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Renesas Electronics Corporation

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USER'S MANUAL

RENESAS

IE-78330-R

IN-CIRCUIT EMULATOR

HARDWARE

Document No. EEU-1326C
(O. D. No. EEU-713D)
Date Published February 1994 P
Printed in Japan

USER'S MANUAL

NEC

IE-78330-R

IN-CIRCUIT EMULATOR

HARDWARE

Main Revisions in This Edition

Page	Description
Throughout	Descriptions for the PG-2000 have been deleted.
	"IBM PC series" has been changed to "IBM PC/AT."
p.4	Table1-1 has been modified.
p.71 and p.72	Chapter 10 has been added.

The mark ★ shows revised points.

The IE-78330-R conforms to the standards of VCCI, which restricts radio interference in commercial and industrial areas.

Since using the IE-78330-R in residential districts or their neighboring districts may cause radio or TV interference, follow this manual.

NEC

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PREFACE

Users:

This manual is intended for users who use 78K/III series 8- and 16-bit single-chip microcomputers and debug their systems using the IE-78330-R.

The IE-78330-R can emulate the μPD78330, μPD78334, and μPD78P334. Before using this manual, the users should be familiar with the functions and use of these devices, and have a knowledge of a debugger.

Organization:

The IE-78330-R Manual consists of the following two parts: Hardware (this manual) and Software.

Hardware
Basic specification
Configuring the System
External interface functions

Software
Function overview
Description of commands

Several cautions must be observed to use the IE-78330-R. Refer to the summary in Chapter 13 of the IE-78330-R: Software For the most recent information about this product, please contact an NEC representative.

Purpose:

- The IE-78330-R Manual:
  The hardware part explains the basic specification of the IE-78330-R and how to connect external devices to it.
- The IE-78330-R Manual:
  The software part explains how to start the IE-78330-R for debugging the target device to develop it and how to execute the commands.

Guidance:

<To understand the basic specifications>

See Chapters 1 and 2 (Hardware).

<To upgrade the system>

See Section 1.3

<To set the user clock>

See Chapter 3 (Hardware).

<To connect peripheral equipment to the IE-78330-R>

See Sections 1.3 and 1.4 and Chapters 4 through 6 (Hardware).

<To understand the differences between the target device and IE-78330-R target interface circuit>

See Chapter 7 (Hardware).

<To understand the details of the functions of an IE-78330-R serial or parallel interface>

See Chapters 8 and 9 (Hardware).

<To understand the basic operating procedure and functions>

See Chapters 2 and 3 (Software).

<To understand the types, functions, and input formats of commands>

See Chapter 8 (Software).

Terminology:

The following table shows the meanings of misunderstandable words in this manual.

Terminology	Meaning
Emulation device	Device that emulates a target device in the emulator, including an emulation CPU
Emulation CPU	CPU that executes the program coded by the user in the emulator
Target device	Device to be emulated such as a μPD78330 chip
Target program	Program to be debugged, that is, user-coded program
Target system	System to be debugged, that is, user-produced system, including a target program and user-produced hardware. In a narrow sense, refers only to hardware.

Notation:

Note Explanation of the part indicated in the text

Caution Information which the user should read with particular care

Remark Supplementary information

CHAPTER 1 OVERVIEW

The IE-78330-R is an in-circuit emulator which has been developed to efficiently debug the hardware and software of an application system using a μPD78330, μPD78334, or μPD78P334.

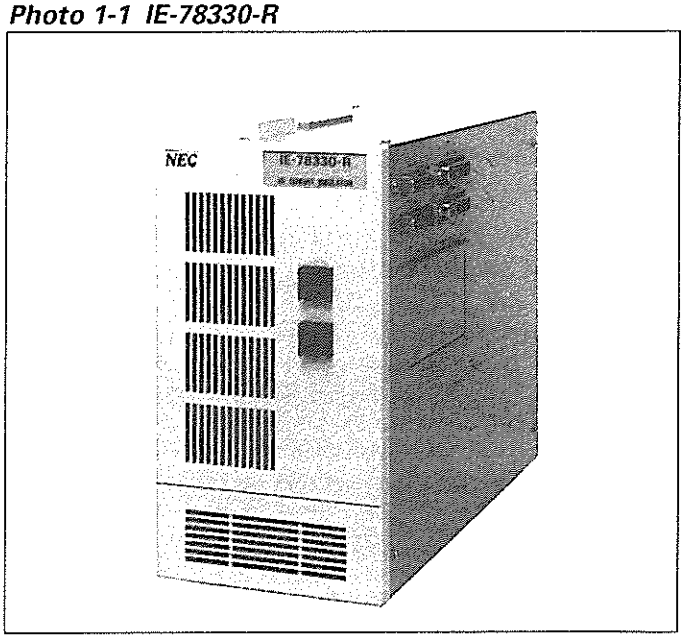
Organization of this chapter

1.1 Features

The IE-78330-R is superior because it:

- Enables real-time execution and real-time trace.
- Has many break and trace functions.
- Can clock the elapsed execution time and count the number of instructions executed.
- Can sample and display data in the specified internal RAM at specified intervals.
- Can display an executed program area.
- Can output the contents of the real-time tracer without stopping the emulation CPU.
- Can search data in the real-time tracer.
- Can perform symbolic debugging.
- Can perform online assembling and disassembling.
- Can input 8-bit trace data using the external sense clips.
- Contains 64K bytes of emulation memory.
- Is available for any package using an optional emulation probe.
- Can be used as an emulator for other 78K series by replacing the emulation board with the optional one.
- Can download object and symbol files at high speed using a parallel interface (Centronics interface). (Ten times faster than down-loading using the RS-232-C interface)

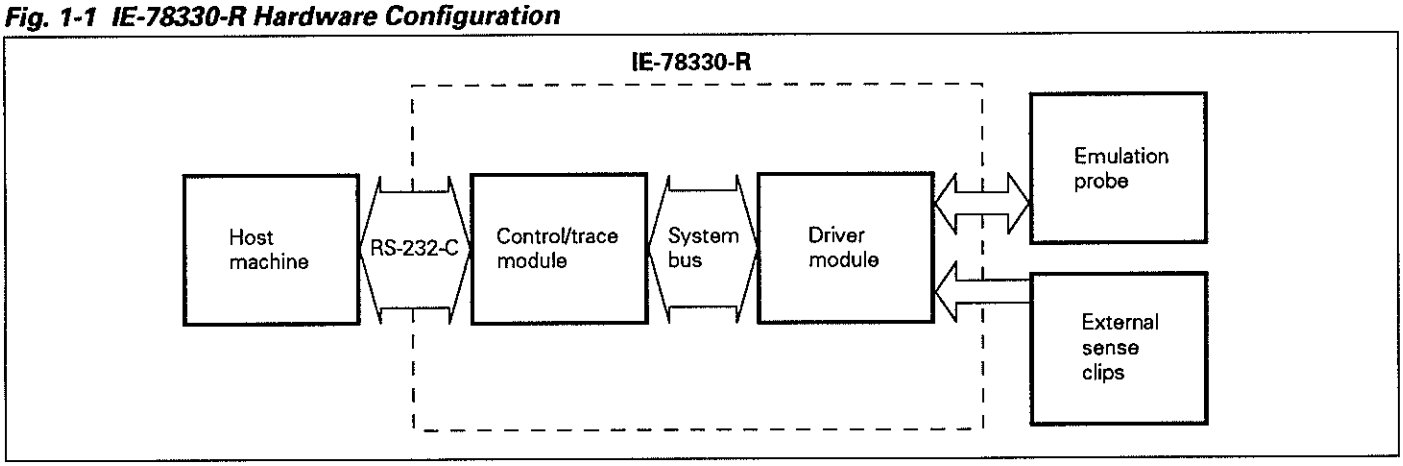
Photo 1-1 IE-78330-R



1.2 Hardware Configuration

Figure 1-1 shows the basic hardware configuration of the IE-78330-R.

Fig. 1-1 IE-78330-R Hardware Configuration

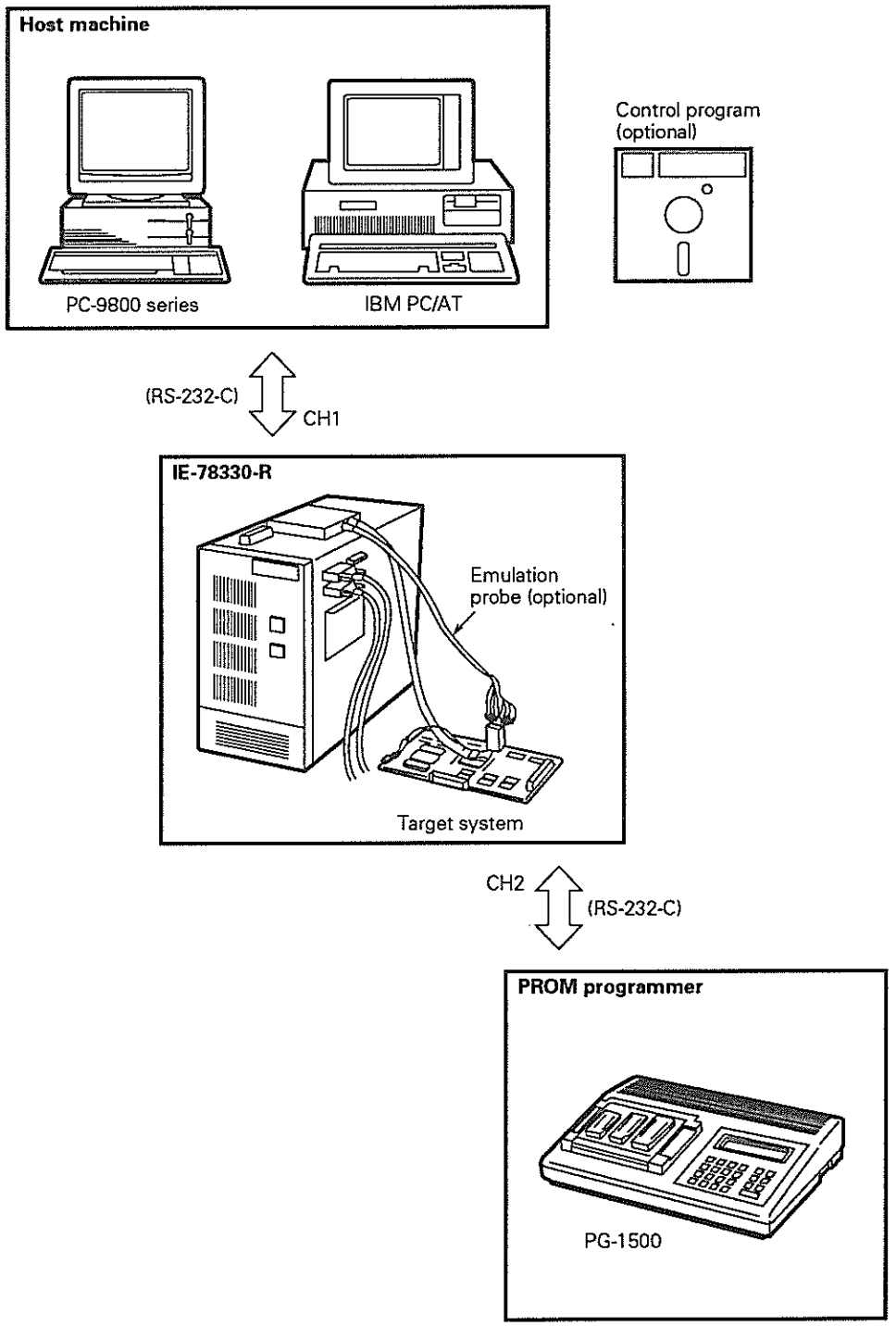


1.3 System Configuration and Upgrade

(1) IE-78330-R system configuration

The IE-78330-R can be used in conjunction with a host machine or PROM programmer.

Fig. 1-2 System Configuration



(2) System upgrade from other emulators to the IE-78330-R

If either the 75X or 78K series in-circuit emulators are currently used, the system can be upgraded to the emulator that has functions equivalent to that of the IE-78330-R. To upgrade the system, replace the emulation and break boards with the boards for the IE-78330-R.

The upgraded in-circuit emulators require the control program for the IE-78330-R.

Table 1-1 lists the boards required for the system upgrade.

★ ***Table 1-1 System Upgrade to the IE-78330-R***

In-circuit emulator in hand		Necessary optional boards	
		IE-78330-R-EM	IE-78330-R-BK
New	IE-75000-R*	Necessary	Necessary
	IE-75001-R	Necessary	Necessary
	IE-78000-R	Necessary	Necessary
	IE-78130-R	Necessary	Necessary
	IE-78140-R	Necessary	Necessary
	IE-78230-R*	Necessary	Necessary
	IE-78240-R*	Necessary	Necessary
	IE-78230-R-A	Necessary	Necessary
	IE-78240-R-A	Necessary	Necessary
	IE-78320-R*	Necessary	Necessary
	IE-78350-R	Necessary	Necessary
	IE-78600-R	Necessary	Necessary
	IE-78327-R	Necessary	Not necessary

* For maintenance only

Remark In-circuit emulators other than those listed in Table 1-1 cannot be upgraded to the IE-78330-R.

To upgrade the system, take the following steps.

(a) Removing the boards

① Check whether the power to the emulator is off.

② Remove the six screws from the top of the main unit and open the cover.

③ Pick up the card pullers at both sides of the emulation and break (or event/trace) boards, and extract the boards from the slot.

(b) Replacing the boards

In place of the extracted boards, install the required emulation board (IE-78330-R-EM) and the break board (IE-78330-R-BK) into the main unit.

Then, the board configuration is equivalent to that of the IE-78330-R.

To set the user clock, take the same steps as those of the IE-78330-R.

1.4 Procedure for Setting Up

The procedure for setting up is as follows:

① <Procedure>

Change the operation clock if necessary.

<See>

Chapter 3

Mount a crystal oscillator on the emulation board of the IE-78330-R to change the operation clock.

② <Procedure>

Connect the target probe to the IE-78330-R.
<See>

Chapter 4

Connect the DIN connector of the emulation probe to that of the IE-78330-R.

③ <Procedure>

Connect the cables supplied to the IE-78330-R.
<See>

Chapter 2

Connect the power cable and interface cable.

④ <Procedure>

Connect the peripheral equipment to the IE-78330-R.

<See>

Chapter 5

Connect the following peripheral equipment:

- Host machine
- PROM programmer (if necessary)
- Printer (if necessary)

⑤ <Procedure>

Connect the target system.

<See>

Chapter 6

Connect the target system to the emulation probe with the sense clips.

1.5 Target Devices

The following devices can be emulated using the IE-78330-R:

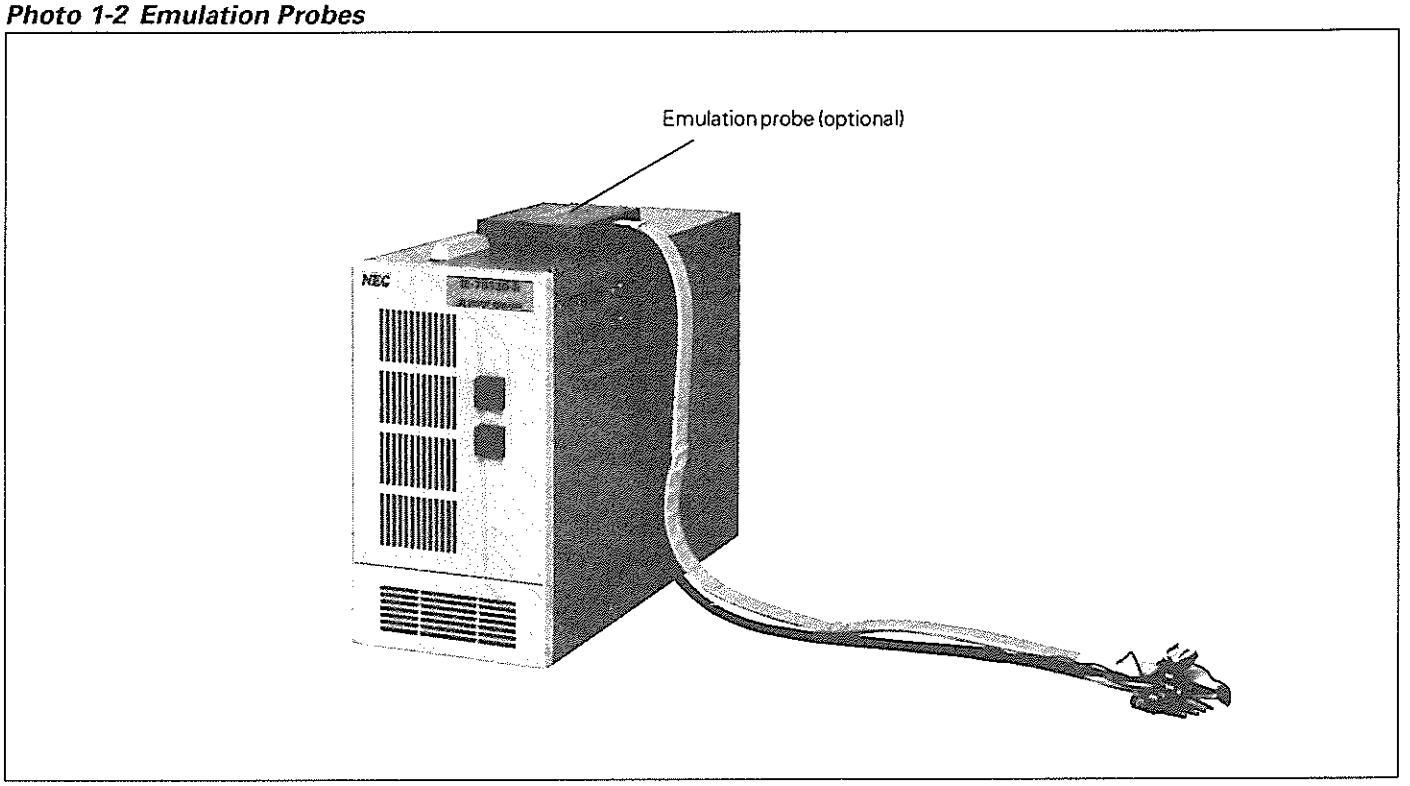
- μPD78330
- μPD78334
- μPD78P334

1.6 Emulation Probes

The following optional emulation probes are available according to the target devices. Use an emulation probe suited to the package.

Part number	
EP-78330GJ-R	(For 94-pin QFP)
EP-78330LQ-R	(For 84-pin QFJ)

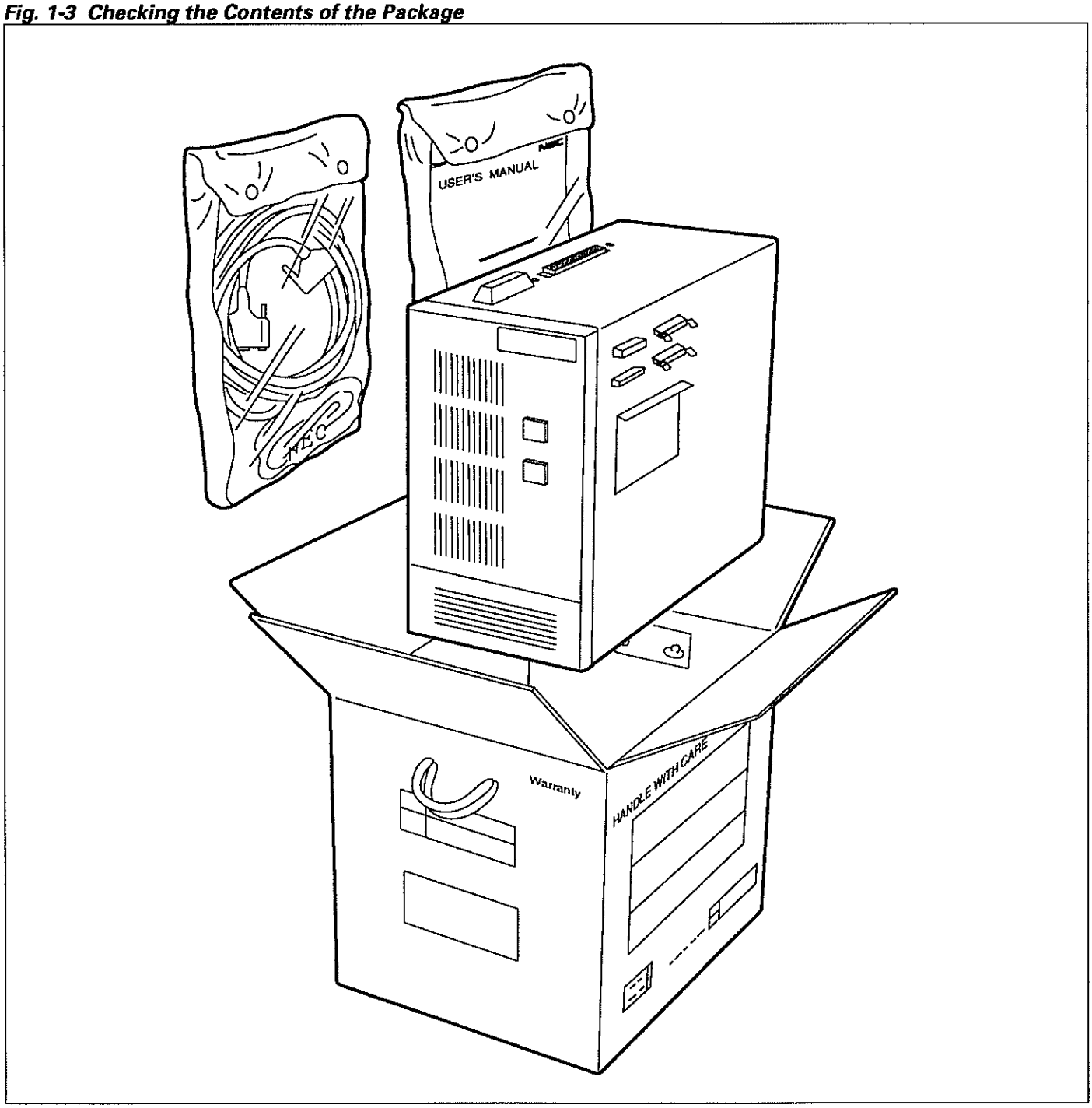
Photo 1-2 Emulation Probes



1.7 Checking the Contents of the Package

The IE-78330-R main unit and accessory bags are packed in a box. Three boards are installed in the main unit. In the accessory bags, this manual, cables, fuse, and other accessories are packed. Check the contents of the package according to this section. Contact an NEC salesperson or authorized dealers if anything is missing or broken.

Fig. 1-3 Checking the Contents of the Package



(1) Checking the boards

Three boards are installed in the IE-78330-R. Remove the six screws from the top of the main unit, open the cover, and check them.

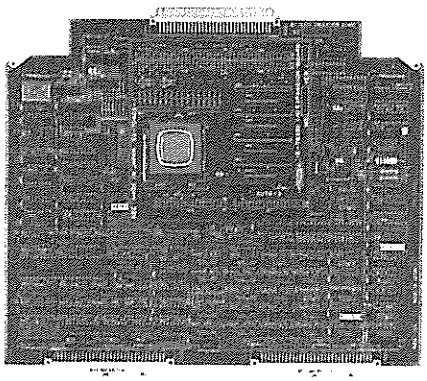
(a) Emulation board (IE-78330-R-EM): 1

(b) Break board[Note] (IE-78330-R-EM): 1

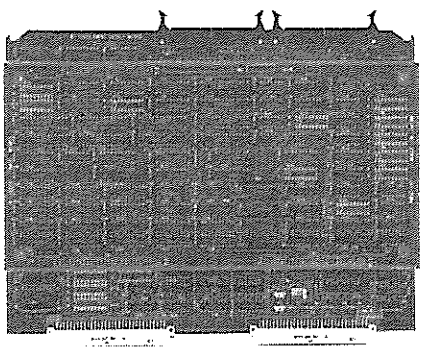
(c) Control/trace board (fixed in the IE-78330-R): 1

Photo 1-3 Boards

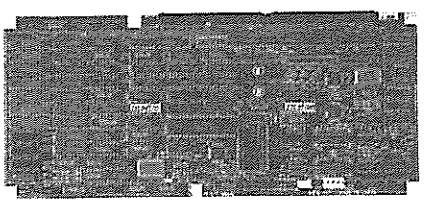
(a) Emulation board



(b) Break board



(c) Control/trace board

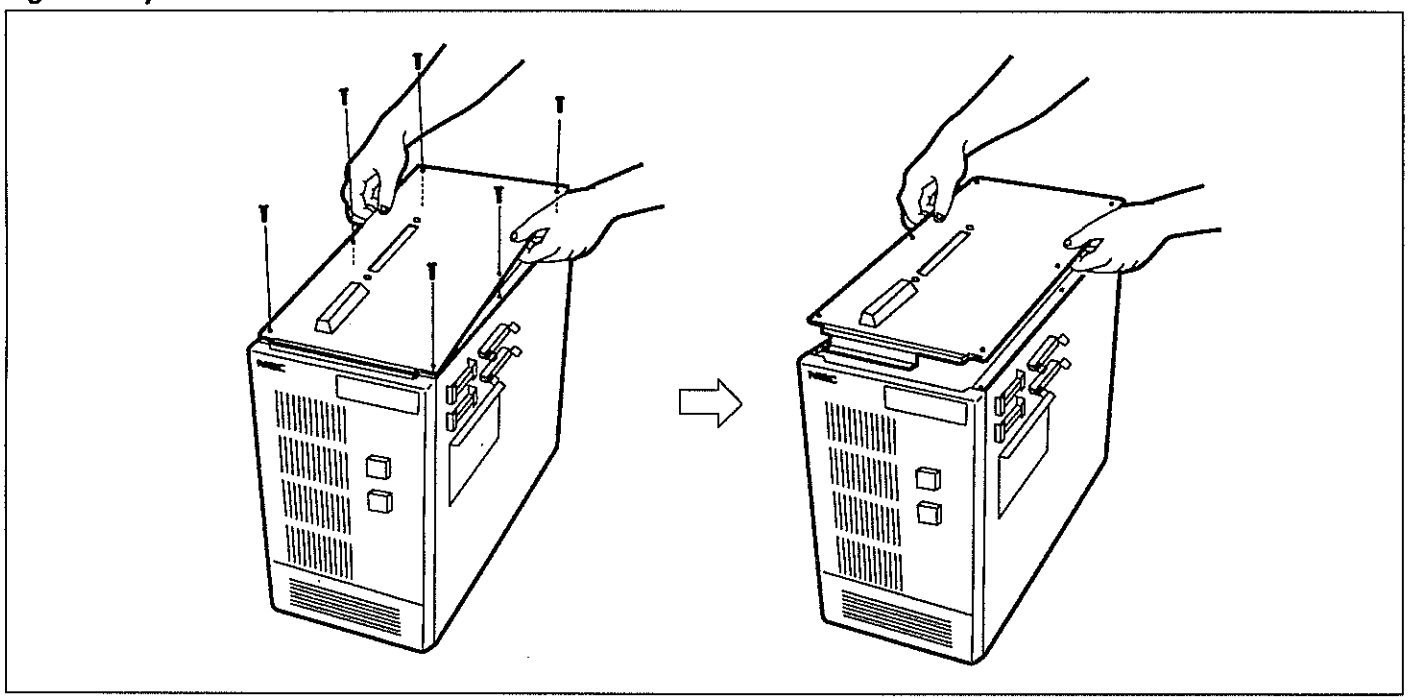


Note The event/trace board is attached to the break board with screws.

❑ Procedure

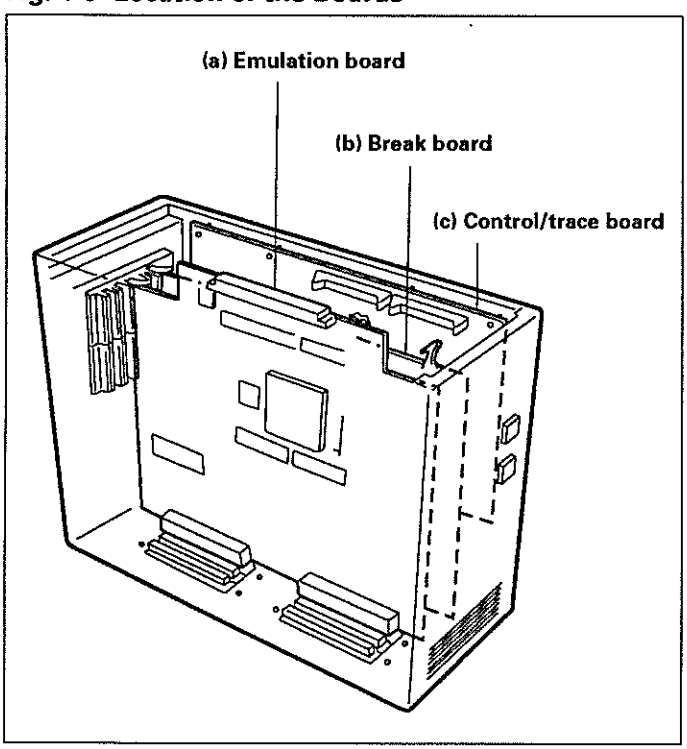
① Remove the six screws from the top of the main unit and open the cover.

Fig. 1-4 Top View of the Main Unit



② Confirm that the boards are installed as follows.

Fig. 1-5 Location of the Boards



(2) Checking the accessories

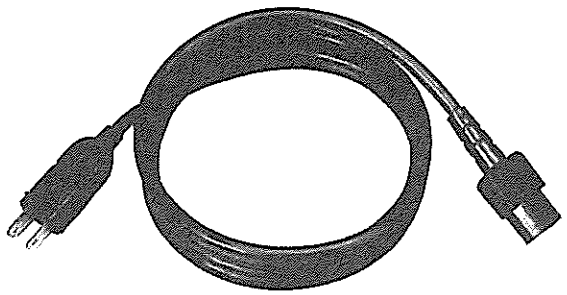
Two accessory bags are packed in the box. Confirm that the following accessories are packed. (See Photo 1-4.)

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

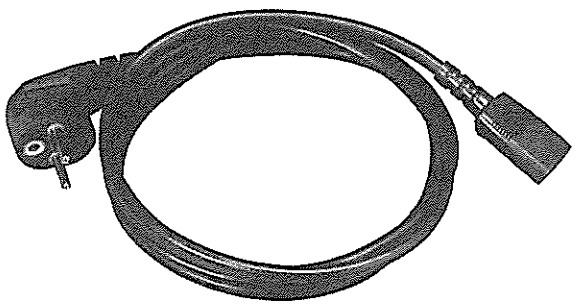
Note The IE-78330-R operates on either 100 VAC or 200 VAC. Use the proper power cable according to the line voltage.

Photo 1-4 Accessories

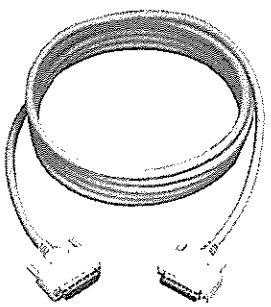
(c) 100-VAC power cable



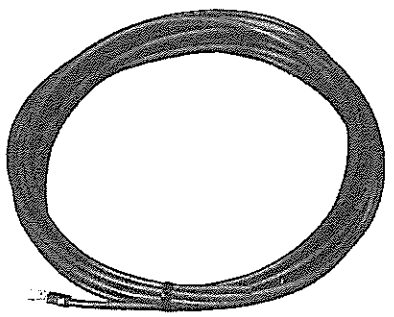
(d) 200-VAC power cable



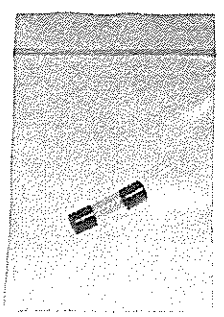
(e) RS-232-C interface cable



(f) Ground lead



(g) Spare fuse



CHAPTER 2 NOMENCLATURE AND FUNCTION OF EACH PART

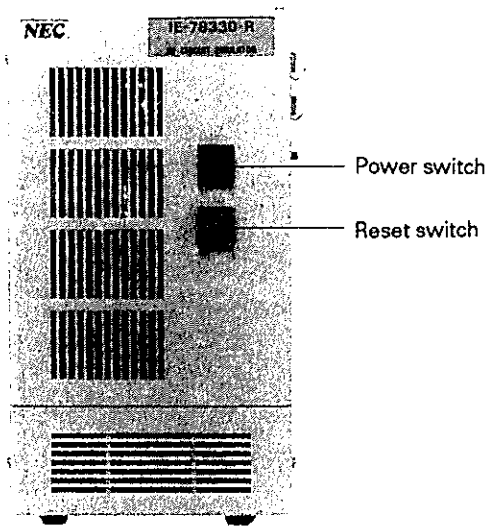
This chapter explains the nomenclature and function of each part of the IE-78330-R, how to set the switches, and how to connect the cables supplied to the IE-78330-R.

Organization of this chapter

2.1 Nomenclature and Function of Each Part in Main Unit

(1) Front

Photo 2-1 Front View of the IE-78330-R



[Power switch]

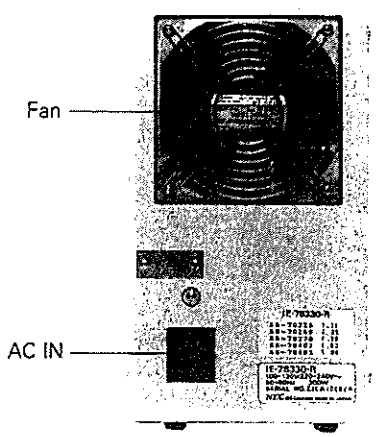
Turns the power on and off.

[Reset switch]

Resets the IE-78330-R.

(2) Rear

Photo 2-2 Rear View of the IE-78330-R



[Fan]

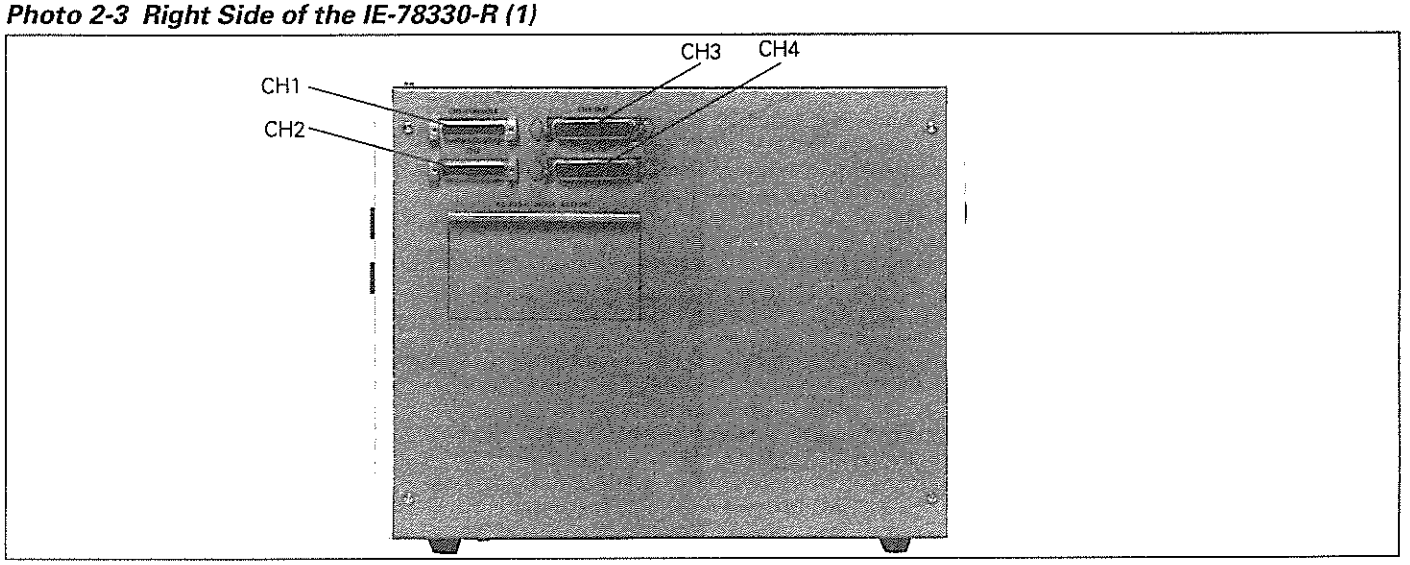
Cools the inside of the cabinet.

[AC IN]

Supplies power by connecting the power cable to it.

(3) Side

Photo 2-3 Right Side of the IE-78330-R (1)



[CH1 (I/O)]

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

[CH2 (I/O)]

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

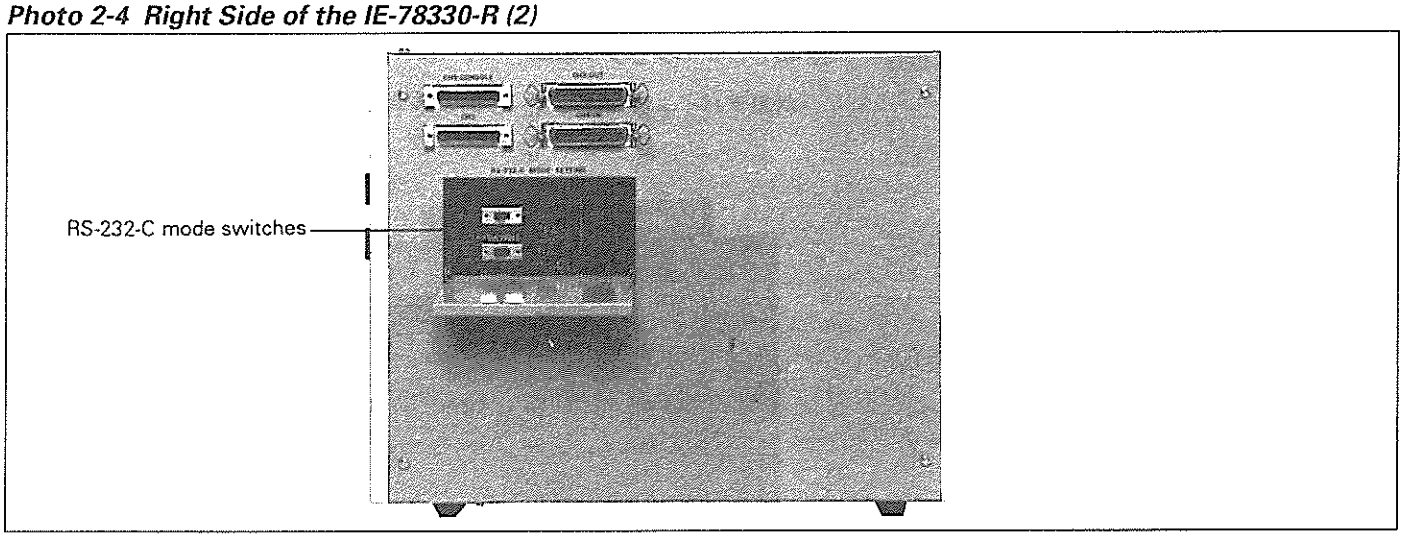
[CH3 (output only)]

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

[CH4 (input only)]

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

Photo 2-4 Right Side of the IE-78330-R (2)

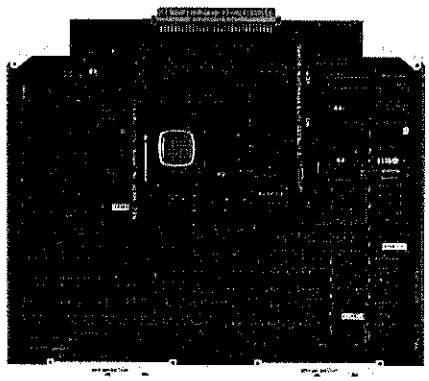


[RS-232-C mode switches]

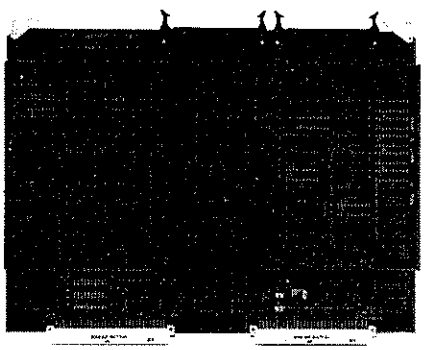
Used for switching the modem/terminal mode, selecting RTS/FG, and setting the baud rate.

(4) Boards

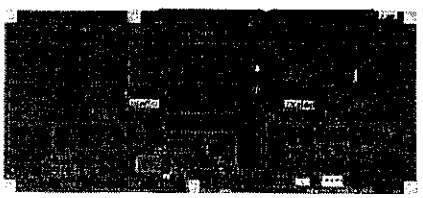
[Emulation board]
Emulates the target device.



[Break board]
Controls the events and tracing.



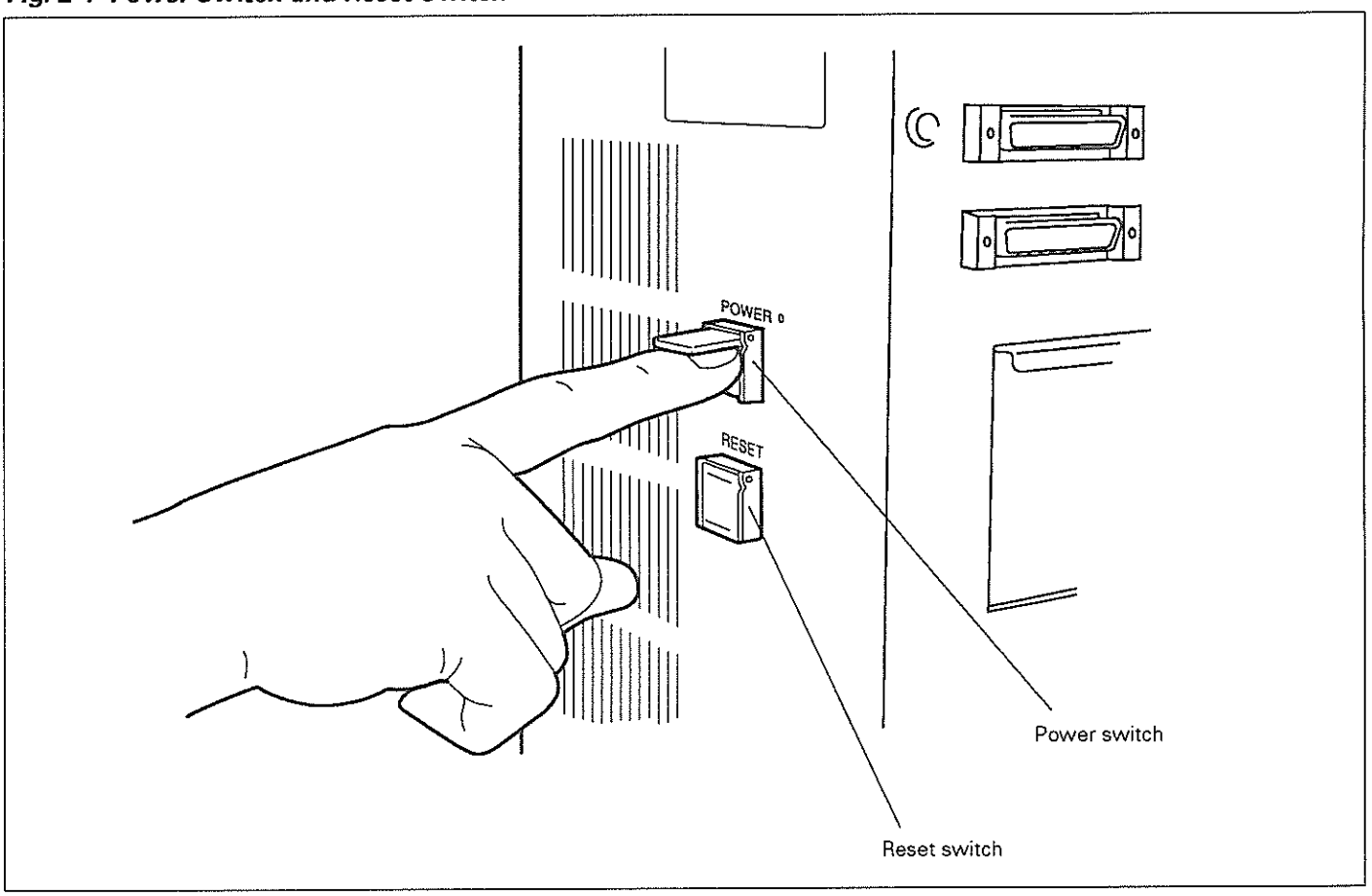
[Control/trace board]
Controls the entire IE-78330-R.



2.2 Setting the Switches

(1) Power switch and reset switch

Fig. 2-1 Power Switch and Reset Switch



[Power switch]
- This is a pushbutton switch.
- Setting
  Power-on: Press this switch once. The power-on LED goes on.
  Power-off: Press this switch once. The LED goes off.

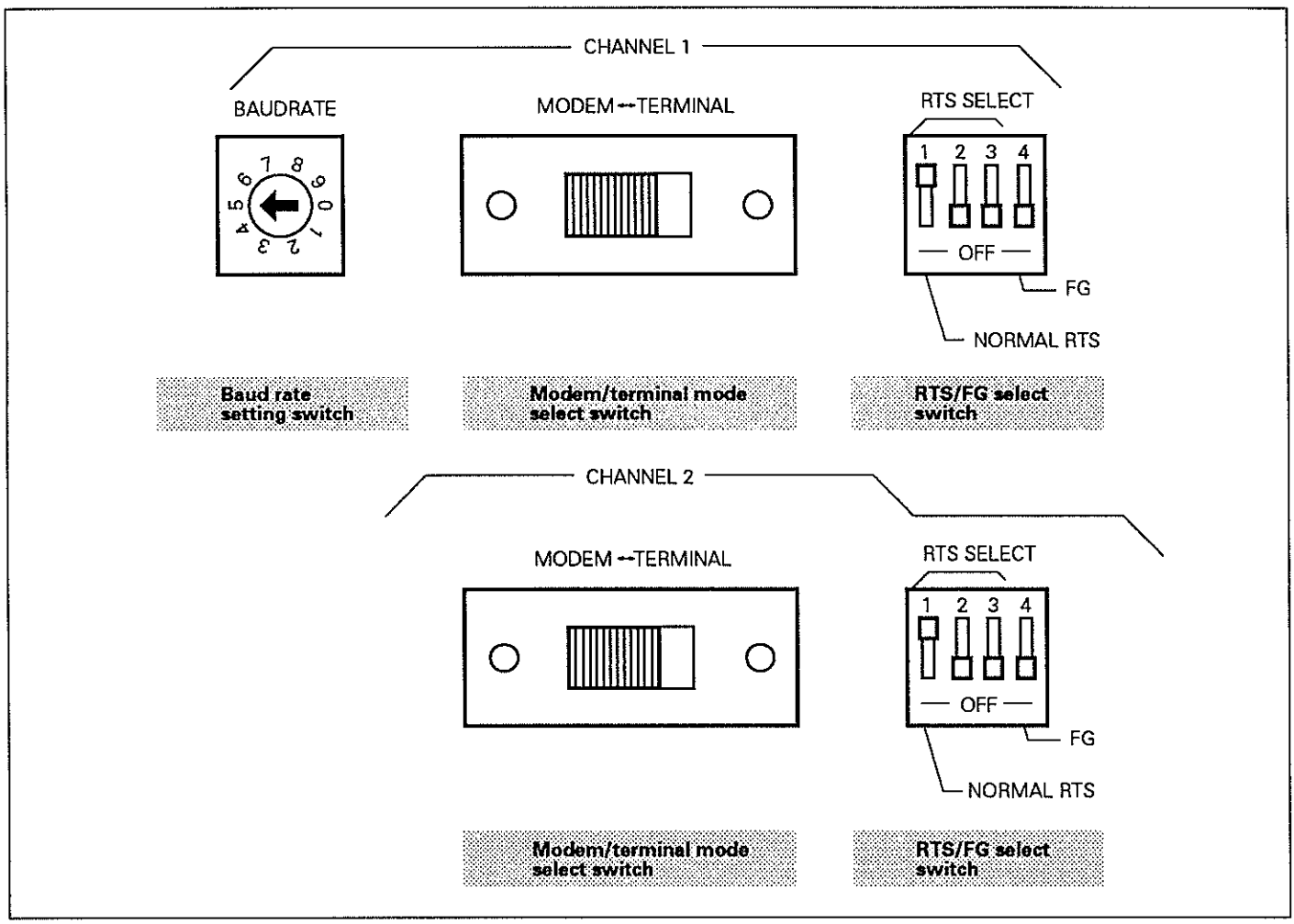
[Reset switch]
- This is a pushbutton switch.
- Setting

  Reset: Press this switch once to reset the IE-78330-R.

(2) RS-232-C mode switches

Open the RS-232-C mode switch cover on the right side of the main unit. (See **Figure 2-2.**) The setting modes depend on each of the peripheral equipment. For details, see **Chapter 5.**

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



[Modem/terminal mode select switch (for channels 1 and 2)]

- This is a slide switch.
- This switch is factory-set to the modem mode.
- Setting
  Modem mode: Slide the switch from right to left.
  Terminal mode: Slide the switch from left to right.

[RTS/FG select switch (for channels 1 and 2)]

- This is a DIP switch.
- This switch consists of switches 1 to 4.
- Slide the switches upward to set them to ON. Slide the switches downward to set them to OFF.
- The switches are factory-set as follows:
  1: ON
  2 and 3: OFF
  4: OFF Setting
  To select RTS: Set switches 1 to 3 as follows:
  1: ON
  2 and 3: OFF
  To put the FG in the open state:
  Set switch 4 to OFF.

[Baud rate setting switch (for channel 1)]

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

Cautions

1. **This switch is used to set the baud rate of channel 1. To set the baud rate of channel 2, use a software command. For details, see Section 5.5 and refer to Section 8.27 in User's Manual: Software.**
2. **Position 7, which corresponds to 0 bps, must not be used.**

2.3 Connecting the Cables Supplied with the IE-78330-R

[Location]

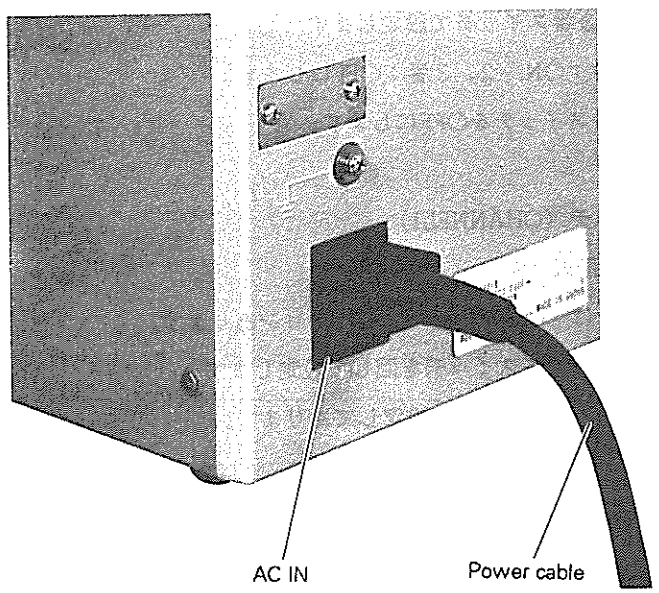
Install the IE-78330-R in a place satisfying the following conditions:

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

(1) Power cable

Connect the power cable to the AC IN jack on the rear of the IE-78330-R main unit.

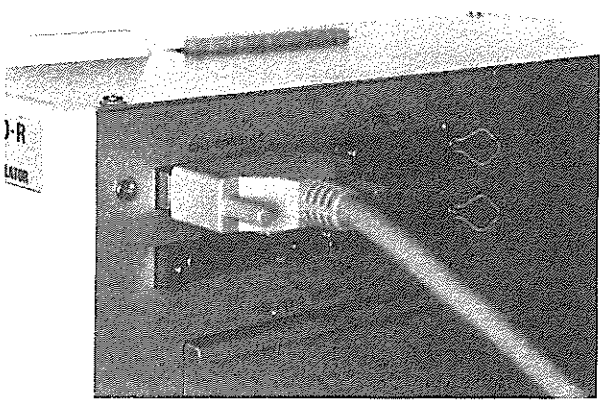
Photo 2-5 Connecting the Power Cable



(2) RS-232-C interface cable

Connect the RS-232-C interface cable to the CH1 or CH2 serial interface port on the right side of the IE-78330-R main unit.

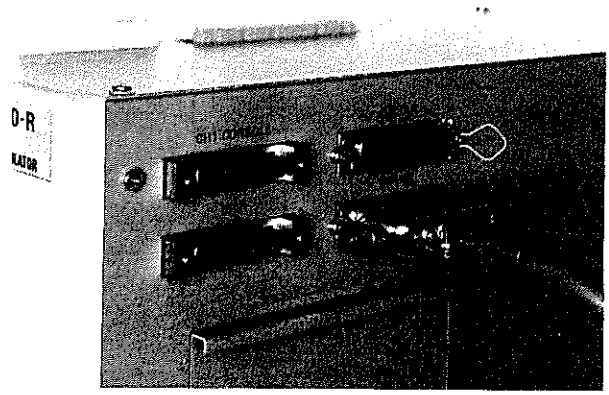
Photo 2-6 Connecting the RS-232-C Interface Cable



(3) Parallel interface cable

Connect a parallel interface cable to the CH3 or CH4 parallel interface port on the right side of the IE-78330-R main unit.

Photo 2-7 Connecting a Parallel Interface Cable



CHAPTER 3 SETTING THE USER CLOCK

This chapter explains setting the user clock.

A clock signal cannot be generated from outside the IE-78330-R main unit, such as from the target system. Unless the clock setting is changed, when the IE-78330-R is started, the crystal oscillator on the emulation board of the IE-78330-R generates a 16-MHz clock signal and supplies it to the emulation device.

Insert a crystal oscillator in the user clock setting socket on the emulation board and specify the user clock in the CLK command to supply the same clock signal as that used in the target system to the IE-78330-R.

Organization of this chapter

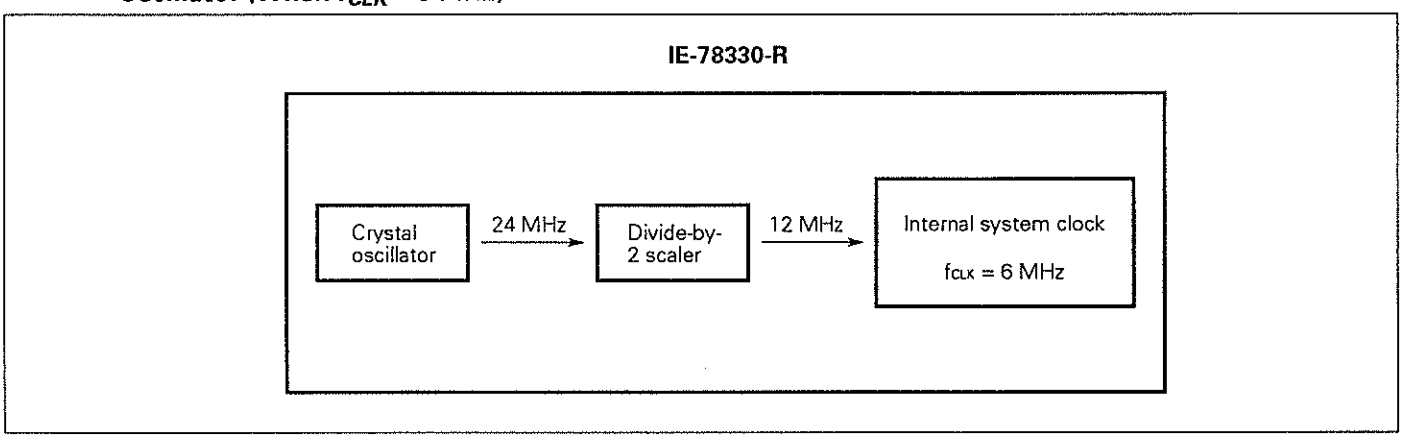
3.1 Conditions of a Crystal Oscillator for the User Clock

Use a crystal oscillator that satisfies the following conditions for the user clock.

[It generates a clock signal at twice the frequency of the operation clock (up to 20 MHz).]

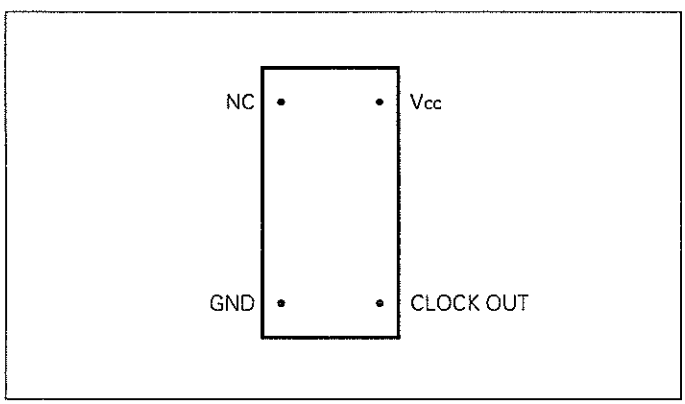
A crystal oscillator which generates a clock signal at twice the frequency of the operation clock is required to change the operation clock of the IE-78330-R. For example, when the 12-MHz operation clock is to be used for the IE-78330-R (when internal system clock f_{CLK} is to be set to 6 MHz), the crystal oscillator must generate the 24-MHz clock signal. This requires twice the frequency of the operation clock.

Fig. 3-1 Clock Signal Generated by the Crystal Oscillator (When f_{CLK} = 6 MHz)



[Its pins are arranged as follows.]

Fig. 3-2 Crystal Oscillator



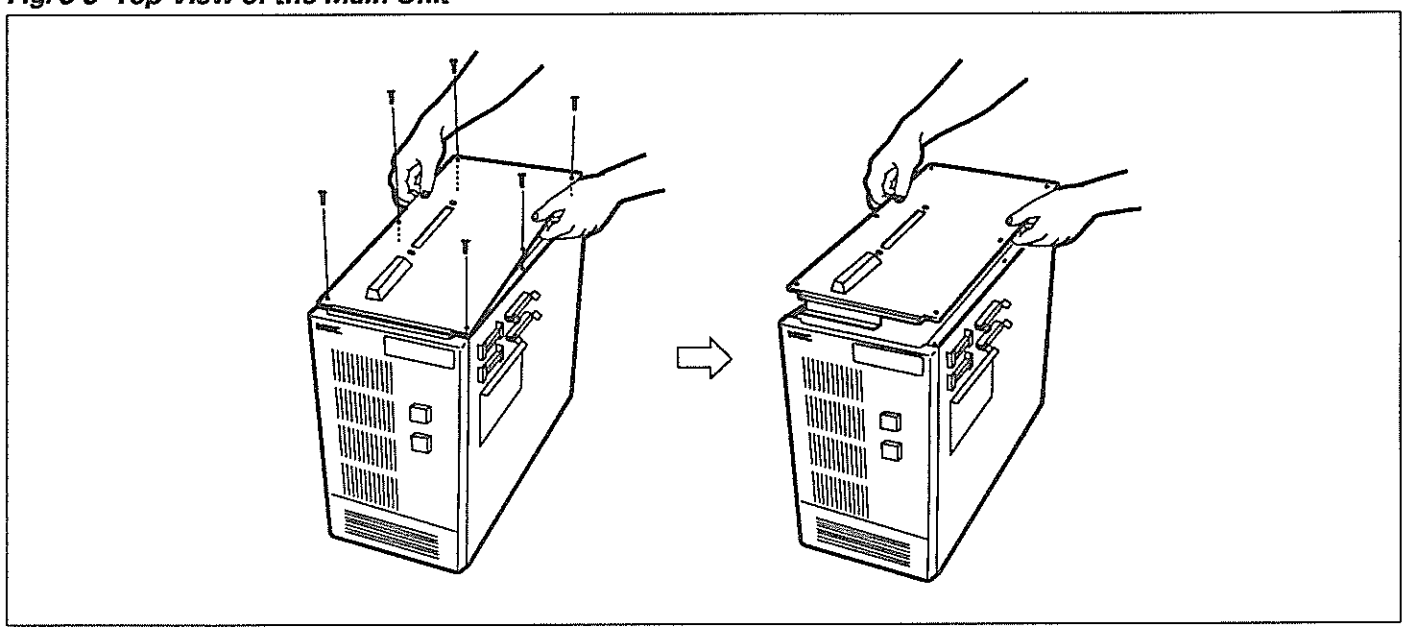
3.2 Mounting the Crystal Oscillator

❑ Procedure

① Turn off the power of the IE-78330-R.

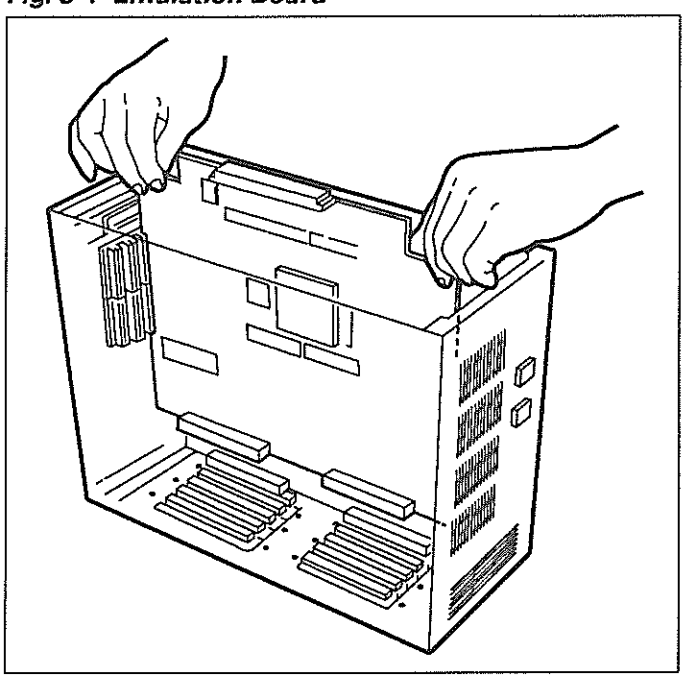
② Remove the six screws from the top of the IE-78330-R and open the cover.

Fig. 3-3 Top View of the Main Unit

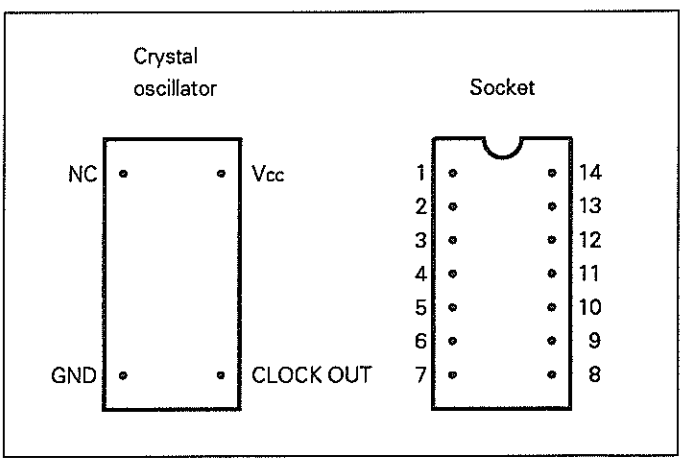


③ Extract the emulation board.

Fig. 3-4 Emulation Board

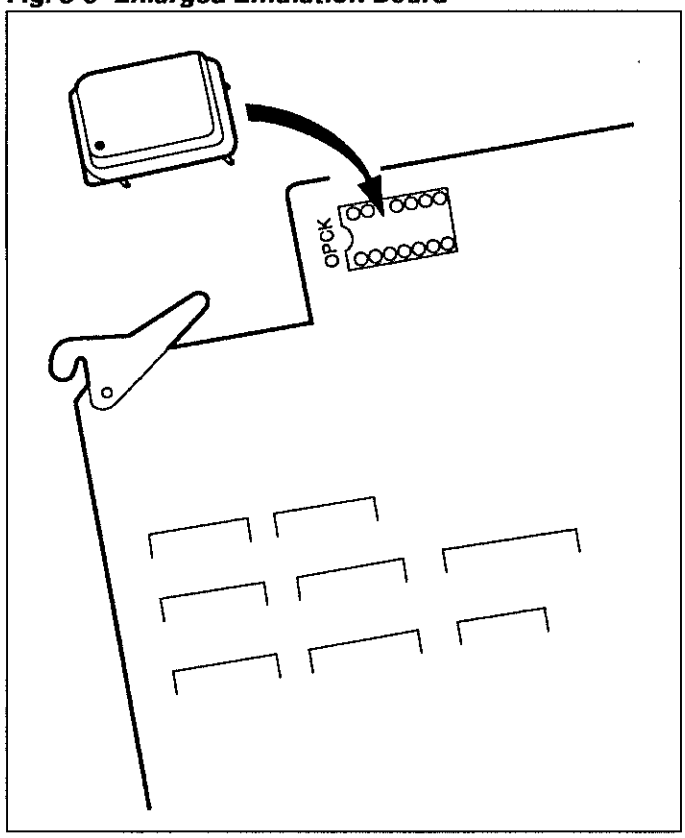


④ Insert the crystal oscillator in the part base socket (OPCK) on the emulation board. Insert the pins of the crystal oscillator into the socket pins as shown in the following figure.



Crystal oscillator pin	Socket pin No.
NC	1
GND	7
CLOCK OUT	8
V_{CC}	14

Fig. 3-5 Enlarged Emulation Board

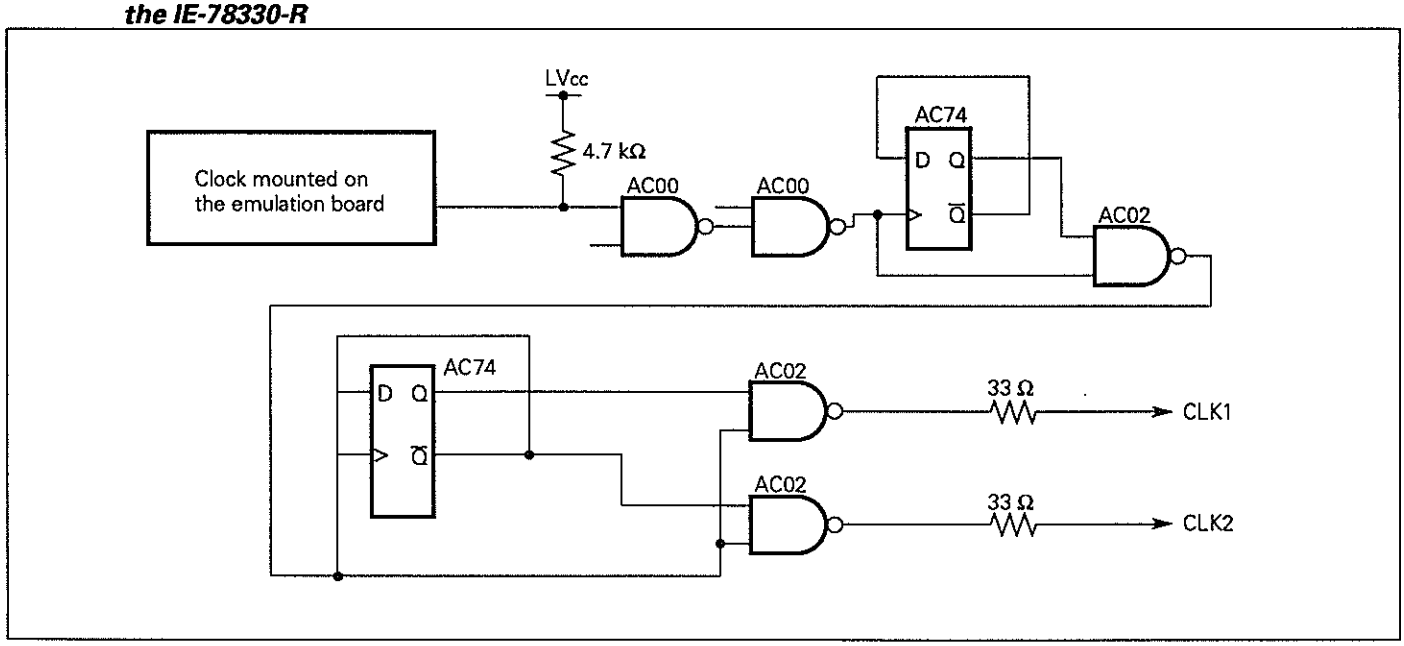


⑤ Install the emulation board in the IE-78330-R.

⑥ Turn on the power of the IE-78330-R.

When CLK U is specified in the CLK command, the following circuit is made, and the crystal oscillator supplies the clock signal to the emulation device in the IE-78330-R.

Fig. 3-6 Diagram of the Clock Generating Circuit of the IE-78330-R



CHAPTER 4 CONNECTING THE EMULATION PROBE

This chapter outlines connection of the emulation probe to the IE-78330-R. For details of the connection, refer to the user's manual for the emulation probe.

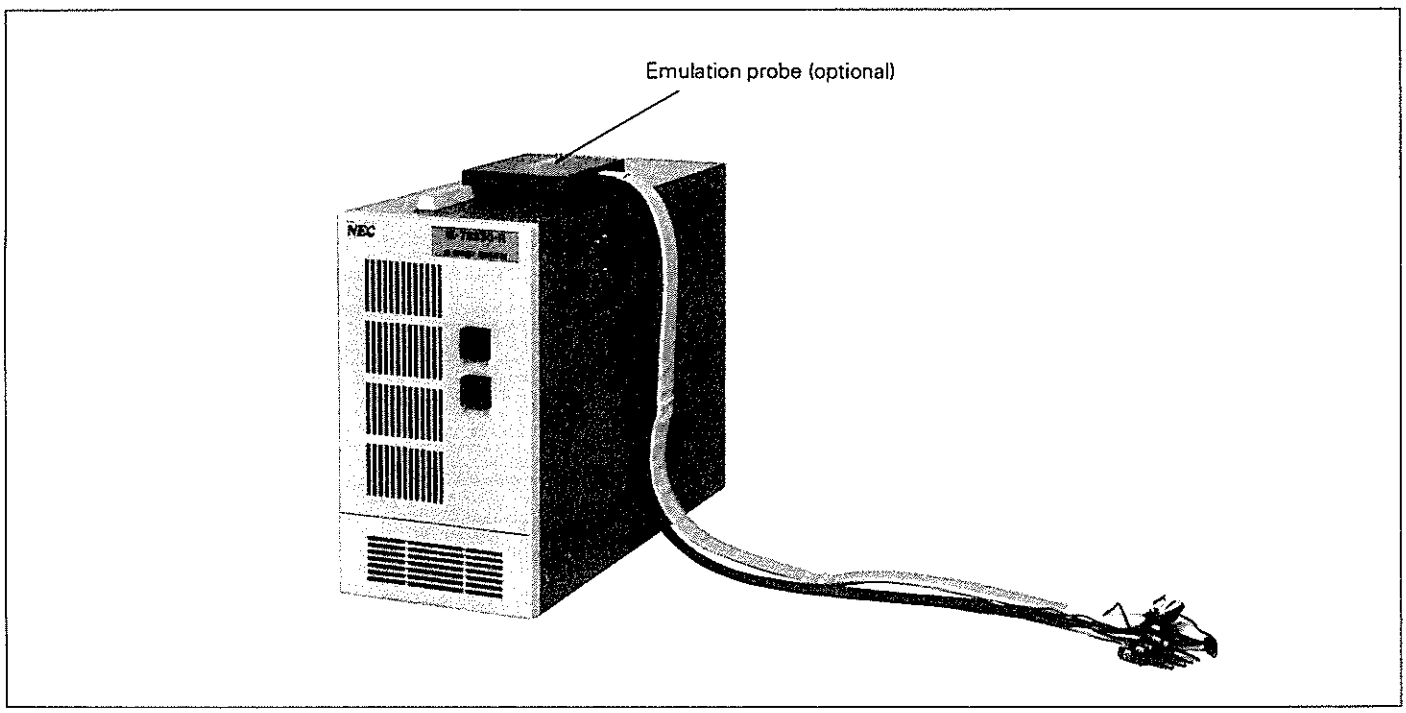
Organization of this chapter

4.1 Ordering Information on the Emulation Probe

The following optional emulation probes are available according to the target devices. Use an emulation probe suited to the package.

Part number
EP-78330GJ-R (For 94-pin QFP)
EP-78330LQ-R (For 84-pin QFJ)

Photo 4-1 Emulation Probes



4.2 Outline of the Connection

[Before connection]

Set the user clock before connecting the emulation probe if required. (See **Chapter 3.**)

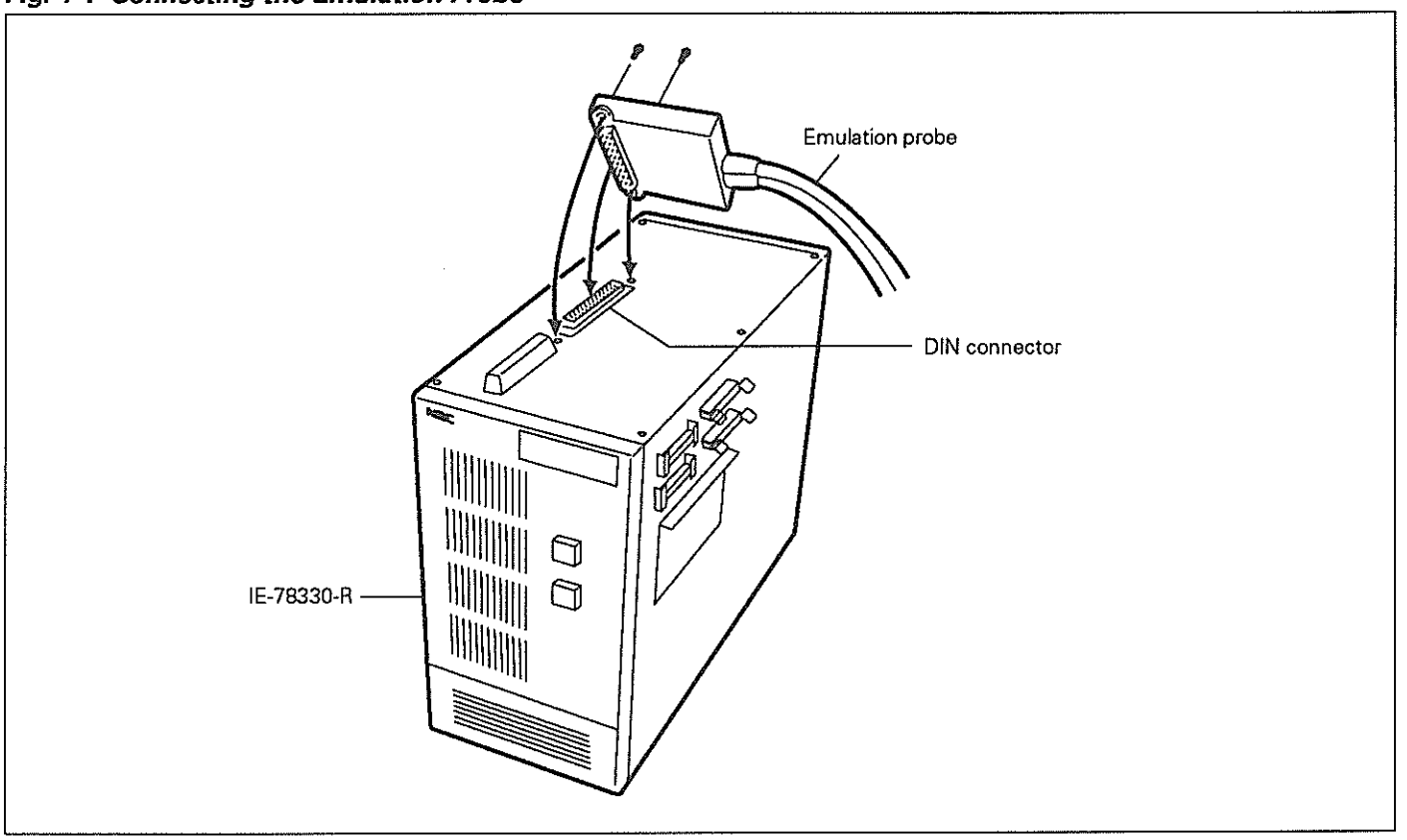
❑ Procedure

Caution For details of the connection of the emulation probe, see Chapter 6. Wrong connection may destroy the IE-78330-R main unit.

① Connect the DIN connector of the emulation probe to that on the top of the IE-78330-R main unit.

② Fasten the emulation probe to the IE-78330-R with the mounting screws.

Fig. 4-1 Connecting the Emulation Probe



CHAPTER 5 CONNECTING PERIPHERAL EQUIPMENT

The IE-78330-R can debug and program the target device after the peripheral equipment has been connected for setting up. This chapter explains how to connect the peripheral equipment to the IE-78330-R and how to set each device. Read this chapter before connecting the peripheral equipment.

For the procedure for setting up, see **Section 1.4.** For details of activating the system, refer to **Chapter 2** in *User's Manual: Software.*

Organization of this chapter

5.1 Peripheral Equipment

The following two types of peripheral equipment can be connected to the IE-78330-R:

- Host machine
- PROM programmer

(1) Host machine

[PC-9800 series]

For the PC-9800 series, the optional IE-78330-R control program can be run under MS-DOS™ to provide a consistent development environment for software development through total evaluation, including the hardware.

[IBM PC/AT™]

For the IBM PC/AT, the optional IE-78330-R control program can be run under PC DOS™ to provide a consistent development environment for software development through total evaluation, including the hardware.

(2) PROM programmer

[PG-1500]

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

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

Use an RS-232-C interface cable available on the market to connect the PG-1500 to the IE-78330-R.

5.2 IE-78330-R Interfaces

The IE-78330-R is connected to peripheral equipment via serial interfaces (channels 1 and 2) and/or parallel interfaces (channels 3 and 4).

(1) Serial interfaces (channels 1 and 2)

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

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

Table 5-1 outlines the functions of channel 1. Table 5-2 outlines the functions of channel 2. For details, see **Chapter 8.**

Table 5-1 Function Outline of Channel 1

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

* H: Switches (Hardware) S: Software

Table 5-2 Function Outline of Channel 2

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

* H: Switches (Hardware) S: Software

(2) Parallel interfaces (channels 3 and 4)

Channel 3 is an output-only channel, and channel 4 is an input-only channel. For details of the functions of channels 3 and 4, see **Chapter 9.**

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

5.3 Connecting a PC-9800 Series Computer

[Outline of connection]

- Turn off the power.
- Set channel 1 of the IE-78330-R.
- Connect the PC-9800 series computer to the IE-78330-R with the cable.
- Turn on the power.

(1) Turning off the power

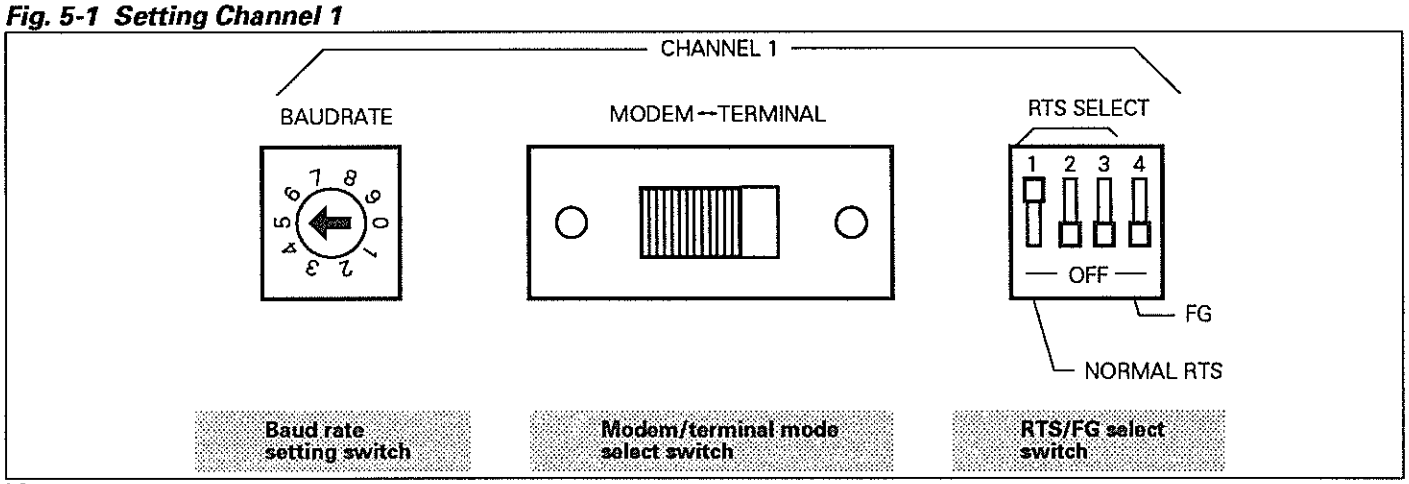
Check whether the power to the IE-78330-R and PC-9800 series computer is off. If the power is on, turn off the power first.

(2) Setting channel 1 of the IE-78330-R

Table 5-3 Setting Channel 1

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

Fig. 5-1 Setting Channel 1



❑ Procedure

① Open the RS-232-C mode switch cover on the right side of the IE-78330-R.

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

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

④ Slide switch 4 of the RTS/FG select switch (CH1) downward (OFF) to put the FG and SG in the open state.

⑤ Set switches 1 to 3 of the RTS/FG select switch (CH1) to set RTS as follows:

1: ON (upward)

2: OFF (downward)

3: OFF (downward)

(3) Connecting the PC-9800 series computer to the IE-78330-R with the cable

❑ Procedure

① Connect the standard RS-232-C channel on the rear of the main unit of the PC-9800 series computer to the CH1 serial interface port above the RS-232-C mode switches of the IE-78330-R with the cable supplied with the IE-78330-R.

② For a parallel interface, connect the printer connector on the rear of the main unit of the PC-9800 series computer to the CH4 parallel interface port of the IE-78330-R with the printer cable for the PC-9800 series.

Table 5-4 Cable Connection

IE-78330-R	Cable to be used	PC-9800 series
CH1	RS-232-C cable	Standard RS-232-C channel
CH4	Printer cable	Printer connector

(4) Turning on the power

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

❑ Procedure

[Power-on sequence]

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

② Turn on the power switch of the IE-78330-R.

[Power-off sequence]

① Turn off the power switch of the IE-78330-R.

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

5.4 Connecting an IBM PC/AT Computer

[Outline of connection]

- Turn off the power.
- Set channel 1 of the IE-78330-R.
- Set the asynchronous communication adapter of the IBM PC/AT computer.
- Connect the IBM PC/AT computer to the IE-78330-R with the cable.
- Turn on the power.

(1) Turning off the power

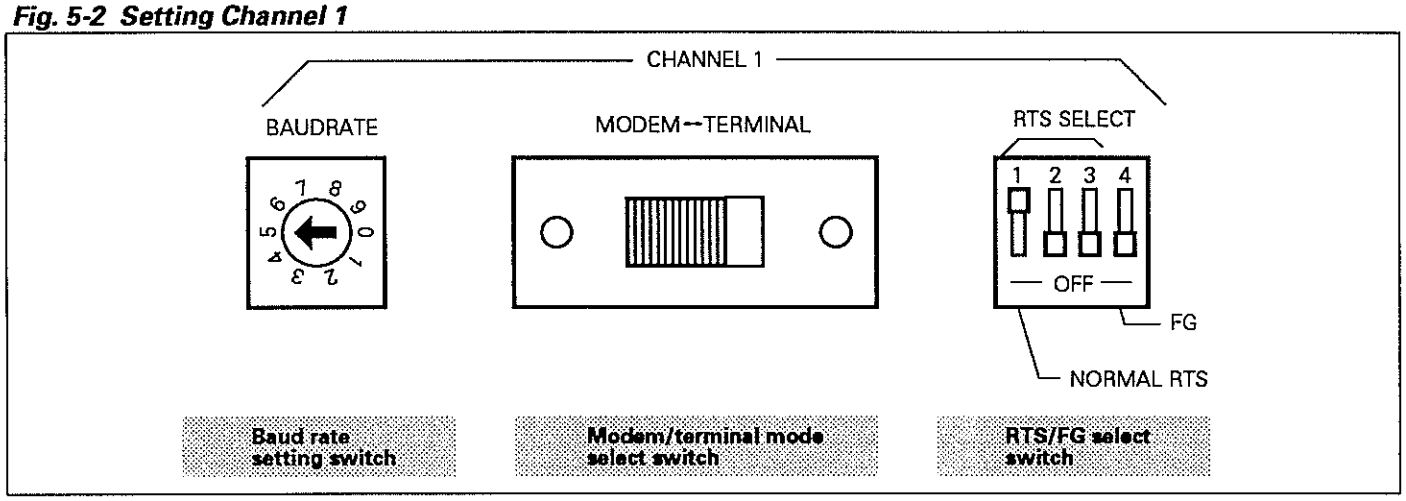
Check whether the power to the IE-78330-R and IBM PC/AT computer is off. If the power is on, turn off the power first.

(2) Setting channel 1 of the IE-78330-R

Table 5-5 Setting Channel 1

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

Fig. 5-2 Setting Channel 1



❑ Procedure

① Open the RS-232-C mode switch cover on the right side of the IE-78330-R.

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

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

④ Slide switch 4 of the RTS/FG select switch (CH1) downward (OFF) to put the FG and SG in the open state.

⑤ Set switches 1 to 3 of the RTS/FG select switch (CH1) to set RTS as follows:

1: ON (upward)

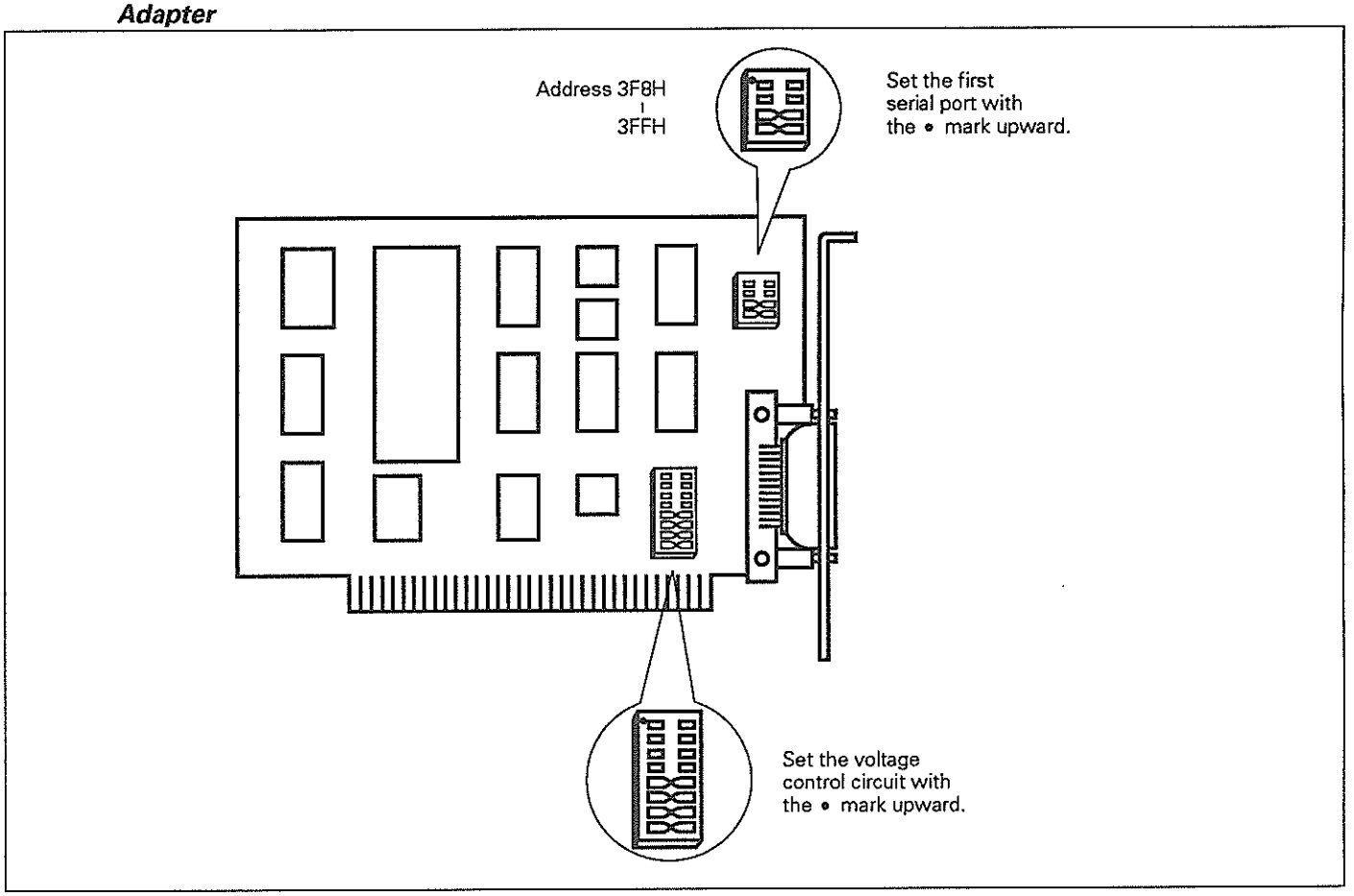
2: OFF (downward)

3: OFF (downward)

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

Set the asynchronous communication adapter in the IBM PC/AT computer as shown in Figure 5-3. The IE-78330-R control program supports only the first serial port (No. 0).

Fig. 5-3 Setting the Asynchronous Communication Adapter

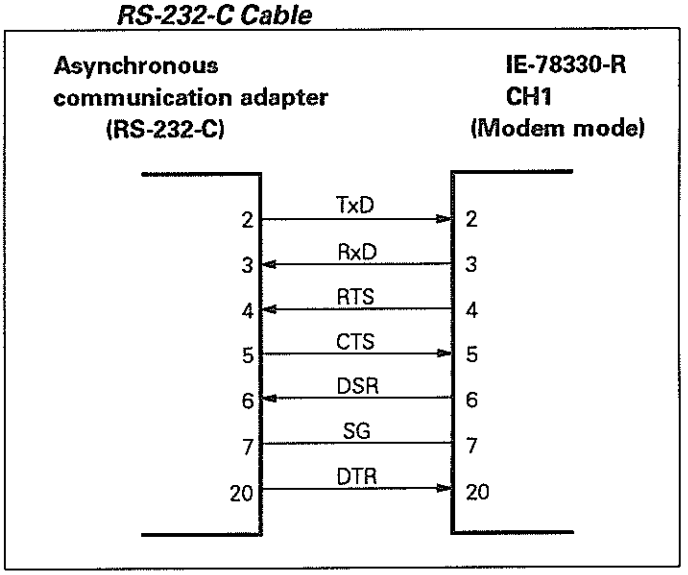


(4) Connecting the IBM PC/AT computer to the IE-78330-R with the cable

❑ Procedure

① Connect the RS-232-C channel of the asynchronous communication adapter, which is an IBM PC/AT option, to the CH1 serial interface port of the IE-78330-R with an RS-232-C cable for the IBM PC/AT.

Fig. 5-4 Connecting the IBM PC/AT Computer with an RS-232-C Cable



② For a parallel interface, connect the printer connector on the rear of the main unit of the IBM PC/AT computer to the CH4 parallel interface port of the IE-78330-R with a printer cable for the IBM PC/AT.

Table 5-6 Cable Connection

IE-78330-R	Cable to be used	IBM PC/AT
CH1	RS-232-C cable	RS-232-C channel of the asynchronous communication adapter
CH4	Printer cable	Printer connector

(5) Turning on the power

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

❑ Procedure

[Power-on sequence]

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

② Turn on the power switch of the IE-78330-R.

[Power-off sequence]

① Turn off the power switch of the IE-78330-R.

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

5.5 Connecting the PG-1500

[Outline of connection]

- Turn off the power.
- Set channel 2 of the IE-78330-R.
- Connect the PG-1500 to the IE-78330-R with the cable.
- Turn on the power to the PG-1500.
- Set the function mode of the PG-1500.
- Turn on the power to the IE-78330-R.

(1) Turning off the power

Check whether the power to the IE-78330-R and PG-1500 is off. If the power is on, turn off the power first.

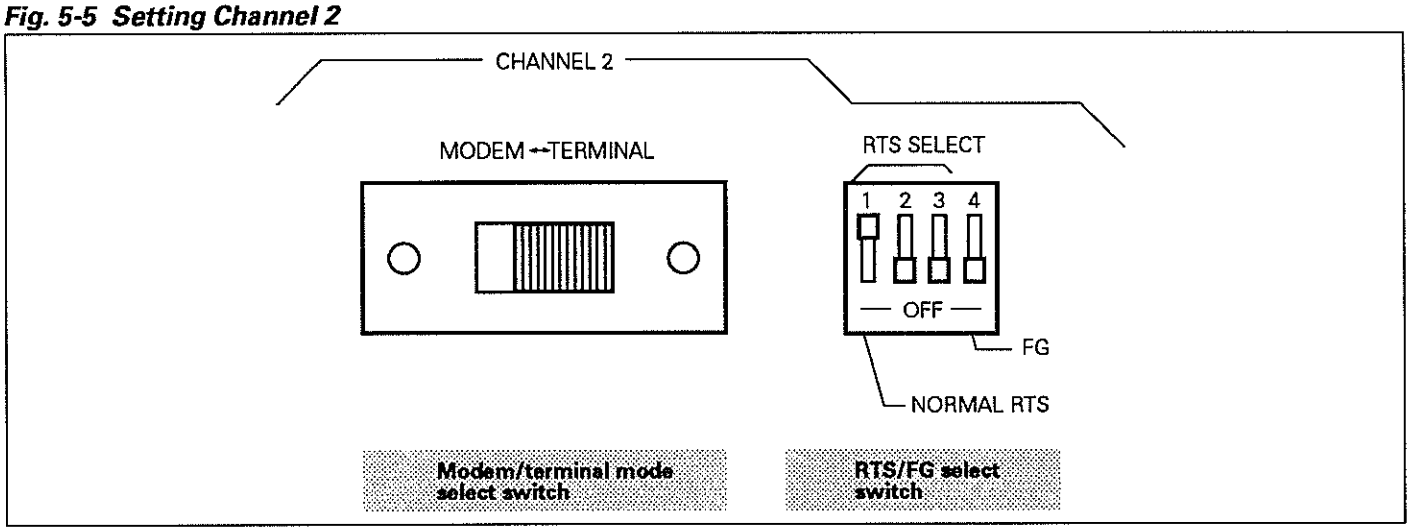
(2) Setting channel 2 of the IE-78330-R

Some settings of channel 2 of the IE-78330-R are set by RS-232-C mode switches on the main unit when the power is off. Some settings are set by executing the MOD command when the IE-78330-R is active. The following shows setting by the RS-232-C mode switches on the main unit.

Table 5-7 Setting Channel 2

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

Fig. 5-5 Setting Channel 2



❑ Procedure

① Open the RS-232-C mode switch cover on the right side of the IE-78330-R main unit.

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

③ Slide switch 4 of the RTS/FG select switch (CH2) downward (OFF) to put the FG and SG in the open state.

④ Set switches 1 to 3 of the RTS/FG select switch (CH2) to set RTS as follows:

1: ON (upward)

2: OFF (downward)

3: OFF (downward)

Remark Setting channel 2 by the MOD command

Use the MOD command to set the handshaking, baud rate, and character specifications of channel 2. For details, refer to **Section 8.27** in *User's Manual: Software.*

Table 5-8 Setting Channel 2 by the MOD Command

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

(3) Connecting the PG-1500 to the IE-78330-R with the cable

Connect the serial interface connector at the right on the PG-1500 rear panel to the CH2 serial interface port of the IE-78330-R. Use an RS-232-C interface cable available on the market for connection.

Table 5-9 Cable Connection

IE-78330-R	Cable to be used	PG-1500
CH2	RS-232-C interface cable available on the market	Serial interface connector

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

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

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

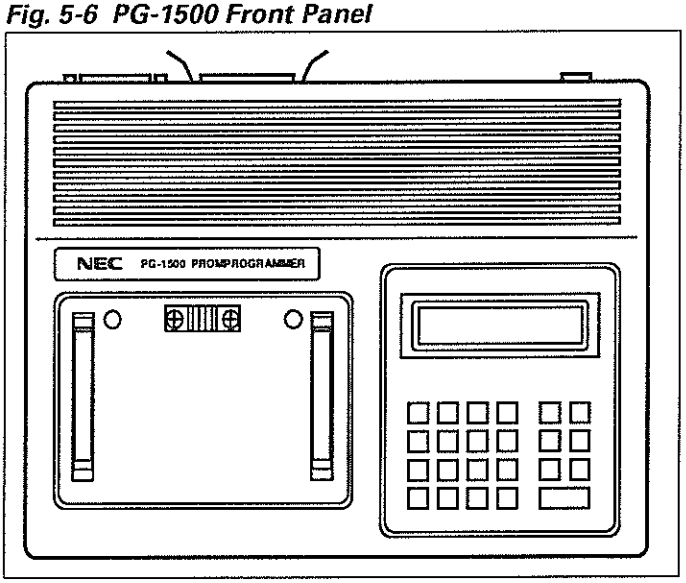
Set the PG-1500 with the key switches on the front panel. For details, refer to *PG-1500 User's Manual.*

Table 5-10 Setting the PG-1500

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

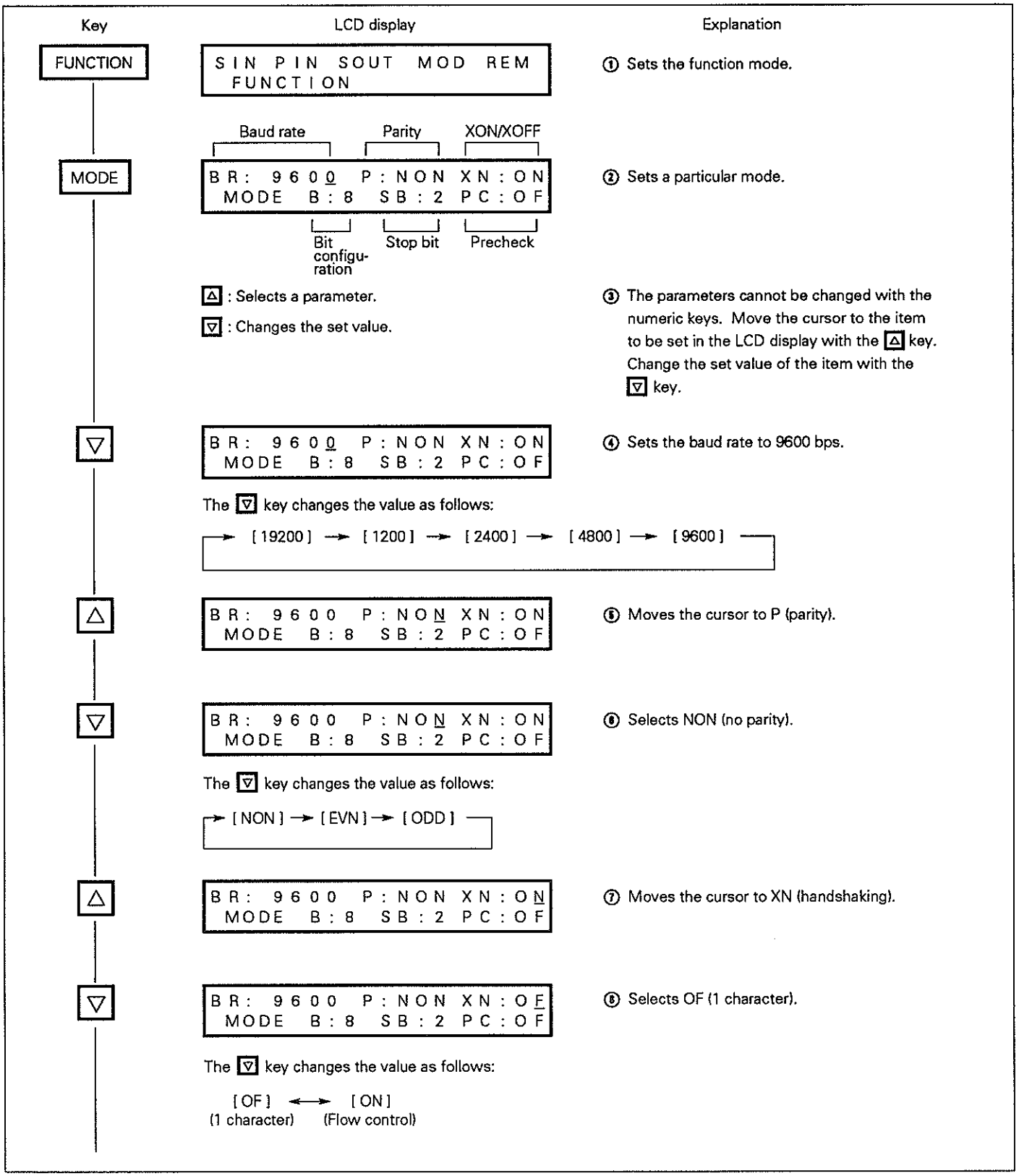
* Function which prechecks if the device is correctly installed. Effective only when the general-purpose PROM is used.

Fig. 5-6 PG-1500 Front Panel

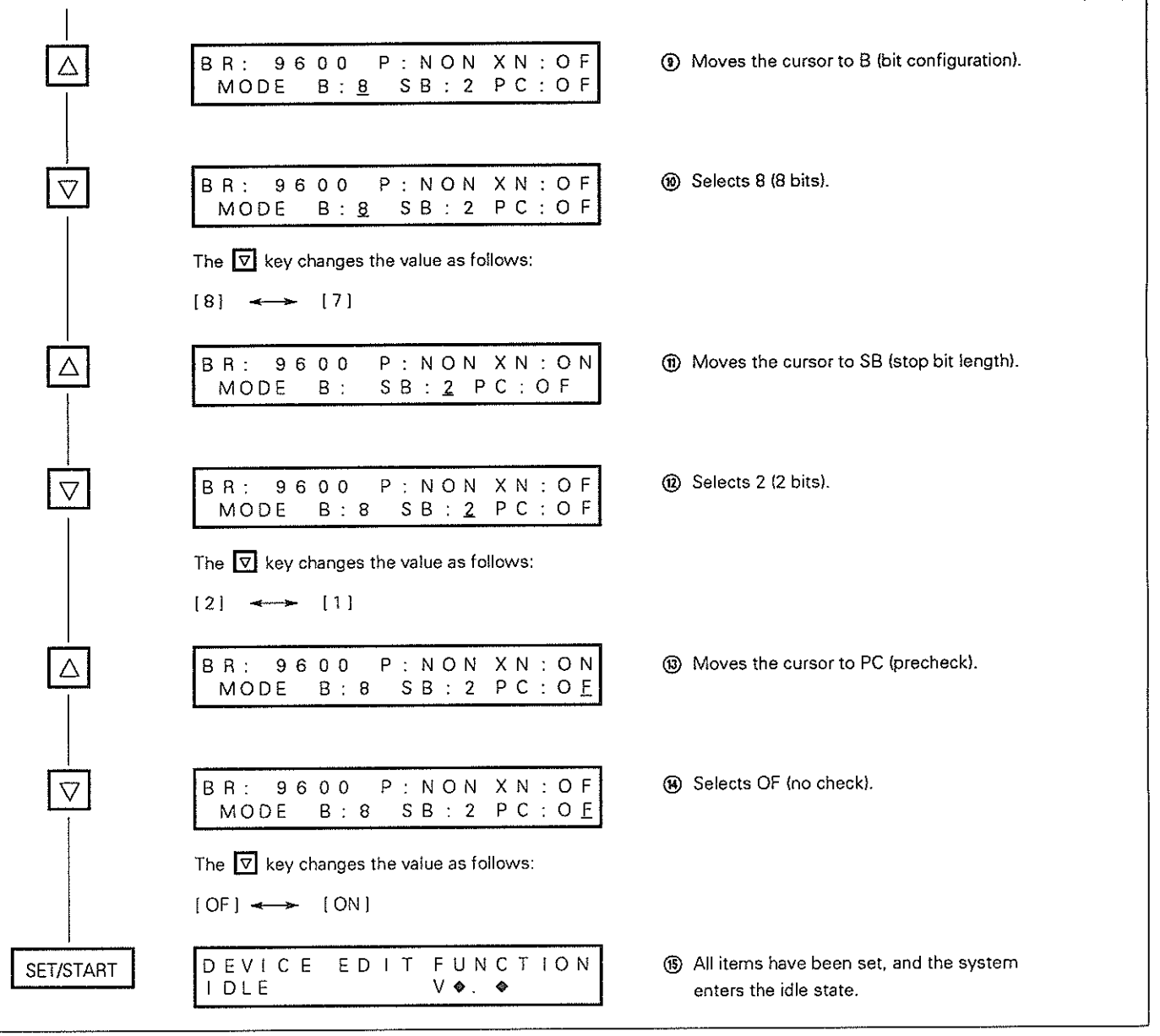


5

❑ Procedure


Key
LCD display
Explanation
FUNCTION
SIN PIN SOUT MOD REM
FUNCTION
① Sets the function mode.
Baud rate
Parity
XON/XOFF
MODE
BR: 9600 P:NON XN:ON
MODE B:8 SB:2 PC:OF
② Sets a particular mode.
Bit configu-ration
Stop bit
Precheck
△ : Selects a parameter.
▽ : Changes the set value.
③ The parameters cannot be changed with the numeric keys. Move the cursor to the item to be set in the LCD display with the △ key. Change the set value of the item with the ▽ key.
▽
BR: 9600 P:NON XN:ON
MODE B:8 SB:2 PC:OF
④ Sets the baud rate to 9600 bps.
The ▽ key changes the value as follows:
[19200] → [1200] → [2400] → [4800] → [9600]
△
BR: 9600 P:NON XN:ON
MODE B:8 SB:2 PC:OF
⑤ Moves the cursor to P (parity).
▽
BR: 9600 P:NON XN:ON
MODE B:8 SB:2 PC:OF
⑥ Selects NON (no parity).
The ▽ key changes the value as follows:
[NON] → [EVN] → [ODD]
△
BR: 9600 P:NON XN:ON
MODE B:8 SB:2 PC:OF
⑦ Moves the cursor to XN (handshaking).
▽
BR: 9600 P:NON XN:OF
MODE B:8 SB:2 PC:OF
⑧ Selects OF (1 character).
The ▽ key changes the value as follows:
[OF] ↔ [ON]
(1 character) (Flow control)

(cont)



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

(6) Turning on the power to the IE-78330-R

Turn on the power switch on the front of the IE-78330-R main unit.

Remark Ordinary power-on and power-off sequences are shown below.

[Power-on sequence]

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

② Press the RESET key then the SERIAL(B) key on the PG-1500 front panel.

③ Turn on the power switch of the IE-78330-R.

[Power-off sequence]

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

② Turn off the power switch of the IE-78330-R.

CHAPTER 6 CONNECTING THE TARGET SYSTEM

This chapter explains how to connect the target system using the target device to the emulation probe connected to the IE-78330-R. It also explains the handling of latch-up. Be sure to read this chapter before connecting the target system.

Organization of this chapter

6.1 Connecting the Target System

[Before connection]

<When the user clock is to be set>

See **Chapter 3.**

<When the emulation probe has not been connected>

See **Chapter 4.**

[Outline of connection]

- Connect the target system to the emulation probe.
- Connect the target system to the external sense clips.

(1) Connecting the target system to the emulation probe

The following outlines how to connect the target system to the emulation probe.

❒ Procedure

① Connect the ground clip of the emulation probe to GND (signal ground) in the CPU socket of the target system. If the ground clip is not connected, the IE-78330-R may be destroyed by static electricity.

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

Fig. 6-1 Connecting the Target System to the EP-78330GJ-R

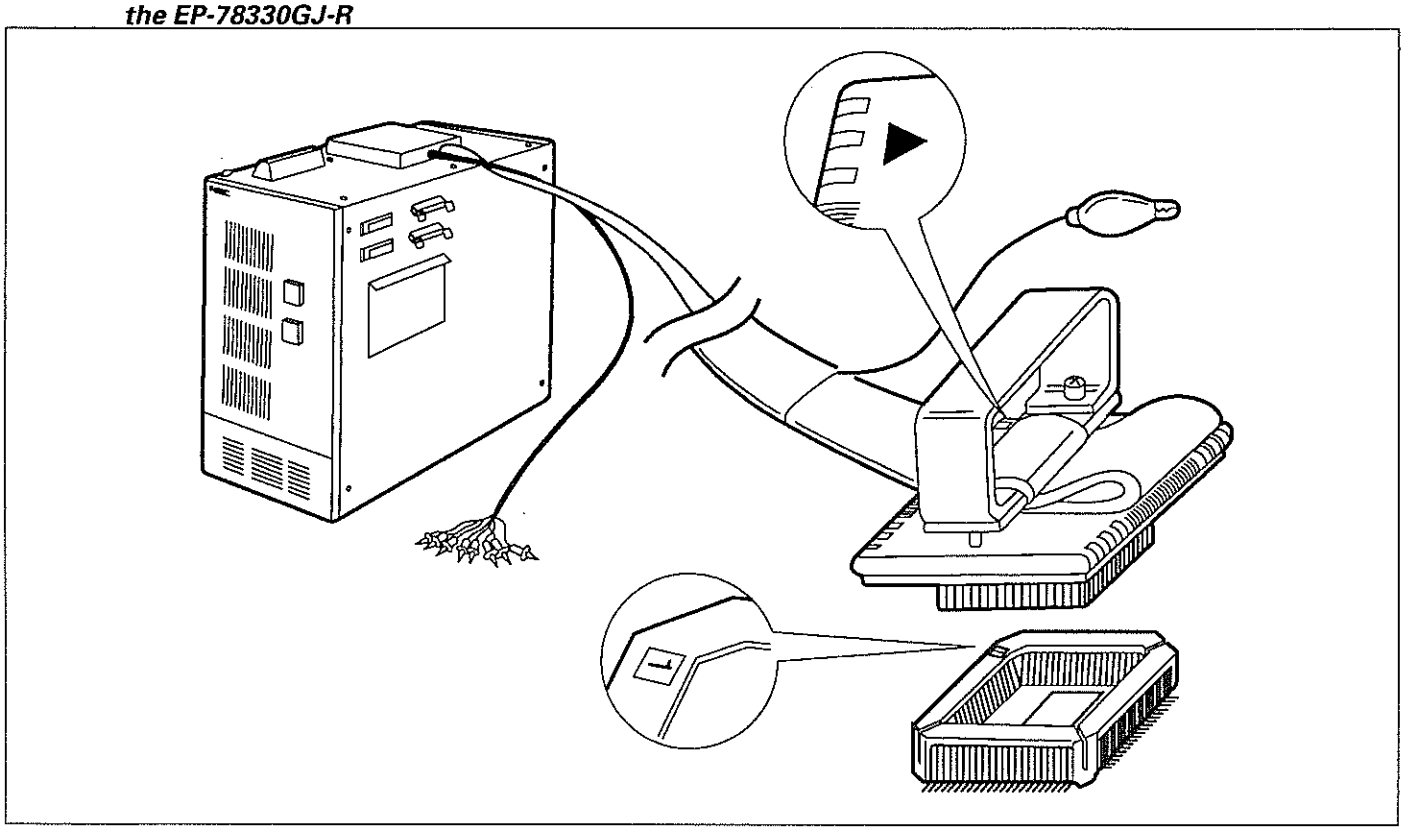
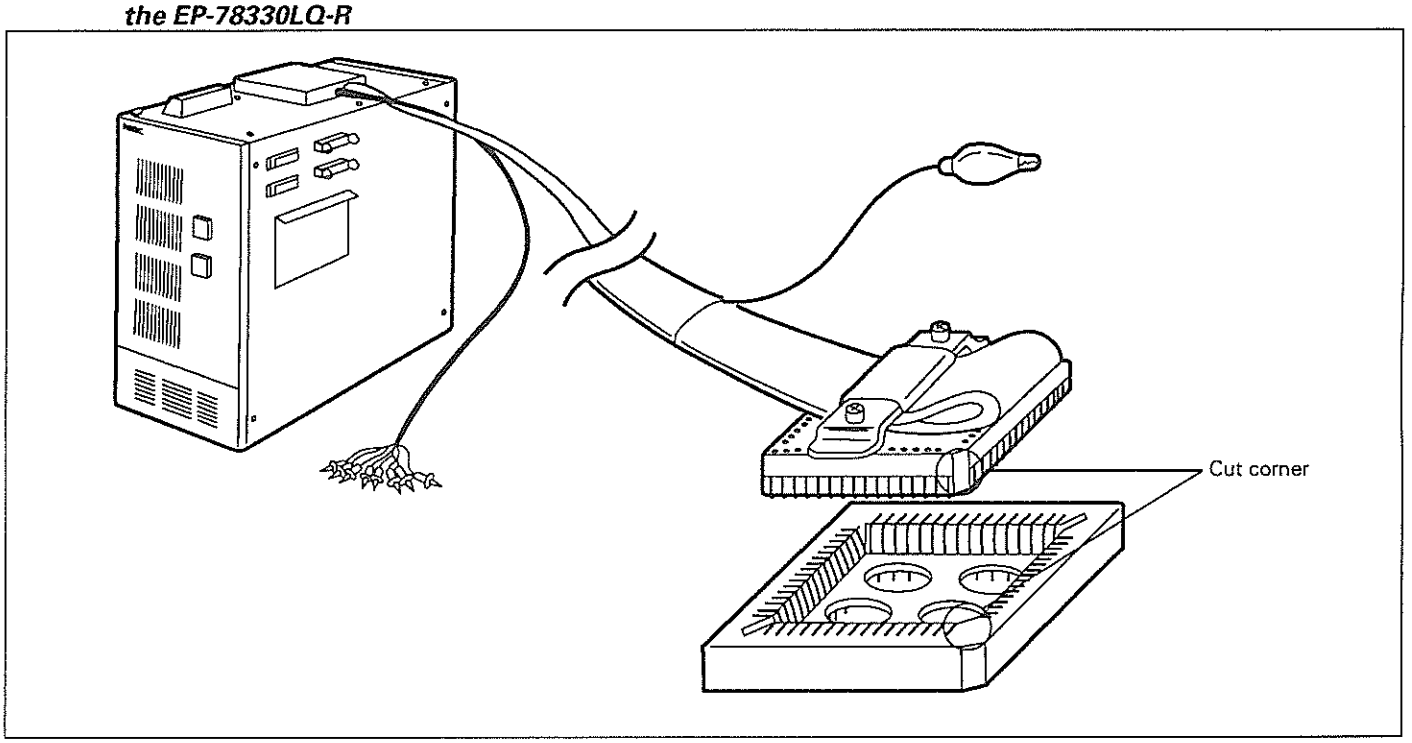


Fig. 6-2 Connecting the Target System to the EP-78330LQ-R



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

The IE-78330-R can trace the bus cycle of the target device in real time. It can also trace any eight signal lines in real time using the external sense function. Eight external sense clips are provided for the eight signal lines.

Cautions

1. **Connect the external sense clips only to the signal lines compatible with the TTL. If a sense clip is connected to another signal line, the IE-78330-R cannot correctly detect the high or low level of the signal. This may destroy the sensor of the IE-78330-R main unit, depending on the voltage level.**
2. **The eight external sense clips are generally input signal lines. The signal line of external sense clip 1, however, can be used as an external trigger output signal line for an event according to the specification in the OUT command. (For details, see the description of the OUT command.) Do not connect the signal line of external clip 1 to be used as an output signal line to any output signal line.**
3. **Use an IC clip for connecting the external sense clips.**

❒ Procedure

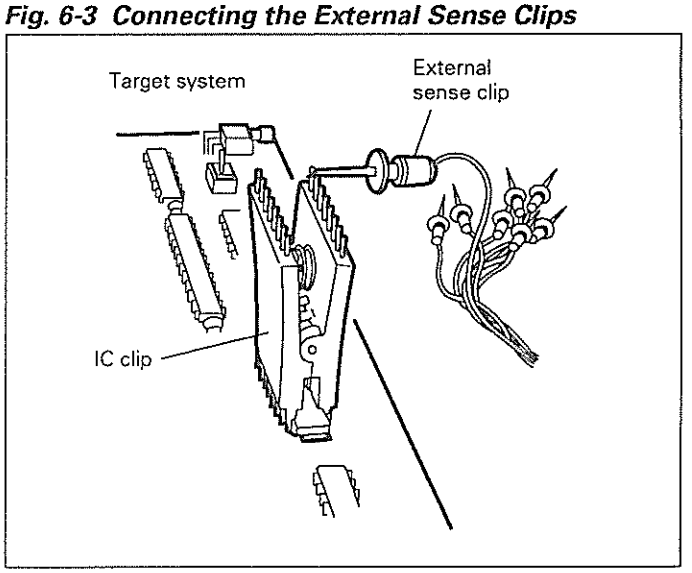
① Turn off the power to the IE-78330-R.

② Turn off the power to the target system.

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

④ Connect the external sense clips to the IC clip.

Fig. 6-3 Connecting the External Sense Clips



6.2 Power-on/Power-off Sequence

Turn on and off the power in the following sequence after connecting the target system. For details of the activation and termination of the IE-78330-R, refer to User's Manual: Software.

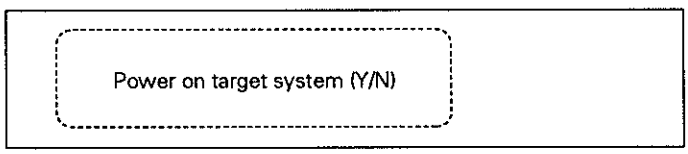
Caution Turn on and off the power in the correct sequence, otherwise the IE-78330-R may operate abnormally or may be destroyed.

❒ Procedure

[Power-on sequence]

① Turn on the power to the IE-78330-R.

② The following message appears.



③ Turn on the power to the target system.

④ Enter Y.

[Power-off sequence]

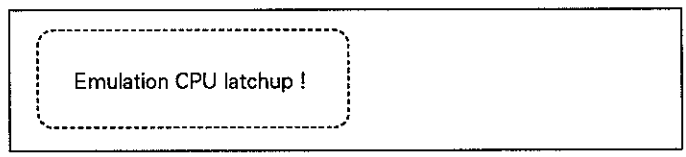
① Turn off the power to the target system.

② Turn off the power to the IE-78330-R.

6.3 Handling Latch-up

If latch-up occurs in the emulation device or neighboring CMOS in the IE-78330-R, turn off the power immediately.

- The IE-78330-R detects latch-up, and the power to the following devices is automatically turned off.
  - Emulation device
  - Neighboring CMOSs
  - Other CMOSs
- The latch-up warning circuit in the IE-78330-R operates, and the following message appears on the terminal (display).



- Turn off the power to the target system.
- Turn off the power to the IE-78330-R.

CHAPTER 7 TARGET INTERFACE CIRCUIT.

The target interface circuit allows the IE-78330-R to behave like the target device and consists of the emulation device and the gates such as CMOS and TTL.

If debugging is performed after the target system is connected to the IE-78330-R, the target interface circuit of the IE-78330-R is used to emulate the target device as if it operated in the target system.

The target device such as μPD78330, μPD78334, or μPD78P334 consists of a CMOS circuit. The emulation device in the target interface circuit also consists of a CMOS circuit. The AC and DC characteristics of the emulation device are therefore almost the same as those of the target device.

If the signals of the emulation device are input and output through gates in the target interface circuit, however, the emulation device differs in AC and DC characteristics from the target device.

For AC characteristics, in particular, the gate delay time in which each gate differs is taken whenever a signal passes through a gate.

Take the above precaution when designing the target system.

Organization of this chapter

7.1 Circuit That Inputs Signals from and Outputs Them to the Emulation Device Directly or through Resistors

This circuit serves as the interface of 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 7
- Signals related to Port 8
- Signals related to Port 9
- A/D converter related signals

Fig. 7-1 Diagram of a Circuit Equivalent to the Port Emulation Circuit (1)

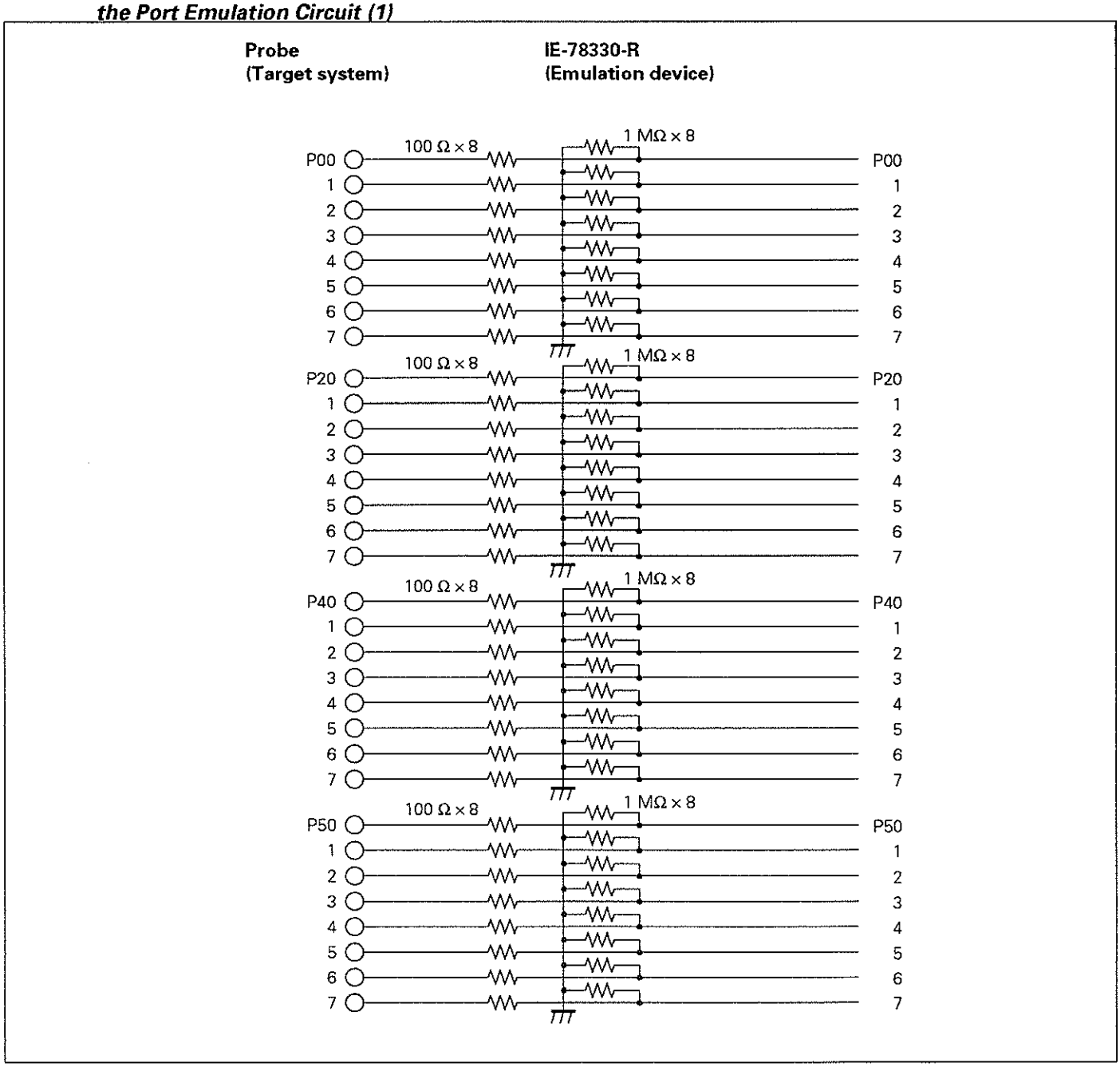
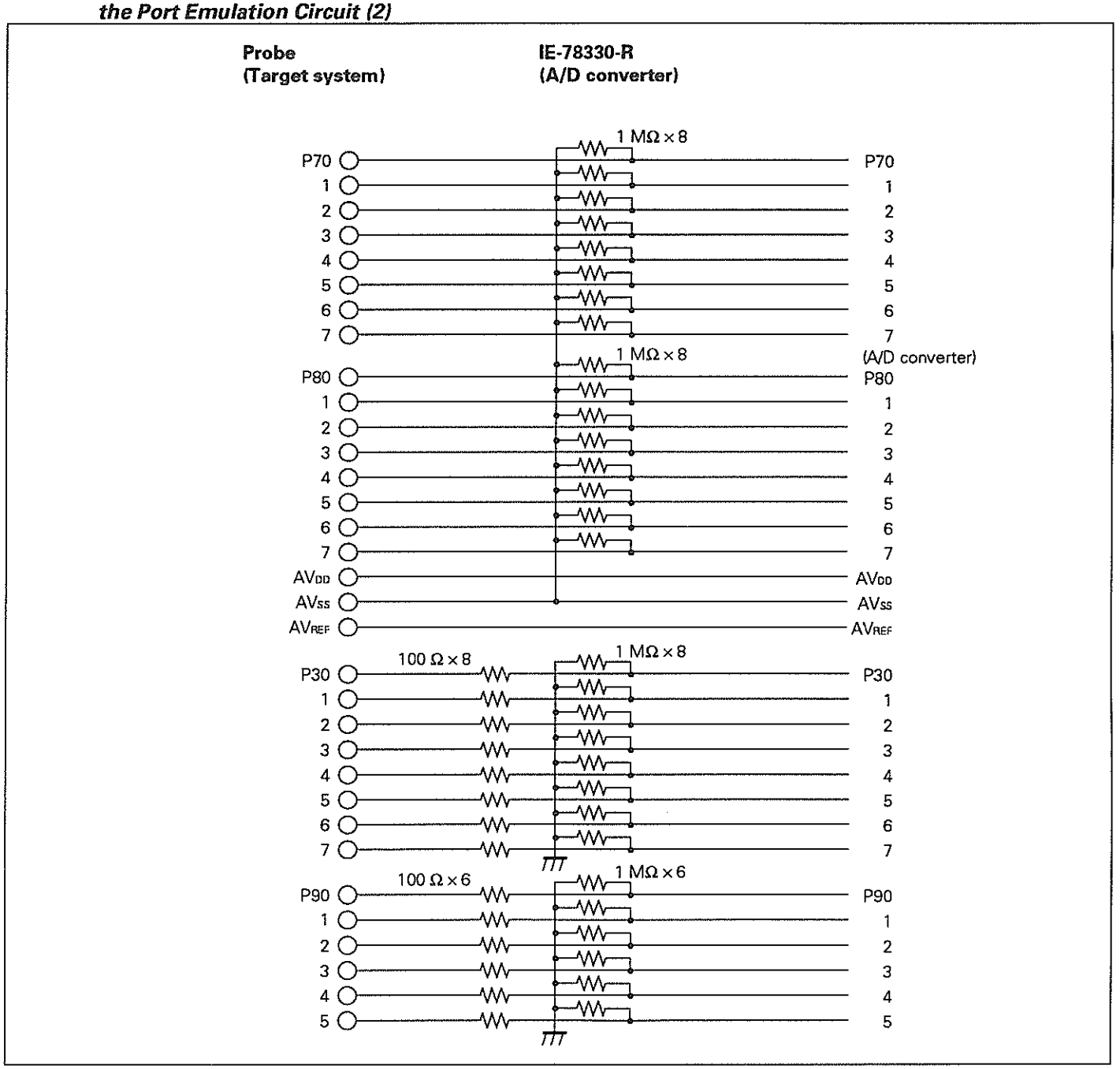


Fig. 7-2 Diagram of a Circuit Equivalent to the Port Emulation Circuit (2)

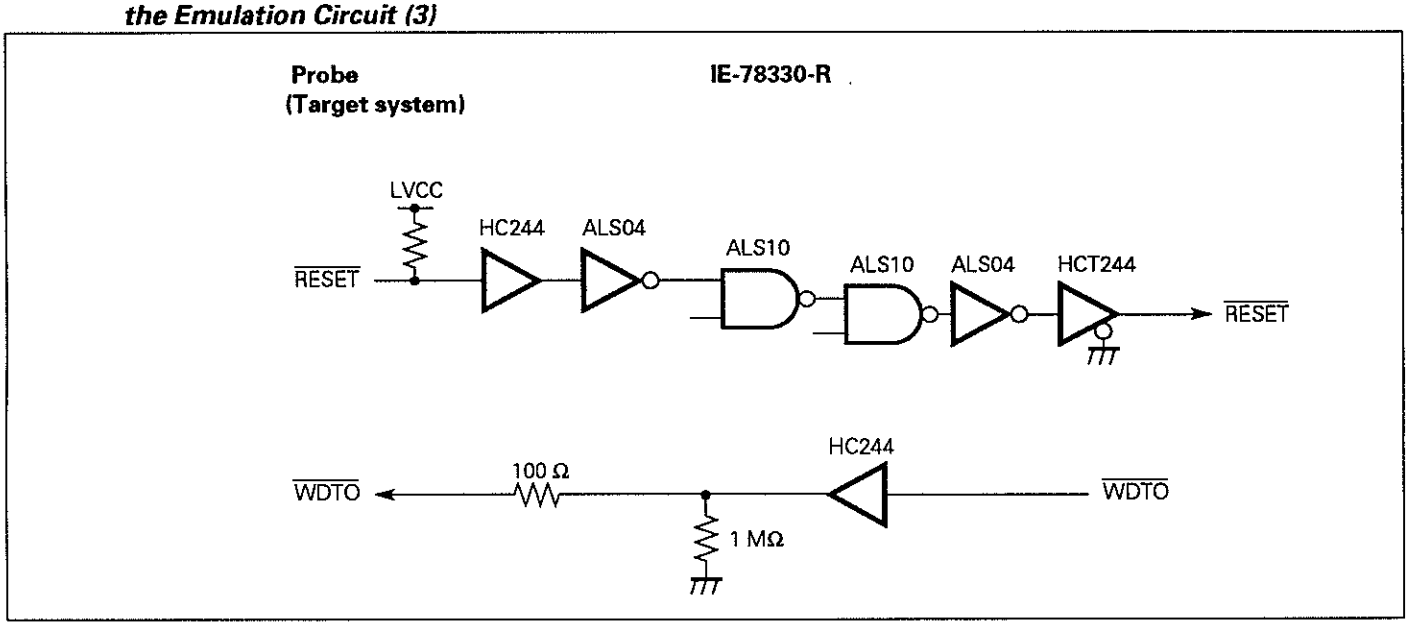


7.2 Circuit That Inputs Signals from and Outputs Them to the Emulation Device through Gates

This circuit serves as the interface of the following signals:

- $\overline{\text{RESET}}$ signal
- $\overline{\text{WDTO}}$ signal

Fig. 7-3 Diagram of a Circuit Equivalent to the Emulation Circuit (3)



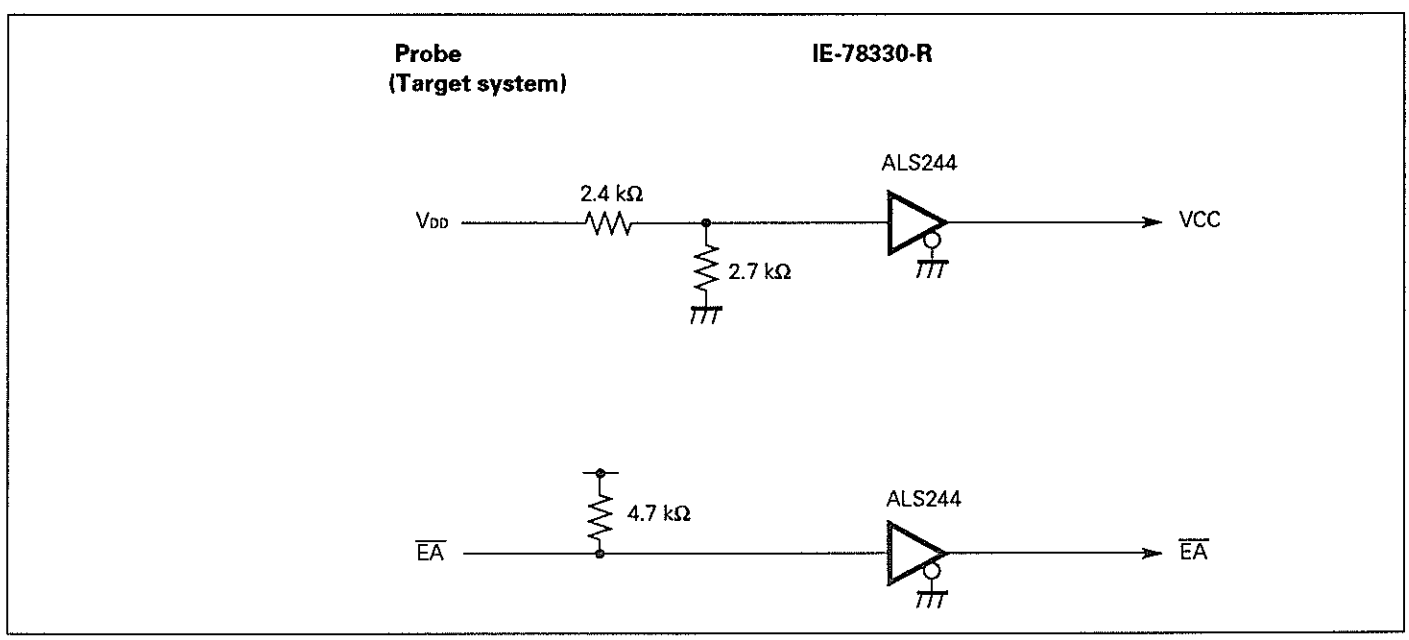
7.3 Circuit That Inputs Signals to the Control/ Trace Module

This circuit serves as the interface of the following signals:

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

Note The V_{CC} signal detects the state of supplying power to the target system (voltage V_{DD}), but does not supply power to the emulation device. The power is supplied from the power supply of the IE-78330-R to the emulation device.

Fig. 7-4 Diagram of a Circuit Equivalent to the Emulation Circuit (4)



CHAPTER 8 FUNCTIONS OF CHANNELS 1 AND 2

This chapter details the functions of channels 1 and 2 of the IE-78330-R. To help the user understand the functions of channels 1 and 2, this chapter begins with the terminal mode and modem mode, which are often discussed when the RS-232-C interface is used.

Without reading this chapter, the user can operate the IE-78330-R correctly by making a connection with the host machine or PROM programmer according to **Chapter 5**. Read this chapter when detailed information about channels 1 and 2 is required.

Organization of this chapter

8.1 Terminal Mode and Modem Mode

Channels 1 and 2 are the serial interfaces used with the IE-78330-R and are based on RS-232-C. The RS-232-C interface is originally used to connect a terminal with a modem.

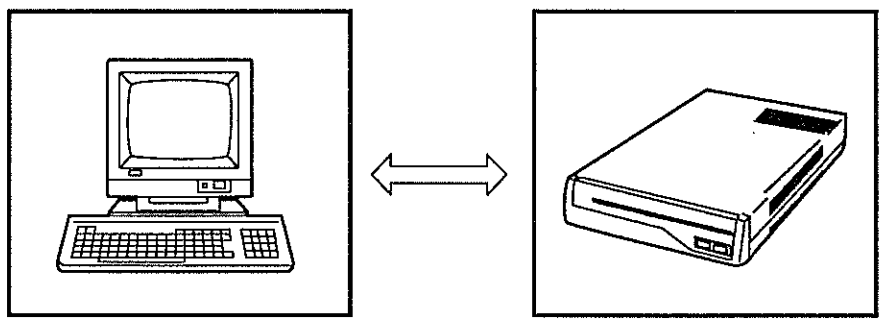
The IE-78330-R has two modes: the terminal mode and modem mode. A terminal is clearly different from a modem. So the question may arise whether the IE-78330-R can really have the two modes. According to two topics, this section explains the terminal mode and modem mode often discussed with the RS-232-C interface. These topics are:

- What are the terminal mode and modem mode?
- RS-232-C connection

(1) What are the terminal mode and modem mode?

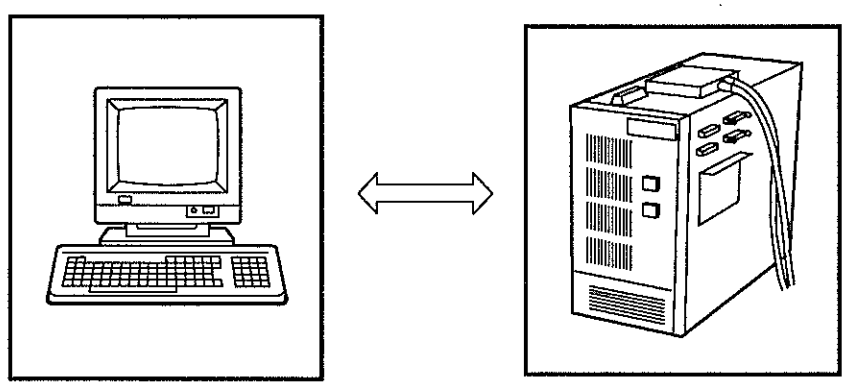
The RS-232-C interface is increasingly used for connection between a terminal and microcomputer-based device and between microcomputer-based devices, as well as for connection between a terminal and modem.

Example 1: Connection between a terminal and modem



Terminal **Modem**

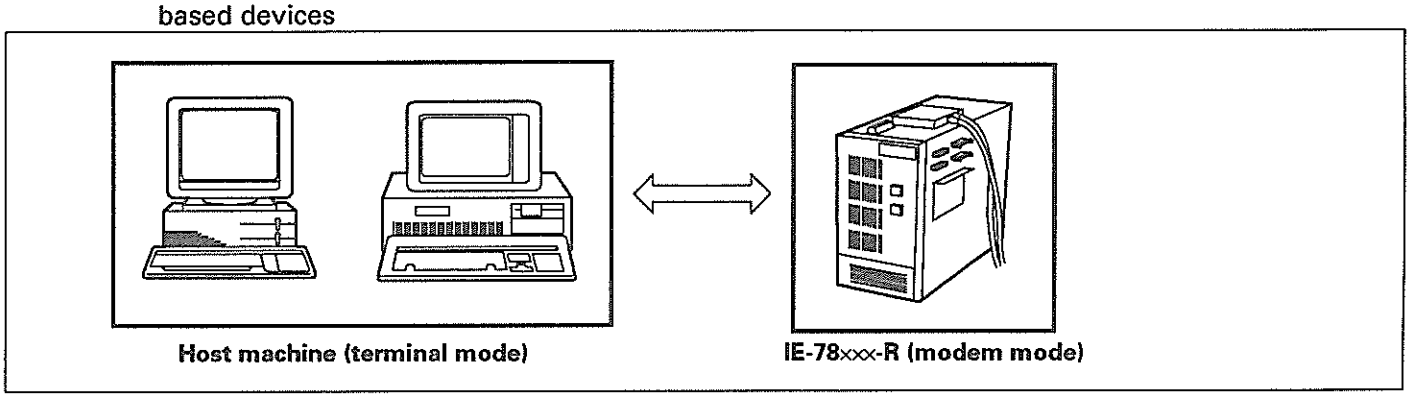
Example 2: Connection between a terminal and microcomputer-based device



Terminal **IE-78×××-R (modem mode)**

Caution The IE-78330-R cannot be connected with a terminal.

Example 3: Connection between microcomputer-based devices



In example 2, the IE-78×××-R (containing a microcomputer) functions as a modem. In this case, the IE-78×××-R is set to the modem mode. In example 3, the host machine (containing a microcomputer) functions as a terminal. In this case, the host machine is set to the terminal mode.

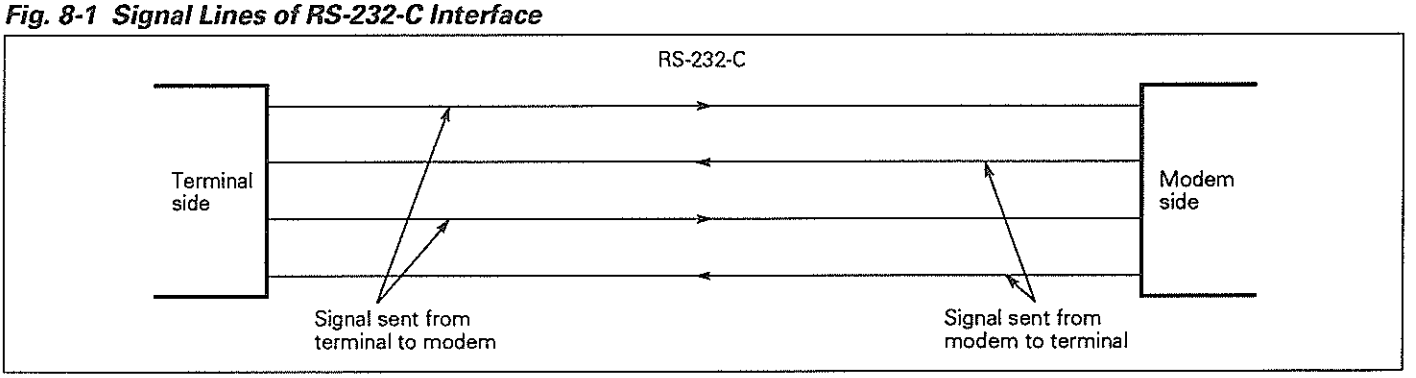
Thus when RS-232-C is used to connect microcomputer-based devices, a device on the terminal side is set to the terminal mode, and a device on the modem side is set to the modem mode according to the original concept of RS-232-C for connection between a terminal and modem. That is, a microcomputer-based device usually has the terminal mode and modem mode, and the user can switch between the two modes.

(2) RS-232-C connection

Each signal line of the RS-232-C interface allows only one-way transmission. As shown Figure 8-1, each signal line has the direction from terminal to modem or from modem to terminal. In addition, a signal line for one direction is paired with another line for the other direction. Thus, the mode can be easily switched between the terminal mode and modem mode.

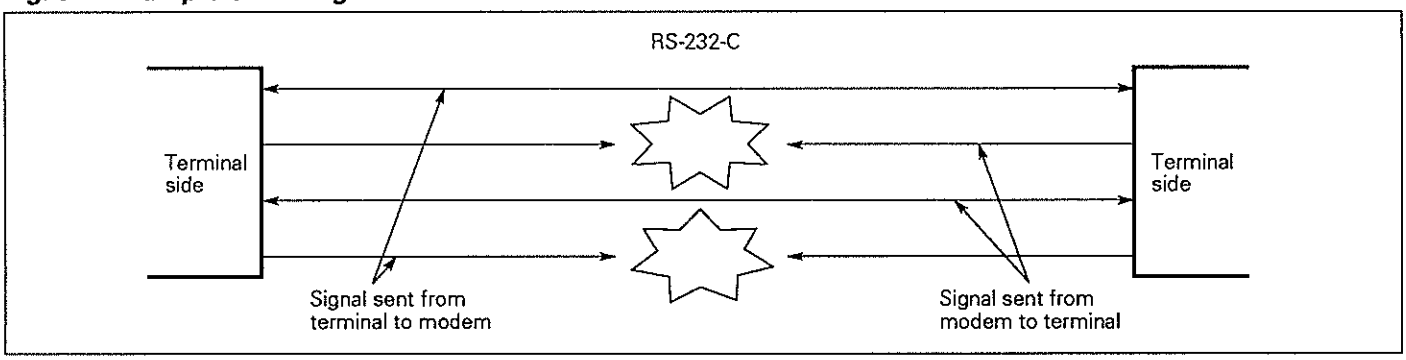
8

Fig. 8-1 Signal Lines of RS-232-C Interface



In example 3 of (1) above, the host machine is set to the terminal mode, and the IE-78×××-R is set to the modem mode. Let us see what happens if the IE-78330-R is set to the terminal mode by mistake. See Figure 8-2.

Fig. 8-2 Example of Wrong Connection



The signals from the terminal collide with the signals from the modem. This causes abnormal operation and destroys the interface driver of one side. The same trouble occurs when both devices are set to the modem mode.

So in RS-232-C connection, the following must be observed:

- Be sure to connect a device set to the terminal mode with a device set to the modem mode.
- Never connect a device set to a mode with another device set to the same mode.

8.2 Signal Lines and Circuit Diagram of RS-232-C Interface

The RS-232-C interface (channels 1 and 2) of the IE-78330-R transfers data with four signal lines and eight types of signals as shown below.

Table 8-1 RS-232-C Signal Lines

(1) Ground

Signal name	Symbol	Function	Pin number
Frame Ground	FG	Ground for safety	1
Signal Ground	SG	Ground for signal	7

(2) Data

Signal name	Symbol	Function	Direction*1 M	Direction*1 T	Pin number
Transmitted Data	TxD	Transmits data from terminal to modem.	←		2
Received data	RxD	Transmits data from modem to terminal.		→	3

(3) Static handshake

Signal name	Symbol	Function	Direction*1 M	Direction*1 T	Pin number
Data Set Ready	DSR	Reports modem ready state.		→	6
Data Terminal Ready	DTR	Reports terminal ready state.	←		20

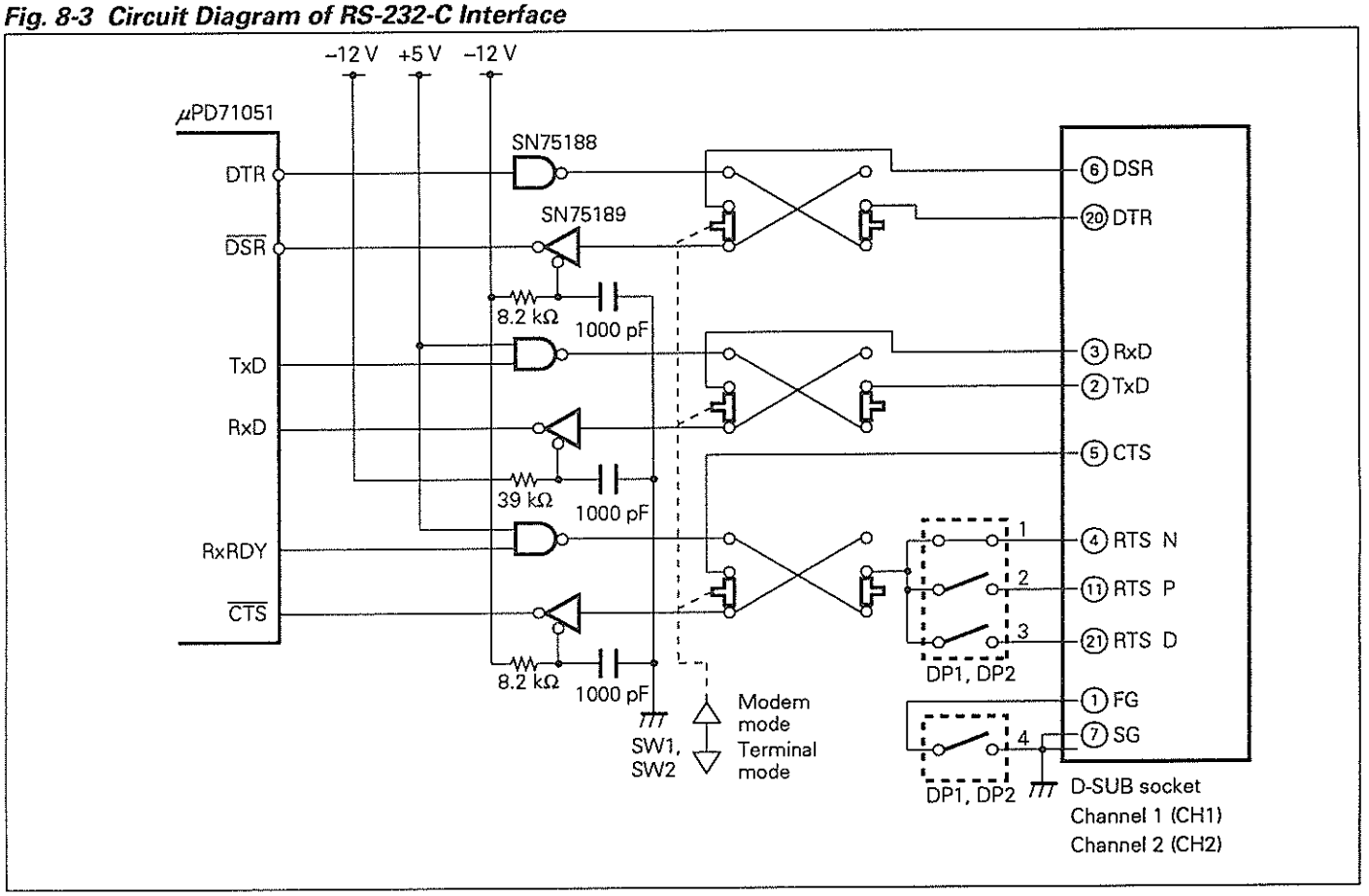
(4) Dynamic handshake

Signal name	Symbol	Function	Direction*1 M	Direction*1 T	Pin number
Request to Send	RTS	Informs modem that terminal is ready to receive data.	←		4*2
Clear to Send	CTS	Informs terminal that modem is ready to receive data.		→	5

*1 M: Device set to the modem mode
T: Device set to the terminal mode

*2 One of three pin numbers is used in actual circuitry, depending on the device connected. See **Section 8.4** and **Section 8.5** for detailed information.

Fig. 8-3 Circuit Diagram of RS-232-C Interface



Data lines, static handshake lines, and dynamic handshake lines are each paired. The signals carried on such a pair of signal lines perform the same function except that one signal is for the transmitting side, and the other for the receiving side.

With correct ground and data line connections, the IE-78330-R can transfer data. In this case, software handshaking is performed. With correct static handshake line and dynamic handshake line connections, hardware handshaking is performed. See **Section 8.4** and **Section 8.5** for detailed information.

When the IE-78330-R is connected with an NEC product (PC-9800 series or PG-1500), hardware handshaking is performed with all signal lines connected. When the IE-78330-R is connected with any other device, a handshake line may not be connected. Even in this case, the IE-78330-R can transfer data by software handshaking.

(1) Ground

[Frame Ground (FG)]

The FG line is used to provide the same potential for the chassis of devices connected. However, if the same FG line is not used by individual devices, data transfer via the RS-232-C interface is not affected.

[Signal Ground (SG)]

The SG line is used to provide the same ground potential for the signal lines of devices connected. If this signal line is not connected, the devices use different ground potentials as their signal bases; data transfer via the RS-232-C interface is not performed normally. With the RS-232-C interface, SG is a key signal.

(2) Data

TxD and RxD are data transmission and reception signals. Basically, three signals, SG, TxD, and RxD, allow data to be transferred. However, the static handshake signals and dynamic handshake signals explained below are used for high-speed, accurate data transfer between the IE-78330-R and a host machine or PROM programmer.

[Transmitted Data (TxD)]

TxD is a data signal transmitted from a terminal to a modem.

[Received Data (RxD)]

RxD is a data signal received by a terminal from a modem.

(3) Static handshake

The static handshake signals must be made valid at initialization and hold the valid state. Both DSR and DTR must be made valid to enable data transfer.

[Data Set Ready (DSR)]

DSR is a signal used to inform the terminal that the modem is ready for operation.

[Data Terminal Ready (DTR)]

DTR is a signal used to inform the modem that the terminal is ready for operation.

(4) Dynamic handshake

The dynamic handshake signals mainly differ from the static handshake signals in that DTR and DSR report the operation status of devices, while RTS and CTS allow a single data item to be transferred at a time. By controlling RTS and CTS, data transfer handshaking is performed.

[Request to Send (RTS)]

RTS is a signal used to inform the modem that the terminal is ready to receive data.

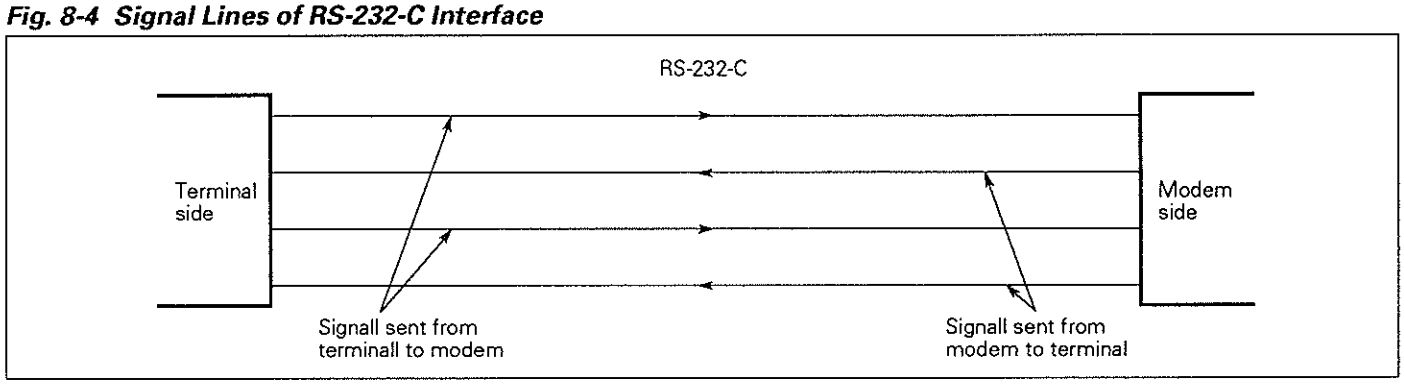
[Clear to Send (CTS)]

CTS is a signal used to inform the terminal that the modem is ready to receive data.

8.3 Mode Setting

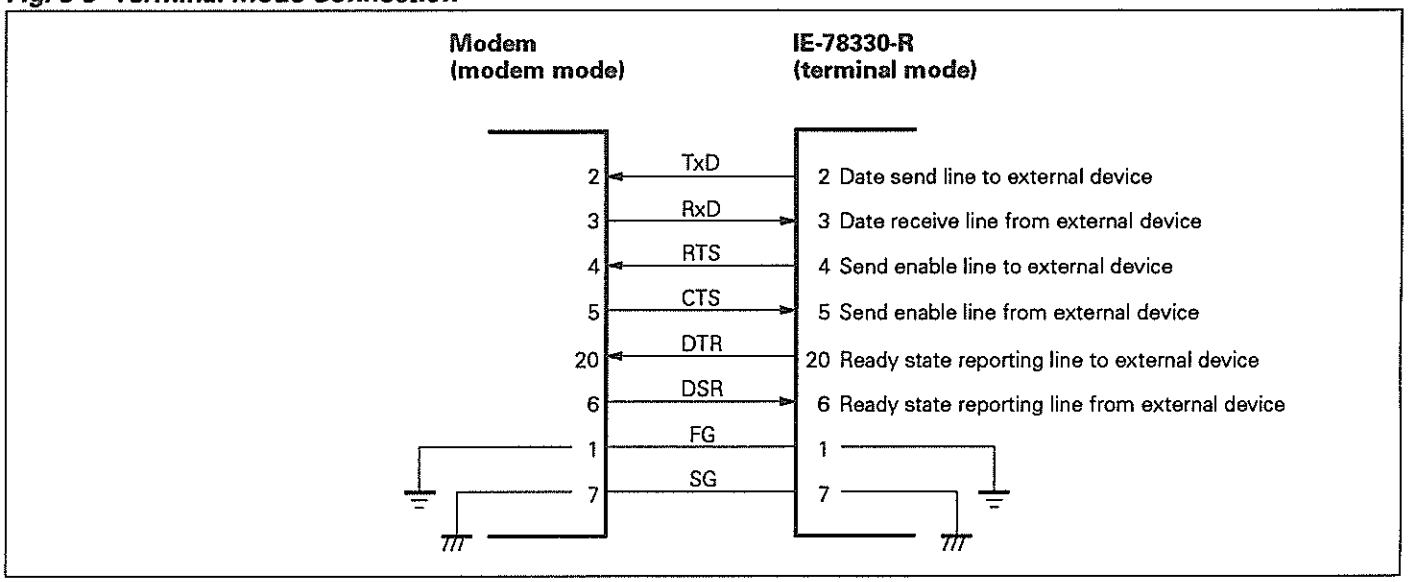
Each type of RS-232-C signal lines (for data signals, static handshake signals, or dynamic handshake signals) of the IE-78330-R are used in pairs: each line of a pair has the same function but operates in the direction opposite to the other line (Figure 8-4). This enables very easy switching between the terminal mode and modem mode. See **Section 8.4** and **Section 8.5** for information about a specific switching procedure.

Fig. 8-4 Signal Lines of RS-232-C Interface



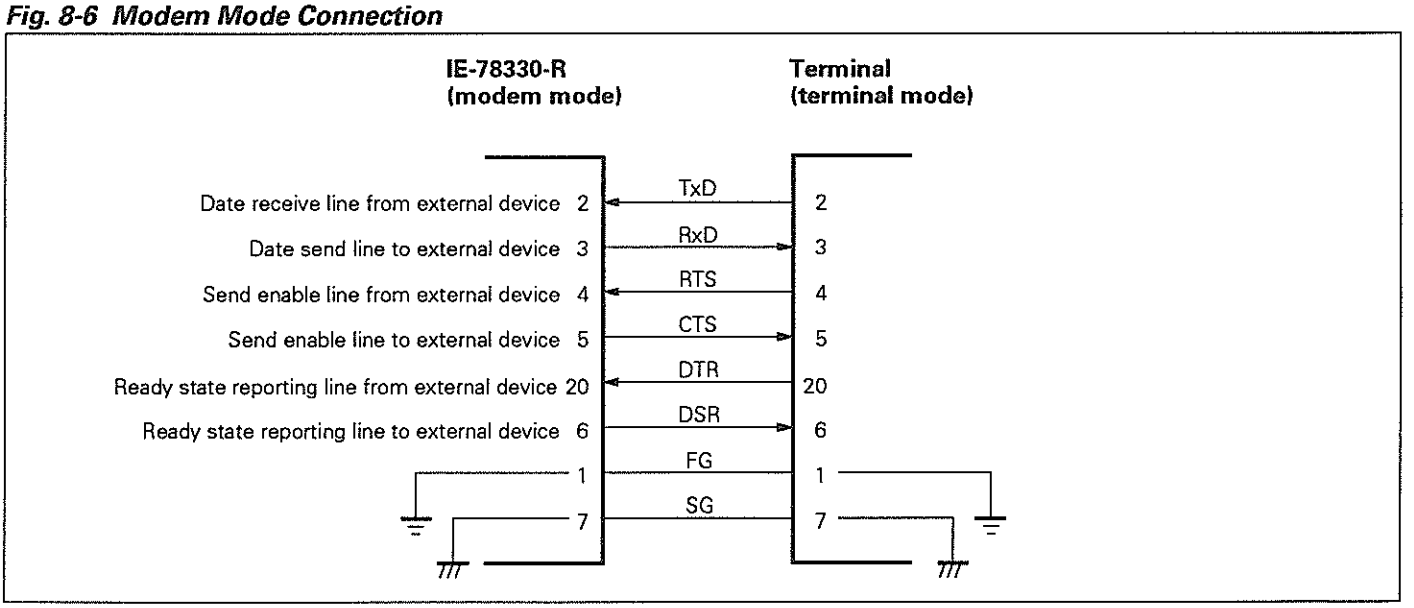
From the viewpoint of data signals, the IE-78330-R is set to the terminal mode when a data send line to an external device is connected to TxD of RS-232-C, and a data receive line from an external device is connected to RxD of RS-232-C.

Fig. 8-5 Terminal Mode Connection



Conversely, the IE-78330-R is set to the modem mode when a data send line to an external device is connected to RxD of RS-232-C, and a data receive line from an external device is connected to TxD of RS-232-C.

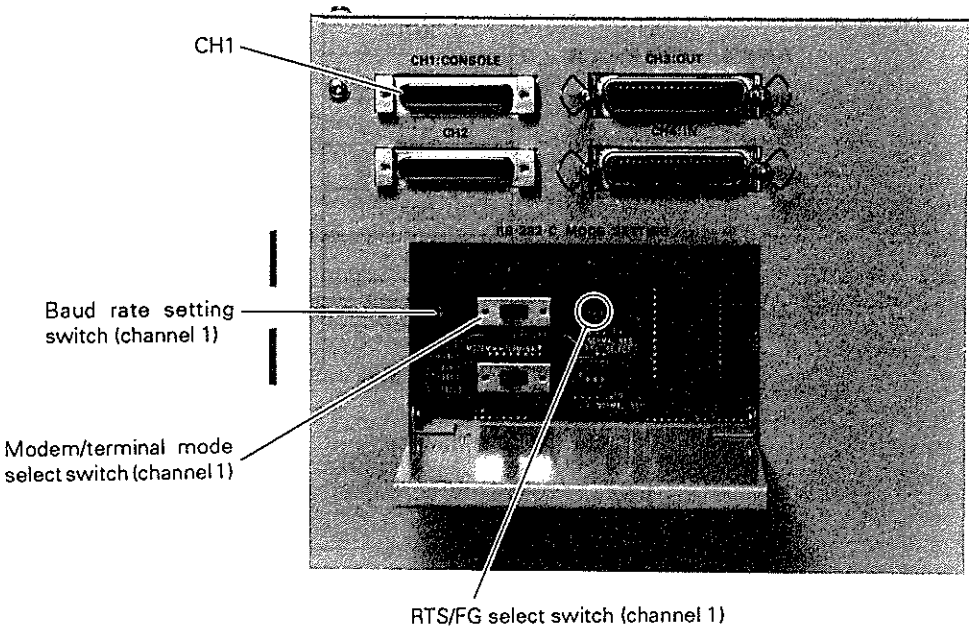
Fig. 8-6 Modem Mode Connection



8.4 Channel 1 Functions

Channel 1 is a serial interface based on RS-232-C. The RS-232-C mode switches on the right side of the IE-78330-R main unit contain channel 1 mode setting switches (CHANNEL 1). A serial interface port (CH1) is provided above the switches.

Photo 8-1 Channel 1



Channel 1 has the functions (1) to (5) below to control the RS-232-C interface. With these functions, channel 1 transfers control data between the IE-78330-R and a terminal or between host machines, and loads files such as object files.

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

(1) Mode switching

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

(2) RTS and FG setting

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

(3) Baud rate selection

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

(4) Handshaking

Setting item	Setting	Switch
Handshaking	For both hardware handshaking and software handshaking	Fixed

(5) Character specification

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

(1) Mode switching

The modem/terminal mode select switch is used for mode switching between the terminal mode and modem mode. The terminal mode is set by sliding the switch from left to right. The modem mode is set by sliding the switch from right to left. The modem mode must be set for connection with the peripheral equipment indicated in Table 8-2.

Fig. 8-7 Modem/Terminal Mode Select Switch (Channel 1)

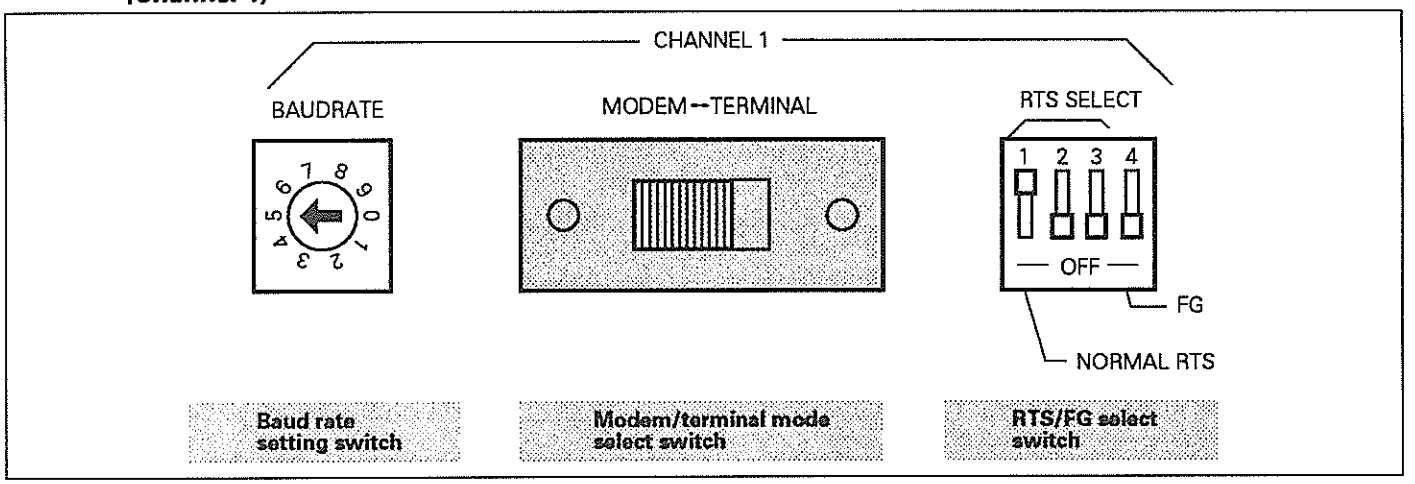
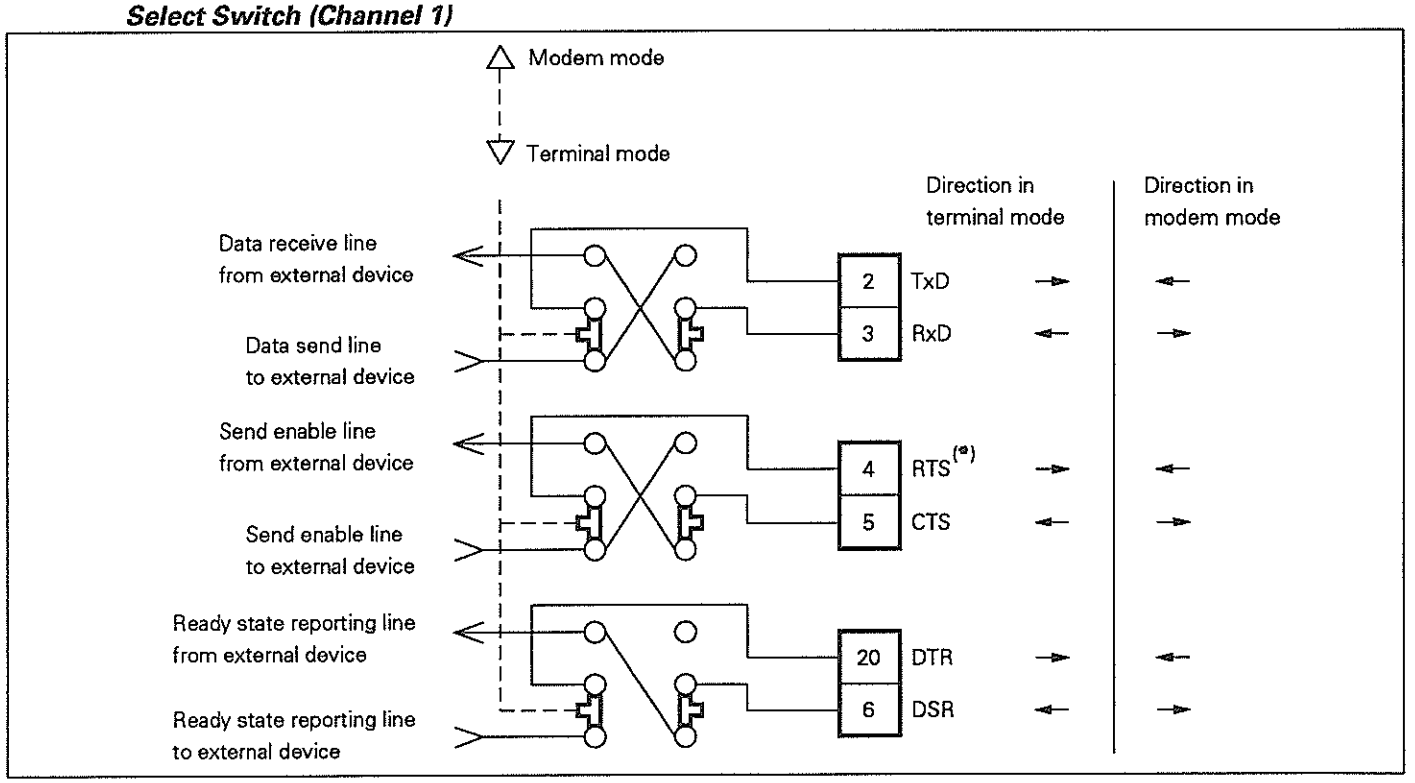


Fig. 8-8 Circuit Diagram of Modem/Terminal Mode Select Switch (Channel 1)



* See **Section 8.4.(2).**

Table 8-2 Connection with Peripheral Equipment

Equipment connected	IE-78330-R mode
Host machine (such as PC-9800 series)	Modem mode

(2) RTS and FG setting

The RTS/FG select switch is used for RTS and FG setting. The switch is on when it is set to the upper position. The switch is off when it is set to the lower position. (See Table 8-3, Figure 8-9, and Figure 8-10.)

[RTS setting]

This setting determines which pin (pin 4, 11, or 21) of the RS-232-C interface cable RTS is to be connected to.

RTS is usually connected to pin 4 of the RS-232-C interface. Besides pin 4, a device may have a signal line with the same function as RTS, and pin 4 may always be active. For hardware handshaking with such a device, RTS must be able to be connected to a pin other than pin 4. A pro-typer is an example of such a device.

The IE-78330-R is designed so that it can be connected to a pro-typer. RTS setting can be performed using RTS/FG select switches 1 to 3. RTS must always be connected to RTS N except in special cases where a device such as a pro-typer is connected.

[FG setting]

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

Table 8-3 RTS and FG Setting (Channel 1)

	RTS and FG setting				
RTS name	**1**	**2**	**3**	**4**	**Device connected**
RTS N	ON	OFF	OFF	OFF	Host machine
RTS P	OFF	ON	OFF	OFF	Pro-typer

Fig. 8-9 RTS/FG Select Switch (Channel 1)

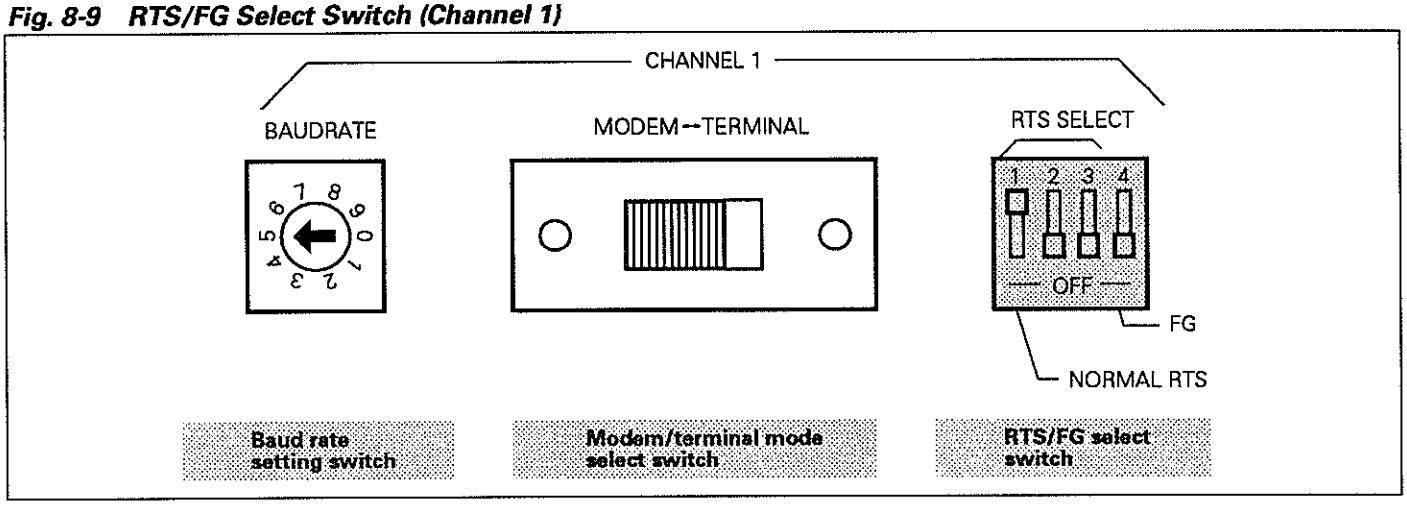
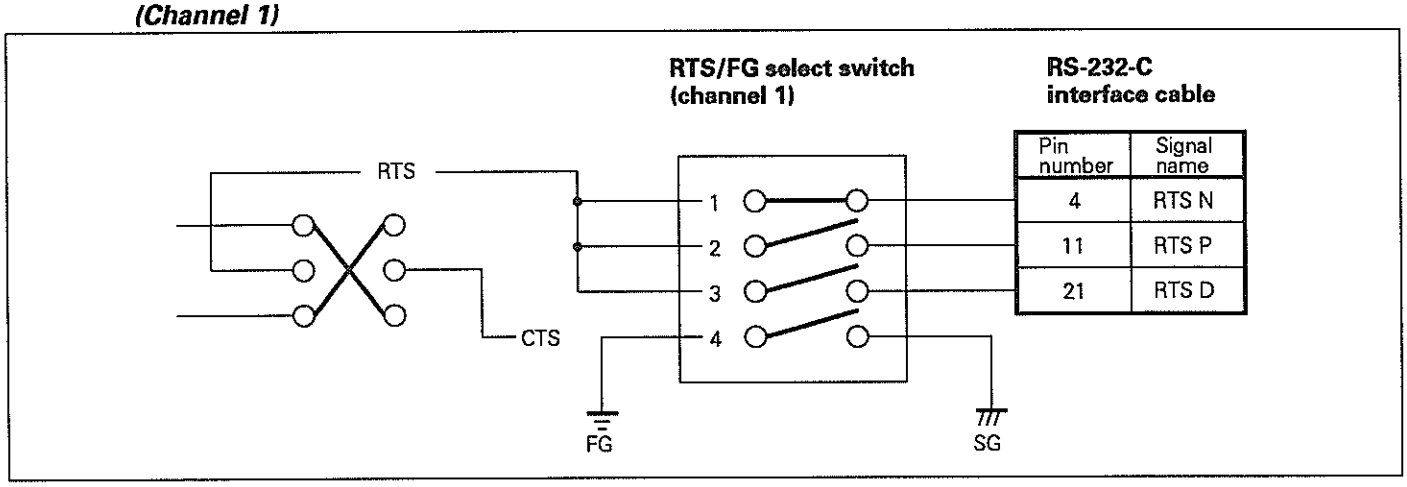


Fig. 8-10 Circuit Diagram of RTS/FG Select Switch (Channel 1)



(3) Baud rate selection

The baud rate of a terminal or host machine connected needs to match the baud rate of the IE-78330-R. A baud rate is selected using the micro DIP switch for baud rate setting (for channel 1).

Fig. 8-11 Baud Rate Setting Switch (Channel 1)

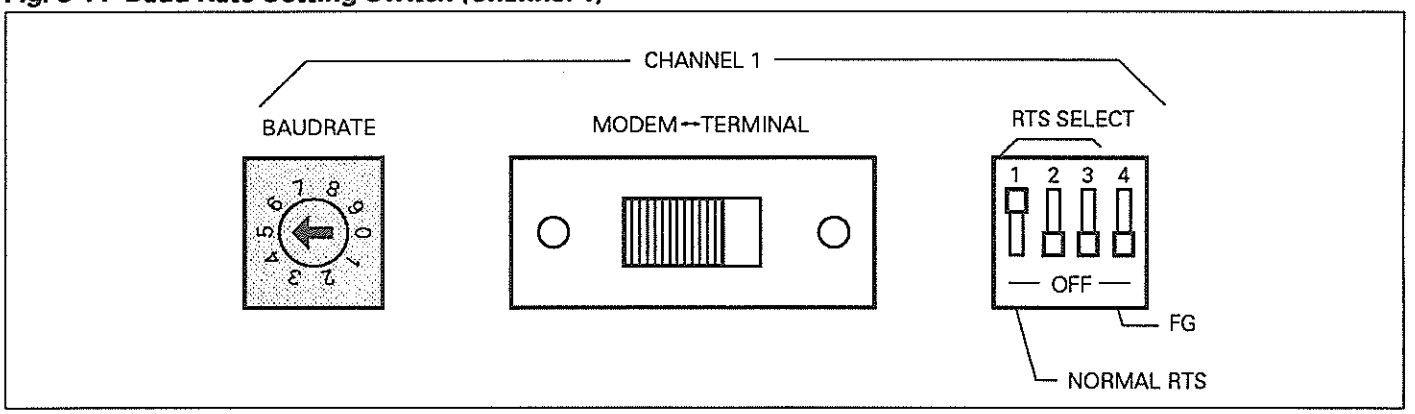


Table 8-4 Baud Rate Setting

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

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

(4) Handshaking

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

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

With the IE-78330-R, an automatic hardware adjustment is made by using a handshake signal to prevent data overlapping during handshaking. When the buffer is full, for example, the CTS signal is controlled to stop data transfer completely. So no data is lost as long as the handshake signal is connected. When no handshake signal is connected, only software handshaking is performed, and data can be lost.

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

[Hardware handshaking (in the modem mode)]

With the IE-78330-R, the μPD71051 is used for the RS-232-C interface. The signal output on the RxRDY pin of the μPD71051 is inverted for output onto the CTS line. When the receive buffer receives data from the RS-232-C interface, 1 appears on the RxRDY pin, and when the CPU in the IE-78330-R receives data from the buffer, 0 appears on the RxRDY pin (single-character handshaking). Thus CTS is controlled to prevent the terminal from sending the next data before the receive buffer becomes available.

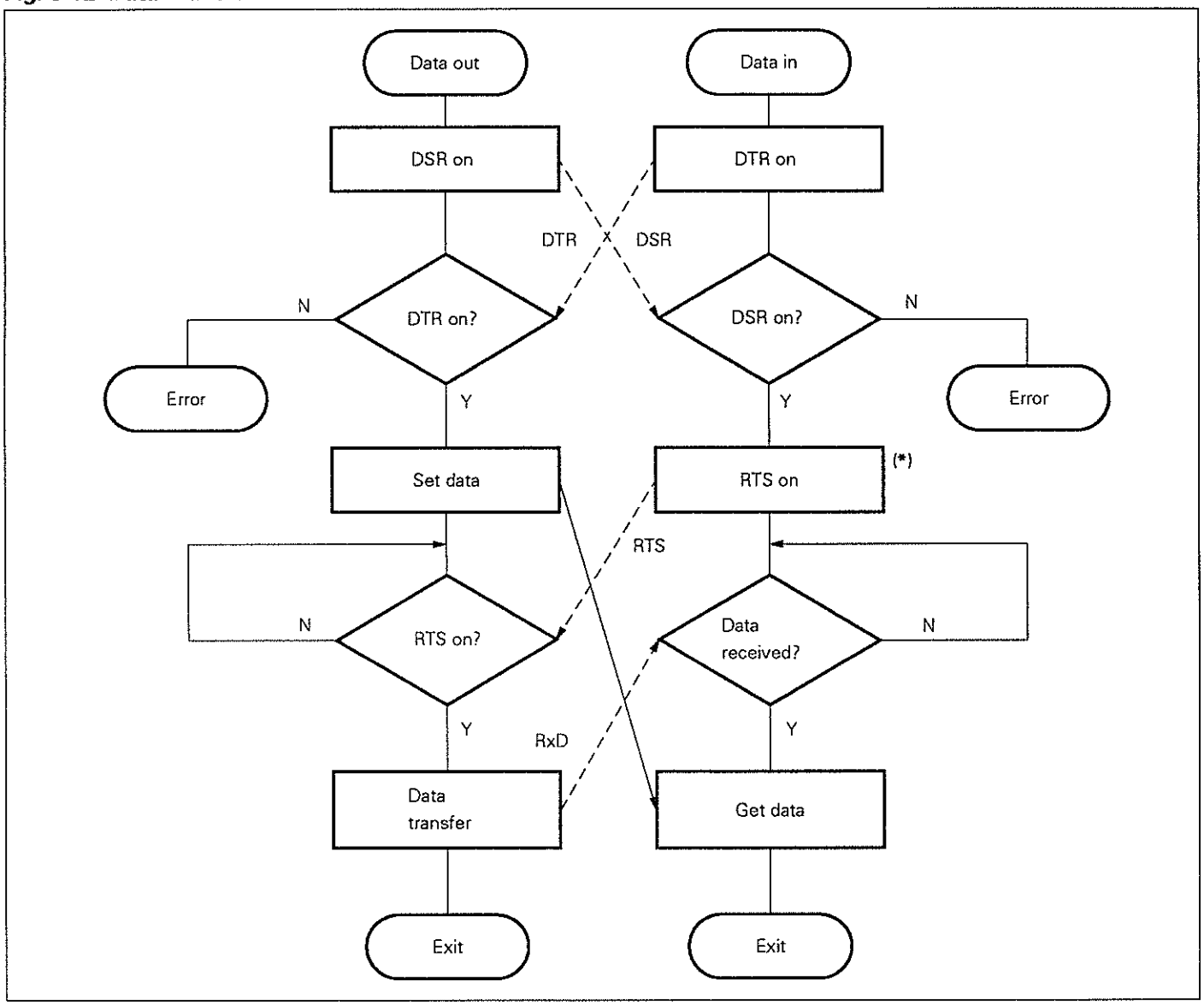
- Data transmission

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

- Data reception

  DSR must always be active. When the IE-78330-R is not ready to receive data, CTS is made inactive. When the IE-78330-R is ready to receive data, CTS is made active. Then data is received from the TxD line.

Fig. 8-12 Data Transfer from Modem to Terminal



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

* RTS is set on as a pulse signal.

① DSR is set on when power is turned on.

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

③ Transfer data is set.

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

⑤ Data is transferred.

① DTR is set on when power is turned on.

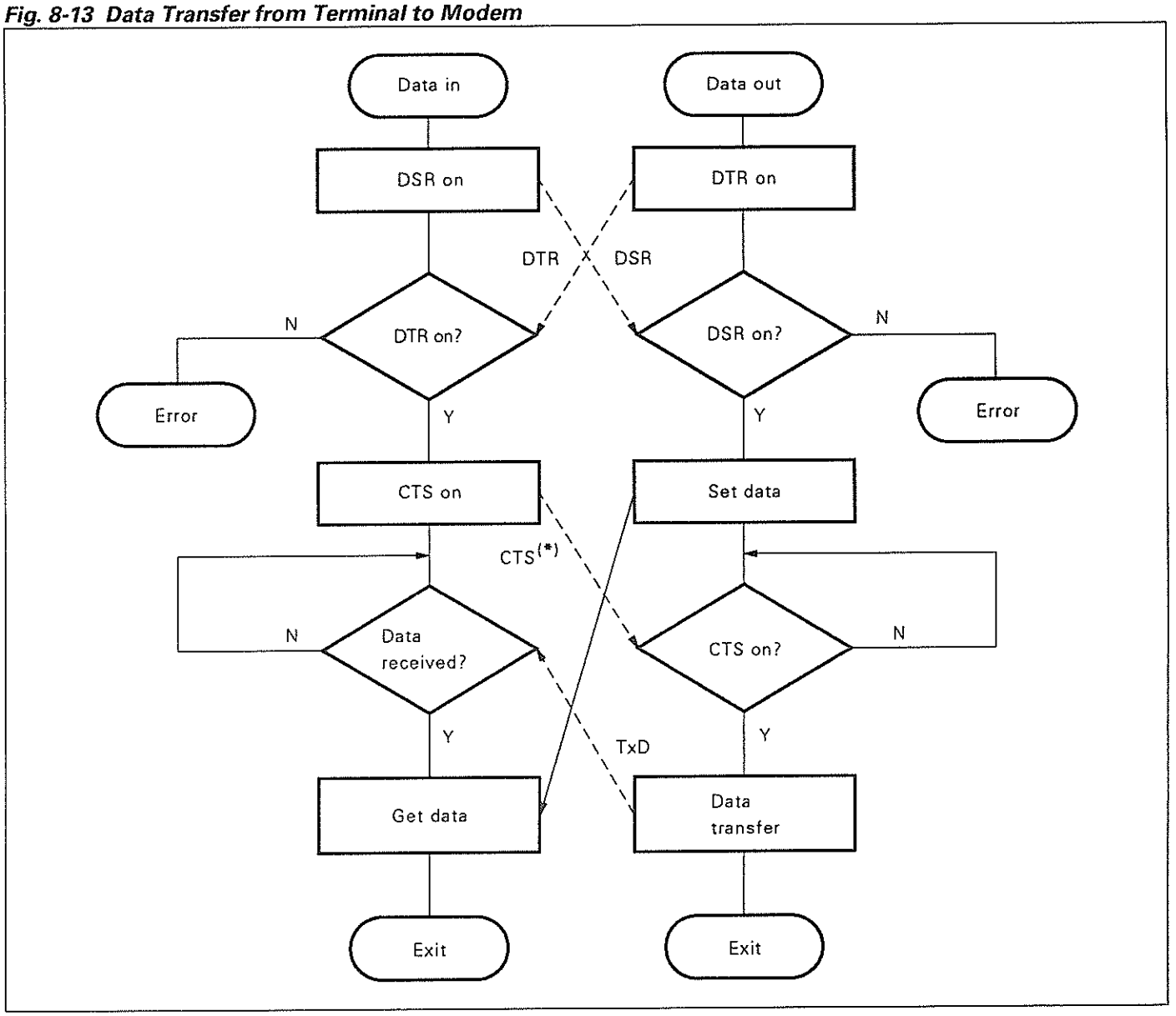
② The DSR pin is checked. When DSR is off, an error results. When DSR is on, processing proceeds to the next step.

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

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

⑤ Data is taken in.

Fig. 8-13 Data Transfer from Terminal to Modem



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

* CTS is set on as a pulse signal.

① DSR is set on when power is turned on.

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

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

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

⑤ Data is taken in.

① DTR is set on when power is turned on.

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

③ Transfer data is set.

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

⑤ Data is transferred.

[Software handshaking (in the modem mode)]

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

- Data transmission

  Basically, the IE-78330-R always assumes that the terminal can receive data, and send data onto the RxD line. However, when Ctrl-S is sent from the terminal on the TxD line, data transfer is suspended. With channel 1 of the IE-78330-R, four or five characters are sent after Ctrl-S is received, then data transfer is stopped.

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

- Data reception

  Basically, the IE-78330-R always receives data. Data is received using interrupts. Received data is loaded into a 128-byte buffer. When the buffer is loaded with data to 50 percent of the buffer capacity, Ctrl-S is sent onto the RxD line to request the terminal to suspend data transmission. When data is transmitted after the request is issued, the data is received and loaded into the buffer. Then the CPU of the IE-78330-R takes in the data held in the buffer. When the data in the buffer is reduced to 35 percent of the buffer capacity, Ctrl-Q is sent onto the RxD line to request the terminal to resume data transfer.

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

(5) Character specification

The character specification for data transmission is described below.

[Character length]

A fixed character length of eight bits is used. When the IE-78330-R sends data, the most significant bit (MSB) is always 0. When the IE-78330-R receives data, the most significant bit is ignored: it is always assumed to be 0.

[Parity bit]

No parity bit is used.

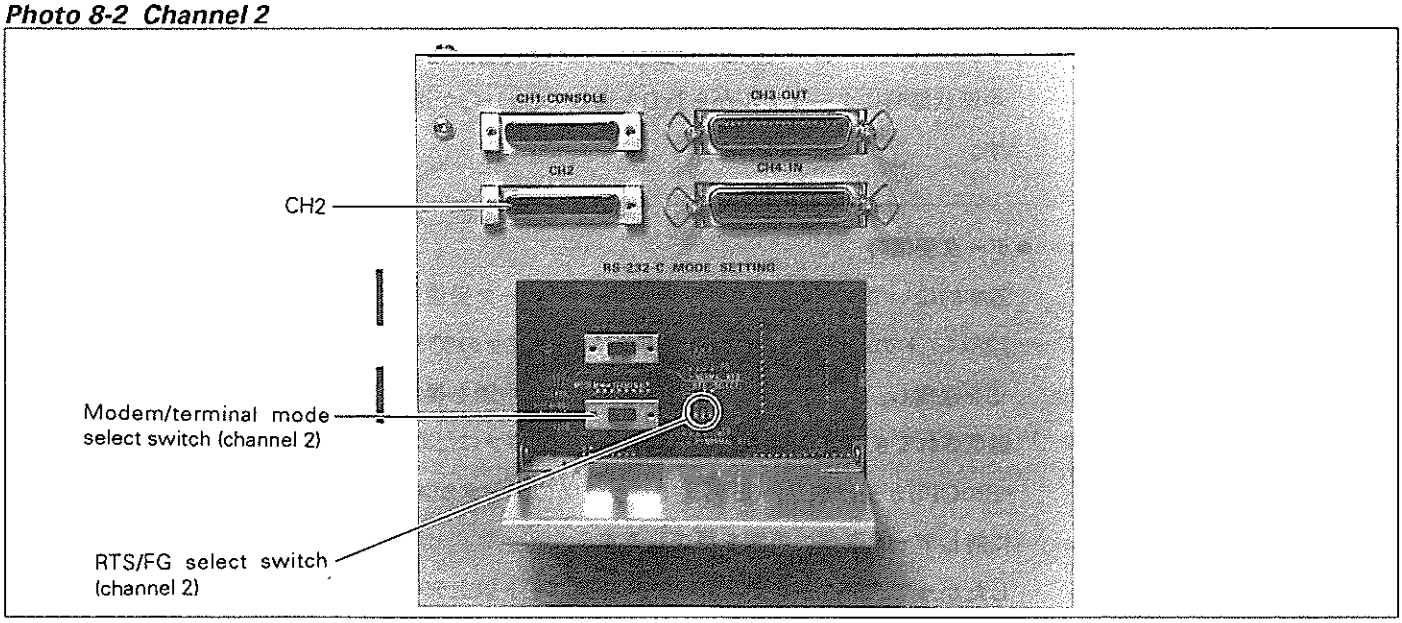
[Stop bit length]

A fixed stop bit length of two bits is used.

8.5 Channel 2 Functions

Channel 2 is a serial interface based on RS-232-C. The RS-232-C mode switches on the right side of the IE-78330-R main unit contain channel 2 mode setting switches (CHANNEL 2). A serial interface port (CH2) is provided above the switches.

Photo 8-2 Channel 2



Channel 2 has the functions (1) to (5) below to control the RS-232-C interface. With these functions, channel 2 transfers control data between the IE-78330-R and a PROM programmer, and loads files.

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

(1) Mode switching

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

(2) RTS and FG setting

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

(3) Baud rate selection

Setting item	Setting	Switch
Baud rate	9600 bps	MOD command

(4) Handshaking

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

(5) Character specification

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

Remark MOD command

The MOD command can be set as a single command line at the time of command input or can be set interactively. By keying in MOD↵, the user can set the MOD command interactively.

[Input format]

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

[Operands]

MODE: Handshaking mode
BAUD: Baud rate
LONG: Character length
PAR: Parity bit
STOP: Stop bit

[System operation mode]

trc:0>	×	emu:0>	○	brk:0>	○

[Example of command setting on a single line]

```
brk:0>MOD MODE=CHAR BAUD=4800 LONG=8 PAR=NON STOP=2↵   ← Set on one line
brk:0>■
```

[Example of interactive setting]

```
brk:0> MOD↵                ← Interactive setting
  Mode CHAR=FLOW↵          ← Change to flow control
  Baud 4800=9600↵          ← Change baud rate to 9600 baud
  Long 8=↵                 ← Character length not changed
  Par  NON=EVEN↵           ← Change parity to even
  Stop 2=1↵                ← Change stop bit to 1
brk:0>■
```

(1) Mode switching

The modem/terminal mode select switch provided as one of the RS-232-C mode switches on the right side of the main unit is used for mode switching between the terminal mode and modem mode (Figure 8-14). The modem mode is set by sliding the switch from right to left. The terminal mode is set by sliding the switch from left to right.

Fig. 8-14 Modem/Terminal Mode Select Switch (Channel 2)

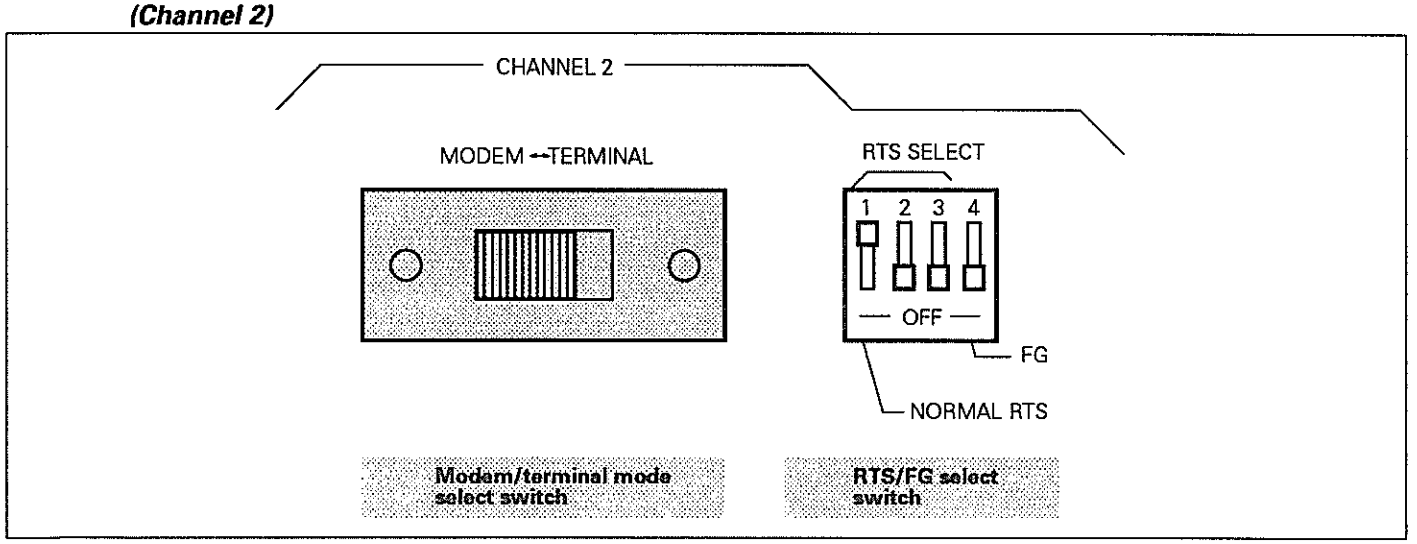
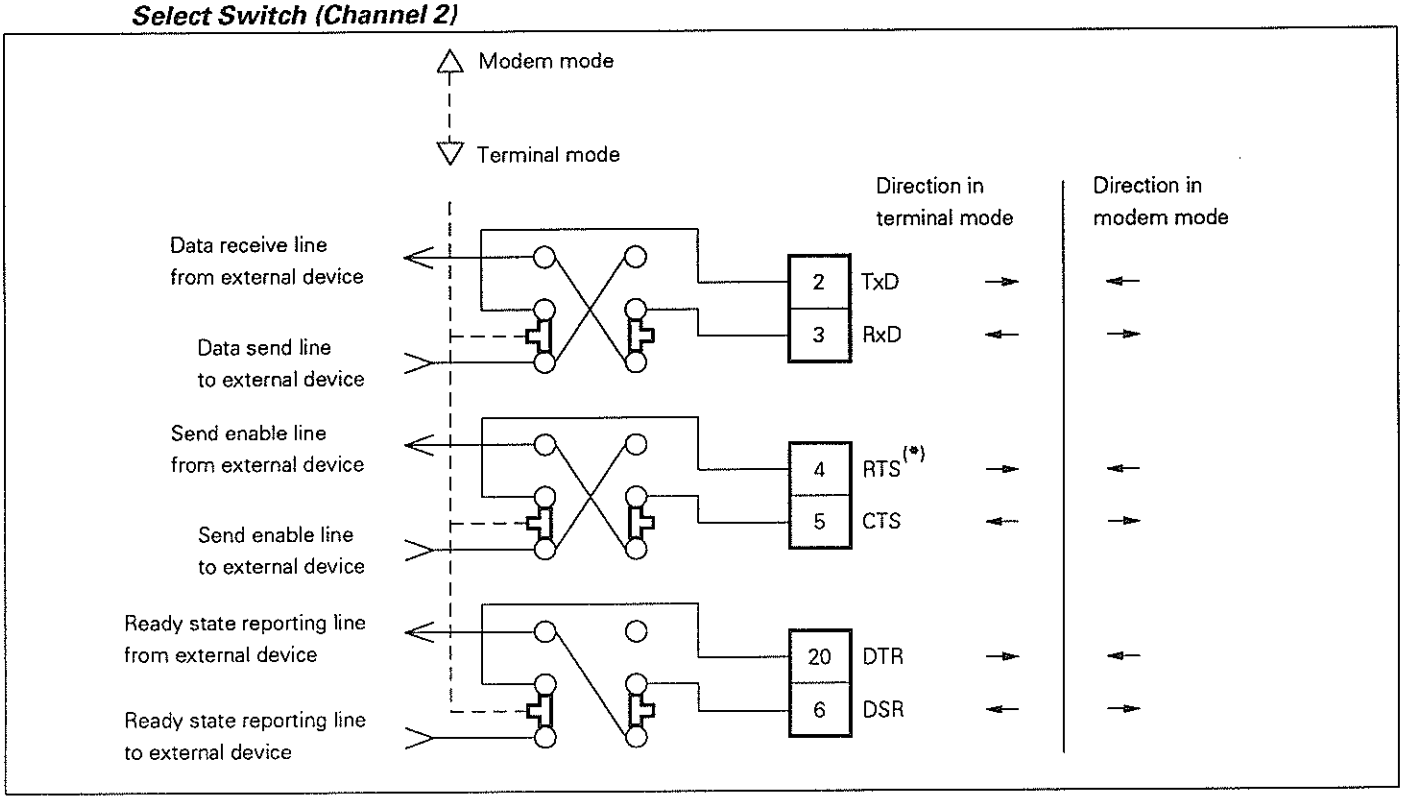


Fig. 8-15 Circuit Diagram of Modem/Terminal Mode Select Switch (Channel 2)



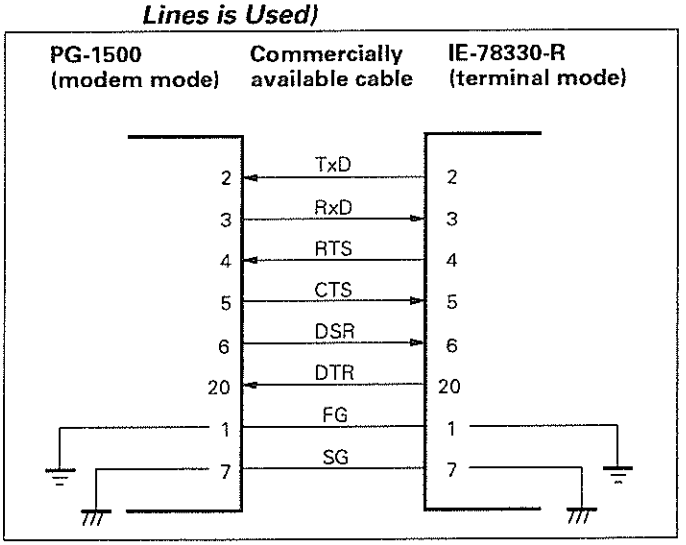
* See **Section 8.5.(2).**

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

[PG-1500]

The PG-1500 is a device that has the modem mode interface. To connect the PG-1500, a commercially available cable consisting of pairs of signal lines should be used. The IE-78330-R must be set to the terminal mode by sliding the switch from left to right.

Fig. 8-16 PG-1500 Connection (when Commercially Available Cable Consisting of Pairs of Signal Lines is Used)



(2) RTS and FG setting

The RTS/FG select switch is used for RTS and FG setting. The switch is on when it is set to the upper position. The switch is off when it is set to the lower position. (See Table 8-5, Figure 8-17 and Figure 8-18.)

[RTS setting]

This setting determines which pin (pin 4, 11, or 21) of the RS-232-C interface cable RTS is to be connected to. RTS is usually connected to pin 4 of the RS-232-C interface. Besides pin 4, a device may have a signal line with the same function as RTS, and pin 4 may always be active. For hardware handshaking with such a device, RTS must be able to be connected to a pin other than pin 4. A pro-typer is an example of such a device. The IE-78330-R is designed so that it can be connected to a pro-typer.

RTS setting can be performed using RTS/FG select switches 1 to 3. RTS must always be connected to RTS N except in special cases where a device such as a pro-typer is connected.

[FG setting]

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

Table 8-5 RTS and FG Setting (Channel 2)

	RTS and FG setting				
RTS name	1	2	3	4	Device connected
RTS N	ON	OFF	OFF	OFF	PROM programmer
RTS P	OFF	ON	OFF	OFF	Pro-typer

Fig. 8-17 RTS/FG Select Switch (Channel 2)

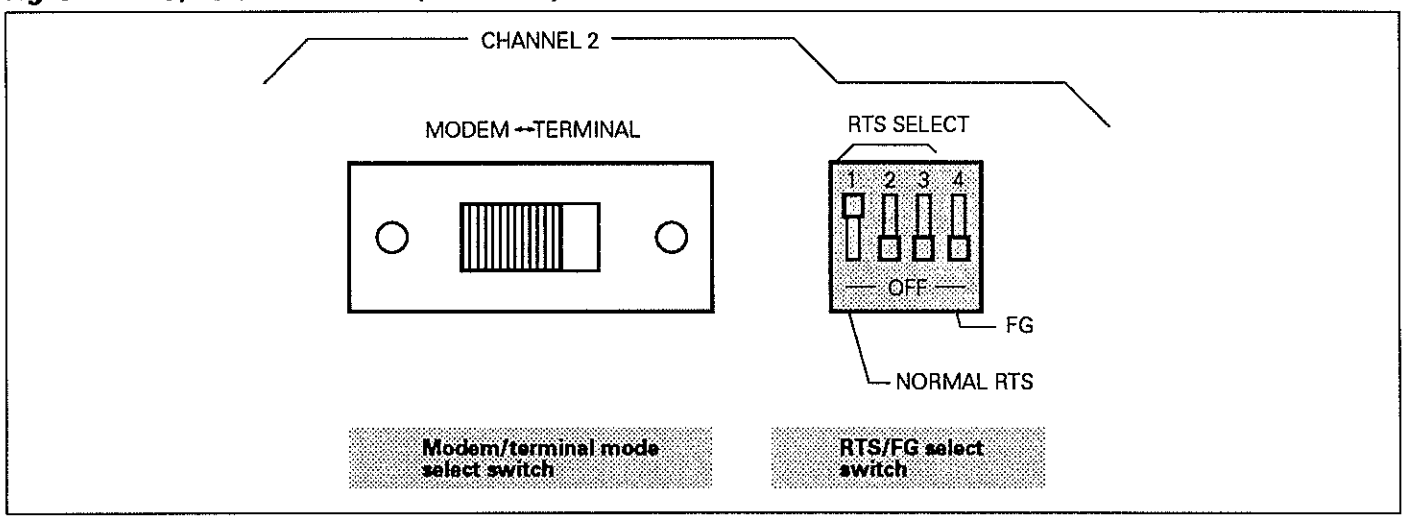
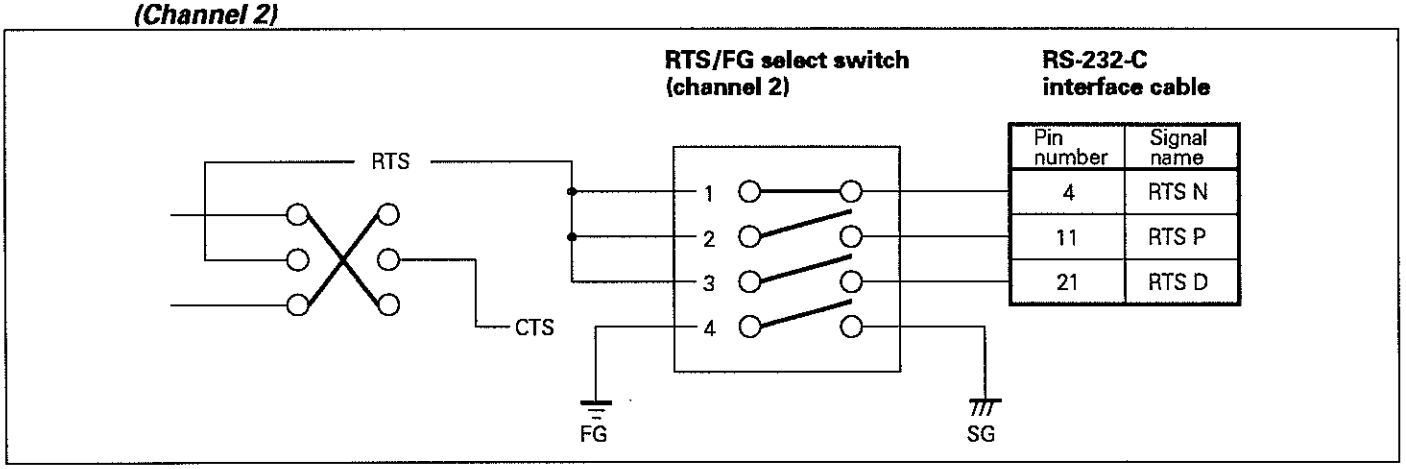


Fig. 8-18 Circuit Diagram of RTS/FG Select Switch (Channel 2)



(3) Baud rate selection

The baud rate of a device connected such as a PROM programmer needs to match the baud rate of the IE-78330-R. A baud rate is selected using the MOD command. The terminal (keyboard) connected to channel 1 of the IE-78330-R can be used to enter the MOD command.

(4) Handshaking

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

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

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

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

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

[Hardware handshaking (in the modem mode)]

With the IE-78330-R, the μPD71051 is used for the RS-232-C interface. The signal output on the RxRDY pin of the μPD71051 is inverted for output onto the CTS line. When the receive buffer receives data from the RS-232-C interface, 1 appears on the RxRDY pin, and when the CPU in the IE-78330-R receives data from the buffer, 0 appears on the RxRDY pin (single-character handshaking).

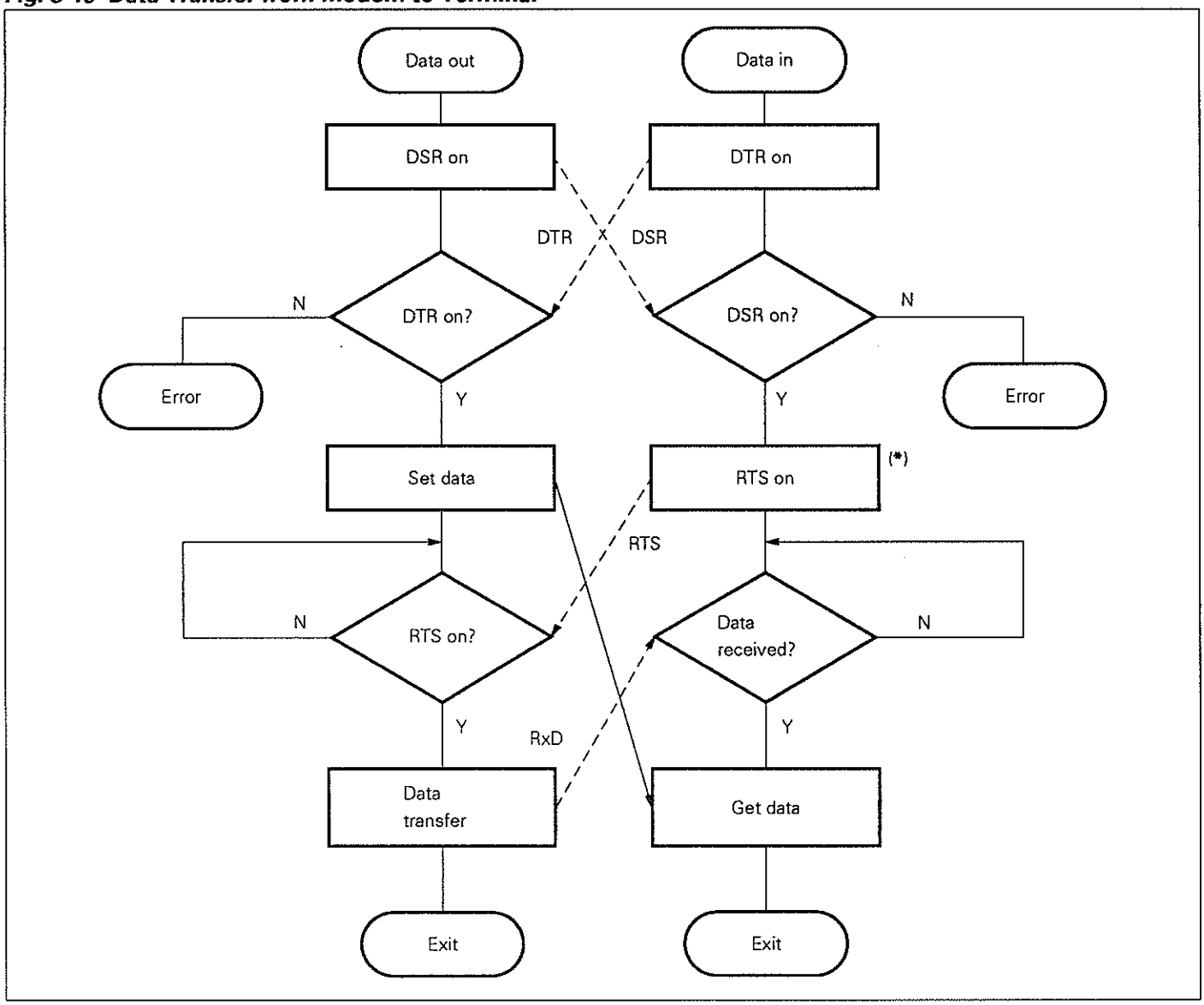
- Data transmission

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

- Data reception

  DSR must always be active. When the IE-78330-R is not ready to receive data, CTS is made inactive. When the IE-78330-R is ready to receive data, CTS is made active. Then data is received from the TxD line.

Fig. 8-19 Data Transfer from Modem to Terminal



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

* RTS is set on as a pulse signal.

① DSR is set on when power is turned on.

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

③ Transfer data is set.

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

⑤ Data is transferred.

① DTR is set on when power is turned on.

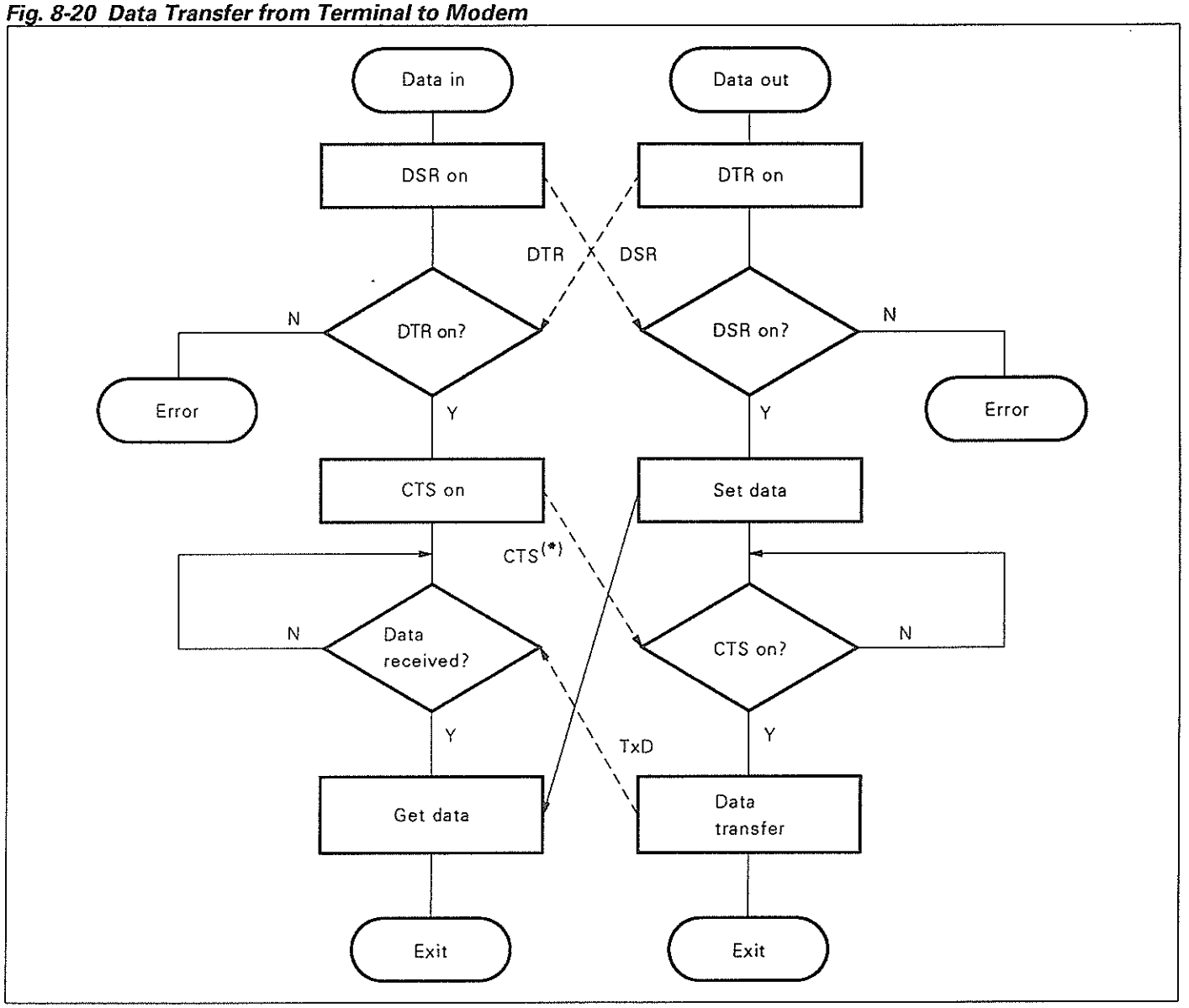
② The DSR pin is checked. When DSR is off, an error results. When DSR is on, processing proceeds to the next step.

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

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

⑤ Data is taken in.

Fig. 8-20 Data Transfer from Terminal to Modem



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

* CTS is set on as a pulse signal.

① DSR is set on when power is turned on.

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

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

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

⑤ Data is taken in.

① DTR is set on when power is turned on.

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

③ Transfer data is set.

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

⑤ Data is transferred.

[Software handshaking (in the modem mode)]

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

- Data transmission

  Basically, the IE-78330-R always assumes that the terminal can receive data, and send data onto the RxD line. However, when Ctrl-S is sent from the terminal on the TxD line, data transfer is suspended. With channel 2 of the IE-78330-R, four or five characters are sent after Ctrl-S is received, then data transfer is stopped.

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

- Data reception

  Basically, the IE-78330-R always receives data. Data is received using interrupts. Received data is loaded into a 96-byte buffer. When the buffer is loaded with data to 50 percent of the buffer capacity, Ctrl-S is sent onto the RxD line to request the terminal to suspend data transmission. When data is transmitted after the request is issued, the data is received and loaded into the buffer. Then the CPU of the IE-78330-R takes in the data held in the buffer. When the data in the buffer is reduced to 35 percent of the buffer capacity, Ctrl-Q is sent onto the RxD line to request the terminal to resume data transfer.

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

(5) Character specification

The character specification for data transmission is described below.

[Character length]

A character length of seven bits or eight bits must be selected using the MOD command. When the 8-bit length is selected, the most significant bit (MSB) of data output from the IE-78330-R is always 0. The most significant bit of data received by the IE-78330-R is ignored: it is always assumed to be 0.

[Parity bit]

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

[Stop bit length]

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

CHAPTER 9 FUNCTIONS OF CHANNELS 3 AND 4

This chapter details channels 3 and 4 of the IE-78330-R. Read this chapter when detailed information about channels 3 and 4 is required.

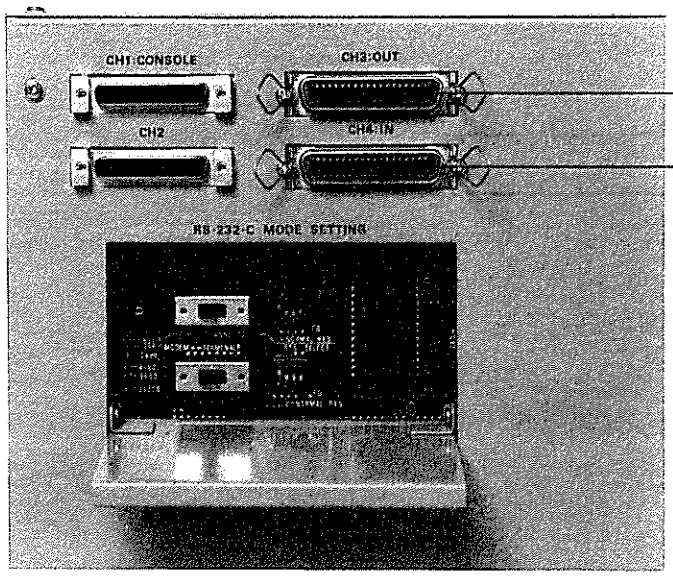
Organization of this chapter

9.1 Functions of Channels 3 and 4

Channels 3 and channel 4 are 8-bit parallel interfaces. Parallel interface ports (CH3 and CH4) are provided above the RS-232-C mode switches on the side of the IE-78330-R main unit. The TTL level is used for all input data and interface control signals. In addition, the interface circuitry conforms to Centronics.

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

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



(1) High-speed download

With the IE-78330-R, two download methods are used. When channel 4 is used, high-speed download is possible.

Load mode	Description	Selection method
High-speed download	Parallel interface output of host machine is downloaded to parallel interface input (channel 4) of IE-78330-R.	① Select high-speed download mode at activation. ② Execute LOD command.
Normal download	RS-232-C interface output of host machine is downloaded to RS-232-C interface input (channel 1) of IE-78330-R.	Execute LOD command. (Do not select high-speed download mode at activation.)

[Executing high-speed download]

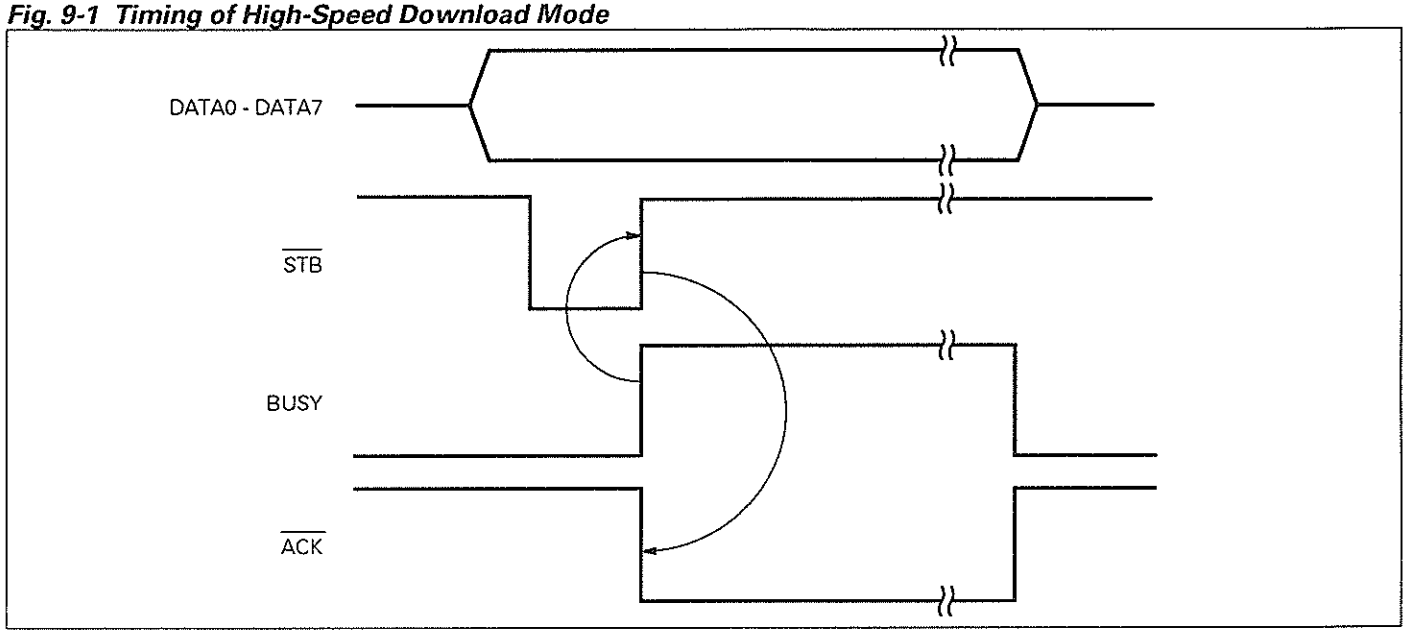
① The following message appears at IE-78330-R activation:

```
Do you use high speed down load mode ?  (Y/N) =
```

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

- Object file
- Symbol file
- Debugging environment file

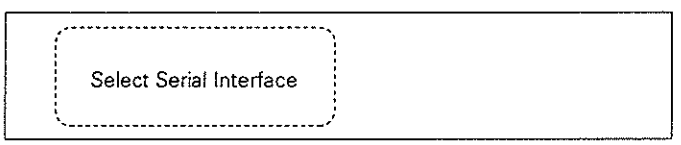
Fig. 9-1 Timing of High-Speed Download Mode



(2) Through output

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

When the parallel interface is already used (for example, for list output) by a command at the time of load command execution, the following message appears, and download operation is performed through serial interface channel 1:



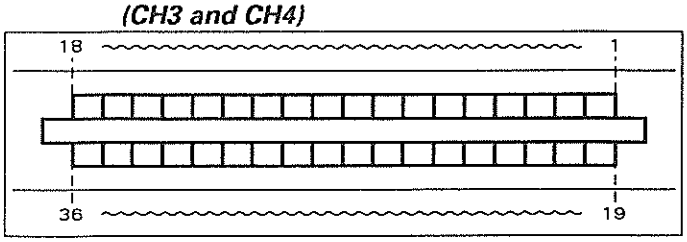
9.2 Signal Lines and Circuit Diagram of Parallel Interface (CH3 and CH4)

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

Table 9-1 Parallel Interface Signals

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

Fig. 9-2 Pin Allocation of Parallel Interface Ports (CH3 and CH4)



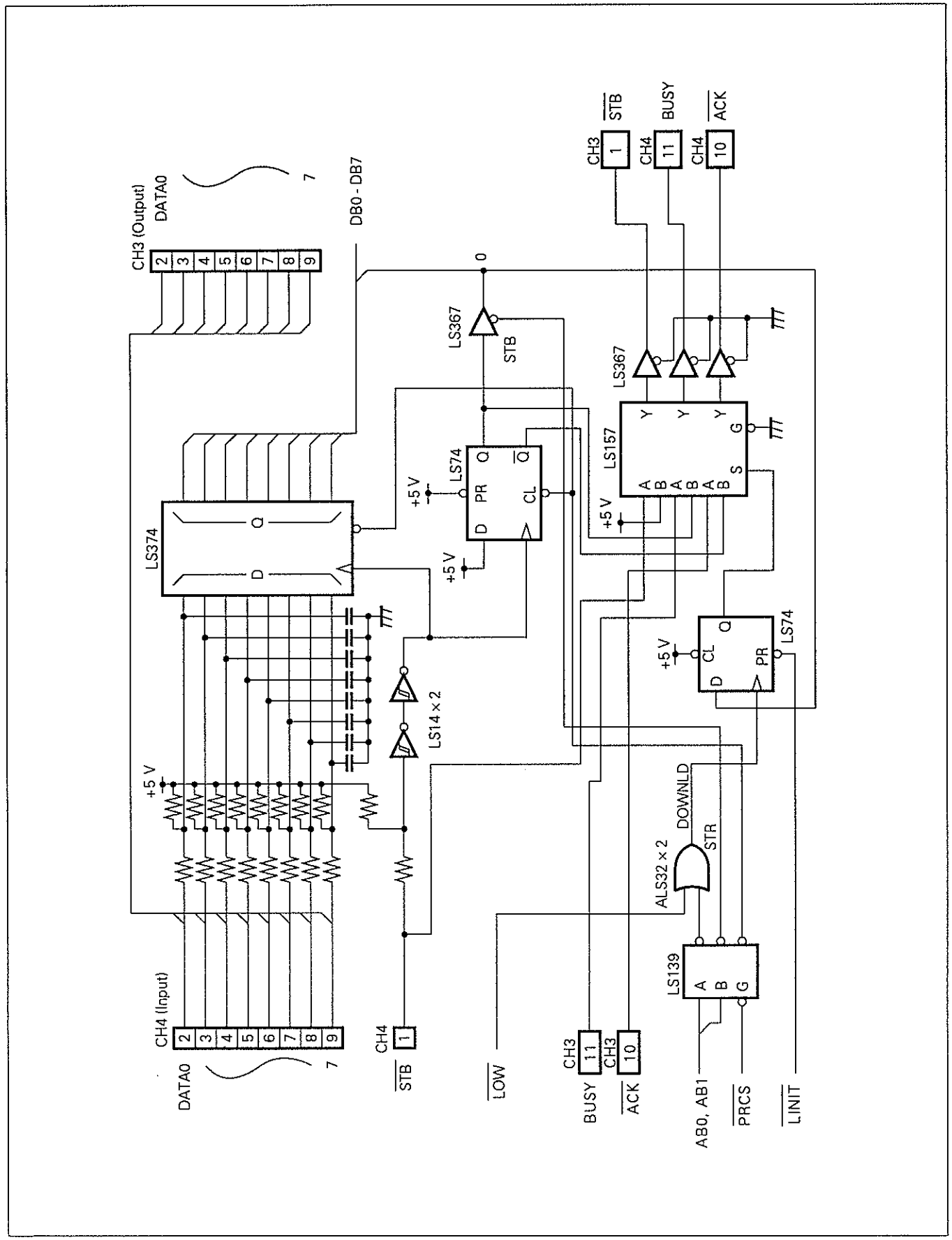


Fig. 9-3 Circuit Diagram of Parallel Interface

CHAPTER 10 TROUBLESHOOTING ★

This chapter describes problems that may occur when the IE-78330-R is used and their causes, and countermeasures.

Table 10-1 Troubleshooting

Problem	Cause	Countermeasure
Although the IE-78330-R is operated alone, it cannot be started or operated when the emulation probe is connected to the target system.	A $\overline{\text{RESET}}$ pin in the target system is low.	Turn on the power to the target system before the IE-78330-R is started, and confirm that the $\overline{\text{RESET}}$ pin is high.
	The connection of the emulation probe and the IE-78330-R or the target system is not correct.	Connect the emulation probe to the IE-78330-R or the target system correctly.
Some of the pins of the emulation probe are not functioning.	The connector pin of the emulation probe is bent.	Straighten any bent connector pins.
	The emulation probe is not inserted correctly into the CPU socket of the target system.	Insert the emulation probe into the CPU socket correctly.
When the IE controller is started without connecting the target system, and N is input in response to the target system power supply confirmation message displayed on the screen, the IE controller displays the confirmation message again. As a result, the IE controller cannot be started.	The IE controller displays the confirmation message again when N is input.	Input Y even if the target system is not connected.
A clock signal is generated by the IE-78330-R instead of the target system.	A clock signal cannot be generated by the target system.	To send the same clock signal as that used in the target system to the IE-78330-R: ① Insert a crystal oscillator in the user clock setting socket on the emulation board. ② Specify the user clock in the CLK command.
The ROM size becomes 0 bytes automatically when the IE controller is started. (When the target devices are the μPD78334 and μPD78P334)	The $\overline{\text{EA}}$ pin goes low.	Connect the $\overline{\text{EA}}$ pin to the V_{DD} pin instead of the V_{SS} pin if the $\overline{\text{EA}}$ pin is connected to the V_{SS} pin.
		Turn on the power to the target system.
The IE-78330-R hangs up when a file is downloaded.	The high-speed download mode is selected but the device driver for the printer is not installed.	Install the device driver for the printer when the high-speed download mode is selected. Input N in response to the high-speed download specification message when the high-speed download mode is not selected.
The IE controller cannot be started.	The setting of the RS-232-C mode is not correct.	Set the RS-232-C mode correctly.
	A cross-connection RS-232-C cable is used when it should not.	Use the RS-232-C cable supplied with the IE-78330-R.
	The emulation board is not inserted correctly in the IE-78330-R main unit.	Insert the emulation board in the IE-78330-R main unit correctly.
	The device driver is not installed.	Install the appropriate device driver.

If the IE-78330-R still does not operate after performing the above countermeasures, consult our authorized dealers or salespeople.

APPENDIX A SPECIFICATIONS

This appendix describes the IE-78330-R specifications. The specifications are divided into two categories: product specifications (including outside dimensions and electric specifications) and debugger specifications.

[Product specifications]

Outside dimensions	Depth: 370 mm Width: 160 mm Height: 283 mm
Weight	8.5 kg
Current	100 VAC 50/60 Hz 3 A
Operating temperature	10 °C to 40 °C
Storage temperature	-15 °C to +45 °C
Ambient humidity	10% to 80% RH

[Basic debugger specifications]

- Applicable device
  μPD78330, μPD78334, μPD78P334
- Operating frequency
  Up to 10 MHz (Default: 8 MHz)
- Clock supply
  From crystal oscillator in IE-78330-R only. Clocks cannot be supplied from target system. However, arbitrary crystal oscillator can be set.
- Memory
  - Alternate memory capacity
    Internal ROM and alternate memory: 56K bytes
    Internal RAM: 1280 bytes
  - Mapping unit
    Internal ROM and alternate memory: In units of 8K bytes
    Internal RAM: In units of 128 bytes
- Event detection
  - Pulse detection:
    4 points
    (address/data/status/external sense signal; 4 types of settings per point are allowed for addresses only.)
  - Program execution detection:
    4 points
    (address signal: no address can be masked.)
  - External signal level detection:
    4 bits of external sense signal
  - Event trigger signal external output:
    1 bit

- Event integration
  - Sequential enable:
    Sequential events are detected.
  - Trigger condition setting:
    Analyzer stop or break condition setting
  - Qualified-trace condition setting:
    Qualified trace is performed.
  - Checkpoint condition setting:
    Data such as contents of specified internal RAM, register, and SFR is traced.
  - Bus count:
    Event conditions specified as trigger condition are counted.
  - Delay count:
    Delay amount from event condition occurrence to triggering is set.
- Event count
  Elapsed execution time and number of instructions (not traceable but displayed only)
- Sampler function
  Data in specified internal RAM is sampled at regular intervals, and is displayed (with only 3 words set).
- Coverage function
  Program area used for execution (including invalid fetches) is displayed.
- Cause of break
  - Break based on event detection
  - Manual break
  - Command-based break
  - Fail-safe breaks:
    Non-map break
    Write-protect break
    SFR illegal access break
    Turbo access break
- Real-time trace
  - Cause of trace
    Total trace
    Sectional trace
    Qualified trace
  - Trace capacity

    8K bytes × 88 bits
  - Trace contents

Main bus[Note 1]	: Address	: 16 bits
	Data	: 16 bits
	Status	: 6 bits
CPU internal bus[Note 2]	: Address	: 9 bits
	Data	: 16 bits
	Status	: 7 bits
Others	: External sense signal:	8 bits (to be selected)
	Time tag:	8 bits
	Others	: 8 bits

Notes
1. Bus for fetching programs into and accessing data in internal ROM or expansion memory
2. Bus for accessing data in CPU internal RAM and SFR

- Command functions
  - Online assembling, disassembling
  - Memory/register/SFR manipulation
  - Event/trace condition setting
  - Mapping
  - Reset
  - Emulation start/stop
  - Symbolic debugging
  - Object/symbol/debugging environment load and save
  - Console redirection, help command, PROM programmer control, history
  - Line edit
- Target interface Emulation probe (optional)
- External interface
  - RS-232-C
    CH1: For terminal and host machine connection
    CH2: For PROM programmer connection
  - Parallel interface (Centronics interface)
    CH3: For parallel output and printer connection
    CH4: For parallel input and high-speed download
- Host machine PC-9800 series
  IBM PC/AT
- Control program For MS-DOS (optional)
  For PC DOS (optional)
- Language processing program
  Relocatable assembler
- Others
  - Support of stand-by functions
  - Built-in latch-up protection circuit
  - Trace display and event detection setting modification during emulation CPU operation.

APPENDIX B BLOCK DIAGRAMS

This appendix provides the block diagrams of the control/trace module and driver module, which represent key functions of the IE-78330-R.

(1) Control/trace module block

<Driver control>

This is an interface with the driver module.

<Trace RAM>

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

<Memory bank selector>

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

<Serial interface>

Two RS-232-C interface channels are used.

<Parallel interface>

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

<I/O selector>

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

<DRAM unit>

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

<ROM>

A 56K-byte ROM is available which contains a program for activating the IE-78330-R.

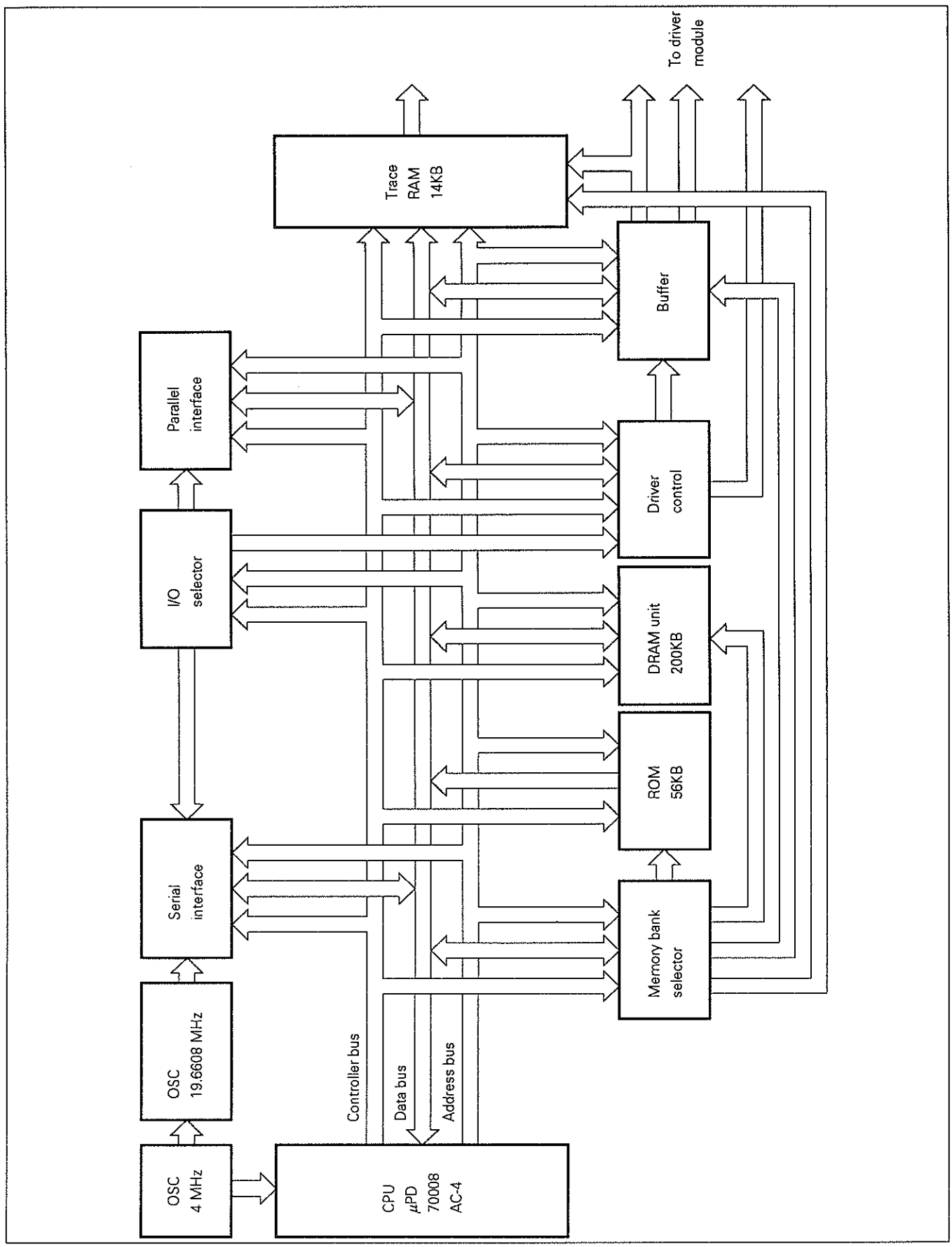


Fig. B-1 Block Diagram of Control/Trace Module

(2) Driver module block

<Event control>

This controls a wide variety of event detection functions available with the IE-78330-R.

<Break control>

This controls a wide variety of break functions provided by the IE-78330-R. Many different break conditions can be set by a combination of event conditions.

<Trace control>

This controls trace conditions. The IE-78330-R has a trace function with a capacity of 8K bytes by 88 bits for storing CPU execution status. Many different trace conditions can be set by a combination of event conditions.

<Latch-up>

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

<Alternate memory>

This memory is used for the supervisor CPU and emulation device to communicate with each other.

<Emulation memory>

This memory is a 56K-byte alternate memory that can be accessed by the μPD78330, μPD78334, or μPD78P334. Even when a target system is not completed yet, software can be debugged by using this memory. By using the mapping function, memory from 0 to 56K bytes can be allocated in units of 8K bytes to internal ROM, alternate RAM, and alternate ROM.

<Fail-safe control>

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

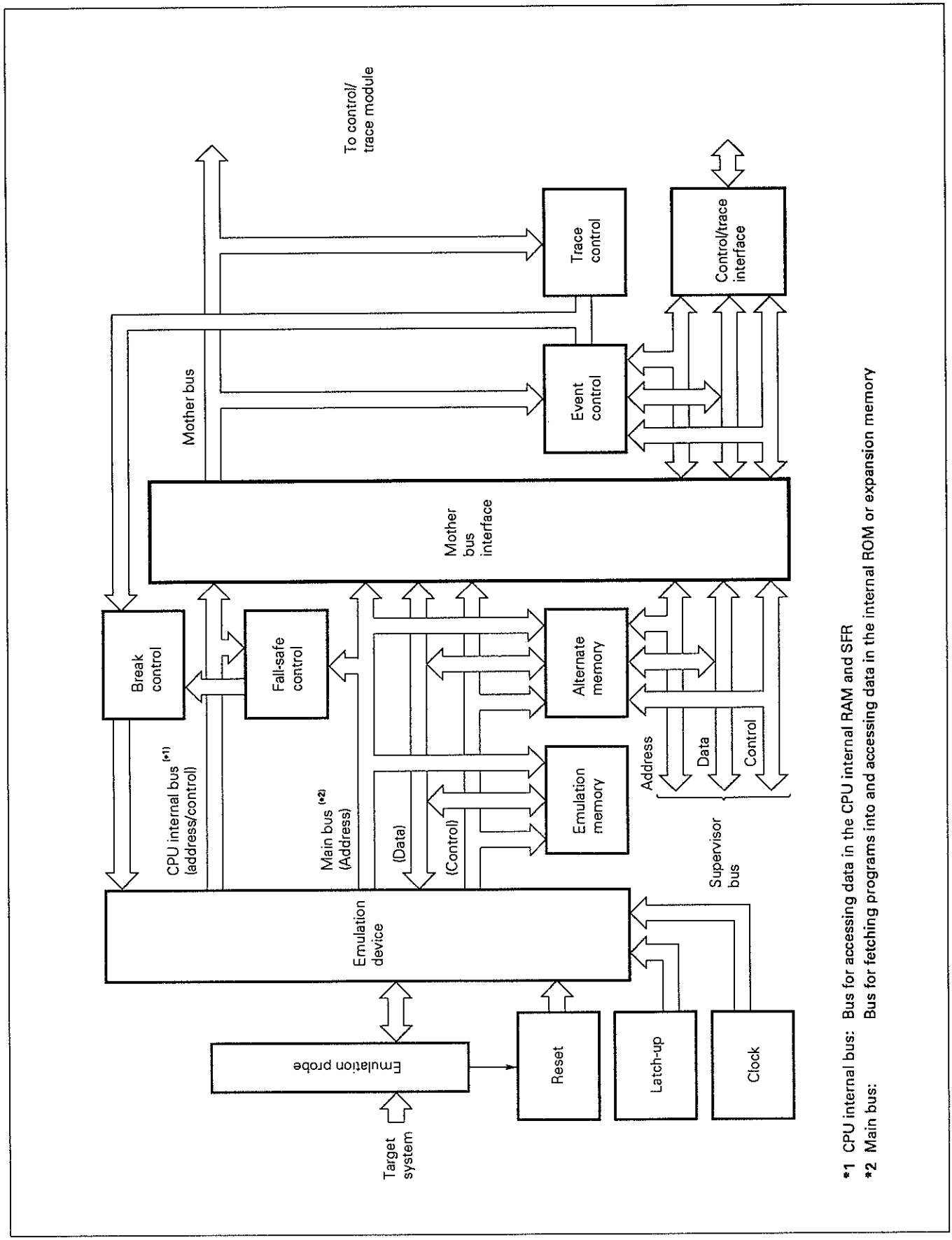


Fig. B-2 Block Diagram of Driver Module

APPENDIX C SETTING OF JUMPERS ON CONTROL TRACE BOARD

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

(1) Jumper setting

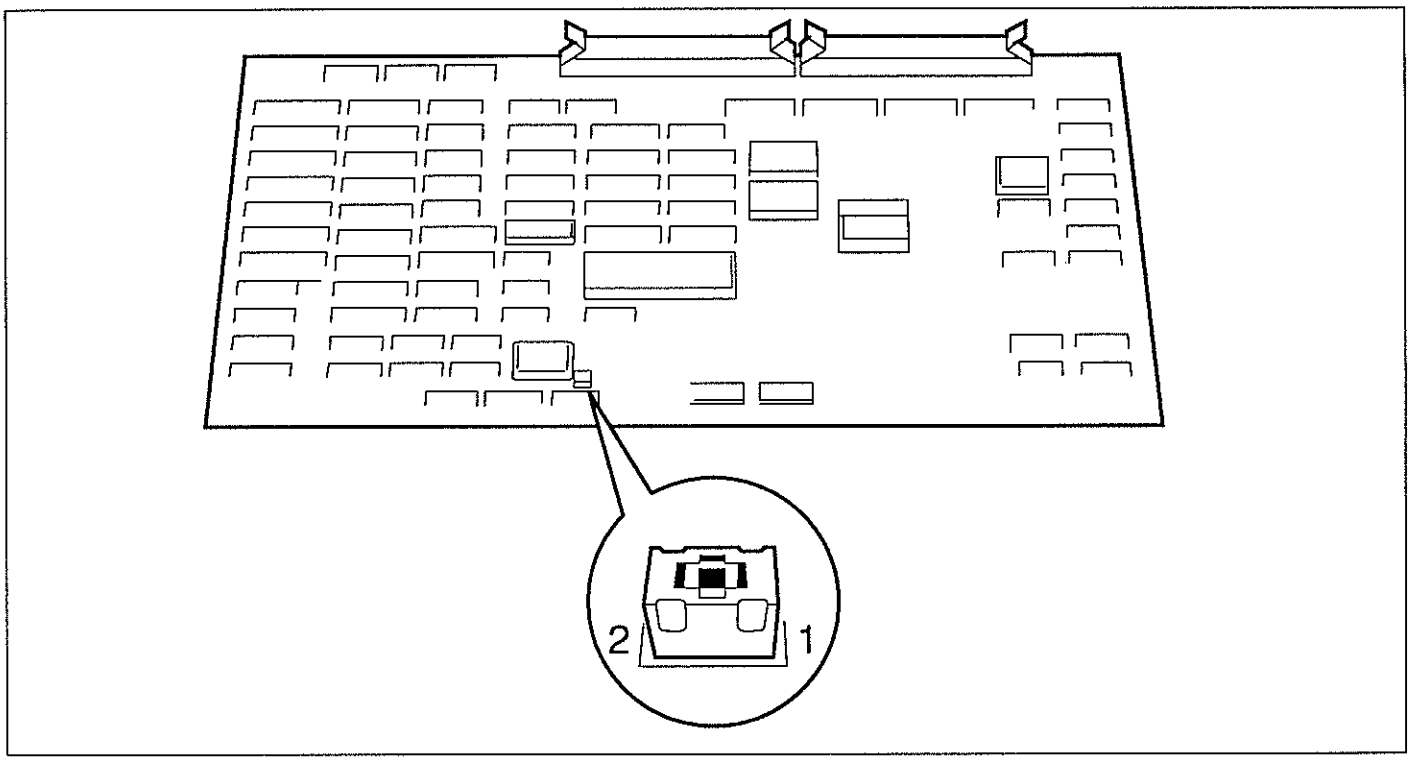
The jumper of the control/trace board is factory-set as described below.

Table C-1 Jumper Setting (Factory-Set)

Jumper No.	Setting
JP1	1-2 connected

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

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



(2) Control/trace board connection

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

❑ Procedure

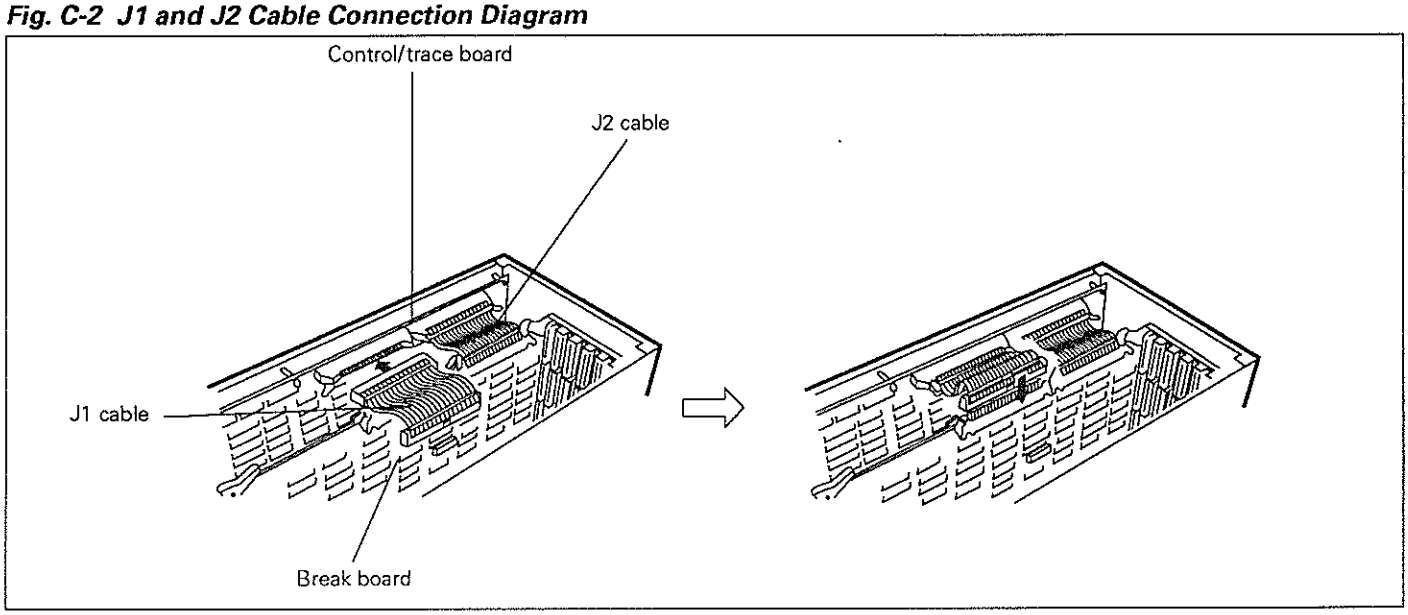
① Remove the six screws from the top of the IE-78330-R main unit to open the cover.

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

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

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

Fig. C-2 J1 and J2 Cable Connection Diagram



APPENDIX D COMMANDS

This appendix lists the commands used in the IE-78330-R in alphabetical order.

Command type	Command body	Subcommand	Operand	Default	Operation status trc:	emu:	brk:
Line assemble	ASM	None	[word] word Assemble start address	0H	×	×	O
Condition setting for detection of each event							
Condition setting for bus event detection	BRA	1 / 2 / 3 / 4	[A=mask16][V=mask8][C=status*][E=mask4] mask16 16-bit detection address range (up to 2 points) mask8 8-bit detection data mask4 4-bit external data status Detection status	A=0XXXXH V=0XXH C=NC E=0XXXXY	×	O	O
Condition setting for external data detection	BRD	None	[mask4] mask4 Signal levels of external sense clip No. 1 to 4	0XXXXY	×	O	O
Condition setting for program execution detection	BRS	1 / 2 / 3 / 4	[A=word] word Detection address	A=0H	×	O	O
Trigger condition setting	BRM	None	[[BRA1][BRA2][BRA3][BRA4][BRD][BRS1][BRS2][BRS3][BRS4] / OFF] BR? Each trigger condition OFF Releases each trigger condition.	BRA1	×	O	O
Check-point condition setting	CHK	None	[[BRA1][BRA2][BRA3][BRA4][BRD][BRS1][BRS2][BRS3][BRS4][REG / sfr / partition] / OFF] BR? Each check condition OFF Releases setting. REG Specifies register. sfr Specifies sfr names (up to 5 names). partition Specifies internal RAM range	OFF	×	O	O

* Select one of the following items for status:

OP / RW / R / W / RWP / RP / WP / RWM / RM / WM / NC

(Cont)

Command type	Command body	Subcommand	Operand	Default	Operation status trc:	emu:	brk:
Clock selection	CLK	None	[I / U] I Clock within emulator U User-set clock	I	×	×	○
Display of elapsed execution time and number of executed instructions	CNT	None	None	None	×	○	○
Command file creation	COM	None	[file / LST: / CON:] file File name LST: Printer CON: Console	CON:	○	○	○
Display of CO coverage measurement results							
Measurement result display	CVD	D*	[partition] partition Display range	None	×	×	○
Measurement result initialization	CVD	K	[partition] partition Initialization range	None	×	×	○
Manipulation of CO coverage measurement range							
Measurement range addition	CVM	A	[partition] partition Coverage range	None	×	×	○
Measurement range display	CVM	D*	[partition] partition Display range	None	×	×	○
Release of measurement range specification	CVM	K	[partition] partition Initialization range	None	×	×	○
Disassemble	DAS	None	[word / partition] word Disassemble start address partition Disassemble address range	0H	×	×	○
Directory display	DIR	None	[file] file File name	Current directory for current drive	○	○	○
Setting of trigger point location	DLY	None	[F / M / L] F Sets trigger point location at start of trace memory. M Sets trigger point location in middle of trace memory. L Sets trigger point location at end of trace memory.	L	×	○	○
Subprocess execution	DOS	None	None Executable only with MS-DOS or PC DOS based machine. User can return to control program by entering EXIT <cr>.	None	○	○	○
Disable condition setting	DSB	None	[{BRA1][BRA2][BRA3][BRA4][BRD][BRS1][BRS2][BRS3][BRS4} / OFF] BR? Each disable condition OFF Releases each disable condition.	OFF	×	○	○

* This subcommand is assumed to be specified and is executed when only the command body is entered.

(Cont)

Command type	Command body	Subcommand	Operand		Default	Operation status trc:	emu:	brk:
Enable condition setting	ENB	1 / 2 / 3	[[BRA1][BRA2][BRA3][BRA4][BRD][BRS1][BRS2][BRS3][BRS4] / ON]	BR? Each enable condition ON Releases each enable condition.	ON	×	○	○
Display of event detector setting status	EVN	None	None		None	○	○	○
Control program termination	EXT	None	None		None	×	×	○
Command history display	HIS	None	None		None	○	○	○
Command help display	HLP	None	[command]	command Command body	None	○	○	○
Loading of object, symbol, and debugging environment	LOD	None	file[module name¥*1][D][C][S][$V]	file File name module name¥ Name of module D Specifies debugging environment. C Specifies object. S Specifies symbol. $V Specifies verification.	None	×	×	○
Result output to file	LST	None	{ file / LST: / CON: }	file File name LST: Printer CON: Console	CON:	○	○	○
Mapping	MAP	I	[partition*2 / 0K / 8K / 16K / 24K / 32K / 40K / 48K / 56K]	I Internal emulation ROM partition Mapping range	None	×	×	○
	MAP	T / W / R / U / K	[partition*2]	T Emulation turbo access manager W Emulation RAM R Emulation ROM U User memory K Releases mapping (non-mapping) partition Mapping range	None	×	×	○
Mathematical operation	MAT	None	expression	expression Expression	None	○	○	○
Memory manipulation								
Memory contents change	MEM	C	[word]	word Change start address	0H	×	○	○

*1 When an IBM PC/AT machine is used as the host machine, \ is used in place of ¥.
*2 Can be set in units of 8K.

NEC

(Cont)

Command type	Command body	Subcommand	Operand	Default	Operation status trc:	emu:	brk:
Memory manipulation							
Memory contents display	MEM	D*	[{word / partition}] word Display start address; partition Display address range	0H	×	O	O
Memory check	MEM	E	[partition] partition Check address range	None	×	×	O
Memory contents initialization	MEM	F	partition data-string partition Initialization address range; data-string Initialization data string	None	×	×	O
Memory contents retrieval	MEM	G	partition data-string partition Retrieval address range; data-string Retrieval data string	None	×	×	O
Memory contents copy	MEM	M	partition word word Copy destination start address; partition Copy source address range	None	×	×	O
Memory contents comparison	MEM	V	partition word word Comparison destination start address; partition Comparison source address range	None	×	×	O
Memory contents exchange	MEM	X	partition word word Exchange destination start address; partition Exchange source address range	None	×	×	O
Channel 2 mode setting	MOD	None	[MODE={CHAR / FLOW}][BAUD={19200 / 9600 / 4800 / 2400 / 1200 / 600 / 300}][LONG={7 / 8}][PAR={NON / EVEN / ODD}][STOP={1 / 2}] Handshaking mode; Baud rate; Character length; Parity bit; Stop bit	MODE=CHAR BAUD=9600 LONG=8 PAR=NON STOP=2	×	O	O
Data transfer between alternate memory and user memory	MOV	{U / I}	partition word[$V] U From alternate memory to user memory; I From user memory to alternate memory; word Transfer destination start address; partition Transfer source address range; $V Specifies verification.	None	×	×	O
Trigger signal external output specification	OUT	None	[{OFF / ON}] OFF Sets external sense clip No.1 as trace signal input. ON Sets external sense clip No.1 as trigger signal output.	OFF	×	O	O
Pass condition setting	PAS	None	pass8 pass8 Pass count	1T	×	O	O
PROM programmer control, control character change and cancellation	PGM	C	C Specifies control character change/cancellation.	None	×	×	O
Sampling address setting	PSA	None	[word][word][word] word Sample address	None	×	O	O

* This subcommand is assumed to be specified and is executed when only the command body is entered.

(Cont)

Command type	Command body	Subcommand	Operand		Default	Operation status trc	emu:	brk:
Sample data display	PSD	None	[ALL / F / L / T / point] [$Y / $B / $W]	ALL Displays all sample data. point Number of sample pointer shifts F Sets sample pointer at start of sample memory. L Sets sample pointer at end of sample memory. T Sets sample pointer at event detection point. $Y Specifies bit display. $B Specifies byte display. $W Specifies word display	None	×	○	○
Sample timing setting	PST	None	[number / .4 / .6 / .8]	number Sample timing .4 0.4 μs .6 0.6 μs .8 0.8 μs	.4	×	○	○
Register manipulation								
Register change	REG	C	[PSW flag name / register name]	PSW flag name Name of PSW flag register name Name of register	R0	×	○	○
Register display	REG	D*1	[ALL / PSW flag name / register name]	ALL Specifies all registers of all register banks. register name Name of register PSW flag name Name of PSW flag	All registers of current bank	×	○	○
Resetting of IE-78330-R and emulation CPU	RES	None	[H]	H Resets IE-78330-R.	None	○	○	○
Execution								
Real-time execution without breaks	RUN	N	[word]	word Execution start address	0H	×	×	○
Real-time execution under break conditions	RUN	B	[word]	word Execution start address	0H	×	×	○
Step-by-step execution	RUN	T	[word][, *2 / step16][REG][TRD]	word Execution start address step16 Number of 16-bit steps REG Specifies register display. TRD Specifies trace display. PRC Specifies procedure execution. *2 See below.	0H 1T	×	×	○
Procedure execution	RUN	T	[word][, *2 / step16][REG][TRD]PRC					

*1 This subcommand is assumed to be specified and is executed when only the command body is entered.

*2 This is to be replaced with the following table:

[register name / PSW flag name] [=, >, <, =>, =<, ><, <>] [mask8*3 / mask16 / bit]

mask8	8-bit mask data
mask16	16-bit mask data
bit	1-bit numeric

*3 Only =, ><, or <> can be used with a mask representation.

(Cont)

Command type	Command body	Subcommand	Operand		Default	Operation status trc:	emu:	brk:
Saving of object and debugging environment	SAV	None	file[partition*1][C][D][$V]	file File name C Specifies object. D Specifies debugging environment. partition Save address range $V Specifies verification.	None	×	×	O
SFR manipulation								
SFR change	SFR	C	[sfr name]	sfr name Name of sfr	PO	×	O	O
SFR display	SFR	D*2	[sfr name]	sfr name Name of sfr	None	×	O	O
Termination	STP	None	[T]	T Terminates analyzer only.	None	O	O*3	×
Command input from file	STR	None	file[parameter]	file File name parameter Actual parameter	None	O	O	O
IE symbol manipulation								
IESYMBOL registration	SYM	A	symbol word	symbol Symbolic name word Symbol value	None	×	O	O
IESYMBOL change	SYM	C	symbol word	symbol Symbolic name word Symbol value	None	×	O	O
IESYMBOL deletion	SYM	E	symbol	symbol Symbolic name	All IE-SYMBOLs registered	×	O	O
IESYMBOL load	SYM	L	None		None	×	O	O
IESYMBOL save	SYM	S	None		None	×	O	O
Symbol manipulation								
Deletion of all symbols	SYM	K	None		All symbols registered	×	O	O
Display of all symbols	SYM	D*2	[module name¥*4]	module name¥ Name of module	All symbols registered	×	O	O
Current module specification	SYM	M	None		None	×	O	O

*1 Up to five save address ranges can be specified in partition.
*2 This subcommand is assumed to be specified and is executed when only the command body is entered.
*3 T specification is not allowed.
*4 When an IBM PC/AT machine is used as the host machine, \ is used in place of ¥.

(Cont)

Command type	Command body	Subcommand	Operand		Default	Operation status trc:	emu:	brk:
Trace data display	TRD	[F / I]	[ALL]{[$F / $J / $Q / $C]}	F Frame display I Instruction display ALL Specifies display of all trace data and all data that match retrieval condition. $F Specifies display of five lines in front of and behind frame that matches retrieval condition. $J Specifies display of frames related to program branch processing. $Q Specifies display of frames that match retrieval condition. $C Specifies display of checkpoint frames.	None	×	○	○
Setting of trace data retrieval condition	TRF	None	[A=[word / partition]][V=mask8][C=status*][E=mask8]	word Retrieval address partition Retrieval address range status Retrieval status mask8 8-bit mask data	A=0XXXXH V=0XXH C=NC E=0XXH	×	○	○
Analyzer reactivation	TRG	None	None		None	×	○	×
Trace mode setting	TRM	None	[ALL / TRX / SEC]	ALL All traces TRX Qualified trace SEC Sectional trace	ALL	×	○	○
Trace data selection	TRS	None	{[E / T]}	E → EXIT External data T → TIME Time tag	EXT	×	○	○

* Select one of the following items for status:

BROP
OP
RWI
RI
WI
RW
R
W
RWP
RP
WP
RWM
RM
WM
NC

(Cont)

Command type	Command body	Subcommand	Operand		Default	Operation status trc:	emu:	brk:
Qualified trace condition setting	TRX	None	[[BRA1]|[BRA2]|[BRA3]|[BRA4] | OFF]	BR? Qualify condition OFF Qualify release	OFF	×	O	O
Comparison of object file with memory contents	VRY	None	file	file File name	None	×	×	O
Memory word length setting	WRD	None	[B | W]	B Byte specification W Word specification	B	×	O	O