-EM

This section describes how to upgrade the 75X series or 78K series in-circuit emulator by using IE-78240-R-EM, to have the functions equivalent to those of IE-78240-R-A.

Therefore, if you use IE-78240-R-A, you may skip this section.

Table 3-3 System Up-grade to IE-78240-R-A from Other Models

Emulator	IE Group No.	Boards Required to be Purchased	Remarks
IE-78112-R*1 IE-78210-R*1 IE-78220-R*1 IE-78310-R*1 IE-78310A-R	1	IE-78200-R-BK IE-78240-R-EM*2	The high-speed down-load function cannot be used. For users having IE groups 1, 2, and 4 in-circuit emulators, an upgrade is recommended. For users having IE group 1 in-circuit emulators, the IE-78200-R-BK is not needed (the IE-78200-R-BK board is contained in the IE group 1 in-circuit emulator).
IE-78240-R*1	2	IE-78200-R-BK	—
IE-78230-R-A IE-78140-R	3	IE-78240-R-EM	—
IE-75000-R IE-75001-R IE-78000-R IE-78130-R IE-78230-R*1 IE-78320-R*1 IE-78327-R IE-78330-R IE-78350-R IE-78600-R	4	IE-78200-R-BK IE-78240-R-EM	For users having IE group 1 in-circuit emulator circuit emulators, the IE-78200-R-BK is not needed (the IE-78200-R-BK board is contained in the IE group 1 in-circuit emulator).

***1**: Production of this has been stopped and it is not currently available.

2: When emulating the μPD78214 series product, if the user already has the IE-78210-R-EM*1, then the IE-78240-R-EM is not necessary.

3.3.1 Upgrading the system by using emulator in groups 2 to 4

The following paragraphs describe how to upgrade your system by using the emulator in the new frame.

Also refer to 1.2.2 Upgrading other model to IE-78240-R-A and 1.2.3 Functional differences between IE-78240-R-A and other in-circuit emulators using IE-78240-R-EM.

(1) Pull out the emulator board from the groups 2 to 4.

①Make sure that the power to the emulator is off.

②Remove the six screws from the top cover, and open the cover.

③Pull the card pullers at both edges of the emulationboard toward you to completely pull out the emulation board from the slot. Disconnect the cables (J1, J2) connecting the break board and the control/trace board before removing the break board.

(2) To upgrade the system by using group 3.

Pull out the emulation board from the frame by following the steps described in (1) above and replace it with IE-78240-R-EM (optional).

The in-circuit emulator will then have the same functions as those of IE-78240-R-A.

The development mode and user clock can be set in the same manner as IE-78240-R-A.

(3) To upgrade the system by using group 2

Pull out the break board from the frame by following the steps described in (1) above and replace it with IE-78200-R-BK (optional).

The in-circuit emulator will then have the same functions as those of IE-78240-R-A.

The development mode and user clock can be set in the same manner as IE-78240-R-A.

(4) To upgrade the system by using an in-circuit emulator in group 4

Pull out the emulation board from the frame by following the steps in (1) above and replace it with IE-78240-R-EM (optional).

Also, pull out and replace the break board with IE-78200-R-BK (optional).

The in-circuit emulator will then have the same functions as those of IE-78240-R-A.

The development mode and user clock can be set in the same manner as IE-78240-R-A.

Remarks: For the upgraded emulator, sole use control programs (screen debugger and device file) are necesary.

No special user's manuals for up-grading groups 2 to 4 are available. This manual should be used.

3.3.2 Upgrading the system by using the emulator in group 1

The following paragraphs describe how to upgrade your system by using the emulator in the group 1.

Also refer to 1.2.2 Upgrading other model to IE-78240-R-A and 1.2.3 Functional differences between IE-78240-R-A and other in-circuit emulators using IE-78240-R-EM.

(1) Pull out the emulator board from the group 1.

① Make sure that the power to the emulator is off.

② Remove the screws from the cover, and open the cover.

③ Remove the screws from the board mounting brackets and remove the brackets.

④ Pull the card pullers at both edges of the emulation board toward you to completely pull out the emulation board. Disconnect the cables (J1, J2) connecting the break board and the control/trace board before removing the break board.

(2) Replacing monitor ROM

Replace the monitor ROMs currently mounted on IC49 and C56 of the control/trace board with the monitor ROMs (I200/Vx.x/IC49 and I200/Vx.x/IC56) supplied with the optional screen debugger.

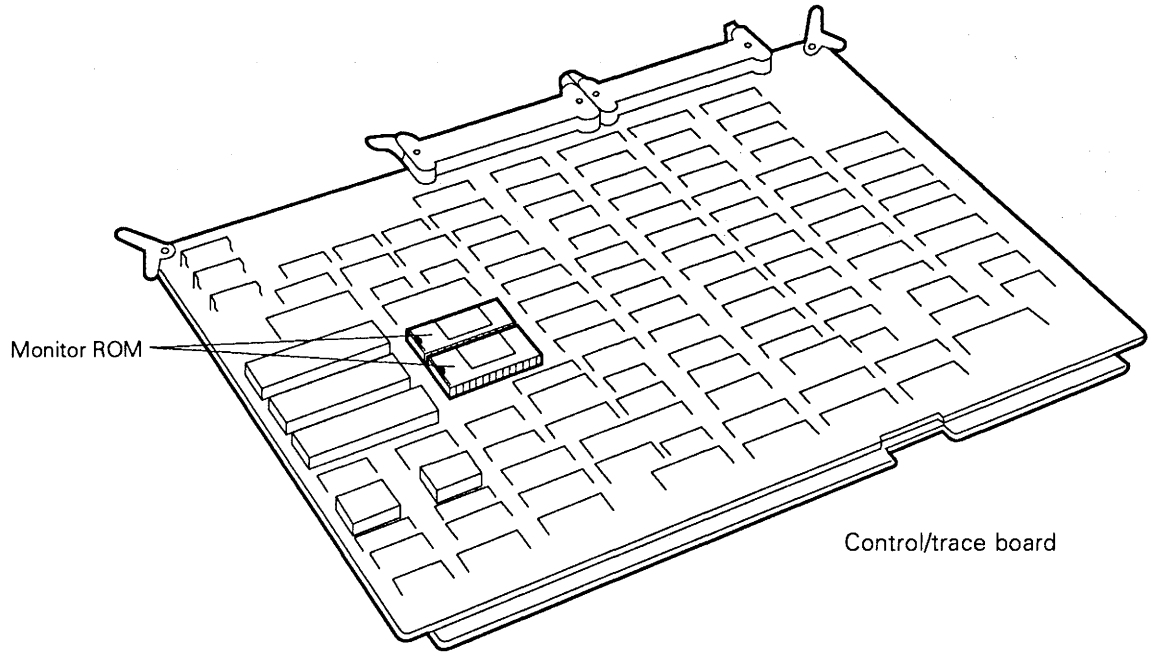


Fig. 3-10 Monitor ROM Mounting Position

Caution: Be sure to mount the monitor ROM in the correct direction; otherwise, the in-circuit emulator will not operate correctly.

(3) To upgrade the system by using the IE-78210-R

Pull out the break board from the frame by following the steps described in (1) above and replace it with IE-78200-R-BK (optional).

The in-circuit emulator will then have the same functions as those of IE-78240-R-A.

★ The emulation probe connection and user clock can be set in the same manner as IE-78210-R.

Caution: Upgrading system in (3) is to develop the μPD78214 series. To develop the μPD78218A series and μPD78244 series, upgrade the system as described in (4) below.

(4) To upgrade the system by using the in-circuit emulator system other than IE-78210-R

Pull out the boards other than the control/trace board from the frame and replace them with IE-78240-R-EM (optional) and IE-78200-R-BK (optional).

The in-circuit emulator will then have the same functions as those of IE-78240-R-A.

The development mode and user clock can be set in the same manner as IE-78240-R-A.

Remarks 1: To upgrade the system by using the emulator in the group 1, the setting other than the name and mounting position of the monitor ROM, and how to pull out the boards are the same as when the emulator in the group 2 to 4 is used.

2: To upgrade the system by using the emulator in the group 1, some functions differ. For details, refer to 1.2.3 Functional differences between IE-78240-R-A and other in-circuit emulators using IE-78240-R-EM.

3: For the upgraded emulator, sole-use control programs (screen debugger and device file) are necessary.

No user's manuals for up-grading using the group 1 is available, so this manual should be used. Please change the monitor ROM name and the mounting location.

CHAPTER 4 CONNECTING EMULATION PROBE

This chapter describes how to connect the emulation probe to IE-78240-R-A. For further information, refer to the emulation probe User's Manual.

Phase-out/Discontinued

4.1 Emulation Probe Ordering Information

The emulation probe is optionally available. The following types of emulation probes are readily available to enable your selection of the probe best suited to the shape of μPD78244 series, μPD78214 series orμPD78218A series microcomputer used on the target system:

Ordering code	
EP-78240GJ-R	(for 74-pin QFP package)
EP-78240GC-R	(for 64-pin QFP package)
EP-78240LP-R	(for 68-pin QFJ package)
EP-78240CW-R	(for 64-pin shrink package)
EP-78240GQ-R	(for 64-pin QUIP package)

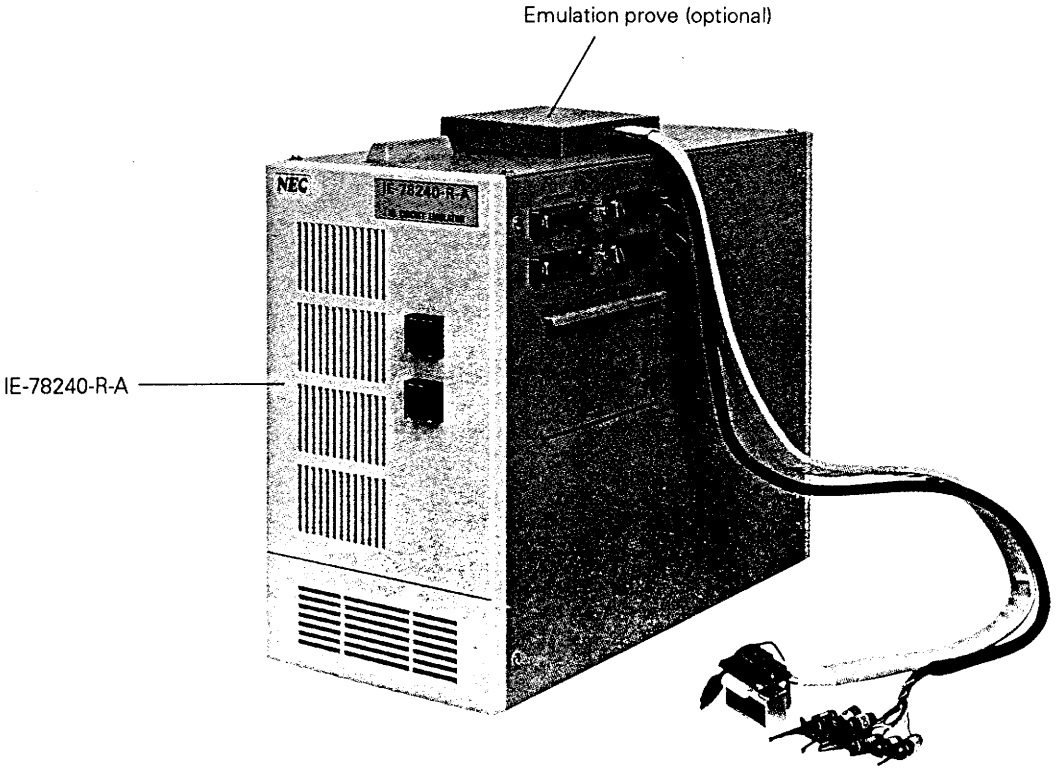


Photo 4-1 Emulation Probe

4.2 Connections Outline

■ Before connection

◉ When changing development mode

➡ Refer to 3.1 Changing Development Mode and accomplish necessary setting, such as the setting of jumpers, before connecting the connector board of the emulation probe and IE-78240-R-A.

◉ When setting user clock

➡ Refer to 3.2 Setting User Clock and perform necessary setting, such as mounting an oscillator on the emulation board, before connecting the connector board of the emulation probe and IE-78240-R-A.

■ Connections outline

▷ Attach the connector board of the emulation probe to the adapter board of IE-78240-R-A.

▷ Connect the emulation probe to the DIN connector on IE-78240-R-A.

Caution 1: For details on how to connect the emulation probe, refer to the emulation probe User's Manual. If the emulation probe is connected erroneously, IE-78240-R-A may be damaged.

2: Unless the connector board for the emulation probe is connected to IE-78240-R-A, the in-circuit emulator is not electrically connected to the target system, and the target system cannot be emulated.

(1) Attach the connector board for the emulation probe to the IE-78240-R-A adapter board.

▷ Step

① Remove the six screws from the IE-78240-R-A top cover and remove the top cover.
② Pull the card pullers at both sides of the emulation board toward you to pull the emulation board out of the slot.
③ Remove the four screws from the adapter board to detach the adapter board from the emulation board.
④ Connect the connector board, supplied with the emulation probe, to the connector (CN2, CN3) of the adapter board.
At this time, confirm that the JP1 of the emulation board and the monitor ROM of the control/trace board are in accordance with the development mode.

Table 4-1 Setting

Item	Setting to develop μPD78244 series (factory-set condition)	Setting to develop μPD78214 series and μPD78218 series
JP1 on the Emulation Board	5-4 shorted 6-3 shorted	Opened
Device File	DF78240	DF78210

⑤ Mount the adapter board on the emulation board.
⑥ Return the emulation board to the origina position in IE-78240-R-A.
⑦ Attach and secure the top cover by tightening the six screws.

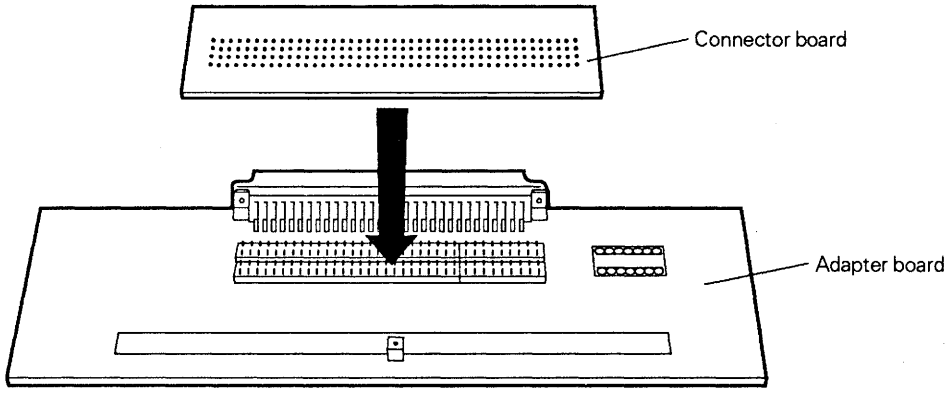


Fig. 4-1 Attaching Connector Board

Remarks: The connector board is supplied with the emulation probe (optional), and is not mounted on IE-78240-R-A as a factory-set condition for shipment.

(2) Connect the emulation probe to the DIN connector for IE-78240-R-A.

▷ **Step**

① Connect the DIN connector on the top of IE-78240-R-A to the emulation probe DIN connector.
② Secure the IE-78240-R-A and emulation probe with mounting screws.

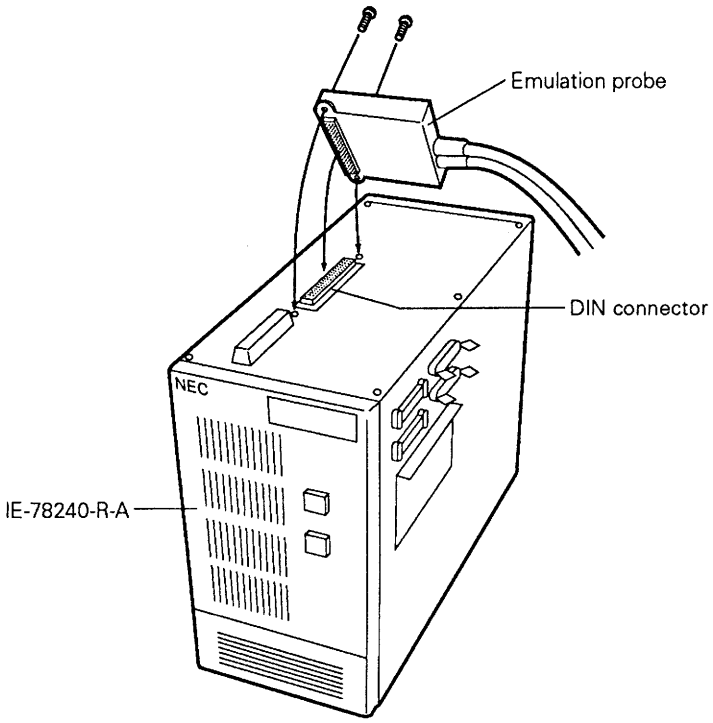


Fig. 4-2 Connecting DIN Connector

CHAPTER 5 CONNECTING PERIPHERAL DEVICES

IE-78240-R-A can debug and program a target device when connected to peripheral devices to set up a system. This chapter describes how to connect the peripheral devices, and the set values and setting method for each device. Before connecting a peripheral device to the emulator, be sure to read through this chapter.

For details on system setup, refer to 1.4 Setup Procedure. For how to start the system, refer to the User's Manual - Beginner's Guide of the optional screen debugger.

5.1 IE-78240-R-A and Peripheral Devices

The following peripheral devices can be connected to IE-78240-R-A:

- Host machine
- PROM programmer

(1) Host machine

■ PC-9800 series

An NEC PC-9800 series personal computer can provide consistent development environments covering software development and total evaluation including hardware by executing the optional screen debugger and device file on MS-DOS.

★ ■ IBM PC/AT

An IBM PC/AT personal computer can provide consistent development environments convering software development and total evaluation including hardware by executing the optional control program for IE-78240-R-A on PC DOS™.

(2) PROM programmer

■ PG-1500

★ PG-1500 is a PROM programmer that can program representative PROMs, from 256K-bit to 4M-bit models. It can program the internal PROM for NEC's single-chip microcomputers, when used in combination with an optional programmer adapter.

PG-1500 has a key panel switch and serial interface.

Therefore, it can also be used as a stand alone PROM programmer. In addition, it can also be remote-controlled by a console connected with a serial interface.

To connect PG-1500 to IE-78240-R-A, use an RS-232-C interface cable commercially available.

■ PG-2000

PG-2000 is a PROM programmer that can program representative PROMs, from 16K-bit to 256K-bit models.

PG-2000 has a key panel switch and serial interface.

Therefore, it can also be used as a stand alone PROM programmer. In addition, it can also be remote-controlled by a console connected with a serial interface.

To connect PG-2000 to IE-78240-R-A, use an RS-232-C interface cable supplied with PG-2000.

Remarks: PG-2000 is a maintenance part and cannot be newly purchased.

5.2 IE-78240-R-A Interfaces

To connect IE-78240-R-A to a peripheral device, either a serial interface (channels 1 and 2) or a parallel interface (channels 3 and 4), or both sets of channels are used.

(1) Serial interface (channels 1 and 2)

The peripheral devices that can be connected to channels 1 and 2 are predetermined as follows:

Serial Interface	Peripheral Device Connected
Channel 1 (I/O)	PC-9800 series IBM PC/AT
Channel 2 (I/O)	PG-1500 PG-2000

★

5

The functions for channels 1 and 2 are briefly described in Tables 5-1 and 5-2, respectively. For more details, refer to CAPTER 8 CHANNELS 1 AND 2 FUNCTIONS.

Table 5-1 Channel 1 Functions

Function		Remarks	Setting*
Mode Selection		Terminal/modem mode	H
Baud Rate		300, 600, 1200, 2400, 4800, 9600, 19200 (bps)	H
Handshaking Method		For both hardware handshake (1 character) and software handshake (flow control)	Fixed
Character Specifications	Character Length	8 bits The most significant bit (MSB) is 0 when output and is ignored when input.	Fixed
	Parity Bit	None	Fixed
	Stop Bit Length	2 bits	Fixed

*: H: selected by switch (Hardware).

Table 5-2 Channel 2 Functions

Function		Remarks	Setting*
Mode Selection		Terminal/modem mode	H
Baud Rate		300, 600, 1200, 2400, 4800, 9600, 19200 (bps)	S
Handshaking Method		Hardware handshake (1 character) or software handshake (flow control)	S
Character Specifications	Character Length	7 or 8 bits When character length is specified to be 8 bits, the most significant bit (MSB) is always 0 when output and is ignored when input.	S
	Parity Bbit	Even, odd, or none	S
	Stop Bit Length	1 or 2 bits	S

*: H: selected by switch (Hardware), S: selected by software

(2) Parallel interfaces (channels 3 and 4)

Channel 3 is an output channel, and channel 4 is an input channel. For details regarding channels 3 and 4, refer to CHAPTER 9 CHANNELS 3 AND 4 FUNCTIONS.

Parallel interface	Peripheral device connected
Channel 3 (output)	Printer
Channel 1 (input)	PC-9800 series IBM PC/AT

5.3 Connecting PC-9800 Series

Connect a PC-9800 series personal computer to IE-78240-R-A by following these steps:

- ▷ Turn power off.
- ▷ Set channel 1 for IE-78240-R-A.
- ▷ Connect IE-78240-R-A to PC-9800 series computer with cables.
- ▷ Turn on power.

(1) Turn power off.

Before connecting any peripheral device to IE-78240-R-A, be sure to turn off power to the device, as well as to the emulator. If power is supplied to either or both of IE-78240-R-A and PC-9800 series computer, be sure to turn it off.

(2) Set channel 1 for IE-78240-R-A.

Table 5-3 Setting Channel 1

Item	Setting
Mode selection	Modem mode
Baud rate	9,600 bps
Frame ground	Pin 4: OFF
RTS select	Pin 1: ON, pins 2 and 3: OFF

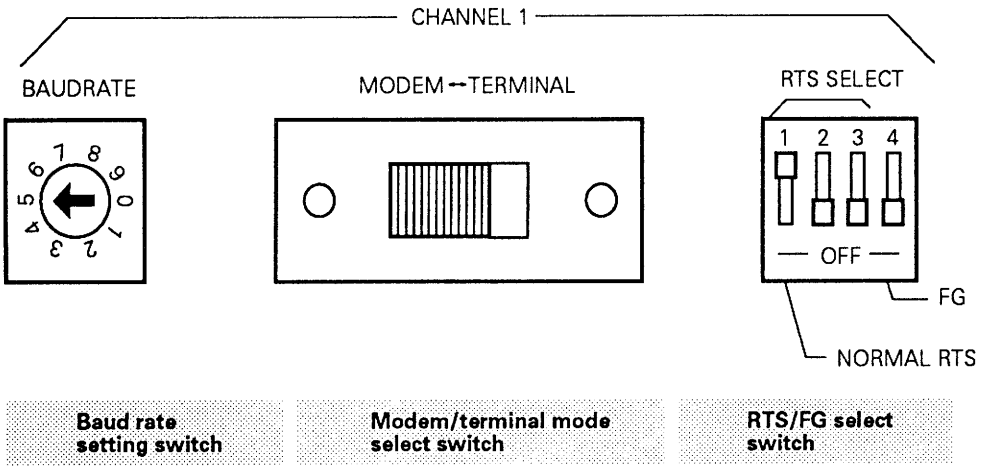


Fig. 5-1 Setting Channel 1

▷ Step

① Open the RS-232-C compartment cover on the IE-78240-R-A side panel.
② Move the CH1 modem/terminal mode selector switch to the left to set the modem mode.
③ Turn the CH1 baud rate selector switch clockwise or counterclockwise to position 5 to set the baud rate to 9,600 bps.
④ To set the frame ground, set pin 4 for the CH1 RTS/FG selector DIP switch to the OFF position (bottom: FG and SG are open).
⑤ To set RTS, set pins 1 through 3 for the CH1 RTS/FG selector DIP switch, as follows:

Pin 1: ON (top)
Pin 2: OFF (bottom)
Pin 3: OFF (bottom)

(3) Connect IE-78240-R-A to PC-9800 series computer with cables.

▷ **Step**

① Connect the CH1 serial interface port in the RS-232-C compartment for IE-78240-R-A to the standard RS-232-C channel on the rear panel of the PC-9800 series computer with the cable supplied with IE-78240-R-A.
② When using a parallel interface, connect the CH4 parallel interface port for IE-78240-R-A to the printer connect or on the rear panel of the PC-9800 series computer, using the printer cable supplied with the PC-9800 series computer.

Table 5-4 Cable Connections

IE-78240-R-A	Cable	PC-9800 Series
CH1	RS-232-C cable	Standard RS-232-C channel
CH4	Printer cable	Printer connector

(4) Turn power on.

Turn power on in the following sequence. Turn power off in the reverse sequence. Normally, observe these sequences.

▷ **Step**

■ To turn on

① Turn on the power switch for the PC-9800 series computer.
② Turn on the IE-78240-R-A power switch.

■ To turn off

① Turn off the IE-78240-R-A power switch.
② Turn off the power switch for the PC-9800 series computer.

★ 5.4 Connecting IBM PC/AT

Connect an IBM PC/AT personal computer to IE-78240-R-A by the following steps:

- ▷ Turn power off.
- ▷ Set channel 1 for IE-78240-R-A.
- ▷ Set the asynchronous communication adapter for the IBM PC/AT computer.
- ▷ Connect IE-78240-R-A to IBM PC/AT computer with cables.
- ▷ Turn on power to IE-78240-R-A.

(1) Turn off power.

Before connecting any peripheral device to IE-78240-R-A, be sure to turn off power to the device as well as to the emulator. If power is supplied to either or both of IE-78240-R-A and IBM PC/AT computer, be sure to turn it off.

(2) Set channel 1 for IE-78240-R-A. ★

Table 5-5 Setting Channel 1

Item	Setting
Mode selection	Modem mode
Baud rate	9,600 bps
Frame ground	Pin 4: OFF
RTS select	Pin 1: ON, pins 2 and 3: OFF

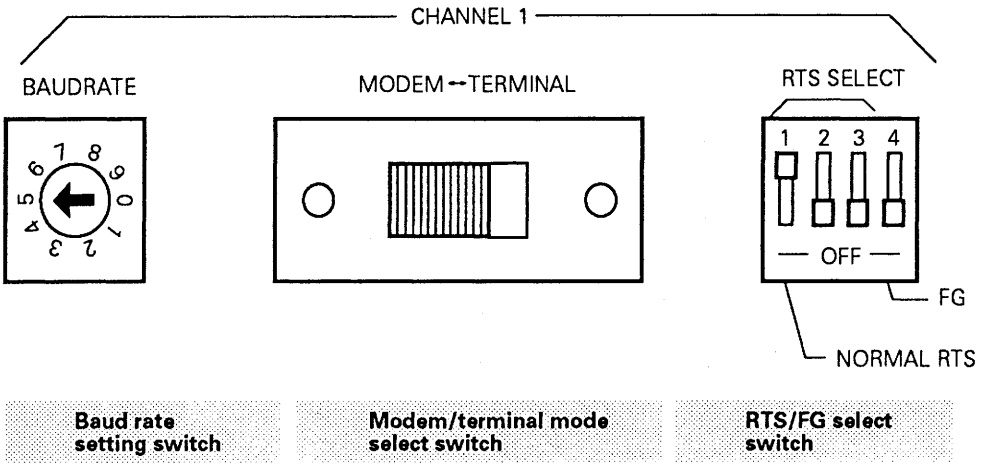


Fig. 5-2 Setting Channel 1

▷ Step

① Open the RS-232-C compartment cover on the IE-78240-R-A side panel.
② Move the CH1 modem/terminal mode selector switch to the left to set the modem mode.
③ Turn the CH1 baud rate selector switch clockwise or counterclockwise to position 5 to set the baud rate to 9,600 bps.
④ To set the frame ground, set pin 4 for the CH1 RTS/FG selector switch to the OFF position (bottom: FG and SG are open).
⑤ To set RTS, set pins 1 through 3 for the CH1 RTS/FG selector switch, as follows:

Pin 1: ON (top)
Pin 2: OFF (bottom)
Pin 3: OFF (bottom)

(3) Set the asynchronous communication adapter for the IBM PC/AT.

Set the asynchronous communication adapter inserted in the IBM PC/AT as shown in Fig. 5-3. The IE-78240-R-A control program supports the first (No. 0) serial port only.

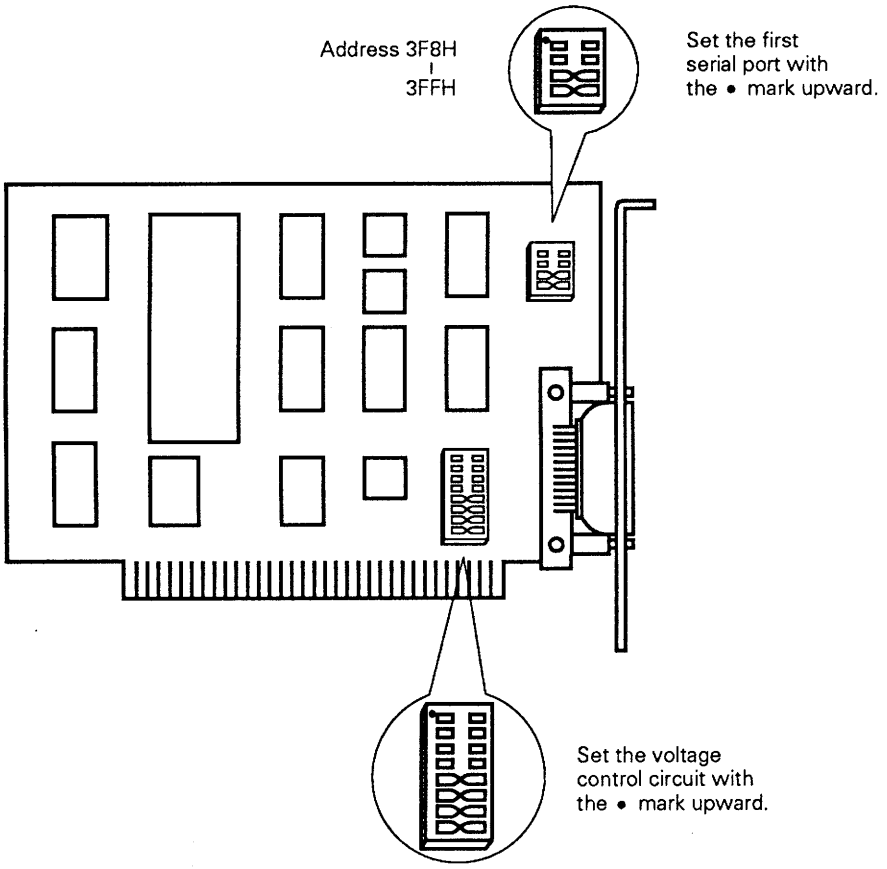


Fig. 5-3 Setting Asynchronous Communication Adapter

(4) Connect IE-78240-R-A to IBM PC/AT computer with cables.

▷ **Step**

① Connect the CH1 serial inteface port for IE-78240-R-A to the RS-232-C channel for the optional asynchronous communication adapter in the IBM PC/AT with the RS-232-C cable for the IBM PC/AT.

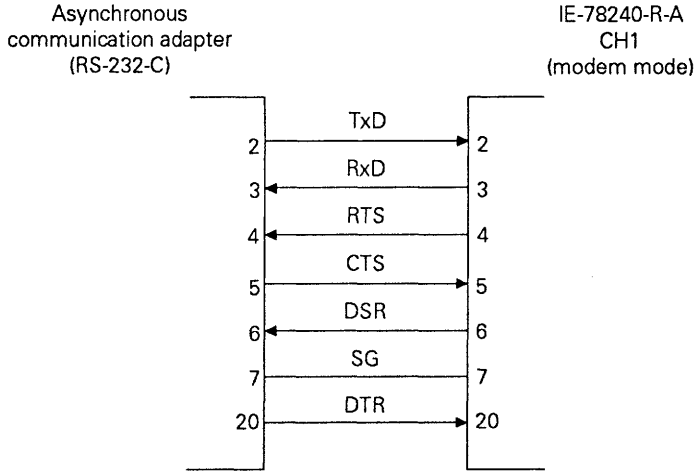


Fig. 5-4 Connecting IBM PC/AT with RS-232-C

② When using a parallel interface, connect the CH4 parallel interface port for IE-78240-R-A to the printer connector on the rear panel of the IBM PC/AT, using the printer cable supplied with the IBM PC/AT.

Table 5-6 Cable Connections

IE-78240-R-A	Cable	IBM PC/AT
CH1	RS-232-C cable	RS-232-C channel for asynchronous communication adapter
CH4	Printer cable	Printer connector

(5) Turn on power

Turn power on in the following sequence. Turn off power in the reverse sequence. Normally, observe these sequences.

▷ **Step**

■ To turn on

① Turn on the IBM PC/AT power switch.
② Turn on the IE-78240-R-A power switch.

■ To turn off

① Turn off the IE-78240-R-A power switch.
② Turn off the IBM PC/AT power switch.

5.5 Connecting PC-1500

Connect a PC-1500 to IE-78240-R-A by the following steps:

- ▷ Turn off power.
- ▷ Set channel 2 for IE-78240-R-A.
- ▷ Turn on power to PG-1500.
- ▷ Set the function mode for PG-1500.
- ▷ Connect IE-78240-R-A to PC-1500 with a cable.
- ▷ Turn on power to IE-78240-R-A.

(1) Turn off power.

Before connecting any peripheral device to IE-78240-R-A, be sure to turn off power to the device as well as to the emulator. If power is supplied to either or both of IE-78240-R-A and PC-1500, be sure to turn it off.

(2) Set channel 2 for IE-78240-R-A.

Channel 2 for IE-78240-R-A can be set in two ways: one is to use the switches with power turned off. The other is to start the emulator and execute the MOD command. This section describes how to set the channel by using the switches.

Table 5-7 Setting Channel 2

Item	Setting
Mode selection	Tminal mode
Fame ground	Pin 4: OFF
RTS select	Pin 1: ON, pins 2 and 3: OFF

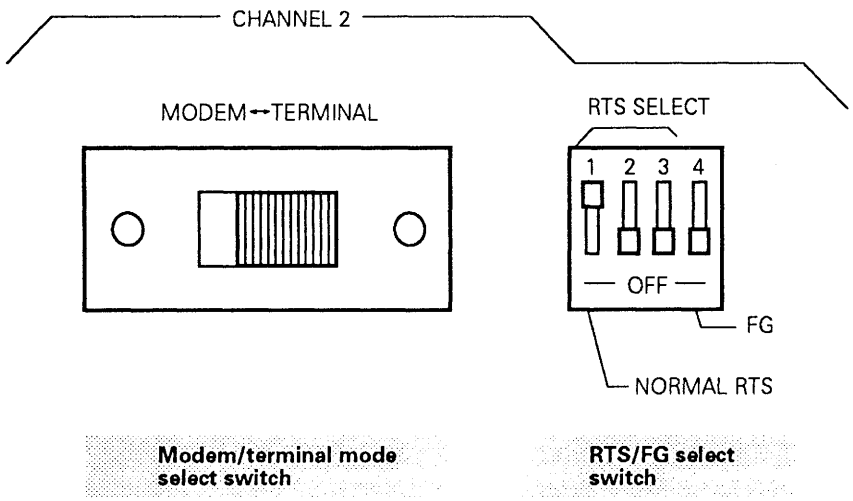


Fig. 5-5 Setting Channel 2

▷ Step

① Open the RS-232-C compartment cover on the IE-78240-R-A side panel.
② Move the CH2 modem/terminal mode selector switch to the right to set the terminal mode.
③ Set pin 4 for the CH2 RTS/FG selector DIP switch to the OFF position (bottom) to open FG and SG.
④ Set pins 1 through 3 for the CH2 RTS/FG selector DIP switch as follows to set RTS:

Pin 1: ON (top)
Pin 2: OFF (bottom)
Pin 3: OFF (bottom)

Remarks: Setting channel 2 by MOD command

The handshake method, baud rate, and character specifications for channel 2 are set by the MOD command. For details, refer to the MOD command description in the User's Manual - Reference of the optional screen debugger.

Table 5-8 Setting Channel 2 by MOD Command

Item		Setting	Command
Handshake Method		1 character	MOD
Baud Rate		9,600 bps	
Character Specifications	Character Length	8 bits	
	Parity Bit	None	
	Stop Bit Length	2 bits	

(3) Turn on power to PG-1500.

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

(4) Set the PG-1500 function mode.

PG-1500 is set by the key switches on the front panel. For details, refer to PG-1500 User's Manual.

Table 5-9 Setting PG-1500

Item	Setting	LCD indication
Baud rate	9,600 bps	BR : 960
Parity bit	None	P : NON
Handshake method	1 character	XN : OF
Character length	8 bits	B : 8
Stop bit length	2 bits	SB : 2
Precheck*	None	PC : OF

*: This function is to check whether or not the device is correctly mounted, and is valid when using the general-purpose PROM.

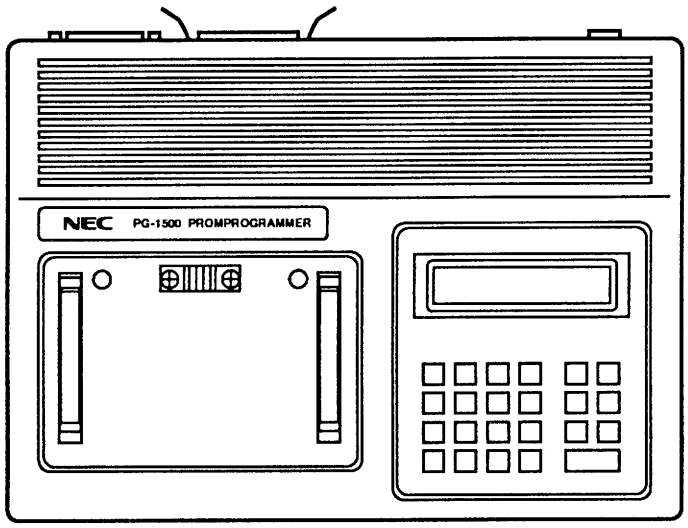


Fig. 5-6 PG-1500 Front Panel

▷ **Step**

Key sequence	LCD display	Description
FUNCTION	SIN PIN SOUT MOD REM FUNCTION	① Sets the function mode
MODE	Baud rate / Parity / XON/XOFF BR: 9600 P:NON XN:ON MODE B:8 SB:2 PC:OF Bit configuration / Stop bit / Precheck	② Sets the setting mode.
△ : Selects parameter ▽ : Changes setting of parameter		③ All the parameters cannot be changed by only the numeric key. Move the cursor to the position of the parameter to be set by using the key △, and change the value of the parameter by using the key ▽.
▽	BR: 9600 P:NON XN:ON MODE B:8 SB:2 PC:OF	④ Select a baud rate (9600 bps in this example).
▽	The baud rate changes as follows each time the key is pressed: → [19200] → [1200] → [2400] → [4800] → [9600] →	
△	BR: 9600 P:NON XN:ON MODE B:8 SB:2 PC:OF	⑤ Move the cursor to the position of the P (parity) parameter.
▽	BR: 9600 P:NON XN:ON MODE B:8 SB:2 PC:OF	⑥ Selects NON (no parity).
▽	The parity setting changes as follows each time the key is pressed. → [NON] → [EVN] → [ODD] →	
△	BR: 9600 P:NON XN:ON MODE B:8 SB:2 PC:OF	⑦ Move the cursor to the position of XN (handshake method) parameter.
▽	BR: 9600 P:NON XN:OF MODE B:8 SB:2 PC:OF	⑧ Select OF (1 character).
▽	The character setting changes as follows each time the key is pressed: [OF] (1 character) ↔ [ON] (Flow control)	

5

△

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

⑨ Move the cursor to the position of the B (bit configuration) parameter.

▽

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

⑩ Select 8 (8 bits).

▽ The number of stop bits changes as follows each time the key is pressed:
[8] ↔ [7]

△

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

⑪ Move the cursor to the position of the SB (stop bit length) parameter.

▽

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

⑫ Select 2 (2 bits).

▽ The number of stop bits changes as follows each time the key is pressed:
[2] ↔ [1]

△

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

⑬ Move the cursor to the position of the PC (precheck) parameter.

▽

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

⑭ Select OF (no check).

▽ The parity check setting changes as follows each time the key is pressed:
[OF] ↔ [ON]

SET/START

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

⑮ All the parameters have now been set and the idle 0 state has been set.

Note: The set parameter value does not become valid until the SET/START key is pressed. When the SET/START key is pressed, the set value for a parameter is written to the internal NV-RAM for PG-1500.

(5) Connect IE-78240-R-A to PG-1500 with a cable.

Connect the CH2 serial interface port for IE-78240-R-A to the serial interface connector (on the right of the rear panel) for PG-1500 with an RS-232-C interface cable commercially available.

Table 5-10 Cable Connections

IE-78240-R-A	Cable	PG-1500
CH2	RS-232-C interface cable	Serial interface connector

(6) Turn on power to IE-78240-R-A.

Turn on the power switch on the front panel of IE-78240-R-A.

Remarks: Normally, turn power on or off by the following steps:

▷ **Step**

■ To turn on

① Turn on the PG-1500 power switch.
② Press the RESET key and SERIAL (B) key on the PG-1500 front panel in this order.
③ Turn on the IE-78240-R-A power switch.

■ To turn off

① Turn off the PG-1500 power switch.
② Turn off the IE-78240-R-A power switch.

5.6 Connecting PG-2000

Connect a PG-2000 to IE-78240-R-A by the following steps:

- ▷ Turn power off.
- ▷ Set channel 2 for IE-78240-R-A.
- ▷ Set the serial interface mode for PG-2000.
- ▷ Connect IE-78240-R-A to PG-2000 with a cable.
- ▷ Turn on power.

(1) Turn power off.

Before connecting any peripheral device to IE-78240-R-A, be sure to turn off power to the device, as well as to the emulator. If power is supplied to either or both of IE-78240-R-A and PG-2000, be sure to turn it off.

(2) Set IE-78240-R-A channel 2.

The IE-78240-R-A channel 2 can be set in two ways: one is to use the switches with power turned off. The other is to start the emulator and execute the MOD command. This section describes how to set the channel by using the switches.

Table 5-11 Setting Channel 2

Item	Setting
Mode selection	Modem mode
Fame ground	Pin 4: OFF
RTS select	Pin 1: ON, pins 2 and 3: OFF

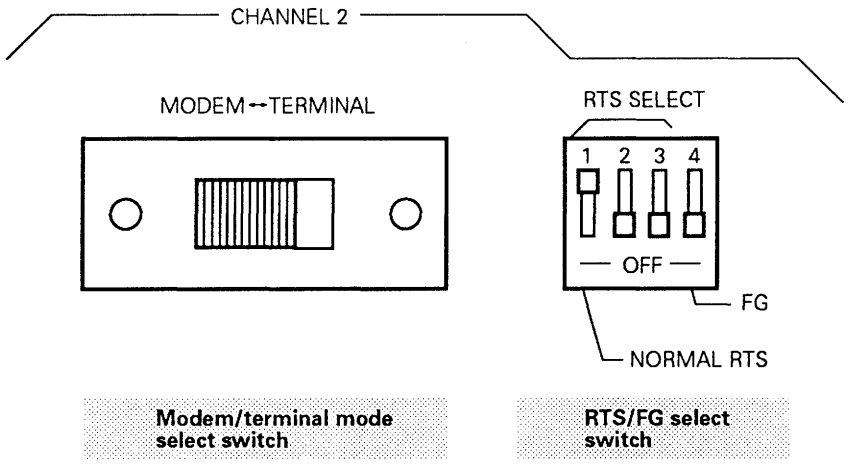


Fig. 5-7 Setting Channel 2

▷ Step

① Open the RS-232-C compartment cover on the IE-78240-R-A side panel.
② Move the CH2 modem/terminal mode selector switch to the left to set the terminal mode.
③ Set pin 4 for the CH2 RTS/FG selector DIP switch to the OFF position (bottom) to open FG and SG.
④ Set pins 1 through 3 for the CH2 RTS/FG selector DIP switch as follows to set RTS.

Pin 1: ON (top)
Pin 2: OFF (bottom)
Pin 3: OFF (bottom)

Remarks: Setting channel 2 by MOD command

The handshake method, baud rate, and character specifications for channel 2 are set by the MOD ommand. For details, refer to the MOD command description in the User's Manual - Reference for optional screen debugger.

Table 5-12 Setting Channel 2 by MOD Command

Item		Setting	Command
Handshake method		1 character	MOD
Baud rate		9,600 bps	
Character specifications	Character length	8 bits	
	Parity bit	None	
	Stop bit length	2 bits	

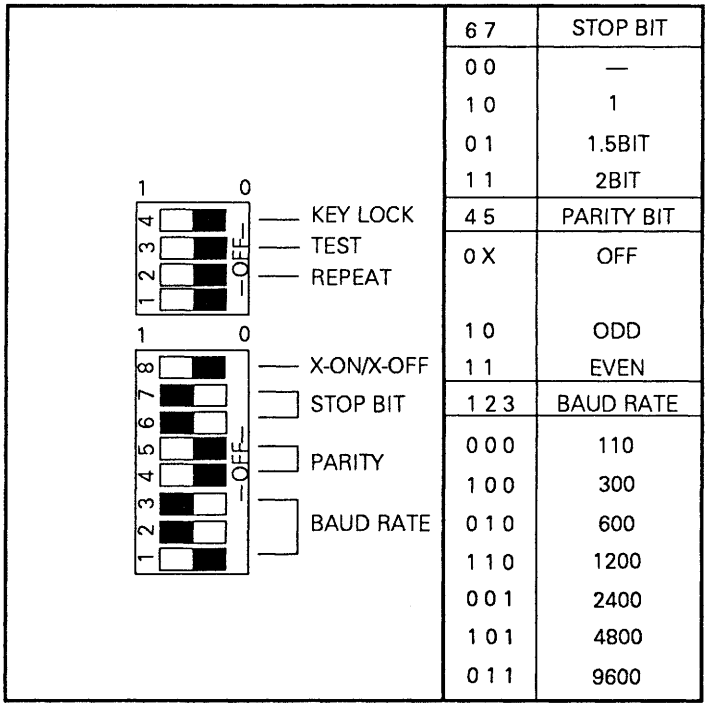
(3) Set the PG-2000 serial interface mode.

The PG-2000 is set by the 8-pin DIP switch on the PG-2000 bottom plate. For details, refer to the PG-2000 User's Manual.

Table 5-13 Setting PG-2000

Item	Setting	Switch
Baud rate	9,600 bps	Pin 1: OFF Pin 2: ON Pin 3: ON
Parity bit	None	Pin 4: OFF Pin 5: ON/OFF*
Stop bit length	2	Pin 6: ON Pin 7: ON
Handshake method	1 character	Pin 8: OFF

*: don't care



6 7	STOP BIT
0 0	—
1 0	1
0 1	1.5BIT
1 1	2BIT
4 5	**PARITY BIT**
0 X	OFF
1 0	ODD
1 1	EVEN
1 2 3	**BAUD RATE**
0 0 0	110
1 0 0	300
0 1 0	600
1 1 0	1200
0 0 1	2400
1 0 1	4800
0 1 1	9600

Fig. 5-8 DIP Switches for PG-2000

Note: The 4-pin DIP switch is used for inspection purposes before shipment. Leave all the switch pins of this switch OFF.

▷ **Step**

① The baud rate is set by pins 1 through 3 of the DIP switch. Set the same baud rate as that of IE-78240-R-A, to 9,600 bps.

Pin 1: OFF (bottom)

Pin 2: ON (top)

Pin 3: ON (top)

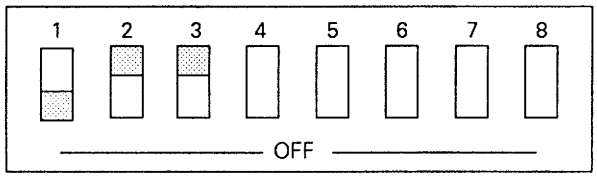


Fig. 5-9 Setting Baud Rate for PG-2000

② The parity bit is set by DIP switch pins 4 and 5. Set the same parity as that for IE-78240-R-A, to none.

Pin 4: OFF (bottom)

Pin 5: ON/OFF (don't care)

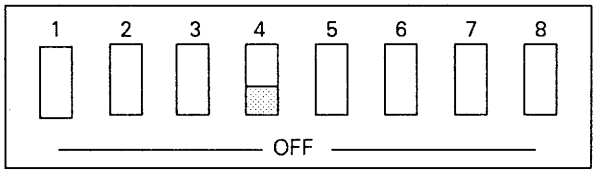


Fig. 5-10 Setting PG-2000 Parity Bit

③ The stop bit length is selected by DIP switch pins 6 and 7. Set the same stop bit length to the same value as that for IE-78240-R-A, to 2 bits.

Pin 6: ON (top)

Pin 5: ON (top)

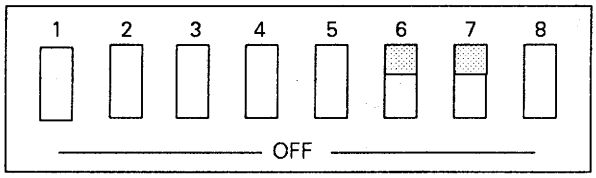


Fig. 5-11 Setting Stop Bit Length for PG-2000

④ The handshake method is set by DIP switch pin 8, as follows:

Pin 8: OFF (bottom)

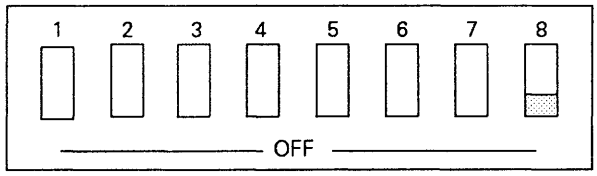


Fig. 5-12 Setting Handshake Method for PG-2000

(4) Connect IE-78240-R-A to PG-2000 with a cable.

Connect the CH2 serial interface port for IE-78240-R-A to the serial interface connector (on the left of the rear panel) for PG-2000 with the RS-232-C interface cable supplied with PG-2000.

Note: Be sure to use the cable supplied with PG-2000.

Table 5-14 Cable Connections

IE-78240-R-A	Cable	PG-2000
CH2	RS-232-C interface cable	Serial interface connector

(5) Turn on power.

Turn on power by following these steps. Normally, turn power on or off in the same manner.

▷ **Step**

■ To turn on

① Turn on the PG-2000 power switch.
② Press the REM key and START key on the PG-2000 front panel in this order.
③ Turn on the IE-78240-R-A power switch.

■ To turn off

① Turn off the PG-2000 power switch.
② Turn off the IE-78240-R-A power switch.

Phase-out/Discontinued

CHAPTER 6 CONNECTING TARGET SYSTEM

This chapter describes how to connect an emulation probe for the IE-78240-R-A to a target system using a target device (μPD78244 series, μPD78214 series or μPD78218A series microcomputer).

The countermeasures against latchup are also described. Before connecting the target system to the in-circuit emulator, be sure to read through this chapter.

6.1 Connection

■ Before connecting the target system and IE-78240-R-A,

◉ When using the user clock
➡ Refer to 3.2 Setting User Clock.

◉ When the emulation probe has not been connected yet
➡ Refer to CHAPTER 4 CONNECTING EMULATION PROBE.

■ Connect IE-78240-R-A to the target system by following these steps:

▷ Connect the emulation probe to the target system.
▷ Connect the external sense clip to the target system.

(1) Connecting Target System and Emulation Probe

The following types of emulation probes are available to enable your selection of the probe best suited to the shape of μPD78244 seires, μPD78214 series or μPD78218A series microcomputer used on the target system.

EP-78240GJ-R (for 74-pin QFP package)
EP-78240GC-R (for 64-pin QFP package)
EP-78240LP-R (for 68-pin QFJ package)
EP-78240CW-R (for 64-pin shrink package)
EP-78240GQ-R (for 64-pin QUIP package)

Connect the target system and emulation probe by following the steps described on the next page. For more details on connections, refer to User's Manual for the emulation probe.

▷ **Step**

① Connect the emulation probe ground clip to GND (signal ground) at the CPU socket on the target system. Unless the ground clip is connected, IE-78240-R-A may be damaged by static electricity.

② Insert the emulation probe tip into the CPU socket on the target system. At this time, match the number 1 pin mark on the emulation probe with the number 1 pin mark on the CPU socket. Exercise care that the emulation probe pins are not bent or damaged.

A connection diagram between the target system and emulation probe is shown on the next page.

Phase-out/Discontinued

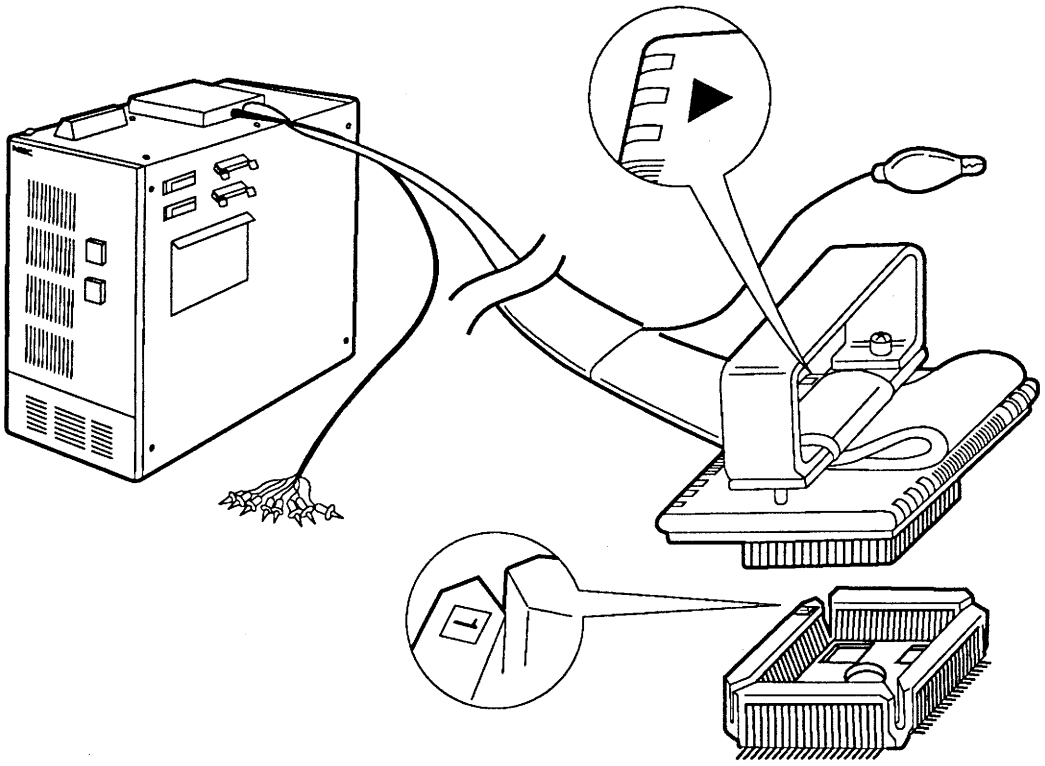


Fig. 6-1 Connecting Target System with EP-78240GC-R

Remarks: EP-78240-GJ-R is basically the same shape as EP-78240GC-R except for the size of probe tip to be connected.

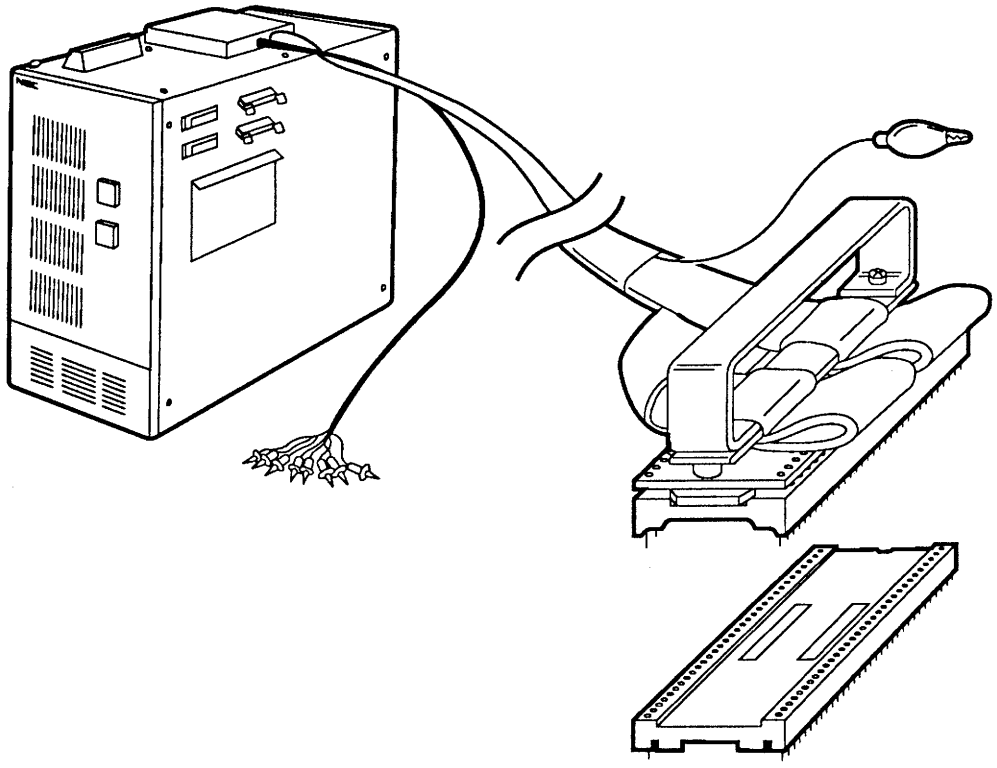


Fig. 6-2 Connecting Target System with EP-78240CW-R

Phase-out/Discontinued

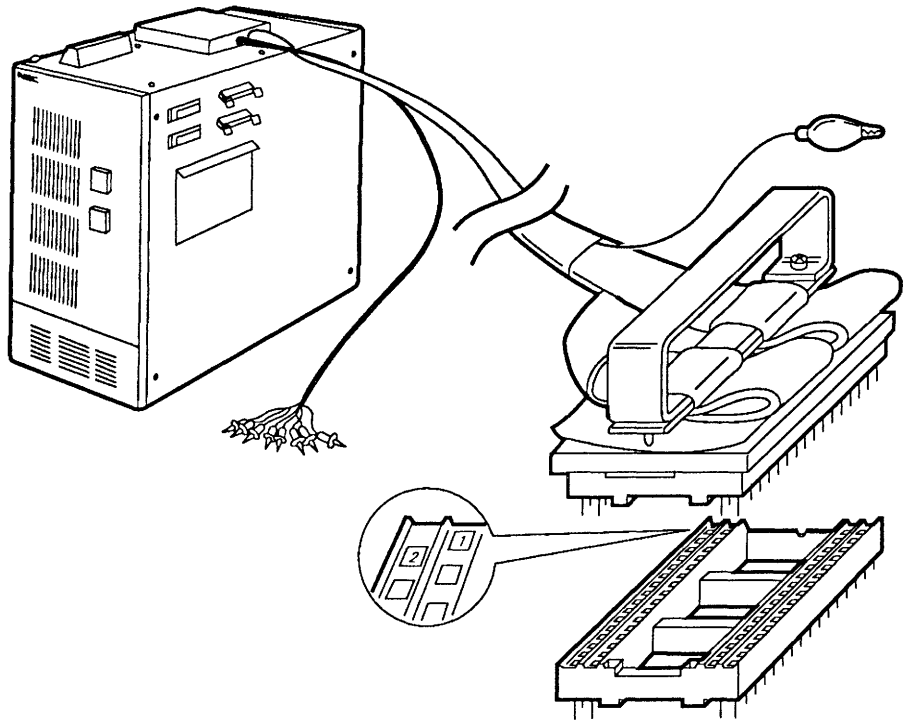


Fig. 6-3 Connecting Target System with EP-78240GQ-R

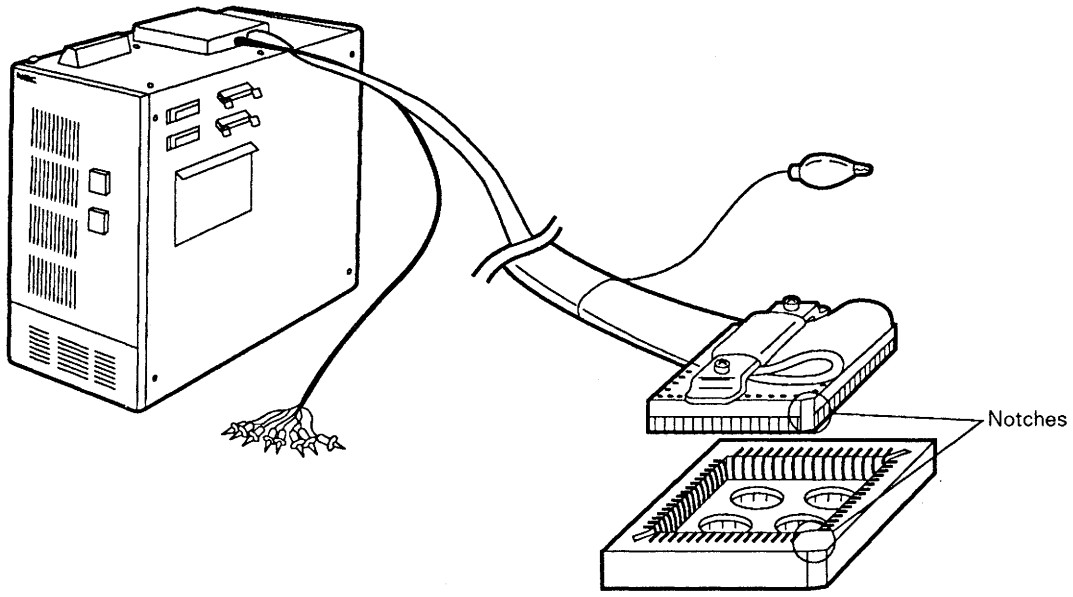


Fig. 6-4 Connecting Target System with EP-78240LP-R

(2) Connecting Target System and External Sense Clip

IE-78240-R-A can trace the bus cycle for the target device (μPD78244, μPD78214 or μPD78218A series) in real-time. In addition, the in-circuit emulator has eight external sense clips that can trace eight signal lines in real-time.

Caution 1: Connect the external sense clip to the signal line for the TTL level only. When the clip is connected to other signal lines, the levels for the signal lines cannot be correctly distinguished between high and low levels. In addition, the IE-78240-R-A sensor may be damaged, depending on the voltage applied.

2: Use the IC clip to connect the external sense clip.

▷ Step

① Turn off power to IE-78240-R-A.
② Turn off power to the target system.
③ Mount the IC clip to the IC on the target system to be traced.
④ Connect the external sense clip to the IC clip.

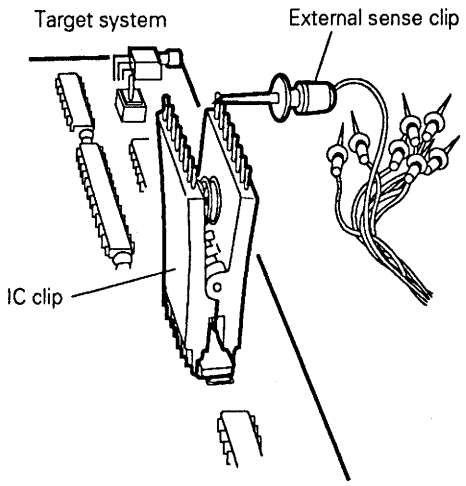


Fig. 6-5 Connecting External Sense Clip

6.2 Turning Power On/Off

After connecting the target system, turn power on or off by following the steps described below. For details on how to start and end IE-78240-R-A, refer to the User's Manual - Beginner's Guide for the optional screen debugger.

Caution: If the sequence for turning power on/off is not observed, IE-78240-R-A may malfunction, or may even be damaged.

▷ Step

■ To turn on

(1) Using PC-9801 series as host machine

① Turn on power to the host machine.
② Turn on power to IE-78240-R-A.
③ Check that MS-DOS prompt is displayed, then input "SD78K2↵". Successful start up is indicated by the following message:

```
IE connection confirmed
```

④ The system then asks the target device series name.
Input the target device series name. For example, if the target device is μPD78214 series or μPD78218A series, input "78210". If it is the μPD78244 series, "78240". ★

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

⑤ The system then asks whether or not to use the target system.
If the target system will be used, input "y". If the target system will not be used, input "n".

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

⑥ If "y" is input in ⑤, check that the target system is turned on. Input "y"after turning on. If"y"is input in ⑤ by mistake, input "n" to return to ⑤.

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

Caution: Turning on the target system power before step ⑤ 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 power to the host machine.
② Turn on power to IE-78240-R-A.
③ Check that PC DOS prompt is displayed, then input "SD78K2↵". Successful start up is indicated by the following message:

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

④ The system then asks the target device series name.
Input the target device series name. For example, if the target device is μPD78214 series, input "78210". If it is the μPD78244 series or the μPD78218A series, "78240"

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

⑤ The system then asks whether or not to use the target system.
If the target system will be used, input "Y". If the target system will not be used, input "N".

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

⑥ If "Y" is input in ⑤, check that the target system is turned on. Input "Y" after turning on. If "Y" is input in ⑤ by mistake, input"N"to return to ⑤.

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

Note: Turning on the target system power before step ⑤ may damage the target system. Be sure that the power is turned off when connecting the target system.

■ To turn off

① Turn off power to the target system first.
② Then turn off power to IE-78240-R-A.

6.3 Countermeasures against Latchup

When a latchup occurs in the emulation device, or CMOS around the emulation device for IE-78240-R-A, turn off the power and take the following measures:

▷ The detection circuit on the IE-78240-R-A detects the latchup and automatically turns off power.

- Emulation device
- CMOS around emulation device
- Other CMOS

▷ The internal latchup warning circuit for IE-78240-R-A is activated and the following message is displayed on the terminal (display):

(1) PC-9801

```
Emulation CPU latchup!
```

(2) IBM-PC/AT

```
Latch up occurs.
```

▶ Turn off power to the target system.

▶ Turn off power to IE-78240-R-A.

Phase-out/Discontinued

CHAPTER 7 TARGET INTERFACE CIRCUIT

The target interface circuit allows IE-78240-R-A to perform the same operation as the target device and consists of an emulation device and various gates (such as CMOS and TTL ICs).

When debugging the target system by connecting it to IE-78240-R-A, the target interface circuit of IE-78240-R-A emulates the operation of the target device as if the actual target device were operating on the target system.

The target device (μPD78244 series, μPD78214 series or μPD78218A series) is a configured CMOS LSI, and the emulation device of the target interface circuit is also a configured CMOS LSI. The DC and AC characteristics for these LSIs are almost the same.

However, that portion of the target interface circuit that inputs/outputs the signals of the emulation device through gates are different from the target device in regard to DC and AC characteristics.

Especially, the AC characteristics involve gate delay times which are generated each time signals go through the gates (these delay times vary, depending on which gate the signals go through).

Therefore, design the target system taking the above into consideration.

Furthermore the target devices μPD78244 series and μPD78214 series are pin compatible making the target interface circuit idential. Next the target interface circuit is indicated.

7.1 Circuit Inputting/Outputting Signals Directly or through Resistor from/to Emulation Device

This circuit interfaces the following signals:

- Signals related to port 0
- Signals related to port 2
- Signals related to port 3
- Signals related to port 4
- Signals related to port 5
- Signals related to port 6
- Signals related to port 7
- Signals related to A/D converter

Probe side
(target system)

IE-78240-R-A side
(emulation device)

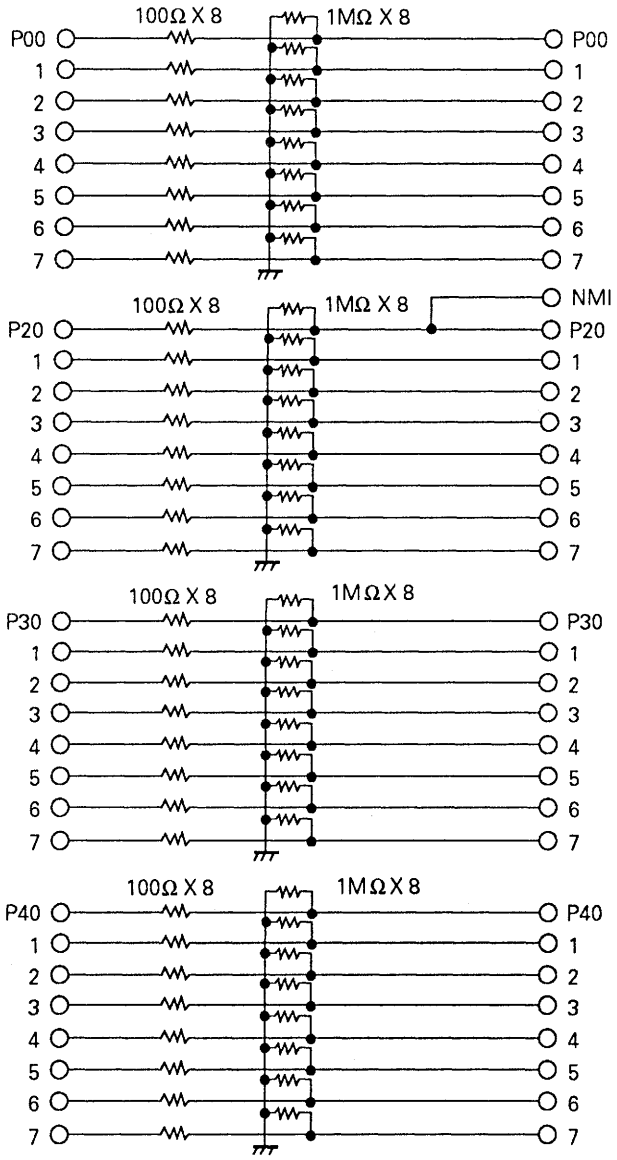
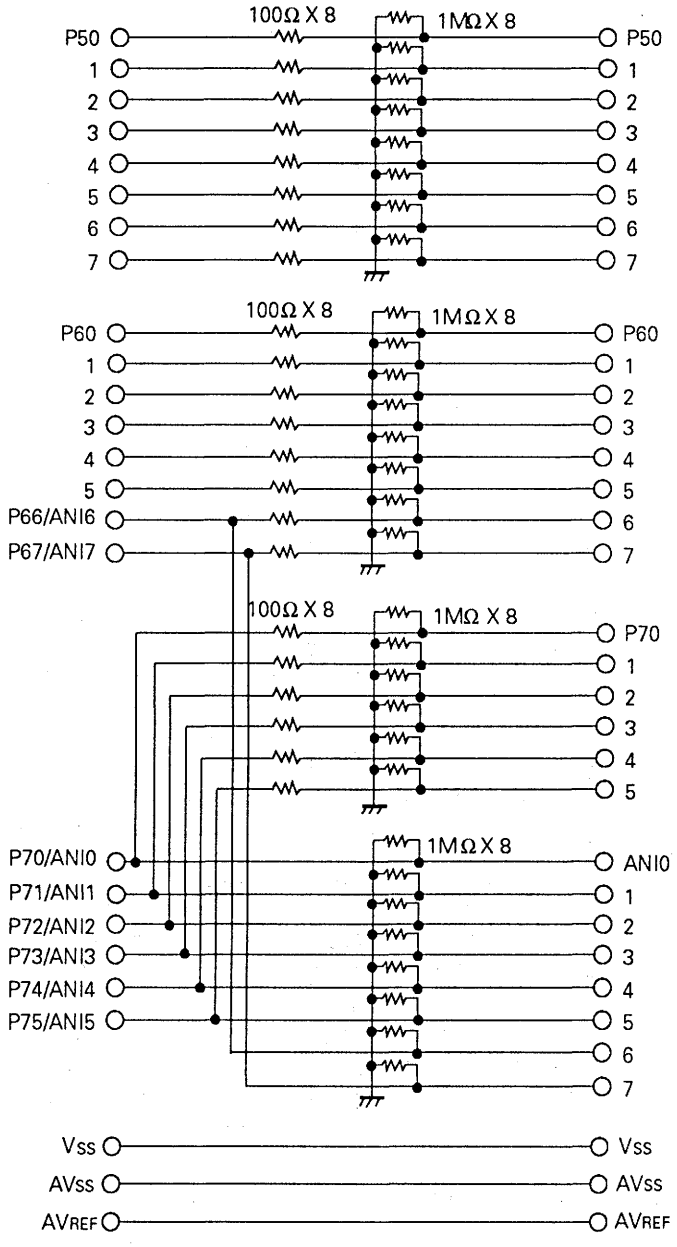


Fig. 7-1 Equivalent Circuits of Port Pin Emulation Circuit (1/2)

Probe side
(target system)

IE-78240-R-A side
(emulation device)



★ **Fig. 7-1 Equivalent Circuits of Port Pin Emulation Circuit (2/2)**

Remarks: The pull-up resistor function of the port of the target device and that of the target interface circuit differ. The pull-up resistor is not connected in IE-78240-R-A, regardless of the set value of the PUO register. However, reading/writing the PUO register can be traced.

7.2 Circuit Inputting/Outputting Signals through Gates to/from Emulation Device

This circuit interfaces the following signals:

- $\overline{\text{RESET}}$ signal
- Clock signal (user clock/X1)
- ASTB signal

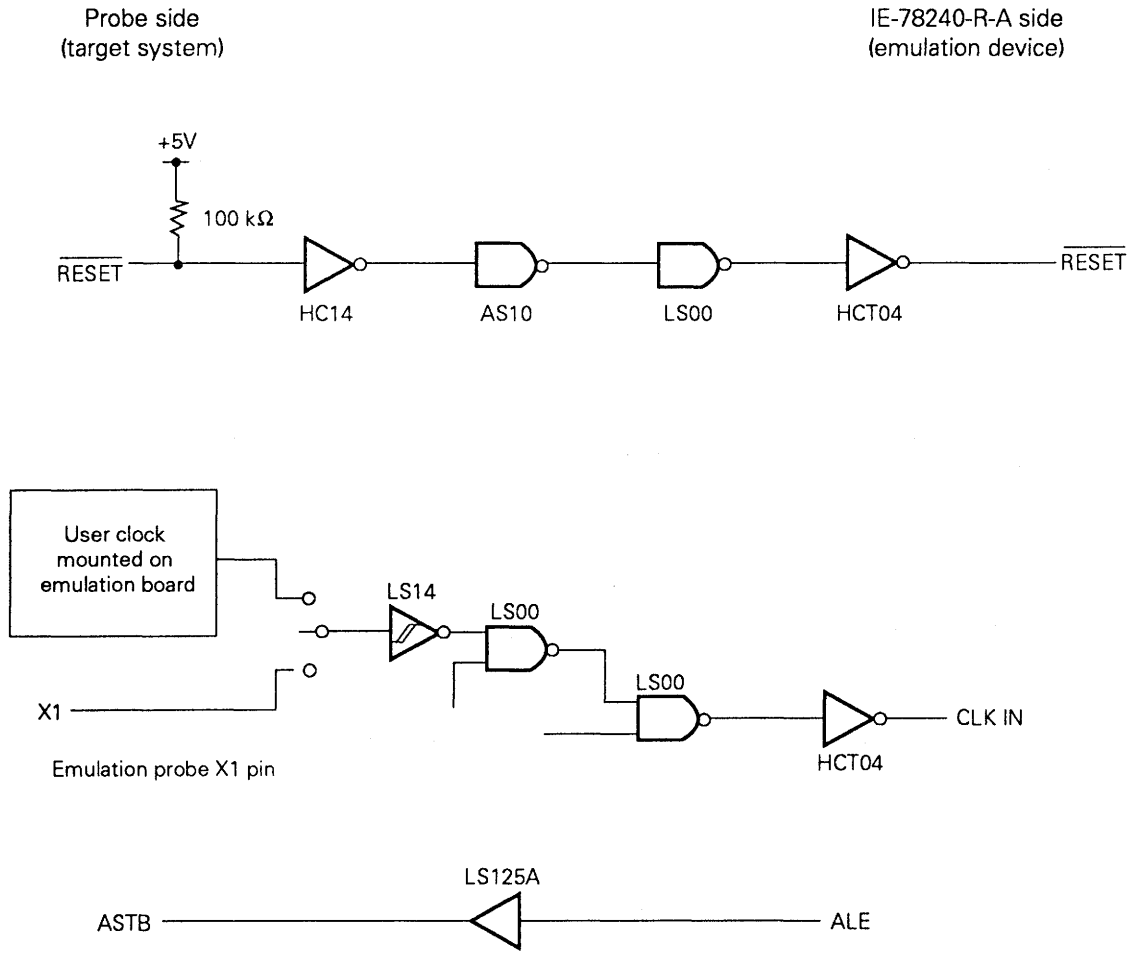


Fig. 7-2 Equivalent Circuit for Emulation Circuit 1

7.3 Circuit Inputting Signals to Control/Trace Module

This circuit interfaces the following signals:

- $\overline{VCC}$ signal (level check signal)*
- EA signal

*: The $\overline{VCC}$ signal detects the power supply status (voltage of V_{DD}) of the target system and does not supply power to the emulation device. Power is supplied to the emulation device from the power supply in IE-78240-R-A.

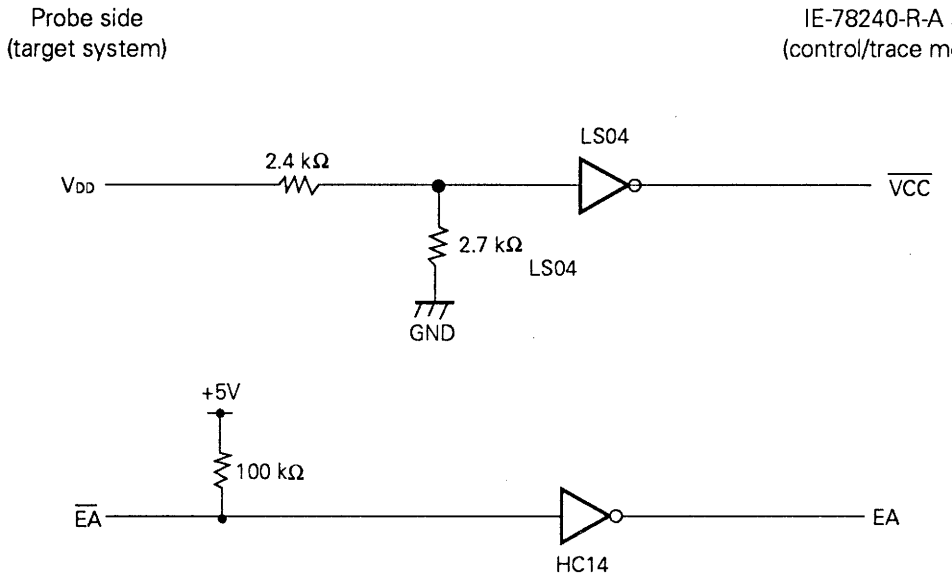


Fig. 7-3 Equivalent Circuit for Emulation Circuit 2

CHAPTER 8 CHANNELS 1 AND 2 FUNCTIONS

This chapter describes in detail the IE-78240-R-A channels 1 and 2 functions.

Channel 1 is a serial interface for the host machine, and channel 2 is for a PROM programmer.

If the serial interface port (CH1) and the host machine, and serial interface port (CH2) and a PROM programmer (if necessary) are correctly connected, as described in CHAPTER 5 CONNECTING PERIPHERAL DEVICES, IE-78240-R-A operates correctly. Therefore, your reading this chapter is not absolutely necessary.

8.1 Channel 1 Function

Channel 1 is a serial interface employing an RS-232-C interface and is used to connect the host machine. Switches for CHANNEL1 are provided in the RS-232-C compartment on the IE-78240-R-A side panel. Serial interface port CH1 is provided above the RS-232-C compartment.

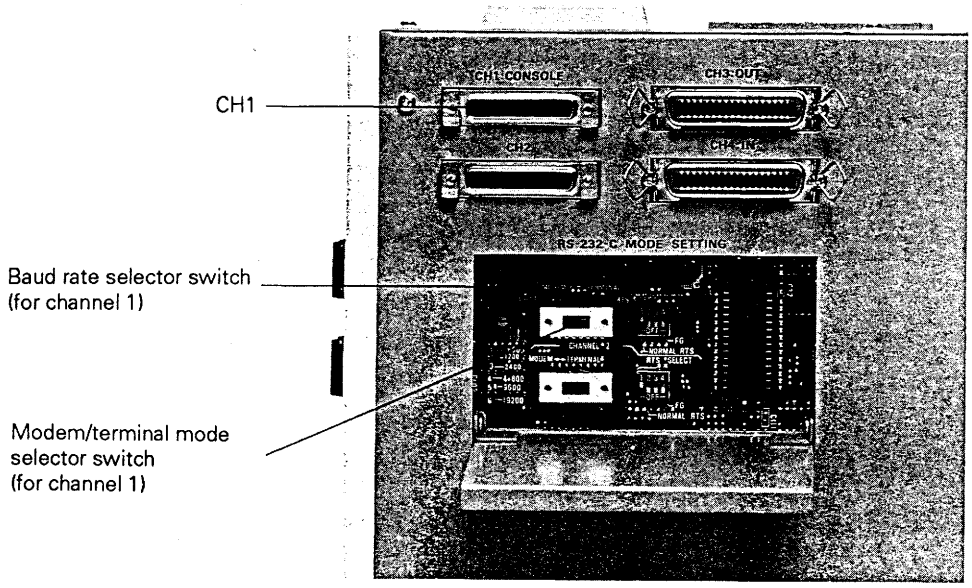


Photo 8-1 Channel 1

Channel 1 controls the RS-232-C interface by using functions (1) through (5) described below, transfers/receives control data between IE-78240-R-A and the terminal or the host machine, and loads object files.

Items (1) through (3) below are set by the switches of CHANNEL1. Items (4) and (5) have fixed set values, which cannot be changed.

(1) Mode selection

Item	Set Contents	Setting
Mode selection	Modem mode and terminal mode	Modem/terminal mode selector switch

(2) Setting RTS and FG

Item	Set Contents	Setting
RTS, FG	Pin 1: ON, Pin 2 to 4: OFF	RTS/FG selector switch

(3) Selecting baud rate

Item	Set Contents	Setting
Baud rate	9,600 bps	Baud rate selector switch

(4) Handshaking

Item	Set Contents	Setting
Handshaking	Hardware/software handshaking	Fixed

(5) Character specifications

Item	Set Contents	Setting
Character length	8 bits (However, the most significant bit is always 0, when output, and is ignored when input)	Fixed
Parity bit	None	
Stop bit length	2 bits	

(1) Mode selection

To switch between the terminal mode and modem mode, the modem/terminal mode selector switch is used. When this switch is moved to the right, the terminal mode is set. Move the switch to the left to set the modem mode. When connecting to the host machine, the modem mode is set.

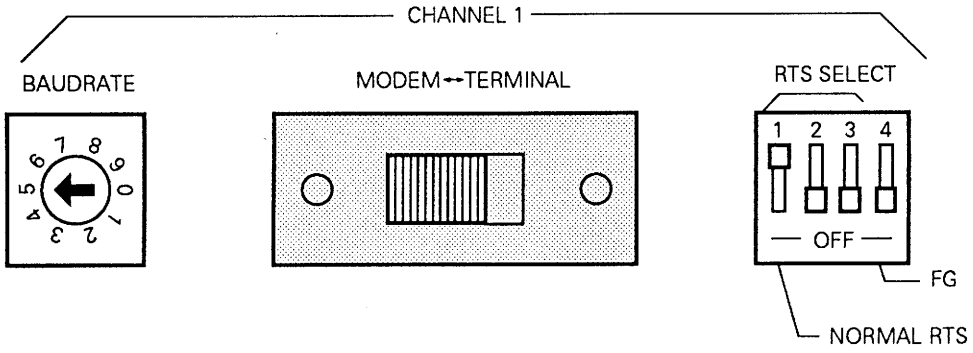
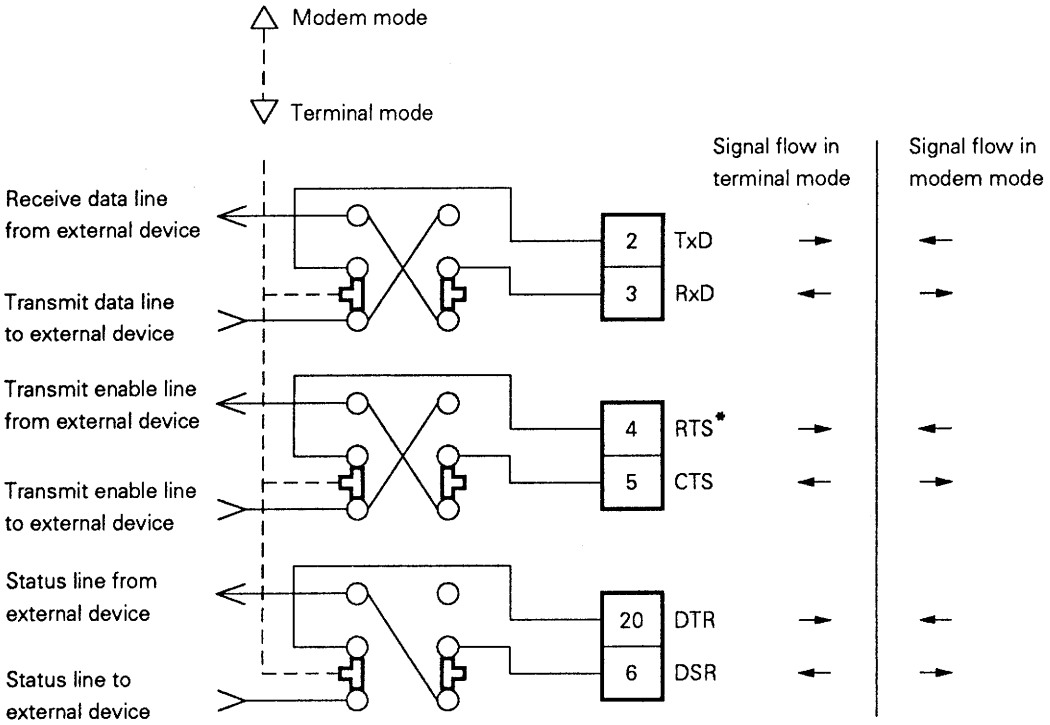


Fig. 8-1 Modem/Terminal Mode Selector Switch (for Channel 1)



*: Refer to (2) Setting RTS and FG.

Fig. 8-2 Circuit of Modem/Terminal Mode Selector Switch (for Channel 1)

(2) Setting RTS and FG

RTS and FG are set by the RTS/FG selector DIP switch. When each pin for this DIP switch is set to the top position, it is turned on. To turn off a switch pin, set it to the bottom position (see Table 8-1 and Figs. 8-3 and 8-4).

- Setting RTS

  RTS is set by switch pins 1 through 3 of the RTS/FG selector switch. Determine to which pin (pin 4, 11, or 21) on the RS-232-C interface cable the RTS is to be connected. RTS is assigned as pin 4 for an RS-232-C interface. Usually, RTS N (pin 1: ON, pin 2: OFF, pin 3: OFF) is selected.

- Setting FG

  Pin 4 for the RTS/FG selector switch is used to specify whether the FG (frame ground) and SG (signal ground) are commonly used or opened. Usually, open FG and SG.

Table 8-1 Setting RTS/FG (Channel 1)

RTS Names	Setting of RTS/FG				Connected Devices
	1	2	3	4	
RTS N	ON	OFF	OFF	OFF	Host machine
RTS P	OFF	ON	OFF	OFF	Inhibited
RTS D	OFF	OFF	ON	OFF	

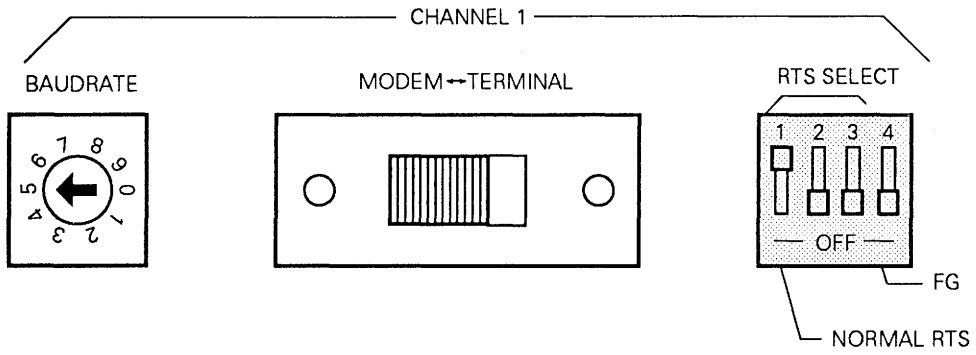


Fig. 8-3 RTS/FG Selector Switch (for Channel 1)

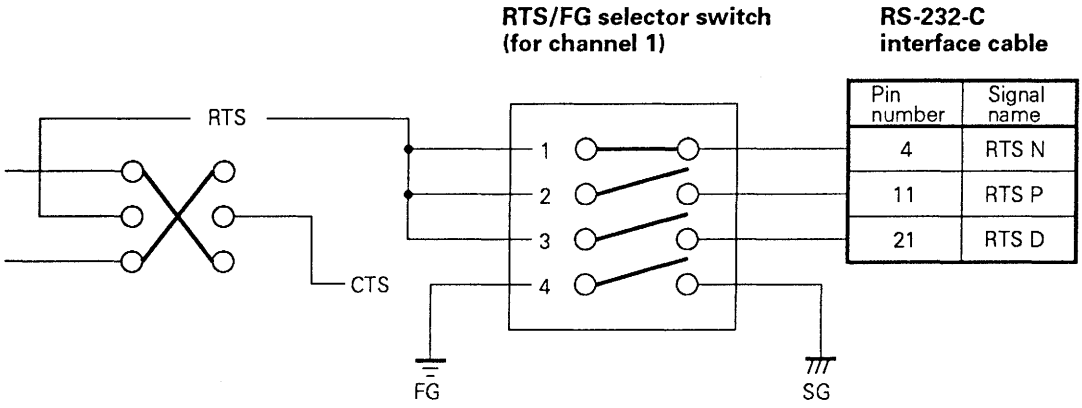


Fig. 8-4 Circuit for RTS/FG Selector Switch (for Channel 1)

(3) Selecting baud rate

It is necessary that the IE-78240-R-A baud rate be matched with that for the host machine to be connected to the in-circuit emulator. The baud rate is selected by the baud rate selector DIP switch (for Channel 1).

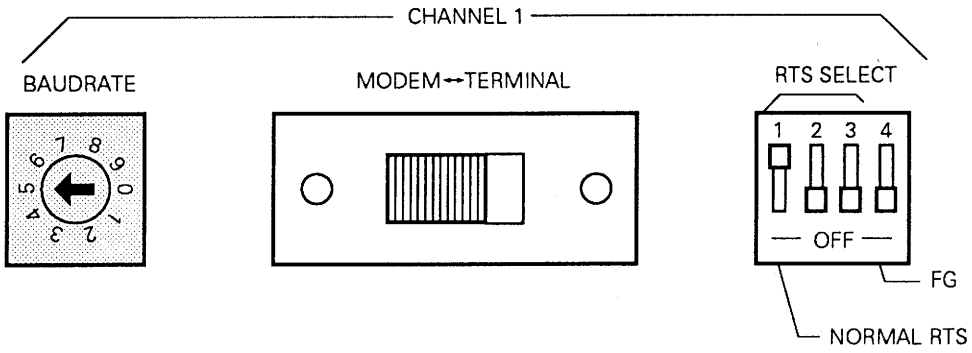


Fig. 8-5 Baud Rate Selector Switch (for Channel 1)

Table 8-2 Baud Rate Setting

Switch	Baud Rate (bps)	Switch	Baud Rate (bps)
0	300	5	9,600
1	600	6	19,200
2	1,200	7*	0
3	2,400	8	300
4	4,800	9	600

*: When the switch is set to this position, data is not transferred because no pulse is generated. Do not set the switch to this position.

(4) Handshaking

Hardware handshaking is established by connecting handshake signals RTS, CTS, DSR, and DTR. If these signals are not connected, software handshaking is implemented. Usually, hardware handshaking andsoftware handshaking are simultaneously executed for Channel 1 to transfer data.

Hardware handshaking transfers 1-byte data at a time, using the handshake signals (this is called 1-character handshaking). Software handshaking transfers blocks of data, which is called flow control, though it cannot establish handshaking on a byte-by-byte basis.

IE-78240-R-A automatically executes hardware adjustment so that no data is overlapped during handshaking. When the buffer becomes full, the CTS signal is controlled and data transfer is completely stopped. Therefore, all data can be transferred or received correctly, if the handshake lines are connected. However, if the handshake lines are not connected, only software handshaking is implemented and some data may not be transferred correctly.

Next, hardware handshaking and software handshaking are described, using an operation in the modem mode as an example.

◆ Hardware handshaking (in modem mode)
IE-78240-R-A uses μPD71051 for RS-232-C interface and inverts the RxRDY pin level for this IC and outputs to the CTS line. The RxRDY pin becomes 1, when the receive buffer has received data from the RS-232-C, and becomes 0, when the CPU in IE-78240-R-A has received data from this buffer (1-character handshaking). In this manner, the CTS line is controlled so that the terminal will not send the next data before the receive buffer becomes empty.

- Data transfer
  It is considered that the terminal is ready for reception when the RTS and DTR lines are both active and data is sent to the RxD line.

- Data reception
  The DSR line is usually made active. If the terminal is not ready for data reception, the CTS signal is left inactive. When the terminal is ready, the CTS signal is made active, and then data is received from the TxD line.

Phase-out/Discontinued

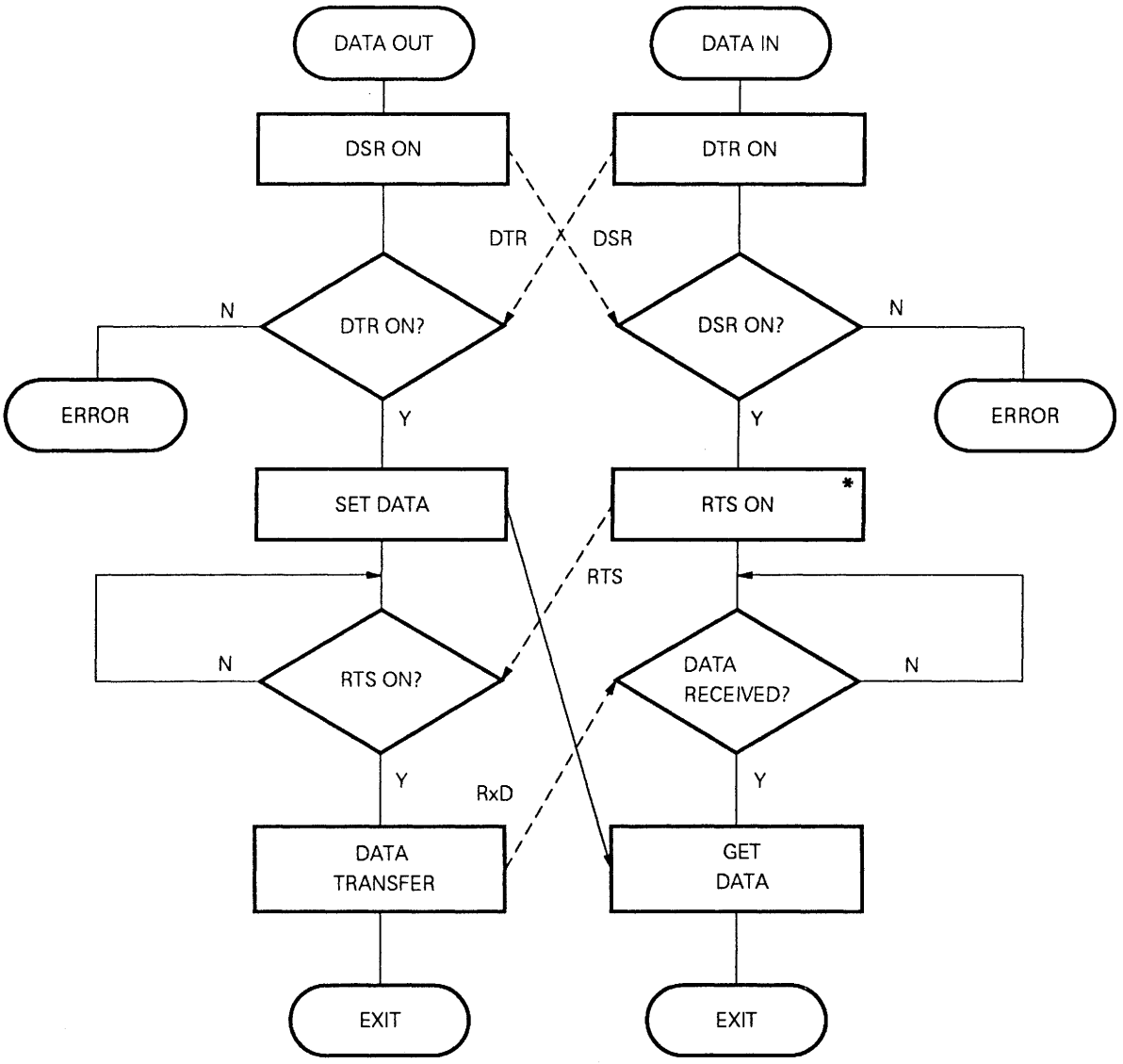


Fig. 8-6 Transfer from Modem to Terminal (Hardware Handshake)

Remarks: ◄---------- Handshake line, ◄———— Data flow
*: RTS turns ON in pulse-wise.

① DSR turns ON, when power is applied.
② An error occurs, if DTR pin is OFF. The next step is executed, if DTR is ON.
③ Transfer data is set.
④ Data is not transferred until RTS turns ON. Transfer is started as soon as RTS turns ON.
⑤ Data is transferred.

① DTR turns ON, when power is applied.
② An error occurs, if DSR pin is OFF. The next step is executed, if DST is ON.
③ RTS is turned ON and data transfer to an external device is enabled.
④ Polling is performed to check whethr data reception has ended.
⑤ Data is received.

8

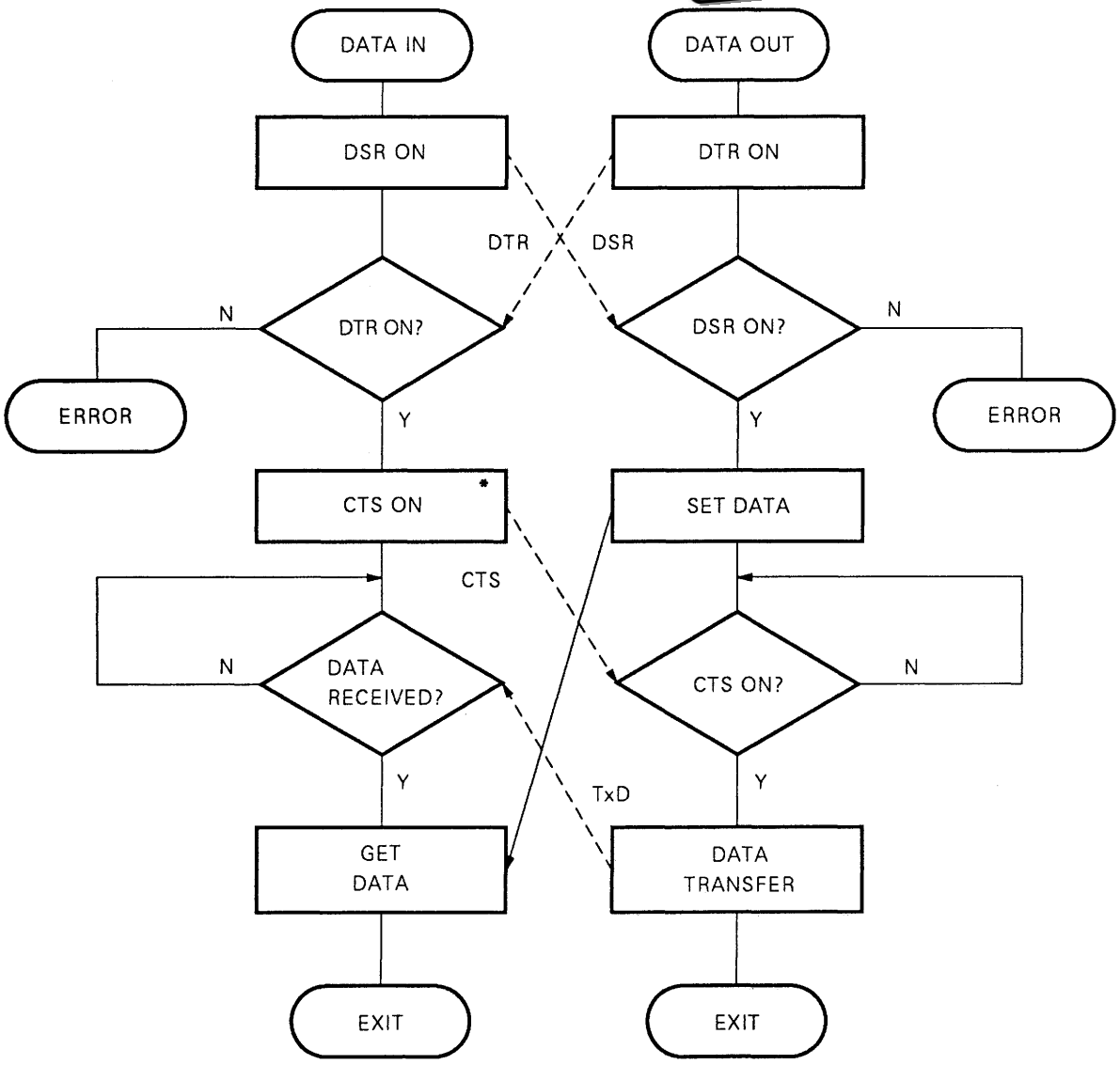


Fig. 8-7 Transfer from Terminal to Modem (Hardware Handshake)

Remarks: ◄---------- Handshake line, ◄———— Data flow
*: CTS turns ON in pulse-wise.

① DSR turns ON, when power is applied.
② An error occurs, if DTR pin is OFF. The next step is executed, if DTR is ON.
③ CTS is turned ON and data transfer to an external device is enabled.
④ Polling is performed to check whether data reception has ended.
⑤ Data is received.

① DTR turns ON, when power is applied.
② An error occurs, if DSR pin is OFF. The next step is executed, if DST is ON.
③ Data to be trasferred is set.
④ Data is not trasferred until CTS turns ON. As soon as CTS turns ON, transfer is started.
⑤ Data is transferred.

■ Software handshaking (in modem mode)

Software handshaking cannot perform handshaking of one byte, but performs handshaking on a block basis (flow control).

- Data transfer

  It is basically considered that the terminal is always ready to receive data and that data is transferred to the RxD line. However, if Ctrl-S is transferred from the terminal through the TxD line, data transfer is aborted. Channel 1 for IE-78240-R-A transfers four to five characters of data after receiving Ctrl-S and before aborting transfer.

  If Ctrl-Q is transferred from the terminal through the TxD line while transfer is aborted, data transfer is resumed.

- Data reception

  Data reception can be performed basically at any time by interrupt processing. The received data is stored in a 128-byte buffer. When the buffer is filled with data to 50% of its capacity, Ctrl-S is sent to the RxD line, requesting the terminal to stop data reception.

  If new data is sent after the request has been made, that data is received and stored in the buffer.

  The data in the buffer is then received by the CPU for IE-78240-R-A. When the data in the buffer decreases to 35% of the buffer capacity, Ctrl-Q is sent to the RxD line, requesting the terminal to resume data transfer.

  Therefore, if a terminal that transfers 64 bytes or more of data, after Ctrl-S has been received, is connected to channel 1, all the data may not be correctly received.

(5) Character specifications

The character specifications for data transfer/reception are as follows:

■ Character length

The character length is fixed to 8 bits. When IE-78240-R-A outputs a character, the most significant bit (MSB) for the character is always 0. When IE-78240-R-A inputs a character, the most significant bit (MSB) for the character is ignored and is regarded as 0.

■ Parity bit

No parity bit is used.

■ Stop bit length

The stop bit length is fixed to 2 bits.

8.2 Channel 2 Function

Channel 2 is a serial interface employing an RS-232-C interface, and is used for a PROM programmer. In the RS-232-C compartment on the IE-78240-R-A side panel, switches for CHANNEL2 are provided. Serial interface port CH2 is provided above the RS-232-C compartment.

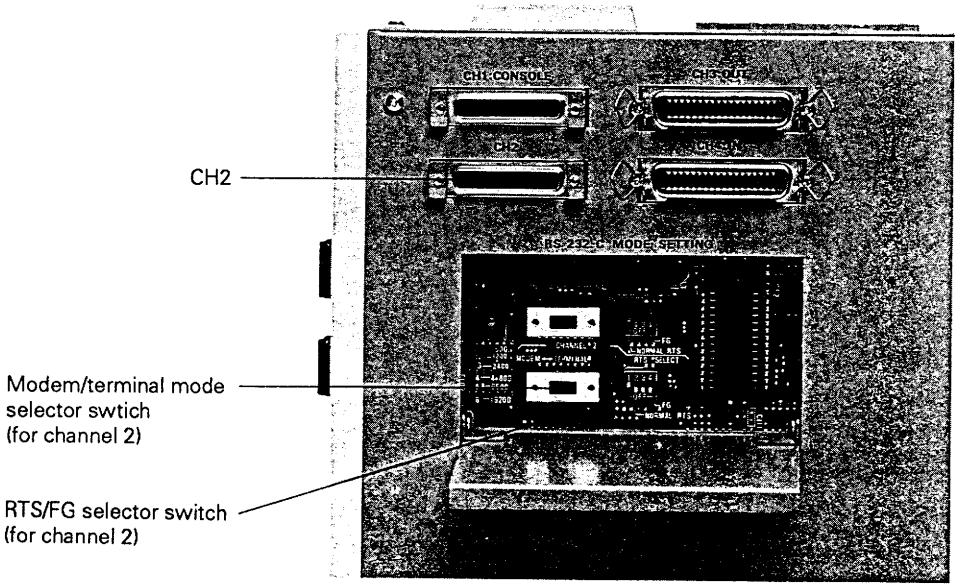


Photo 8-2 Channel 2

Channel 2 controls the RS-232-C interface by using the functions (1) through (5) described from the next page, transfers/receives control data and files between IE-78240-R-A and a PROM programmer.

The setting necessary for this channel, except (1) mode selection (terminal or modem) and (2) setting of RTS and FG, can be performed by the MOD command. The default assumptions are 9,600 baud, 1-character handshaking, 8 data bits, no parity bit, and 2 stop bits.

(1) Mode selection

Item	Set Contents	Setting
Mode selection	Modem mode and terminal mode	Modem/terminal mode selector switch

(2) Setting RTS and FG

Item	Set Contents	Setting
RTS, FG	Pin 1: ON, Pin 2 to 4: OFF	RTS/FG selector switch

(3) Selecting baud rate

Item	Set Contents	Setting
Baud rate	9,600 bps	MOD command

(4) Handshaking

Item	Set Contents	Setting
Handshaking	Hardware or software handshaking	MOD command

(5) Character specifications

Item	Set Contents	Setting
Character length	7 or 8 bits (However, the most significant bit is always 0, when output, and is ignored when input, when character length is set to 8 bits)	MOD command
Parity bit	Even/odd/none	
Stop bit length	1 or 2 bits	

Remarks: MOD command

Setting by the MOD command can be performed by inputting all the operands of the command on one line.

■ Input format

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

■ Operand

MODE: handshake mode
BAUD: baud rate
LONG : character length
PAR : parity bit
STOP : stop bit

■ System operation mode

Execution is possible if "TRACE" is not displayed as a status.

■ Setting example

Set as follows at the command stage.

```
CMD: MOD MODE=CHAR BAUD=4800 LONG=8 PAR=NON STOP=2↵   ←Setting for 1 line
CMD: ■
```

(1) Mode selection

To switch between the terminal mode and modem mode, the modem/terminal mode selector switch in the RS-232-C compartment on the IE-78240-R-A side panel is used (see Fig. 8-8). When this switch is moved to the right, the terminal mode is set. Move the switch to the left to set the modem mode.

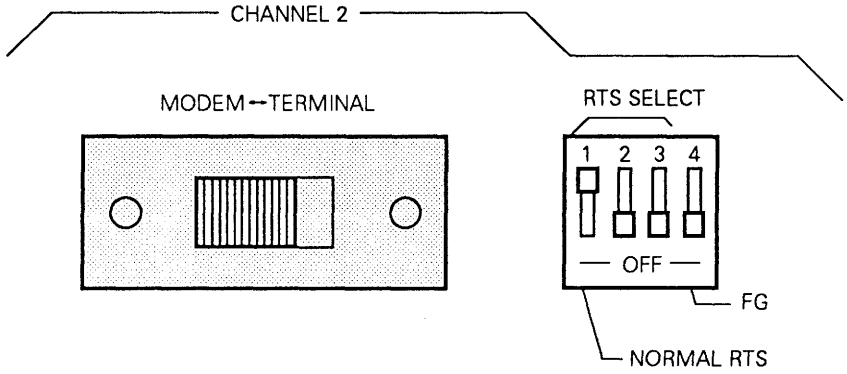
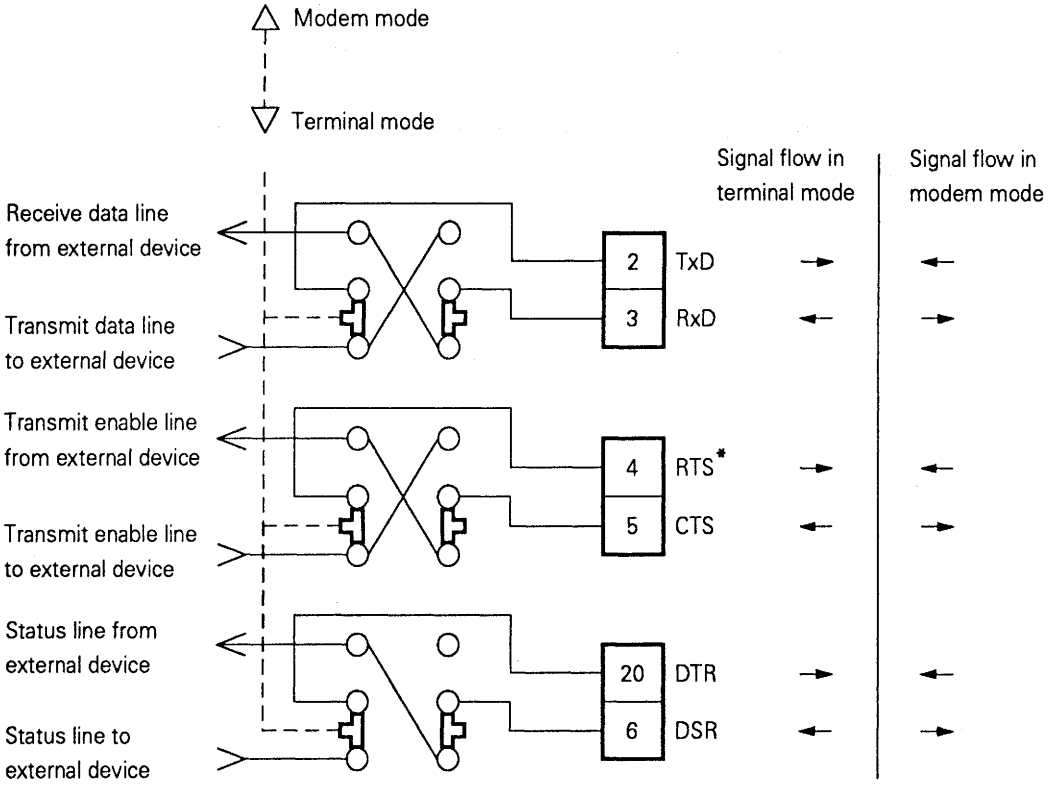


Fig. 8-8 Modem/Terminal Mode Selector Switch (for Channel 2)



*: Refer to (2) Setting RTS and FG.

Fig. 8-9 Circuit for Modem/Terminal Mode Selector Switch (for Channel 2)

How to set a mode is explained, assuming that a PROM programmer (PG-1500/2000) is connected to IE-78240-R-A.

■ PG-1500

PG-1500 is a device having an interface in modem mode. When connecting the PROM programmer, use a commercially available cable whose signal lines correspond to those for IE-78240-R-A on a one-to-one basis. Move the IE-78240-R-A modem/terminal selector switch to the right to set the terminal mode.

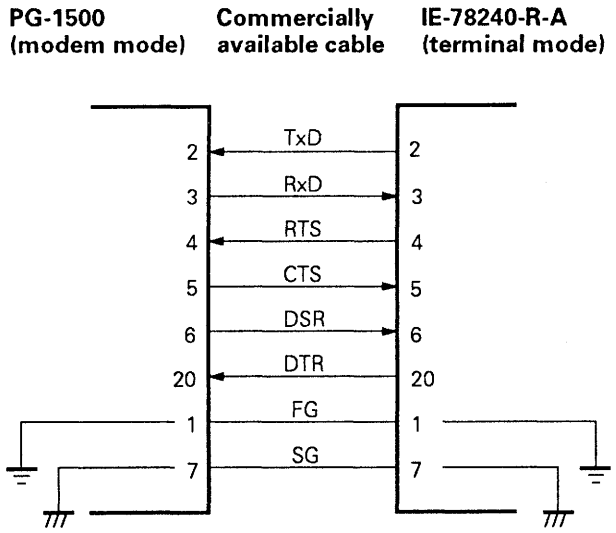


Fig. 8-10 PG-1500 Connection (with commercially available cable)

■ PG-2000

PG-2000 is a device having an interface in modem mode. When connecting the PROM programmer, use the cable supplied as an accessory. Move the IE-78240-R-A modem/terminal selector switch to the left to set the modem mode.

Caution: IE-78240-R-A and PG-2000 are connected with both set in the modem mode. However, this is possible because the internal connections for the cable supplied with PG-2000 are so designed. Therefore, when connecting IE-78240-R-A and PG-2000, always use the cable supplied with PG-2000 as an accessory. Do not use any other cable.

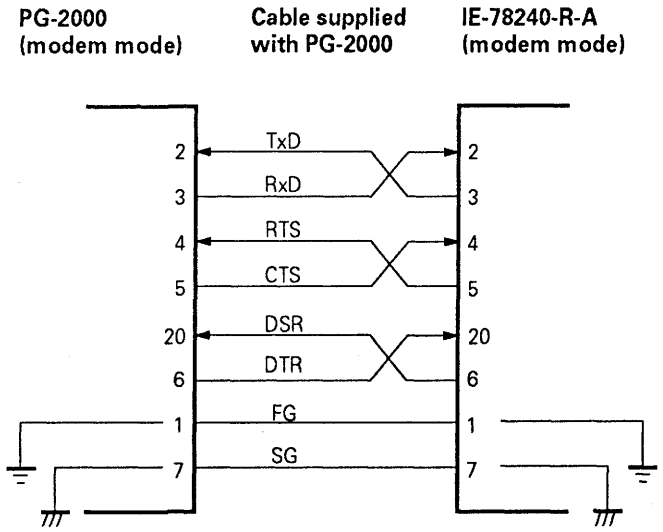


Fig. 8-11 PG-2000 Connection (with cable supplied as accessory)

(2) Setting RTS and FG

RTS and FG are set by the RTS/FG selector DIP switch. When each pin for this DIP switch is set to the top position, it is turned on. To turn off a switch pin, set it to the bottom position (see Table 8-3 and Figs. 8-12 and 8-13).

- Setting RTS

  RTS is set by switch pins 1 through 3 of the RTS/FG selector switch. Determine to which pin (4, 11, or 21) on the RS-232-C interface cable the RTS is to be connected.

  RTS is assigned as pin 4 for an RS-232-C interface. Usually, RTS N (pin 1: ON, pin 2: OFF, pin 3: OFF) is selected.

- Setting FG

  Pin 4 for the RTS/FG selector switch is used to specify whether the FG (frame ground) and SG (signal ground) are commonly used or opened. Normally, FG and SG are open.

Table 8-3 Setting RTS/FG (Channel 2)

RTS Names	Setting of RTS/FG				Connected Devices
	1	2	3	4	
RTS N	ON	OFF	OFF	OFF	PROM programmer
RTS P	OFF	ON	OFF	OFF	Inhibited
RTS D	OFF	OFF	ON	OFF	

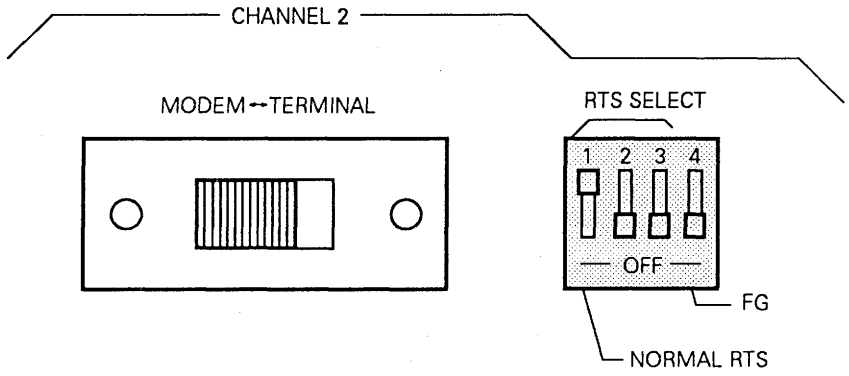


Fig. 8-12 RTS/FG Selector Switch (for Channel 2)

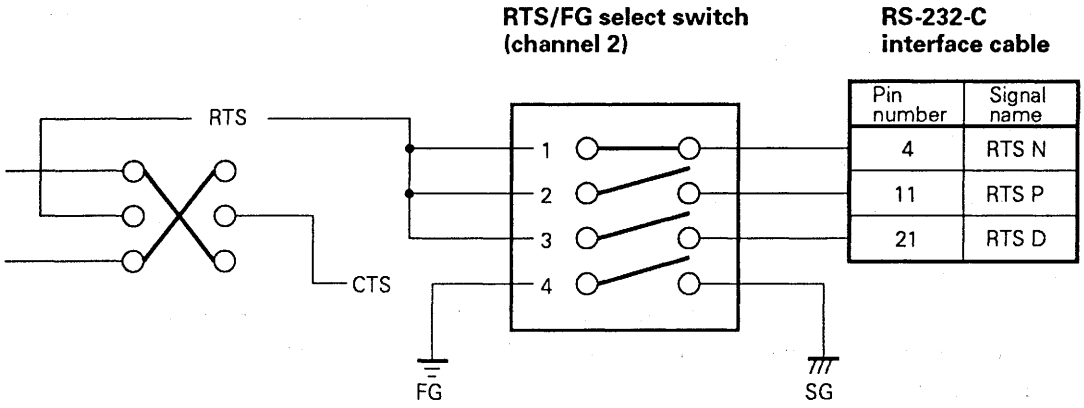


Fig. 8-13 Circuit for RTS/FG Selector Switch (for Channel 2)

(3) Selecting baud rate

It is necessary that the IE-78240-R-A baud rate be matched with that for the PROM programmer. The baud rate is selected by the MOD command. To input the command, the host machine connected to IE-78240-R-A channel 1 is used.

(4) Handshaking

Hardware handshaking is established by connecting dynamic handshake signals RTS, CTS, DSR, and DTR. If these signals are not connected, software handshaking is implemented. Usually, either hardware handshaking or software handshaking is executed for channel 2 to transfer data. Which handshaking is used is specified by the MOD command.

Hardware handshaking transfers 1-byte data at a time, using the handshake signals (this is called 1-character handshaking). Software handshaking transfers blocks of data. This is called flow control, though it cannot establish handshaking on a byte-by-byte basis.

One thing to be noted is that the handshake signals must be connected when the hardware handshaking mode (1-character handshaking: CHAR) is selected. Since no buffer is provided, handshaking is not correctly established, if hardware handshaking is selected without the handshake signals connected.
When software handshaking (flow control: FLOW) is selected, a 96-byte buffer is available in which serial data is stored, but all data may not be correctly stored in the buffer.

Next, hardware handshaking and software handshaking are described, using an operation in the modem mode as an example.

■ Hardware handshaking (in modem mode)
IE-78240-R-A uses μPD71051 for RS-232-C interface and inverts the RxRDY pin level for this IC and outputs it to the CTS line. The RxRDY pin becomes 1, when the receive buffer has received data from the RS-232-C, and becomes 0, when the CPU in IE-78240-R-A has received data from this buffer (1-character handshaking).

- Data transfer
  It is considered that the terminal is ready for reception, when the RTS and DTR lines are both active and data is sent to the RxD line.

- Data reception
  The DSR line is usually made active. If the terminal is not ready for data reception, the CTS signal is left inactive. When the terminal is ready, the CTS signal is made active. Then, data is received from the TxD line.

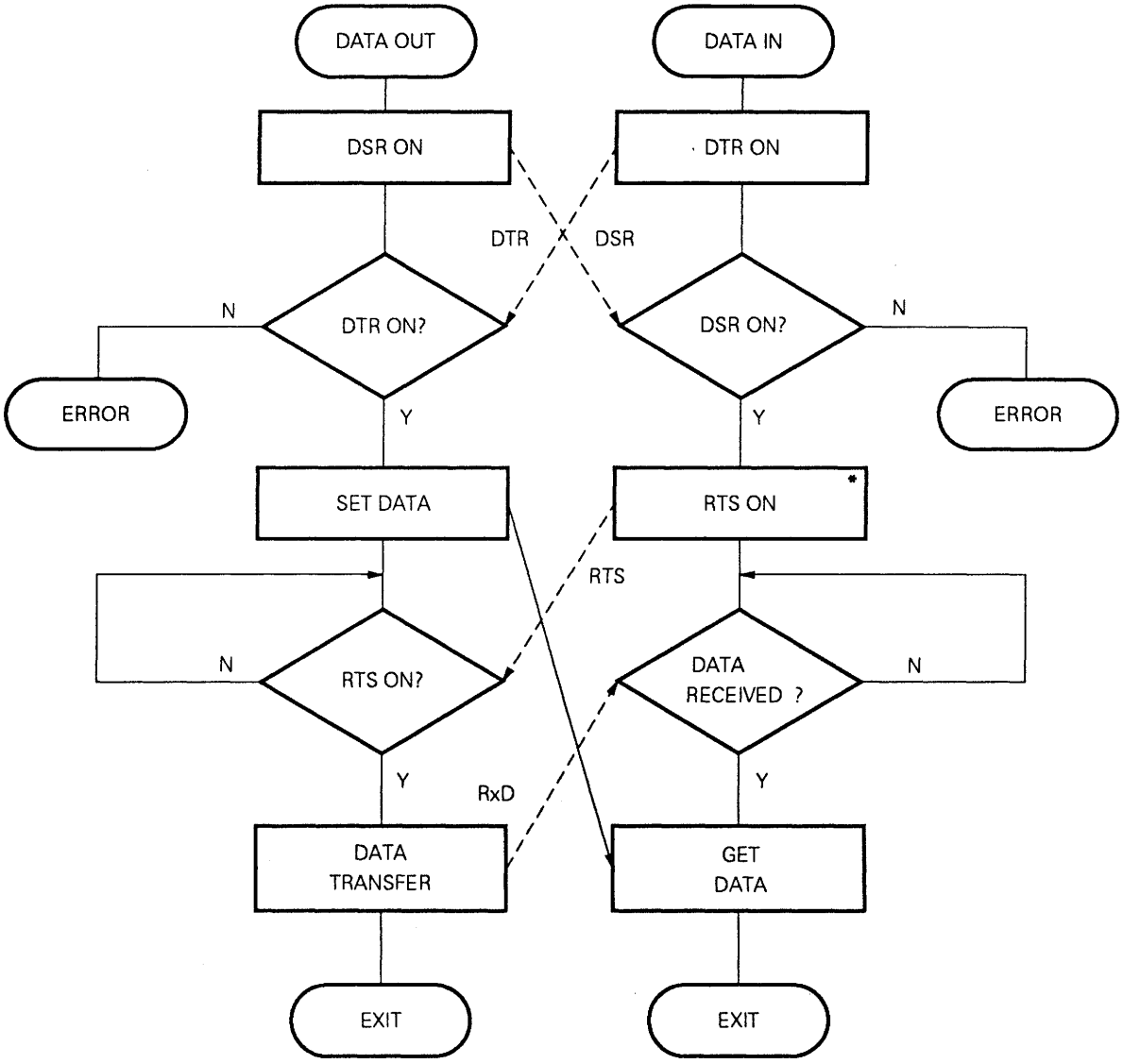


Fig. 8-14 Transfer from Modem to Terminal (Hardware Handshake)

Remarks: ◄---------- Handshake line, ◄——— Data flow

*: RTS turns ON in pulse-wise.

① DSR turns ON, when power is applied.
② An error occurs, if DTR pin is OFF. The next step is executed, if DTR is ON.
③ Transfer data is set.
④ Data is not transferred until RTS turns ON. Transfer is started as soon as RTS turns ON.
⑤ Data is transferred.

① DTR turns ON, when power is applied.
② An error occurs, if DSR pin is OFF. The next step is executed, if DSR is ON.
③ RTS is turned ON and data trasfer to an external device is enabled.
④ Polling is performed to check whether data reception has ended.
⑤ Data is received.

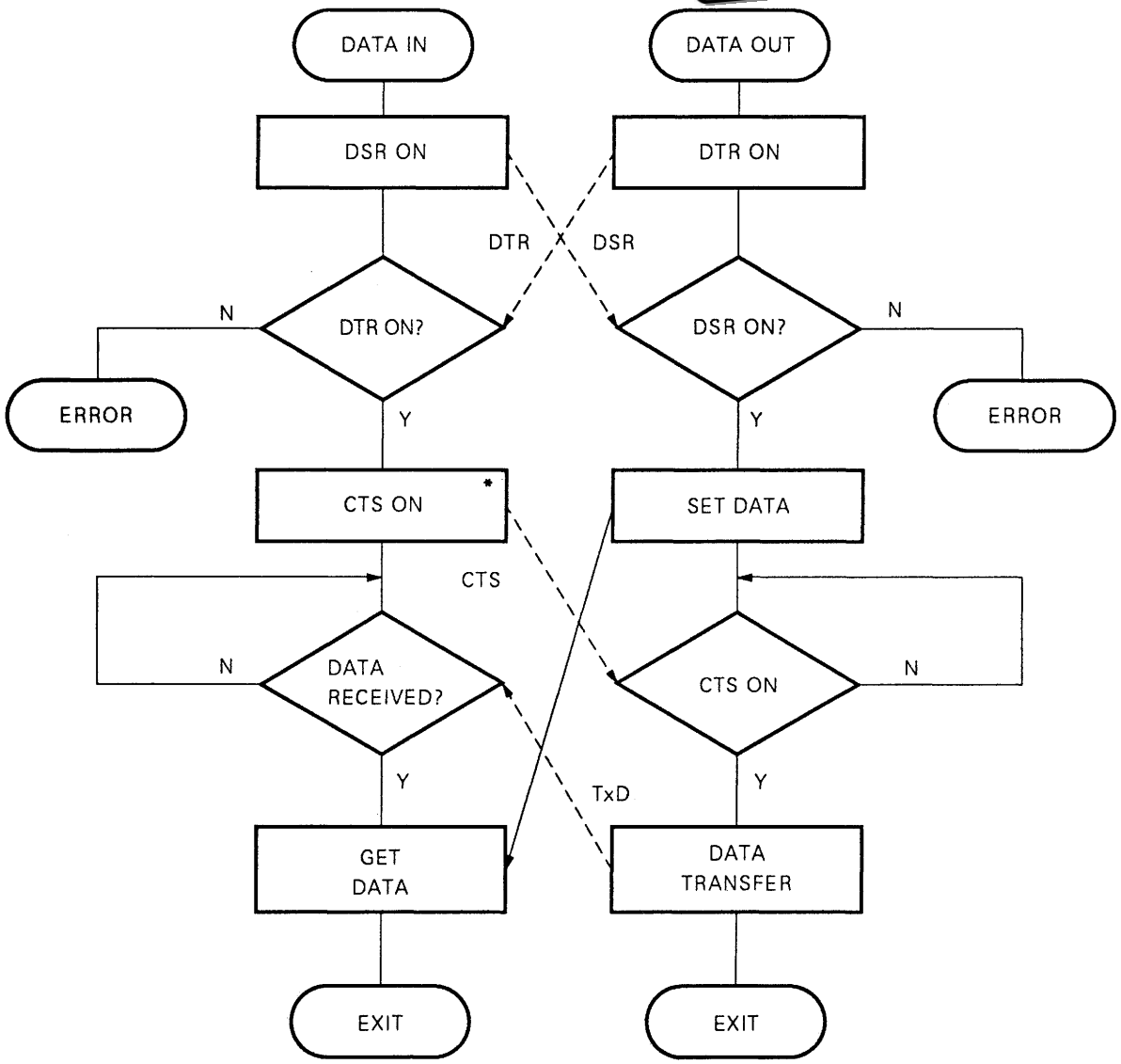


Fig. 8-15 Transfer from Terminal to Modem (Hardware Handshake)

Remarks: ◄---------- Handshake line, ◄———— Data flow
*: CTS turns ON in pulse-wise.

① DSR turns ON, when power is applied.
② An error occurs, if DTR pin is OFF. The next step is executed, if DTR is ON.
③ CTS is turned ON and data transfer to an external device is enabled.
④ Polling is performed to check whether data reception has ended.
⑤ Data is received.

① DTR turns ON, when power is applied.
② An error occurs, if DSR pin is OFF. The next step is executed, if DSR is ON.
③ Transfer data is set.
④ Data is not trasferred until CTS turns ON. As soon as CTS turns ON, trasfer is started.
⑤ Data is transferred.

- Software handshaking (in modem mode)
  Software handshaking cannot perform handshaking of one byte, but can perform handshaking on a block basis (flow control).

  - Data transfer
    It is basically considered that the terminal is always ready to receive data and that data is transferred to the RxD line. However, if Ctrl-S is transferred from the terminal through the TxD line, data transfer is aborted. Channel 2 in IE-78240-R-A transfers data of four to five characters, after receiving Ctrl-S and before aborting transfer.
    If Ctrl-Q is transferred from the terminal hrough the TxD line while transfer is aborted, data transfer is resumed.

  - Data reception
    Data reception can be performed basically at any time by interrupt processing. The receive data is stored in a 96-byte buffer. When the buffer is filled with data to 50% of its capacity, Ctrl-S is sent to the RxD line, requesting the terminal to stop data reception. If new data is sent after the request has been made, that data is received and stored in the buffer. The data in the buffer is then received by the CPU for IE-78240-R-A.
    When the data in the buffer decreases to 35% of the buffer capacity, Ctrl-Q is sent to the RxD line, requesting the terminal to resume data transfer.
    Therefore, if a terminal that transfers 48 bytes or more of data after Ctrl-S has been received is connected to Channel 2, all the data may not be correctly received.

(5) Character specifications

Character specifications for data transfer/reception are as follows:

- Character length
  The character length can be set to 7 or 8 bits by the MOD command. When it is set to 8 bits, the most significant bit (MSB) is always 0, when it is output by IE-78240-R-A, and is ignored and regarded as 0, when it is input.

- Parity bit
  Even, odd, or no parity is selected by the MOD command.

- Stop bit length
  The stop bit length can be set to 1 or 2 bits by the MOD command.

Phase-out/Discontinued

CHAPTER 9 CHANNELS 3 AND 4 FUNCTIONS

This chapter describes in detail the IE-78240-R-A channels 3 and 4 functions. Read this chapter when you wish to know the functions of these channels.

9.1 Channels 3 and 4 Functions

Channels 3 and 4 are 8-bit parallel interfaces. CH3 and CH4 parallel interface ports are located above the RS-232-C compartment on the IE-78240-R-A side panel. All input data and interface control signals are at TTL level. The interface circuit conforms to Centronics.

Channel 3 is connected to a printer and outputs through the data input from channel 4 to the printer. Channel 4 is connected to a host machine to download object files at high speed.

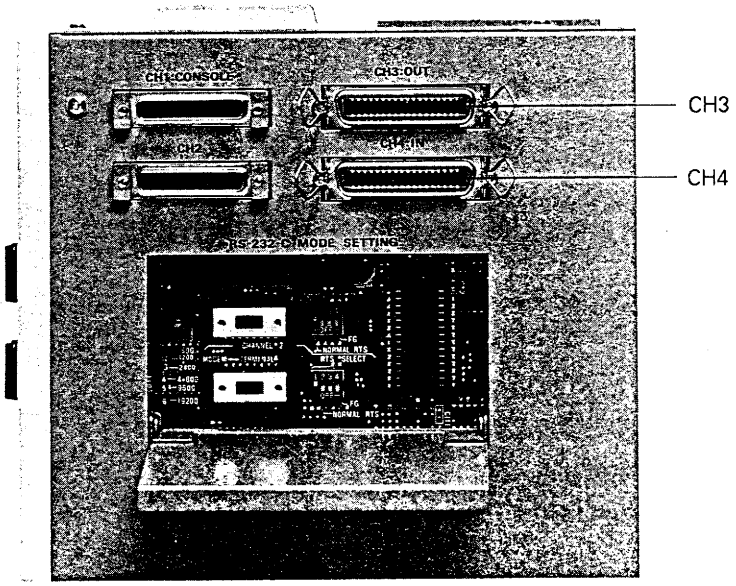


Photo 9-1 Parallel Interface Ports (CH3, CH4)

(1) High-speed downloading

IE-78240-R-A can download object files in the two modes listed in the table below. Channels 4 can perform high-speed downloading.

Loading method	Operation	Selection method
High-speed downloading	Downloads from parallel interface output for the host machine to parallel interface input (channel 4) for IE-78240-R-A	The high-speed down-load mode is selected by the initial value setting panel, by the environment setting on the configuration panel, or by issuing the PPC command during start up.
Ordinary downloading	Downloads from RS-232-C interface output for host machine to RS-232-C interface input (channel 1) for IE-78240-R-A.	The high-speed down-load mode is un-selected by the initial value setting panel, on the configuration panel, or by issuing the PPC command during start up.

When the high speed download mode is selected, the following files can be downloaded from the host machine through he parallel interface input (channel 4):

- Object files
- Debug environment files
- Load module files
- Patch data files

◆ Executing high-speed down-loading

① The following message is displayed, when setting the high-speed down-load mode in the initial value setting panel or environment setting on the configuration panel:

```
High speed down-load mode? [yes•no]
```

The high-speed down-load mode can be selected by selecting "Yes" and carriage return.

② Input the PPC P command on the command stage.

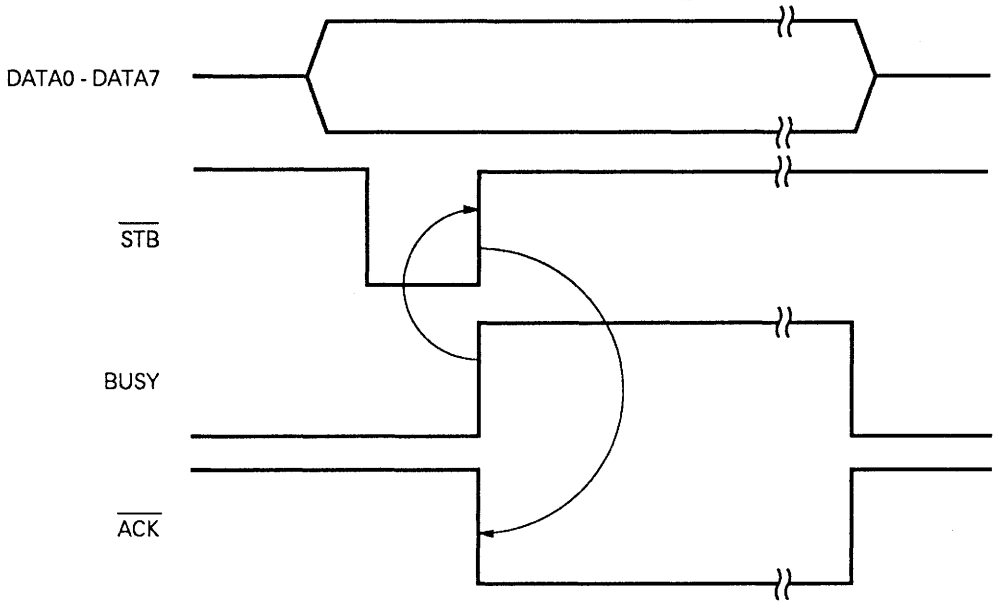


Fig. 9-1 High-Speed Downloading Timing

(2) Through output

To download files by using any other command than LOD, all the files are output through from Channel 4 to Channel 3. For example, to output a list by using the PRINT command for MS-DOS, the list can be output from a printer connected to channel 3, even if no other printer is connected to the PC-9800.

If the parallel interface is used (to output a list etc.) while the verify command is executed, downloading is executed from Channel 1 of the serial interface:

9.2 Signal Lines and Circuits for Parallel Interface

The signals, pin configuration, and circuit diagrams for the parallel interface are shown below.

Table 9-1 Parallel Interface Signals

Pin No.	Signal Name	Flow		Function
		CH3	CH4	
1	$\overline{STB}$	Output	Input	Strobe pulse to read data
2	DATA 0	Output	Input	Parallel data 0
3	DATA 1	Output	Input	Parallel data 1
4	DATA 2	Output	Input	Parallel data 2
5	DATA 3	Output	Input	Parallel data 3
6	DATA 4	Output	Input	Parallel data 4
7	DATA 5	Output	Input	Parallel data 5
8	DATA 6	Output	Input	Parallel data 6
9	DATA 7	Output	Input	Parallel data 7
10	$\overline{ACK}$	Input	Output	Output when data input is completed
11	BUSY	Input	Output	Signal indicating that data reception is impossible
19-30 33	GND	–	–	Signal ground
12	PE	–	Input	Unused (+5 V, pulled up by 3.3KΩ resistor)
32	$\overline{ERROR}$	–	Input	Unused (+5 V, pulled up by 3.3KΩ resistor)

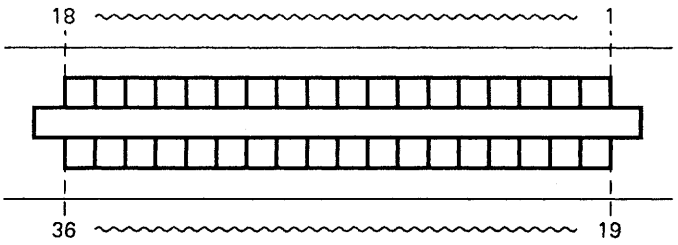


Fig. 9-2 Pin Configuration for Parallel Interface (CH3 and CH4)

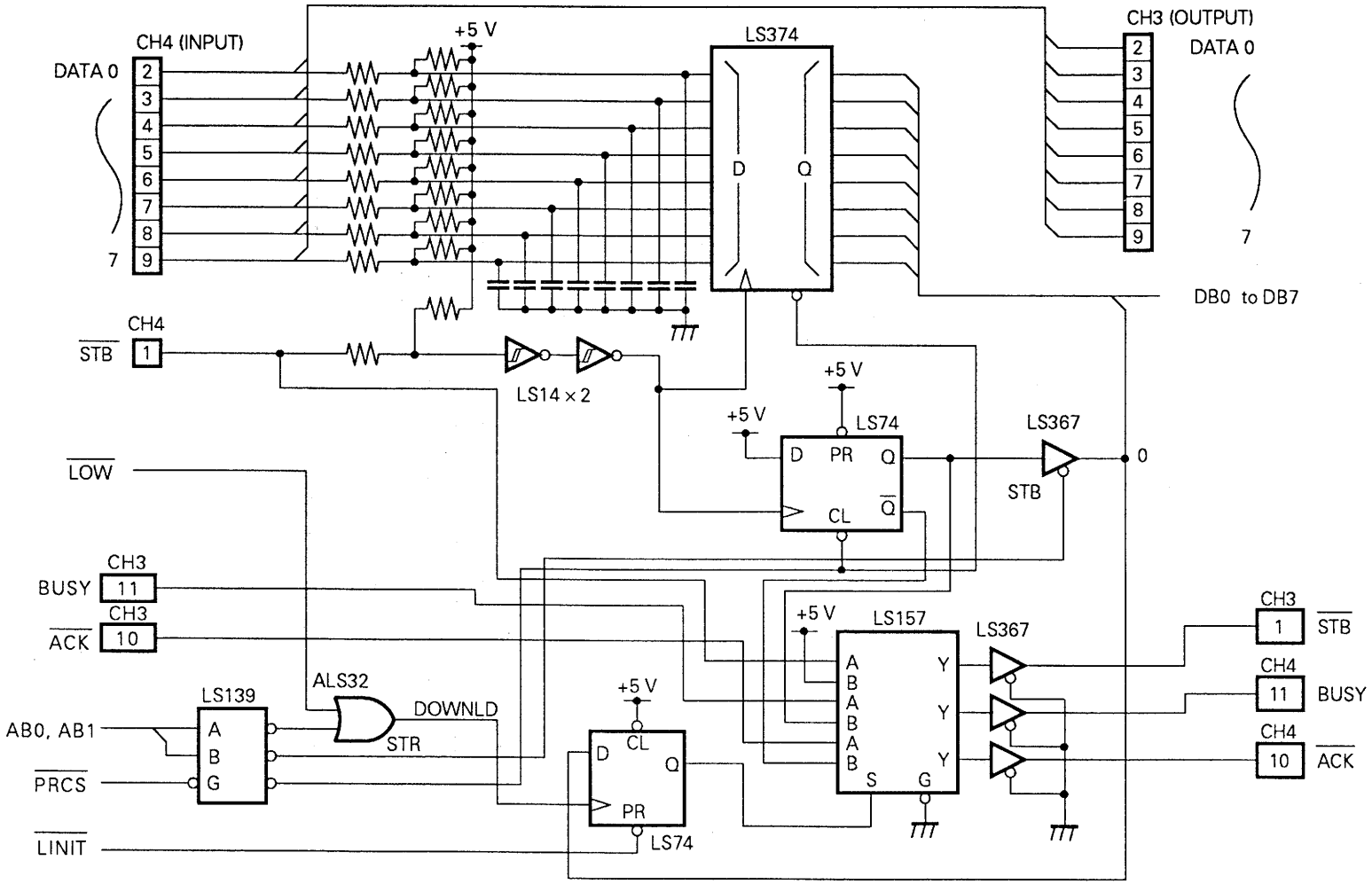


Fig. 9-3 Parallel Interface Circuit Diagram

APPENDIX A REINFORCED POINTS OF IE-78240-R-A FROM IE-78240-R

As compared with the existing IE-78240-R, IE-78240-R-A is reinforced on the following respects:

1. Screen debugger can be used.

2. Reinforced event detection functions
   - Number of bus detection points increased from 1 to 4
   - Number of program execution detection points increased from 4 to 8
   - Bus detection combined with external sense data
   - Program execution detection combined with external sense data

3. Increased trace capacity
   - Number of steps increased from 2K to 8K steps
   - Simultaneous trace of fetch bus and access bus

4. Additional trace modes
   - Qualify trace
   - Section trace

5. Coverage function

6. Execution time, number of instructions measuring function

7. Internal RAM real-time display function

8. Check point function

Remarks: For details, refer to the User's Manual (Introduction and Reference Manuals) supplied with the optional screen debugger.

APPENDIX B SPECIFICATIONS

This section describes the following two items in the basic IE-78240-R-A specifications:

Product specifications ... Dimensions and electrical characteristics
Basic specifications as debugger

Product specifications

Dimensions	Depth : 370 mm Width : 160 mm Height: 283 mm
Weight	8.5 kg
Power requirements	AC 100 V 50/60 Hz 3 A
Operating temperature	10 to 40 °C
Storage temperature	-15 to +45 °C
Humidity	10 to 80% RH (No condensation)

Phase-out/Discontinued

■ Basic specifications as debugger

▶ Target device

- μPD78244 series : μPD78243, 244 ★
- μPD78218A series: μPD78217A, 218A, P218A
- μPD78214 series : μPD78210, 212, 213, 214, P214

▶ Operating frequency: 12 MHz max. (default: 12 MHz)

▶ Clock supply: Crystal in IE-78240-R-A (clock signal can also be supplied from target system)

▶ Memory

• Alternate memory capacity	Internal ROM	: 32KB
	Expansion memory	: 64KB
	Internal RAM and EEPROM	: 4KB
• Mapping unit	Internal ROM	: 4KB
	Expansion memory	: 256B
	Internal RAM	: 128B
	Internal EEPROM	: 256B

▶ Event detection

- Bus detection : 4 points (address/data/status/external sense data; however, data of register access instruction cannot be detected)
- Program execution detection : 8-point parallel (address/external sense data)
  4-level sequential (address/external sense data)
- Path count : 1 to 254 steps
- Delay counter : L (delay: 0K), M (delay: 4K), F (delay: 8K)

B

▶ Break functions and sources
- Event detection
  - Access: Address
    - Data
    - Status
    - External signal data
  - Fetch : Number of steps
    - External signal data
    - 8-point parallel fetch
    - 4-stage sequential fetch
- Fail-safe break
  - Manual break
  - Non-map break
  - Write-protect break
  - SFR illegal access break
- Path count
- Delay count

▶ Real-time trace
- Trace source : Triggered by all sources or event detection
- Trace capacity : 72 bits x 8K steps
- Trace contents : Fetch address bus (16 bits), access address bus (20 bits), fetch data bus (8 bits) Access data bus (8 bits), external sense data (8 bits), status (12 types)

▶ Check point
- Contents of registers, memory, and SFRs can be written to real-time tracer by generation of check point

▶ Internal RAM real-time display function
- Internal RAM (0FE00H-0FEFFH) data or external sense data can be displayed in real-time during emulation (up to 3 points)

▶ Target interface
- Emulation probe (optional)

▶ External interface
- RS-232-C
  CH1: Host machine
  CH2: PROM programmer
- Centronics interface
  CH3: Parallel output, printer
  CH4: Parallel input, high-speed download

▶ Host machine
- PC-9800 series
- IBM PC/AT ★

▶ Control program
- Screen debugger (optional) [for MS-DOS]
- Device file (optional) [for MS-DOS]

▶ Language processing program
- Relocatable assembler
- C compiler

▶ Others
- Standby functions
- Latchup protection circuit
- Changing event detection during emulation CPU operation and trace display operation

▶ Other functions
- On-line assemble/disassemble
- Memory/register/SFR manipulation
- Mapping
- Reset
- Emulation start/stop
- Symbolic debugging
- Loading/saving of object/symbol/debug environment
- Help command, PGM mode, history
- Line edit
- Source debug

- ▶ Coverage function
  - Access (1M bytes max. (only in units 64K bytes))
  - Fetch (64K bytes max.)

- ▶ Execution time, number of instructions measuring function
  - Execution time: 4 minutes max.
  - Number of instructions: 65535 times max.

APPENDIX C JUMPER SETTING ON CONTROL/TRACE BOARD AND ADAPTER BOARD

This section describes how to change the setting of the jumpers on the control/trace board and adapter board. However, these jumpers usually can be left untouched.

(1) Jumper setting

The jumpers on the control/trace board and adapter board are factory-set as follows for shipment:

Table C-1 Jumper Setting (Factory-Set)

Board	Jumper No.	Setting
Control/trace board	JP1	1 and 2 shorted
Adapter board	JP1	1 and 2 shorted

Caution: If the factory-set conditions of the jumpers are changed, the in-circuit emulator may not operate correctly. Do not change the setting of the jumpers.

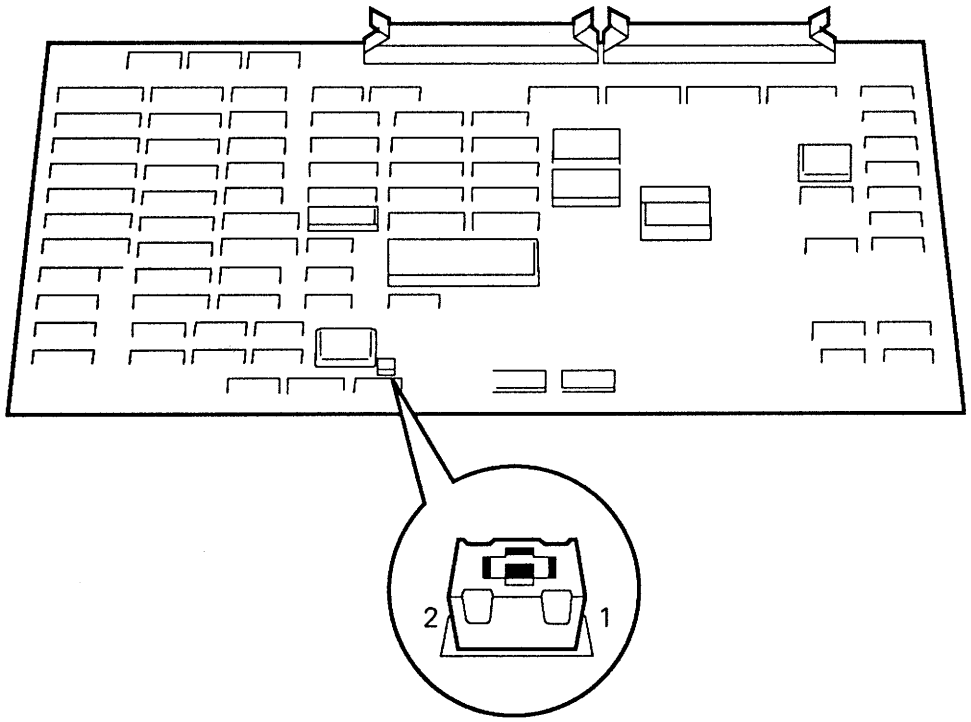


Fig. C-1 Jumper Position on Control/Trace Board

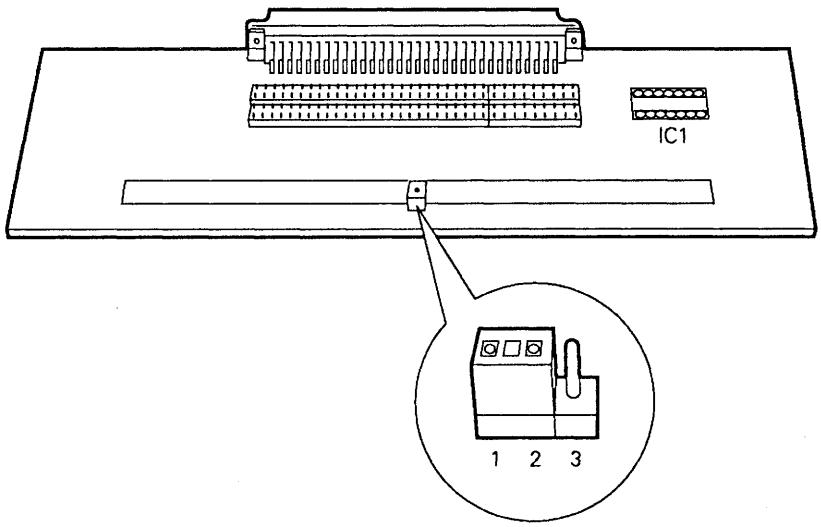


Fig. C-2 Jumper Position on Adapter Board

Remarks: Refer to 3.1.2 Setting changing sequence for how to detach the adapter board.

(2) Connection of control/trace board

Install or detach the control/trace board by following these steps:

▷ **Step**

① Remove the six screws from the IE-78240-R-A top cover and remove the cover.
② Disconnect cables J1 and J2, which connect the break board and control/trace board.
③ Pull the card pullers at both sides of the boards toward you to remove all the PC boards from the slot.
④ Remove the four screws on the side of the unit, then remove the side cover.
⑤ Remove the screws holding the control/trace board to the unit, then remove the board.
⑥ Connect J1 and J2 cables, as illustrated in Fig. C-3.

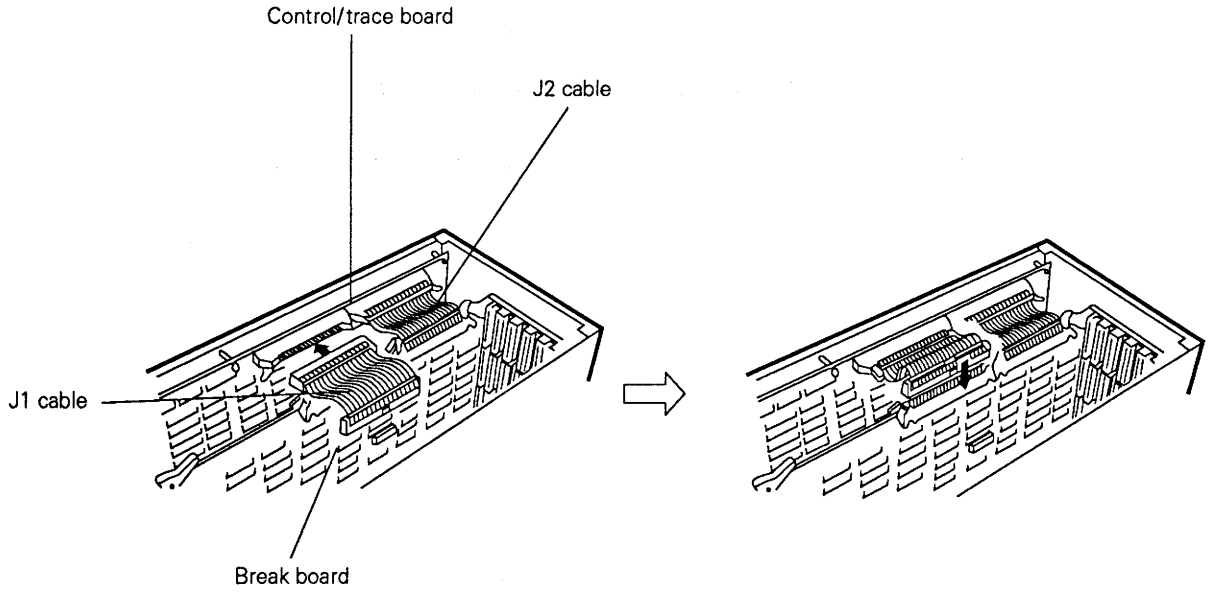


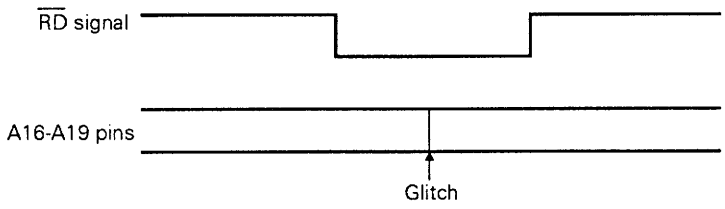
Fig. C-3 Connecting J1 and J2 Cables

APPENDIX D NOTES ON CORRECT USE

This section describes several points to be noted when you use IE-78240-R-A.
Pay attention to the points described in this section, when creating application programs.

(1) Glitch output from A16-A19 pins

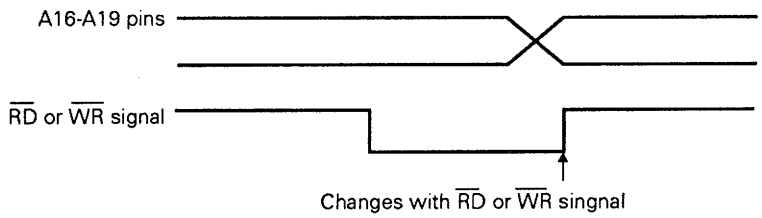
When the 1M expansion mode is used, a glitch may be output from the A16-A19 pins, while the RD signal is active.



Since this glitch may be decreased depending on the capacity of the emulation probe, this problem rarely affects the target system. Therefore, it is not corrected for the next remodeling.

(2) Trouble of address hold time for A16-A19 pins

In the 1M expansion mode, the address hold time output from the A16-A19 pins at the rising edge of the RD or WR signal is insufficient. The address output by the A16-A19 pin disappears at the same time, as when the RD or WR signal rises.



It is considered from the capacity of the emulation probe that this problem rarely affects the target system. Therefore, it is not corrected for the next remodeling.

(3) Discrepancies with command input in standby mode

If writing to the STBC register or fetching the 4th byte of the "MOV STBC, #xx" instruction is specified as an event condition, after the tracer is stopped by the STP command, or by the excape key after the standby condition has been initiated by the event, further command input will not be accepted.
This condition can only be released by pressing the reset switch on the IE-78240-R-A unit or by turning off the power.
Up-grading will not resolve this condition. Event condition settings must be planned so as to avoid the problem.

Note: If the reset switch on the IE-78240-R-A unit is pressed, the IE-78240-R-A will start up not in the host mode but rather in the stand-alone mode. The following is the procedure for changing to the hostmode:

① Input "^C" to terminate the IE-78240-R-A control program.
② Press the reset switch on the IE-78240-R-A again.
③ Start up the IE-78240-R-A control program again.

If restarting the IE-78240-R-A falls in the above procedure, consult your IE-78240-R-A supplier.

(4) Illegal write access during macro service execution

Illegal write access may occur while macro service type A or type C is used. This illegal access takes place, when the local bus interface is used. The conditions, under which the illegal write access occurs, and the address and data output during this write access are as follows:

① Data transfer from memory to SFR by macro service type A

[Condition]
When the value of the data transferred by the macro service is 0D0H-0DFH

[Output address and data]
Address ..... Address of transfer destination SFR for macro service type A that has caused the illegal access
Data ..... Transferred data for macro service type A that has caused the illegal access

② Data transfer from SFR to memory by macro service type A

[Condition]
When the memory address, to which data is to be transferred by the macro service, is 0FED0H-0FEDFH

[Output address and data]
Address ..... Address of transfer source SFR for macro service type A that has caused the illegal access
Data ..... Lower 8 bits of transfer destination memory address for macros service type A that has caused the illegal access

③ Macro service type C

[Condition]
When the MPTL address for macro service type C is 0FED0H-0FEDFH

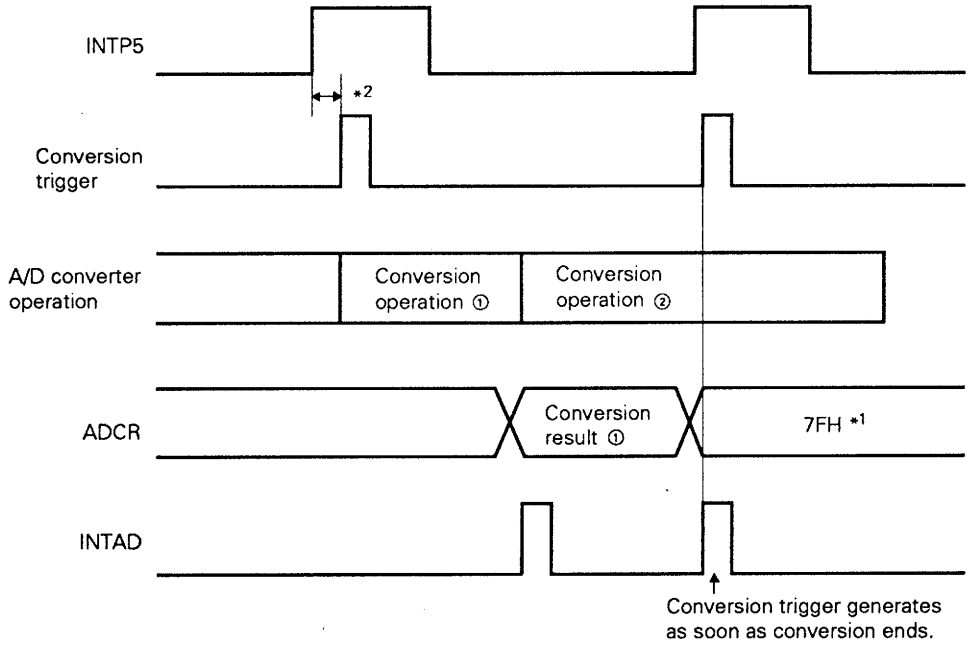
[Output address and data]
Address ..... Address of compare register (CR10 or CR11) to which data is to be transferred by macro service type C that has caused the illegal access

Data ..... Lower 8 bits of MPTL address

These troubles also occur in the target device.
Correcting these troubles is extremely difficult. Therefore, they are left uncorrected (the target device is not corrected either, for the same reason).
Therefore, do not use the data or address that can cause the troubles when using the macro service.

(5) Malfunctioning of A/D converter on hardware start

When A/D conversion is started by means of hardware start, and if the valid edge is input again to the INTP5 pin after the valid edge has been input to the INTP5 pin during A/D conversion, the A/D converter may malfunction. This malfunctioning takes place, if the valid edge is input to the INTP5 pin when the result of the conversion is to be stored in the A/D conversion result register (ADCR) after conversion has been once completed. At this time, the A/D conversion end interrupt (INTAD) occurs, but the value stored in the ADCR register is not the result of the conversion, but always 7FH.



***1**: The result of conversion operation 2 should be stored, but 7FH is stored due to malfunctioning.

***2**: Time required since the INTP5 pin has changed until the valid edge is detected.

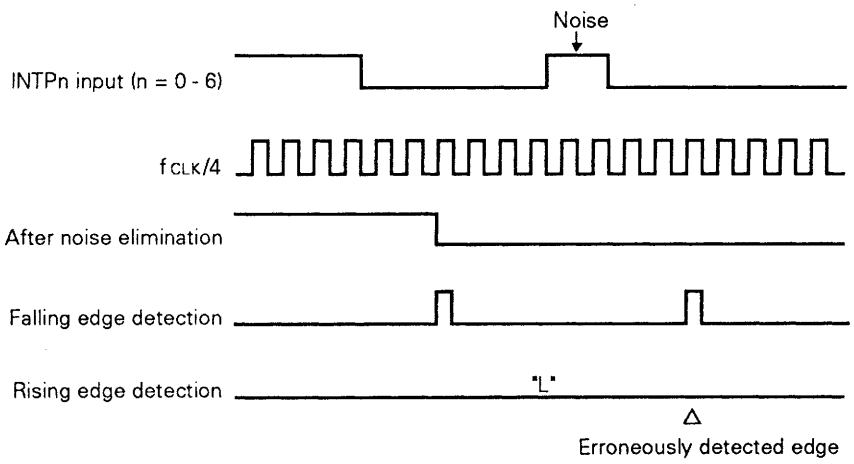
To avoid this problem, it is necessary to set again the A/D converter mode register (ADM) after the necessary A/D conversion has been performed by means of hardware start.

Correcting this trouble is extremely difficult. Therefore it is left uncorrected (the target device is not corrected either for the same reason).

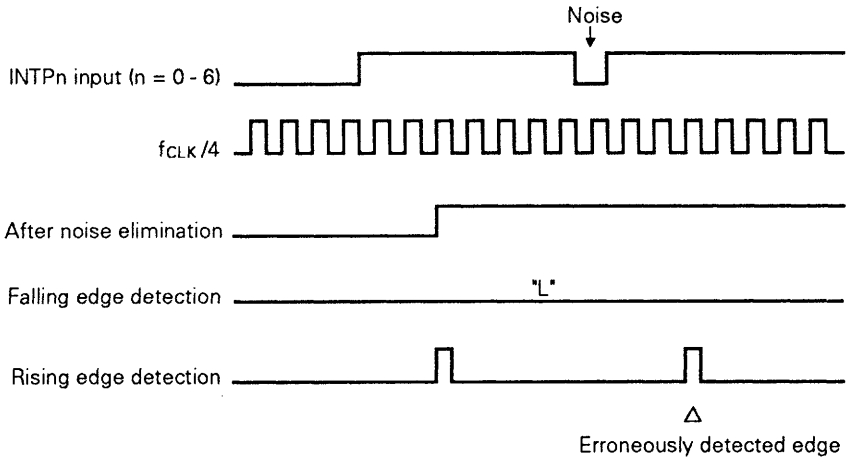
(6) Erroneous edge detection

Digital noise elimination cannot normally be performed in the in-circuit emulator. Noise may cause erroneous falling edge detection during low level detection, or erroneous rising edge detection during high level detection. In addition, when reading from port 2, noise may not be eliminated but read, as input.

(a) Erroneous edge detection during low level input



(b) Erroneous edge detection during high level input



D

The real-time output port, timer/counter, and A/D converter are affected as follows:

- Real-time output port: Operates according to the erroneously detected edge.
- A/D converter: Operates according to the erroneously detected dege.
- Timer/counter capture operation, clear operation:
  Not affected by erroneous edge detection. Therefore, even if an interrupt is generated by the error, the captured value will not be updated. It should be noted especially that the value of the CR22 , becomes undefined after it is read by the CPU.
- Timer/counter compare operation:
  The coincidence interrupt generation timing will vary due to the erronelusly detected edge, and depends on whether the mode for clearing after capture has been set, or whether the timer/counter 2 has been selected to be used as the external event counter. Coincidence interrupts will continue to be generated, but will not be coincidentwith the time at which the timer/counter and the compare register coincide.
  - If in the mode in which clearing is performed after capture, interrupt generation timing will return to normal when either a normal edge is input or when the timer/counter operation stops.
  - If the timer/counter 2 has been selected to be used as the external event counter, interrupt generation wil return to normal when the timer/counter operation stops.

  The timer/output is not affected by an erroneously detected edge, and is performed at normal speed.

APPENDIX E OLD TYPE EMULATION PROBES

The following describes the old type emulation probes and their alternate products.

Phase-out/Discontinued

[Old type emulation probes]

- EP-78210GJ (for 74-pin QFP package)
- EP-78210GC (for 64-pin QFP package)
- EP-78210GQ (for 64-pin QUIP package)
- EP-78210CW (for 64-pin shrink package)
- EP-78210L (for 68-pin QFJ package)

Caution 1: EP-78210GJ is used in conjunction with the EP-78210L or the EP-78240LP-R. This product is currently under product.
However, it is recommended to purchase the EP-78240GJ-R, which is upward compatible with the EP-78210GJ and more convenient.

2: Except for the EP-78210GJ, other emulation probes described above are available for maintenance purpose. For a new purchase, it is recommended to purchase upward compatible indicated in Table E-1.

Table E-1 The Old Type Emulation Probes and Their Upward Compatible Emulation Probes

Old Type Emulation Probes	Upward Compatible Emulation Probes
EP-78210GC	EP-78240GC-R
EP-78210GQ	EP-78240GQ-R
EP-78210CW	EP-78240CW-R
EP-78210L	EP-78240LP-R

Phase-out/Discontinued