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RENESAS

User's Manual

IE-78K4-NS

In-Circuit Emulator

Target Devices
78K/IV Series

Document No. U13356EJ3V0UM00 (3rd edition)
Date Published May 2003 N CP(K)

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- Availability of related technical literature
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Major Revisions in This Edition

Page	Description
Throughout	Change of interface board for desktop PC from IE-700000-PCI-IF to IE-70000-PCI-A
p.12	Modification of **Figure 1-1 IE-78K4-NS System Configuration**
p.28	**A.1 Introduction** • Deletion of **Applicable models**
p.30	**B.1 Introduction** • Deletion of **Applicable models**

The mark ★ shows major revised points.

INTRODUCTION

Product Overview

The IE-78K4-NS is used in combination with an I/O emulation board (IE-784×××-NS-EM1) to debug products of the 78K/IV Series of 16-bit single-chip microcontrollers.

Target Readers

This manual is intended for engineers who will perform debugging of systems that employ 78K/IV Series 16-bit single-chip microcontrollers using the IE-78K4-NS in combination with an I/O emulation board (IE-784×××-NS-EM1).

Purpose

The purpose of this manual is to help the reader understand the debugging functions that are available by using the IE-78K4-NS and the I/O emulation board (IE-784×××-NS-EM1) together.

Organization

When using the IE-78K4-NS, refer to the manual (this manual) that comes with the IE-78K4-NS as well as the manual that comes with the I/O emulation board (IE-784×××-NS-EM1).

IE-78K4-NS User's Manual (This manual)	IE-784×××-NS-EM1 User's Manual
• Basic specifications • System configuration • External interface function	• Function outline • Target interface differences

How to Read This Manual

To understand the overall functions of the IE-78K4-NS

→ Read this manual in the order of the **CONTENTS**.

To understand the basic specifications

→ Refer to **CHAPTER 1 GENERAL** and **CHAPTER 2 PART NAMES**.

To know the appropriate settings when debugging 78K/IV Series products while connected to the IE-784×××-NS-EM1

→ Refer to **CHAPTER 3 INSTALLATION**.

Terminology The meanings of the terms used in this manual are described in the table below.

Term	Meaning
Emulation device	Refers to the generic name for the device in the emulator that performs emulation of the target device. This includes the emulation CPU.
Emulation CPU	Refers to the CPU block that executes the user's program in the emulator.
Target device	Refers to the device to be emulated.
Target program	Refers to the program to be debugged.
Target system	Refers to the system to be debugged. This includes the target program and the hardware created by the user. In the narrow sense, it means hardware only.

Conventions **Data significance: Higher digits on the left and lower digits on the right**

Note: Footnote for item marked with **Note** in the text

Caution: Information requiring particular attention

Remark: Supplementary information

Related Documents Please use the following documents in conjunction with this manual.
The related documents listed below may include preliminary versions. However, preliminary versions are not marked as such.

○ **Documents Related to Development Tools (User's Manuals)**

Document Name		Document Number
IE-78K4-NS In-Circuit Emulator		This manual
RA78K4 Assembler Package	Operation	U15254E
	Language	U15255E
	Structured Assembler Preprocessor	U11743E
CC78K4 C Compiler Package	Operation	U15557E
	Language	U15556E
SM78K Series System Simulator Ver.2.30 or later	Operation (Windows™ Based)	U15373E
	External part user open interface specifications	U15802E
ID78K Series Integrated Debugger Ver.2.30 or later	Operation (Windows Based)	U15185E
RX78K4 Real-Time OS	Basics	U10603E
	Installation	U10604E
	Debugger	–
Project Manager Ver. 3.12 or later (Windows Based)		U14610E
PG-FP4 Flash Memory Programmer		U15260E

Caution The documents listed above are subject to change without notice. Be sure to use the latest documents for designing.

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CHAPTER 1 GENERAL

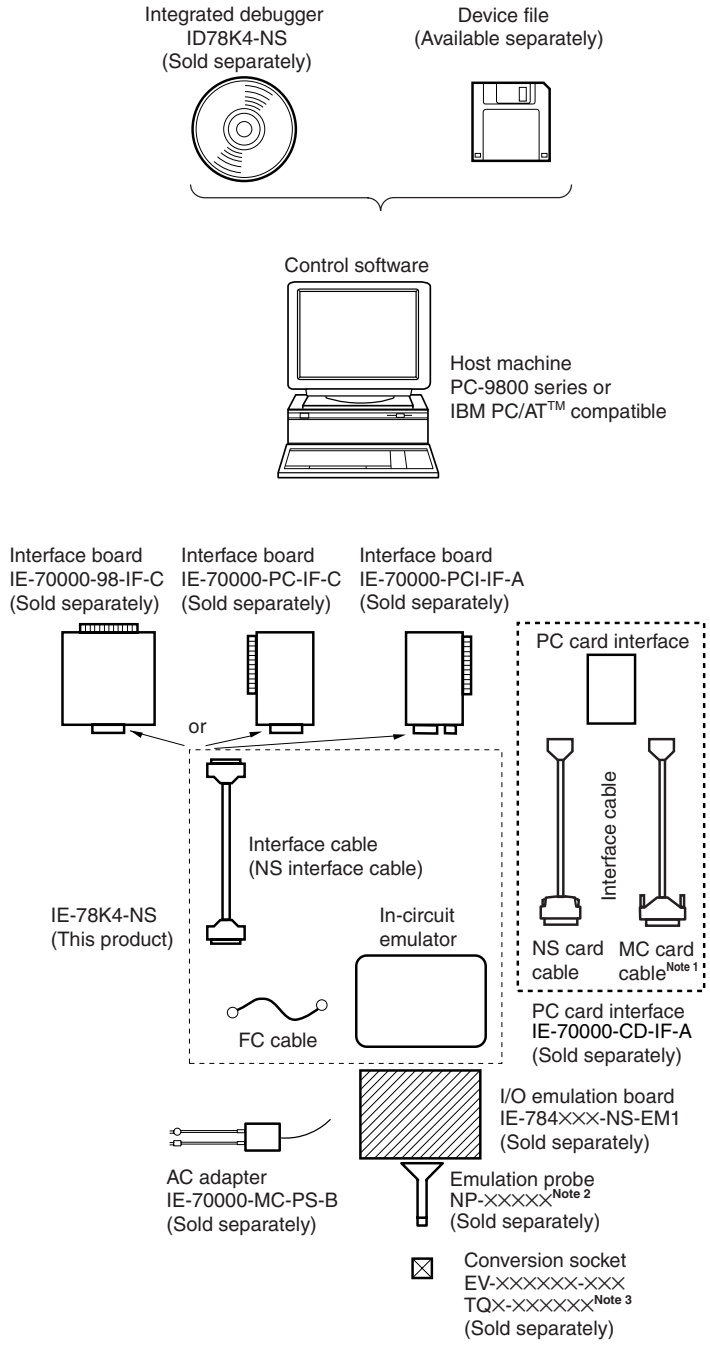
The IE-78K4-NS is a development tool for effective debugging of hardware and software using a 78K/IV Series 16-bit single-chip microcontroller.

This chapter describes the system configuration and basic specifications of the IE-78K4-NS.

1.1 System Configuration

Figure 1-1 shows the system configuration of the IE-78K4-NS.

★ **Figure 1-1. IE-78K4-NS System Configuration**



Notes 1. This cable is used for the V850 Family™. It cannot be used for the IE-78K4-NS.

2. The NP-××××× is a product of Naito Densei Machida Mfg. Co., Ltd. For further information, contact Naito Densei Machida Mfg. Co., Ltd. (TEL: +81-45-475-4191)

3. The TQ×-××××××× is a product of TOKYO ELETECH CORPORATION.
Inquiries: Daimaru Kogyo, Ltd.
Tokyo Electronics Department (TEL: +81-3-3820-7112)
Osaka Electronics Department (TEL: +81-6-6244-6672)

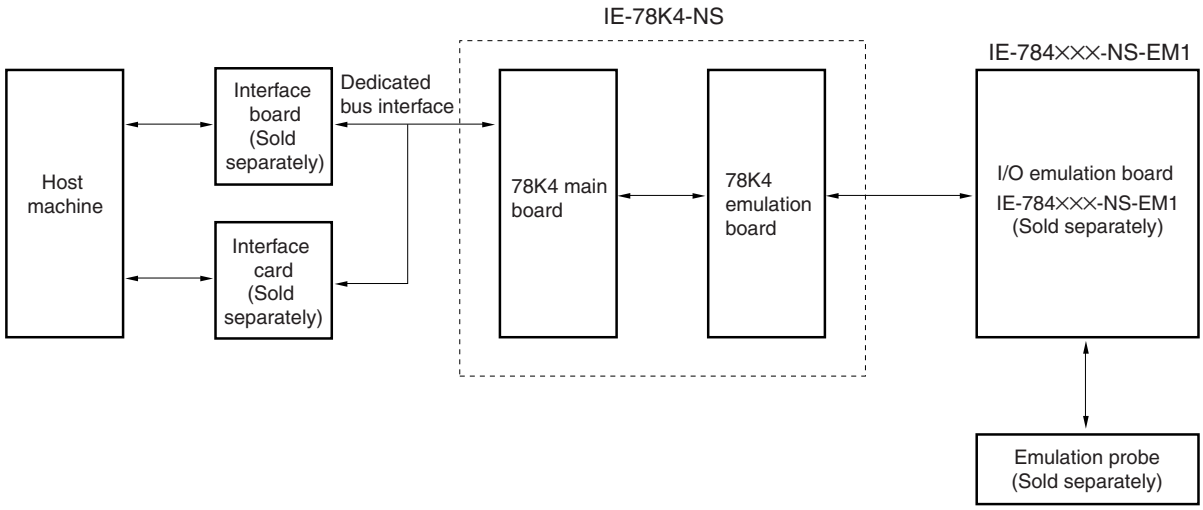
4. The device file can be downloaded from the NEC Electronics Website.
(URL: http://www.necel.com/micro).

1.2 Hardware Configuration

The IE-78K4-NS consists of the following hardware units (such as cabinet and boards).

- Cabinet
- 78K4 main board
- 78K4 emulation board
- NS interface cable

Figure 1-2. Basic Hardware Configuration of IE-78K4-NS



1.3 Basic Specifications

Table 1-1. List of Functions (MAX. Specifications) (1/2)

Parameter		Description
Supervisor		V40™ (operating frequency: 9.8304 MHz)
Target device		μPD784××× Series
System clock		Same as target device
Clock supply	External	Pulse input
	Internal	Mounted on IE-784×××-NS-EM1
Substitute memory capacity		1 MB
Mapping unit	Internal ROM	8 KB
	External RAM	512 bytes
	Peripheral RAM	256 bytes
	External substitute memory	• 64 KB space or less: 4 KB • 1 MB space or less: 64 KB • 1 MB space or more: 1 MB
Emulation function		• Real-time execution • Break execution • Step execution
Real-time internal RAM monitor		All internal RAM area
Event detection		• Program execution detection • Bus event detection • External trigger detection Trigger output (1 unit) and open-drain output
Event integration		• Path condition • Sequential condition • Trace qualify condition • Section trace start/end condition (time measurement counter start/end) • Trigger output condition (trace delay)
Break factor		• Event break • Manual break • Command break • Fail-safe break
Real-time trace	Trace factor	• All trace • Section trace • Qualify trace
	Trace capacity	96 bits × 32 KB
	Trace content	Address, data, and status

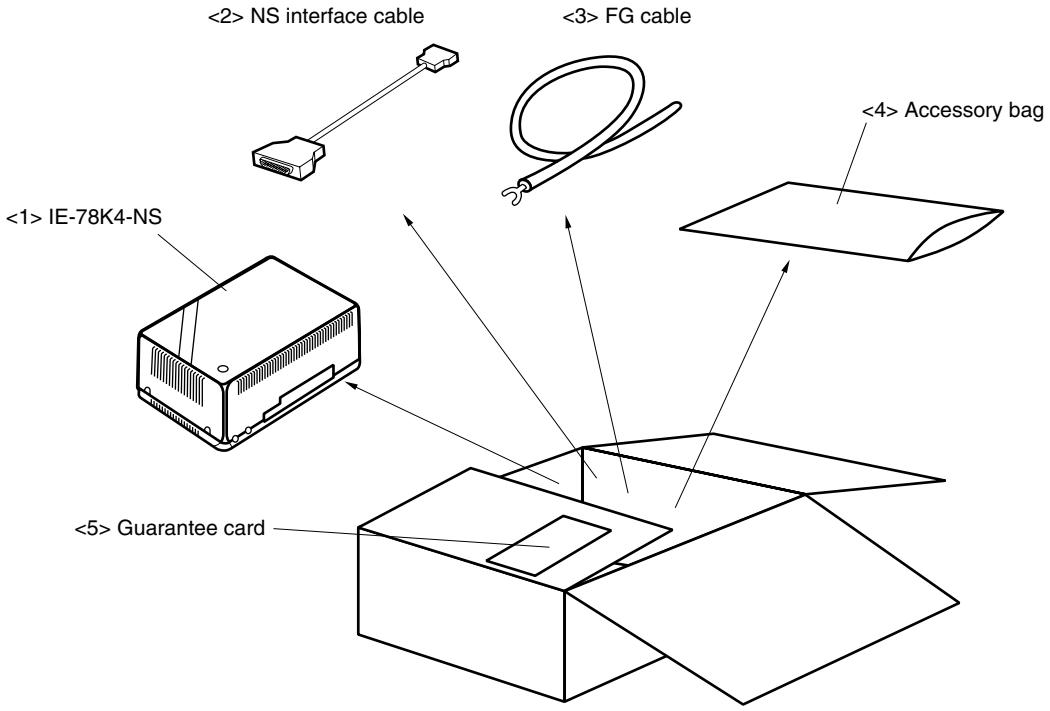
Table 1-1. List of Functions (MAX. Specifications) (2/2)

Parameter	Description
Execution time measurement	Up to 14 min. 33 sec., resolution: 203.45 ns Number of measured section executions: 65536 MAX.
Target interface	Emulation probe (sold separately) provided for each target device shape
Pin mask	RESET, HLDRQ, NMI, WAIT, and Hardware STOP are maskable
Host interface	Dedicated bus interface
Low-voltage support	Based on the I/O emulation board (sold separately)
Host machine	PC-9800 series and PC/AT compatibles
Power supply	DC 5 V
Dimensions	W240 × D197 × H73 (mm)

1.4 Package Contents

The packing box of the IE-78K4-NS contains the main unit, cables, an accessory bag, and a guarantee card.
A detailed list of contents, this user's manual, and screws are in the accessory bag. If anything is missing or broken, contact an NEC Electronics sales representative or an NEC Electronics distributor.

Figure 1-3. Package Contents

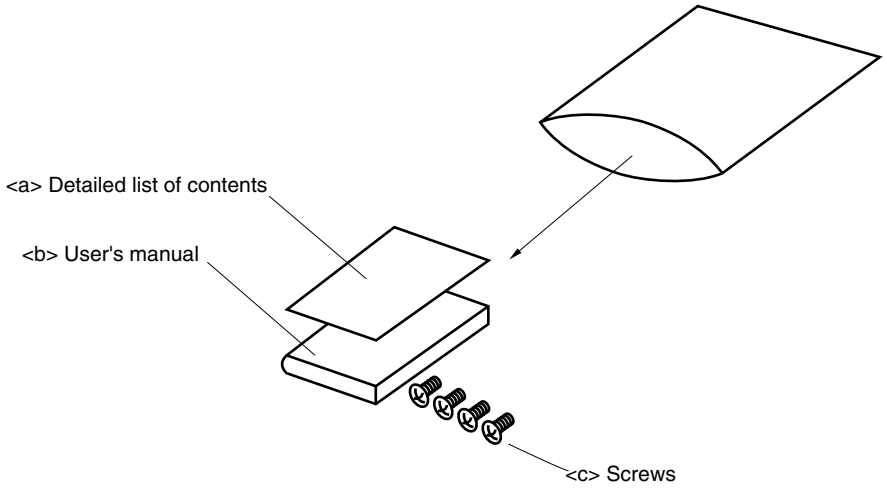


<1> IE-78K4-NS main unit: 1
<2> NS interface cable: 1
<3> FG cable: 1
<4> Accessory bag: 1
<5> Guarantee card: 1

Make sure that the following items are contained in the accessory bag (see Figure 1-4 Contents of the Accessory Bag).

<a> Detailed list of contents: 1
<b> User's manual (this manual): 1
<c> Screws: 4

Figure 1-4. Contents of Accessory Bag



CHAPTER 2 PART NAMES

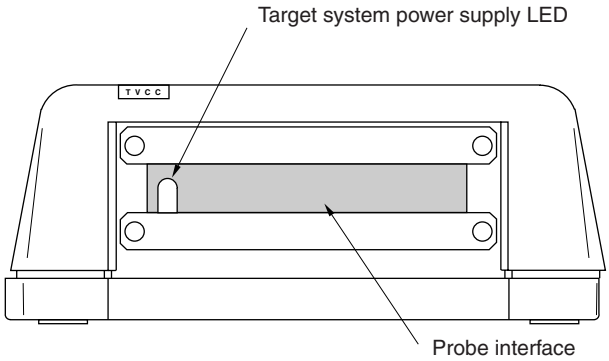
This chapter introduces the parts of the IE-78K4-NS main unit.

The packing box contains the IE-78K4-NS main unit. If anything is missing or damaged, please contact an NEC Electronics sales representative.

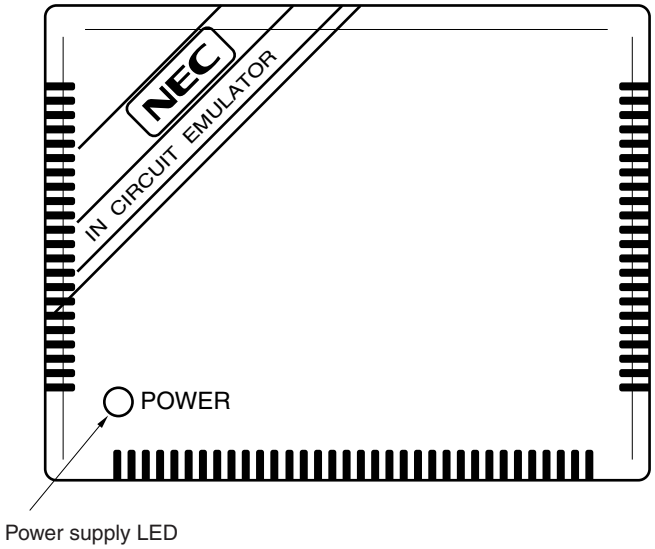
Please make sure to fill out and return the guarantee card that comes with the main unit.

2.1 Parts of Main Unit

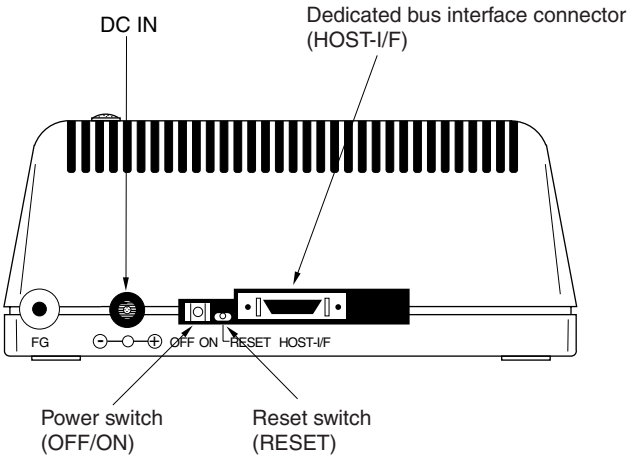
(1) Probe end



(2) Top view



(3) Interface end



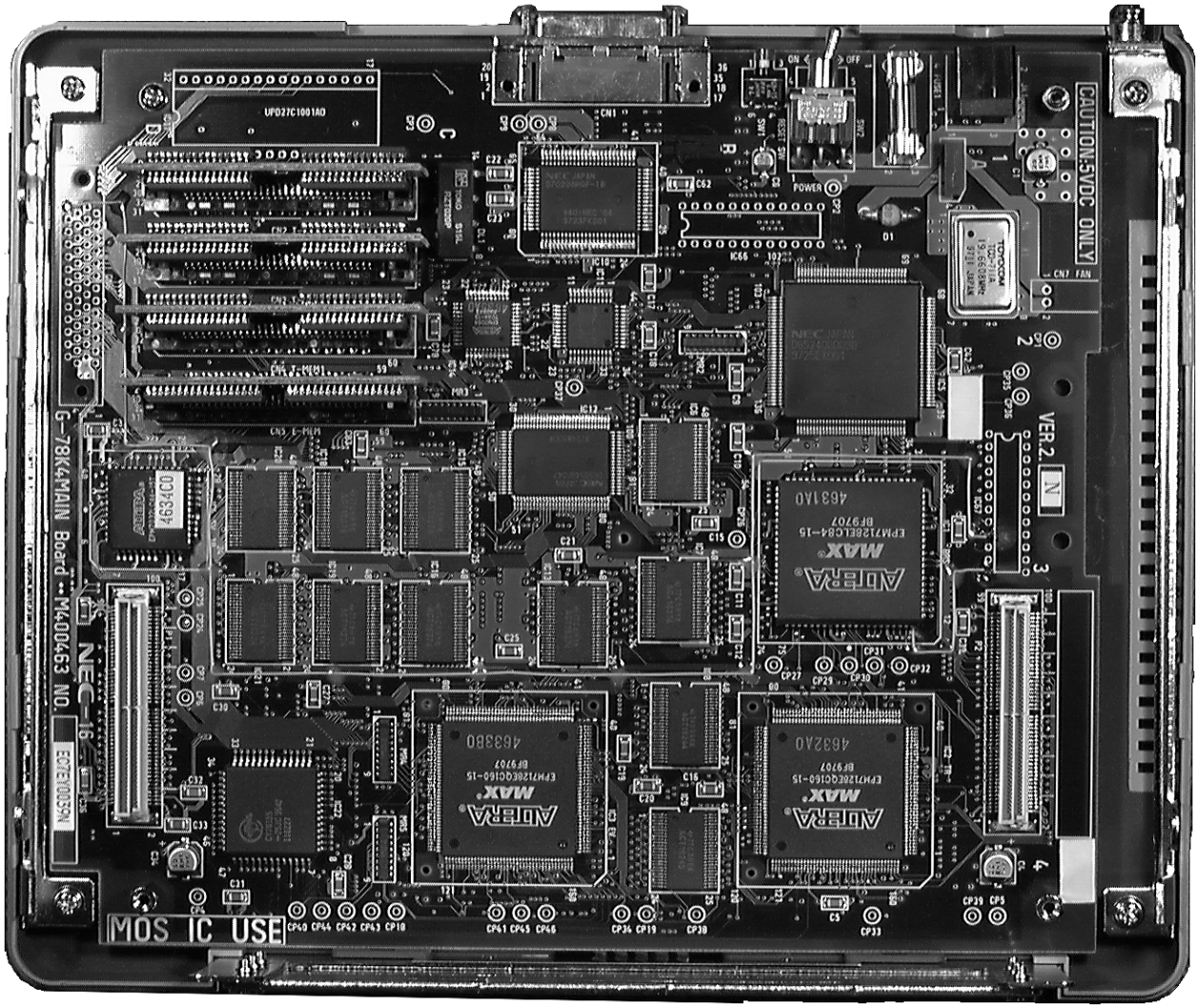
2.2 Board Name

IE-78K4-NS contains two boards.

- Main board (G-78K4 MAIN Board): 1
- Emulation board (G-78K4 EM Board): 1

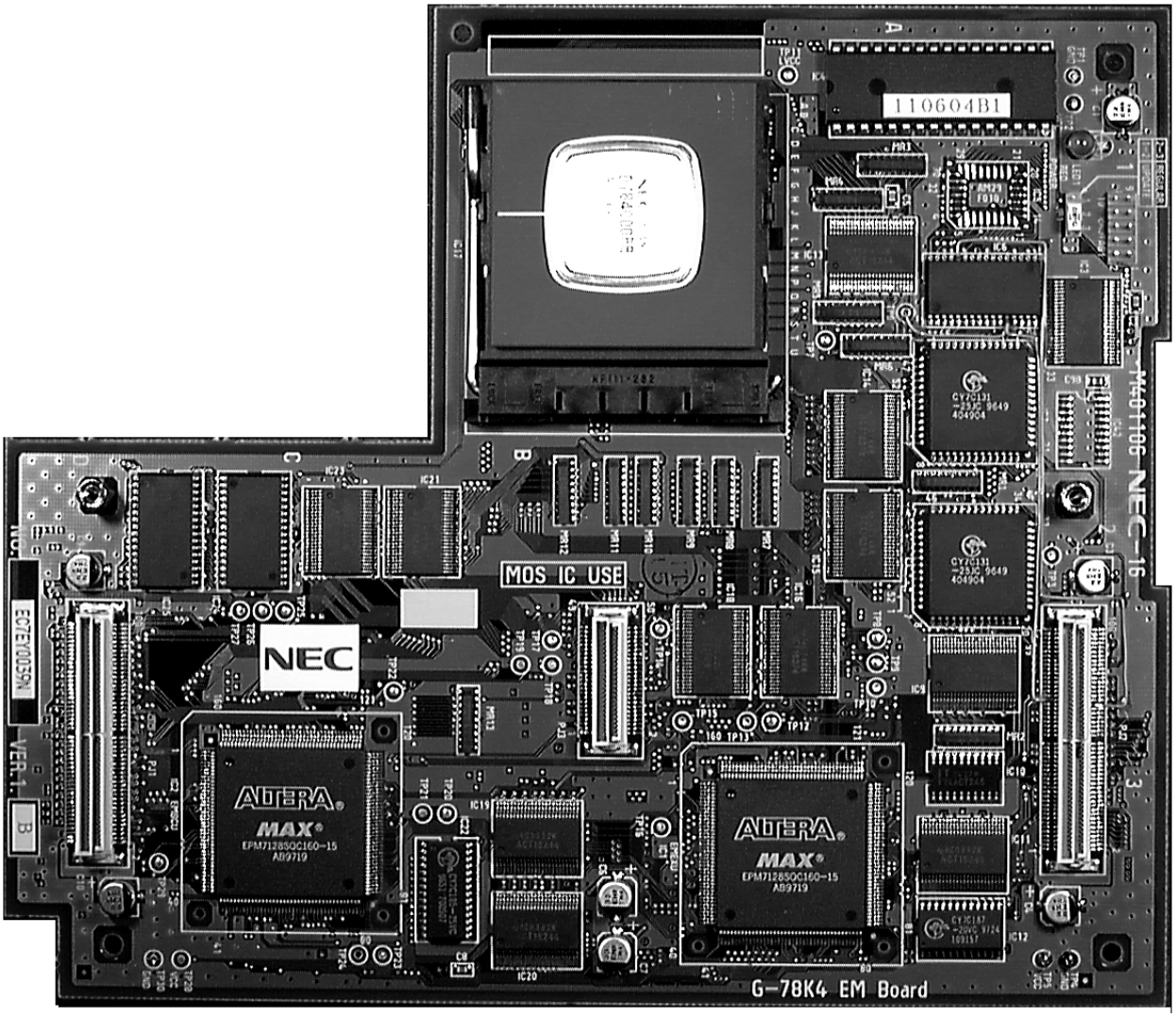
Check that you have the correct two boards. To access the inside of the unit, remove the four screws from the sides of the main unit and open the lid.

Figure 2-1. Main Board (G-78K4 MAIN Board)



Remark The main board is shown mounted in the main unit.

Figure 2-2. Emulation Board (G-78K4 EM Board)



CHAPTER 3 INSTALLATION

This chapter explains how to connect the cables to the IE-78K4-NS and the mode settings.

3.1 Connection

Connect the following seven products, which are sold separately.

Refer to **Figure 1-1 IE-78K4-NS System Configuration** in **CHAPTER 1 GENERAL** for the system configuration of the IE-78K4-NS.

- IE-70000-98-IF-C: Interface board (Use cable that comes with IE-78K4-NS)
- IE-70000-PC-IF-C: Interface board (Use cable that comes with IE-78K4-NS)
- IE-70000-PCI-IF-A: Interface board (Use cable that comes with IE-78K4-NS)
- IE-70000-CD-IF-A: PC card interface (Use NS card cable)
- IE-70000-MC-PS-B: AC adapter
- IE-784XXX-NS-EM: I/O emulation board
- NP-XXXXX: Emulation probe

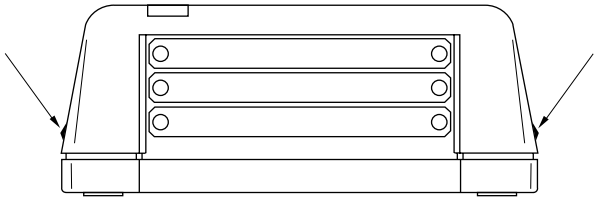
Caution Connecting and removing cables or components from the target system and changing the settings of switches, etc. must be carried out after turning off the power of the IE-78K4-NS main unit and the target system.

(1) Connecting I/O emulation board (IE-784XXX-NS-EM1)

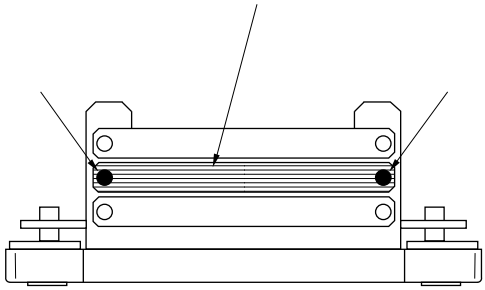
IE-784XXX-NS-EM1 is sold separately.

Figure 3-1. Connecting I/O Emulation Board

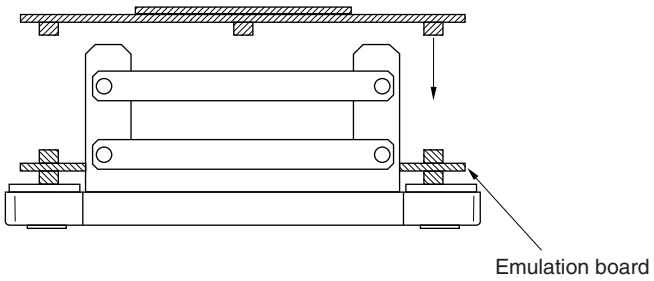
<1> Remove the screws from the sides of the main unit, and then remove the top cover.



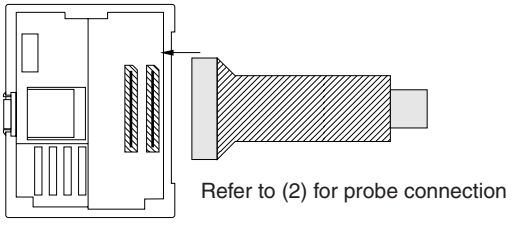
<2> Remove the second plate from the bottom by removing the screws.



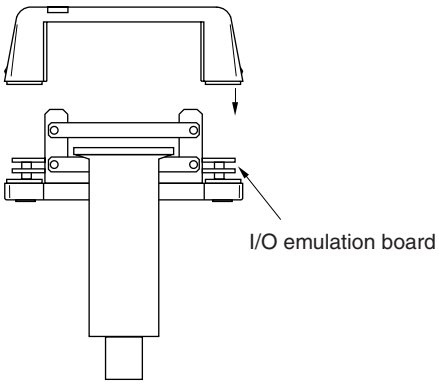
<3> Remove the four screws from the top of the emulation board, connect the IE-784XXX-NS-EM1 and then tighten the screws.



<4> Connect the relevant probe.



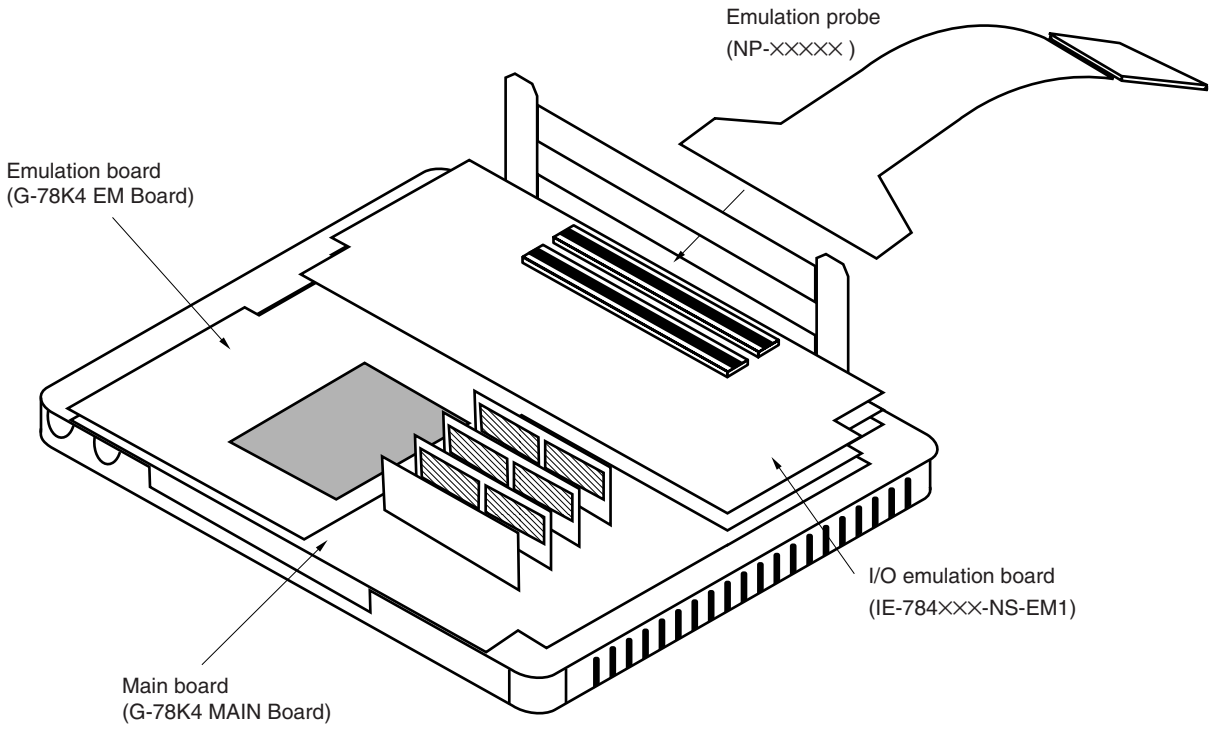
<5> Connect the top cover and tighten the four screws on the sides.



(2) Connecting emulation probe (NP-××××)

NP-××××× is sold separately.

Figure 3-2. Connecting Emulation Probe



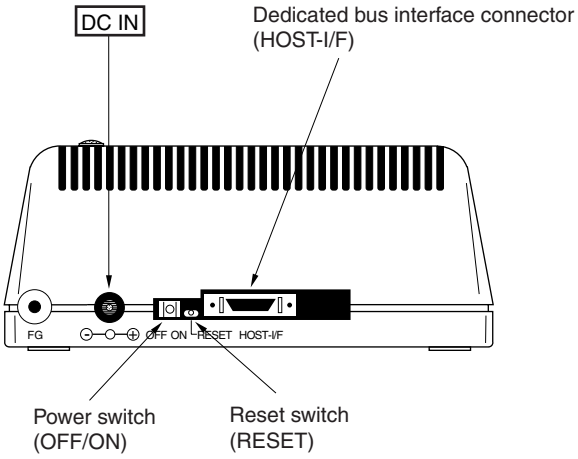
Caution The emulation probe (NP-××××) mounting location varies depending on the model of the I/O emulation board (IE-784×××-NS-EM1) in use. For details, refer to the IE-784×××-NS-EM1 User's Manual.

(3) Connecting AC adapter (IE-70000-MC-PS-B)

IE-70000-MC-PS-B is sold separately.

<1> Insert the AC adapter plug into the DC IN socket on the interface end of the IE-78K4-NS.

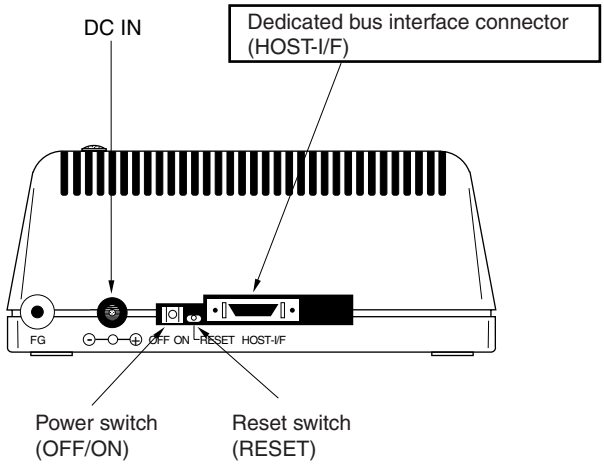
Figure 3-3. Connecting AC Adapter



(4) Connecting interface cable

<1> Insert the cable into the dedicated bus interface connector on the interface end of the IE-78K4-NS.

Figure 3-4. Connecting Dedicated Bus Interface Cable



Caution The type of interface cable varies depending on the interface board and PC card interface.

- **When using an interface board (IE-70000-98-IF-C, IE-70000-PC-IF-C, or IE-70000-PCI-IF-A)**

→ Connect the NS interface cable that comes with the IE-78K4-NS.

- **When using a PC card interface (IE-70000-CD-IF-A)**

→ Connect the NS card cable that comes with the IE-70000-CD-IF-A.

The IE-70000-98-IF-C, IE-70000-PC-IF-C, IE-70000-PCI-IF-A, and IE-70000-CD-IF-A are sold separately.

3.2 External Trigger Functions

(1) EXTOUT

At the occurrence of a break event, the EXTOUT pin on the I/O emulation board (IE-784×××-NS-EM1) outputs a high level for a single CPU operating clock.

Caution Because the output is open drain, connect a pull-up resistor in the target system.

(2) EXTIN

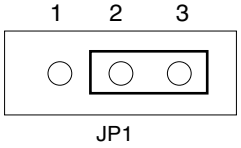
The EXTIN pin on the I/O emulation board (IE-784×××-NS-EM1) can be used to input an event signal. Enter high-level pulse signals for three or more CPU operating clocks.

Caution For the electrical specifications, refer to Table 3-1.

Table 3-1. Electrical Specifications

Parameter	MIN. [V]	MAX. [V]
High-level input voltage	Target voltage × 0.7	Target voltage
Low-level input voltage	0	Target voltage × 0.3

3.3 Jumper Setting (on Emulation Board (G-78K4 EM Board))



Default setting : 2, 3 = Shorted

Caution Use the default setting (2, 3 = shorted) for JP1.

CHAPTER 4 RESTRICTIONS WHEN DETECTING TRACE EVENT

When the emulation CPU is operating at 16 MHz or higher (when the X1 pin is supplied with a signal of 32 MHz or higher and the standby control register (STBC) is set to 00H), detection of the following three trace events may not be performed normally.

- Vector read
- Macro service read
- Macro service write

APPENDIX A INTERFACE BOARD (IE-70000-PCI-IF-A) FOR DESKTOP PC

The settings when connecting the IE-78K4-NS are described below.
For details, refer to the **IE-70000-PCI-IF-A User's Manual (to be prepared)**.

A.1 Introduction

★ The IE-70000-PCI-IF-A is an interface board for the IE series, to be used mounted in the PCI bus slot.
First of all, check that you have following items.

- Interface board (IE-70000-PCI-IF-A) for desktop PC: 1
- 8-bit connector board (connected to IE-70000-PCI-IF): 1
- 32-bit connector board: 1
- User's manual: 1
- DLL-DISK: 1
- DRV-DISK: 1

★ **<Basic specifications>**

Hardware resources

- I/O address: 0000H to FFFFH
- Interrupt: Unused
- Memory: 80H bytes used

Current consumption

300 mA (MAX. @ +5 V)

Cautions 1. Do not place heavy objects on or apply pressure to the board.
2. Do not drop the board or subject it to excessive vibration or shock.
3. When removing a cable, be sure not to pull it by the cord.
4. Do not use or keep the board in a hot, humid or dusty environment or in a location where it is directly exposed to sunlight.
5. Avoid subjecting the board to extreme changes in temperature or humidity.
6. Be careful not to spill drinks or other liquids onto the board or its accessories.
7. Be careful not to connect a cable for a different product to the connector.

A.2 Installation

(1) Board settings

The IE-70000-PCI-IF-A does not have jumper and DIP switches

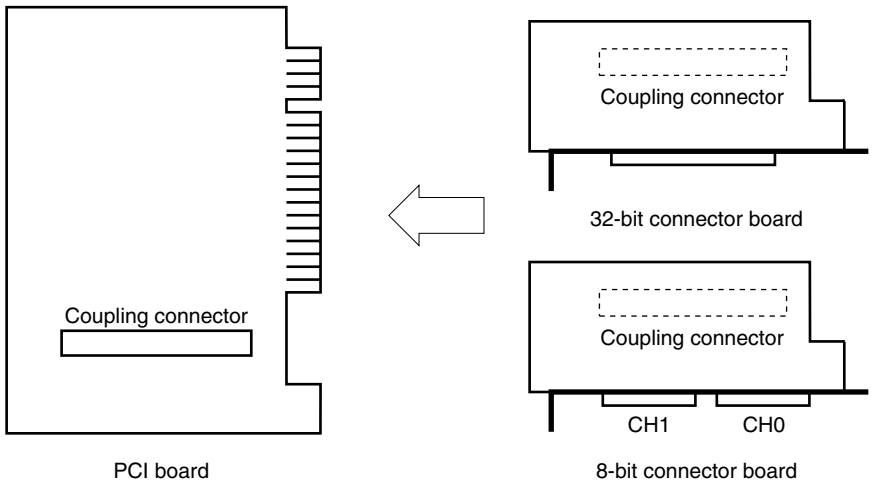
(2) Mounting 8-bit connector board

The 8-bit connector board has been mounted before shipment.

Remark When mounting the 32-bit board, mount it on top of the 8-bit connector board using a coupling connector (see Figure A-1). After mounting these boards, fix them tightly with screws.

Caution The 32-bit connector board is supplied for future function expansion. Be sure to store it carefully.

Figure A-1. Mounting PCI Board and Connector Board



(3) Mounting in PC

After checking that the PC's power is off, insert the interface board into the PCI bus slot following the instructions in the PC's user's manual.

(4) Installation of PCI driver

Install the PCI driver referring to the DRV-DISK Readme_e.txt that comes with the IE-70000-PCI-IF.

(5) Connecting to IE-78K4-NS

Using the cable that comes with the IE-70000-PCI-IF, connect the IE-78K4-NS to CH0.

Caution Connection with the IE-78K4-NS is possible on the CH0 side only.

APPENDIX B PC CARD INTERFACE (IE-70000-CD-IF-A)

The settings when connecting the IE-78K4-NS are described below.
For details, refer to the **IE-70000-CD-IF-A User's Manual (to be prepared)**.

B.1 Introduction

★ The PC card interface (IE-70000-CD-IF-A) is an interface card to be used mounted in a PC card slot compliant with PCMCIA2.1/JEIDA standard Ver.4.2.
First of all, check that you have following items.

- PC card interface (IE-70000-CD-IF-A): 1
- MC-A CABLE: 1
- NS-A CABLE: 1
- User's manual: 1
- DLL-DISK: 1
- DRV-DISK: 1

★ **<Basic specifications>**

Hardware resources

- I/O address: 20H bytes with base address of 220H, 260H, 2E0H, 320H, or 3E0H
- Interrupt: Unused
- Memory: Unused

Current consumption

300 mA (MAX. @ +5 V)

Cautions 1. Do not place heavy objects on or apply pressure to the card.
2. Do not drop the card or subject it to excessive vibration or shock.
3. When removing a cable, be sure not to pull it by the cord.
4. Do not use or keep the board in a hot, humid or dusty environment or in a location where it is directly exposed to sunlight.
5. Avoid subjecting the board to extreme changes in temperature or humidity.
6. Be careful not to spill drinks or other liquids onto the board or its accessories.
7. Be careful not to connect a cable for a different product to the connector.

B.2 Installation

(1) Mounting in PC

Insert the PCMCIA card into the card slot when the PC's power is on.

For Windows NT 4.0, insert the card into the slot when the PC's power is off. When inserting the card, make sure that the card is facing the right way.

(2) Installation of PCMCIA driver

Install the PCMCIA driver referring to the DRV-DISK Readme_e.txt that comes with the IE-70000-CD-IF-A.

Caution This interface card cannot be connected to the IE-78XXXX-R. If the IE-78XXXX-R displayed on the DRV-DISK installation menu is selected, the installation menu will close normally but the installation is not valid.

(3) Connecting to IE-78K4-NS

Connect the IE-70000-CD-IF-A to the IE-78K4-NS using the NS-A CABLE.

Caution Be sure to use the NS-A CABLE when connecting to the IE-78K4-NS. If the MC-A CABLE is used, the IE-70000-CD-IF-A may be damaged.

APPENDIX C INTERFACE BOARD (IE-70000-98-IF-C) FOR PC-9800 SERIES

The settings when connecting the IE-78K4-NS are described below.
For details, refer to the **IE-70000-98-IF-C User's Manual (to be prepared)**.

C.1 Introduction

The IE-70000-98-IF-C is an interface board that is mounted in the C bus slot of the PC-9800 series.

Caution The PC98-NX Series is regarded as IBM PC/AT compatible. Refer to APPENDIX A INTERFACE BOARD (IE-70000-PCI-IF) FOR DESKTOP PC.

First of all, check that you have the correct interface board.

- Interface board (IE-70000-98-IF-C) for PC-9800 series: 1

<Basic specifications>

Applicable models

This product is designed to work with PC-9800 series devices equipped with a C bus.

Hardware resources

- I/O addresses: 16 bytes at the 256-byte boundary (00D×H, 01D×H,...FFD×H)
- Interrupts and other: Unused

Current consumption

500 mA (MAX. @ +5 V)

Cautions 1. Do not place heavy objects on or apply pressure to the board.
2. Do not drop the board or subject it to excessive vibration or shock.
3. When removing a cable, be sure not to pull it by the cord.
4. Do not use or keep the board in a hot, humid or dusty environment or in a location where it is directly exposed to sunlight.
5. Avoid subjecting the board to extreme changes in temperature or humidity.
6. Be careful not to spill drinks or other liquids onto the board or its accessories.
7. Be careful not to connect a cable for a different product to the connector.

C.2 Installation

(1) I/O address settings

SW1 and SW2 are the switches for selecting the C bus I/O addresses. SW1 numbers 1 to 8 correspond to C bus addresses A4 to A11, and SW2 numbers 1 to 4 correspond to C bus addresses A12 to A15.

In the IE-78K4-NS, the addresses should be set in the 16 bytes between 00D×H and FFD×H. The switch takes the value “0” when ON and “1” when OFF.

The addresses to be set must be values that are not used in the PC system or for other boards. In addition, since these values are used during software installation, make a note of them for future reference.

Table C-1. SW1 and SW2 Settings When Using IE-78K4-NS

SW1 Number	1	2	3	4	5	6	7	8	
Address	A4	A5	A6	A7	A8	A9	A10	A11	I/O Address
ON		0				0	0	0	01D×H
OFF	1		1	1	1				

SW2 Number	1	2	3	4	5	6	7	8	
Address	A12	A13	A14	A15	OFF	OFF	ON	OFF	I/O Address
ON	0	0	0	0			0		01D×H
OFF					1	1		1	

Cautions 1. Use the default setting for SW1 numbers 1 to 4.

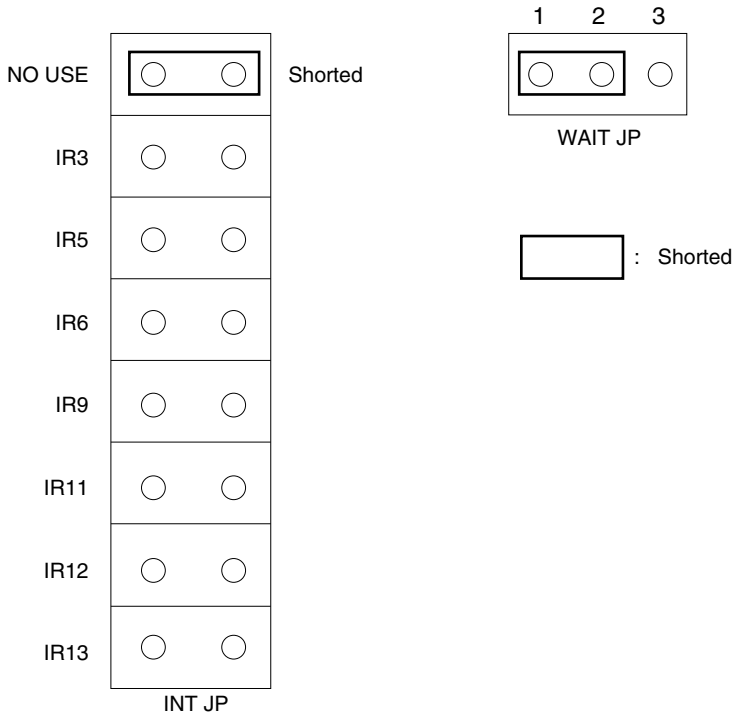
2. Set SW2 number 7 to ON and SW2 numbers 5, 6, and 8 to OFF.

(2) Jumper settings

INT JP and WAIT JP are jumpers that select C bus interrupt and WAIT.

For the IE-78K4-NS, set INT JP to NO USE, and WAIT JP to 1-2 shorted.

Figure C-1. Settings of INT JP and WAIT JP



(3) Mounting in PC

Make sure that the PC is turned off, then insert the interface board into the C bus slot following the instructions in the PC's user's manual.

(4) Connecting with IE-78K4-NS

Using the supplied cable, connect the IE-78K4-NS to the CH0 side.

Caution Connection with the IE-78K4-NS is possible on the CH0 side only.
For connection with other models, refer to their respective user's manuals.

APPENDIX D INTERFACE BOARD (IE-70000-PC-IF-C) FOR IBM PC/AT AND COMPATIBLES

The settings when connecting IE-78K4-NS are described below.
For details, refer to the **IE-70000-PC-IF-C User's Manual (to be prepared)**.

D.1 Introduction

The IE-70000-PC-IF-C is an interface board that is mounted in the ISA bus slot of an IBM PC/AT or compatible. First of all, check that you have the correct interface board.

- Interface board (IE-70000-PC-IF-C) for IBM PC/AT: 1

<Basic specifications>

Applicable models

The IE-70000-PC-IF-C is designed for IBM PC/AT and compatibles equipped with an ISA bus.

Hardware resources

- I/O address: 16 bytes at any 16-byte boundary (020×H to 03F×H)
- Interrupts and other: Unused

Current consumption

500 mA (MAX. @ +5 V)

Cautions
1. **Do not place heavy objects on or apply pressure to the board.**
2. **Do not drop the board or subject it to excessive vibration or shock.**
3. **When removing a cable, be sure not to pull it by the cord.**
4. **Do not use or keep the board in a hot, humid or dusty environment or in a location where it is directly exposed to sunlight.**
5. **Avoid subjecting the board to extreme changes in temperature or humidity.**
6. **Be careful not to spill drinks or other liquids onto the board or its accessories.**
7. **Be careful not to connect a cable for a different product to the connector.**

D.2 Installation

(1) I/O address settings

SW1 and SW2 are the switches for selecting the ISA bus I/O addresses. SW1 numbers 1 to 8 correspond to ISA bus addresses A4 to A11, and SW2 numbers 1 to 4 correspond to ISA bus addresses A12 to A15.

In the IE-78K4-NS, the addresses should be set between 020×H and 03F×H. The switch takes the value “0” when ON and “1” when OFF.

The addresses to be set must be values that are not used in the PC system or for other boards. In addition, since these values are used during software installation, make a note of them for future reference.

Table D-1. SW1 and SW2 Settings When Using IE-78K4-NS

SW1 Number	1	2	3	4	5	6	7	8	
Address	A4	A5	A6	A7	A8	A9	A10	A11	I/O Address
ON	0	0	0	0	0		0	0	020×H
OFF						1			

SW2 Number	1	2	3	4	5	6	7	8	
Address	A12	A13	A14	A15	OFF	OFF	ON	OFF	I/O Address
ON	0	0	0	0			0		020×H
OFF					1	1		1	

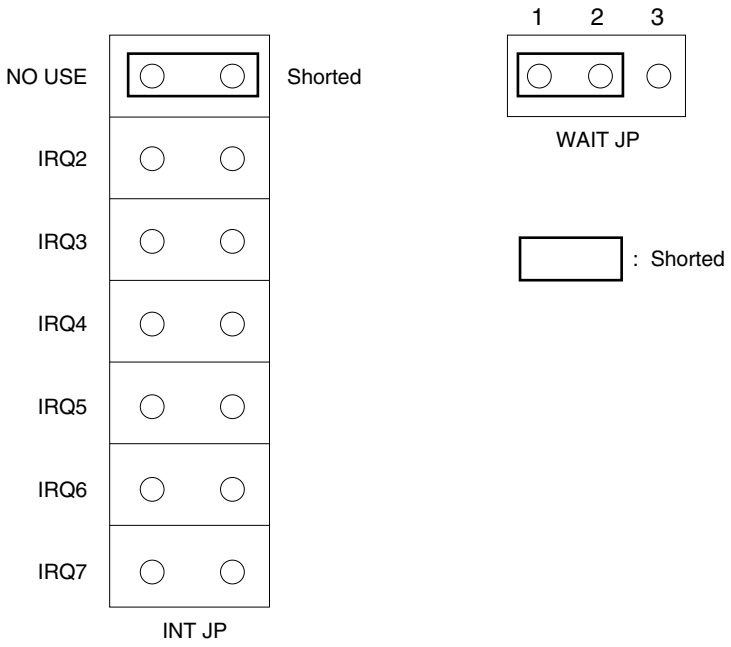
Caution Set SW2 numbers 1 to 4 and 7 to ON and SW2 numbers 5, 6, and 8 to OFF.

(2) Jumper settings

INT JP and WAIT JP are jumpers that select C bus interrupt and WAIT.

For the IE-78K4-NS, set INT JP to NO USE, and WAIT JP to 1-2 shorted.

Figure D-1. Settings of INT JP and WAIT JP



(3) Mounting in PC

Make sure that the PC is turned off, then insert the interface board into the ISA bus slot following the instructions in the PC's user's manual.

(4) Connecting with IE-78K4-NS

Using the supplied cable, connect the IE-78K4-NS to the CH0 side.

Caution Connection with the IE-78K4-NS is possible on the CH0 side only.
For connection with other models, refer to their respective user's manuals.

★ APPENDIX E REVISION HISTORY

The revisions up to this edition are shown in the table below.

Edition	Revisions from Previous Edition	Revised Chapters
2nd	Addition of **1.4 Package Contents**	CHAPTER 1 GENERAL
	Addition of **APPENDIX A INTERFACE BOARD (IE-70000-PCI-IF) FOR DESKTOP PC**	APPENDIX A
	Addition of **APPENDIX B PC CARD INTERFACE (IE-70000-CD-IF-A)**	APPENDIX B
	Addition of explanation in **APPENDIX C INTERFACE BOARD (IE-70000-98-IF-C) FOR PC-9800 SERIES**	APPENDIX C
	Addition of explanation in **APPENDIX D INTERFACE BOARD (IE-70000-PC-IF-C) FOR IBM PC/AT AND COMPATIBLES**	APPENDIX D
	Addition of **APPENDIX E REVISION HISTORY**	APPENDIX E
3rd	Change of interface board for desktop PC from IE-70000-PCI-IF to IE-70000-PCI-IF-A	Throughout
	Modification of **Figure 1-1 IE-78K4-NS System Configuration**	**CHAPTER 1 GENERAL**
	A.1 Introduction • Deletion of **Applicable models**	**APPENDIX A**
	B.1 Introduction • Deletion of **Applicable models**	**APPENDIX B**

[MEMO]