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April 1st, 2010
Renesas Electronics Corporation

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USER'S MANUAL

RENESAS

Phase-out/Discontinued

IE-78044-R-EM

Emulation Board

Phase-out/Discontinued

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

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Major Changes

Page	Contents
Throughout	μ PD78044A Subseries has been added to the target device.
P. 6	1.7 Difference between μPD78044 Subseries and μPD78044A Subseries has been added.
P. 25	Fig. 4-4 Using an External Clock has been changed. Remarks have been added to Table 4-1 Main System Clock Setting .
P. 32	The figure on the IE-78000-R side (emulation device) in the section 4.2.2 (2) To use a crystal oscillator has been changed.
P. 36	Typical values for each pin has been added to the table in the section 4.3.1 (1) To use a ceramic/crystal resonator .
P. 45	The peripheral emulation device in APPENDIX A IE-78044-R-EM SPECIFICATIONS has been changed from the μ PD78P044 to the μ PD78P048A.
P. 54-59	Table D-1 IE-78000-R System Configuration <ul style="list-style-type: none"> • The following subseries have been added to the target device. The corresponding emulation boards and emulation probes for these subseries have been added: μPD78018F, 78044A, 78054Y, 78078, 78083, and 780208 Subseries • μPD78098 Subseries and DF78098 have been developed.
P. 63	APPENDIX F REVISION HISTORY has been added.

The mark ★ shows major revised points.

INTRODUCTION

Outline: IE-78044-R-EM is connected to IE-78000-R to debug the μ PD78024 Subseries, 78044 Subseries, and 78044A Subseries 8-bit singlechip micorcomputers.

Readers: This manual is intended for engineers who debug μ PD78024 Subseries, 78044 Subseries, and 78044A Subseries systems with IE-78000-R and IE-78044-R-EM. IE-78000-R can emulate the μ PD78024 Subseries, 78044 Subseries, and 78044A Subseries. Therefore, the engineers who read this manual are required to have sufficient knowledge regarding the μ PD78024 Subseries, 78044 Subseries, and 78044A Subseries functions and applications, and debugger.

Organization: To use IE-78000-R, read the manual supplied with IE-78044-R-EM (this manual), the manual supplied with IE-78000-R, and the manuals supplied with the screen degbugger (Introduction and Reference Manuals).

IE-78044-R-EM
User's Manual

(Supplied with IE-78044-R-EM)
Functional outline
Connecting IE-78044-R-EM
Connecting emulation probe

IE-78000-R
User's Manual

(Supplied with IE-78000-R)
Basic specifications
System configuration
External interface function

SD78K0
Screen Debugger
User's Manual
Introduction

(Supplied with screen debugger)

SD78K0
Screen Debugger
User's Manual
Reference

Basic use of IE-78000-R

Functional outline
Command description
Menu description

Purpose: This manual describes basic specifications and correct connections for IE-78044-R-EM.

How to read this manual:

- To understand the basic specifications, read "CHAPTER 1 GENERAL".
- To connect IE-78044-R-EM, read "CHAPTER 2 INSTALLATION" and the IE-78000-R User's Manual

Terms: The following terms are used throughout this manual:

Term	Meaning
Emulation Device	Device emulating the target device in the emulator. Includes the emulation CPU.
Emulation CPU	CPU executing the user-developed program in the emulator.
Target Device	Device to be emulated (actual chip).
Target Program	Program to be debugged (user-developed program).
Target System	System to be debugged (user-developed system). Includes the target program and user-developed hardware. Narrowly, means the hardware only.

Legend: *: Footnote

Caution: Points to be noted

Remarks: Supplement

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CHAPTER 1 GENERAL

IE-78044-R-EM is an emulation board for the IE-78000-R development system for NEC's μ PD78024 Subseries, 78044 Subseries, and 78044A Subseries 8-bit single-chip microcomputers. By combining this board with an optional IE-78000-R with an emulation probe, the μ PD78024 Subseries, 78044 Subseries, and 78044A Subseries can be efficiently emulated. ★

1.1 Features

The IE-78044-R-EM features, when it is connected to IE-78000-R, are as follows:

- (1) Emulates the peripheral functions (such as I/O ports) for the target device
- (2) Traces the I/O port status during emulation
- (3) Controls mask option resistor connections and P04/XT1 pin switching through software

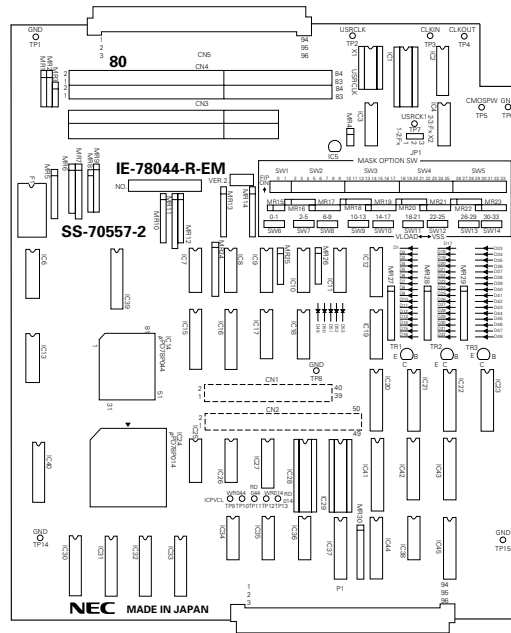
1.2 Unpacking

The IE-78044-R-EM shipping carton contains the following accessories, as well as IE-78044-R-EM. On unpacking, confirm that these items are present.

	Qty
(1) IE-78044-R-EM	1
(2) Component block (w/cover)	2
(3) Screw	5
(4) User's manual (this manual)	1

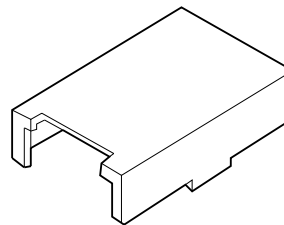
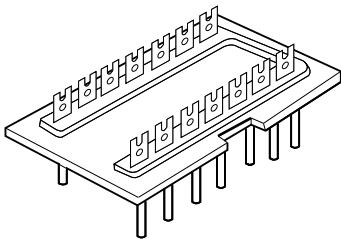
Fig. 1-1 IE-78044-R-EM Accessories

(1) IE-78044-R-EM



(2) Component block*

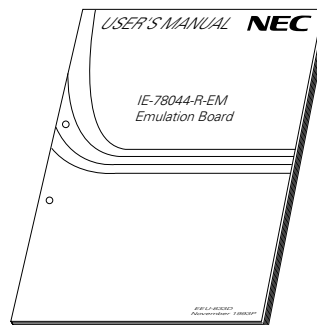
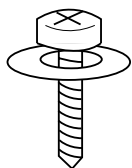
Component block cover



*: The component block is supplied with the cover shown on the right.

(3) Screw

(4) User's Manual (this manual)



Phase-out/Discontinued

1.3 IE-78044-R-EM Appearance and Names for Respective Parts

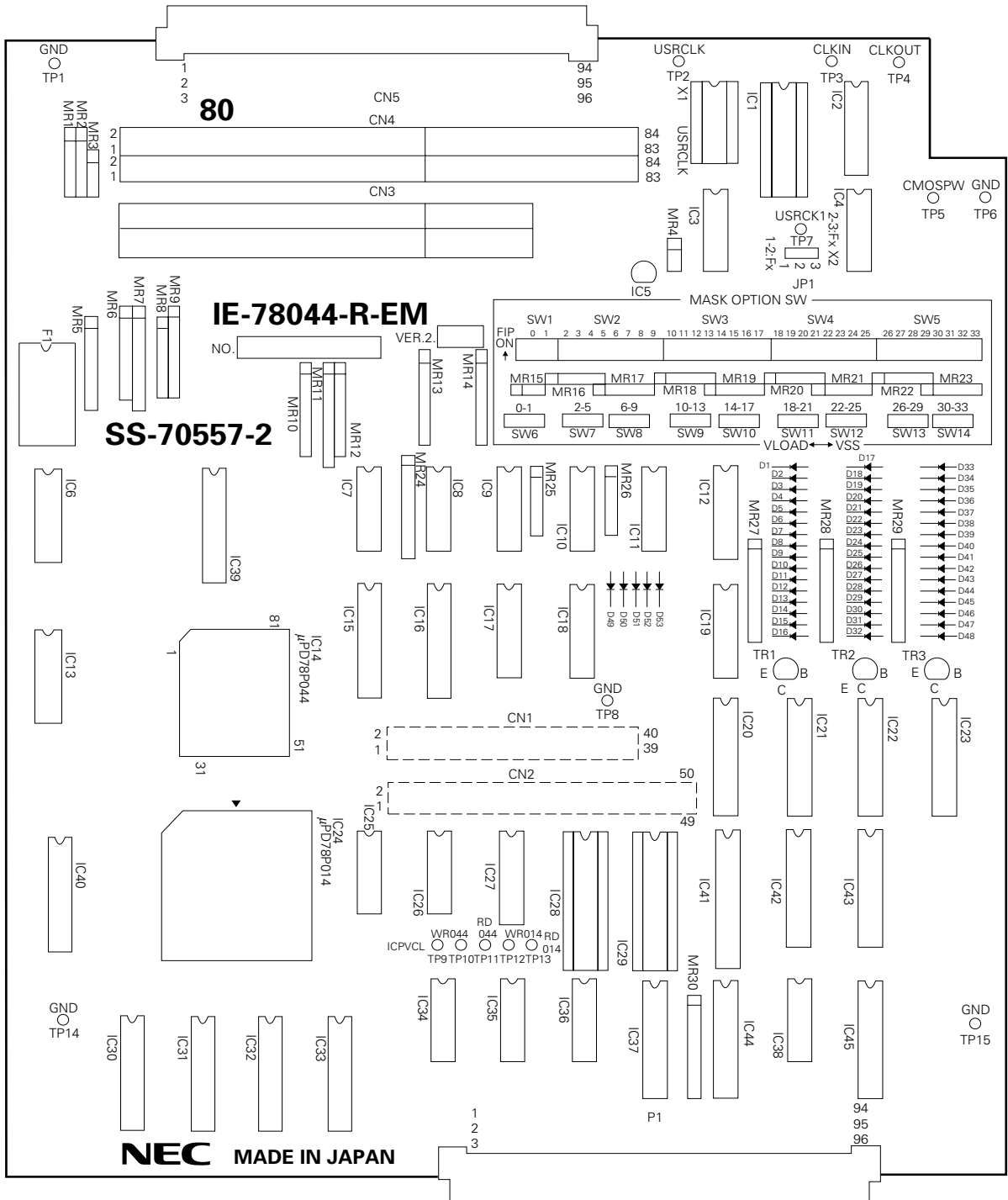


Table 1-1 Respective Part Names

Name	Function
CN1	Break board connector
CN2	
CN3	Break board connector
CN4	
CN5	Emulation probe connector
P1	Main bus connector

1.4 Target Device

Devices that can be emulated by IE-78000-R with IE-78044-R-EM are as follows:

Series Name	Target Device
μ PD78024 Subseries*	μ PD78023 μ PD78024 μ PD78P024
μ PD78044 Subseries	μ PD78042 μ PD78043 μ PD78044 μ PD78P044
μ PD78044A Subseries	μ PD78042A μ PD78043A μ PD78044A μ PD78045A μ PD78P048A*

*: Under development

★

1.5 Emulation Probe

The emulation probe is optional. Select the one best suited to your target device package.

Table 1-2 Emulation Probe and Target Device

Emulation Probe	Target Device
EP-78024GF-R (64-pin plastic QFP)	μ PD78023 μ PD78024
EP-78024CW-R (64-pin shrink DIP)	μ PD78P024
EP-78130GF-R (80-pin plastic QFP)	μ PD78042 μ PD78042A μ PD78043 μ PD78043A μ PD78044 μ PD78044A μ PD78045A μ PD78P044 μ PD78P048A

★

1.6 Notes on correct use of IE-78044-R-EM

- (1) Be sure to turn off the power to IE-78000-R and the target system before connecting or disconnecting IE-78000-R and the target system, and changing the setting of switches.
- (2) When emulating the target device by using IE-78044-R-EM and IE-78000-R, the target device operations slightly differ from those for the actual device. (Refer to CHAPTER 3 DIFFERENCES BETWEEN TARGET DEVICES.)
- (3) To input data through the external sense clip, maintain voltage at +15 V.
- (4) To output data through the external sense clip, connect a pull-up resistor to the external sense clip on the target system, because the external sense clip has an open-collector output configuration.
- (5) Be sure to connect the emulation probe ground clip to the target system signal ground line.
- (6) Pins P8 and P12 cannot be traced as port pins.
- (7) 5V must be supplied to the target system as V_{DD} .

★ **1.7 Differences between μ PD78044 Subseries and μ PD78044A Subseries**

Table 1-3 lists the differences between the μ PD78044 Subseries and μ PD78044A Subseries. Other than these differences, the μ PD78044 Subseries and μ PD78044A Subseries have the same functions.

Table 1-3 Differences between μ PD78044 Subseries and μ PD78044A Subseries

Product Name	μ PD78044 Subseries	μ PD78044A Subseries
Internal high-speed RAM capacity	μ PD78042 : 512 bytes μ PD78043 : 1024 bytes μ PD78044 : 1024 bytes μ PD78P044 : 1024 bytes	μ PD78042A : 512 bytes μ PD78043A : 512 bytes μ PD78044A : 1024 bytes μ PD78045A : 1024 bytes μ PD78P048A : 2048 bytes
Minimum instruction execution time	0.48 μ s (operated at 4.19 MHz)	0.4 μ s (operated at 5.0 MHz)
Main system clock oscillation frequency (maximum value)	4.19 MHz	5.0 MHz
FIP controller/driver display output current	– 22 mA TYP. (FIP0-15) – 5.5 mA TYP. (FIP16-33)	– 18 mA TYP. (FIP0-33)
A/D converter conversion time	38.1 μ sMIN.	19.1 μ sMIN.

CHAPTER 2 INSTALLATION

This chapter describes the procedure for installing the μ PD78024 Subseries, 78044 Subseries, and 78044A Subseries development system with the IE-78044-R-EM connected to the following: ★

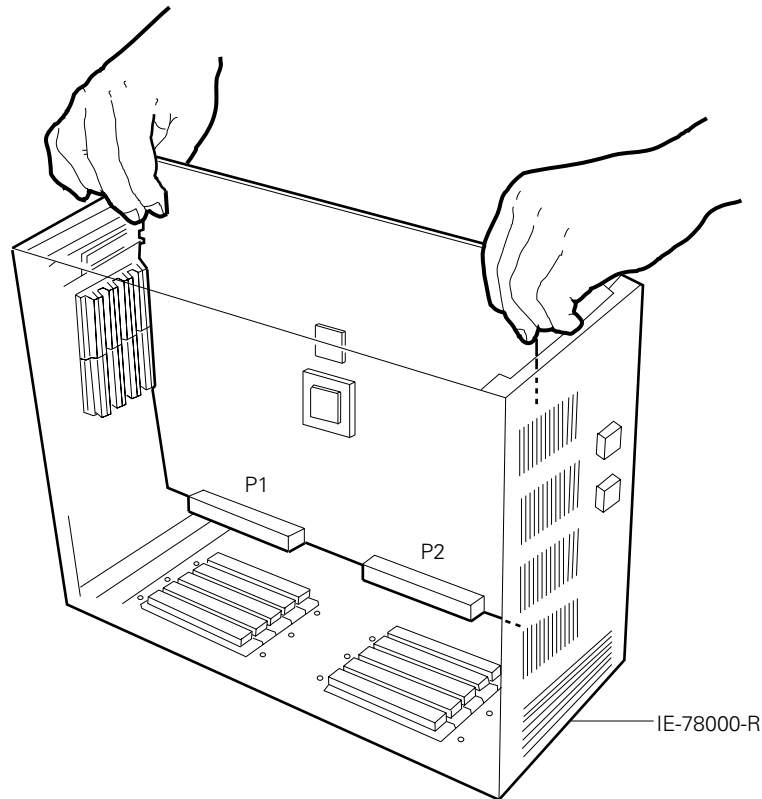
- Break board installed in IE-78000-R (IE-78000-R-BK)
- IE-78000-R
- Connector board and emulation probe (optional)

Before connecting these boards and probe, be sure to turn off the power to IE-78000-R and the target system.

For connecting the emulation probe to the target system, refer to **CHAPTER 5 CONNECTING TARGET SYSTEM** in the **IE-78000-R User's Manual**.

Connect IE-78044-R-EM, break board, IE-78000-R, connector board, and emulation probe as follows:

- (1) Remove the six screws from the top cover of IE-78000-R and remove the cover.
- (2) Disconnect cables J1 and J2 connecting the control/trace board (IE-78000-R-CS-A) and break board.
- (3) Pull the card pullers at both edges of the break board toward you, to pull out the break board from the slot.



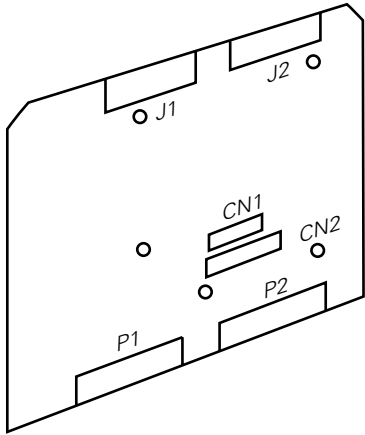
- (4) Connect IE-78044-R-EM to the break board.
Connect connectors CN1 and CN2 on IE-78044-R-EM to mating connectors CN1 and CN2 on the break board.
Secure the connectors with the screws supplied as accessories.

Caution: Be sure to connect CN1 and CN2 securely.

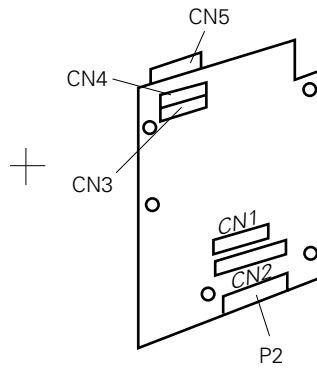
- (5) To use the user clock, mount the main system clock to the emulation board and the subsystem clock to the break board by using the component block (refer to **CHAPTER 4 SETTING CLOCK**).
- (6) Set the mask option by using the DIP switch on IE-78044-R-EM (refer to **3.1 Setting Mask Option**).
- (7) Connect connectors CN3 and CN4 for IE-78044-R-EM to mating connectors CN3 and CN4 on the connector board, supplied with the optional emulation probe.
- (8) Connect IE-78044-R-EM to the slot for the master board for the IE-78000-R's housing (connect the break board to the second slot from the right, and IE-78044-R-EM to the third slot from the right).
- (9) Connect cables J1 and J2.
- (10) Confirm the positions for the boards. Attach the top cover.
- (11) Connect connector CN5, on top of IE-78000-R, to the mating connector CN5 on the emulation board. Secure the connectors with screws.

Phase-out/Discontinued

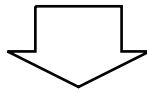
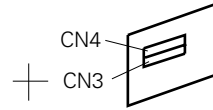
IE-78000-R-BK



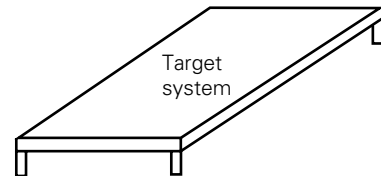
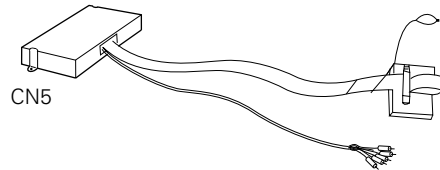
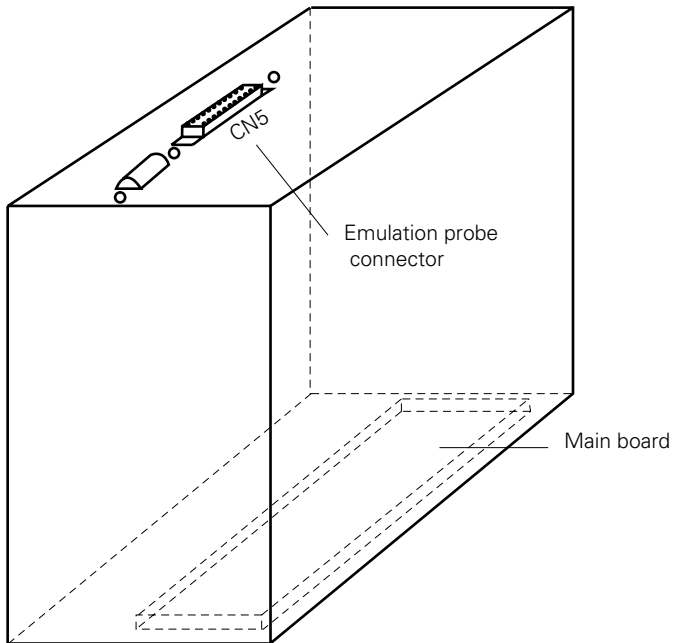
IE-78044-R-EM



**Connector board
(supplied with
emulation board)**



Emulation probe for your target system



IE-78000-R housing

CHAPTER 3 DIFFERENCES BETWEEN TARGET DEVICES

When emulating the target device with IE-78044-R-EM and IE-78000-R, the operations for the target device slightly differ from those for the actual device. This chapter describes these differences.

3.1 Setting Mask Option

Settings for the mask option resistors P3, P7*, P8, P9, P10, P11, and P12* can be changed by using the screen debugger (SD78K0) or the DIP switch on IE-78044-R-EM.

3.1.1 Setting mask option with screen debugger (SD78K0)

(1) P3

P3 is a CMOS I/O pin that can be connected to a pull-down resistor. Whether the pull-down resistor is connected or not can be selected on the configuration panel of the screen debugger.

(2) P7*

P7 is N-ch open-drain pins, that can be connected to a pull-up resistor. Note that P7 is a medium-voltage pin that can withstand +15 V. To connect or disconnect a pull-up resistor to these pins, use the configuration panel for the screen debugger.

(3) P0

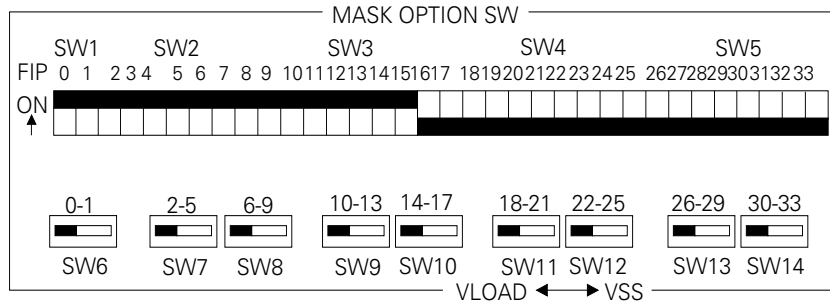
The P0/XT1 pin is a multiplexed pin and can be used as a port pin or a subsystem clock input pin. The function for this pin can be switched by the screen debugger configuration panel.

*: μ PD78024 Subseries is not provided with this port.

3.1.2 Setting mask option with DIP-SW

P8 through P12* also serve as FIP pins (-40 V). Connecting the mask option resistor to these pins is specified by the DIP switch on IE-78044-R-EM in 1 bit units. The connection destination (V_{SS} or V_{LOAD}) is specified by the slide switch below the DIP switch in 4 bit units.

Fig. 3-1 Setting Mask Option (factory-set condition)



FIP0-FIP15: pulled down to V_{LOAD}

FIP16-FIP33: not connected

*: μ PD78024 Subseries is not provided with P12.

Remarks: When emulating μ PD78024 Series, the target of mask option to be set with DIP-SW will be FIP0 to FIP25.

3.2 Target Interface Circuit

The target interface circuit allows the device to operate in the same manner as the target device on the IE-78000-R. It consists of an emulation device and various gates (ICs, such as CMOS and TTL).

To debug the target system connected to IE-78000-R, emulation is carried out by the target interface circuit in IE-78000-R, as if the actual target device were operating on the target system.

Individual target devices consist of CMOS LSIs. The target interface circuit emulation device also consists of CMOS LSIs. Therefore, the DC and AC characteristics for the target interface circuit are almost the same as those for the target device ($V_{DD} = 5$ V when operating).

However, the DC and AC characteristics for the target interface circuit are different from those for the target device, when the emulation device signals are input/output through gates.

Note that, a gate delay time (whose duration varies, depending on the gate) occurs each time the signal goes through a gate. This is responsible for the differences in the AC characteristics.

Therefore, design the target system, giving thorough consideration to these points.

Caution: When using IE-78000-R and IE-78044-R-EM, 5 V must be supplied to the target system (as the supply voltage V_{DD}).

3.2.1 Circuit inputting/outputting signal directly or via resistor to/from emulation device

(1) μ PD78024 Subseries as target

(a) Signals related to port

This circuit interfaces the following signals:

- Signal related to port 0
- Signal related to port 1
- Signal related to port 2
- Signal related to port 3
- Signal related to port 8
- Signal related to port 9
- Signal related to port 10
- Signal related to port 11

Fig. 3-2 Equivalent Emulation Circuit 1 (1/2)

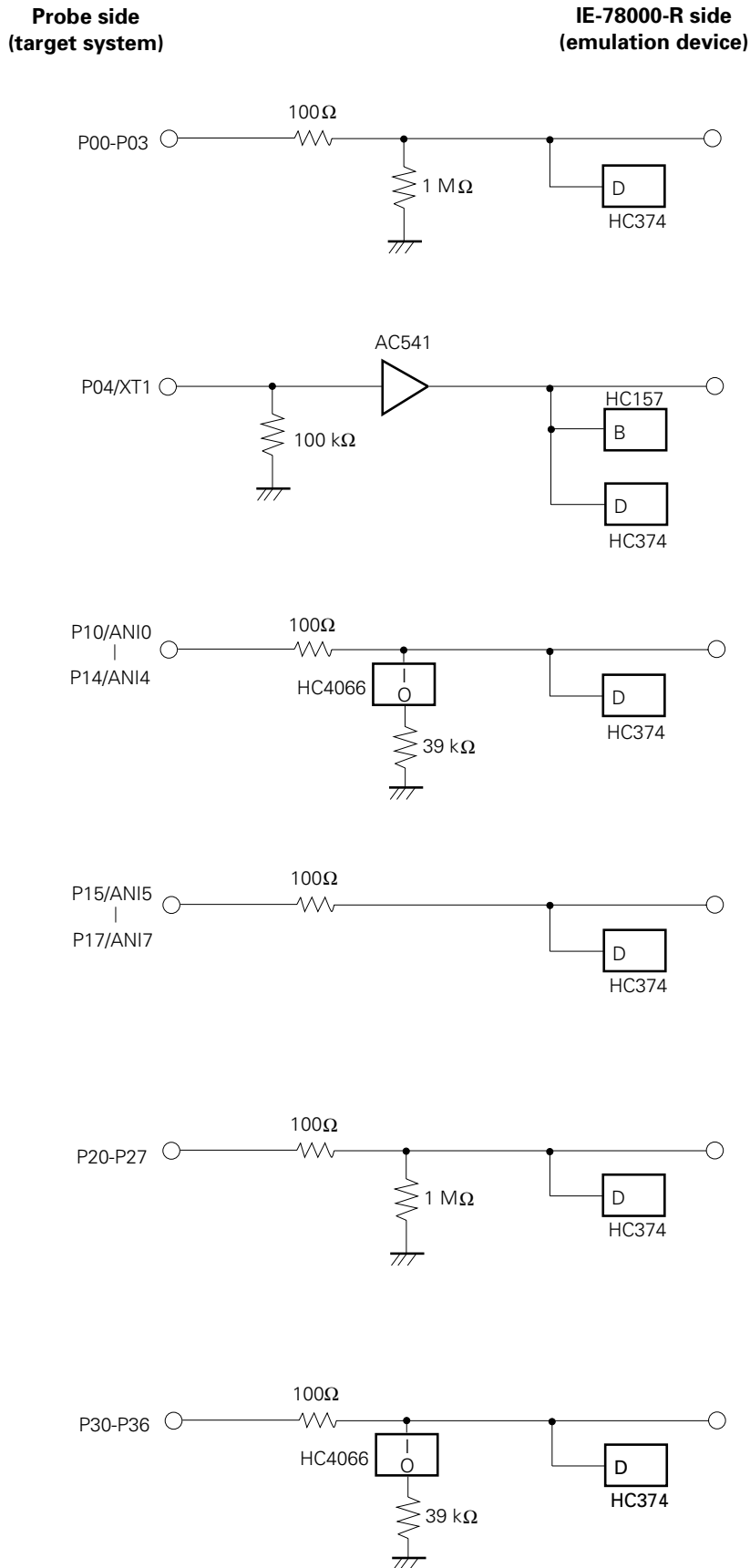
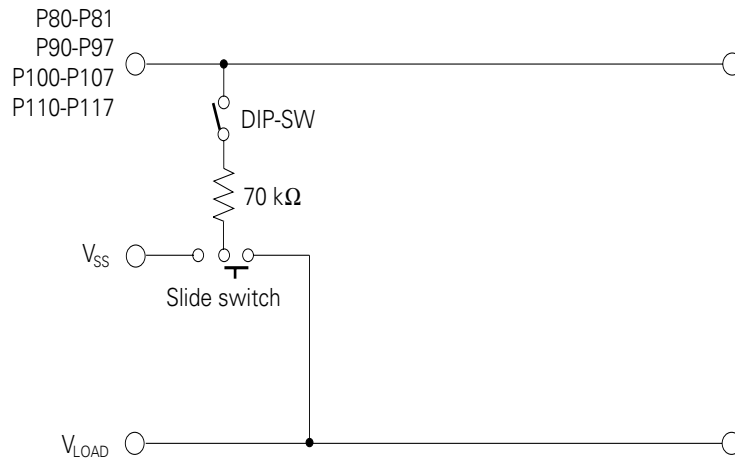


Fig. 3-2 Equivalent Emulation Circuit 2 (2/2)

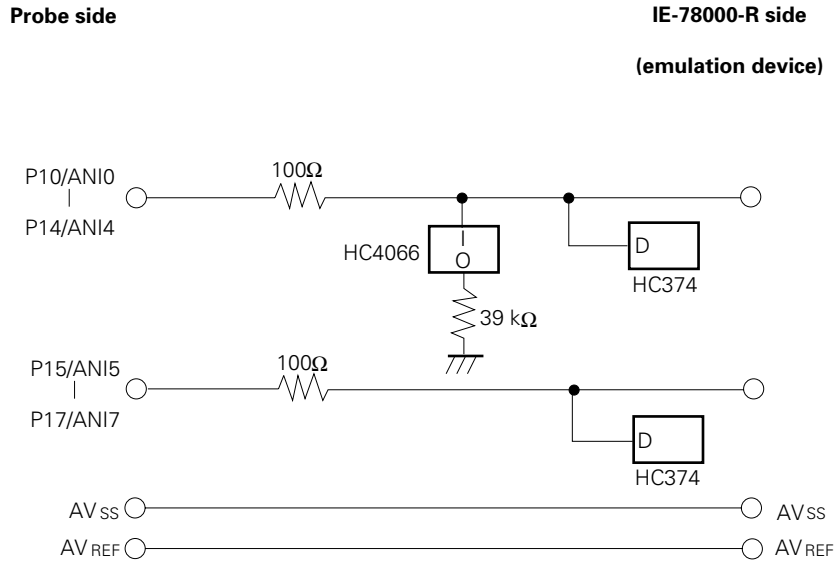
Probe side

IE-78000-R side
(emulation device)



(b) Analog signals

Fig. 3-3 Equivalent Emulation Circuit 2



(2) μ PD78044 Subseries and 78044 Subseries as target

★

(a) Signals related to port

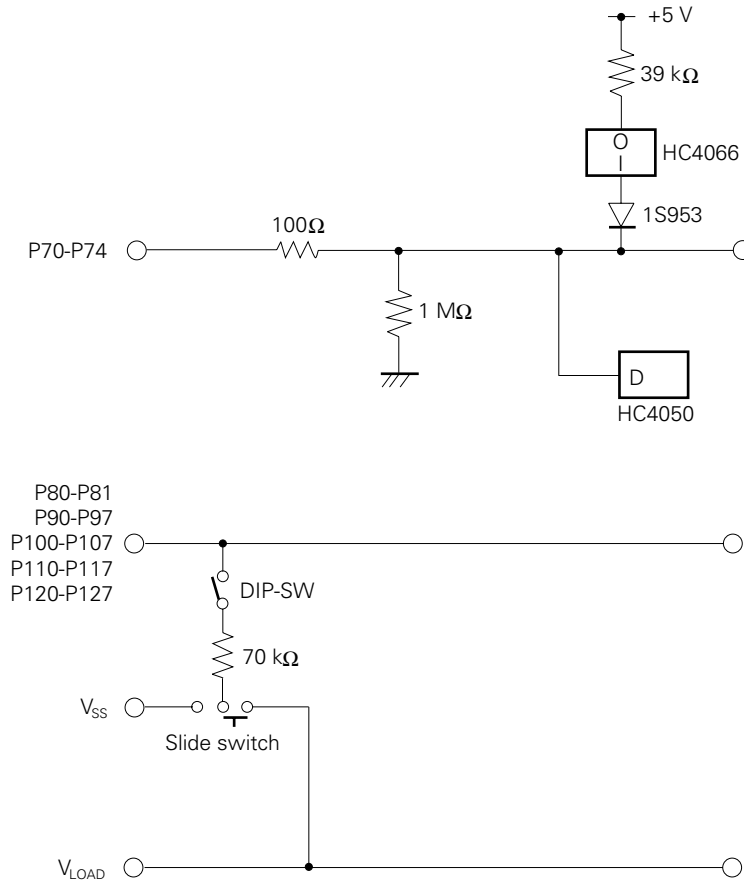
This circuit interfaces the following signals:

- Signal related to port 0
- Signal related to port 1
- Signal related to port 2
- Signal related to port 3
- Signal related to port 7
- Signal related to port 8
- Signal related to port 9
- Signal related to port 10
- Signal related to port 11
- Signal related to port 12

Fig. 3-4 Equivalent Emulation Circuit 3 (2/2)

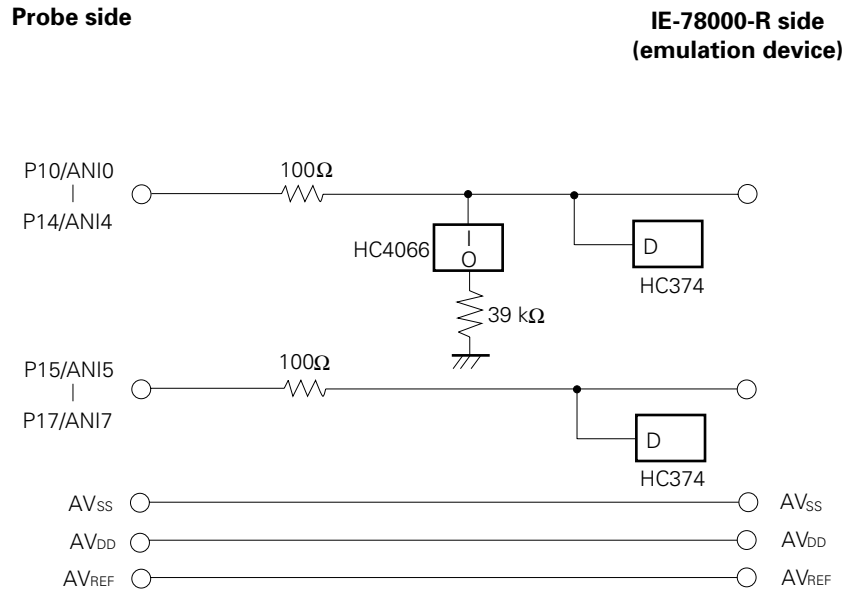
Probe side

**IE-78000-R side
(emulation device)**



(b) Analog signals

Fig. 3-5 Equivalent Emulation Circuit 4

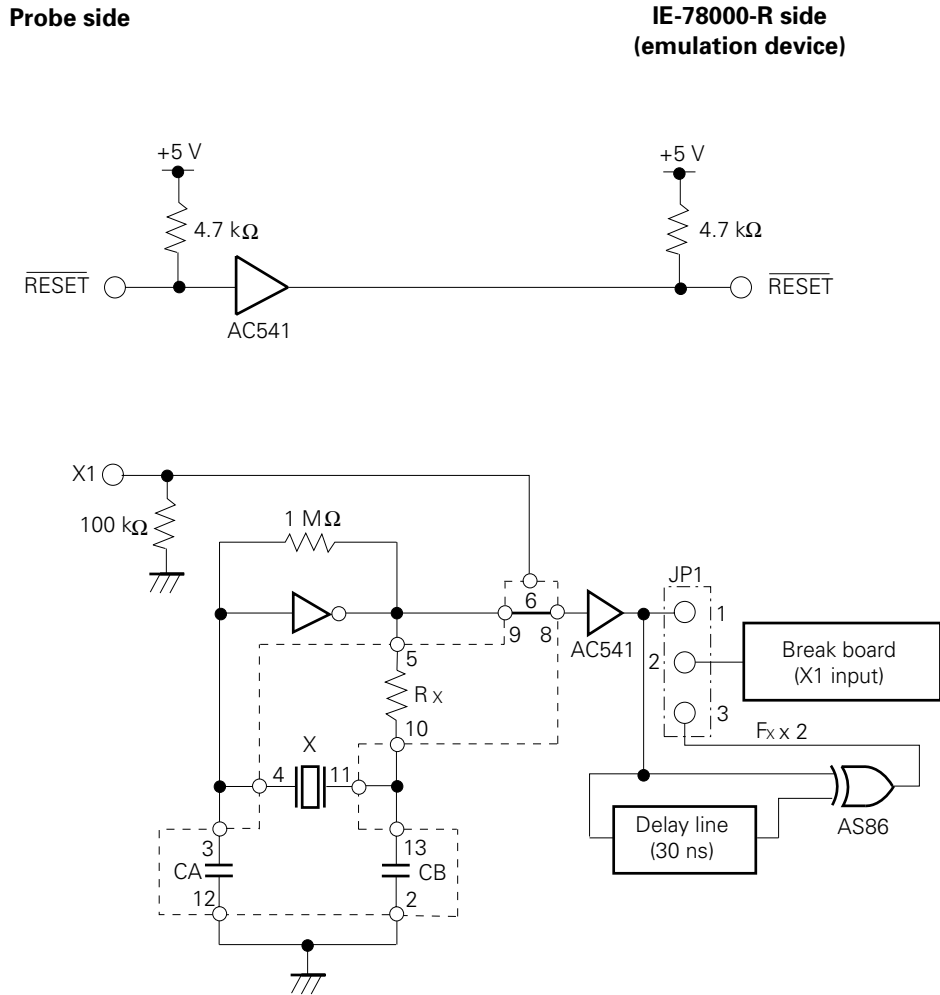


3.2.2 Circuit inputting signal via gate to emulation device

This circuit interfaces the following signals:

- $\overline{\text{RESET}}$ signal
- Signals related to clock input

Fig. 3-6 Equivalent Emulation Circuit 5



Remarks: The area enclosed by dotted lines indicates the portion to be attached to the component block.

3.2.3 Circuit inputting signal to control/trace module

This circuit interfaces the following signals:

- V_{DD} signal

Fig. 3-7 Equivalent Emulation Circuit 6



*: S-805 is a Seiko Instruments Inc. IC.

CHAPTER 4 SETTING CLOCK

This chapter describes how to set the clock.

4.1 Outline of Clock Setting

The main system clock can be selected from any of the following for debugging.
The subsystem clock can only be selected from (2) and (3).

- (1) Clock already mounted on the break board**
- (2) Clock mounted by user**
- (3) External clock**

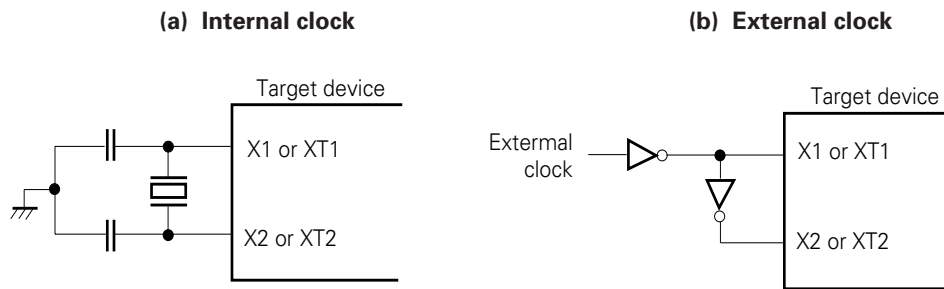
If the target system is provided with an internal clock, select **(1)** or **(2)**, above. The internal clock is the internal oscillator circuit of the target device. **Fig. 4-1 (a)** shows an external circuit. The oscillator mounted on the target system is not used for emulation. Instead, the clock mounted on the break board installed in the IE-78000-R is used.

If the target system is provided with an external clock, select **(3)**. The external clock is supplied from to the target device from an external source, and the internal oscillator circuit of the target device is not used. **Fig. 4-1 (b)** shows the external circuit.

Caution: An oscillator for a subsystem clock is not mounted on the break board.

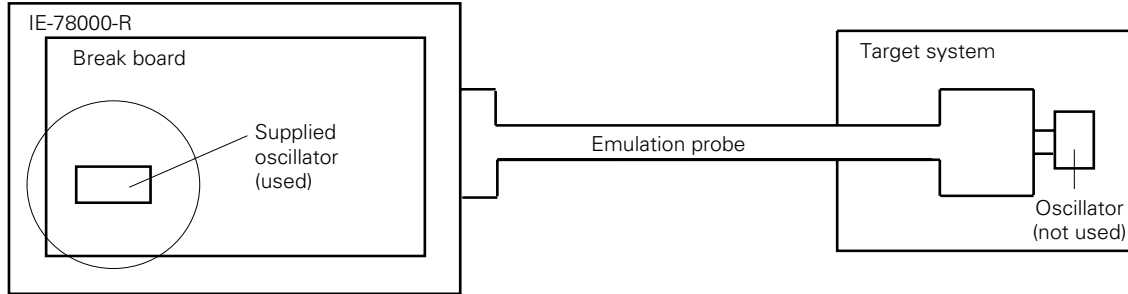
To use the subsystem clock either mount an oscillator to the break board or use an external clock.

Fig. 4-1 External Circuits of System Clock Oscillator Circuit



(1) Clock already mounted on break board

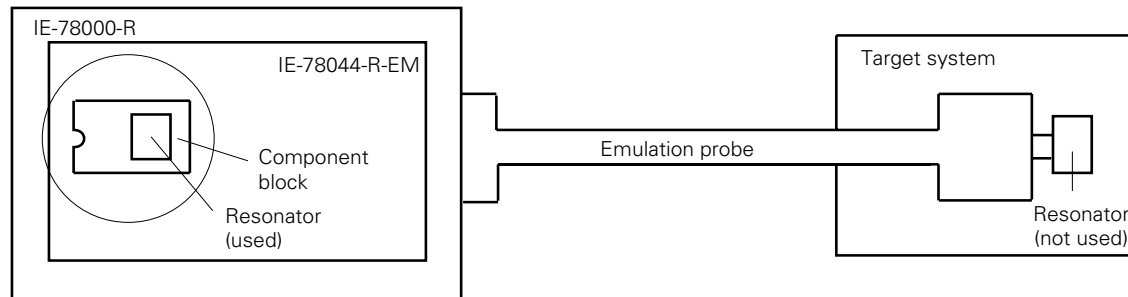
A crystal oscillator has been mounted on the break board, and its frequency is 4.19 MHz.

Fig. 4-2 Using Clock Mounted on Break Board

Remarks: The clock supplied by the oscillator on the break board (circled in the above figure) is used.

(2) User mounted clock

A clock meeting specific user specifications can be mounted on the IE-78044-R-EM. Mount the resonator to be used on the component block, and connect the component block to the IE-78044-R-EM. In this way, the target system can be debugged at a frequency different from that of the supplied clock.

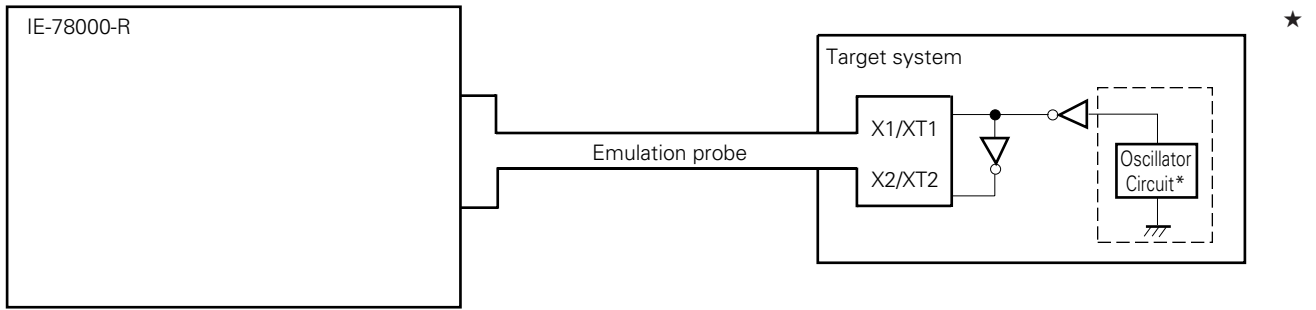
Fig. 4-3 Using a User Mounted Clock

Remarks: The clock supplied by the oscillator on the IE-78044-R-EM (circled in the above figure) is used.

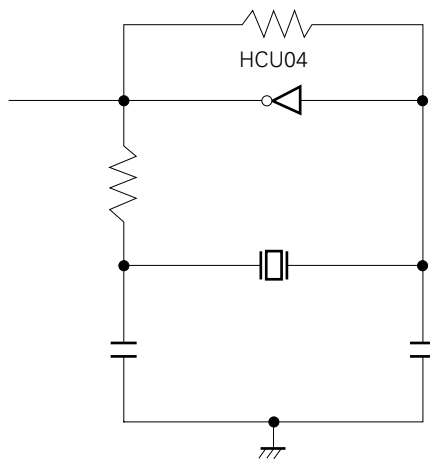
(3) External clock

The external clock on the target system can be used via an emulation probe.

Fig. 4-4 Using an External Clock



*: The following shows the circuit contained in the dotted line.



Remarks: The clock supplied by the external clock on the target system is used.

Table 4-1 shows the settings of the main system clock.

Table 4-1 Main System Clock Settings

Main System Clock Frequency		X1 (MAIN) Component Block of IE-78000-R-BK	IE-78044-R-EM		Clock Setting for Screen Debugger
			X1 (USRCLK) Component Block	JP1	
To use board mounted clock	4.19 MHz	6-8 shorted	6-8 shorted	2-3 shorted (Fx x 2 side)	IE
To use user mounted clock	A frequency other than 4.19 MHz		Create oscillation circuit		USER
To use external clock	4.19 MHz		6-8 shorted		

Remarks 1: The factory setting for the IE-78044-R-EM is for the case where "to use board mounted clock" in the above table.

2: The screen debugger must be Version 2.0 or higher.

4.2 Main System Clock Setting

4.2.1 Using the clock mounted on the break board

As a factory-set condition for shipment, a component block wired as shown in Fig. 4-5 is mounted to the X1 USRCLK socket on the IE-78044-R-EM. If the wiring of this component block remains the same as the factory-set condition, no additional hardware adjustments are required. However, if the user prepares a component block because another clock source is to be used, or because the wired component block has been lost, then make the connections in accordance with the procedure described below.

When starting the screen debugger (SD78K/0), select "IE" for the clock setting on the initial setting screen or configuration panel (this selects the internal clock of the emulator).

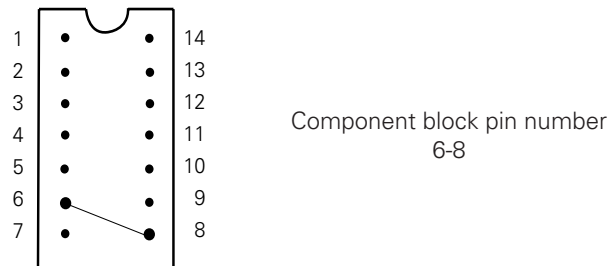
Prerequisites

- Component block (accessory of IE-78000-R)
- Lead wires
- Soldering tools

Procedure

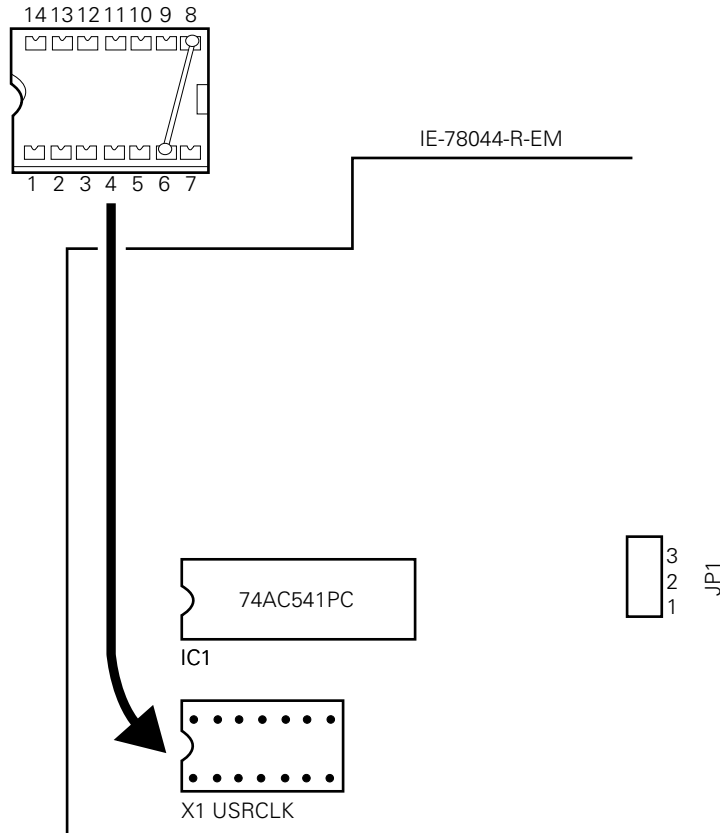
- ① Wire and solder the component block as illustrated below.

Fig. 4-5 Wiring of Component Block (to use the clock mounted on break board as the main system clock)



- ② Prepare the IE-78044-R-EM and the wired break board.
- ③ Mount the component block in 1 to the socket (labeled X1 USRCLK) on the IE-78044-R-EM. At this time, make sure that the pin mark 1 faces the correct direction.

Fig. 4-6 Component Block Mounting Position (to use the clock mounted on break board as the main system clock)



- ④ Confirm that the component mounted on the X1 (MAIN) socket on the break board is wired as shown in Fig. 4-5.
- ⑤ Connect the IE-78044-R-EM and break board to the IE-78000-R.

4.2.2 To use user mounted clock

Either procedure (1) or (2) below must be carried out depending on the clock to be used.

After the screen debugger has been started up, select "USER" on the initial setting screen or the clock configuration panel (selection of the user clock).

(1) To use a ceramic/crystal oscillator

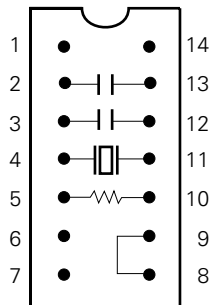
Prerequisites

- Component block (IE-78000-R accessory)
- Ceramic resonator or crystal resonator
- Resistor Rx
- Capacitor CA
- Capacitor CB
- Soldering tools

Procedure

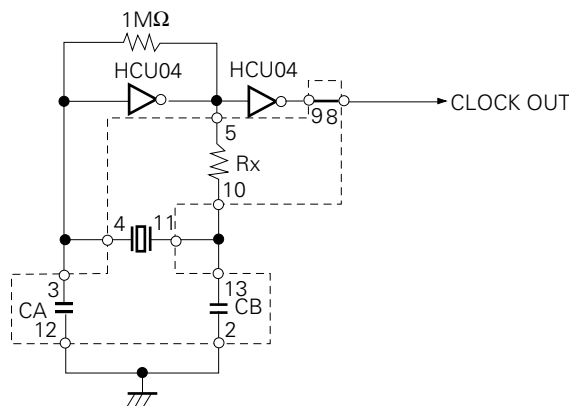
- ① Solder a ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB, all conforming to the frequency of the oscillator, to the component block.

Component block



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

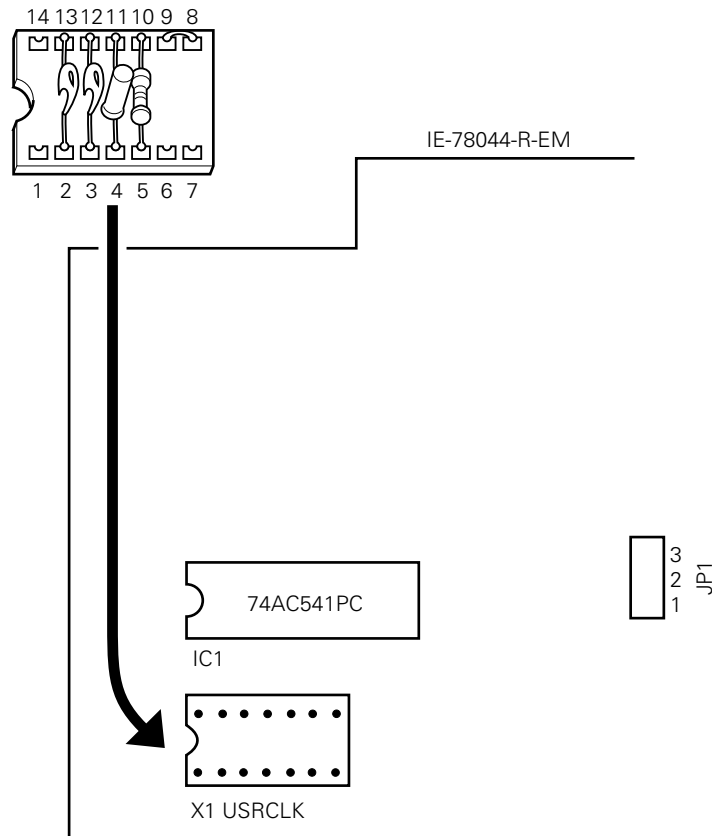
Circuit diagram



Remarks: The area enclosed by the broken line indicates the portion to be connected to the component block.

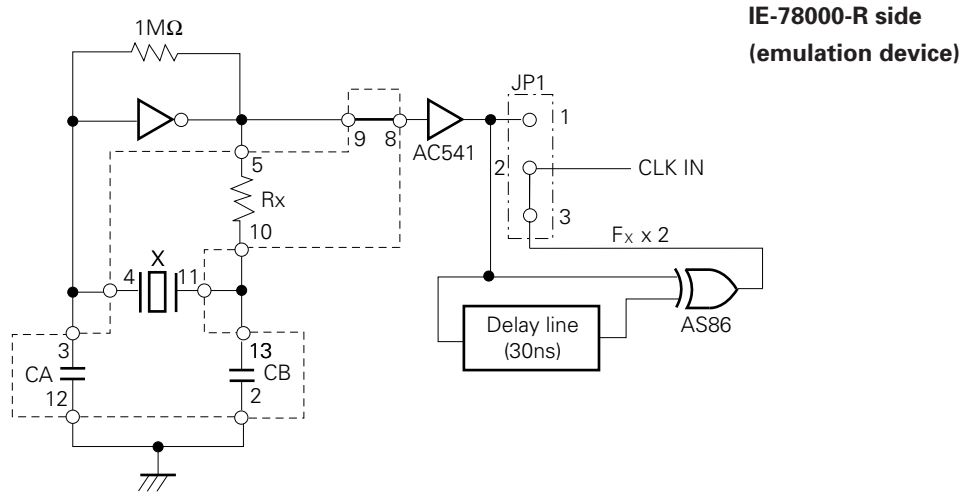
- ② Prepare the IE-78044-R-EM and the wired break board.
- ③ Remove the external clock component block from the socket on the IE-78044-R-EM (socket labeled X1 USRCLK).
- ④ Attach the component block in 1 to the socket (X1 USRCLK) from which the external clock component block has been removed in step 3. At this time, make sure that pin 1 faces the correct direction.

Fig. 4-7 Component Block Mounting Position (to use a user mounted clock as the main system clock)



- ⑤ Confirm that the component block mounted to socket X1 (MAIN) on the break board is wired as shown in Fig. 4-5.
- ⑥ Connect the IE-78044-R-EM and break board to the IE-78000-R.

The following circuit is configured by the above procedure, and the clock can be supplied from the mounted resonator to the emulation device.



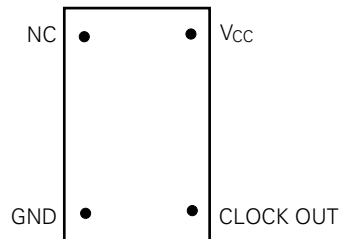
Remarks: The area enclosed by the broken lines indicates the portion to be attached to the component block.

(2) To use a crystal oscillator

Prerequisites

- Crystal oscillator (with pins wired as shown in Fig. 4-8)

Fig. 4-8 Crystal Oscillator (to use a user mounted clock as the main system clock)



Procedure

- ① Prepare the IE-78044-R-EM and the wired break board.
- ② Remove the external clock component block from the socket (socket labeled X1 USRCLK) on the IE-78044-R-EM.
- ③ Mount the crystal oscillator in socket X1 USRCLK.
Connect the crystal resonator to the socket pins as illustrated next.

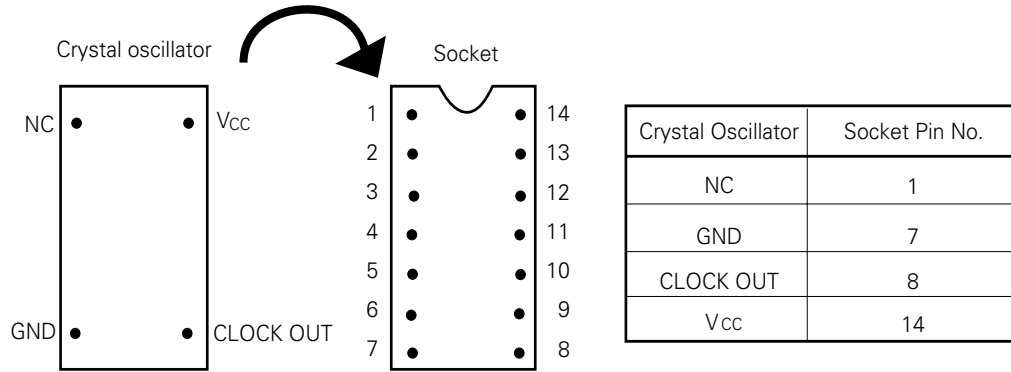
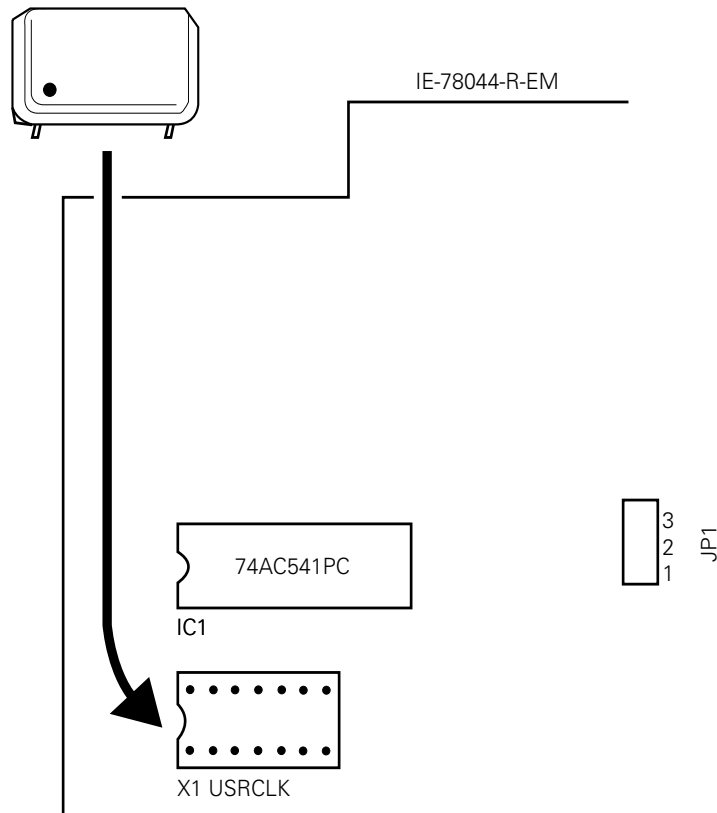
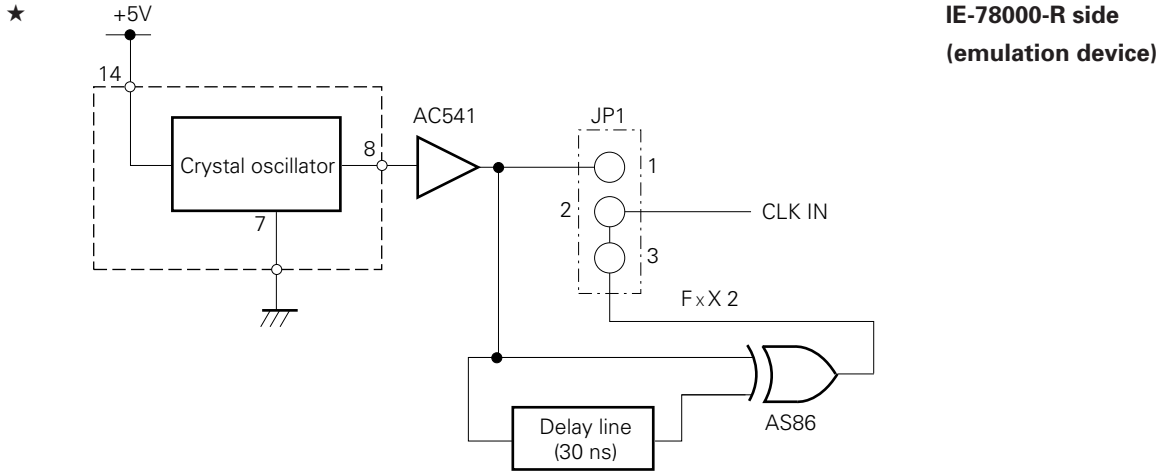


Fig. 4-9 Crystal Oscillator Mounting Position (to use a user mounted clock as the main system clock)



- ④ Confirm that the component block attached to socket X1 (MAIN) on the break board is wired as shown in Fig. 4-5.
- ⑤ Connect the IE-78044-R-EM and break board to the IE-78000-R.

The following circuit is configured by the above procedure and the clock can be supplied to the emulation device.



4.2.3 To use an external clock

As a factory-set condition for shipment, a component block wired as shown in Fig. 4-10 is mounted to the X1 USRCLK socket on the IE-78044-R-EM. If the wiring of this component block remains in the factory-set condition, no hardware adjustments are necessary.

However, if the user prepares his or her own component block because another clock source is to be used, or because the wired component block has been lost, then make connections in accordance with the procedure described below.

When starting the screen debugger, select "USER" for the clock setting on the initial setting screen or configuration panel (selection of the user clock).

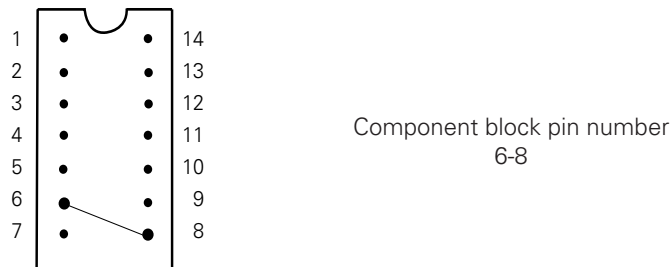
Prerequisites

- Component block (IE-78000-R accessory)
- Lead wires
- Soldering tools

Procedure

- ① Wire and solder the leads to the component block as shown below.

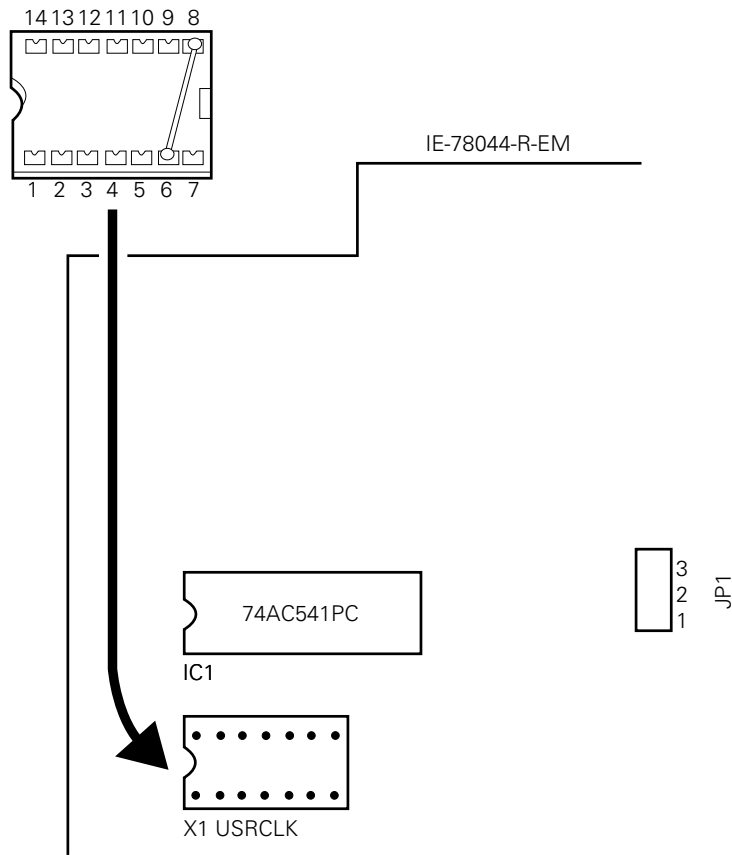
Fig. 4-10 Wiring of Component Block (to use an external clock as the main system clock)



- ② Prepare the IE-78044-R-EM and the wired break board.

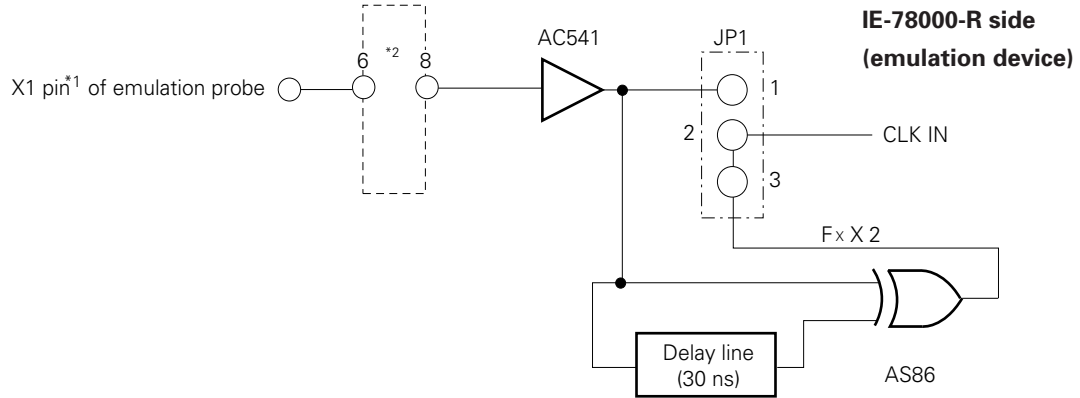
- ③ Attach the component block in 1 to the socket (socket printed X1 USRCLK) on the IE-78044-R-EM. At this time, make sure that pin 1 faces the correct direction.

Fig. 4-11 Component Block Mounting Position (to use an external clock as the main system clock)



- ④ Confirm that the component block attached to socket X1 (MAIN) on the break board is wired as shown in Fig. 4-10.
- ⑤ Connect the IE-78044-R-EM and break board to the IE-78000-R.

The following circuit is configured by the above procedure and the clock can be supplied from the mounted oscillator to the emulation device.



*1: Indicates the pin name of the target device.

*2: Indicates the pin name of the component block.

Remarks: The area enclosed by the broken lines indicates the portion attached to the component block.

4.3 Setting the Subsystem Clock

4.3.1 To use the user mounted clock

Procedure (1) or (2) below must be carried out depending upon the type of the clock to be used. These procedures do not have to be performed on the screen debugger.

(1) To use a ceramic/crystal resonator

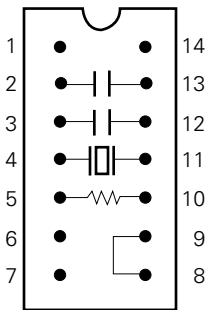
Prerequisites

- Component block (IE-78000-R accessory)
- Ceramic oscillator or crystal resonator
- Resistor Rx
- Capacitor CA
- Capacitor CB
- Soldering tools

Procedure

- ① Solder a ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB, all conforming to the frequency of the resonator, to the component block.

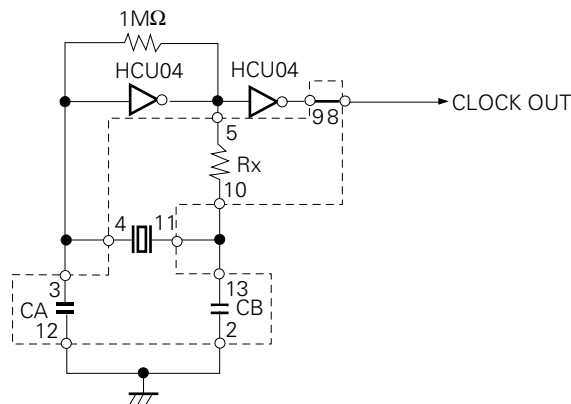
Component block



Pin No.	Connection	Typical Value*
2-13	Capacitor CB	33pF
3-12	Capacitor CA	15pF
4-11	Ceramic/crystal oscillator	32.768 kHz
5-10	Resistor Rx	330 kΩ
8-9	Shorted	-

*: It is to be emphasized that these values are for reference only. Because the circuit constants can differ depending on the resonator, if oscillation is not produced, please consult the manufacturer of the resonator.

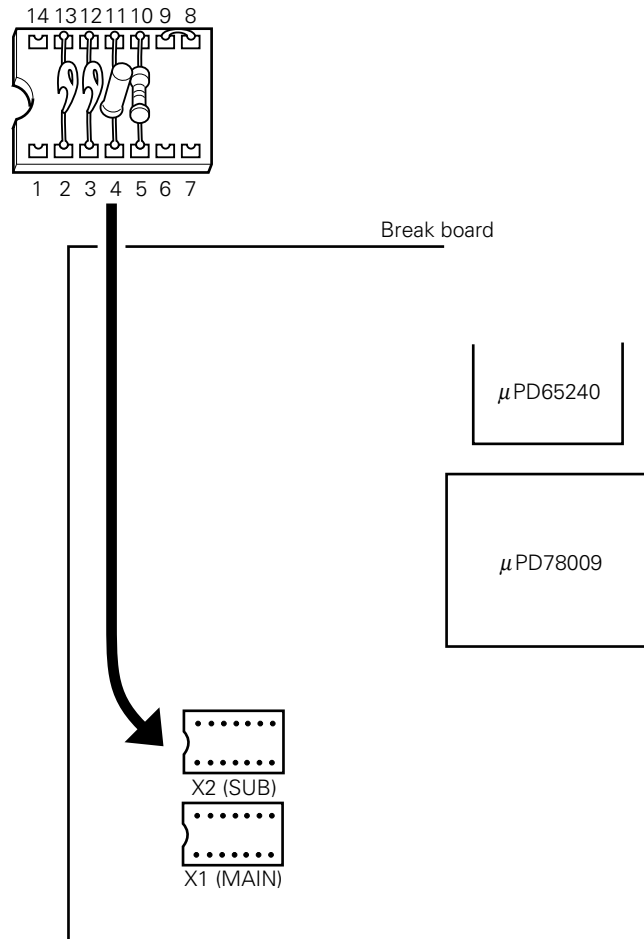
Circuit diagram



Remarks: The area enclosed by the broken line indicates the portion to be attached to the component block.

- ② Prepare the IE-78044-R-EM and the wired break board.
- ③ Remove the external clock component block from the socket (socket labeled X2 (SUB)) on the IE-78044-R-EM.
- ④ Mount the component block in 1 to socket X2 (SUB), from which the external clock component block was removed in step 3. Make sure that pin 1 faces in the correct direction.

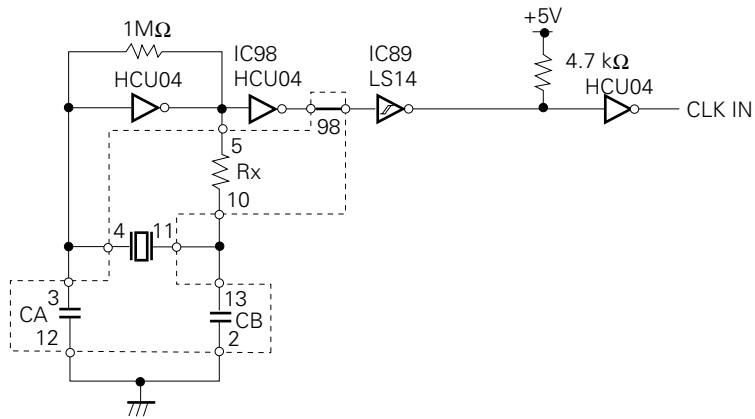
Fig. 4-12 Component Block Mounting Position (to use a user mounted clock as the subsystem clock)



- ⑤ Connect the IE-78044-R-EM and the break board to the IE-78000-R.

The following circuit is configured by the above procedure, and the clock can be supplied from the mounted oscillator to the emulation device.

IE-78000-R side
(emulation device)



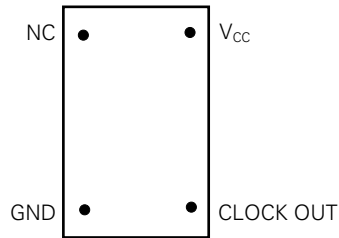
Remarks: The area enclosed by the broken line indicates the portion to be attached to the component block.

(2) To use a crystal oscillator

Prerequisites

- Crystal oscillator (with pins wired as shown in Fig. 4-13)

Fig. 4-13 Crystal Oscillator (to use a user mounted clock as the subsystem clock)



Procedure

- ① Prepare the IE-78044-R-EM and the wired break board.
- ② Remove the external clock component block mounted from the socket (socket labeled X2 (SUB)) on the break board.
- ③ Attach the crystal oscillator to socket X2 (SUB), from which the external clock component block was removed in step 2. Insert the crystal oscillator into the socket pins as illustrated below.

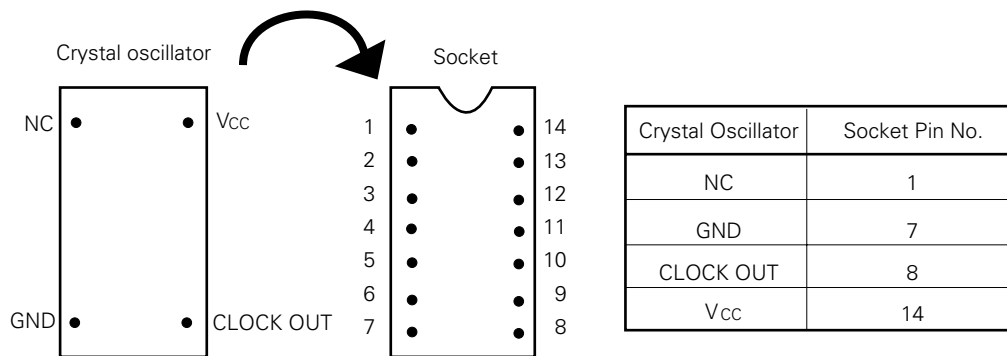
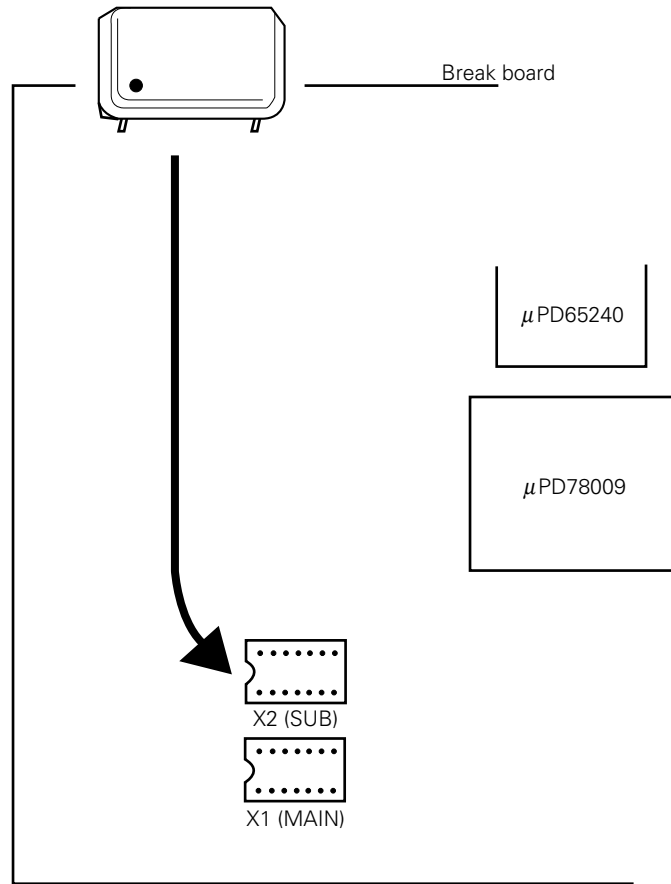
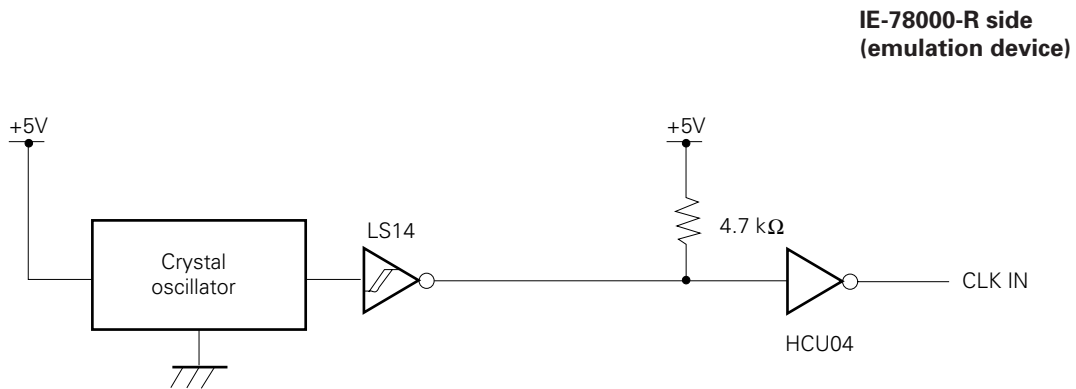


Fig. 4-14 Crystal Oscillator Mounting Position (to use a user mounted clock as the subsystem clock)



④ Connect the IE-78044-R-EM and the break board to the IE-78000-R.

The following circuit is configured by the above procedure and the clock can be supplied to the emulation device.



4.3.2 To use an external clock

As a factory-set condition for shipment, a component block wired as shown in Fig. 4-15 is connected to the X2 (SUB) socket on the IE-78044-R-EM. If the wiring of this component block remains the same as the factory-set condition, no hardware adjustments are necessary. However, if the user prepares a component block because another clock source is to be used, or because the wired component block has been lost, make all connections in accordance with the procedure described below.

No special setting has to be made on the screen debugger.

Prerequisites

- Component block (IE-78000-R accessory)
- Lead wires
- Soldering tools

Procedure

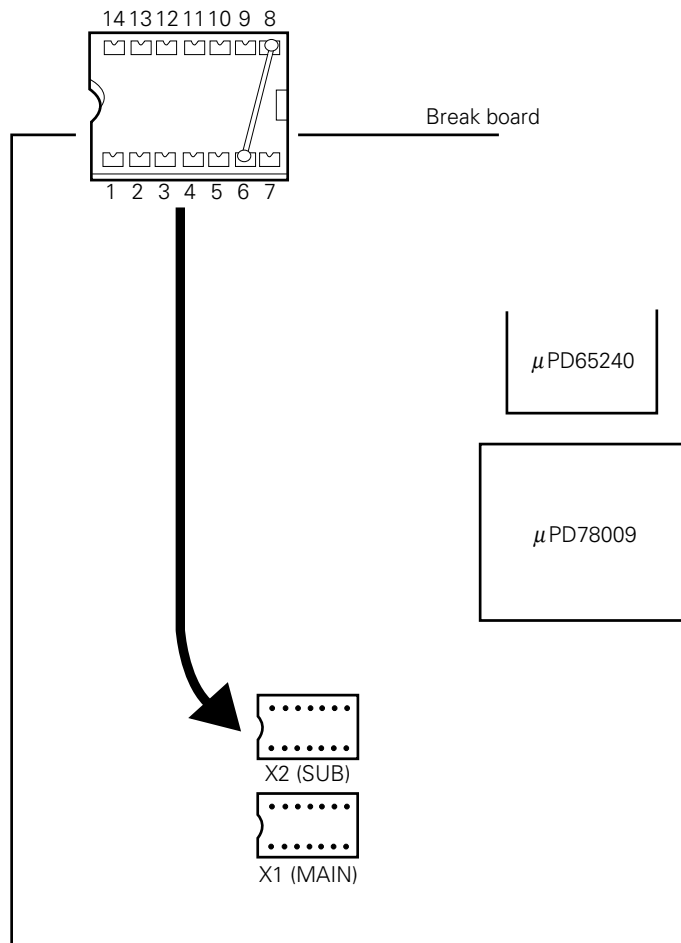
- ① Wire and solder the leads to the component block as shown below.

Fig. 4-15 Wiring of Component Block (to use an external clock as the subsystem clock)



- ② Prepare the IE-78044-R-EM and the wired break board.
- ③ Mount the component block in 1 to the socket (socket labeled X2 (SUB) on the break board. At this time, make sure that pin 1 faces in the correct direction.

Fig. 4-16 Component Block Mounting Position (to use an external clock as the subsystem clock)



- ④ Connect the IE-78044-R-EM and the break board to the IE-78000-R.

The following circuit is configured by the above procedure and the clock signal on the target system can be supplied to the emulation device.

IE-78000-R side
(emulation device)

*1: Indicates the pin name of the target device.

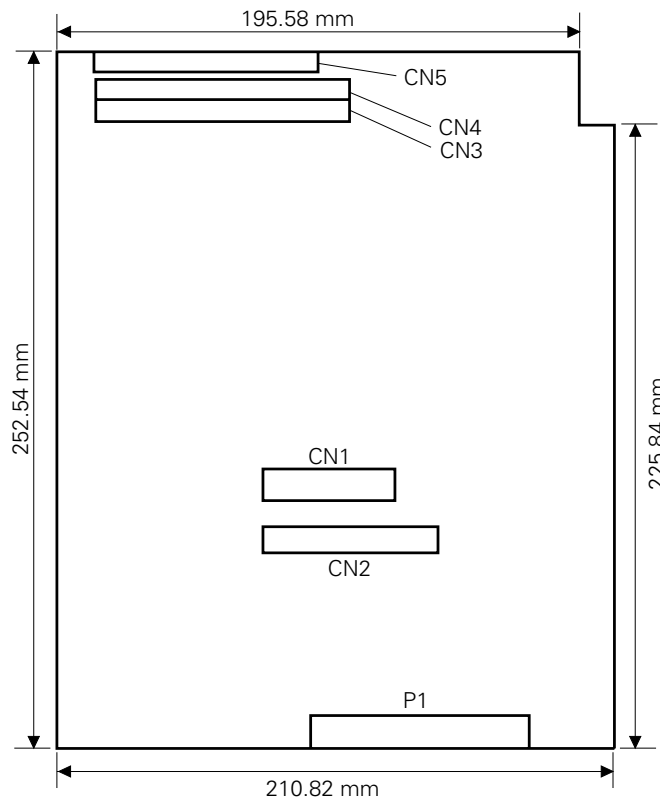
*2: Indicates the pin number of the component block.

Remarks: The area enclosed by the broken line indicates the portion attached to the component block.

Phase-out/Discontinued

APPENDIX A IE-78044-R-EM PRODUCT SPECIFICATIONS

Product name : IE-78044-R-EM
 Peripheral emulation device : μ PD78P048A
 Operating temperature : 0 to 50°C
 Humidity : 10 to 80% RH (without condensation)
 Storage temperature : -15 to +60°C
 Power requirements : DC 0.5 A max. 2.5 W (supplied from IE-78000-R)
 Board dimensions :



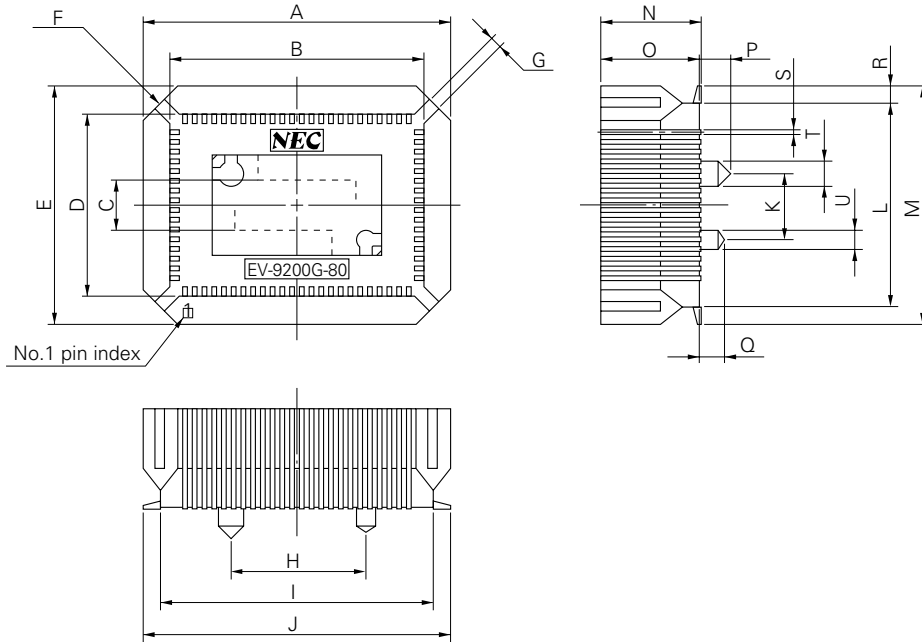
Connector : Connector on IE-78044-R-EM board

CN1	Break board connector
CN2	
CN3	Connector board connector
CN4	
CN5	Emulation probe connector
P1	Main bus connector

Phase-out/Discontinued

APPENDIX B DIMENSIONS OF CONVERSION SOCKET AND RECOMMENDED BOARD MOUNTING PATTERN

Fig. B-1 Dimensions of EV-9200G-80 (reference)

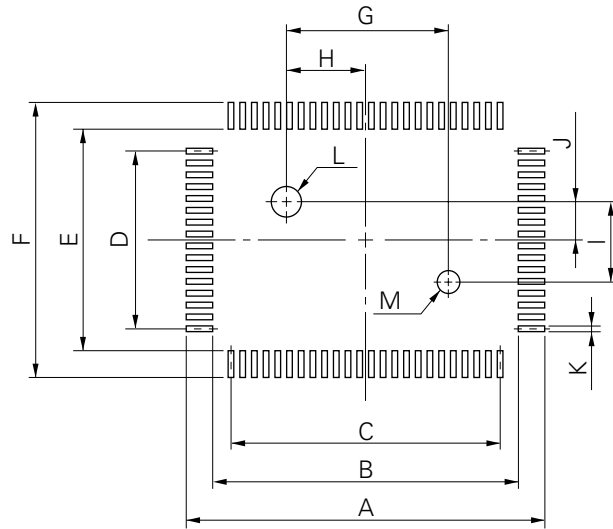


EV-9200G-80-G0

ITEM	MILLIMETERS	INCHES
A	25.0	0.984
B	20.30	0.799
C	4.0	0.157
D	14.45	0.569
E	19.0	0.748
F	4-C 2.8	4-C 0.11
G	0.8	0.031
H	11.0	0.433
I	22.0	0.866
J	24.7	0.972
K	5.0	0.197
L	16.2	0.638
M	18.9	0.744
O	8.0	0.315
N	7.8	0.307
P	2.5	0.098
Q	2.0	0.079
R	1.35	0.053
S	0.35±0.1	0.014 ^{+0.004} _{-0.005}
T	∅2.3	∅0.091
U	∅1.5	∅0.059

Phase-out/Discontinued

Fig. B-2 Recommended Board Mounting Pattern of EV-9200G-80 (reference)



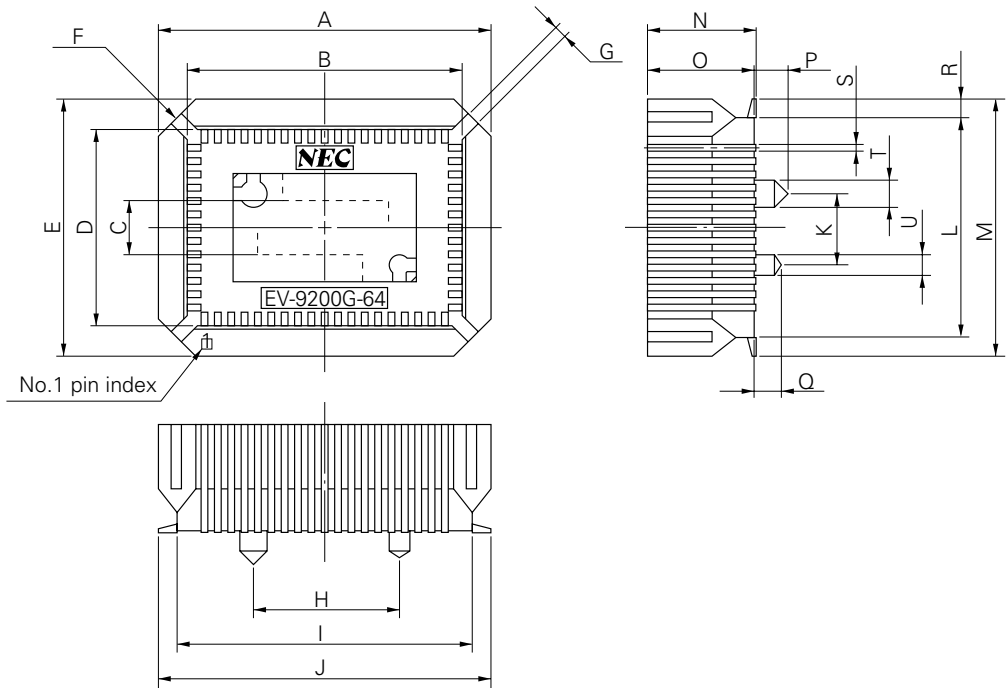
EV-9200G-80-P0

ITEM	MILLIMETERS	INCHES
A	25.7	1.012
B	21.0	0.827
C	$0.8 \pm 0.02 \times 23 = 18.4 \pm 0.05$	$0.031^{+0.002}_{-0.001} \times 0.906 = 0.724^{+0.003}_{-0.002}$
D	$0.8 \pm 0.02 \times 15 = 12.0 \pm 0.05$	$0.031^{+0.002}_{-0.001} \times 0.591 = 0.472^{+0.003}_{-0.002}$
E	15.2	0.598
F	19.9	0.783
G	11.00 ± 0.08	$0.433^{+0.004}_{-0.003}$
H	5.50 ± 0.03	$0.217^{+0.001}_{-0.002}$
I	5.00 ± 0.08	$0.197^{+0.003}_{-0.004}$
J	2.50 ± 0.03	$0.098^{+0.002}_{-0.001}$
K	0.5 ± 0.02	$0.02^{+0.001}_{-0.002}$
L	$\phi 2.36 \pm 0.03$	$\phi 0.093^{+0.001}_{-0.002}$
M	$\phi 1.57 \pm 0.03$	$\phi 0.062^{+0.001}_{-0.002}$

Caution Dimensions of mount pad for EV-9200 and that for target device (QFP) may be different in some parts. For the recommended mount pad dimensions for QFP, refer to "SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (IEI-1207).

Phase-out/Discontinued

Fig. B-3 Dimensions of EV-9200G-64 (reference)

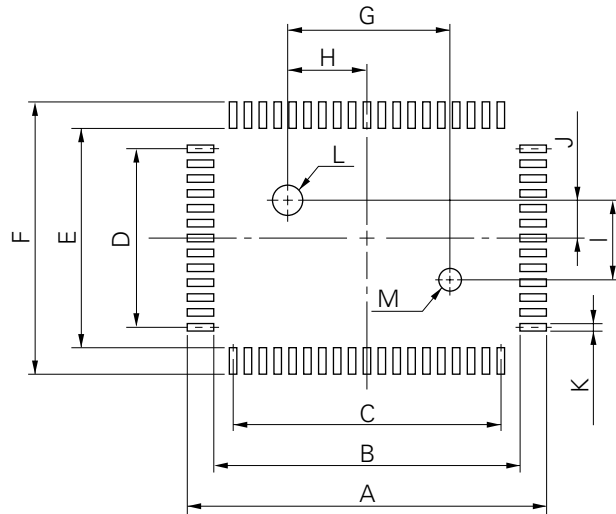


EV-9200G-64-G0

ITEM	MILLIMETERS	INCHES
A	25.0	0.984
B	20.30	0.799
C	4.0	0.157
D	14.45	0.569
E	19.0	0.748
F	4-C 2.8	4-C 0.11
G	0.8	0.031
H	11.0	0.433
I	22.0	0.866
J	24.7	0.972
K	5.0	0.197
L	16.2	0.638
M	18.9	0.744
O	8.0	0.315
N	7.8	0.307
P	2.5	0.098
Q	2.0	0.079
R	1.35	0.053
S	0.35±0.1	0.014 ^{+0.004} _{-0.005}
T	φ2.3	φ0.091
U	φ1.5	φ0.059

Phase-out/Discontinued

Fig. B-4 Recommended Board Mounting Pattern of EV-9200G-64 (reference)



EV-9200G-64-P0

ITEM	MILLIMETERS	INCHES
A	25.7	1.012
B	21.0	0.827
C	$1.0 \pm 0.02 \times 18 = 18.0 \pm 0.05$	$0.039^{+0.002}_{-0.001} \times 0.709 = 0.709^{+0.002}_{-0.003}$
D	$1.0 \pm 0.02 \times 12 = 12.0 \pm 0.05$	$0.039^{+0.002}_{-0.001} \times 0.472 = 0.472^{+0.003}_{-0.002}$
E	15.2	0.598
F	19.9	0.783
G	11.00 ± 0.08	$0.433^{+0.004}_{-0.003}$
H	5.50 ± 0.03	$0.217^{+0.001}_{-0.002}$
I	5.00 ± 0.08	$0.197^{+0.003}_{-0.004}$
J	2.50 ± 0.03	$0.098^{+0.002}_{-0.001}$
K	0.6 ± 0.02	$0.024^{+0.001}_{-0.002}$
L	$\phi 2.36 \pm 0.03$	$\phi 0.093^{+0.001}_{-0.002}$
M	$\phi 1.57 \pm 0.03$	$\phi 0.062^{+0.001}_{-0.002}$

Caution Dimensions of mount pad for EV-9200 and that for target device (QFP) may be different in some parts. For the recommended mount pad dimensions for QFP, refer to "SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (IEI-1207).

APPENDIX C PIN CONFIGURATION OF EMULATION PROBE

Table C-1 Pin Configuration of EP-78130GF-R

CN5 Pin No.	Emulation Probe	CN5 Pin No.	Emulation Probe	CN5 Pin No.	Emulation Probe	CN5 Pin No.	Emulation Probe
1	GND	25	16	49	38	73	62
2	GND	26	17	50	39	74	NC
3	EXT0	27	18	51	40	75	
4	EXT1	28	19	52	41	76	63
5	EXT2	29	20	53	42	77	64
6	EXT3	30	21	54	43	78	65
7	EXT4	31	22	55	44	79	66
8	EXT5	32	NC	56	45	80	67
9	EXT6	33		57	46	81	68
10	EXT7	34	23	58	47	82	69
11	2	35	24	59	48	83	70
12	3	36	25	60	49	84	71
13	4	37	26	61	50	85	72
14	5	38	27	62	51	86	73
15	6	39	28	63	52	87	74
16	7	40	29	64	53	88	75
17	8	41	30	65	54	89	76
18	9	42	31	66	55	90	77
19	10	43	32	67	56	91	78
20	11	44	33	68	57	92	79
21	12	45	34	69	58	93	80
22	13	46	35	70	59	94	1
23	14	47	36	71	60	95	GND
24	15	48	37	72	61	96	

Remarks: The meanings of the symbols and figures in the column under the heading “Emulation probe” are as follows:

- GND : Ground clip
- EXT0-EXT7 : External sense clip
- 1- 80 : Emulation probe pin numbers
- NC : No connection

Table C-2 Pin Configuration of EP-78024GF-R/EP-78024CW-R

CN5 Pin No.	Emulation Probe	CN5 Pin No.	Emulation Probe	CN5 Pin No.	Emulation Probe	CN5 Pin No.	Emulation Probe
1	GND	25	15	49	39	73	63
2	GND	26	16	50	40	74	64
3	EXT0	27	17	51	41	75	NC
4	EXT1	28	18	52	42	76	
5	EXT2	29	19	53	43	77	
6	EXT3	30	20	54	44	78	
7	EXT4	31	21	55	45	79	
8	EXT5	32	22	56	46	80	
9	EXT6	33	23	57	47	81	
10	EXT7	34	24	58	48	82	
11	1	35	25	59	49	83	
12	2	36	26	60	50	84	
13	3	37	27	61	51	85	
14	4	38	28	62	52	86	
15	5	39	29	63	53	87	
16	6	40	30	64	54	88	
17	7	41	31	65	55	89	
18	8	42	32	66	56	90	
19	9	43	33	67	57	91	
20	10	44	34	68	58	92	
21	11	45	35	69	59	93	
22	12	46	36	70	60	94	
23	13	47	37	71	61	95	GND
24	14	48	38	72	62	96	

Remarks: The meanings of the symbols and figures in the column under the heading "Emulation probe" are as follows:

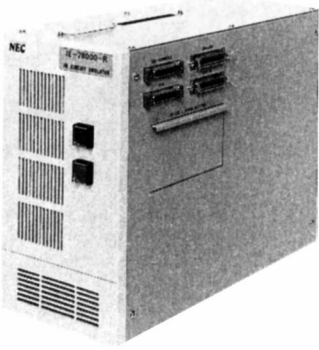
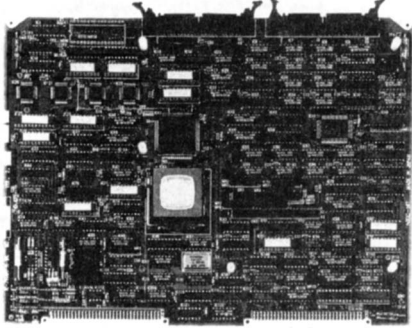
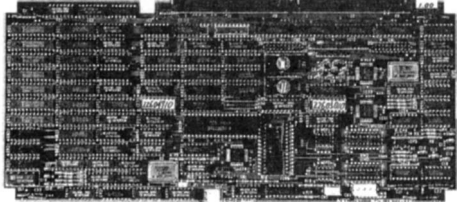
- GND : Ground clip
- EXT0-EXT7 : External sense clip
- 1- 64 : Emulation probe pin numbers
- NC : No connection

APPENDIX D SYSTEM CONFIGURATION

The IE-78000-R system configuration is shown on the following pages:

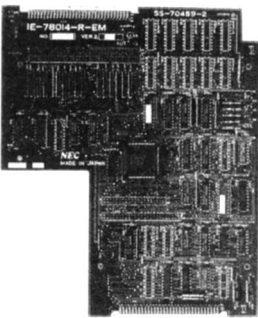
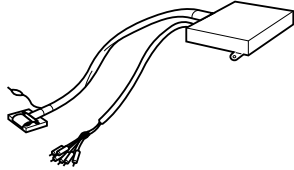
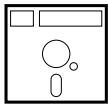
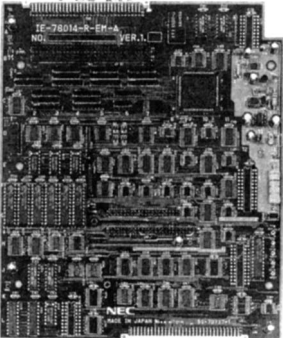
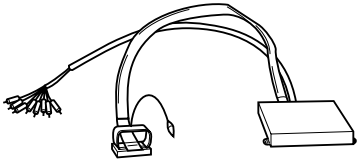
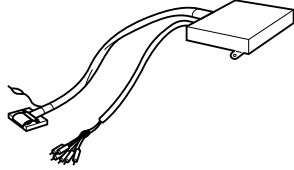
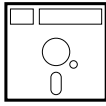
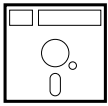
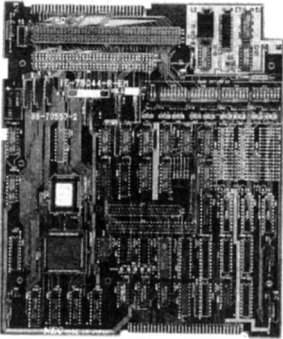
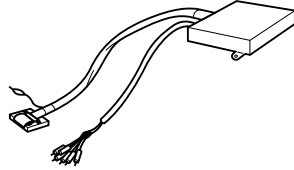
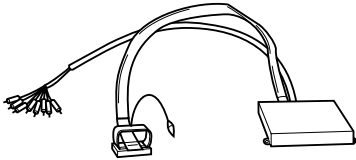
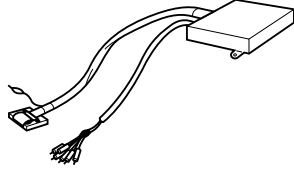
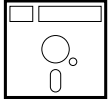
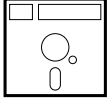
Phase-out/Discontinued

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

Target Device	Housing and Control/Trace Board	Break Board
<p>μPD78002 Subseries</p> <p>μPD78002Y Subseries</p>	 <p>78K Series housing (w/power supply)</p>	 <p>IE-78000-R-BK (78K/0 Series common break board)</p>
<p>μPD78014 Subseries</p> <p>μPD78014Y Subseries</p>		
<p>★ μPD78018F Subseries*</p>	 <p>IE-78000-R-CS-A (78K Series common control/trace board)</p>	
<p>μPD78024 Subseries*</p>		
<p>★ μPD78044 Subseries</p> <p>μPD78044A Subseries</p>		

*: Under development

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

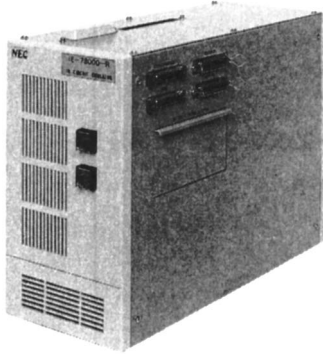
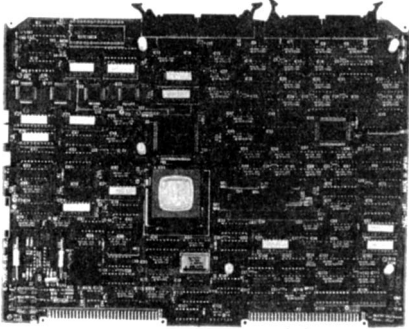
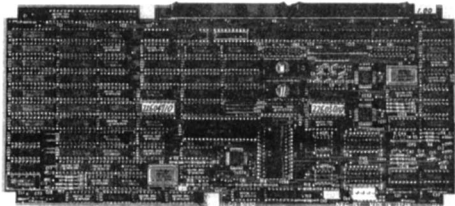
Emulation Board (Optional)	Emulation Probe (Optional)	Screen Debugger (Optional)	Device File (Optional)
 <p>IE-78014-R-EM</p>	 <p>(Accessory: EV-9200GC-64 (1)) EP-78240GC-R</p>		 <p>DF78002</p>
 <p>IE-78014-R-EM-A*1</p>	 <p>EP-78240CW-R</p>  <p>(Accessory: EV-9500GK-64 (1)) EP-78012GK-R*2</p>	 <p>SD78K0 (with ROM)</p>	 <p>DF78014</p>
 <p>IE-78044-R-EM</p>	 <p>(Accessory: EV-9200G-64 (1)) EP-78024GF-R</p>  <p>EP-78024CW-R</p>  <p>(Accessory: EV-9200G-80 (1)) EP-78130GF-R</p>		 <p>DF78024</p>  <p>DF78044</p>

*1. Under development

*2. Only for μ PD78018F Subseries

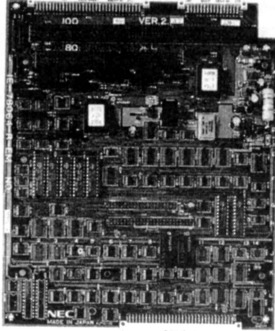
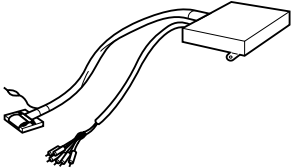
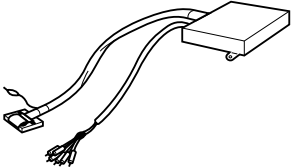
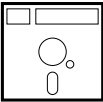
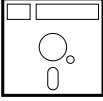
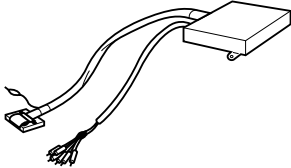
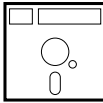
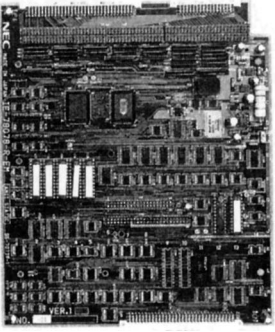
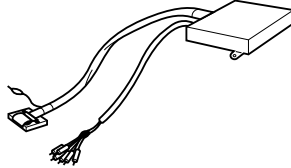
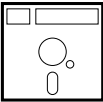
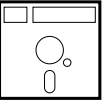
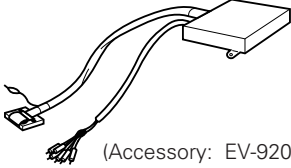

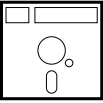
Phase-out/Discontinued

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

Target Device	Housing and Control/Trace Board	Break Board
★ μ PD78054 Subseries μ PD78054Y Subseries		
μ PD78064 Subseries	78K Series housing (w/power supply)	
★ μ PD78078 Subseries*		IE-78000-R-BK (78K/0 Series common break board)
★ μ PD78083 Subseries*	IE-78000-R-CS-A (78K Series common control/trace board)	

*: Under development

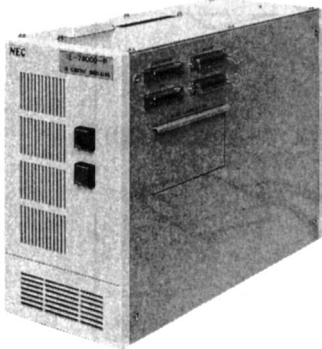
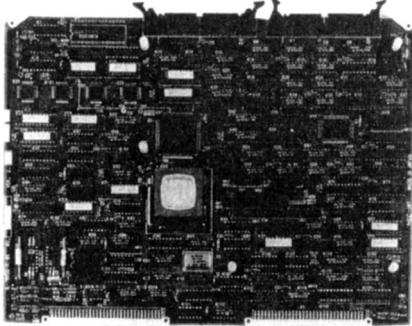
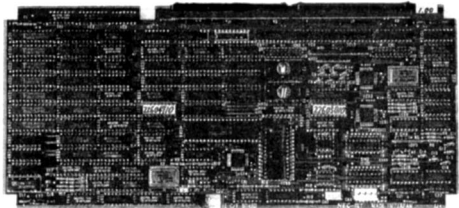
Table D-1 IE-78000-R System Configuration (4/6)

Emulation Board (Optional)	Emulation Probe (Optional)	Screen Debugger (Optional)	Device File (Optional)
 <p>IE-78064-R-EM</p>	 <p>(Accessory: EV-9200GC-80 (1)) EP-78230GC-R</p>  <p>(Accessory: EV-9500GK-80 (1)) EP-78054GK-R</p>	 <p>SD78K0 (with ROM)</p>	 <p>DF78054</p>
	 <p>(Accessory: EV-9500GC-100 (1)) EP-78064GC-R</p>		 <p>DF78064</p>
 <p>IE-78078-R-EM*</p>	 <p>(Accessory: EV-9200GF-100 (1)) EP-78064GF-R</p>	 <p>SD78K0 (with ROM)</p>	 <p>DF78078</p>
	 <p>(Accessory: EV-9200G-44 (1)) EP-78083GB-R</p>  <p>EP-78083CU-R</p>		 <p>DF78083*</p>

*: Under development

Phase-out/Discontinued

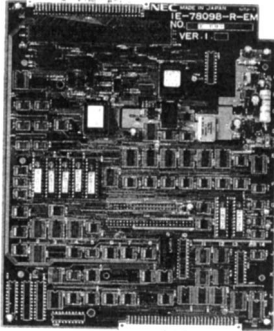
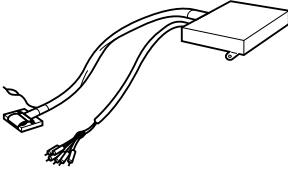
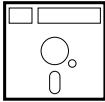
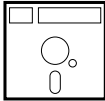
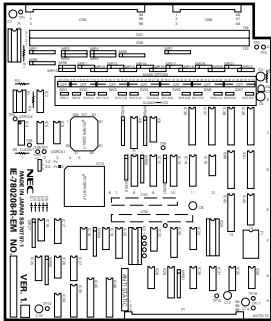
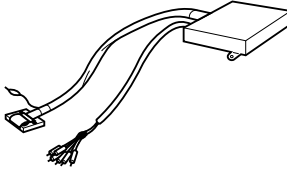
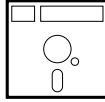
Table D-1 IE-78000-R System Configuration (5/6)

Target Device	Housing and Control/Trace Board	Break Board
<p>μPD78098 Subseries</p>	 <p>78K Series housing (w/power supply)</p>	 <p>IE-78000-R-BK (78K/0 Series common break board)</p>
<p>★ μPD780208 Subseries*</p>	 <p>IE-78000-R-CS-A (78K Series common control/trace board)</p>	

*: Under development

Phase-out/Discontinued

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

Emulation Board (Optional)	Emulation Probe (Optional)	Screen Debugger (Optional)	Device File (Optional)
 <p>IE-78098-R-EM</p>	 <p>(Accessory: EV-9200GC-80 (1)) EP-78230GC-R</p>	 <p>SD78K0 (with ROM)</p>	 <p>DF78098*</p>
 <p>IE-780208-R-EM</p>	 <p>(Accessory: EV-9200GF-100 (1)) EP-78064GF-R</p>	<p>SD78K0 (with ROM)</p>	 <p>DF780208*</p>

*: Under development

Phase-out/Discontinued

[MEMO]

APPENDIX E UPGRADING OTHER IN-CIRCUIT EMULATORS TO THE IE-78000-R

If you already have an in-circuit emulator in the 78K Series or 75X Series, it can be upgraded to the 78K/0 in-circuit emulator IE-78000-R by replacing the internal break board with the IE-78000-R-BK.

Table E-1 Upgrading System

Series Name	Your In-Circuit Emulator	Necessary Board
75X Series	IE-75000-R, IE-75001-R	IE-78000-R-BK
78K/I Series	IE-78130-R, IE-78140-R	
78K/II Series	IE-78230-R, IE-78230-R-A, IE-78240-R, IE-78240-R-A	
78K/III Series	IE-78320-R, IE-78327-R, IE-78330-R, IE-78350-R	
78K/VI Series	IE-78600-R	

Phase-out/Discontinued

[MEMO]

APPENDIX F REVISION HISTORY



The revision history is listed below. “Applied to” indicates the chapters affected.

Version No.	Revision from the Previous Version	Applied to
5	μ PD78024 Subseries have been added to the target devices.	Throughout
	μ PD78024 Subseries emulation probe has been added.	CHAPTER 1 GENERAL
	Remarks concerning the mask option setting have been added.	CHAPTER 3 DIFFERENCE BETWEEN TARGET DEVICES
	μ PD78024 Subseries as target has been added to the circuit inputting/outputting signal directly or via resistor to/from emulation device.	
	Dimensions of EV-9200G-64 and Recommended Board Mounting Pattern of EV-9200G-64 have been added.	APPENDIX B DIMENSIONS OF CONVERSION SOCKET AND RECOMMENDED BOARD MOUNTING PATTERN
	Pin configuration of EP-78024GF-R/EP-78024CW-R has been added.	APPENDIX C PIN CONFIGURATION OF EMULATION PROBES
	μ PD78024 Series and μ PD78098 Series have been added to the target devices. The corresponding emulation boards and emulation probes for these Series also have been added.	APPENDIX D SYSTEM CONFIGURATION
	The following products have been developed: μ PD78P044, 78054 Subseries, 78064 Subseries, DF78054, DF78064.	
6	μ PD78044A Subseries has been added to the target devices.	Throughout
	Devices to be used have been changed as follows: μ PD78P044→ μ PD78P048A, μ PD78P014→ μ PD78P018F	CHAPTER 1 GENERAL APPENDIX A IE-78044-R-EM SPECIFICATION
	Difference between μ PD78044 Subseries and μ PD78044 Subseries has been added.	CHAPTER 1 GENERAL
	The figure “Using an External Clock” has been changed.	CHAPTER 4 SETTING CLOCK
	Remarks have been added to the table “Main System Clock Setting”.	
	The figure on the IE-78000-R side (emulation device) in the case of using a crystal oscillator has been changed.	
	The typical values for each pin has been added to the table in the case of using a ceramic/crystal resonator in the section when using the user mounted clock for setting the Subsystem Clock.	
	The following Subseries have been added. The corresponding emulation boards and emulation probes for these Subseries have also been added: μ PD78018F, 78044A, 78054Y, 78078, 78083, and 780208 Subseries.	APPENDIX D SYSTEM CONFIGURATION
	The following products have been developed: μ PD78098 Subseries, DF78098.	