NEC

User's Manual

IE-178048-NS-EM1

Emulation Board

Target device
μPD178048 Subseries

[MEMO]

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INTRODUCTION

Product Overview   The IE-178048-NS-EM1 is designed to be used with the IE-78K0-NS or IE-78K0-NS-A to debug the following target devices that belong to the 178K Series of 8-bit single-chip microcontrollers.

- μPD178048 Subseries: μPD178046, 178048, 178F048

Target Readers   This manual is intended for engineers who will use the IE-178048-NS-EM1 with the IE-78K0-NS or IE-78K0-NS-A 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-178048-NS-EM1, refer to not only this manual (supplied with the IE-178048-NS-EM1) but also the manual that is supplied with the 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. In this case therefore, read IE-78K0-NS + IE-78K0-NS-PA for IE-78K0-NS-A in this document, as necessary.

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

- Basic specifications
- System configuration
- External interface functions

IE-178048-NS-EM1
User's Manual

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

Purpose   This manual's purpose is to explain various debugging functions that can be performed when using the IE-178048-NS-EM1.

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 device (real chip) 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) and the emulation board (IE-178048-NS-EM1).

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   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 Number
IE-78K0-NS	U13731E
IE-78K0-NS-A	U14889E
IE-178048-NS-EM1	This manual
ID78K Series Integrated Debugger Ver.2.30 or Later Operation (Windows™ Based)	U15185E
μPD178048 Subseries	U13985E

Caution   **The related documents listed above are subject to change without notice. Be sure to use the latest version of each document for designing.**

CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1 GENERAL

The IE-178048-NS-EM1 is a development tool for efficient debugging of hardware or software when using one of the following target devices that belong to the 178K Series of 8-bit single-chip microcontrollers.

This chapter describes the IE-178048-NS-EM1's system configuration and basic specifications.

- Target device
  - μPD178048 Subseries

1.1   System Configuration

Figure 1-1 illustrates the IE-178048-NS-EM1's system configuration.

Figure 1-1. System Configuration
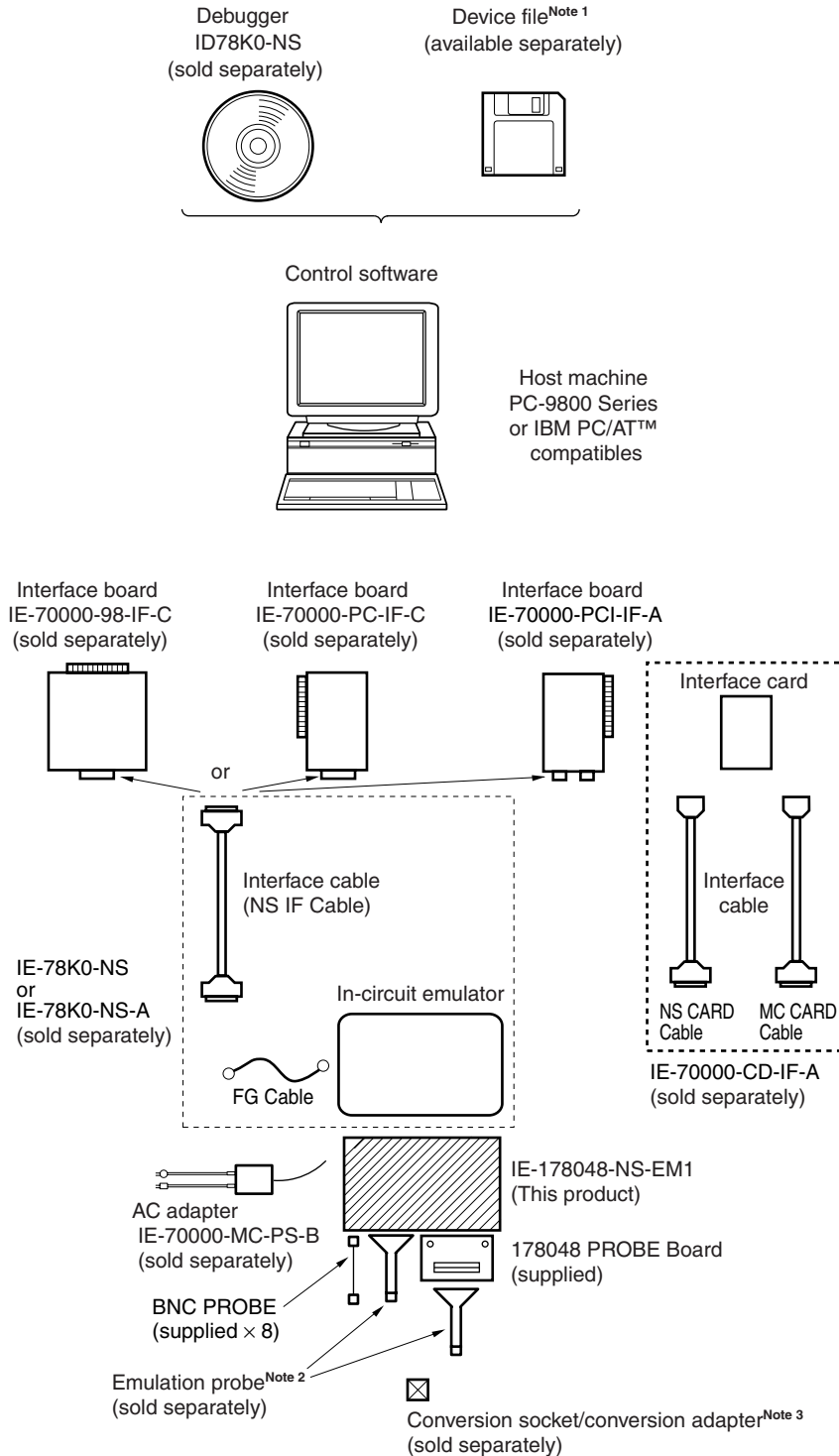
Notes 1. The device file is as follows, in accordance with the subseries.

      μS××××DF178048: μPD178048 Subseries

    The device file can be downloaded from the Web site of NEC Electron Devices.

      (URL: http://www.ic.nec.co.jp/micro/)

2. The emulation probe is as follows, in accordance with the package.

    NP-64CW, NP-H64CW: 64-pin plastic shrink DIP (CW type)

    NP-80GK, NP-H80GK-TQ: 80-pin plastic TQFP (GK type)

    The NP-64CW, NP-H64CW, NP-80GK, and NP-H80GK-TQ are products of Naito Densei Machida Mfg. Co., Ltd.

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

3. The conversion socket/conversion adapter are as follows, in accordance with the package.

    TGK-080SDW: 80-pin plastic TQFP (GK type)

    The TGK-080SDW 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)

Package	Emulation Probe	Conversion Socket/Conversion Adapter
64-pin plastic shrink DIP (CW type)	NP-64CW, NP-H64CW	–
80-pin plastic TQFP (GK type)	NP-80GK, NP-H80GK-TQ	TGK-080SDW

1.2 Hardware Configuration

Figures 1-2 and 1-3 show the IE-178048-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration (When Using IE-78K0-NS)
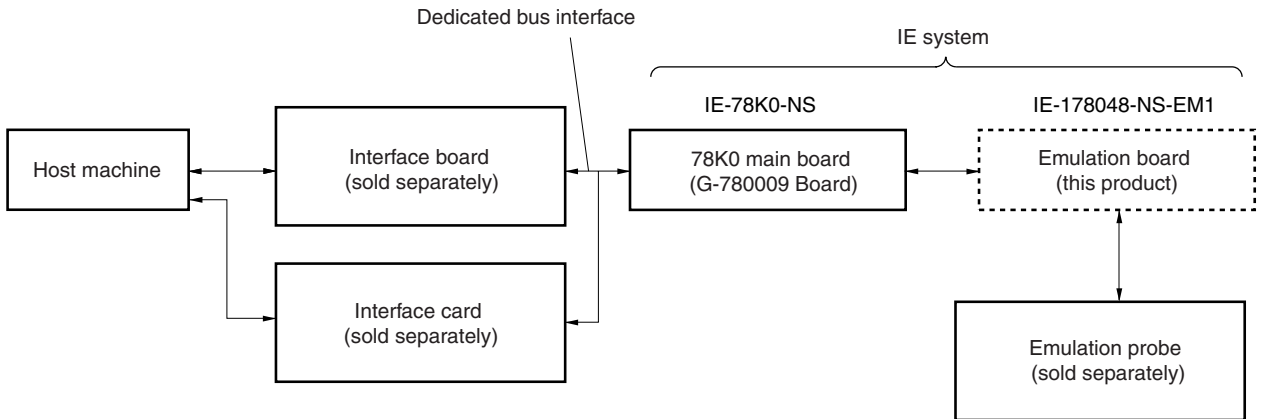
Figure 1-3. Basic Hardware Configuration (When Using IE-78K0-NS-A)
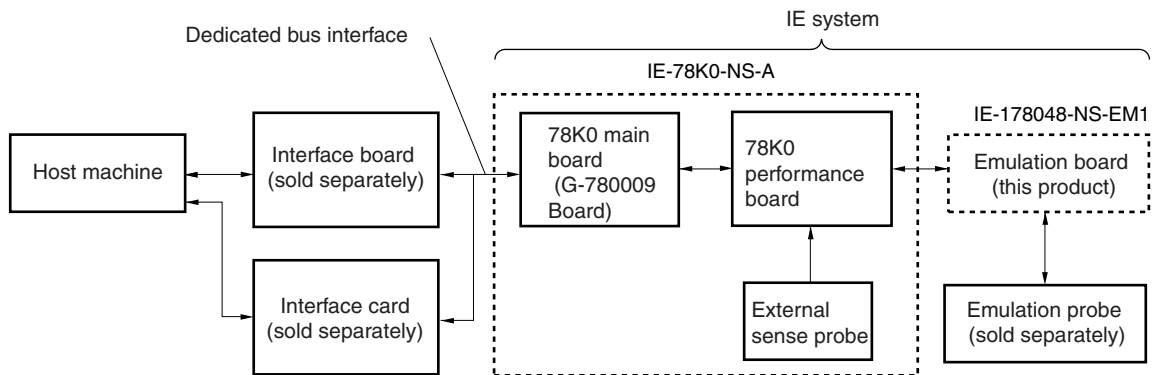
1.3 Basic Specifications

The IE-178048-NS-EM1's basic specifications are listed in Table 1-1.

Table 1-1. Basic Specifications

Parameter	Description
Target device	μPD178048 Subseries
System clock	5 MHz
Clock supply	External: Input via an emulation probe from the target system Internal: Mounted on emulation board (5 MHz), or mounted on the board by the user
Low-voltage support	V_{DD} = 3.3$\pm$0.2 V to 5 V $\pm$10% (same as target device)

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-178048-NS-EM1 main unit.

The packing box contains the emulation board (IE-178048-NS-EM1).

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

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

2.1 Parts of Main Unit

Figure 2-1. IE-178048-NS-EM1 Part Names
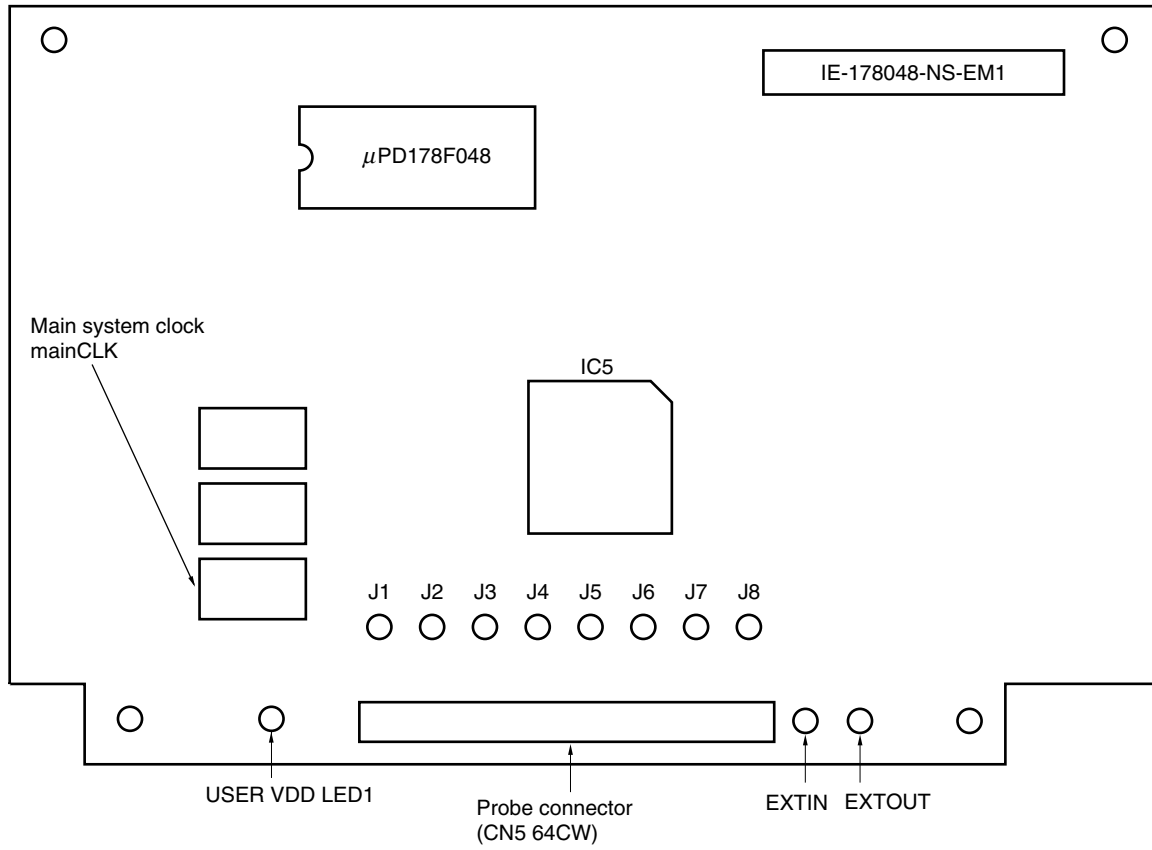
Figure 2-2. 178048 PROBE Board

Probe connector (CN2 80GK)
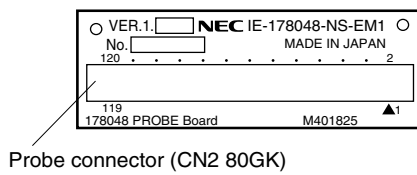
CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-178048-NS-EM1 to the 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 or IE-78K0-NS-A main unit

See **IE-78K0-NS User's Manual (U13731E)** for a description of how to connect the IE-178048-NS-EM1 to the IE-78K0-NS. See **IE-78K0-NS-A User's Manual (U14889E)** for a description of how to connect the IE-178048-NS-EM1 to the IE-78K0-NS-A.

(2) Connection with 178048 PROBE Board

When using the emulation probe NP-80GK, use the 178048 PROBE Board. Connect CN5 of the IE-178048-NS-EM1 and CN1 of the 178048 PROBE Board, aligning pin 1 of each.

(3) Connection with emulation probe

See the manual of the in-circuit emulator to be used (**IE-78K0-NS User's Manual (U13731E)** or **IE-78K0-NS-A User's Manual (U14889E)**) for a description of how to connect the emulation probe to the IE-178048-NS-EM1. When using the emulation probe NP-64CW, connect it to CN5 on this board. When using the emulation probe NP-80GK, connect it to CN2 on the 178048 PROBE Board.

(4) Connection with BNC PROBE

Connect the supplied BNC PROBE to the J1 to J8 connectors on the IE-178048-NS-EM1.

Signals corresponding to J1 to J8 are as follows. Connect to amplify inputs from the target system.

J1: $\overline{\text{VSYNC}}$ J5: B

J2: $\overline{\text{HSYNC}}$ J6: I

J3: R   J7: Open (not connected)

J4: G   J8: BLANK

Caution **Incorrect connection methods may damage the IE system.**
Be sure to read the emulation probe's user's manual for a detailed description of the correct connection method.

Figure 3-1. Connection of Emulation Probe (NP-64CW/H64CW) and BNC PROBE
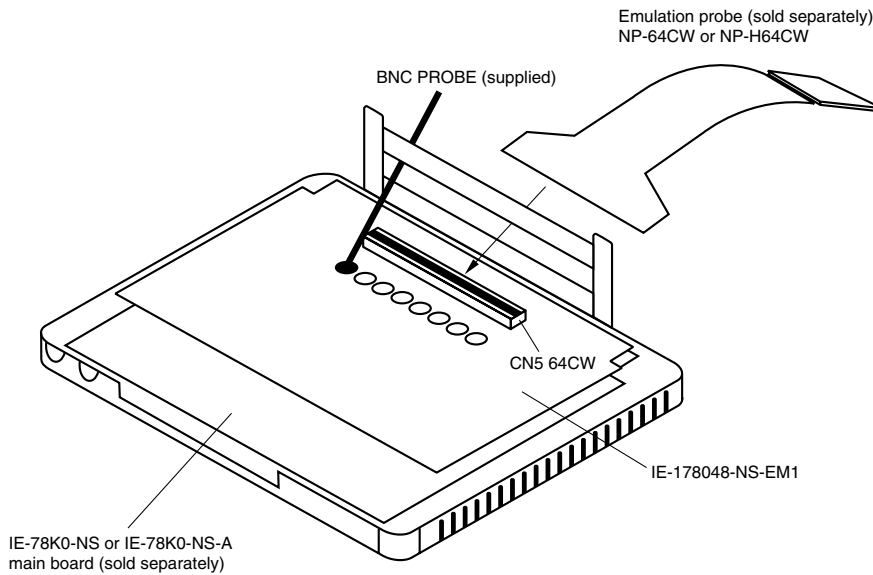
Remark The NP-64CW/H64CW is a product of Naito Densei Machida Mfg. Co., Ltd.

Figure 3-2. Connection of Emulation Probe (NP-80GK/H80GK-TQ) and BNC PROBE
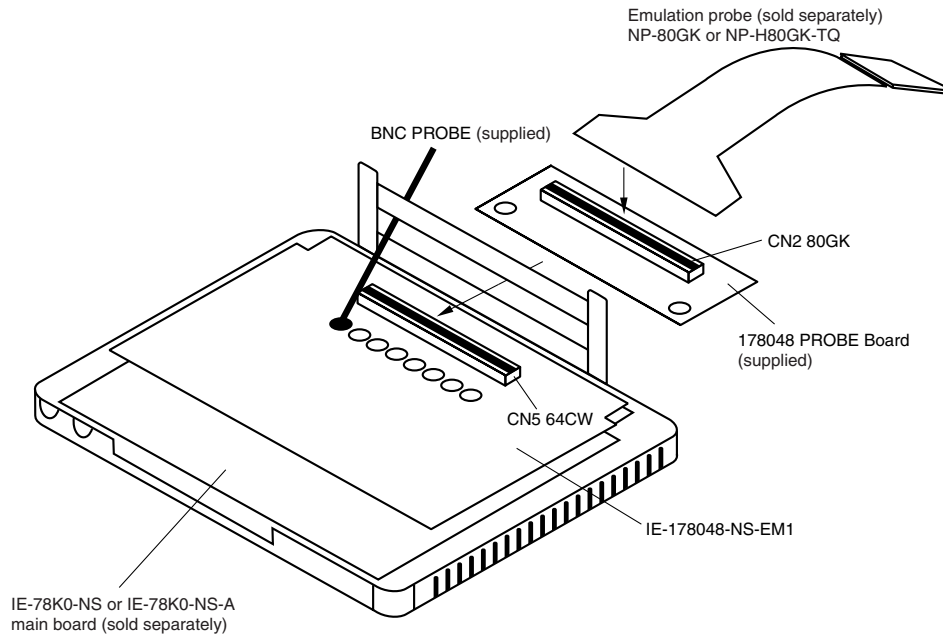
Remark The NP-80GK/H80GK-TQ is a product of Naito Densei Machida Mfg. Co., Ltd.

3.2 Clock Settings

3.2.1 Overview of clock settings

The main 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, the target device is connected to a resonator and the target device's internal oscillator is used. An example of the external circuit is shown in part (a) of Figure 3-3. During emulation, the resonator that is mounted on the target system is not used. Instead, it uses the clock that is mounted on the emulation board which is connected to the IE-78K0-NS or IE-78K0-NS-A.

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

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

Caution **The IE system will be hung-up if the main system clock is not supplied normally. Moreover, be sure to input a rectangular wave as the clock from the target. There is no need to supply a clock to X2 pin.**

Figure 3-3. External Circuits Used as System Clock Oscillator

(a) Internal clock   (b) External clock
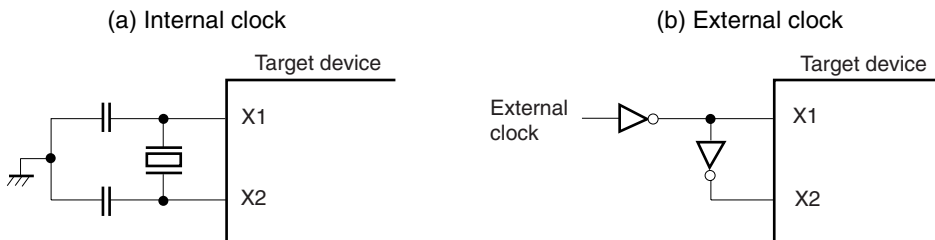
(1) Clock that is already mounted on emulation board

A crystal oscillator is already mounted on the emulation board. Its frequency is 5 MHz.

Figure 3-4. When Using Clock That Is Already Mounted on Emulation Board
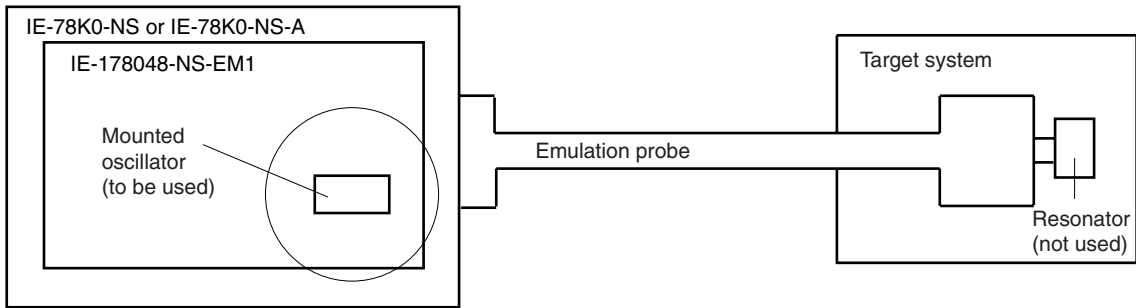
Remark The clock that is supplied by the IE-178048-NS-EM1's oscillator (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-178048-NS-EM1. First mount the resonator on the parts board, then attach the parts board to the IE-178048-NS-EM1. This method is useful when using a different frequency from that of the pre-mounted clock.

Figure 3-5. When Using User-Mounted Clock
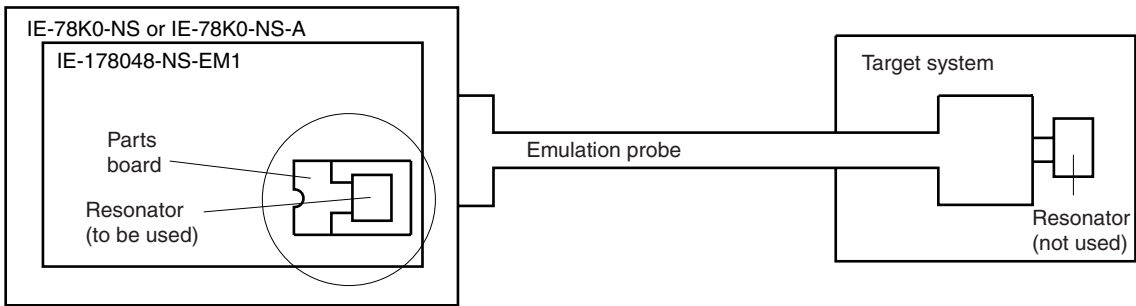
Remark The clock that is supplied by the IE-178048-NS-EM1's resonator (encircled in the figure) is used.

(3) External clock

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

Figure 3-6. When Using an External Clock
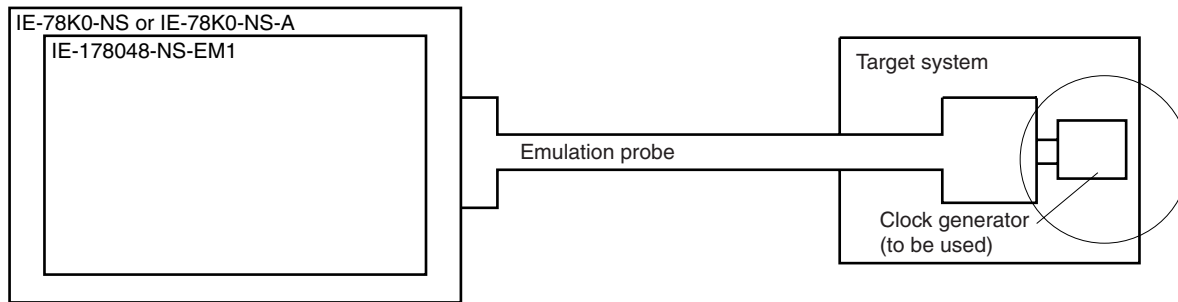
Remark   The clock supplied by the target system's clock generator (encircled in the figure) is used.

3.2.2   Main system clock settings

Table 3-1. Main System Clock Settings

Frequency of Main System Clock		IE-178048-NS-EM1	CPU Clock Source
		Parts Board (mainCLK)	Selection (ID)
When using clock that is already mounted on emulation board	5 MHz	Oscillator used	Internal
When using clock mounted by user	Other than 5 MHz	Oscillator assembled by user	
When using external clock		Oscillator not used	External

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   The IE-178048-NS-EM1's factory settings are those listed above under "when using clock that is already mounted on emulation board".

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

When the IE-178048-NS-EM1 is shipped, a 5 MHz crystal oscillator is already mounted in the IE-178048-NS-EM1's mainCLK socket. When using the factory-set mode settings, no hardware settings are required.

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, resistor Rx, capacitor CA, and capacitor CB (all with a suitable oscillation frequency) onto the parts board (as shown below).

Figure 3-7. Connections on Parts Board (When Using Main System Clock or User-Mounted Clock)

Parts board (mainCLK)
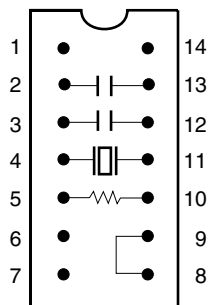
Pin No.	Connection
2-13	Capacitor CB
3-12	Capacitor CA
4-11	Ceramic resonator or crystal resonator
5-10	Resistor Rx
8-9	Short

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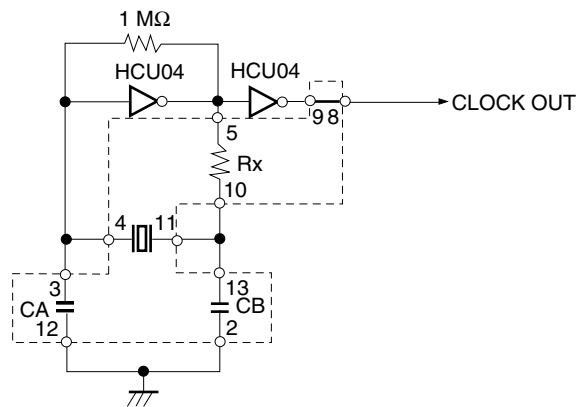
Remark   The sections enclosed in broken lines indicate parts that are attached to the parts board.

<2> Prepare the IE-178048-NS-EM1.

<3> Remove the crystal oscillator that is mounted in the IE-178048-NS-EM1's socket (the socket marked as mainCLK).

<4> Connect the parts board (from <1> above) to the socket (mainCLK) from which the crystal oscillator was removed (in <3> above). Check the pin 1 mark to make sure the board is mounted in the correct direction.

<5> Make sure that the parts board mounted in the mainCLK socket on the emulation board is wired as shown in Figure 3-7 above.

<6> Connect the IE-178048-NS-EM1 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.

IE-78K0-NS or IE-78K0-NS-A side
(Emulation device)
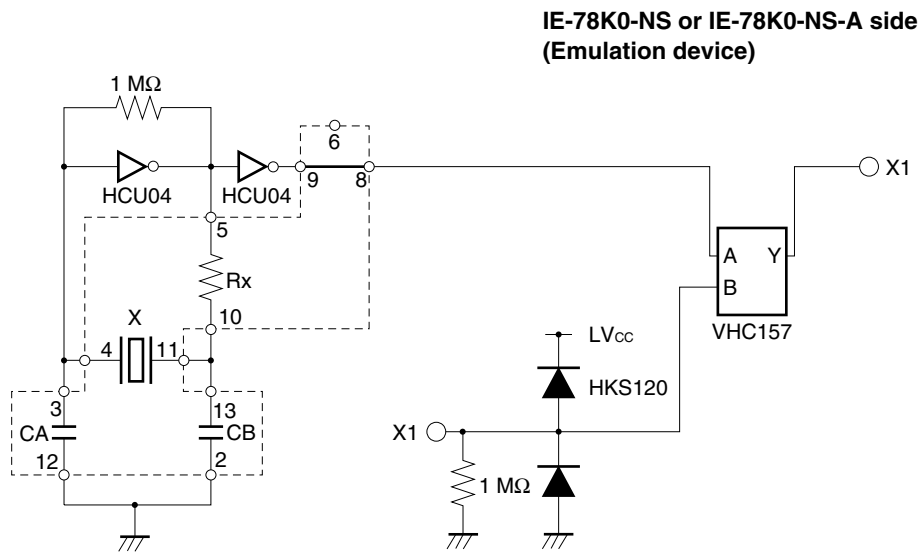
Remark   The sections enclosed in broken lines indicate parts that are attached to the parts board.

(b) When using a crystal oscillator

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-8)

Figure 3-8. Crystal Oscillator (When Using Main System Clock or User-Mounted Clock)

NC ● ● V_{CC}

GND ● ● CLOCK OUT
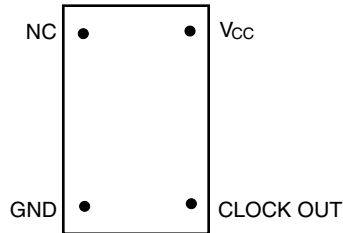
<Steps>
<1> Prepare the IE-178048-NS-EM1.
<2> Remove the crystal oscillator that is mounted in the IE-178048-NS-EM1's socket (the socket marked as mainCLK).
<3> Connect a crystal oscillator to the socket (mainCLK) from which the crystal oscillator was removed (in <2> above). Insert the crystal oscillator pins into the socket pins as shown in the figure below.

Figure 3-9. Pin Alignment of Crystal Oscillator and Socket

Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
V_{CC}	14
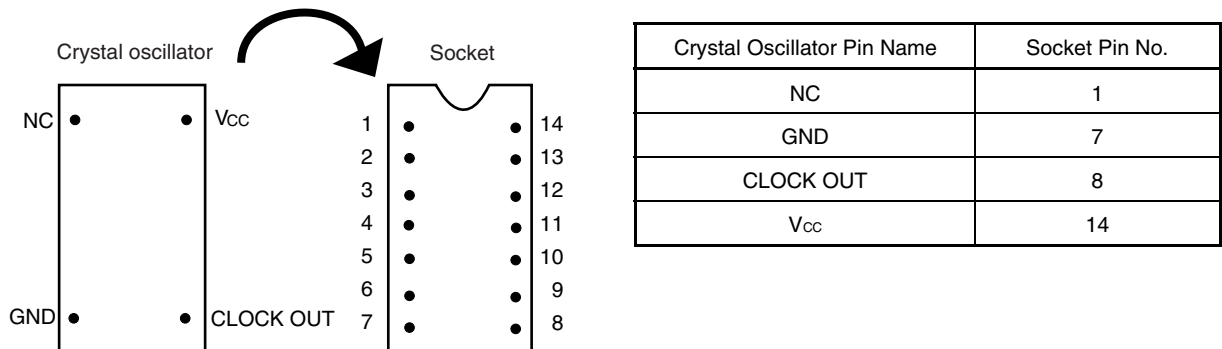
<4> Connect the IE-178048-NS-EM1 to the IE-78K0-NS or IE-78K0-NS-A.

The above steps configure the following circuit and enable supply of the clock from the mounted resonator to the emulation device.
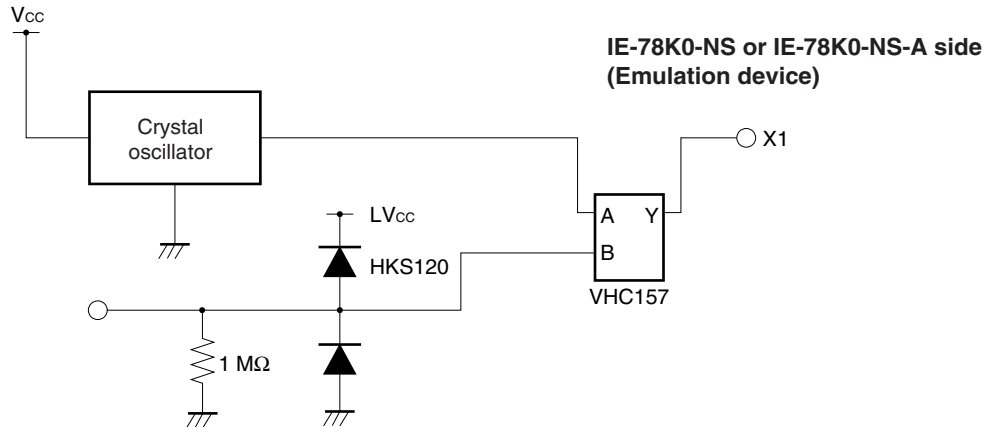
(3) When using external clock

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-178048-NS-EM1's check pins EXTOUT and EXTIN as shown below.

See **ID78K Series Integrated Debugger Ver. 2.30 or Later Operation Manual (Windows Based) (U15185E)** for descriptions of related use methods. See **IE-78K0-NS User's Manual (U13731E) or IE-78K0-NS-A User's Manual (U14889E)** for pin characteristics.

Figure 3-10. External Trigger Input Position
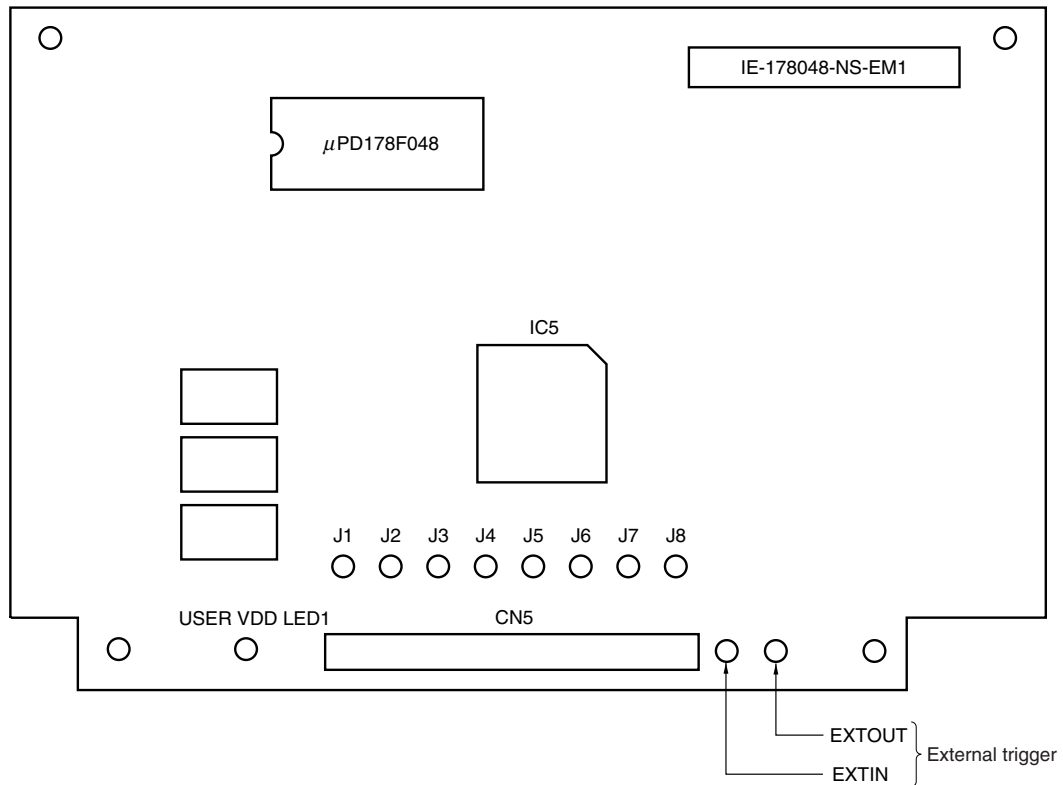
3.4 Jumper Settings on IE-78K0-NS

When using the IE-178048-NS-EM1, set the jumpers on the IE-78K0-NS as follows. For details of these jumper settings, refer to **IE-78K0-NS User's Manual (U13731E)**.

Caution **If the jumper is set incorrectly, the board may be damaged.**

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

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 to 3 shorted	1 to 2 shorted	1 to 2 shorted	3 to 4 shorted	1 to 2 shorted	1 to 2 shorted

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

When using the IE-178048-NS-EM1 in combination with the IE-78K0-NS-A, set the jumper on the IE-78K0-NS-A as follows. For details of these jumper positions, refer to **IE-78K0-NS-A User's Manual (U14889E)**.

Caution **If the jumper is set incorrectly, the board may be damaged.**

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

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 to 3 shorted	1 to 2 shorted	1 to 2 shorted	3 to 4 shorted	1 to 2 shorted	1 to 2 shorted

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

	JP2
Setting	2 to 3 shorted

3.6 Low-Voltage Emulation Setting

When the target system is operating on low voltage, supply the same voltage as 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 (this is unnecessary when target system is operating on 5 V).

Set the supply voltage of the target system to 3.3 ±0.2 V to 5.0 V ±10%.

Caution   To emulate at 4.5 V or lower, first start at 5 V, and then lower the target system voltage.

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

Supply Voltage to TP1	Maximum Current Consumption of TP1
3.3±0.2 V to 5.0 V±10%	300 mA

Figure 3-11. Main Board (G-780009 Board) of IE-78K0-NS or IE-78K0-NS-A

TP1

GND V_{CC}

Dedicated bus interface connector
(HOST-I/F)
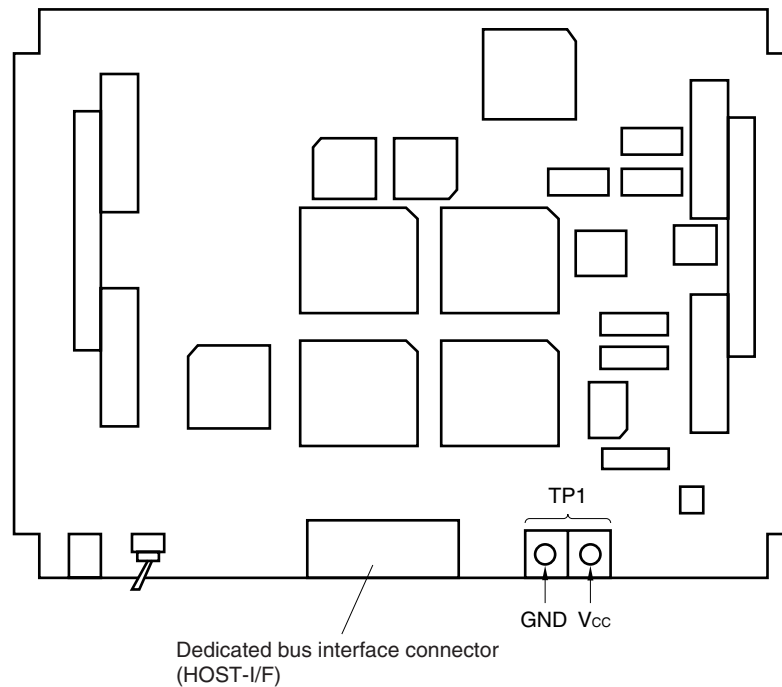
CHAPTER 4   DIFFERENCES BETWEEN TARGET DEVICES AND TARGET INTERFACE CIRCUITS

This chapter describes differences between the target device's signal lines and the signal lines of the IE-178048-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-178048-NS-EM1's target interface circuit consists of an emulation CPU, TTL, CMOS-IC, and other components.

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 to or output from the emulation CPU (μPD178F048)
(2) Signals input to or output from the emulation CPU (μPD780009)
(3) Signals input to or output from the FPGA (EPFI0K50)
(4) Other signals

The IE system's circuit is used as follows for signals listed in (1) to (4) above.

(1) Signals input to or output from the emulation CPU (μPD178F048)
   See **Figure 4-1 Equivalent Circuit 1 of Emulation Circuit.**

   - P00 to P03
   - P10 to P13
   - P20 to P23
   - P70 to P77
   - P130 to P134

(2) Signals input to or output from the emulation CPU (μPD780009)
   See **Figure 4-2 Equivalent Circuit 2 of Emulation Circuit.**

   - $\overline{\text{RESET}}$
   - X1
   - P40 to P47
   - P50 to P54
   - P60 to P67

(3) Signals input to or output from the FPGA (EPFI0K50)
   See **Figure 4-3 Equivalent Circuit 3 of Emulation Circuit.**

   - J1 ($\overline{\text{VSYNC}}$)
   - J2 ($\overline{\text{HSYNC}}$)
   - J3 (R)
   - J4 (G)
   - J5 (B)
   - J6 (I)
   - J8 (BLANK)

(4) Other signals

See **Figure 4-4 Equivalent Circuit 4 of Emulation Circuit.**

- USERV$_{DD}$ (V$_{DD}$PORT)
- GND00, GND01, GND10, GND11, GNDPORT
- $\overline{\text{VSYNC}}$, $\overline{\text{HSYNC}}$, R, G, B, I, BLANK
- J7

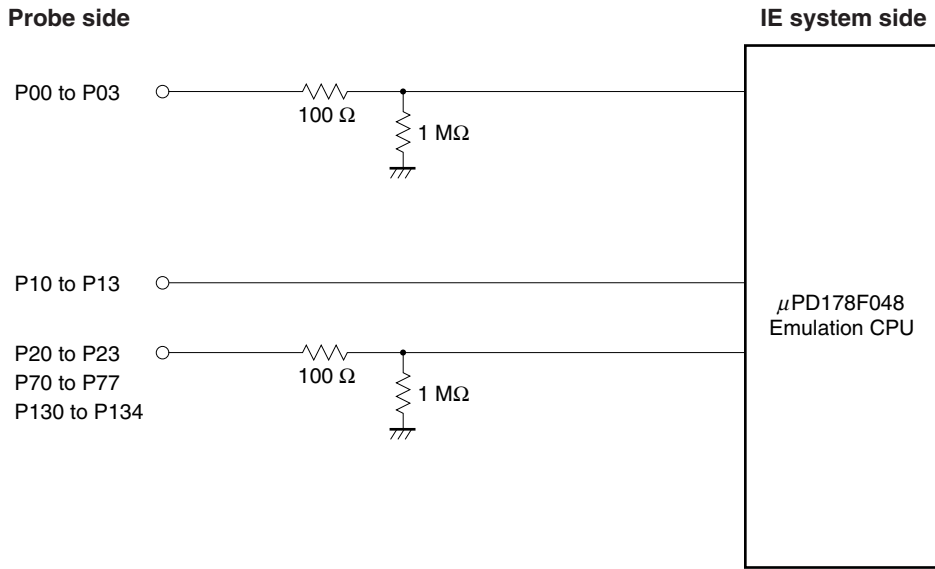**Figure 4-1. Equivalent Circuit 1 of Emulation Circuit**

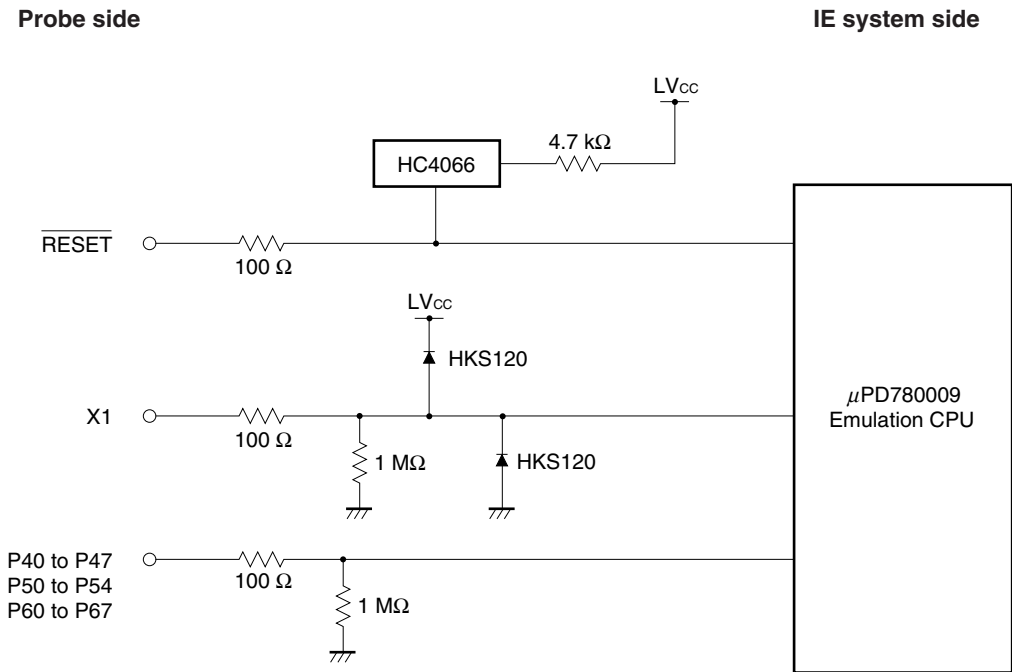**Figure 4-2. Equivalent Circuit 2 of Emulation Circuit**

Figure 4-3. Equivalent Circuit 3 of Emulation Circuit
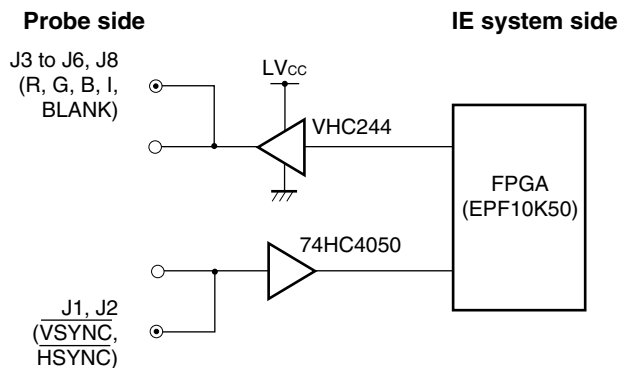
Figure 4-4. Equivalent Circuit 4 of Emulation Circuit
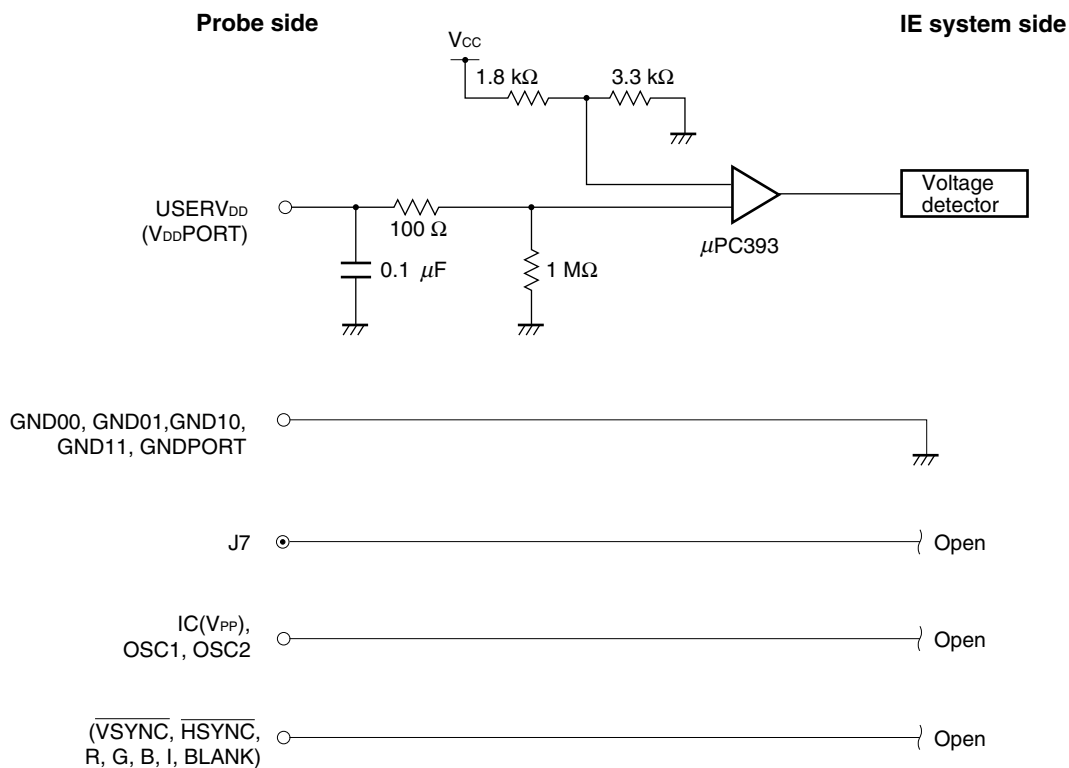
APPENDIX A   EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. NP-64CW/H64CW Pin Assignments

Emulation Probe	CN5 Pin No.	Emulation Probe	CN5 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/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.

Table A-2. NP-80GK/H80GK-TQ Pin Assignments

Emulation Probe	CN2 Pin No.	Emulation Probe	CN2 Pin No.	Emulation Probe	CN2 Pin No.
1	114	28	57	55	102
2	113	29	58	56	101
3	108	30	59	57	106
4	107	31	60	58	105
5	104	32	55	59	112
6	103	33	56	60	111
7	100	34	49	61	83
8	99	35	50	62	77
9	94	36	45	63	78
10	93	37	46	64	73
11	30	38	41	65	74
12	29	39	42	66	69
13	24	40	35	67	70
14	23	41	8	68	63
15	20	42	7	69	64
16	19	43	14	70	61
17	16	44	13	71	62
18	15	45	18	72	65
19	10	46	17	73	66
20	9	47	22	74	71
21	37	48	21	75	72
22	43	49	28	76	75
23	44	50	27	77	76
24	47	51	92	78	79
25	48	52	91	79	80
26	51	53	98	80	85
27	52	54	97	–	–

Remarks 1. The NP-80GK/H80GK-TQ 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.

3. The numbers in the "CN2 Pin No." column indicate the corresponding pin number of CN2 on the 178048 PROBE Board.

APPENDIX B NOTES ON TARGET SYSTEM DESIGN

The following shows a diagram of the connection conditions between the emulation probe and conversion adapter or IC socket. Design your system making allowances for conditions such as the form of parts mounted on the target system, as shown below.

Of the products described in this chapter, the NP-80GK, NP-H80GK-TQ, NP-64CW, and NP-H64CW are from Naito Densei Machida Mfg. Co., Ltd, and the TGK-080SDW is from TOKYO ELETECH CORPORATION.

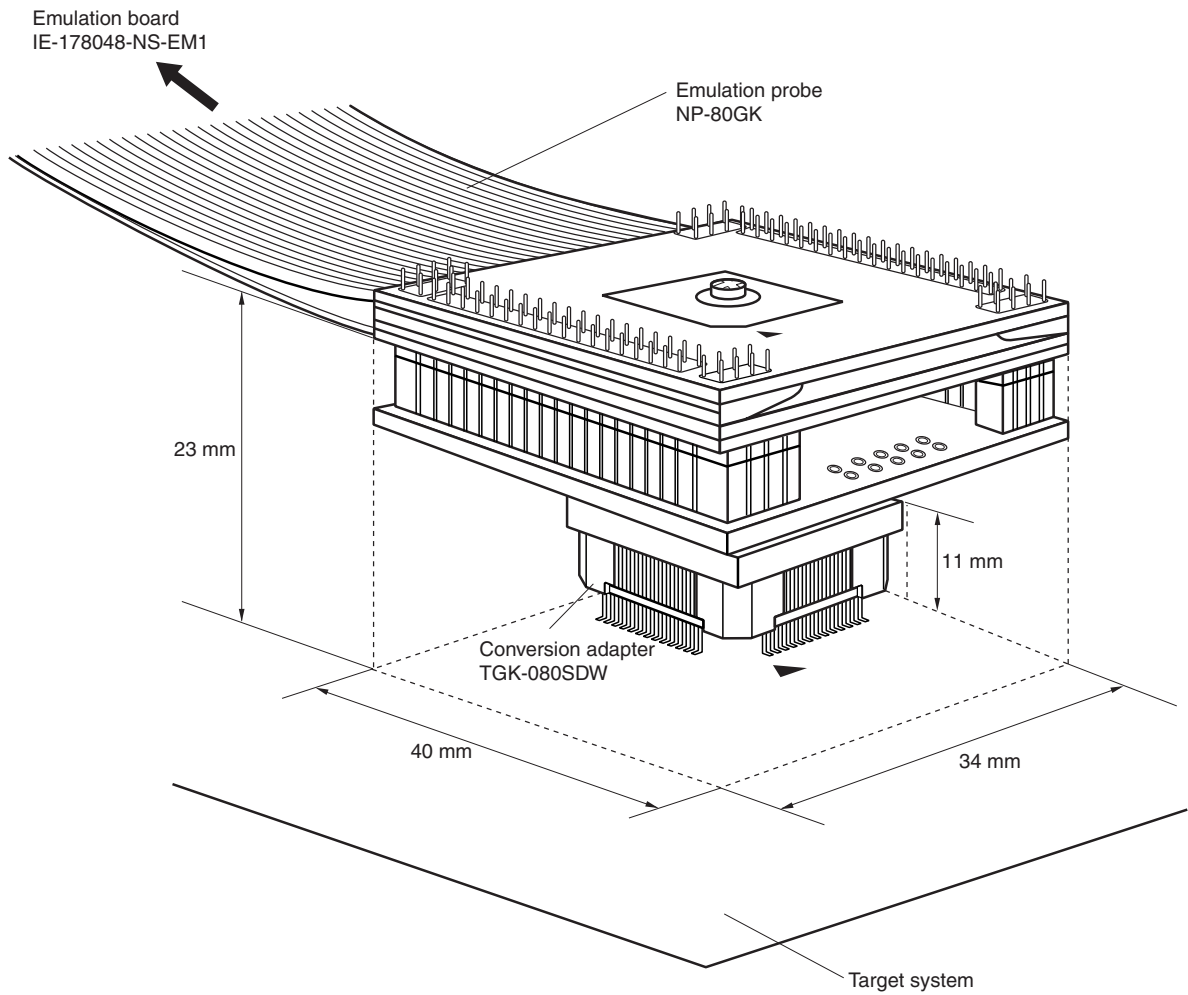**Table B-1. Distance Between IE System and Conversion Adapter or IC Socket**

Emulation Probe	Conversion Adapter	Distance Between IE System and Conversion Adapter or IC Socket
NP-80GK	TGK-080SDW	170 mm
NP-H80GK-TQ	TGK-080SDW	370 mm
NP-64CW	–	170 mm
NP-H64CW	–	370 mm

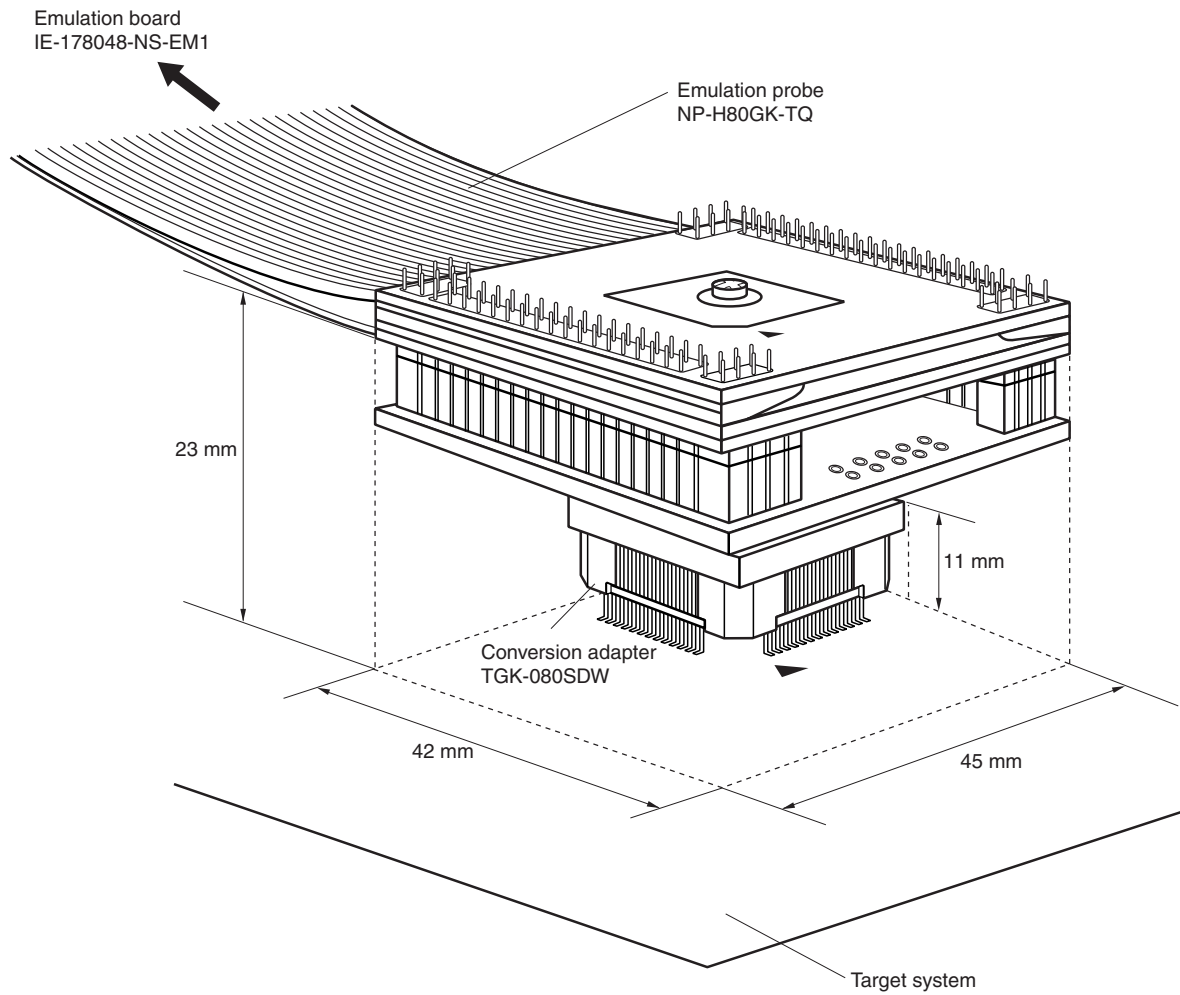**Figure B-1. Distance Between IE System and Conversion Adapter (When Using NP-80GK/H80GK-TQ)**
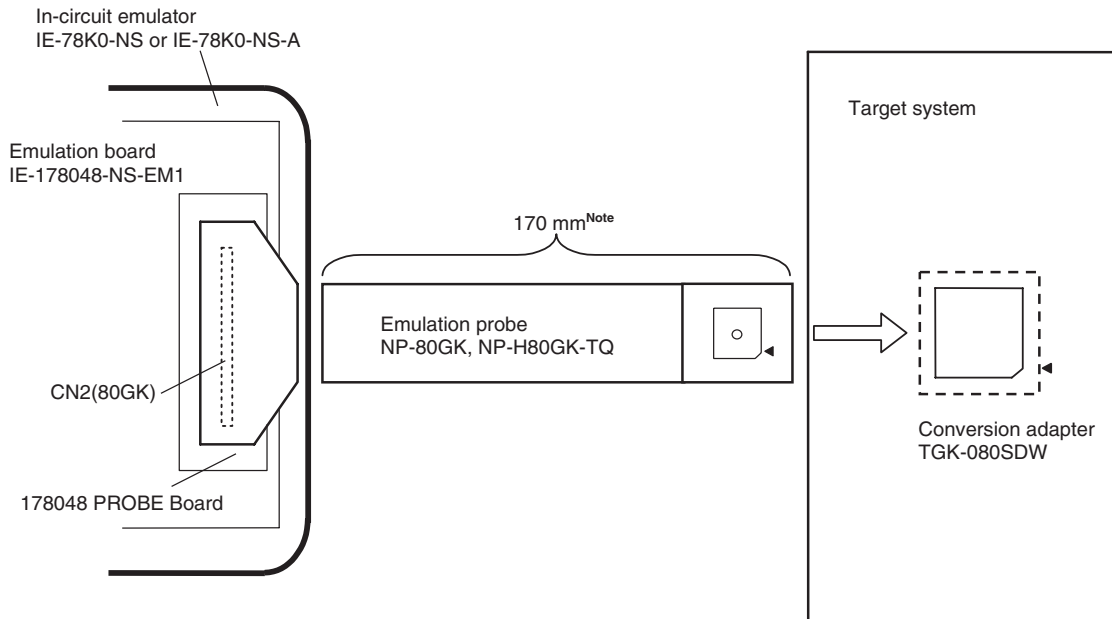
Note Distance when using NP-80GK. This is 370 mm when using NP-H80GK-TQ.

Figure B-2. Connection Conditions of Target System (When Using NP-80GK)

Remark   The body size of the TGK-080SDW is 18 × 18 mm.

Figure B-3. Connection Conditions of Target System (When Using NP-H80GK-TQ)

Emulation board
IE-178048-NS-EM1

Emulation probe
NP-H80GK-TQ

23 mm

11 mm

Conversion adapter
TGK-080SDW

42 mm

45 mm

Target system

Remark The body size of the TGK-080SDW is 18 × 18 mm.

Figure B-4. Distance Between IE System and IC Socket (When Using NP-64CW)

In-circuit emulator
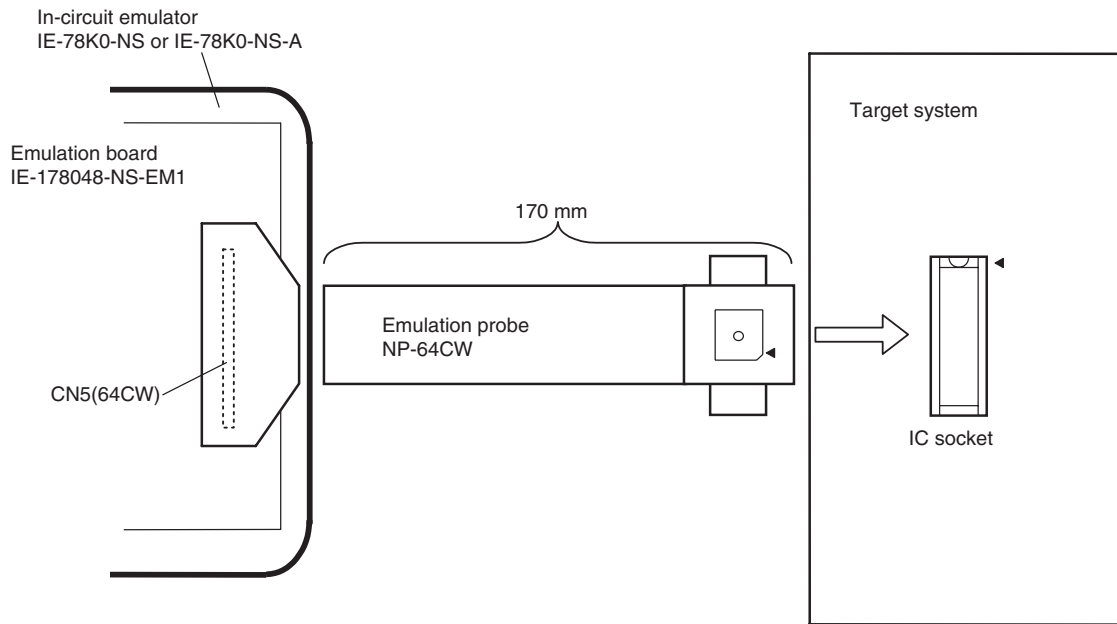IE-78K0-NS or IE-78K0-NS-A

Emulation board
IE-178048-NS-EM1

170 mm

Emulation probe
NP-64CW

CN5(64CW)

Target system

IC socket

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

Emulation board
IE-178048-NS-EM1

Emulation probe
NP-64CW

20 mm

14 mm

13 mm

8 mm

24 mm
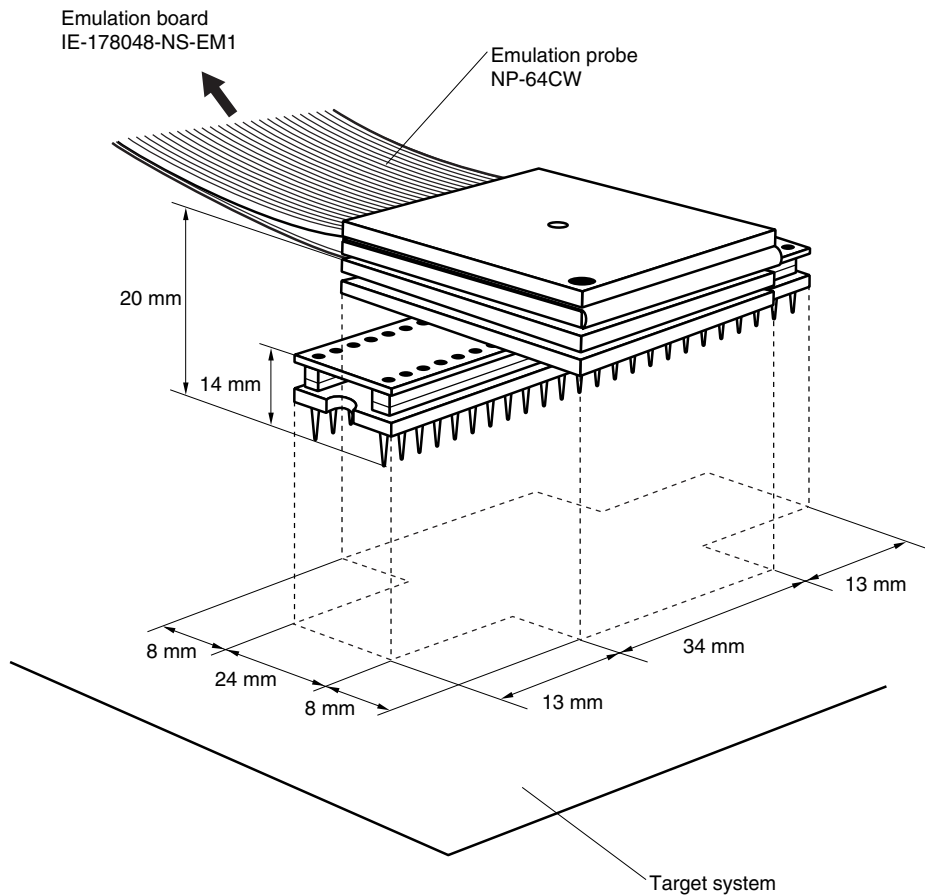
8 mm

34 mm

13 mm

Target system

Figure B-6. Distance Between IE System and IC Socket (When Using NP-H64CW)
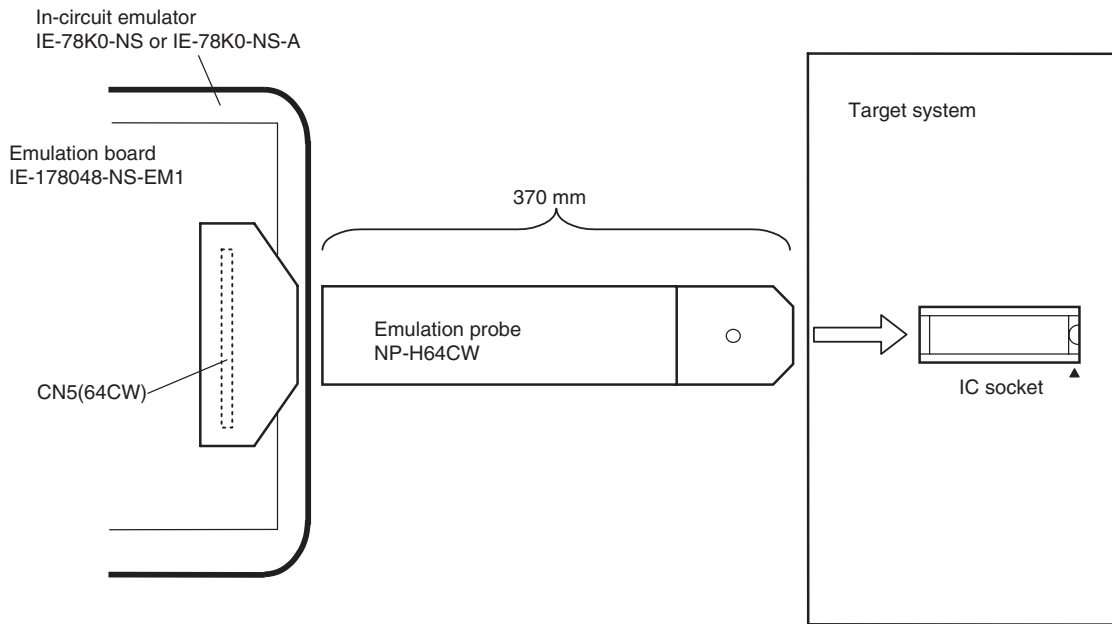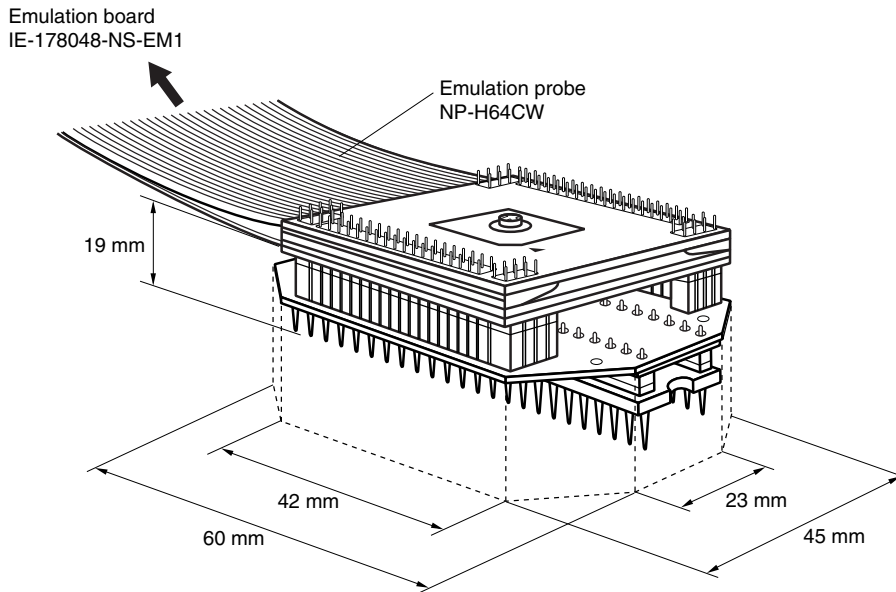

Figure B-7. Connection Conditions of Target System (When Using NP-H64CW)

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