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Preliminary User's Manual

IE-784218-R-EM1

I/O Emulation Board

Document No. U12155EJ1V1UM00 (1st edition)
Date Published October 1997 N

NEC

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M7A 96.10

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INTRODUCTION

General Product Description:

The IE-784218-R-EM1 board connects to the IE-784000-R-EM board, which is then inserted into the IE-784000-R cabinet. The IE-784038-R-EM1 board is used to debug the μPD784038/μPD784038Y Subseries [Note] of 16-bit single-chip microcontrollers.

Note μPD784216 Subseries : μPD784214, μPD784215, μPD784216, μPD78F4216
μPD784216Y Subseries : μPD784214Y, μPD784215Y, μPD784216Y, μPD78F4216Y

Remark The μPD784216 and μPD784216Y Subseries are under development.

Target users: This manual is intended for engineers who plan to develop systems containing the μPD784216/μPD784216Y Subseries 16-bit single-chip microcontroller and want to debug the system using the IE-784000-R and IE-784000-R-EM in combination with the IE-784218-R-EM1. In addition, it is also intended for engineers who wish to use other in-circuit emulators by providing them with the same functions as the IE-784000-R. Therefore, this manual assumes that the readers/are well-versed in the functions and methods of using the μPD784216/μPD784216Y Subseries of microcontrollers and have knowledge about debugging.

Objectives: The objectives of this manual are to provide an understanding of the methods of connecting the IE-784218-R-EM1 to the IE-784000-R-EM and the IE-784000-R as well as the methods of making settings when debugging the μPD784218/μPD784218Y Subseries of microcontrollers.

Organization: The manuals describing how to use the IE-784000-R are the manual that comes with the IE-784218-R-EM1 (this manual) and the manual that comes with the IE-784000-R.

IE-784218-R-EM1 User's Manual	IE-784000-R User's Manual
System configuration	Basic specifications
External interface functions to the IE-784000-R	System configuration
	Connection methods

How to read this manual:

To obtain a general understanding of the IE-784038-R-EM1 functions, read this manual in the same sequence as the table of contents.

For an understanding of the specifications, read the general description in **CHAPTER 1.**

To examine the settings for connecting the IE-784218-R-EM1 to the IE-784000-R and debugging the μPD784216/μPD784216Y Subseries devices, read the installation procedures in **CHAPTER 2.**

Terminology:

The special terms used in the manual are defined in the following table:

Term	Definition
Emulation device	A generic term for devices in the emulator that are to be emulated. This includes the emulation CPU.
Emulation CPU	The CPU portion of the emulator that executes the user-created program.
Target device	The device whose operation is emulated (the actual device).
Target program	The program that is to be debugged (a user-created program).
Target system	The system that is the subject of debugging (a user-created system). This includes the target program and the hardware created by the user. The narrow definition refers only to the hardware.

Legend:

Note : Footnote explaining items marked with "Note" in the text.
Caution : Description of point that requires particular attention.
Remark : Supplementary information added to the text.

CONTENTS

[MEMO]

CHAPTER 1 GENERAL DESCRIPTION

The IE-784218-R-EM1 is the I/O emulation board for the μPD784216/μPD784216Y Subseries of 16-bit single-chip microcontrollers.

The IE-784218-R-EM1 and emulation probe (EP-78064GC-R/EP-78064GF-R) can be used in combination with the IE-784000-R and IE-784000-R-EM for efficient debugging and operation check of systems using the μPD784216/μPD784216Y Subseries of microcontrollers.

1.1 Characteristics

The characteristics of the IE-784218-R-EM1 when combined with the IE-784000-R-EM and the IE-784000-R are as follows:

(1) The peripheral functions (I/O ports, etc.) of the μPD784216/μPD784216Y Subseries devices can be emulated.
(2) A CPU operation clock can be provided.

1.2 Packing List

The IE-784218-R-EM1 board consists of the components indicated below. Be sure to check the contents of the package.

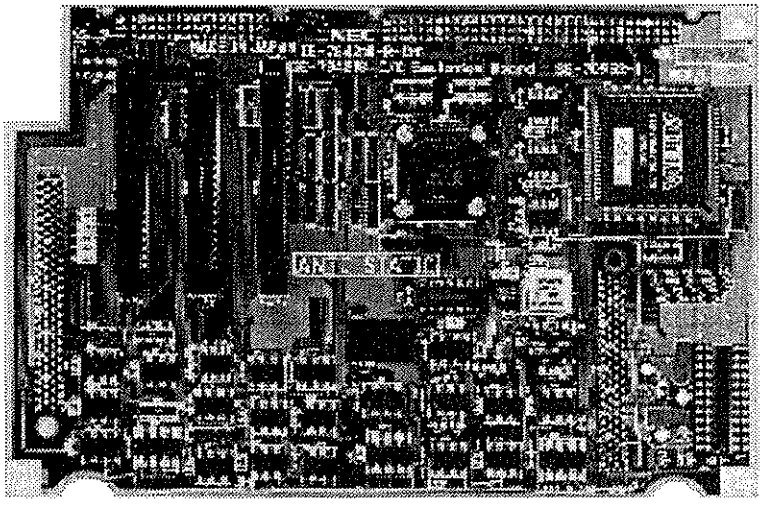
(1) One IE-784218-R-EM1 board : 1
(2) 4218 connector board : 1
(3) One user's manual (this manual) : 1

Caution The dedicated devices (peripheral emulation devices) for emulating the peripheral functions (I/O ports, etc.) of the target device are on the IE-784218-R-EM1.

Figure 1-1. IE-784218-R-EM1 Board Configuration

(1) IE-784218-R-EM1

Front



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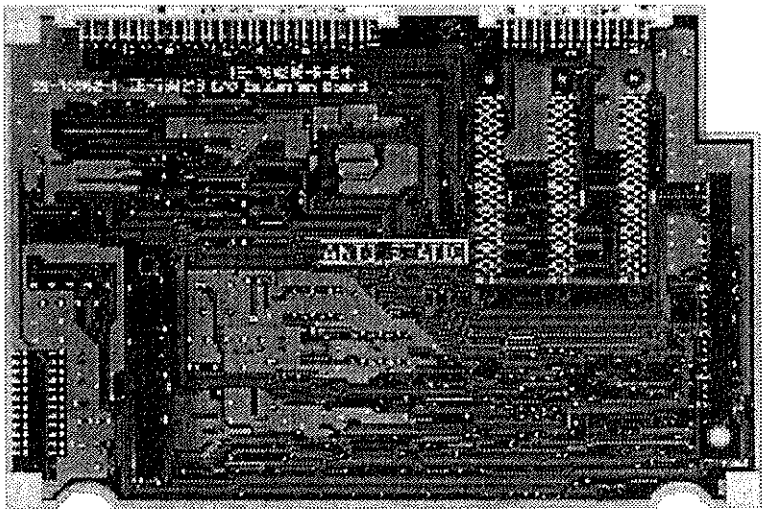
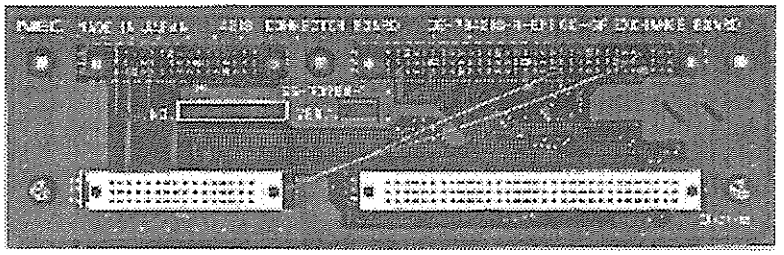
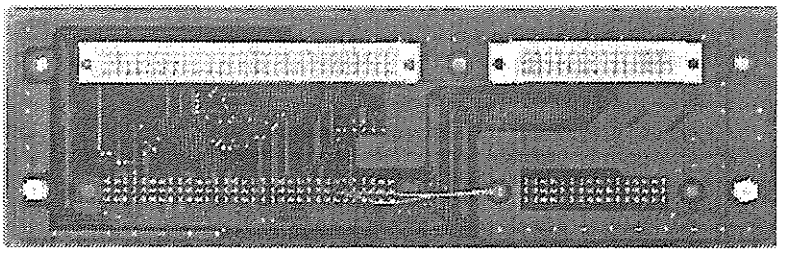


(2) 4218 connector board

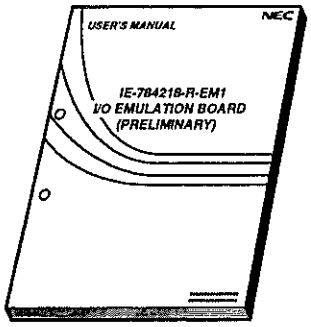
Front



Back



(3) User's manual (this manual)



1.3 Name of Components

Table 1-1 shows the names of connectors, etc.

Table 1-1. IE-784218-R-EM1 Component Names

Name	Function
CN1 CN2	Emulation probe connector 4218 connector board connector
PJ1 PJ2	Emulation board connector
TGCN1 TGCN2 TGCN3	Emulaiton probe connector for in-circuit emulator IE-780000SL[Note]
IC23	User clock setting socket
IC20	User subclock setting socket

Note Under development

Remark Emulation probe: EP-78064GC-R, EP-78064GF-R

Table 1-2. 4218 Connector Board Component Names

Name	Function
CN1 CN2	IE-784218-R-EM1 connector
CN3 CN4	Emulation probe connector

Remark Emulation probe: EP-78064GF-R

1.4 Target Devices

The following devices of the μPD784038/μPD784038Y Subseries can be emulated by using the IE-784000-R-EM and the IE-784000-R in combination with the IE-784218-R-EM1:

<μPD784216 Subseries>	<μPD784216Y Subseries>
• μPD784214	• μPD784214Y
• μPD784215	• μPD784215Y
• μPD784216	• μPD784216Y
• μPD78F4216	• μPD78F4216Y

1.5 Emulation Probe

The emulation probe is sold separately.

Part Number
EP-78064GC-R (for 100-pin QFP : 14 × 14 mm)
EP-78064GF-R (for 100-pin QFP : 14 × 20 mm)

1.6 Precautions

(1) Turn the IE-784000-R and the target system power supplies off when connecting or disconnecting the IE-784218-R-EM1, IE-784000-R, IE-784000-R-EM or the target system.

(2) Be aware that there are differences in the pin characteristics when the IE-784218-R-EM1 is connected to the IE-784000-R and IE-784000-R-EM to emulate the target device. (refer to **CHAPTER 5 DIFFERENCES BETWEEN IN-CIRCUIT EMULATOR AND TARGET DEVICE.**)

(3) Connect the IE-784218-R-EM1 appropriately to the IE-784000-R-EM.

(4) Insert the IE-784000-R-EM appropriately in the IE-784000-R cabinet.

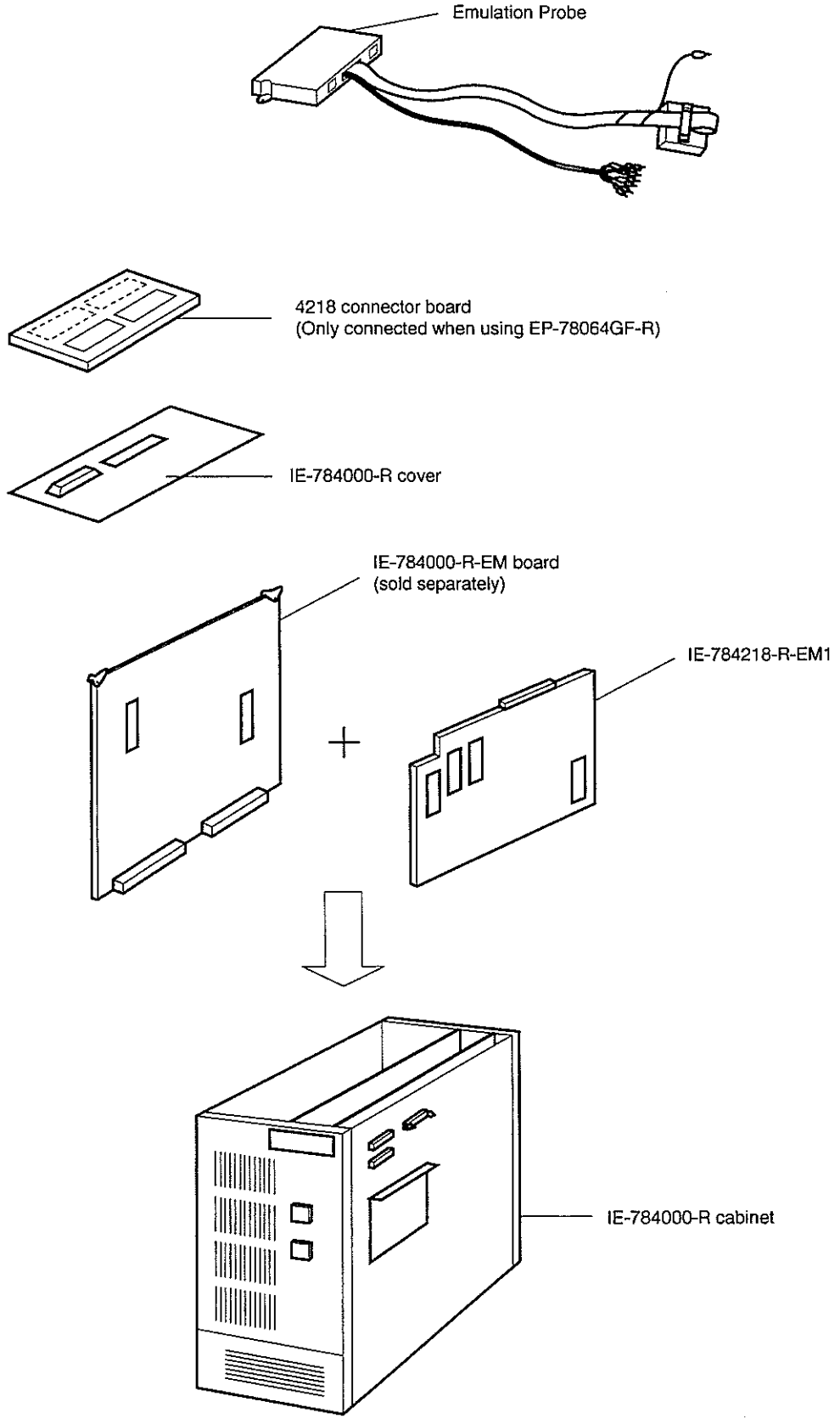
[MEMO]

CHAPTER 2 INSTALLATION PROCEDURES

2.1 Connecting to IE-784000-R

Figure 2-1 shows a diagram for setting up the IE-784000-R.

Figure 2-1. IE-784000-R Installation



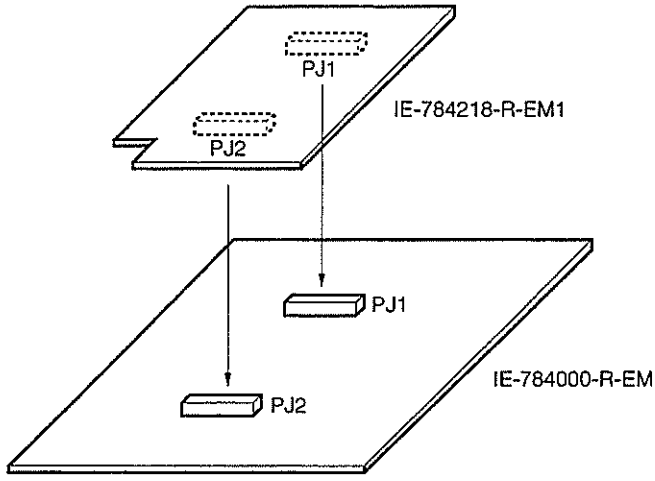
<1> Setting the user clock

Refer to the section on the user clock setting in **CHAPTER 3.**

<2> Connecting the IE-784218-R-EM1 to the IE-784000-R-EM

Connect the PJ1 and PJ2 connectors on the IE-784000-R-EM board to connectors PJ1 and PJ2 on the IE-784218-R-EM1 board.

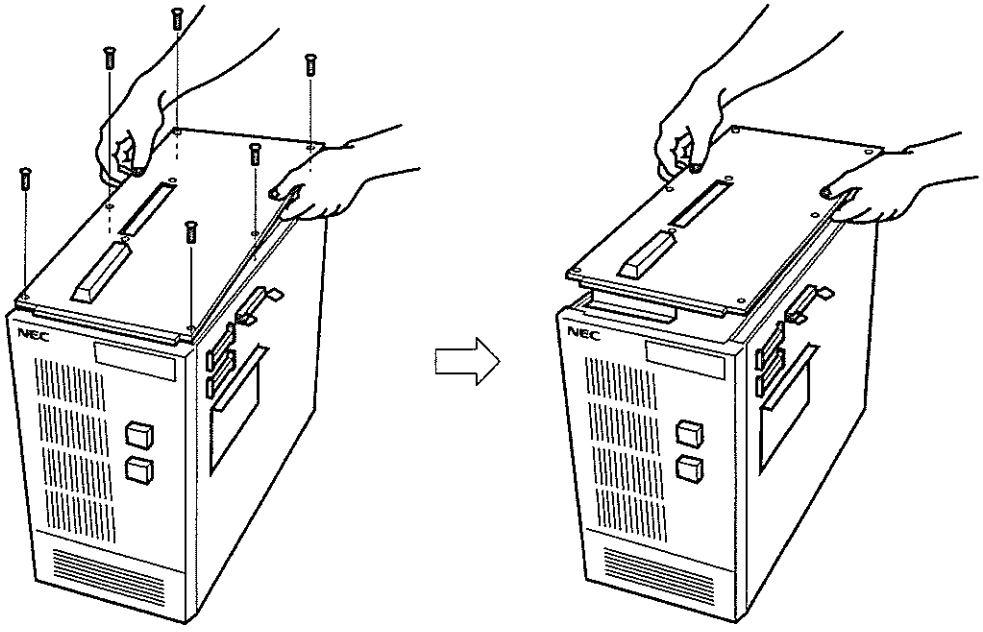
Figure 2-2. Connecting IE-784218-R-EM1 and IE-784000-R-EM



<3> Removing the top cover

Remove the six screws from the top of the cabinet shown in **Figure 2-3.** Then remove the top cover.

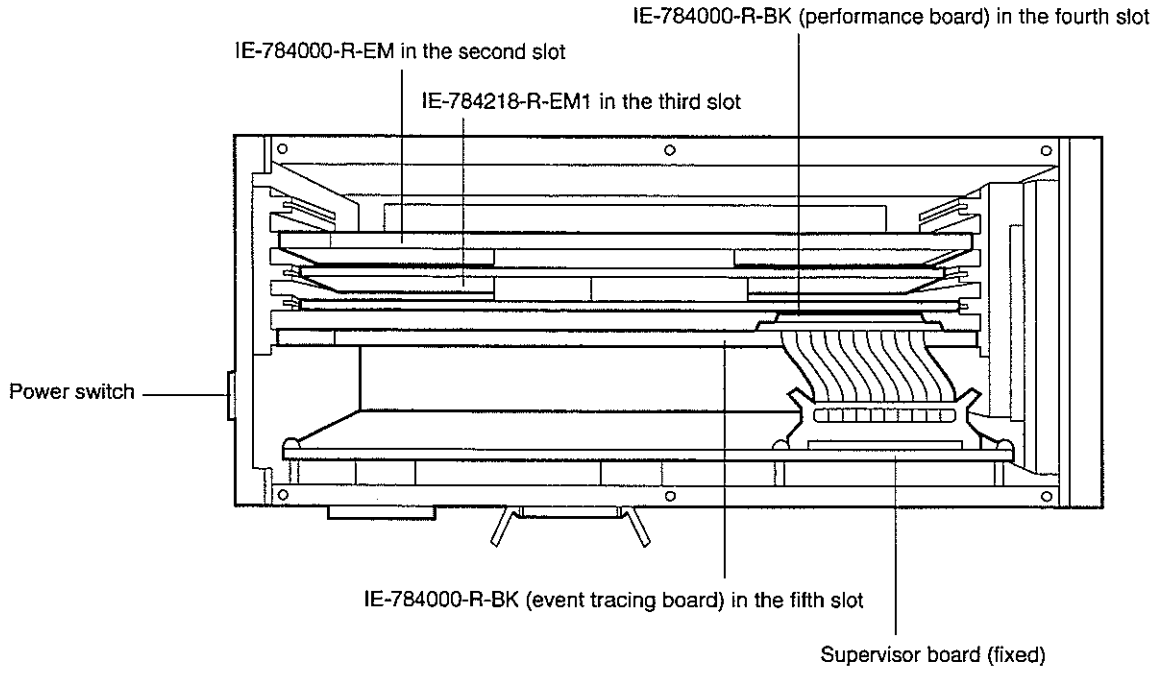
Figure 2-3. Removing Top Cover of IE-784000-R



<4> Removing the rubber of the top cover.
Remove the top cover, then remove the rubber cover.

<5> Insert the IE-784000-R-EM and the IE-784218-R-EM1 into the second and third slots of the IE-784000-R, respectively. Then, replace the top cover and tighten it down with the screws.

Figure 2-4. Inserting IE-784000-R-EM and IE-784038-R-EM1 Boards in IE-784000-R



2.2 Connecting to Target System

To connect the IE-784000-R and the target system, use the EP-78064GC-R or EP-78064GF-R emulation probe, which is sold separately.

Figure 2-5. Connecting EP-78064GC-R to Target System

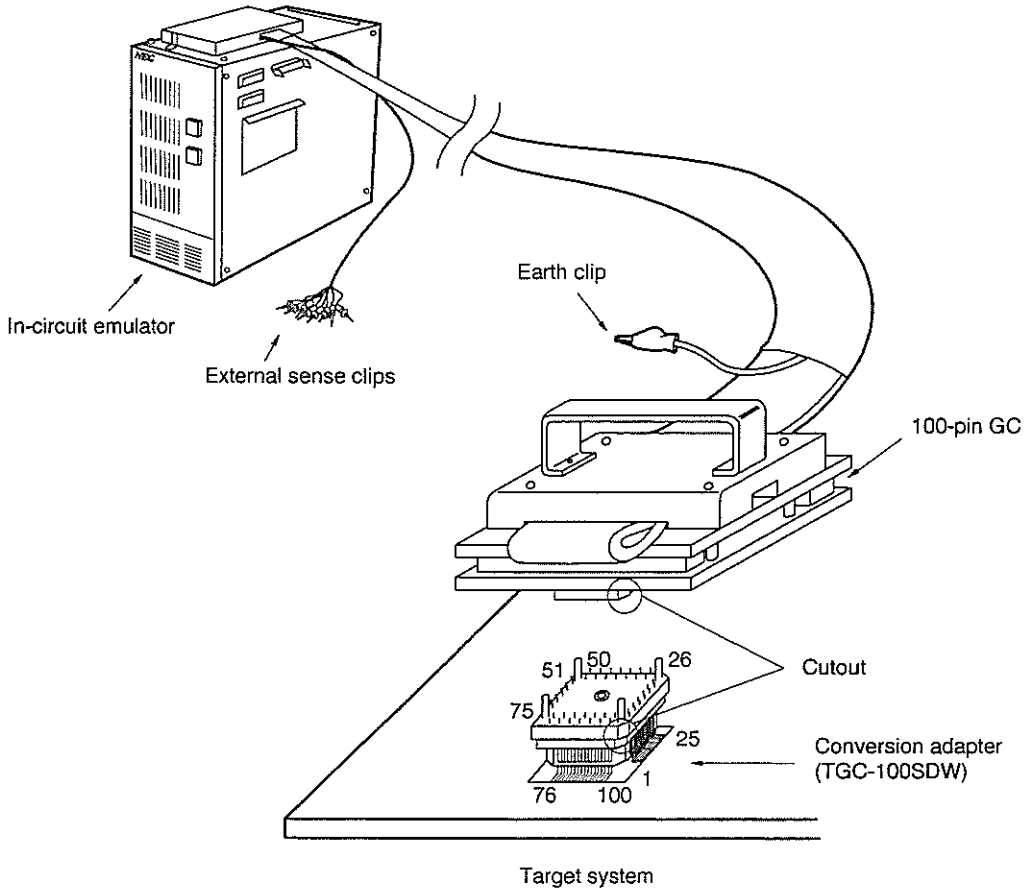
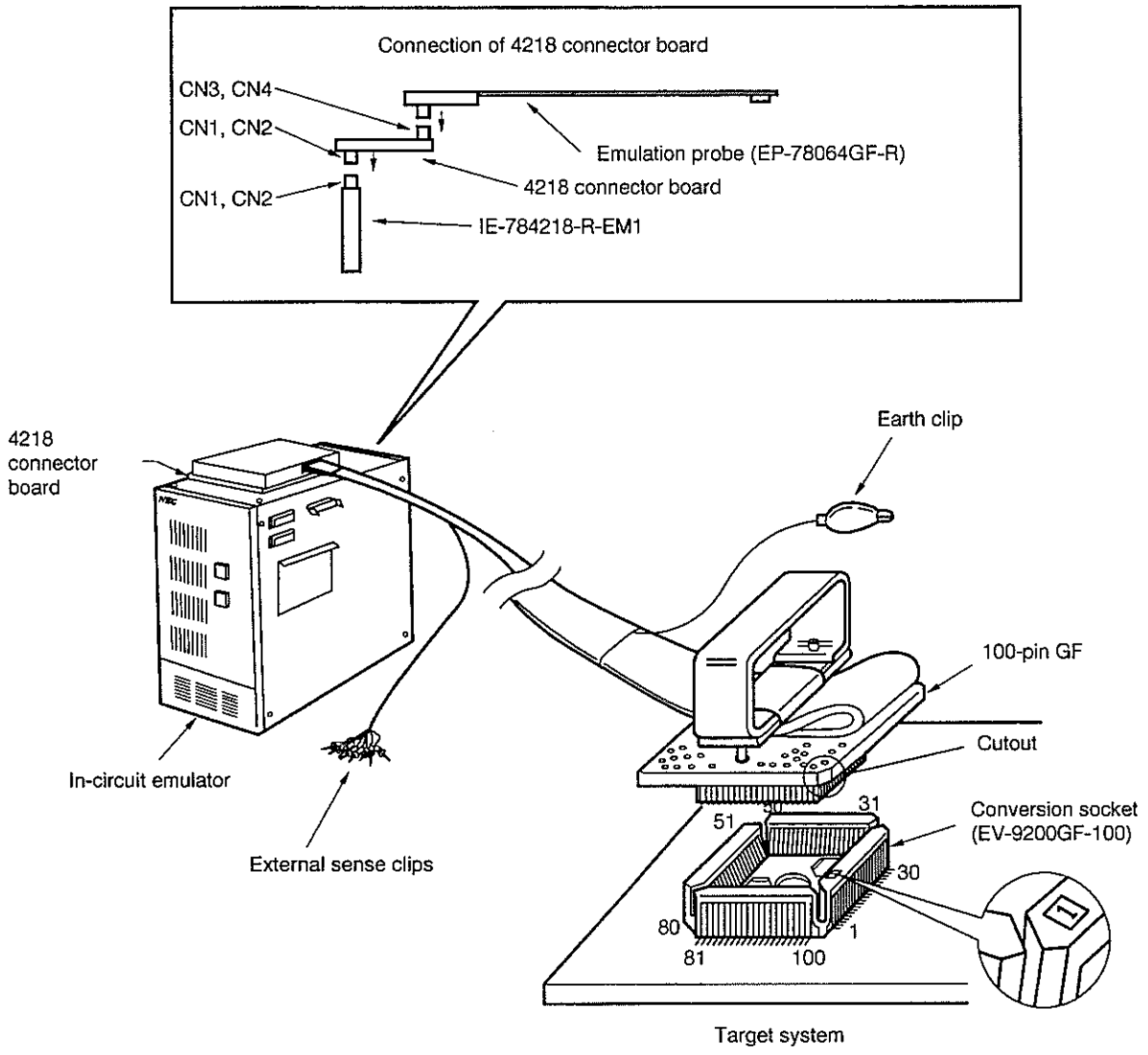


Figure 2-6. Connecting EP-78064GF-R to Target System



2.3 No Connection to Target System

The IE-784000-R can be started up even when it is not connected to the target system.

CHAPTER 3 SETTING OF USER CLOCK

In the case of the IE-784000-R, as long as the settings of the clock are not changed, the dedicated clock on the IE-784218-R-EM1 board will be supplied to the emulation device. When operating with the target system oscillating clock or with an optional clock, the clock IC socket (IC23 OPCK) must be selected and the debugger must be used to select the user-selected clock.

For the methods of making settings using the debugger, refer to the **ID78K4 Integrated Debugger User's Manual.**

3.1 Setting of Operating Clock

Using the IE-784000-R, the following operating clock settings are possible.

(1) Operation with the dedicated clock on the IE-784218-R-EM1 board

When the debugger is used to select the clock within the emulator, the dedicated clock (25 MHz) on the emulator board will be supplied to the emulation device. This mode is entered after the IE-784000-R power is turned on.

(2) Operation with an optional clock on the IE-784218-R-EM1 board

The debugger is used to select the external clock and that is determined by the oscillator in the clock IC socket (IC23 OPCK) is supplied to the emulation device. However, before selecting the external clock, whether or not to multiply the input clock must be set with JP1. For details, refer to **3.2 Installing the Crystal Oscillator.**

Setting of JP1

Setting	Function
1 to 2	Don't multiply
2 to 3	Multiply

(3) Operation of oscillating clock on target system

By inserting the 74HC04 CMOS IC in the clock IC socket (IC23 OPCK) on the emulation board and using the debugger to select external clock, the square-wave clock supplied from the target system will be supplied to the emulation device. Moreover, whether the frequency multiplication is used or not must be set as in (2).

For details, refer to **3.3 Supplying Clock from Target System.**

For connection information, refer to **CHAPTER 2 INSTALLATION PROCEDURES.**

Caution It is prohibited to perform an emulation in which oscillation is obtained by directly connecting a crystal resonator or ceramic resonator into the X1 and X2 pins of the target device. When using a frequency other than 25 MHz, provide an oscillating frequency clock that is actually employed using the method in (2) and (3) above.

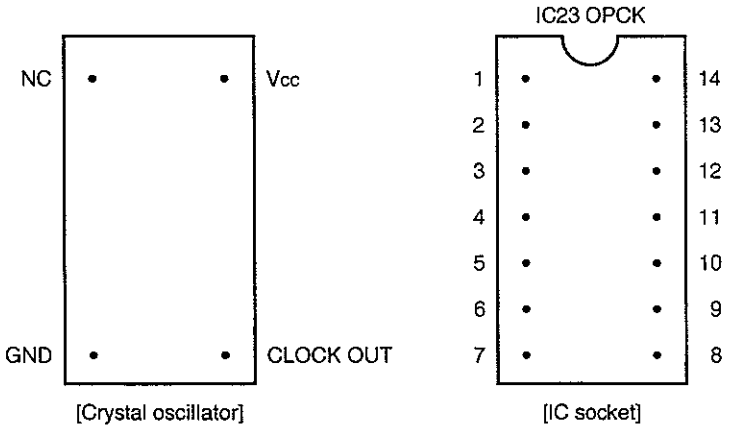
3.2 Installing Crystal Oscillator

◊ **Procedures:**

<1> Ready an IE-784218-R-EM1 board.

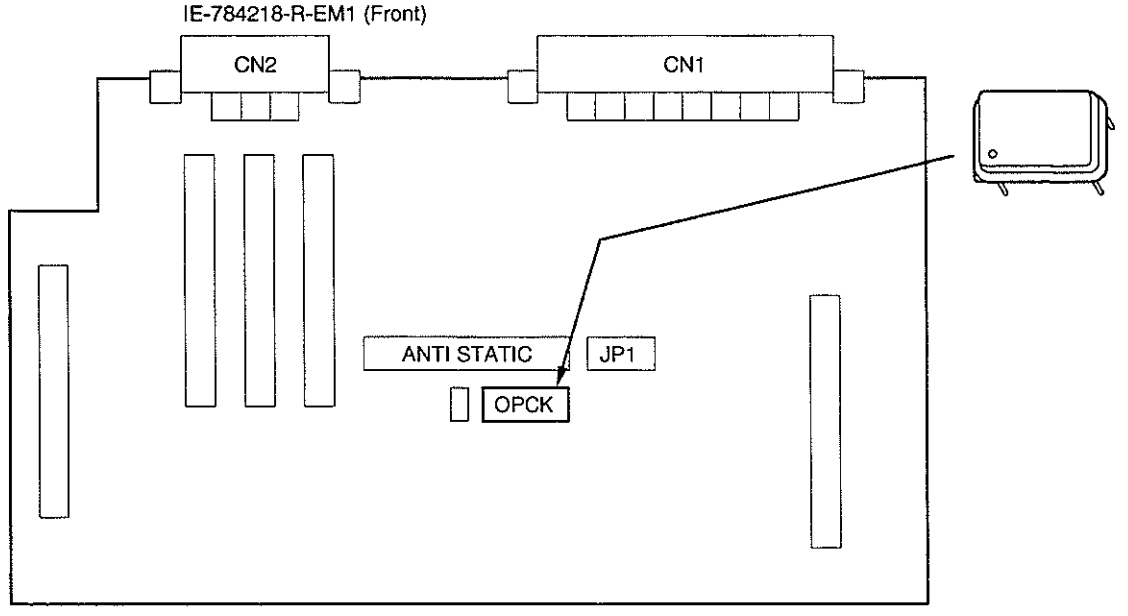
<2> For shipment, the 74HC04 is inserted in the IE-784218-R-EM1 clock IC socket (IC23 OPCK). Remove it.

<3> Install the crystal oscillator (max. 25 MHz) to the clock IC socket (IC3 OPCK) on the IE-784218-R-EM1. Insert the pins of the crystal oscillator into the clock IC socket as indicated in the table below.



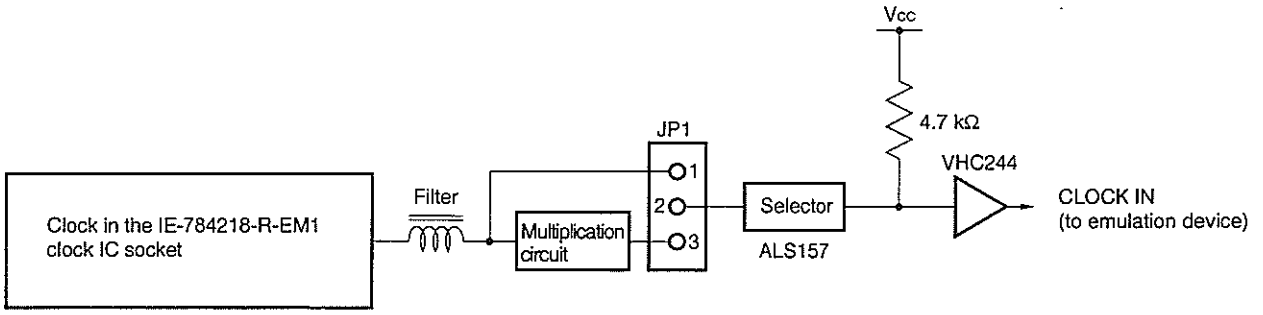
Crystal Oscillator Pin	Socket Pin Number
NC	1
GND	7
CLOCK OUT	8
Vcc	14

Figure 3-1. Clock IC Location on IE-784218-R-EM1 Board



When the user clock setting is selected using the debugger, the following circuit will be formed and a clock will be supplied from the crystal oscillator to the emulation device in the IE-784000-R-EM.

Figure 3-2. IE-784218-R-EM1 Clock Supply Diagram



Caution In the case of the IE-784000-R, the frequency multiplication function cannot be used by setting the oscillation mode register (CC).
When using an external clock, set the value of JP1 in advance.

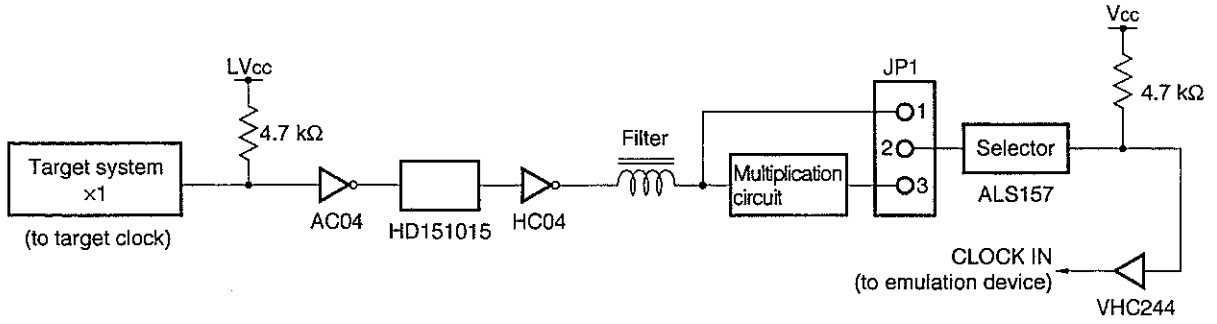
Setting of JP1

Setting	Function
1 to 2	Don't multiply
2 to 3	Multiply

3.3 Supplying Clock from Target System

For shipment, the 74HC04 CMOS IC is inserted in the IE-784218-R-EM1 clock IC socket (IC23 OPCK). If the user clock setting is selected using the debugger, the following circuit will be formed and a clock will be supplied from the target system to the IE-784000-R-EM emulation devices.

Figure 3-3. IE-784218-R-EM1 Clock Supply Diagram



Setting of JP1

Setting	Function
1 to 2	Don't multiply
2 to 3	Multiply

Caution A clock cannot be supplied from a crystal resonator or a ceramic resonator that is connected to the X1 and X2 pins of the target system.

If the 74HC04 is removed for some reason, such as a change in the operating clock, make the setting as indicated below:

◊ **Procedures:**

<1> Ready an IE-784218-R-EM1.

<2> Insert a 74HC04 in the IE-784218-R-EM1 clock IC socket (IC23 OPCK) paying close attention so that the number 1 pin marks match.

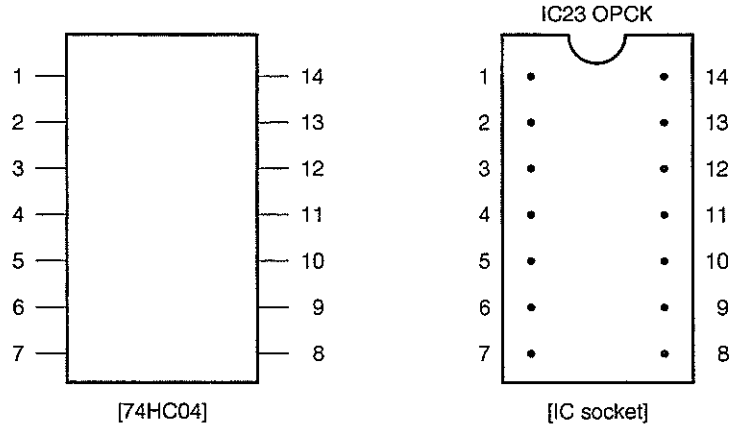
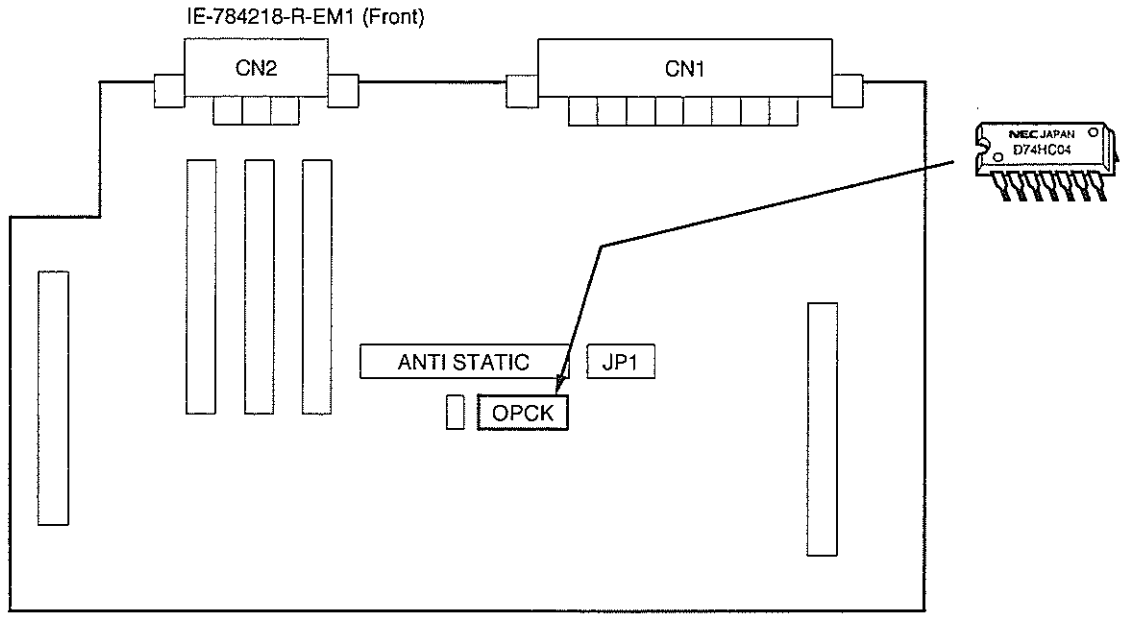


Figure 3-4. Clock IC Location on IE-784218-R-EM1 Board

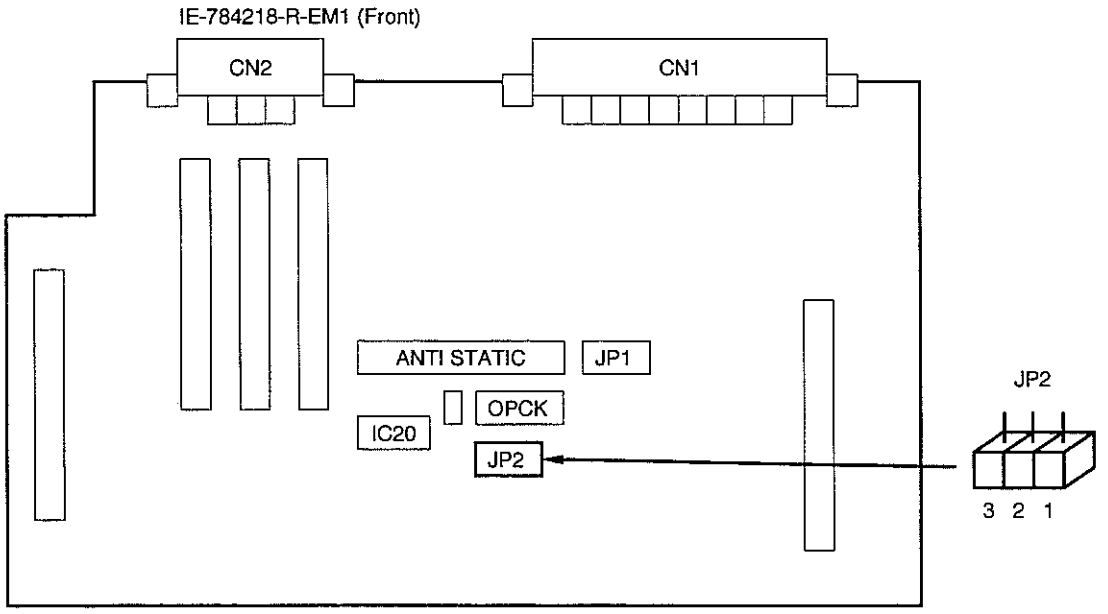


3.4 Supplying Clock for Clock

The following methods can be used to supply the subclock for the clock.

JP2	Supply Clock
1 to 2 short	32.768 kHz (factory setting)
2 to 3 short	Supply from part holder (IC20) circuit

Figure 3-5. IE-784218-R-EM1 Mounting Position



Setting clock for part holder (IC20)

◊ **Procedures:**

<1> Ready an IE-784218-R-EM1.

<2> For shipping, pin 3 and pin 12 of the part holder for setting the subclock on the IE-784218-R-EM1 are connected, and therefore must be disconnected.

<3> Set a capacitor, resistor and resonator on the part holder for setting the subclock on the IE-784218-R-EM1.

<4> For shipping, pins 1 and 2 of JP2 of the IE-784218-R-EM1 are shorted; Change this setting so that pins 2 and 3 are shorted.

Figure 3-6. Part Holder Setting

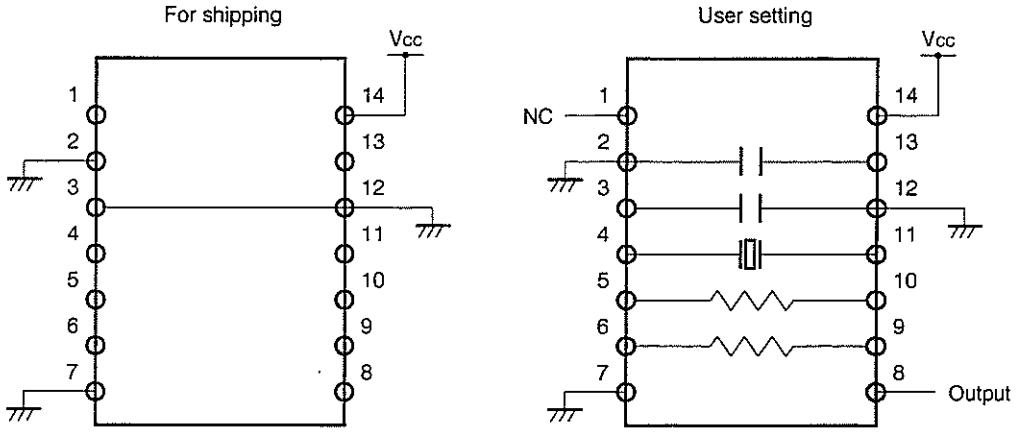
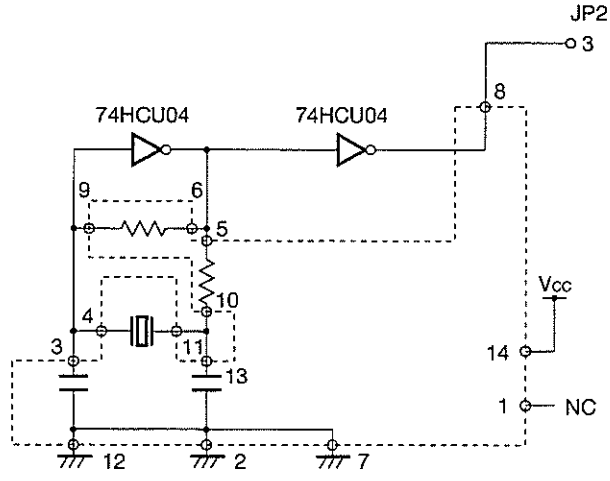


Figure 3-7. IE-784218-R-EM1 Subclock Sample Clock Supply



Remark The area enclosed in broken lines indicates components installed on the part holder.

Setting of JP2

Setting	Function
1 to 2	For shipping
2 to 3	User setting

[MEMO]

CHAPTER 4 STARTUP

For the startup method, after connecting the board to the host computer, refer to the **ID78K4 Integrated Debugger User's Manual**.

If startup is not successful, check that all required conditions (connection, settings) are satisfied by referring to this document or the **IE-784000-R User's Manual (EEU-5004)**.

[MEMO]

CHAPTER 5 DIFFERENCES BETWEEN IN-CIRCUIT EMULATOR AND TARGET DEVICE

Because this in-circuit emulator emulates through the emulation CPU and the peripheral emulation devices, there are differences in pin characteristics.

Figure 5-1. Equivalent Circuits of Port Pin Emulation Circuits (1 of 3)

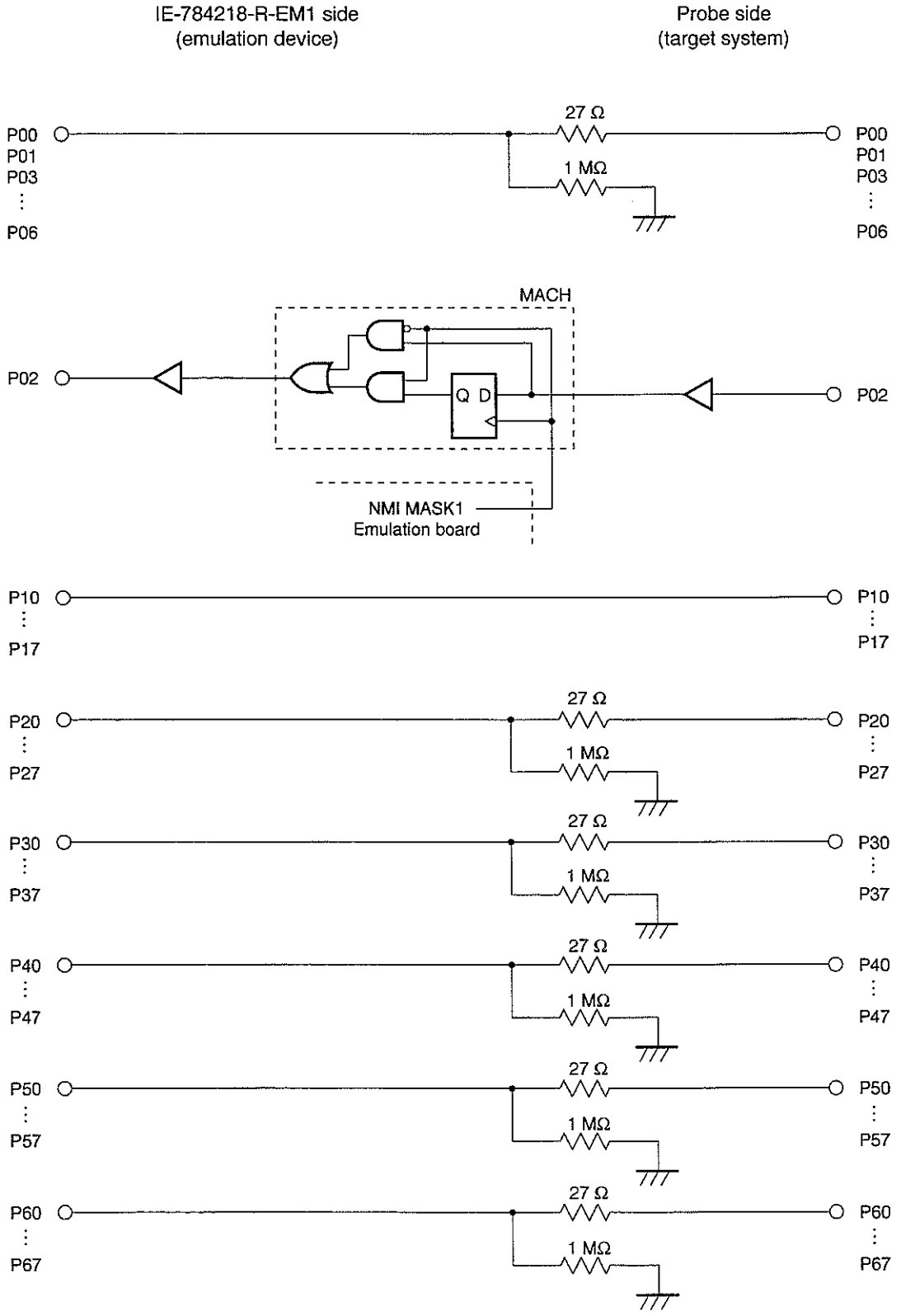


Figure 5-1. Equivalent Circuits of Port Pin Emulation Circuits (2 of 3)

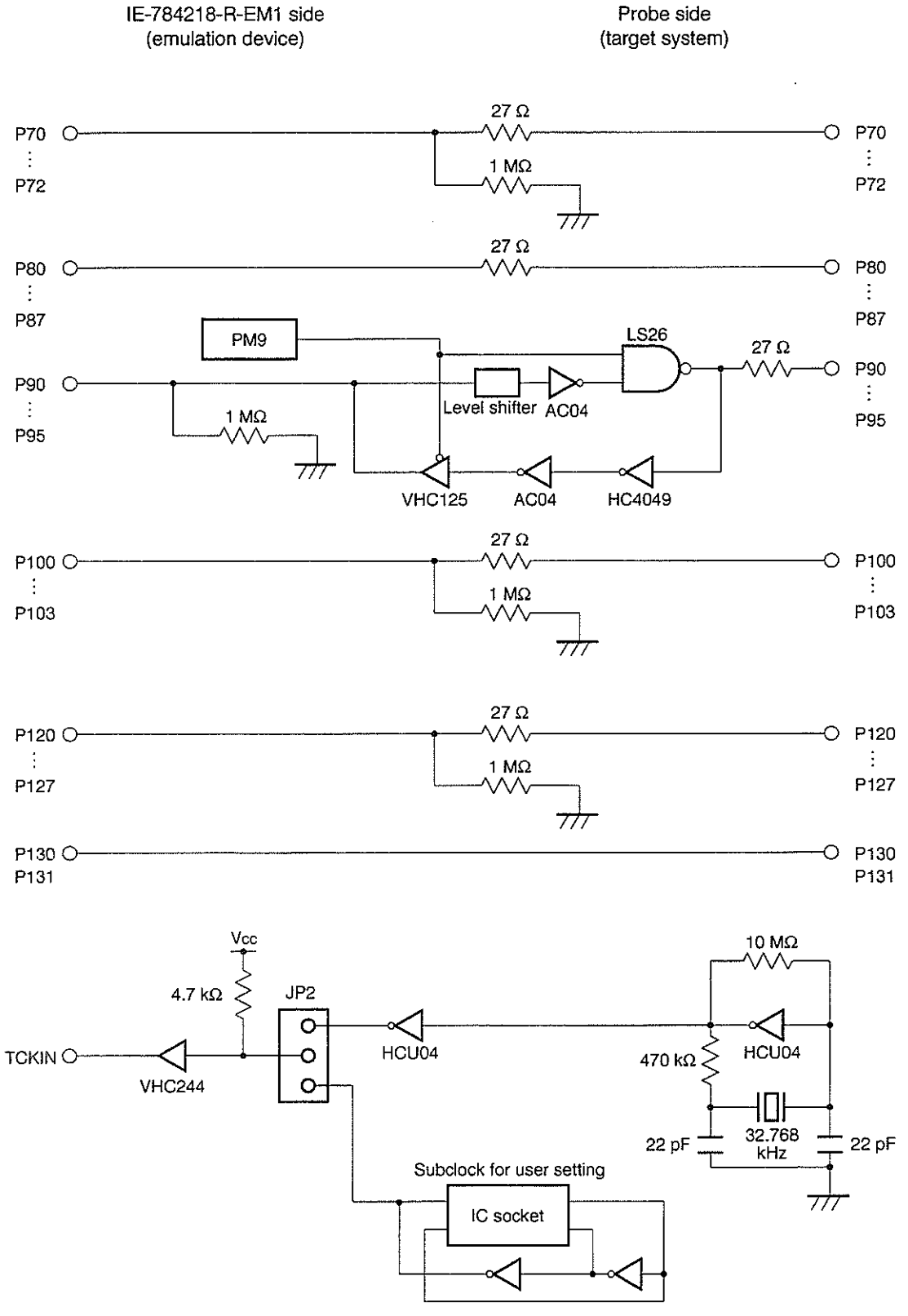
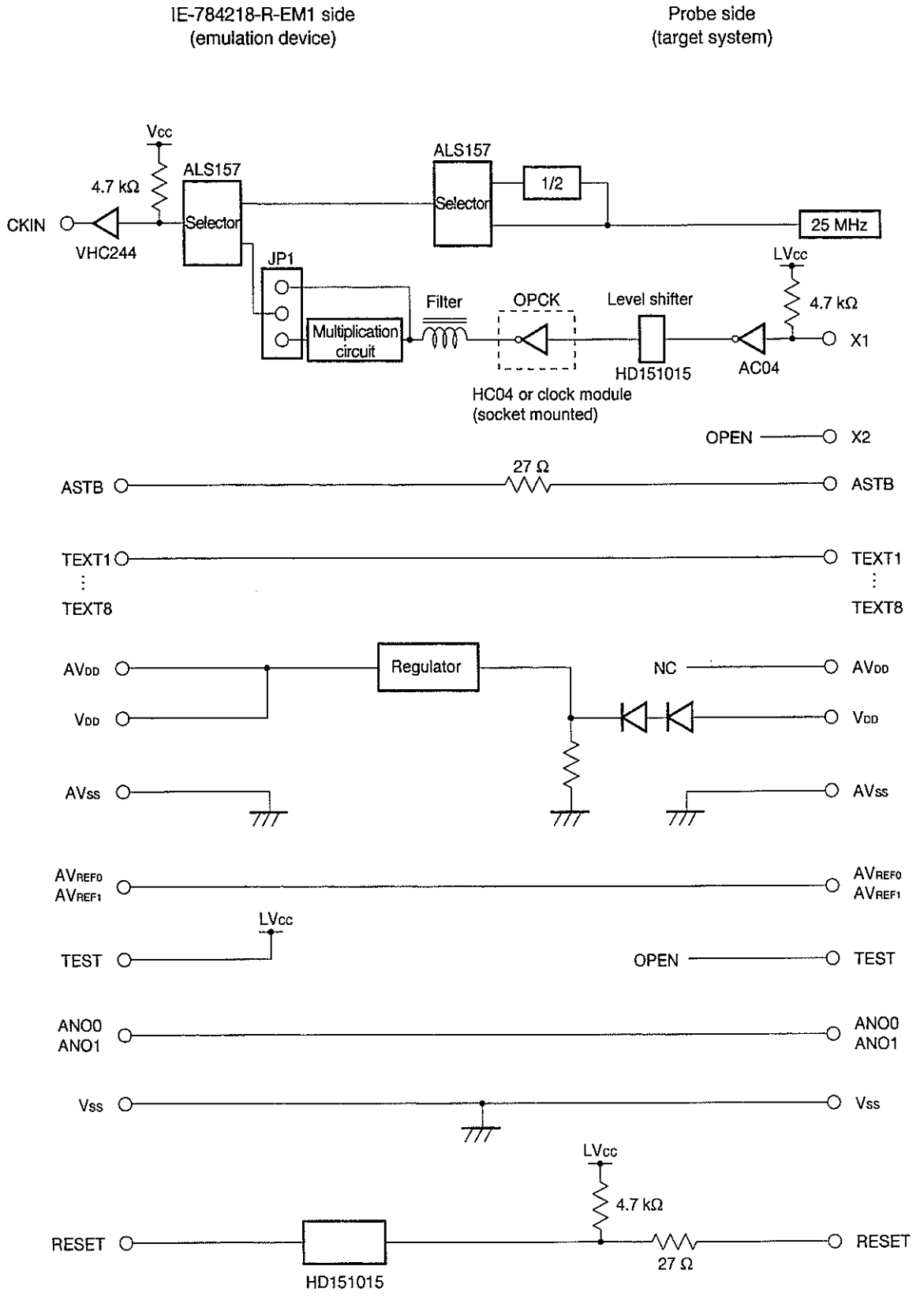


Figure 5-1. Equivalent Circuits of Port Pin Emulation Circuits (3 of 3)



APPENDIX A PRODUCT SPECIFICATIONS

Part number : IE-784218-R-EM1
Operating temperature : 0°C to 40°C (without condensation)
Humidity : 10% to 80% (without condensation)
Storage temperature : –15°C to +60°C (without condensation)
Power supply : +3.0 V to +5.5 V (supplied from the IE-784000-R)
Printed circuit board dimensions : (vertical) 140 mm × (horizontal) 210 mm
Connectors :

PJ1	Emulation board connector
PJ2	
CN1	Emulation probe connector
CN2	
TGCN1	Emulaiton probe connector for in-circuit emulator IE-780000-SL[Note]
TGCN2	
TGCN3	

Note Under development

[MEMO]

APPENDIX B CN1, CN2 AND EMULATION PROBE PINS

B.1 EP-78064GC-R Pin List

Figure B-1. Pin No. Correspondence Table for CN1 and EP-78064GC-R

CN1 Pin No.	Emulation probe	CN1 Pin No.	Emulation probe	CN1 Pin No.	Emulation probe	CN1 Pin No.	Emulation probe
1	GND	25	3	49	15	73	45
2	GND	26	2	50	14	74	46
3	30	27	1	51	100	75	47
4	29	28	NC	52	99	76	48
5	28	29	NC	53	98	77	49
6	27	30	NC	54	97	78	50
7	26	31	NC	55	96	79	63
8	25	32	NC	56	95	80	64
9	24	33	NC	57	94	81	65
10	23	34	NC	58	93	82	66
11	22	35	NC	59	92	83	67
12	21	36	40	60	91	84	81
13	20	37	39	61	NC	85	82
14	19	38	38	62	NC	86	83
15	13	39	37	63	NC	87	84
16	12	40	36	64	NC	88	85
17	11	41	35	65	NC	89	86
18	10	42	34	66	NC	90	87
19	9	43	33	67	NC	91	88
20	8	44	32	68	NC	92	89
21	7	45	31	69	41	93	90
22	6	46	18	70	42	94	NC
23	5	47	17	71	43	95	NC
24	4	48	16	72	44	96	NC

Figure B-2. Pin No. Correspondence Table for CN2 and EP78064GC-R

CN2 Pin No.	Emulation probe	CN2 Pin No.	Emulation probe	CN2 Pin No.	Emulation probe	CN2 Pin No.	Emulation probe
1	NC	13	58	25	75	37	NC
2	NC	14	59	26	76	38	NC
3	NC	15	60	27	77	39	EXT0
4	NC	16	61	28	78	40	EXT1
5	NC	17	62	29	79	41	EXT2
6	51	18	68	30	80	42	EXT3
7	52	19	69	31	NC	43	EXT4
8	53	20	70	32	NC	44	EXT5
9	54	21	71	33	NC	45	EXT6
10	55	22	72	34	NC	46	EXT7
11	56	23	73	35	NC	47	GND
12	57	24	74	36	NC	48	GND

B.2 EP-78064GF-R Pin List

Figure B-3. Pin No. Correspondence Table for CN1 and EP78064GF-R

CN1 Pin No.	Emulation probe	CN1 Pin No.	Emulation probe	CN1 Pin No.	Emulation probe	CN1 Pin No.	Emulation probe
1	GND	25	3	49	15	73	45
2	GND	26	2	50	14	74	46
3	30	27	1	51	100	75	47
4	29	28	NC	52	99	76	48
5	28	29	NC	53	98	77	49
6	27	30	NC	54	97	78	50
7	26	31	NC	55	96	79	63
8	25	32	NC	56	95	80	64
9	24	33	NC	57	94	81	65
10	23	34	NC	58	93	82	66
11	22	35	NC	59	92	83	67
12	21	36	40	60	91	84	81
13	20	37	39	61	NC	85	82
14	19	38	38	62	NC	86	83
15	13	39	37	63	NC	87	84
16	12	40	36	64	NC	88	85
17	11	41	35	65	NC	89	86
18	10	42	34	66	NC	90	87
19	9	43	33	67	NC	91	88
20	8	44	32	68	NC	92	89
21	7	45	31	69	41	93	90
22	6	46	18	70	42	94	NC
23	5	47	17	71	43	95	NC
24	4	48	16	72	44	96	NC

Figure B-4. Pin No. Correspondence Table for CN2 and EP-78964GF-R

CN2 Pin No.	Emulation probe	CN2 Pin No.	Emulation probe	CN2 Pin No.	Emulation probe	CN2 Pin No.	Emulation probe
1	NC	13	58	25	75	37	NC
2	NC	14	59	26	76	38	NC
3	NC	15	60	27	77	39	EXT0
4	NC	16	61	28	78	40	EXT1
5	NC	17	62	29	79	41	EXT2
6	51	18	68	30	80	42	EXT3
7	52	19	69	31	NC	43	EXT4
8	53	20	70	32	NC	44	EXT5
9	54	21	71	33	NC	45	EXT6
10	55	22	72	34	NC	46	EXT7
11	56	23	73	35	NC	47	GND
12	57	24	74	36	NC	48	GND

APPENDIX C SWITCH SETTINGS

Table C-1. JP1, and JP2 Settings

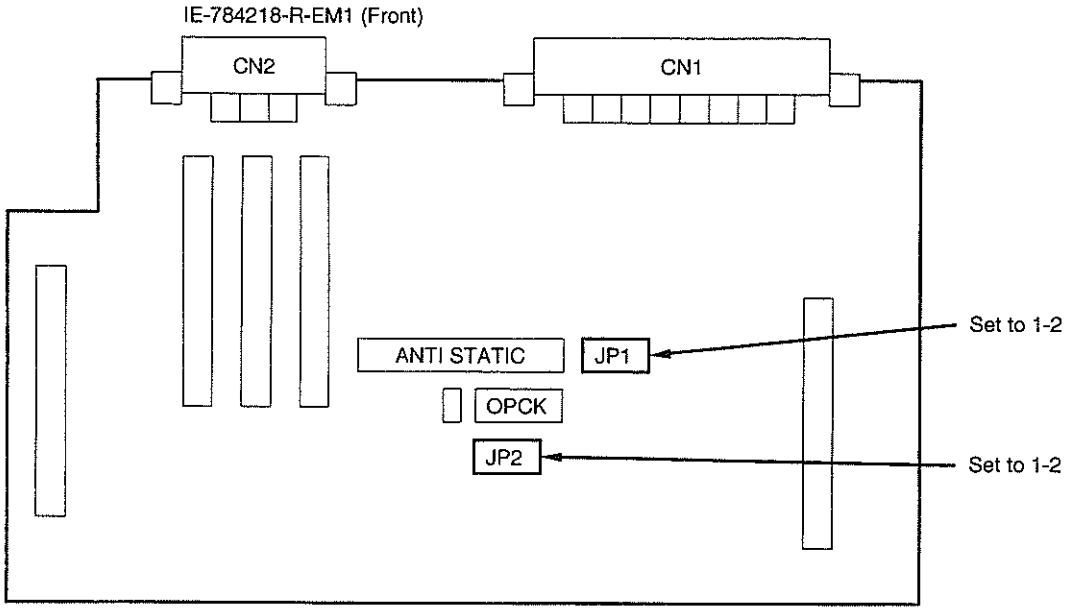
Setting of JP1

Setting	Function
1 to 2	Don't multiply (factory setting)
2 to 3	Multiply

Setting of JP2

Setting	Operation Clock
1 to 2	32.768 kHz (factory setting)
2 to 3	Supply from part holder (IC20) circuit

Figure C-1. Position of JP1 and JP2 of IE-784218-R-EM1



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