User's Manual

NEC

IE-780831-NS-EM4

Emulation Board

Target Devices
μPD780833Y Subseries

[MEMO]

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- Ordering information

- Product release schedule

- Availability of related technical literature

- Development environment specifications (for example, specifications for third-party tools and components, host computers, power plugs, AC supply voltages, and so forth)

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INTRODUCTION

Product Overview The IE-780831-NS-EM4 is designed to be used with the IE-78K0-NS-P02, 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.

- μPD780833Y Subseries: μPD780833Y, 78F0833Y

Target Readers This manual is intended for engineers who will use the IE-780831-NS-EM4 with the IE-78K0-NS-P02, 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 usage methods and to be knowledgeable about debugging.

Organization When using the IE-780831-NS-EM4, refer to not only this manual (supplied with the IE-780831-NS-EM4) but also the manual that is supplied with the IE-78K0-NS-P02, 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	IE-780831-NS-EM4 User's Manual
• Basic specifications • System configuration • External interface functions	• General • Part names • Installation • Differences between target devices and target interface circuits

IE-78K0-NS-P02 User's Manual
• Function overview • Part names • Installation

Purpose This manual is intended to give users an understanding of the various debugging functions that can be performed when using the IE-780831-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), I/O board (IE-78K0-NS-P02), and the emulation board (IE-780831-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

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-P02 I/O board	U16108E
IE-780831-NS-EM4 Emulation Board	This manual
ID78K Series Integrated Debugger Ver. 2.30 or Later Operation Windows™ Based	U15185E
μPD780833Y Subseries	U13892E

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

CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1 GENERAL

The IE-780831-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 the IE-780831-NS-EM4's system configuration and basic specifications.

- Target devices
  - μPD780833Y Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-780831-NS-EM4's system configuration.

Figure 1-1. System Configuration
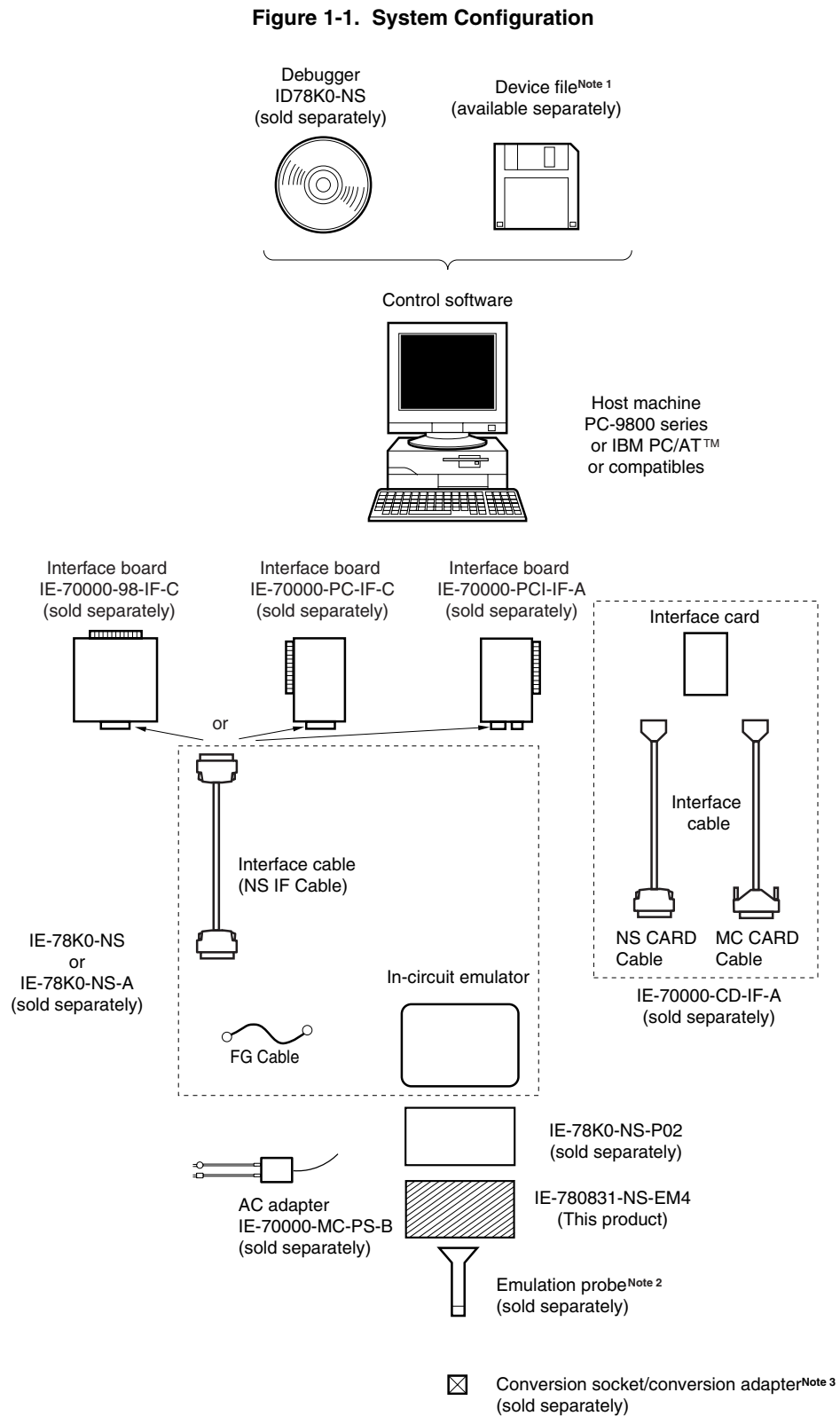
Notes 1. The device file is as follows.

μS××××DF780833: μPD780833Y Subseries

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

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

2. The emulation probes NP-80GC, NP-80GC-TQ, and NP-H80GC-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 adapter TGC-080SBP is a product of TOKYO ELETECH CORPORATION.

For further information, contact Daimaru Kogyo, Ltd.

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

The correspondence between the emulation probes and conversion socket/conversion adapters that are sold separately is shown in the Table 1-1.

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

Package	Emulation Probe	Conversion Socket/Conversion Adapter
80-pin plastic QFP	NP-80GC (Probe length: 200 mm)	EV-9200GC-80
	NP-80GC-TQ (Probe length: 200 mm)	TGC-080SBP
	NP-H80GC-TQ (Probe length: 400 mm)	

1.2 Hardware Configuration

Figures 1-2 and 1-3 show the IE-780831-NS-EM4's position in the basic hardware configuration.

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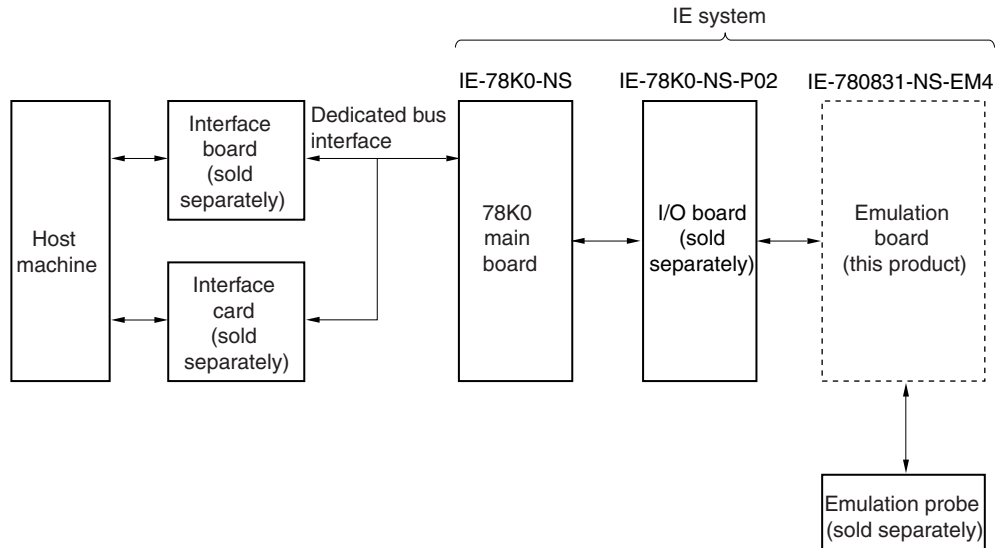
Figure 1-3. Basic Hardware Configuration (Using IE-78K0-NS-A)
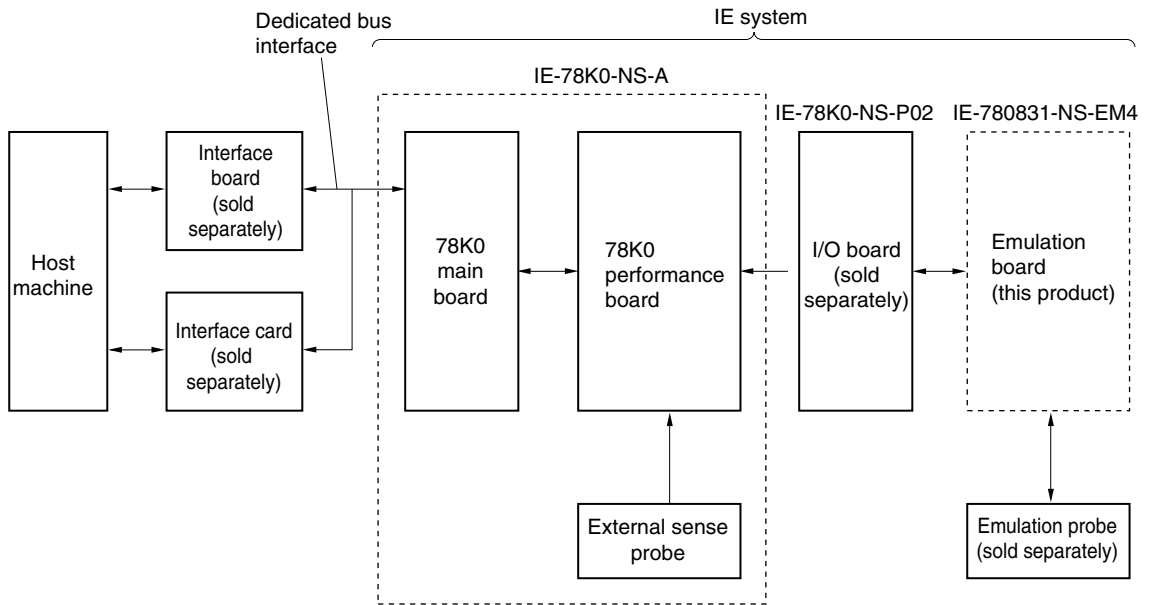
1.3 Basic Specifications

The IE-780831-NS-EM4's basic specifications are listed in Table 1-2.

Table 1-2. Basic Specifications

Parameter	Description
Target device	μPD780833Y, 78F0833Y Subseries
System clock	4.194304 MHz
System clock supply	External: Clock input from the target system via an emulation probe Internal: Clock mounted on the I/O board (4.194304 MHz) or mounted on the parts board by the user
Low voltage support	Not supported

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-780831-NS-EM4 main unit.

The packing box contains the emulation board (IE-780831-NS-EM4), packing list, user's manual, and guarantee card.

If there are any missing or damaged items, please contact an NEC 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-780831-NS-EM4 Part Names
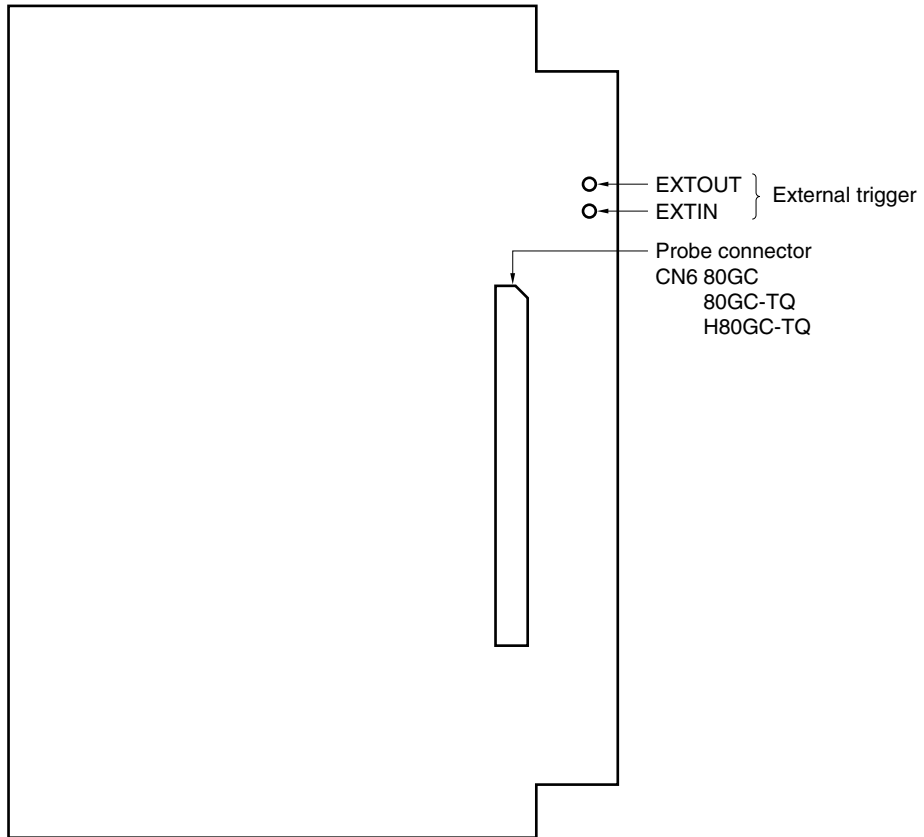
CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-780831-NS-EM4 to the IE-78K0-NS-P02, 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-P02 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-780831-NS-EM4 to the IE-78K0-NS-P02 and IE-78K0-NS.

See the **IE-78K0-NS-A User's Manual (U14889E)** for a description of how to connect the IE-780831-NS-EM4 to the IE-78K0-NS-P02 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-780831-NS-EM4.

On this board, connect the emulation probe to CN6.

> **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

IE-78K0-NS-P02 (sold separately)

Emulation probe (sold separately)

CN6 80GC
80GC-TQ
H80GC-TQ

IE-780831-NS-EM4

Main board of IE-78K0-NS (sold separately) or IE-78K0-NS-A (sold separately)
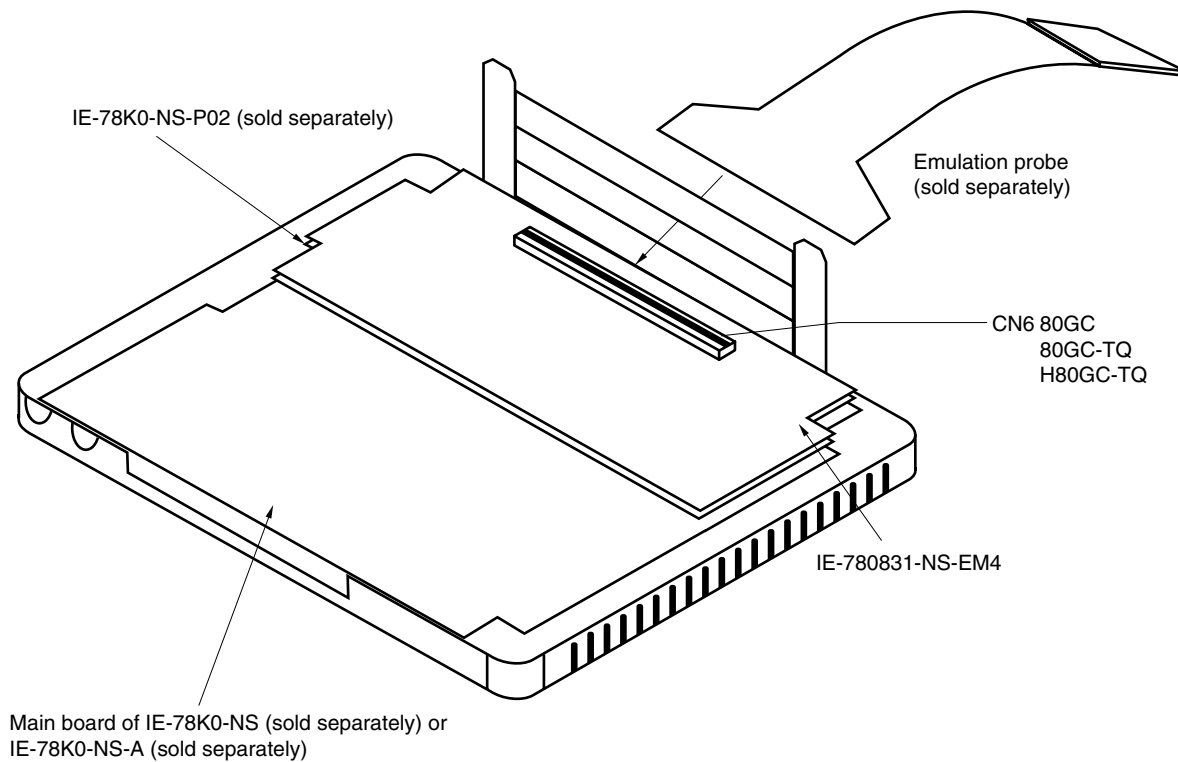
3.2 Clock Settings

3.2.1 Overview of clock settings

The system clocks to be used during debugging can be selected from (1) or (2) below.

(1) Clock that is mounted by user

(2) External clock

If the target system includes an internal clock, select **(1) Clock that is mounted by user**. For an internal clock, a resonator is connected to the target device and the target device's internal oscillator 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 (X1) that is to be mounted on the IE-78K0-NS-P02 is used.

If the target system includes an external clock, select **(2) External clock**.

For an external clock, a clock signal is supplied from outside 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 3-2.

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 Oscillator

(a) Internal clock   (b) External clock
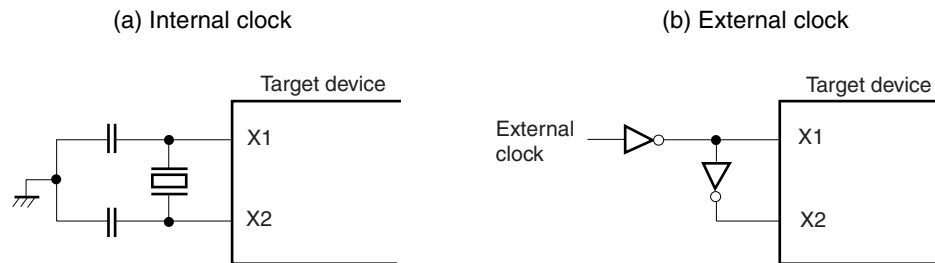
(1) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-78K0-NS-P02.

Remove the parts board (X1) that is already mounted on the IE-78K0-NS-P02, 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 3-3. When Using User-Mounted Clock (System Clock)
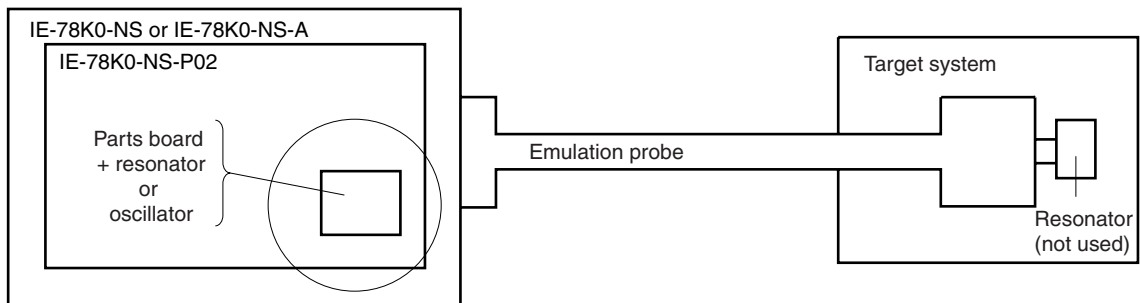
Remark The clock that is supplied by the IE-78K0-NS-P02's resonator or oscillator (encircled in the figure) is used.

(2) External clock

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

Figure 3-4. When Using an External Clock
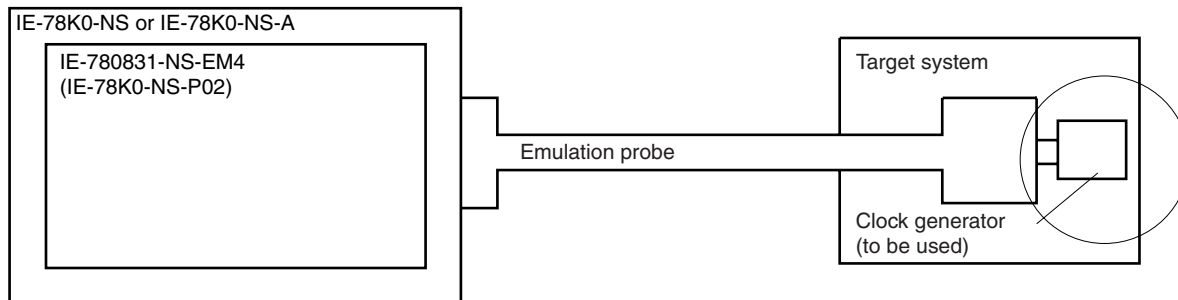
Remark The clock supplied by the target system's clock generator (encircled in the figure) is used.

3.2.2   System clock settings

Table 3-1. System Clock Settings

Frequency of System Clock		IE-78K0-NS-P02	CPU Clock Source Selection (ID78K0-NS)
		X1 Socket	
When using clock mounted by user	Up to 4.194304 MHz	Oscillator assembled by user	External
When using external clock		Oscillator (not used)	

Caution   Open the configuration dialog box when starting the integrated debugger (ID78K0-NS) and select "External" in the area (Clock) for selecting the CPU clock source (this selects the user clock). When "Internal" is selected, the system clock frequency is 8.38 MHz.

(1) When using clock mounted by user

Execute 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 "External" in the area (Clock) for selecting the CPU clock source (this selects the emulator 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 frequency) as shown below.

Figure 3-5. Connections on Parts Board (When Using System Clock or User-Mounted Clock)

Parts board (X1) of
IE-78K0-NS-P02
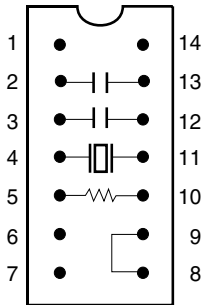
Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Ceramic resonator or crystal resonator
5-10	Resistor Rx
8-9	Shorted

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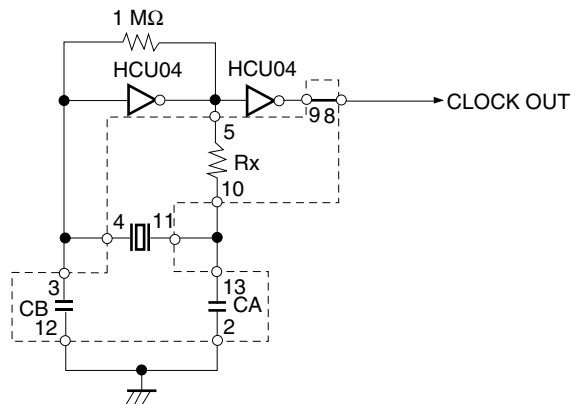
Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

<2> Prepare the IE-78K0-NS-P02.

<3> Remove the crystal oscillator that is mounted in the IE-78K0-NS-P02's X1 socket.

<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 3-5 above.

<6> Connect to the IE-78K0-NS or IE-78K0-NS-A to the combined IE-78K0-NS-P02 and IE-780831-NS-EM4.

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

(b) When using a crystal oscillator

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-6)

Figure 3-6. Crystal Oscillator (When Using System Clock or User-Mounted Clock)

```
NC  ●        ●  Vcc




GND ●        ●  CLOCK OUT
```

<Steps>
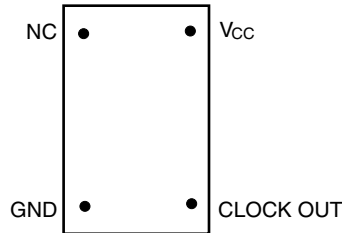
<1> Prepare the IE-78K0-NS-P02.

<2> Remove the parts board that is mounted in the IE-78K0-NS-P02's X1 socket.

<3> Mount the crystal oscillator prepared by the user in the X1 socket from which the parts board was removed in <2> above. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

Figure 3-7. Pin Alignment of Crystal Oscillator and Socket

Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
Vcc	14
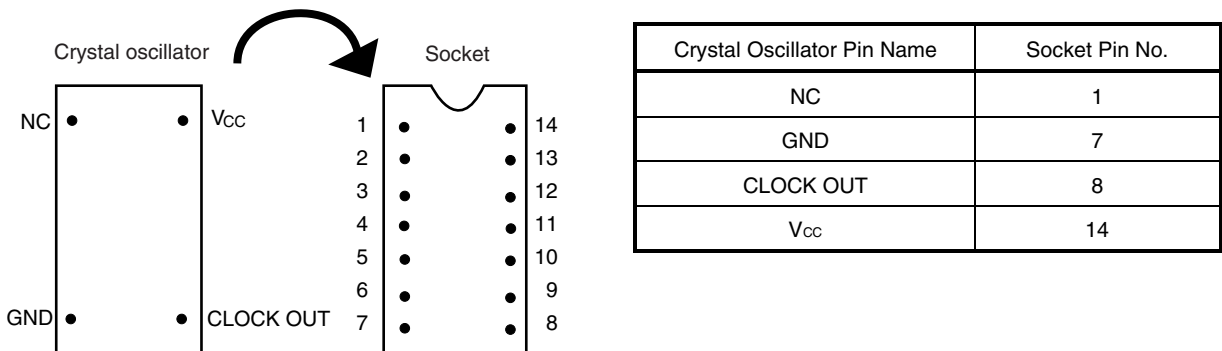
<4> Connect to the IE-78K0-NS or IE-78K0-NS-A to the combined IE-78K0-NS-P02 and IE-780831-NS-EM4.

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

(2) 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 clock).

3.3 External Trigger

Connect the external trigger to the IE-780831-NS-EM4's check pins EXTOUT and EXTIN as shown below.

See the **ID78K Series Operation (Windows Based) User's Manual (U15185E)** 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 3-8. External Trigger Input Position
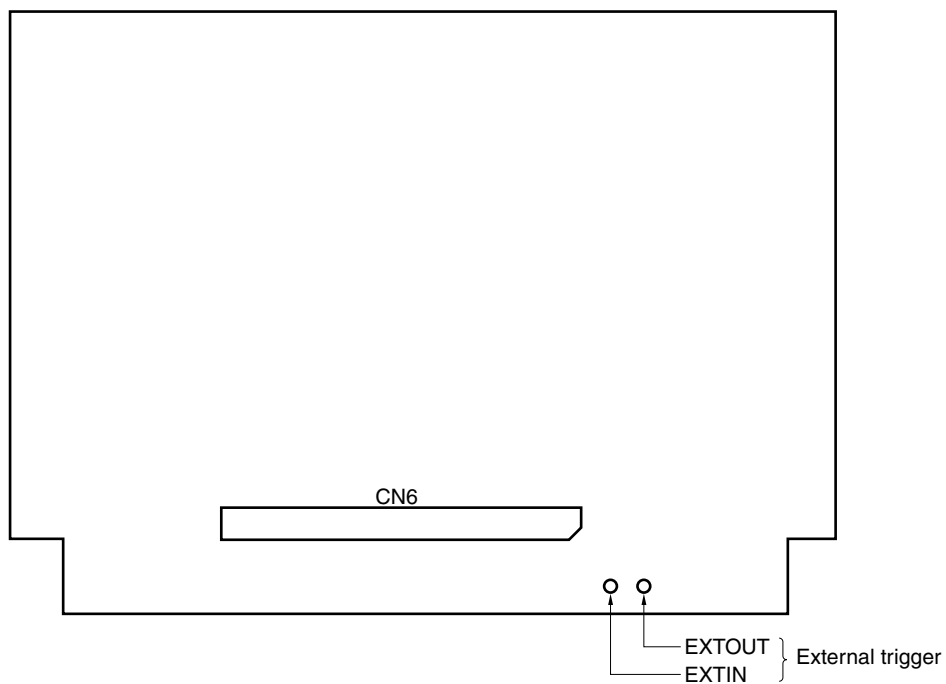
3.4 Jumper Settings on IE-78K0-NS

When using the IE-780831-NS-EM4 in combination with the IE-78K0-NS, set the jumper 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   If the jumpers are 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	3 to 4 shorted

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

When using the IE-780831-NS-EM4 in combination with the IE-78K0-NS-A, set the jumper 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   If the jumpers are 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	3 to 4 shorted

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

	JP2
Setting	2 to 3 shorted

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-780831-NS-EM4's target interface circuit.

Although the target device is a CMOS circuit, the IE-780831-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 (μPD7880)
(2)   Signals input or output from the emulation CPU (μPD7881)
(3)   Other signals

The circuits of the IE-78K0-NS-P02 and IE-780831-NS-EM4's are used as follows for signals listed in (1) to (3) above.

(1)   Signals input to or output from the emulation CPU (μPD7880)
See **Figure 4-1 Equivalent Circuit of Emulation Circuit 1**.

- P27 to P20
- P36 to P30
- P75 to P70
- P87 to P80
- P97 to P90
- AV_{DD0}
- AV_{REF0}
- AV_{SS0}
- AV_{REF1}
- AV_{SS1}
- $\overline{RESET}$
- X1

(2)   Signals input to or output from the emulation CPU (μPD7881)
See **Figure 4-2 Equivalent Circuit of Emulation Circuit 2**.

- P07 to P00
- P47 to P40
- P57 to P50
- P67 to P64

(3) Other signals

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

- V_{DD0}, V_{DD1}
- V_{SS0}, V_{SS1}
- V_{PP}/TEST
- X2
- C2TX
- C2RX

Figure 4-1. Equivalent Circuit of Emulation Circuit 1
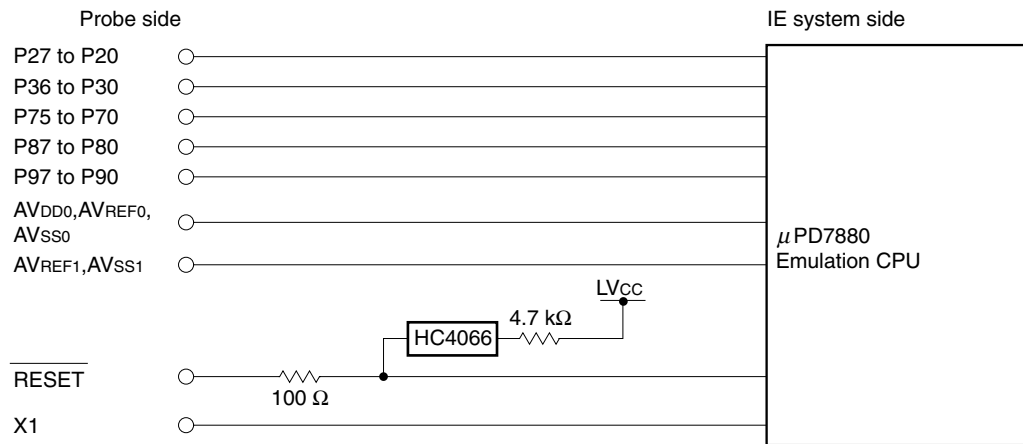
Figure 4-2. Equivalent Circuit of Emulation Circuit 2

Figure 4-3. Equivalent Circuit of Emulation Circuit 3

Probe side   IE system side

V_{CC}

V_{DD0}, V_{DD1} 100 Ω

$0.1\mu F$ 1 MΩ μPC393

V_{SS0}, V_{SS1}

V_{PP}/TEST,   Open
X2

C2TX,C2RX   Internal circuit
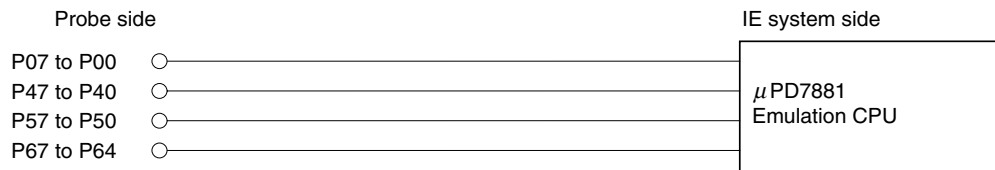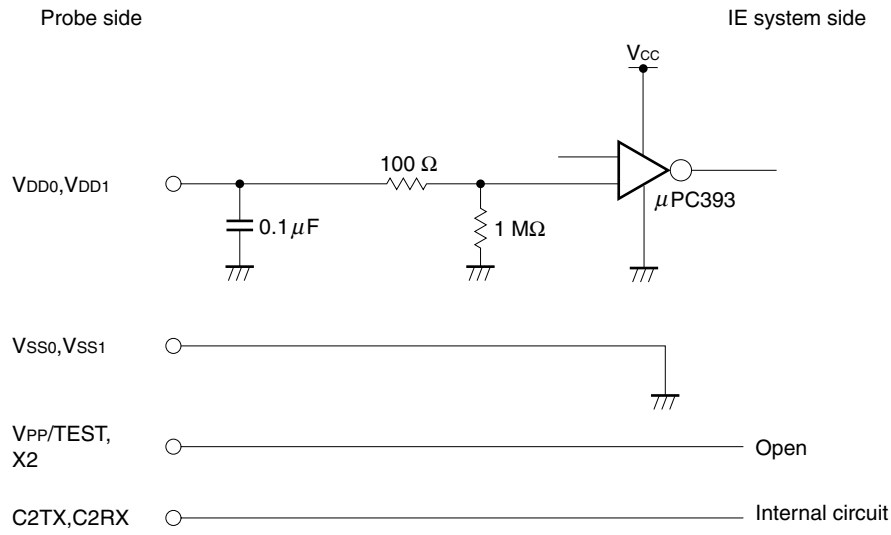
CHAPTER 5 RESTRICTIONS

The restrictions for the IE-780831-NS-EM4 are shown below.

(1) When the target system is not connected, the initial values of the ports are undefined.

Table 5-1. Initial Values of Ports at IE System Startup While Target System Is Not Connected

	Emulator	Target Device
Initial value of port	Undefined	00H

(2) The values of the bits fixed to 1 become undefined in the port mode registers PM3, PM6, and PM7.
- Bit 7 of PM3
- Bits 0, 1, 2, and 3 of PM6
- Bits 6 and 7 of PM7

APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. NP-80GC, NP-80GC-TQ, and NP-H80GC-TQ Pin Assignments (1/2)

Emulation Probe	CN6 Pin No.	Emulation Probe	CN6 Pin No.
1	114	33	56
2	113	34	49
3	108	35	50
4	107	36	45
5	104	37	46
6	103	38	41
7	100	39	42
8	99	40	35
9	94	41	8
10	93	42	7
11	30	43	14
12	29	44	13
13	24	45	18
14	23	46	17
15	20	47	22
16	19	48	21
17	16	49	28
18	15	50	27
19	10	51	92
20	9	52	91
21	37	53	98
22	43	54	97
23	44	55	102
24	47	56	101
25	48	57	106
26	51	58	105
27	52	59	112
28	57	60	111
29	58	61	83
30	59	62	77
31	60	63	78
32	55	64	73

Remarks 1. The NP-80GC, NP-80GC-TQ, and NP-H80GC-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.

Table A-1. NP-80GC, NP-80GC-TQ, and NP-H80GC-TQ Pin Assignments (2/2)

Emulation Probe	CN6 Pin No.	Emulation Probe	CN6 Pin No.
65	74	73	66
66	69	74	71
67	70	75	72
68	63	76	75
69	64	77	76
70	61	78	79
71	62	79	80
72	65	80	85

Remarks 1. The NP-80GC, NP-80GC-TQ, and NP-H80GC-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.

APPENDIX B CAUTIONS ON DESIGNING TARGET SYSTEM

Figures B-1 to B-3 show 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.

In the product names described in this appendix, NP-80GC-TQ and NP-H80GC-TQ are products of Naito Densei Machida Mfg. Co., Ltd. and TGC-080SBP 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-80GC-TQ	TGC-080SBP	170 mm
NP-H80GC-TQ		370 mm

Figure B-1. Distance Between IE System and Conversion Adapter
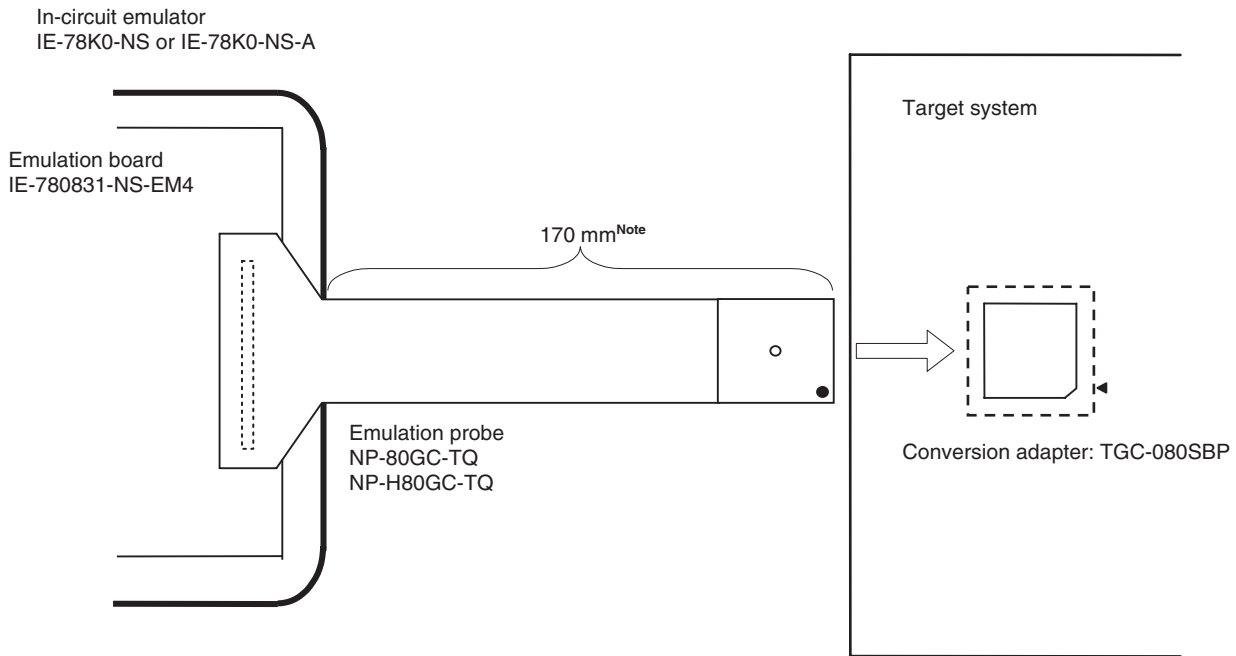
Note Distance when NP-80GC-TQ is used. When NP-H80GC-TQ is used, the distance is 370 mm.

Figure B-2. Connection Condition of Target System (NP-80GC-TQ)

Emulation board
IE-780831-NS-EM4

Emulation probe
NP-80GC-TQ

24.8 mm

Conversion
adapter
TGC-080SBP

11 mm

25 mm

21 mm

1pin

21 mm

40 mm

34 mm
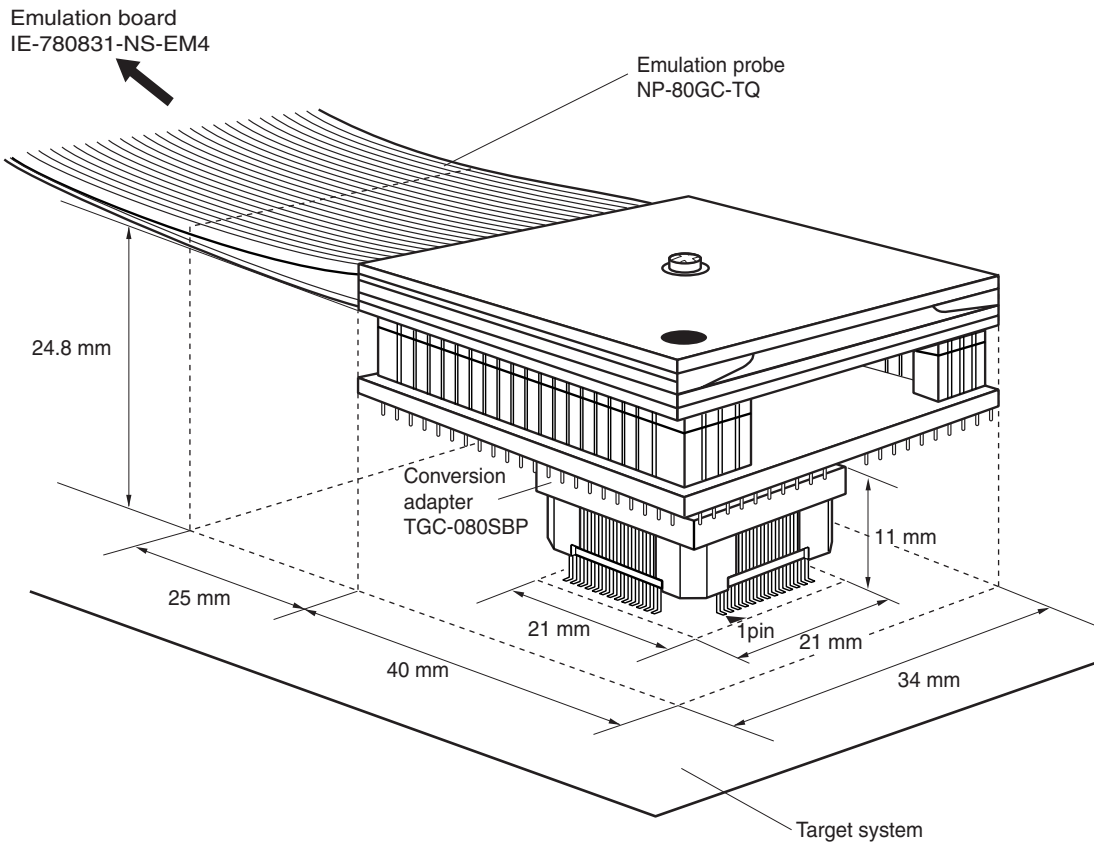
Target system

Figure B-3. Connection Condition of Target System (NP-H80GC-TQ)

Emulation board
IE-780831-NS-EM4

Emulation probe
NP-H80GC-TQ

25.3 mm

Conversion
adapter
TGC-080SBP

11 mm

25 mm

21 mm

1pin

21 mm

42 mm

45 mm

Target system

33
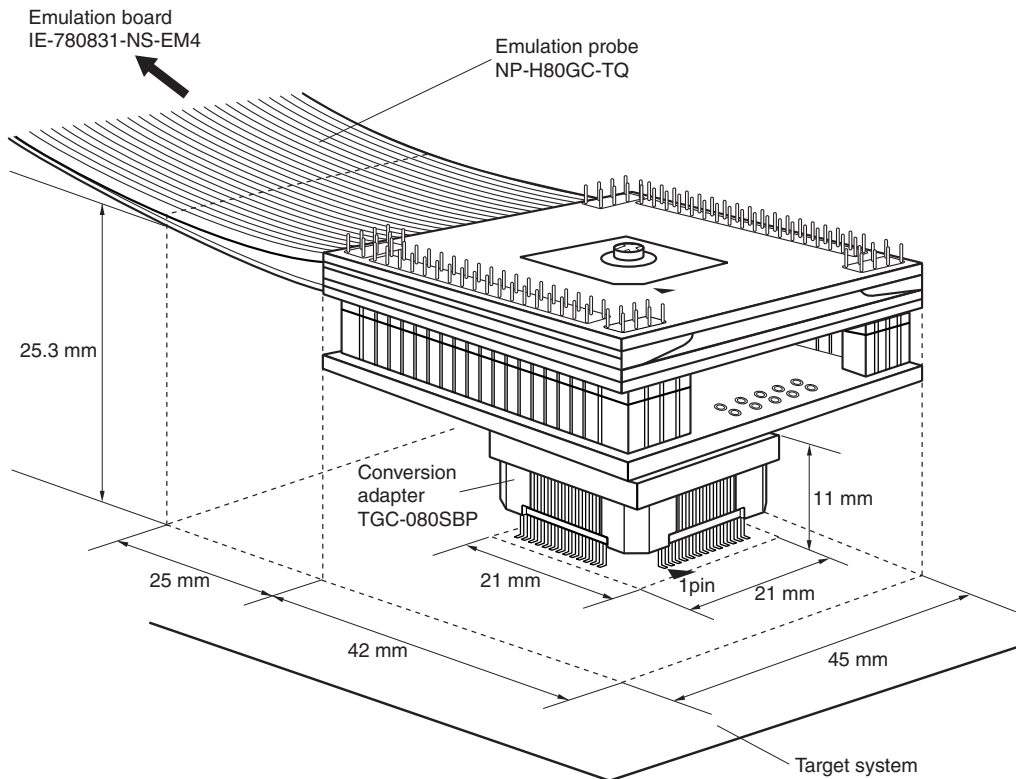
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