

NEC

User's Manual

IE-780988-NS-EM4

Emulation Board

Target Devices
 μ PD780988 Subseries

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[MEMO]

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- Availability of related technical literature
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1. Circumstances not covered by product guarantee

- If the product was disassembled, altered, or repaired by the customer
- If it was dropped, broken, or given another strong shock
- Use at overvoltage, use outside guaranteed temperature range, storing outside guaranteed temperature range
- If power was turned on while connection to the power supply, PC interface cable, or target system was in an unsatisfactory state
- If the cable of the power supply, the PC interface cable, the emulation probe, or the like was bent or pulled excessively
- If a power supply other than the product described in the system configuration was used
- If the product got wet
- If this product is connected to the target system when there is a potential difference between the GND of this product and GND of the target system.
- If the connectors or cables are plugged/unplugged while this product is in the power-on state.
- If excessive load is applied to the connectors or sockets.

2. Safety precautions

- If used for a long time, the product may become hot (50°C to 60°C). Be careful of low temperature burns and other dangers due to the product becoming hot.
- Be careful of electrical shock. There is a danger of electrical shock if the product is used as described above in **1 Circumstances not covered by product guarantee**.

INTRODUCTION

Product Overview

The IE-780988-NS-EM4 is designed to be used with the IE-78K0-NS-P01 and IE-78K0-NS or IE-78K0-NS-A to debug the following target devices that belong to the 78K/0 Series of 8-bit single-chip microcontrollers.

- μ PD780988 Subseries: μ PD780982, 780983, 780984, 780986, 780988, 78F0988A, 780982(A), 780983(A), 780984(A), 780986(A), 780988(A), 78F0988A(A)

Target Readers

This manual is intended for engineers who will use the IE-780988-NS-EM4 with the IE-78K0-NS or IE-78K0-NS-A and IE-78K0-NS-P01 to perform system debugging. Engineers who use this manual are expected to be thoroughly familiar with the target device's functions and use methods and to be knowledgeable about debugging.

Organization

When using the IE-780988-NS-EM4, refer to not only this manual (supplied with the IE-780988-NS-EM4) but also the manuals that are supplied with the IE-78K0-NS-P01 and IE-78K0-NS or IE-78K0-NS-A.

The IE-78K0-NS used in combination with the IE-78K0-NS-PA is functionally equivalent to the IE-78K0-NS-A. Therefore, as necessary, read IE-78K0-NS + IE-78K0-NS-PA for IE-78K0-NS-A in this document.

IE-78K0-NS or IE-78K0-NS-A
User's Manual

- Basic specifications
- System configuration
- External interface functions

IE-780988-NS-EM4
User's Manual

- General
- Part names
- Installation
- Differences between target devices and target interface circuits

IE-78K0-NS-P01
User's Manual

- General
- Part names
- Installation

Purpose

This manual's purpose is to explain various debugging functions that can be performed when using the IE-780988-NS-EM4.

Terminology

The meanings of certain terms used in this manual are listed below.

Term	Meaning
Emulation device	This is a general term that refers to the device in the emulator that is used to emulate the target device. It includes the emulation CPU.
Emulation CPU	This is the CPU block in the emulator that is used to execute user-generated programs.
Target device	This is the device that is the target for emulation.
Target system	This includes the target program and the hardware provided by the user. When defined narrowly, it includes only the hardware.
IE system	This refers to the combination of the in-circuit emulator (IE-78K0-NS or IE-78K0-NS-A), the I/O board (IE-78K0-NS-P01), and the emulation board (IE-780988-NS-EM4).

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

The mark ★ shows major revised points.

Related Documents

The related documents (user's manuals) indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Document Name	Document No.
IE-78K0-NS In-Circuit Emulator	U13731E
IE-78K0-NS-A In-Circuit Emulator	U14889E
IE-78K0-NS-P01 I/O Board	U16106E
IE-780988-NS-EM4 Emulation Board	This manual
ID78K0-NS Ver. 2.52 Integrated Debugger Operation	U16488E
μPD780988 Subseries	U13029E

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

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CHAPTER 1 GENERAL

The IE-780988-NS-EM4 is a development tool for efficient debugging of hardware or software when using one of the following target devices that belong to the 78K/0 Series of 8-bit single-chip microcontrollers.

This chapter describes system configuration and basic specifications of the IE-780988-NS-EM4.

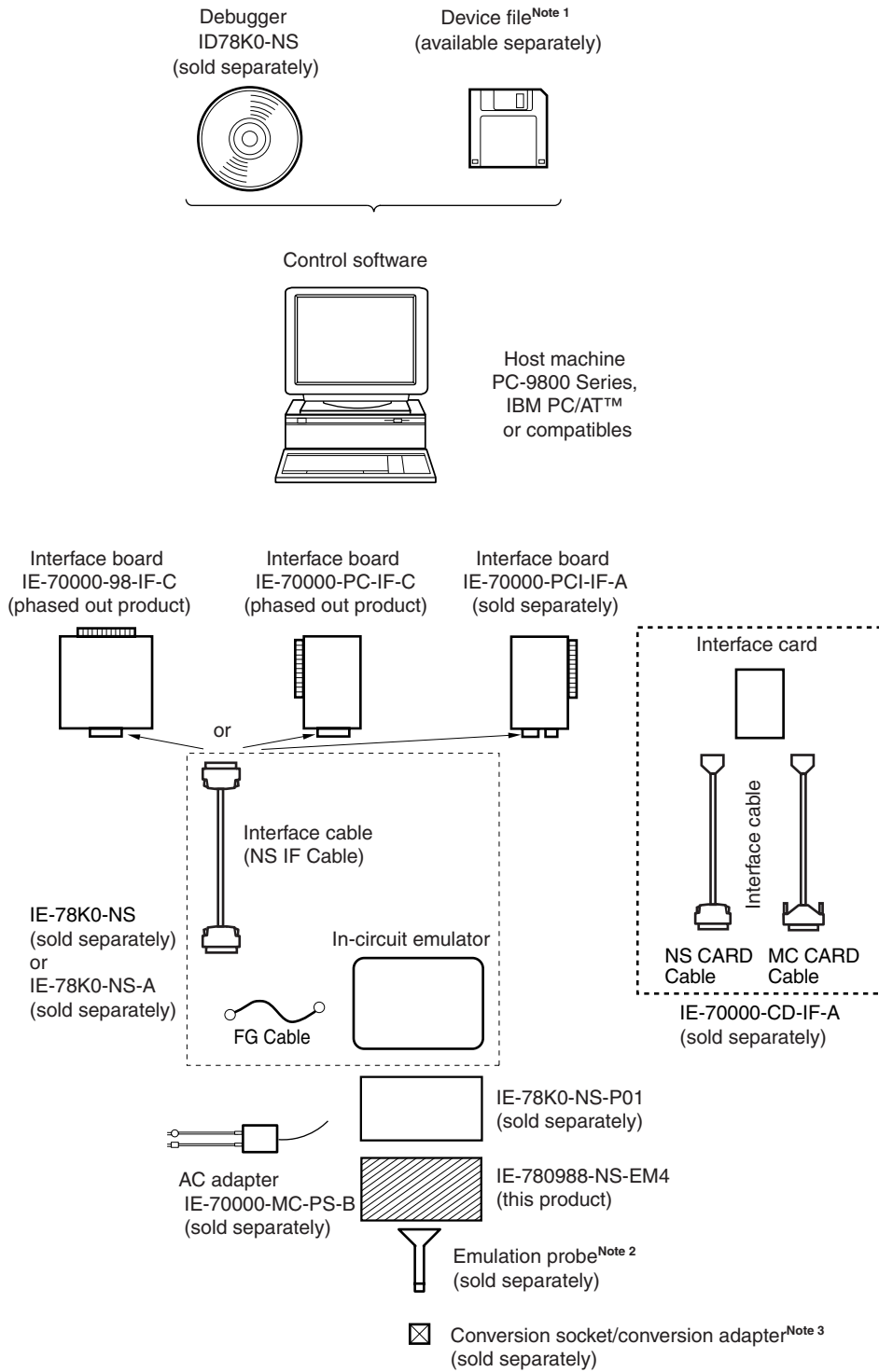
- Target devices
 - μ PD780988 Subseries

1.1 System Configuration

Figure 1-1 illustrates system configuration of the IE-780988-NS-EM4.

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Figure 1-1. System Configuration



Notes 1. The device file is as follows.

μ SxxxxDF780988: μ PD780988 Subseries

Obtain device files from the NEC Electronics website.

(http://www.necel.com/micro/index_e.html)

2. The emulation probes NP-64CW, NP-H64CW, NP-64GC, NP-64GC-TQ, and NP-H64GC-TQ are products of Naito Densai Machida Mfg. Co., Ltd.

For further information, contact Naito Densai Machida Mfg. Co., Ltd. (TEL: +81-45-475-4191)

3. The conversion adapter TGC-064SAP is a product of TOKYO ELETECH CORPORATION.

For further information, contact Daimaru Kogyo Co., Ltd.

Tokyo Electronics Department (TEL: +81-3-3820-7112)

Osaka Electronics Department (TEL: +81-6-6244-6672)

The correspondence between the separately available emulation probes and conversion socket/conversion adapter is shown in Table 1-1.

Table 1-1. Correspondence Between Emulation Probes and Conversion Socket/Conversion Adapter

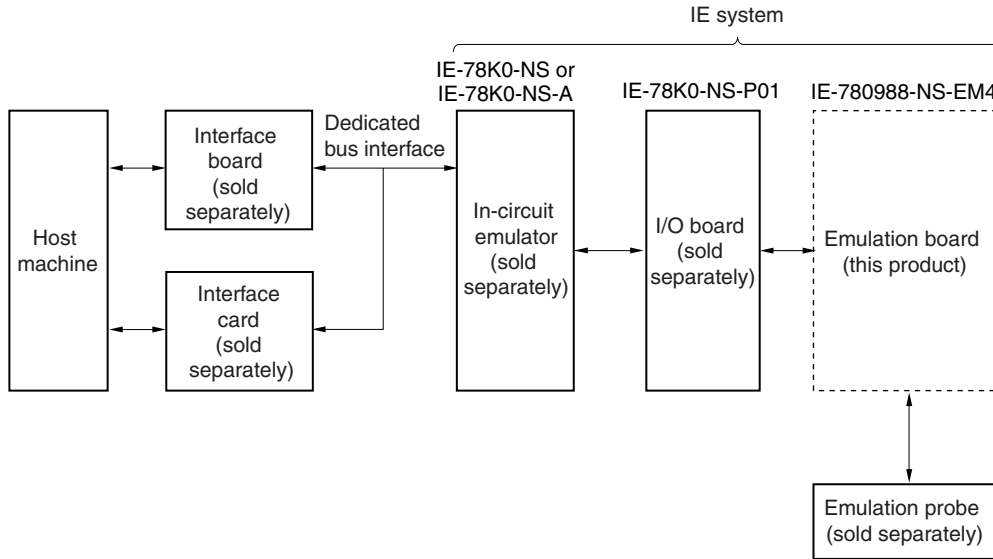
Package	Emulation Probe	Conversion Socket/Conversion Adapter
64-pin plastic QFP (GC type)	NP-64GC (Probe length: 200 mm)	EV-9200GC-64
	NP-64GC-TQ (Probe length: 200 mm) NP-H64GC-TQ (Probe length: 400 mm)	TGC-064SAP
64-pin plastic SDIP (CW type)	NP-64CW (Probe length: 200 mm) NP-H64CW (Probe length: 400 mm)	—

1.2 Hardware Configuration

Figure 1-2 shows the IE-780988-NS-EM4's position in the basic hardware configuration.

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Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The basic specifications of the IE-780988-NS-EM4 are listed in Table 1-2.

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Table 1-2. Basic Specifications

Parameter	Description
Target device	μ PD780988 Subseries
System clock	12.0 MHz
System clock supply	External: Input via an emulation probe from the target system Internal: Mounted on the emulation board (8.38 MHz) or mounted on the parts board by the user
Low voltage support	V _{DD} = 3.0 to 5.5 V (same as the target device)

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-780988-NS-EM4 main unit.

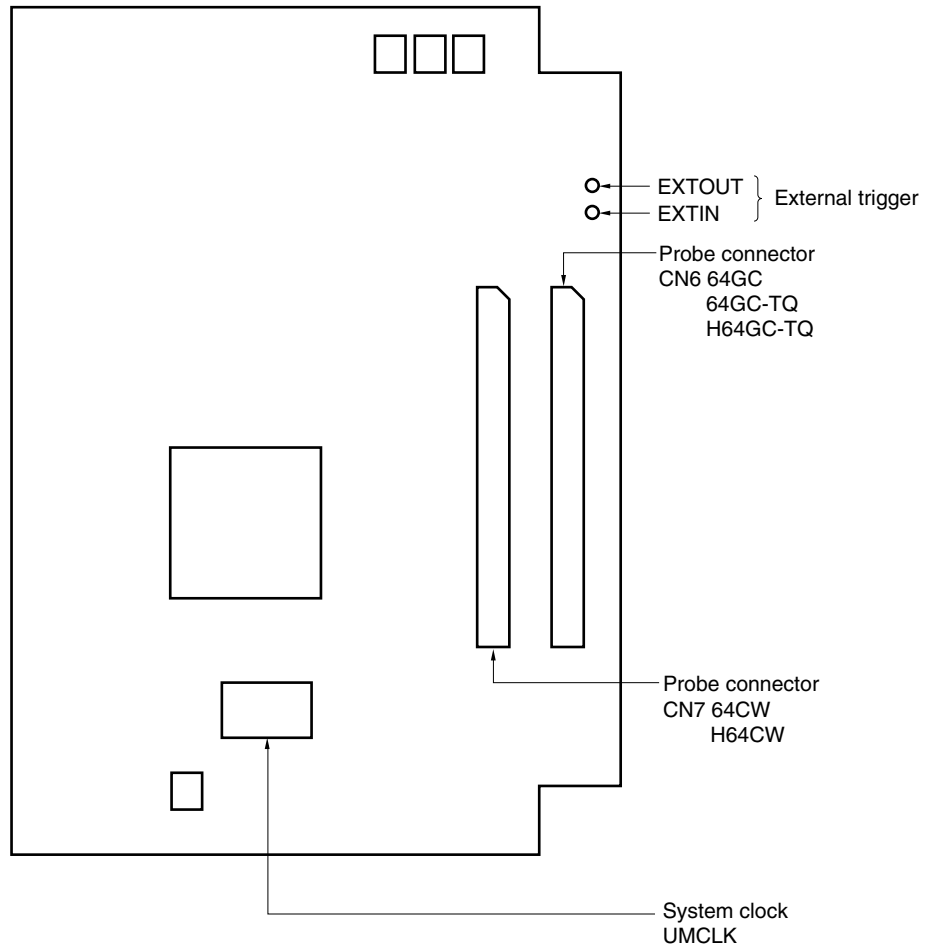
The packing box contains the emulation board (IE-780988-NS-EM4), packing list, user's manual, and guarantee card.

If there are any missing or damaged items, please contact an NEC Electronics sales representative.

Fill out and return the guarantee card that comes with the main unit.

2.1 Parts of Main Unit

Figure 2-1. IE-780988-NS-EM4 Part Names



CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-780988-NS-EM4 to the IE-78K0-NS-P01 and IE-78K0-NS or IE-78K0-NS-A, emulation probe, etc. Mode setting methods are also described.

Caution **Connecting or removing components to or from the target system, or making switch or other setting changes must be carried out after the power supply to both the IE system and the target system has been switched OFF.**

3.1 Connection

(1) Connection with IE-78K0-NS-P01 and IE-78K0-NS or IE-78K0-NS-A main unit

See the **IE-78K0-NS User's Manual (U13731E)** for a description of how to connect the IE-780988-NS-EM4 to the IE-78K0-NS-P01 and IE-78K0-NS.

See the **IE-78K0-NS-A User's Manual (U14889E)** for a description of how to connect the IE-780988-NS-EM4 to the IE-78K0-NS-P01 and IE-78K0-NS-A.

(2) Connection with emulation probe

See the **IE-78K0-NS User's Manual (U13731E)** or **IE-78K0-NS-A User's Manual (U14889E)** for a description of how to connect an emulation probe to the IE-780988-NS-EM4.

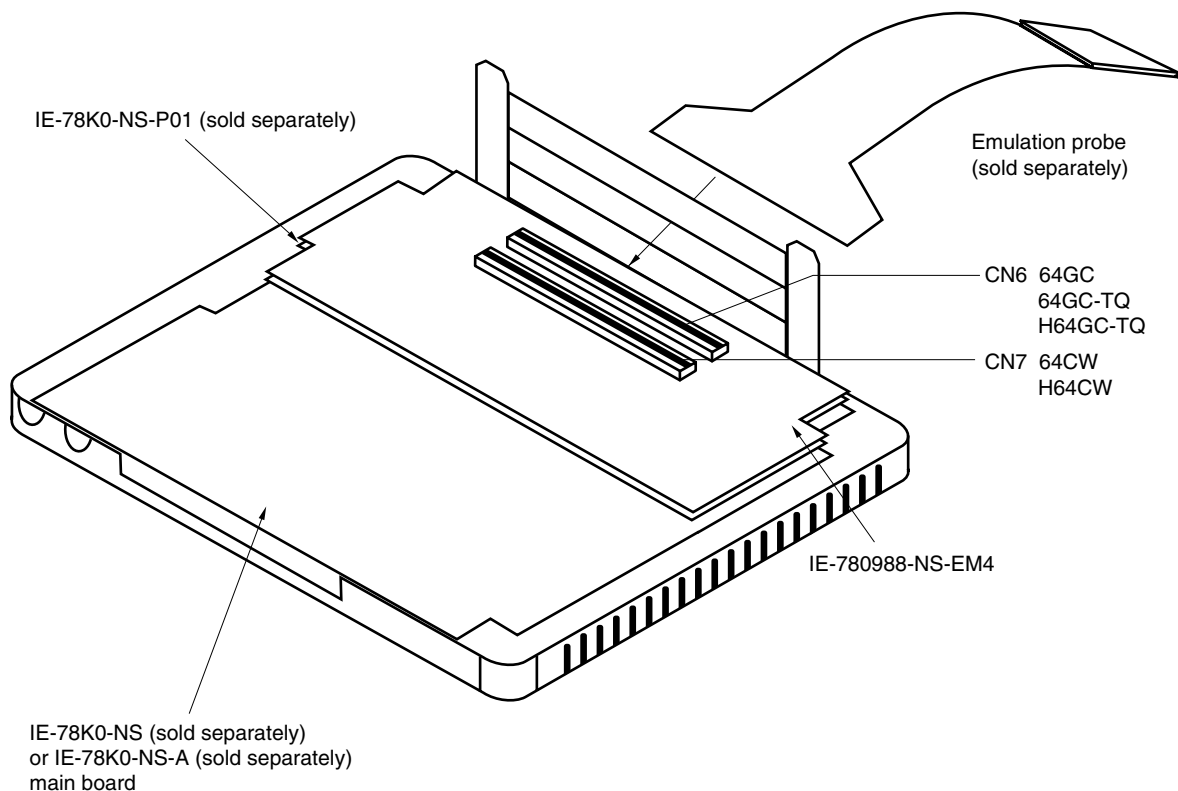
On this board, the probe connector differs depending on the emulation probe used.

- When using NP-64GC, NP-64GC-TQ, or NP-H64GC-TQ, connect it to CN6.
- When using NP-64CW or NP-H64CW, connect it to CN7.

Caution Incorrect connection may damage the IE system.

Be sure to read the emulation probe's user's manual for a detailed description of the connection method.

Figure 3-1. Connection of Emulation Probe



3.2 Clock Settings

3.2.1 Overview of clock settings

The system clock to be used during debugging can be selected from (1) to (3) below.

- (1) Clock that is already mounted on emulation board
- (2) Clock that is mounted by user
- (3) External clock

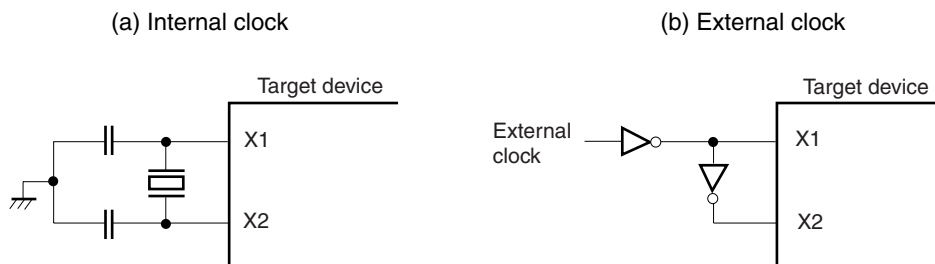
If the target system includes an internal clock, select either **(1) Clock that is already mounted on emulation board** or **(2) Clock that is mounted by user**. For an internal clock, a resonator is connected to the target device and the target device's internal oscillation circuit is used. An example of the external circuit is shown in part (a) of Figure 3-2. During emulation, the resonator that is mounted on the target system is not used. Instead, the clock that is mounted on the emulation board connected to the IE-78K0-NS or IE-78K0-NS-A is used.

If the target system includes an external clock, select **(3) External clock**.

For an external clock, a clock signal is supplied from outside the target device and the target device's internal oscillation circuit is not used. An example of the external circuit is shown in part (b) of Figure 3-2.

Caution The IE system will be hung-up if the system clock is not supplied normally. Moreover, be sure to input a rectangular wave as the clock from the target. The IE system does not operate if the crystal resonator is directly connected to X1.

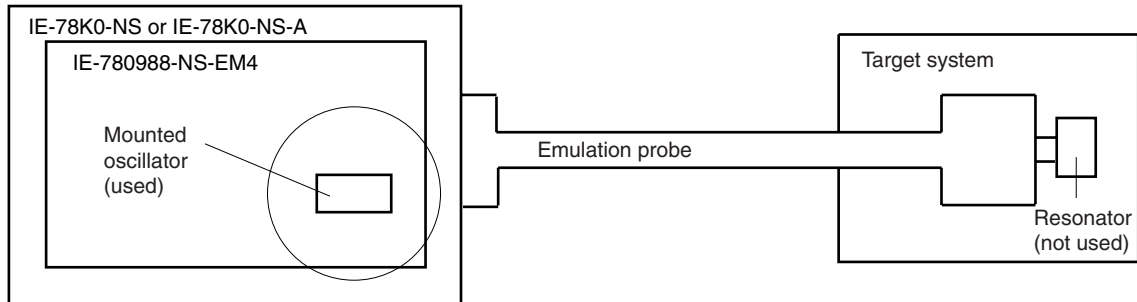
Figure 3-2. External Circuits Used as System Clock Oscillation Circuit



(1) Clock that is already mounted on emulation board

A crystal oscillator (UMCLK) is already mounted on the emulation board. Its frequency is 8.38 MHz.

Figure 3-3. When Using Clock That Is Already Mounted on Emulation Board



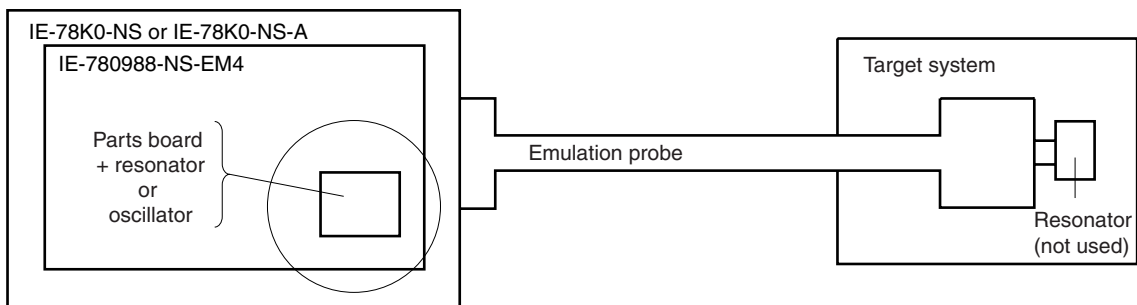
Remark The clock that is supplied by the oscillator of the IE-780988-NS-EM4 (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-780988-NS-EM4.

Remove the crystal oscillator (UMCLK) that is already mounted on the emulation board, and mount either the parts board on which the resonator to be used is mounted or an oscillator. This method is useful when using a different frequency from that of the pre-mounted clock.

Figure 3-4. When Using User-Mounted Clock

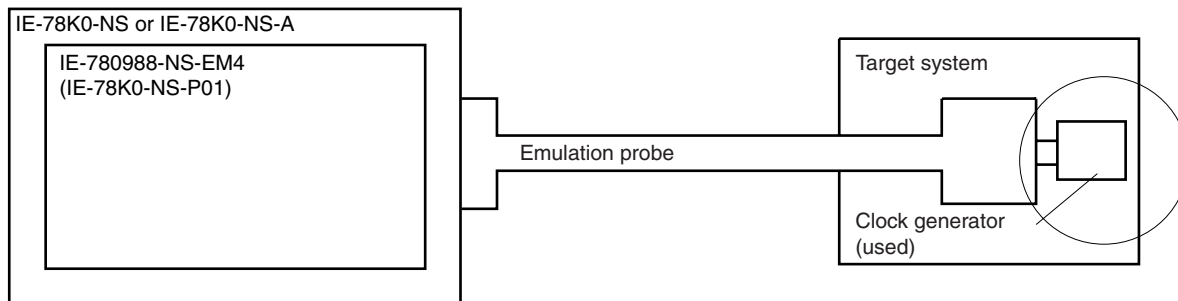


Remark The clock that is supplied by the resonator or oscillator of the IE-780988-NS-EM4 (encircled in the figure) is used.

(3) External clock

An external clock connected to the target system can be used via an emulation probe.

Figure 3-5. When Using External Clock



Remark The clock supplied by the target system’s clock generator (encircled in the figure) is used.

3.2.2 System clock settings

Table 3-1. System Clock Settings

Frequency of System Clock		IE-780988-NS-EM4	CPU Clock Source Selection (ID78K0-NS)
		UMCLK Socket	
When using clock that is already mounted on emulation board	8.38 MHz	Oscillator used	Internal
When using clock mounted by user	Other than 8.38 MHz	Oscillation circuit assembled by user	
When using external clock			Oscillator (not used)

Caution When using an external clock, open the configuration dialog box when starting the integrated debugger (ID78K0-NS) and select “External” in the area (Clock) for selecting the CPU’s clock source (this selects the user’s clock).

Remark When the IE-780988-NS-EM4 is shipped, the settings for “when using clock that is already mounted on emulation board” are preset.

(1) When using clock that is already mounted on emulation board

When the IE-780988-NS-EM4 is shipped, an 8.38 MHz crystal oscillator is already mounted in the UMCLK socket of the IE-780988-NS-EM4. When using the factory-set mode settings, there is no need to make any other hardware settings.

When starting the integrated debugger (ID78K0-NS), open the configuration dialog box and select “Internal” in the area (Clock) for selecting the CPU’s clock source (this selects the emulator’s internal clock).

(2) When using clock mounted by user

Perform the settings described under either (a) or (b), depending on the type of clock to be used.

When starting the integrated debugger (ID78K0-NS), open the configuration dialog box and select "Internal" in the area (Clock) for selecting the CPU's clock source (this selects the emulator's internal clock).

(a) When using a ceramic resonator or crystal resonator

● Items to be prepared

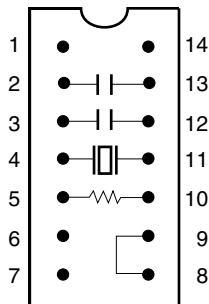
- Parts board
- Ceramic resonator or crystal resonator
- Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

<Steps>

- <1> Solder the target ceramic resonator or crystal resonator and resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequencies) as shown below.

Figure 3-6. Connections on Parts Board (When Using User-Mounted Clock)

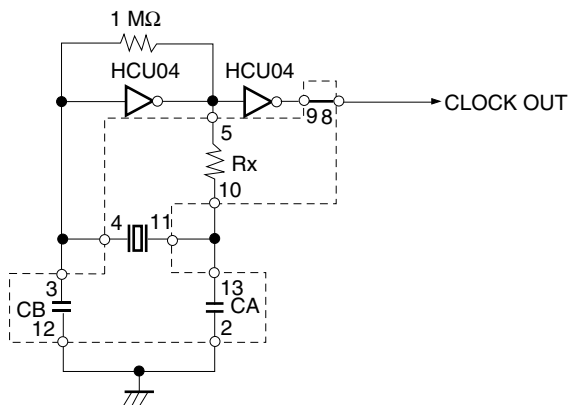
Parts board (UMCLK)



(Top view)

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

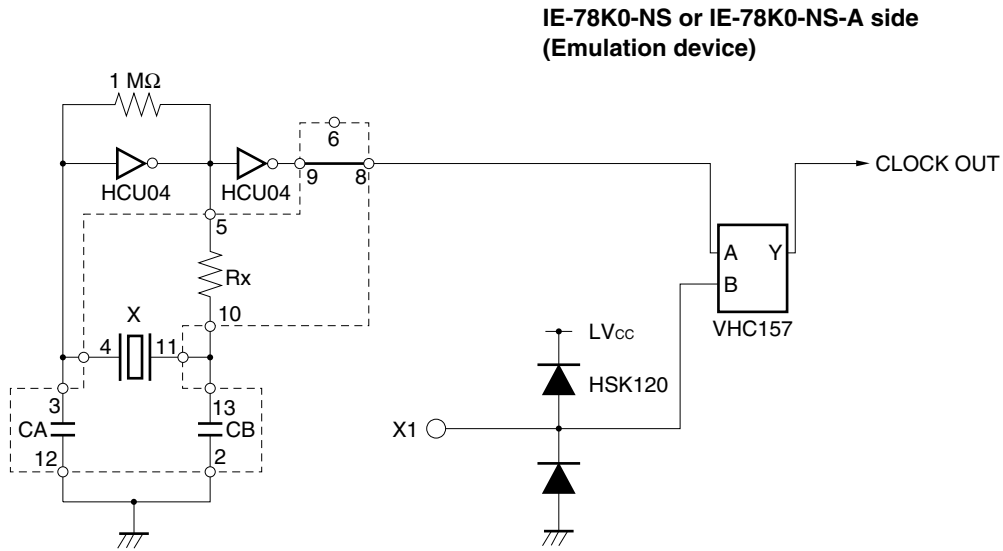
Circuit diagram



Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

- <2> Prepare the IE-780988-NS-EM4.
- <3> Remove the crystal oscillator that is mounted in the of the X1 socket of the IE-780988-NS-EM4.
- <4> Connect the parts board (from <1> above) to the X1 socket from which the crystal oscillator was removed. Check the pin 1 mark to make sure the board is mounted in the correct direction.
- <5> Make sure that the parts board is wired as shown in Figure 3-6 above.
- <6> Connect the IE-780988-NS-EM4 and IE-78K0-NS-P01 to the IE-78K0-NS or IE-78K0-NS-A.

The above steps configure the following circuit and enable supply of the clock from the mounted resonator to the emulation device.



Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

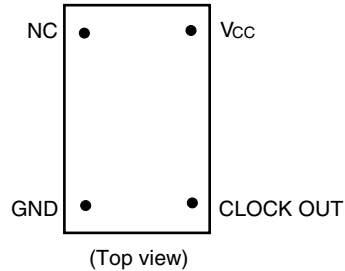
(b) When using a crystal oscillator

- Items to be prepared

★

- Crystal oscillator (pins are as shown in Figure 3-7, V_{cc}: +5 V, CLOCKOUT: CMOS level)

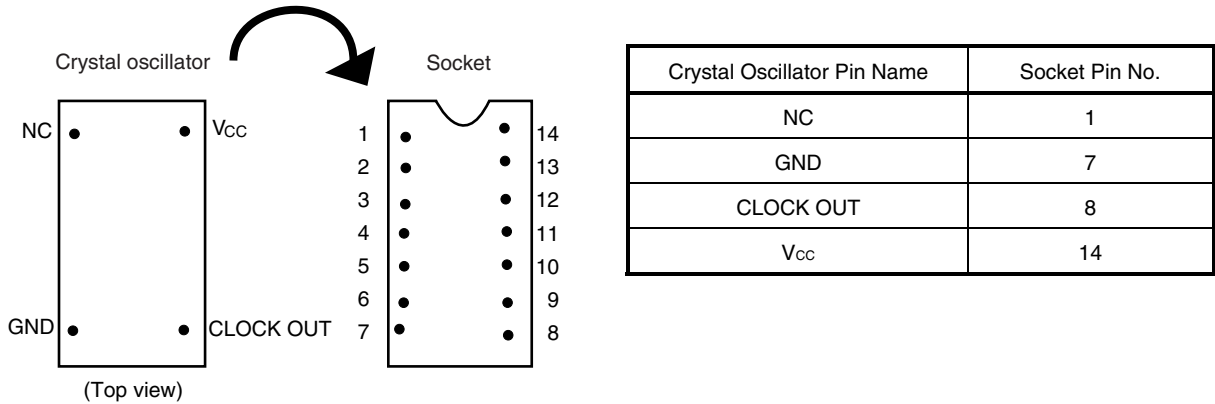
Figure 3-7. Crystal Oscillator (When Using User-Mounted Clock)



<Steps>

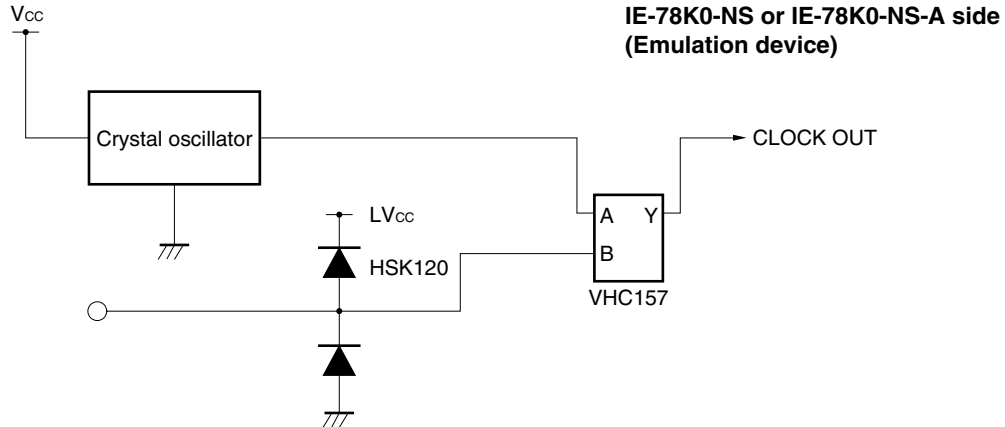
- <1> Prepare the IE-780988-NS-EM4.
- <2> Remove the crystal oscillator that is mounted in the X1 socket of the IE-780988-NS-EM4.
- <3> Mount the crystal oscillator prepared by the user in the X1 socket from which the crystal oscillator was removed in <2> above. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

Figure 3-8. Pin Alignment of Crystal Oscillator and Socket



- <4> Connect the IE-780988-NS-EM4 to the IE-78K0-NS or IE-78K0-NS-A.

The above steps configure the following circuit and enable supply of the clock from the mounted resonator to the emulation device.



(3) When using external clock

No hardware settings are required for this situation.

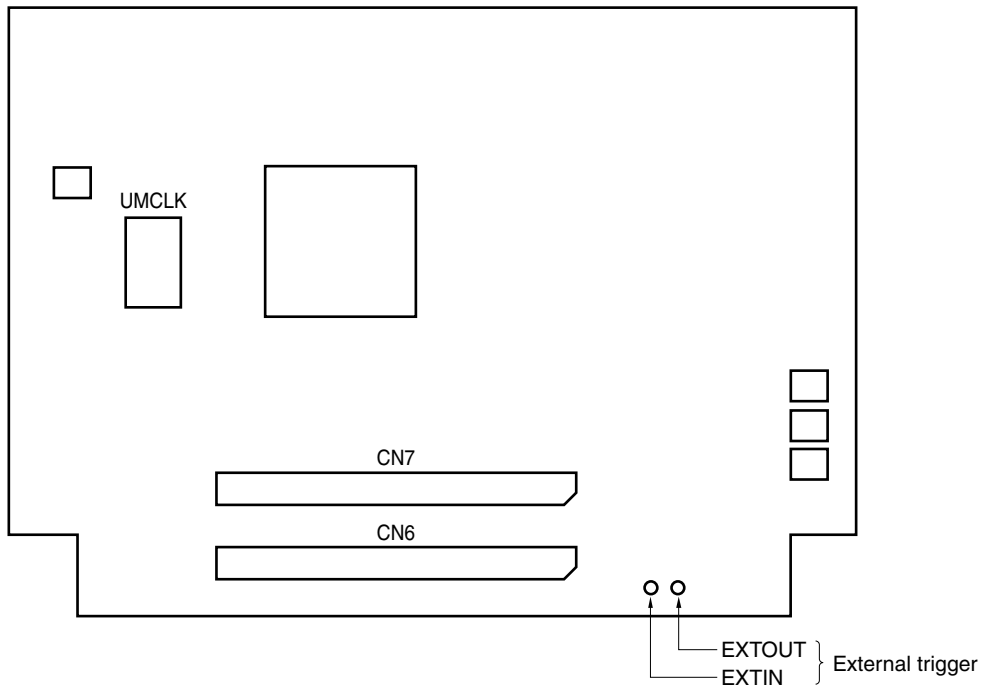
When starting the integrated debugger (ID78K0-NS), open the configuration dialog box and select "External" in the area (Clock) for selecting the CPU's clock source (this selects the user's clock).

3.3 External Trigger

Connect the external trigger to the IE-780988-NS-EM4's check pins EXTOUT and EXTIN as shown below.

See the **ID78K-NS Ver. 2.52 Integrated Debugger Operation User's Manual (U16488E)** for descriptions of related use methods, and see the **IE-78K0-NS User's Manual (U13731E)** or **IE-78K0-NS-A User's Manual (U14889E)** for pin characteristics.

Figure 3-9. External Trigger Input Position



3.4 Jumper Settings on IE-78K0-NS

When using the IE-780988-NS-EM4 in combination with the IE-78K0-NS, set the jumpers on the IE-78K0-NS as shown below.

For details of these jumper positions, refer to the **IE-78K0-NS User's Manual (U13731E)**.

Caution Incorrect jumper settings may damage the devices.

Table 3-2. Jumper Settings on IE-78K0-NS

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 and 3 shorted	1 and 2 shorted	1 and 2 shorted	5 and 6 shorted	1 and 2 shorted	3 and 4 shorted

3.5 Jumper Settings on IE-78K0-NS-A

When using the IE-780988-NS-EM4 in combination with the IE-78K0-NS-A, set the jumpers on the IE-78K0-NS-A as shown below.

For details of these jumper positions, refer to the **IE-78K0-NS-A User's Manual (U14889E)**.

Caution Incorrect jumper settings may damage the devices.

Table 3-3. Jumper Settings on IE-78K0-NS-A G-780009 Board

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 and 3 shorted	1 and 2 shorted	1 and 2 shorted	5 and 6 shorted	1 and 2 shorted	3 and 4 shorted

Table 3-4. Jumper Settings on IE-78K0-NS-A G-78K0H Option Board

	JP2
Setting	2 and 3 shorted

3.6 Low-Voltage Emulation Setting

When the target system operates on low power voltage, supply the same power supply voltage as that of the target system to the TP1 terminal pin on the main board (G-780009 board) of the IE-78K0-NS or IE-78K0-NS-A (same as when the target system is 5 V).

- ★ In this case, the power supply voltage of the target system should be in the range of 3.0 to 5.5 V.

Table 3-5. Supply Voltage and Maximum Current Consumption During Low-Voltage Emulation

Supply Voltage to TP1	Maximum Current Consumption of TP1
3.0 to 5.5 V	300 mA

★

Figure 3-10. IE-78K0-NS or IE-78K0-NS-A Main Board (G-780009 Board)



CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICES AND TARGET INTERFACE CIRCUITS

This chapter describes differences between the target device's signal lines and the signal lines of the IE-780988-NS-EM4 target interface circuit.

Although the target device is a CMOS circuit, the IE-780988-NS-EM4's target interface circuit consists of emulation circuits such as an emulation CPU, TTL, and CMOS-IC.

When the IE system is connected with the target system for debugging, the IE system performs emulation so as to operate as the actual target device would operate in the target system.

However, some minor differences exist since the operations are performed via the IE system's emulation.

- (1) Signals input or output from the emulation CPU (μ PD7880)
- (2) Signals input or output from the emulation CPU (μ PD7881)
- (3) Other signals

The circuit of the IE system is used as follows for signals listed in (1) to (3) above.

(1) Signals input or output from the emulation CPU (μ PD7880)

See **Figure 4-1 Equivalent Circuit of Emulation Circuit (1)**.

- P17 to P10
- P26 to P20
- P37 to P30
- P57 to P50
- AV_{DD}
- AV_{SS}
- AV_{REF}
- $\overline{\text{RESET}}$
- X1

(2) Signals input or output from the emulation CPU (μ PD7881)

See **Figure 4-2 Equivalent Circuit of Emulation Circuit (2)**.

- P03 to P00
- P47 to P40
- P67 to P64

(3) Other signals

See **Figure 4-3 Equivalent Circuit of Emulation Circuit (3)**.

- TO75 to TO70
- V_{DD0}, V_{DD1}
- V_{SS0}, V_{SS1}
- V_{PP}/TEST
- X2

Figure 4-1. Equivalent Circuit of Emulation Circuit (1)

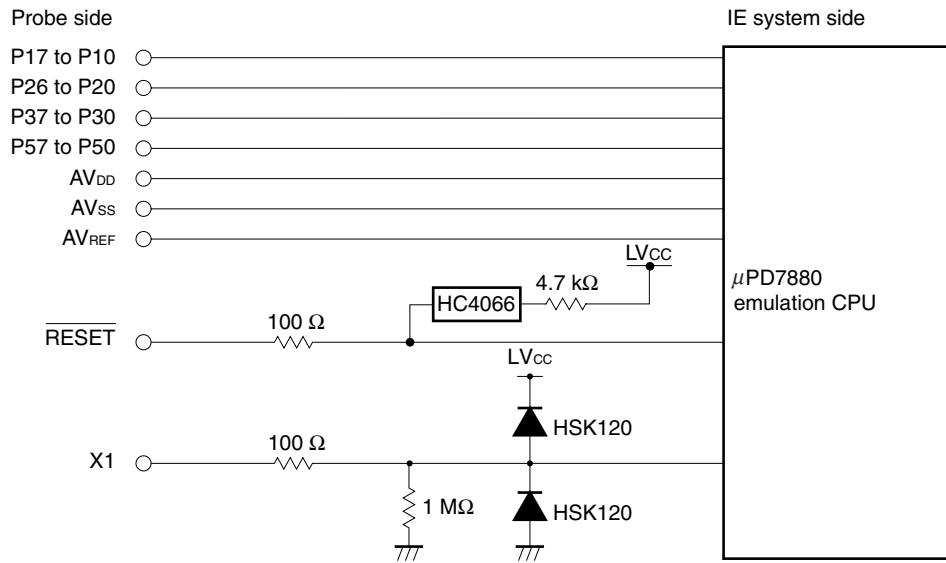


Figure 4-2. Equivalent Circuit of Emulation Circuit (2)

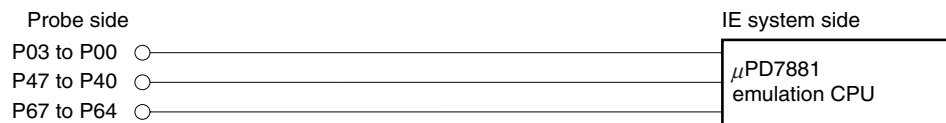
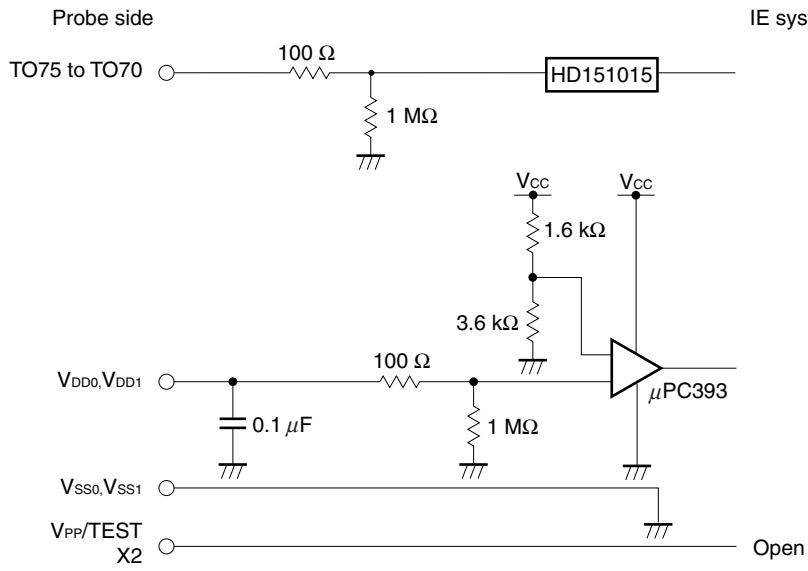


Figure 4-3. Equivalent Circuit of Emulation Circuit (3)



CHAPTER 5 RESTRICTIONS

The following are the restrictions of the IE-780988-NS-EM4.

- (1) When the IE system is started without the target system connected, the initial value of each port is undefined.

Table 5-1. Initial Value of Port When IE System Is Started Without Target System Connected

	Emulator	Target Device
Initial value of each port	Undefined	00H

- (2) When emulating the μ PD78F0988, the functions related to flash memory, such as the SFR self-write function, are not supported.
- (3) Even if a watchdog timer interrupt (INTWDT) occurs in watchdog timer mode 1 (WDTM3 = 0, WDTM4 = 1), output from the TO70 to TO75 pins does not stop.

APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. NP-64GC, NP-64GC-TQ, NP-H64GC-TQ Pin Assignments

Emulation Probe	CN6 Pin No.	Emulation Probe	CN6 Pin No.
1	108	33	14
2	107	34	13
3	104	35	18
4	103	36	17
5	100	37	22
6	99	38	21
7	94	39	28
8	93	40	27
9	30	41	92
10	29	42	91
11	24	43	98
12	23	44	97
13	20	45	102
14	19	46	101
15	16	47	106
16	15	48	105
17	43	49	77
18	44	50	78
19	47	51	73
20	48	52	74
21	51	53	69
22	52	54	70
23	57	55	63
24	58	56	64
25	59	57	61
26	60	58	62
27	55	59	65
28	56	60	66
29	49	61	71
30	50	62	72
31	45	63	75
32	46	64	76

- Remarks**
1. The NP-64GC, NP-64GC-TQ, and NP-H64GC-TQ are products of Naito Densai Machida Mfg. Co., Ltd.
 2. The numbers in the “Emulation Probe” column indicate the corresponding pin number on the emulation probe tip.

Table A-2. NP-64CW, NP-H64CW Pin Assignments

Emulation Probe	CN7 Pin No.	Emulation Probe	CN7 Pin No.
1	29	33	91
2	24	34	98
3	23	35	97
4	20	36	102
5	19	37	101
6	16	38	106
7	15	39	105
8	43	40	77
9	44	41	78
10	47	42	73
11	48	43	74
12	51	44	69
13	52	45	70
14	57	46	63
15	58	47	64
16	59	48	61
17	60	49	62
18	55	50	65
19	56	51	66
20	49	52	71
21	50	53	72
22	45	54	75
23	46	55	76
24	14	56	108
25	13	57	107
26	18	58	104
27	17	59	103
28	22	60	100
29	21	61	99
30	28	62	94
31	27	63	93
32	92	64	30

- Remarks**
1. The NP-64CW and NP-H64CW are products of Naito Densei Machida Mfg. Co., Ltd.
 2. The numbers in the “Emulation Probe” column indicate the corresponding pin number on the emulation probe tip.

APPENDIX B CAUTIONS ON DESIGNING TARGET SYSTEM

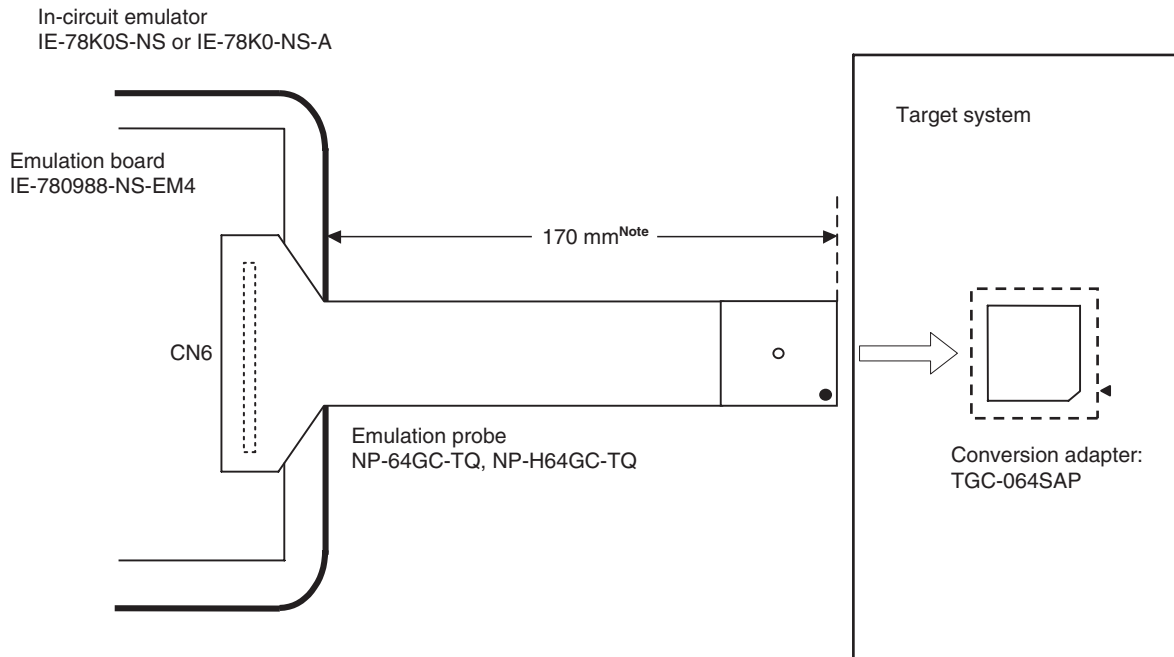
The following shows the conditions when connecting the emulation probe to the conversion adapter. Follow the configuration below and consider the shape of parts to be mounted on the target system when designing a system.

Among the products described in this appendix, the NP-64GC-TQ, NP-H64GC-TQ, NP-64CW, and NP-H64CW are products of Naito Densai Machida Mfg. Co., Ltd., and the TGC-064SAP is a product of TOKYO ELETECH CORPORATION.

Table B-1. Distance Between IE System and Conversion Adapter

Emulation Probe	Conversion Adapter	Distance Between IE System and Conversion Adapter
NP-64GC-TQ	TGC-064SAP	170 mm
NP-H64GC-TQ		370 mm
NP-64CW	-	160 mm
NP-H64CW		360 mm

Figure B-1. Distance Between IE System and Conversion Adapter (NP-64GC-TQ, NP-H64GC-TQ)



Note Distance when the NP-64GC-TQ is used. When the NP-H64GC-TQ is used, the distance is 370 mm.

Figure B-2. Connection Conditions of Target System (When NP-64GC-TQ Is Used)

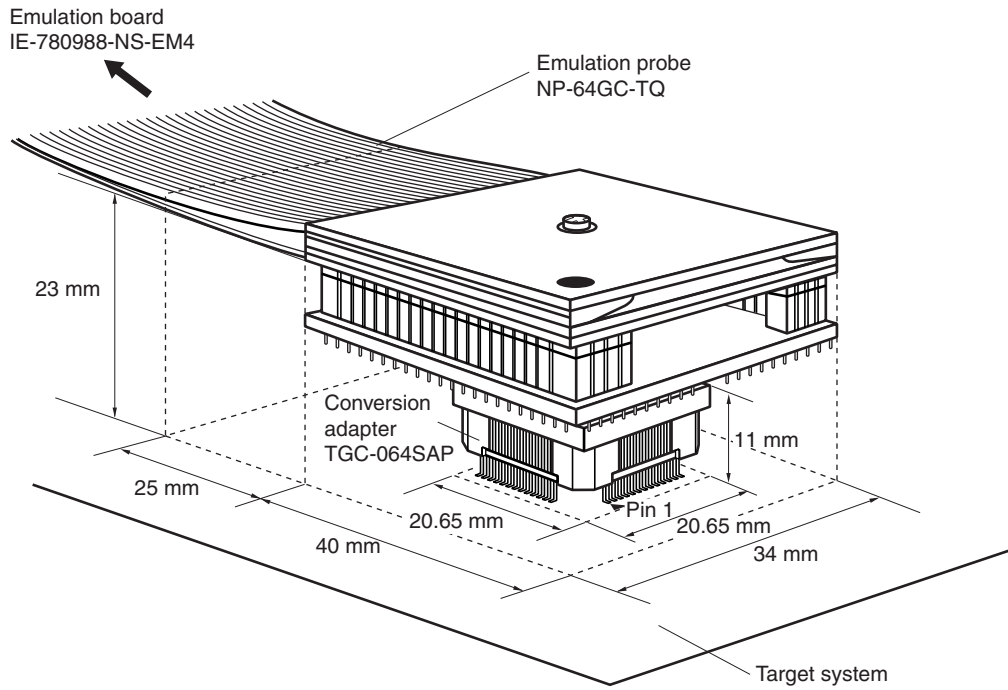


Figure B-3. Connection Conditions of Target System (When NP-H64GC-TQ Is Used)

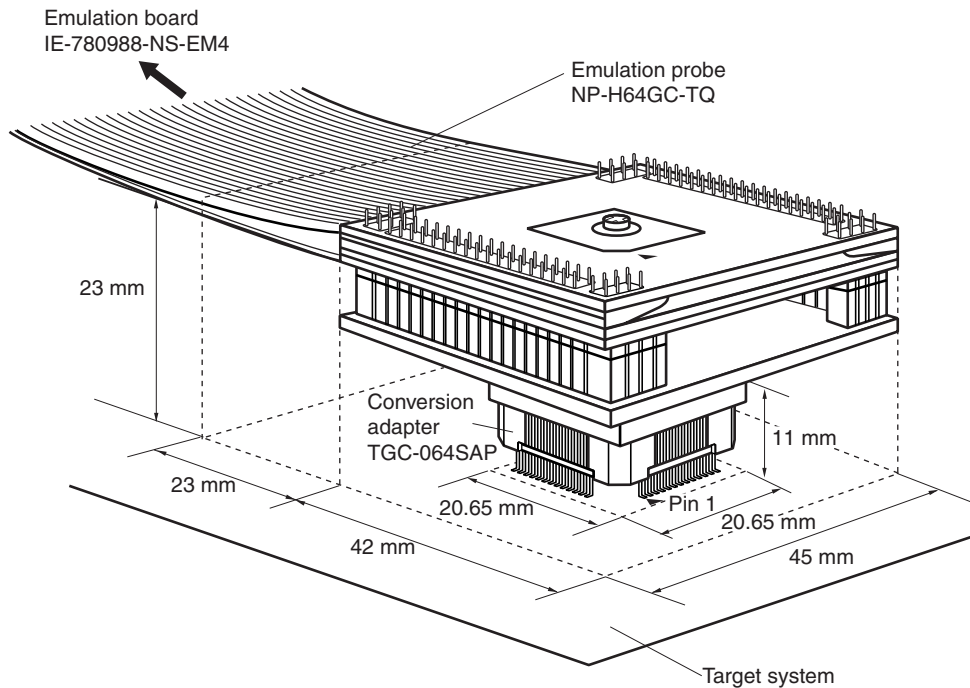
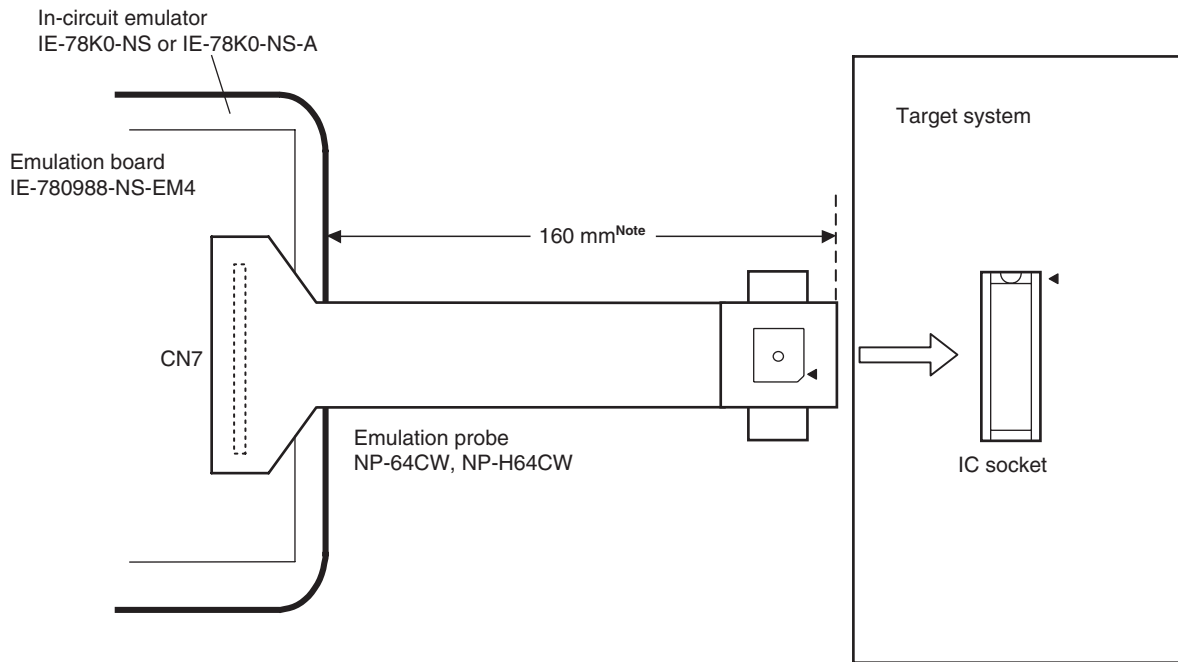


Figure B-4. Distance Between IE System and Conversion Adapter (NP-64CW, NP-H64CW)



Note Distance when the NP-64CW is used. When the NP-H64CW is used, the distance is 360 mm.

Figure B-5. Connection Conditions of Target System (When NP-64CW Is Used)

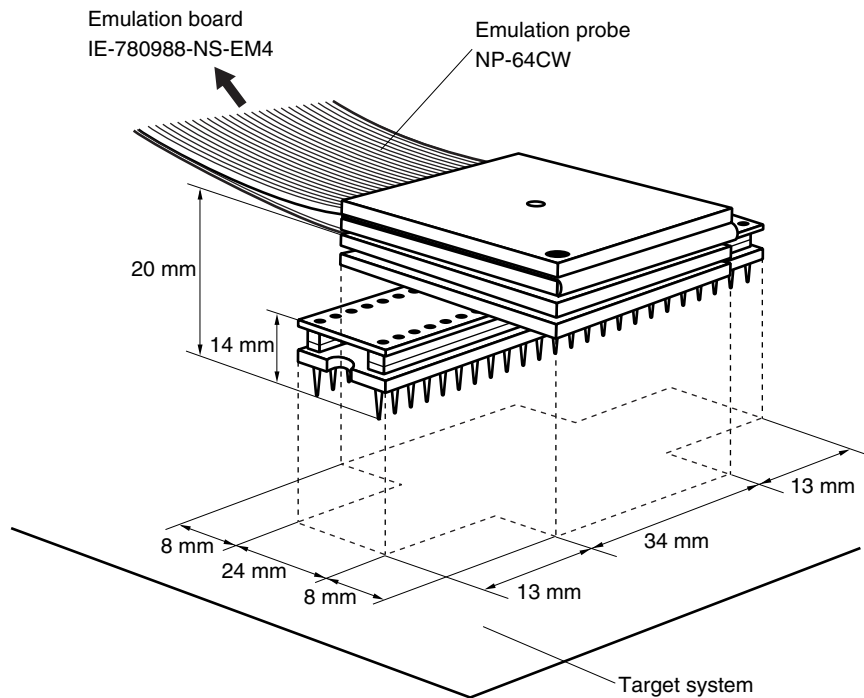
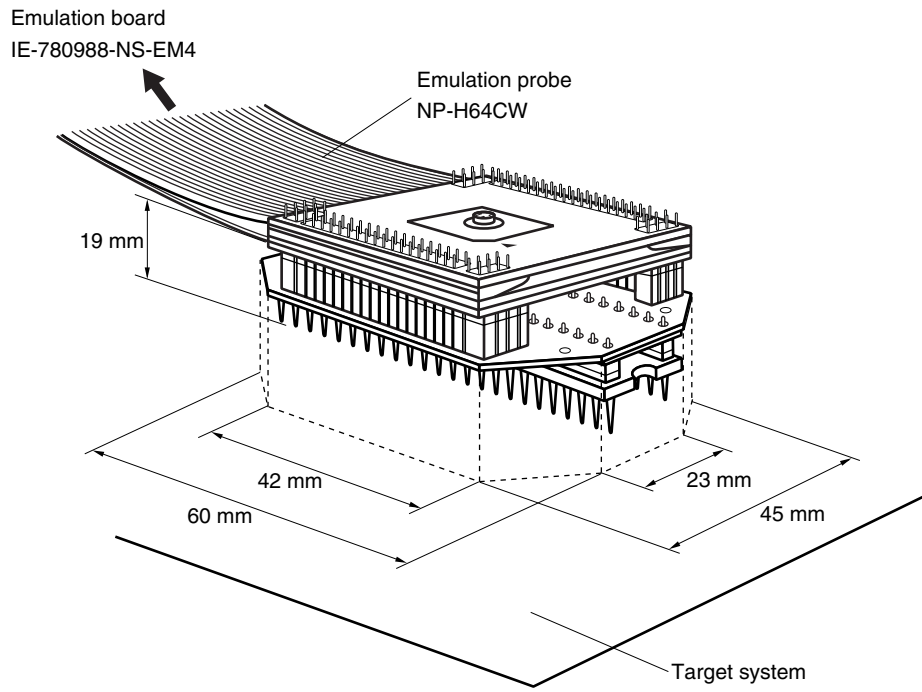


Figure B-6. Connection Conditions of Target System (When NP-H64CW Is Used)



APPENDIX C REVISION HISTORY

The following table shows the revision history up to this edition. The “Applied to:” column indicates the chapters of each edition in which the revision was applied.

Edition	Major Revision from Previous Edition	Applied to:
2nd edition	Modification of dimensions of adapter in Figures B-2 and B-3	APPENDIX B CAUTIONS ON DESIGNING TARGET SYSTEM
3rd edition	Modification of Figures 1-1 System Configuration	CHAPTER 1 GENERAL
	Modification of Figure 1-2 Basic Hardware Configuration	
	Deletion of Figure 1-3 Basic Hardware Configuration (Using IE-78K0-NS-A)	
	Modification of Table 1-2 Basic Specifications	
3rd edition	3.2.2 System clock settings Addition of description on crystal oscillator	CHAPTER 3 INSTALLATION
	3.6 Low-Voltage Emulation Setting Modification of supply voltage	