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## **User's Manual**

# **IE-78098-NS-EM1**

## **Emulation Board**

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### **Target Devices**

**$\mu$ PD78098 Subseries**

**$\mu$ PD78098B Subseries**

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# INTRODUCTION

## Product Overview

The IE-78098-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 78K/0 Series of 8-bit single-chip microcontrollers.

- $\mu$ PD78098 Subseries:  $\mu$ PD78094, 78095, 78096, 78P098, 78P098A
- $\mu$ PD78098B Subseries:  $\mu$ PD78095B, 78096B, 78097B, 78098B, 78P098B

## Target Readers

This manual is intended for engineers who will use the IE-78098-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-78098-NS-EM1, refer to not only this manual (supplied with the IE-78098-NS-EM1) but also the manual that is supplied with the IE-78K0-NS or IE-78K0-NS-A.

IE-78K0-NS  
User's Manual

- Basic specifications
- System configuration
- External interface functions

IE-78098-NS-EM1  
User's Manual

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

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

- Basic specifications
- System configuration
- External interface functions

## Purpose

This manual's purpose is to explain various debugging functions that can be performed when using the IE-78098-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 the device to be emulated.
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-78098-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 In-Circuit Emulator	U13731E
IE-78K0-NS-A In-Circuit Emulator	U14889E
IE-78098-NS-EM1 Emulation Board	This manual
ID78K Series Integrated Debugger Ver. 2.30 or Later Operation Windows™ Based	U15185E
μPD78098 Subseries	IEU-1381A
μPD78098B Subseries	U12761E

**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-78098-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 78K/0 Series of 8-bit single-chip microcontrollers.

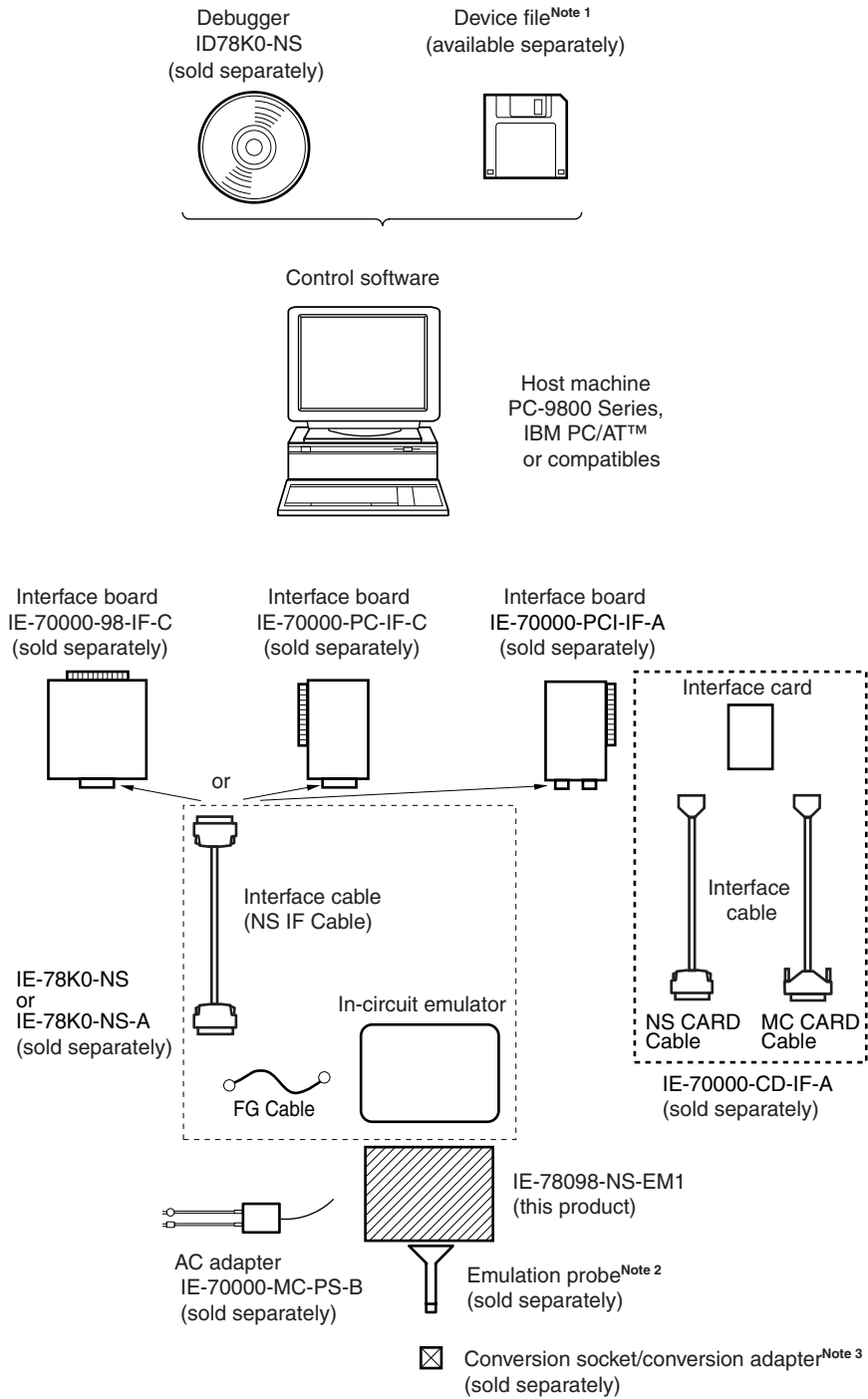
This chapter describes the IE-78098-NS-EM1's system configuration and basic specifications.

- Target devices
  - $\mu$ PD78098 Subseries
  - $\mu$ PD78098B Subseries

## 1.1 System Configuration

Figure 1-1 illustrates the IE-78098-NS-EM1's system configuration.

**Figure 1-1. System Configuration**



**Notes** 1. The device file is as follows, in accordance with the subseries.

$\mu$ SxxxxDF78098:  $\mu$ PD78098, 78098B Subseries

The device file can be downloaded from the website of NEC Electronics (<http://www.necel.com/micro/>)

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

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

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

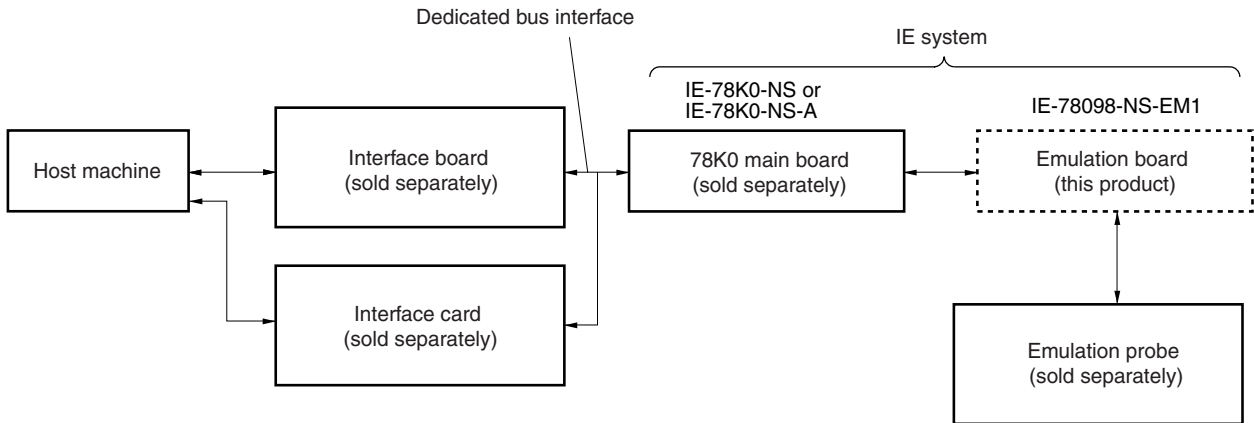
**Table 1-1. Correspondence Between Emulation Probes and Conversion Socket/Conversion Adapters**

Package	Emulation Probe	Conversion Socket/Conversion Adapter
80-pin plastic QFP (GC type)	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)	

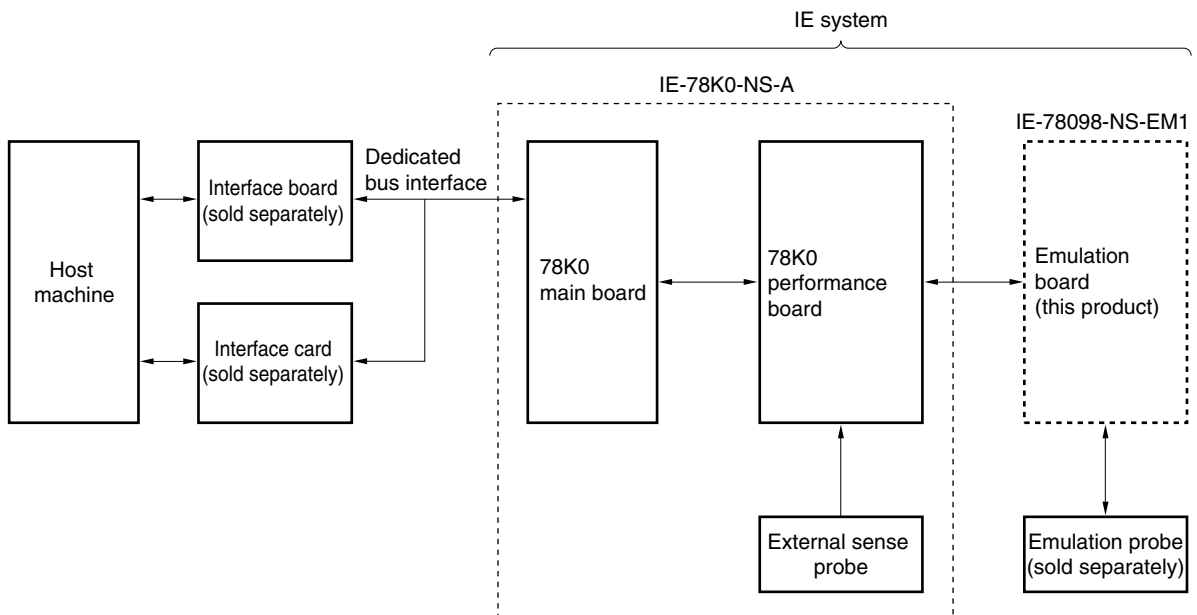
## 1.2 Hardware Configuration

Figure 1-2 shows the IE-78098-NS-EM1's position in the basic hardware configuration.

**Figure 1-2. Basic Hardware Configuration (When IE-78K0-NS Is Used)**



**Figure 1-3. Basic Hardware Configuration (When IE-78K0-NS-A Is Used)**



### 1.3 Basic Specifications

The basic specifications of the IE-78098-NS-EM1 are listed in Table 1-2.

**Table 1-2. Basic Specifications**

Parameter	Description
Target device	$\mu$ PD78098, 78098B Subseries
System clock	Main system clock: 6.000 MHz Subsystem clock: 32.768 kHz
Main system clock supply	External: Input via an emulation probe from the target system Internal: Mounted on the emulation board (6.000 MHz), or mounted on the parts board by the user
Subsystem clock supply	External: Input via an emulation probe from the target system Internal: Mounted on the emulation board (32.768 kHz), or mounted on the parts board by the user
Low-voltage support	$V_{DD} = 2.7$ to 5.5 V (same as target device)



## CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-78098-NS-EM1 main unit.

The packing box contains the emulation board (IE-78098-NS-EM1), packing list, user's manual, and guarantee card.

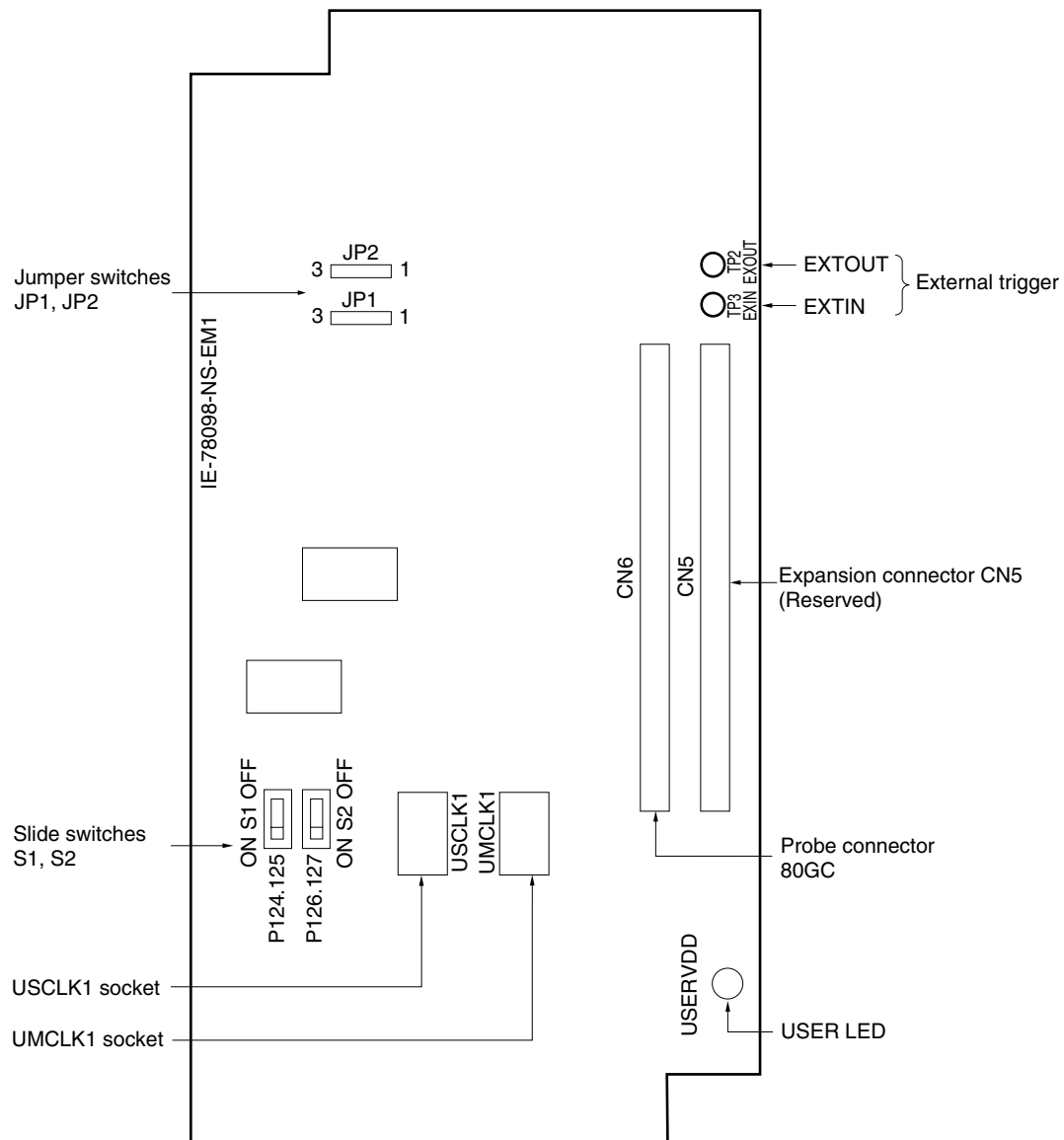
If there are any missing or damaged items, please contact an NEC Electronics sales representative.

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

## 2.1 Parts of Main Unit

Figure 2-1 shows the part names of the IE-78098-NS-EM1.

Figure 2-1. IE-78098-NS-EM1 Part Names



## CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-78098-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 the **IE-78K0-NS User's Manual (U13731E)** for a description of how to connect the IE-78098-NS-EM1 to the IE-78K0-NS<sup>Note</sup>.

**Note** When using the IE-78K0-NS-A, see the **IE-78K0-NS-A User's Manual (U14889E)**.

#### (2) Connection with emulation probe

See the **IE-78K0-NS User's Manual (U13731E)** for a description of how to connect an emulation probe to the IE-78098-NS-EM1<sup>Note</sup>.

On this board, connect the emulation probe to CN6.

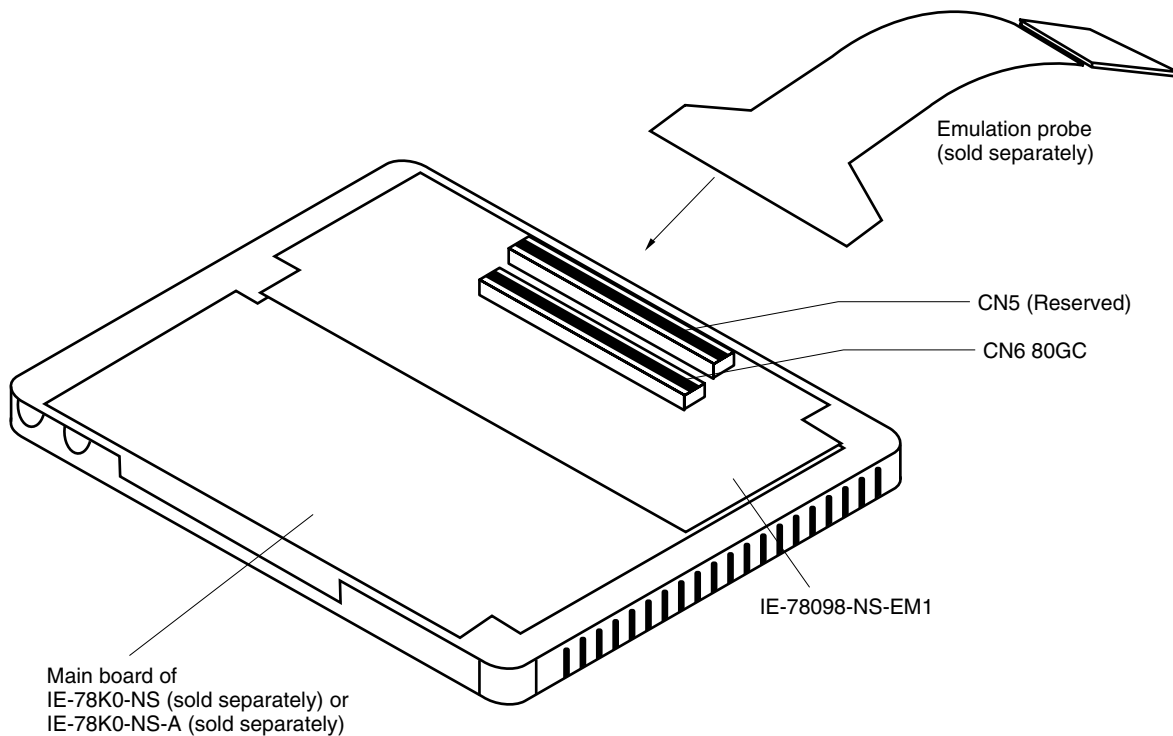
Do not connect the emulation probe to CN5.

**Note** When using the IE-78K0-NS-A, see the **IE-78K0-NS-A User's Manual (U14889E)**.

**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 main system clock and subsystem 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) Pulse input from target system

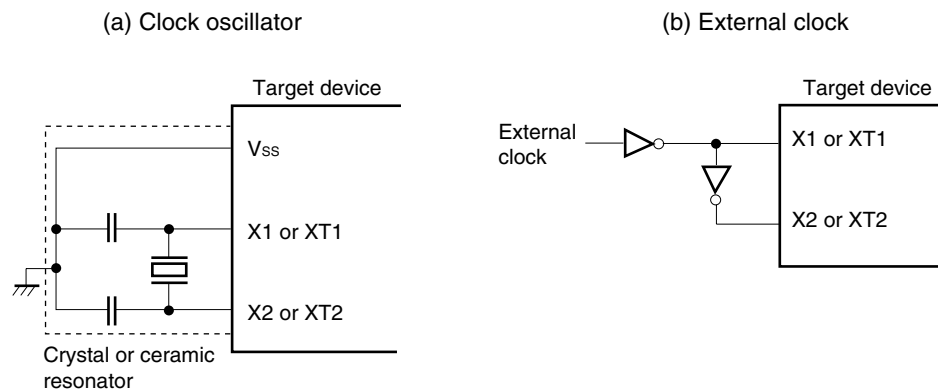
If the target system includes a clock oscillator, select either **(1) Clock that is already mounted on emulation board** or **(2) Clock that is mounted by user**. For the clock oscillator, a resonator is connected to the target device and the target device's internal oscillator is used. An example of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

If the target system includes an external clock, select either **(1) Clock that is already mounted on emulation board**, **(2) Clock that is mounted by user**, or **(3) Pulse input from target system**.

For the 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 3-2.

**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 pulse from the target system. There is no need to supply a clock to the X2 and XT2 pins. Also, even if a crystal resonator is connected directly to X1 (for the main system clock) or XT1 (for the subsystem clock), the target device will not operate.

Figure 3-2. External Circuits Used as System Clock Oscillator



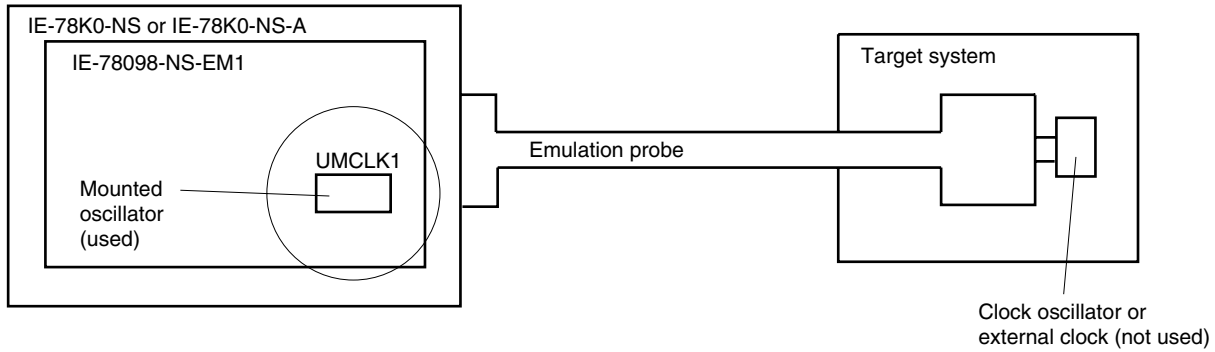
**(1) Clock that is already mounted on emulation board**

The crystal oscillator mounted on the IE-78098-NS-EM1 can be used.

**(a) Main system clock**

A crystal oscillator (UMCLK1) is already mounted on the emulation board. Its frequency is 6.000 MHz.

**Figure 3-3. When Using Clock That Is Already Mounted on Emulation Board (Main System Clock)**

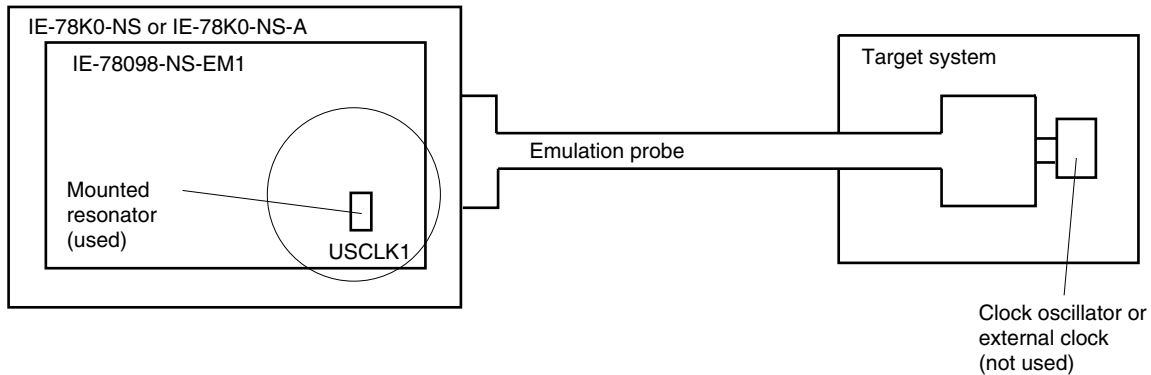


**Remark** The clock that is supplied by the oscillator of the IE-78098-NS-EM1 (encircled in the figure) is used.

**(b) Subsystem clock**

A crystal resonator (USCLK1) is already mounted on the emulation board. Its frequency is 32.768 kHz

**Figure 3-4. When Using Clock That Is Already Mounted on Emulation Board (Subsystem Clock)**



**Remark** The clock that is supplied by the resonator of the IE-78098-NS-EM1 (encircled in the figure) is used.

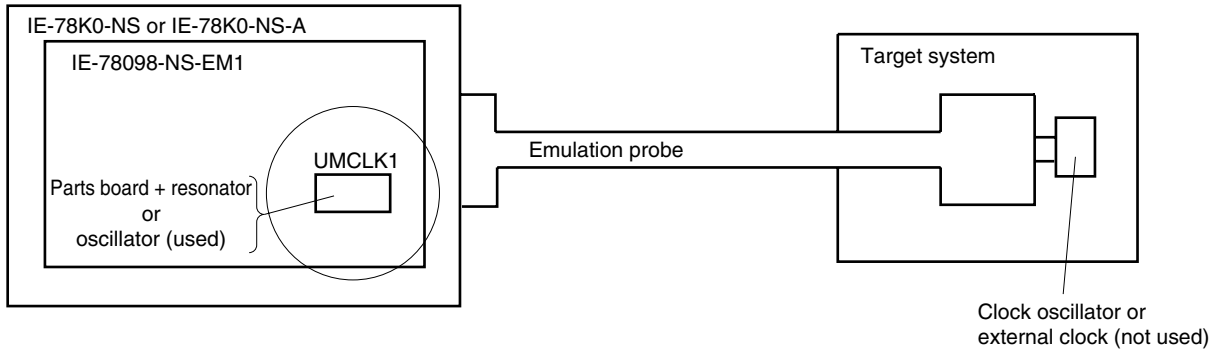
**(2) Clock that is mounted by user**

The user can mount any clock supported by the set specifications on the IE-78098-NS-EM1. This feature is effective when debugging at a different frequency than the clock already mounted.

**(a) Main system clock**

Remove the crystal oscillator (UMCLK1) that is already mounted on the emulation board, and mount the parts board on which the resonator to be used is mounted or mount the oscillator to be used.

**Figure 3-5. When Using User-Mounted Clock (Main System Clock)**

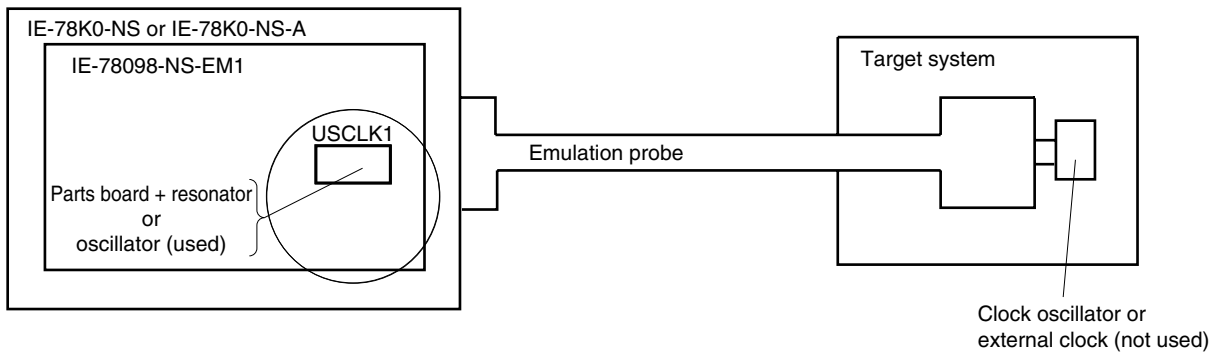


**Remark** The clock that is supplied by the resonator of the IE-78098-NS-EM1 (encircled in the figure) or the oscillator is used.

**(b) Subsystem clock**

Remove the parts board (USCLK1) that is already mounted on the emulation board, and mount the parts board on which the resonator to be used is mounted or mount the oscillator to be used.

**Figure 3-6. When Using User-Mounted Clock (Subsystem Clock)**

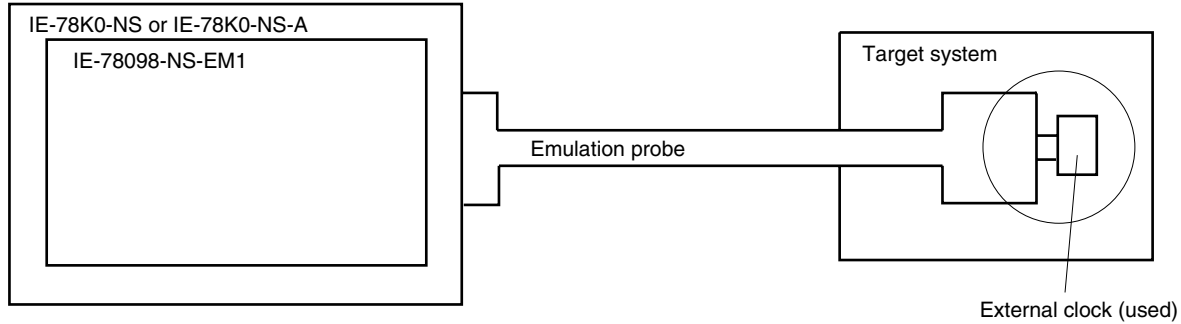


**Remark** The clock that is supplied by the resonator of the IE-78098-NS-EM1 (encircled in the figure) or the oscillator is used.

**(3) Pulse input from target system**

An external clock on the target system can be used as both the main system clock and subsystem clock via an emulation probe.

**Figure 3-7. When Supplying Pulse from Target System**



**Remark** The pulse that is supplied by the external clock on the target system (encircled in the figure) or the oscillator is used.

**3.2.2 Main system clock settings**

Table 3-1 shows the settings of the IE-78098-NS-EM1 when the main system clocks in (1) to (3) are used.

**Table 3-1. Main System Clock Settings**

Frequency of Main System Clock		IE-78098-NS-EM1	CPU Clock Source Selection (ID78K0-NS)
		UMCLK1 Socket	
(1) When using clock that is already mounted on emulation board	6.000 MHz	Oscillator	Internal
(2) When using clock mounted by user	Other than 6.000 MHz	Oscillator configured by user	
(3) When inputting pulse from target system		Oscillator (not used)	External

**Caution** When inputting a pulse from the target system, 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 factory settings of the IE-78098-NS-EM1 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-78098-NS-EM1 is shipped, a 6.000 MHz crystal oscillator is already mounted in the IE-78098-NS-EM1’s UMCLK1 socket. 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

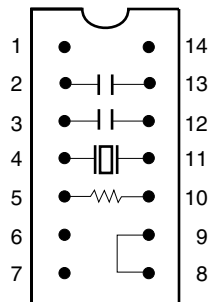
- Parts board
- Ceramic resonator or crystal resonator
- Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

<Steps>

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

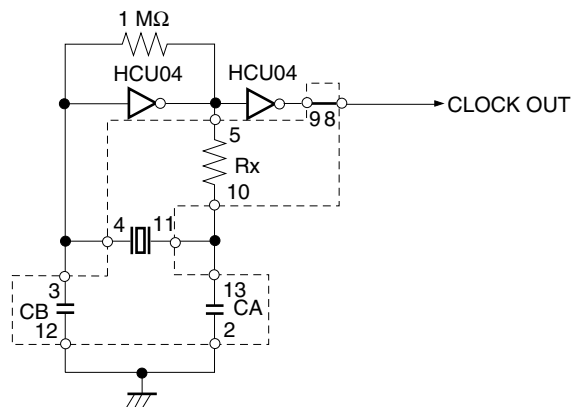
**Figure 3-8. Connections on Parts Board (Main System Clock)**

Parts board (UMCLK1)



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.

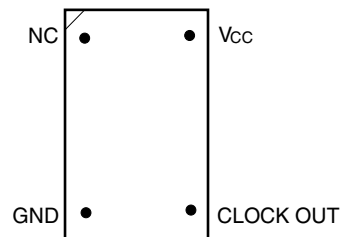
- <2> Prepare the IE-78098-NS-EM1.
- <3> Remove the crystal oscillator that is mounted in the IE-78098-NS-EM1's UMCLK1 socket.
- <4> Connect the parts board (from <1> above) to the UMCLK1 socket from which the crystal oscillator was removed. Check the pin 1 mark to make sure the board is mounted in the correct direction.
- <5> Make sure that the parts board is wired as shown in Figure 3-8 above.
- <6> Install the IE-78098-NS-EM1 in 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.

**(b) When using a crystal oscillator**

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-9)

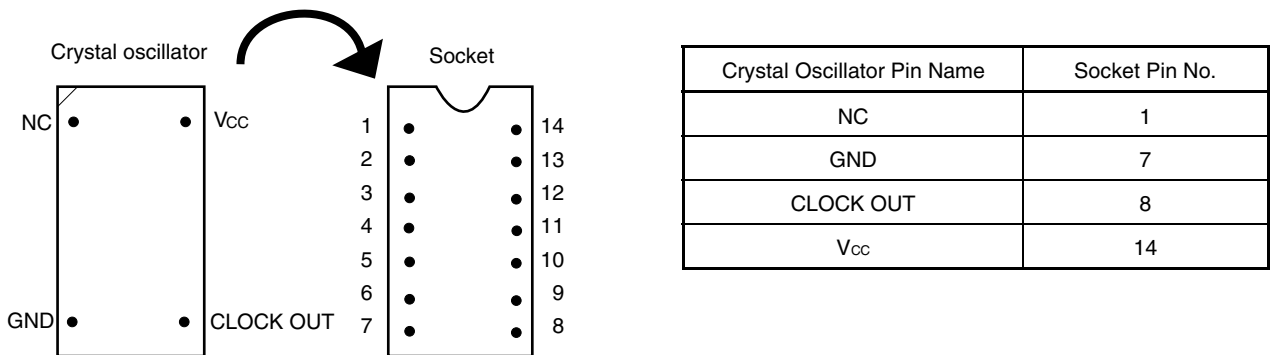
**Figure 3-9. Crystal Oscillator (Main System Clock)**



**<Steps>**

- <1> Prepare the IE-78098-NS-EM1.
- <2> Remove the crystal oscillator that is mounted in the IE-78098-NS-EM1's UMCLK1 socket.
- <3> Connect a crystal oscillator to the UMCLK1 socket from which the crystal oscillator was removed (in <2> above). Insert the pins of the crystal oscillator into the socket aligning the pins as shown in the figure below.

**Figure 3-10. Pin Alignment of Crystal Oscillator and Socket (Main System Clock)**



<4> Install the IE-78098-NS-EM1 in the IE-78K0-NS or IE-78K0-NS-A.

**(3) When inputting pulse from target system**

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).

3.2.3 Subsystem clock settings

Table 3-2 shows the settings of the IE-78098-NS-EM1 when the subsystem clocks in (1) to (3) are used.

**Table 3-2. Subsystem Clock Settings**

Frequency of Subsystem Clock		IE-78098-NS-EM1	IE-78K0-NS or IE-78K0-NS-A	ID78K0-NS
		USCLK1 Socket	JP1	Mask Option Setting
(1) When using clock that is already mounted on emulation board	32.768 kHz	6 and 8 shorted	2 and 3 shorted	XT1
(2) When using clock mounted by user	Other than 32.768 kHz	Oscillator configured by user		
(3) When inputting pulse from target system		Not used	1 and 2 shorted	

**Caution** Before setting JP8 to switch between the clock on the board and external clock, turn off the power of the IE-78K0-NS or IE-78K0-NS-A.

**Remark** The factory settings of the IE-78098-NS-EM1 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-78098-NS-EM1 is shipped, a 32.768 kHz crystal resonator and a parts board (USCLK1) on which pins 6 and 8 are shorted are already mounted on the IE-789306-NS-EM1. Short 1 and 2 of the jumper (JP8) on the IE-78098-NS-EM1. Set XT1 using the mask option setting dialog box on the integrated debugger (ID78K0-NS). For operations, refer to the **ID78K0-NS User’s Manual (U15185E)**.

**(2) When using clock mounted by user**

Perform the settings in (a) or (b) below, depending on the type of clock to be used. Short 1 and 2 of the jumper (JP8) on the IE-78098-NS-EM1. For jumper locations, refer to the **IE-78K0-NS User’s Manual (U13731E)** when using the IE-78K0-NS or the **IE-78K0-NS-A User’s Manual (U14889E)** when using the IE-78K0-NS-A. Set XT1 using the mask option setting dialog box on the integrated debugger (ID78K0S-NS). For operations, refer to the **ID78K0-NS User’s Manual (U15185E)**.

**(a) When using a ceramic resonator or crystal resonator**

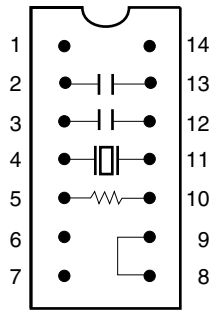
- Items to be prepared
  - Ceramic resonator or crystal resonator
  - Resistor Rx
  - Capacitor CA
  - Capacitor CB
  - Solder kit

<Steps>

- <1> Prepare the IE-78098-NS-EM1.
- <2> Solder the target ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequencies) onto the parts board (USCLK1).

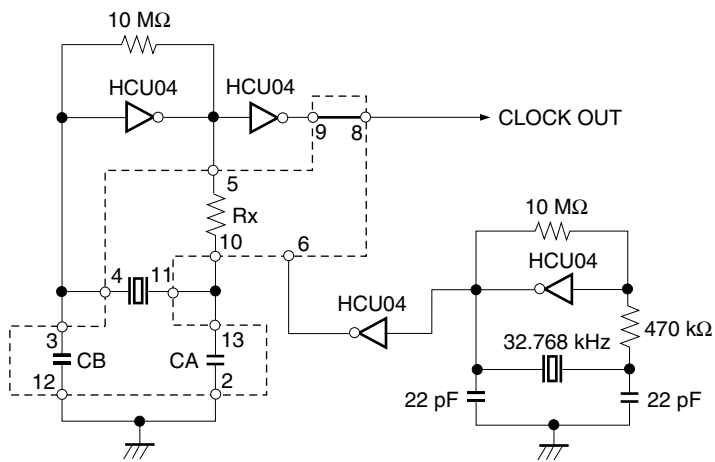
**Figure 3-11. Connections on Parts Board (Subsystem Clock)**

Parts board (USCLK1)



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



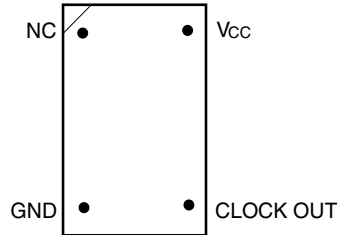
**Remark** The sections enclosed in broken lines indicate parts that are attached to the parts board.

- <3> Make sure that the parts board (USCLK1) is wired as shown in Figure 3-11 above.
- <4> Install the IE-78098-NS-EM1 in the IE-78K0-NS or IE-78K0-NS-A.

**(b) When using a crystal oscillator**

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-12)

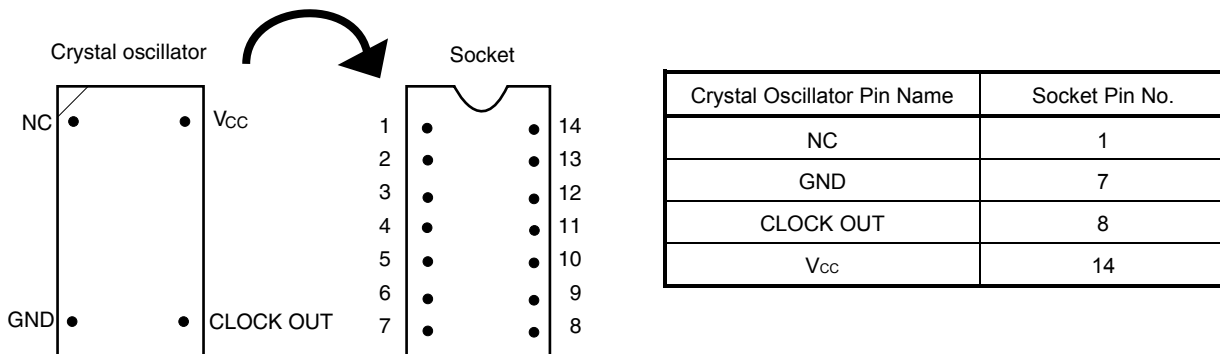
**Figure 3-12. Crystal Oscillator (Subsystem Clock)**



<Steps>

- <1> Prepare the IE-78098-NS-EM1.
- <2> Remove the parts board that is mounted in the USCLK1 socket of the IE-78098-NS-EM1.
- <3> Connect a crystal oscillator to the USCLK1 socket from which the parts board was removed (in <2> above). Insert the crystal oscillator pins into the socket aligning the pins as shown in the figure below.

**Figure 3-13. Pin Alignment of Crystal Oscillator and Socket (Subsystem Clock)**



- <4> Install the IE-78098-NS-EM1 in the IE-78K0-NS or IE-78K0-NS-A.

**(3) When inputting pulse from target system**

Short 3 and 4 of the jumper (JP8) on the IE-78K0-NS or IE-78K0-NS-A.  
 Set XT1 using the mask option setting dialog box on the integrated debugger (ID78K0-NS). For operations, refer to the **ID78K0-NS User's Manual (U15185E)**.

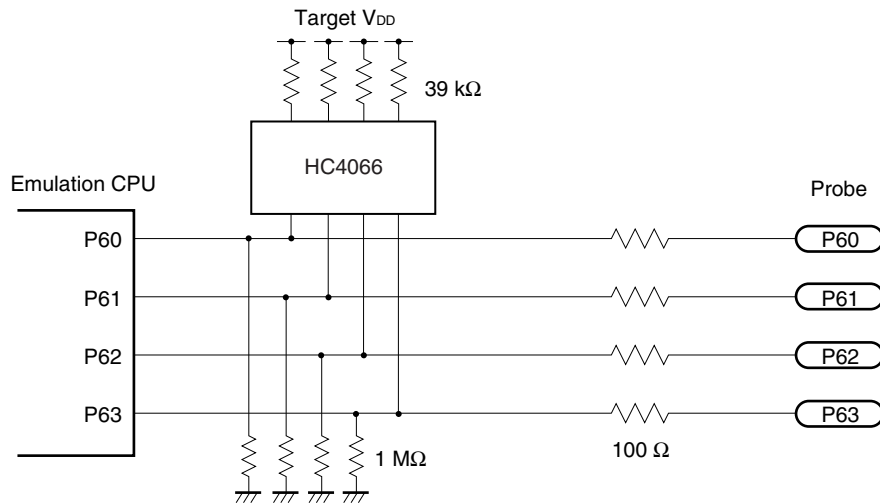
### 3.3 Mask Option Setting

#### 3.3.1 Pull-up resistor

By setting the integrated debugger (ID78K0-NS), a 33 k $\Omega$  pull-up resistor can be connected to P60 to P63 by mask option.

Pull-up resistors are pulled up by the V<sub>DD</sub> pin of the target socket.

**Figure 3-14. Pull-up Resistor**



#### 3.3.2 Switching alternate-function pins

By setting the integrated debugger (ID78K0-NS), the P07/XT1 port and subsystem clock are switched by mask option.

### 3.4 External Trigger

To set an external trigger, connect the IE-78098-NS-EM1's check pins EXTOUT and EXTIN as shown below.

See the **IE-78K0-NS User's Manual (U13731E)** or **IE-78K0-NS-A User's Manual (U14889E)** for pin characteristics.

For the use methods, see the **ID78K Series Ver.2.30 or Later Operation Windows Based User's Manual (U15185E)**.

#### (1) EXTOUT

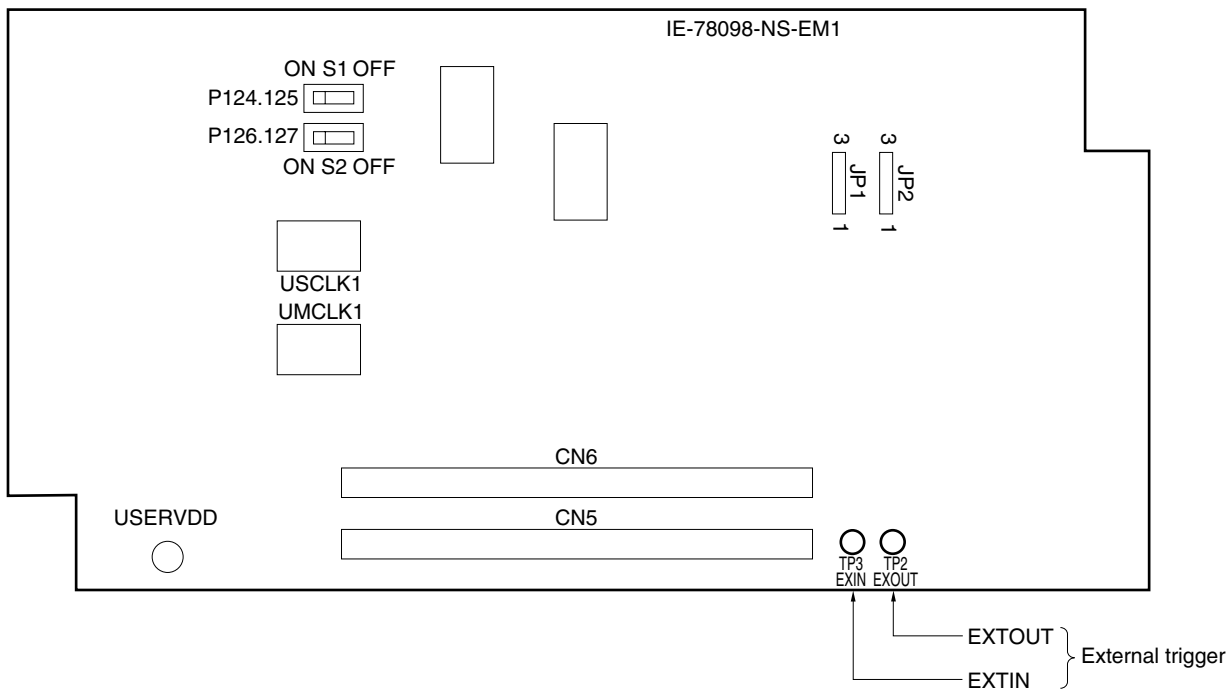
The EXTOUT pin on the IE-78098-NS-EM1 outputs a low level for 1.3  $\mu$ s when a break event occurs.

**Caution** Connect a pull-up resistor on the target system because this is an open drain output.

#### (2) EXTIN

An event signal can be input from the EXTIN pin on the IE-78098-NS-EM1. Input a high-level pulse signal for 2 CPU operation clocks or more.

**Figure 3-15. External Trigger Input Position**





### 3.5 Jumper Setting of IE-78K0-NS

When using the IE-78098-NS-EM1 with the IE-78K0-NS, set the jumpers of the IE-78K0-NS as follows. For jumper locations, refer to the IE-78K0-NS User's Manual (U13731E).

**Caution** Incorrect jumper setting may damage the IE-78098-NS-EM1.

**Table 3-3. Jumper settings of IE-78K0-NS**

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 and 3 shorted	1 and 2 shorted	1 and 2 shorted	3 and 4 shorted	1 and 2 shorted	1 and 2 shorted (internal subsystem clock) or 3 and 4 shorted (external subsystem clock)

### 3.6 Jumper Setting of IE-78K0-NS

When using the IE-78098-NS-EM1 with the IE-78K0-NS-A, set the jumpers of the IE-78K0-NS-A as follows. For jumper locations, refer to the IE-78K0-NS-A User's Manual (U148891E).

**Caution** Incorrect jumper setting may damage the IE-78098-NS-EM1.

**Table 3-4. Jumper settings on G-780009 Board of IE-78K0-NS-A**

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 and 3 shorted	1 and 2 shorted	1 and 2 shorted	3 and 4 shorted	1 and 2 shorted	1 and 2 shorted (internal subsystem clock) or 3 and 4 shorted (external subsystem clock)

**Table 3-5. Jumper setting on G-78K0H Option Board of IE-78K0-NS-A**

	JP2
Setting	2 and 3 shorted

### 3.7 Jumper Setting of IE-78098-NS-EM1

Set the jumpers of the IE-78098-NS-EM1 as follows.

**Caution** Incorrect jumper setting may damage the IE-78098-NS-EM1.

**Table 3-6. Jumper Setting of IE-78098-NS-EM1**

	JP1	JP2
Setting	1 and 2 shorted	1 and 2 shorted

### 3.8 Switch Settings of IE-78098-NS-EM1

Set the switches of the IE-78098-NS-EM1 as follows.

**Table 3-7. Switch settings of IE-78098-NS-EM1**

Switch	Setting	Description	Factory Setting
S1	ON	Used as port pins (P124, P125)	ON
	OFF	Used as IEBUS pin ( $\overline{TX}$ , $\overline{RX}$ )	
S2	ON	Do not change (do not set to OFF).	ON

### 3.9 Low Voltage Emulation Setting

If the target system operates on a low voltage, supply the TP1 terminal pin on the main board (G-780009 Board) with the same power supply voltage as that of the target system (this processing is not required when the target system operates on 5 V).

Supply a power supply voltage within the range of 2.7 and 5.5 V to the target system.

**Caution** When emulating at 4.5 V or lower, start the target system at 5 V and then lower the voltage for the target system.

**Table 3-8. Supply Voltage and Maximum Current Consumption**

Supply Voltage to TP1	Maximu Current Consumption at TP1
2.7 to 5.5 V	300 mA

**Figure 3-16. Main Board of IE-78K0-NS or IE-78K0-NS-A (G-780009 Board)**

## **CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICE AND TARGET INTERFACE CIRCUIT**

This chapter describes differences between the target device's signal lines and the signal lines of the target interface circuit of the IE system.

The target interface circuit of the IE system realizes emulation via an emulation circuit configured by an emulation CPU, TTL, CMOS-IC, and other components. The electrical characteristics are different from those of the target device because a protector and other circuits are provided.

- (1) Signals input to or output from the emulation CPU ( $\mu$ PD780009)**
- (2) Signals input/output from the emulation CPU ( $\mu$ PD78P054)**
- (3) Other signals**

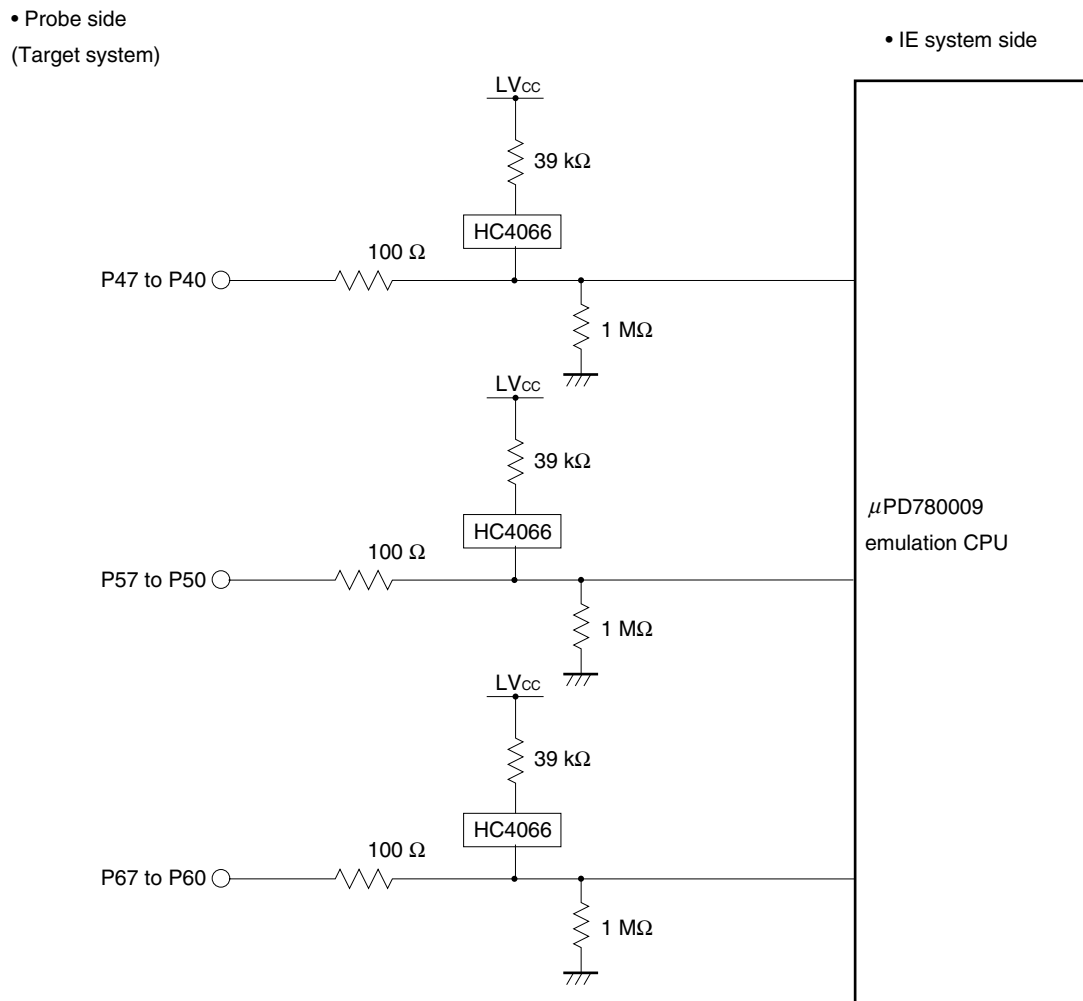
The circuits of the IE-78098-NS-EM1 are used as follows for signals listed in (1) to (3) above. The same applies to handling alternate-function pins, for which no circuit is provided in the IE system.

(1) Signals input to or output from the emulation CPU ( $\mu$ PD780009)

Refer to Figure 4-1 Equivalent Circuit 1 of Emulation Circuit.

- P47 to P40
- P57 to P50
- P67 to P60

Figure 4-1. Equivalent Circuit 1 of Emulation Circuit

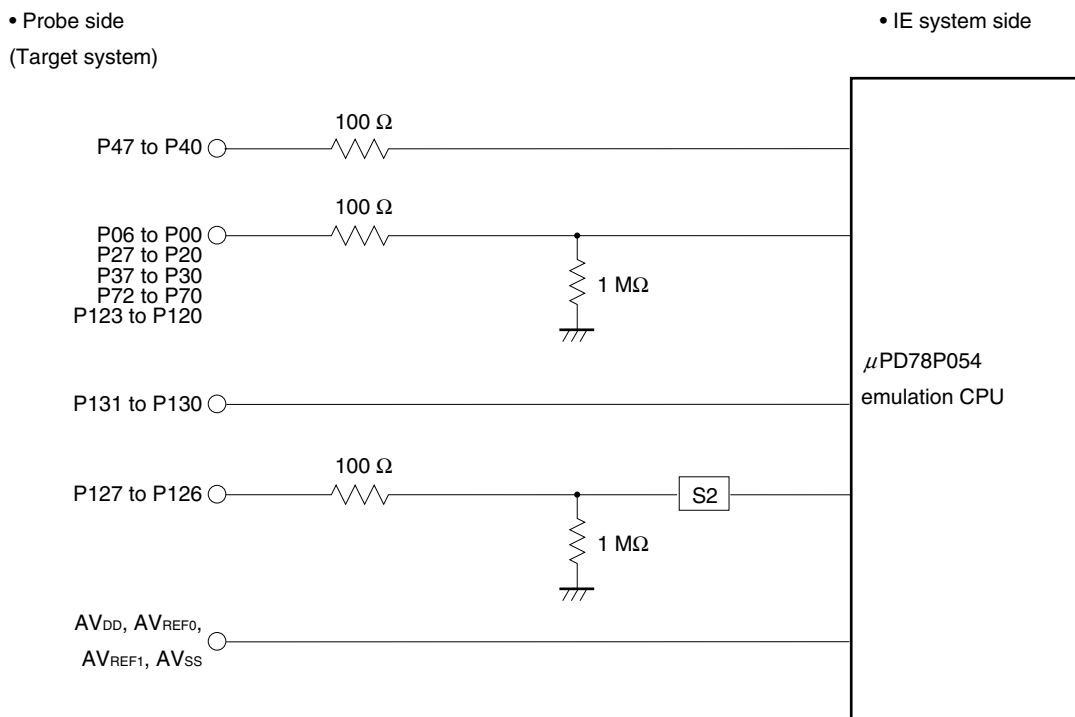


(2) Signals input/output from the emulation CPU ( $\mu$ PD78P054)

Refer to Figure 4-2 Equivalent Circuit 2 of Emulation Circuit.

- P06 to P00
- P17 to P10
- P27 to P20
- P37 to P30
- P72 to P70
- P127 to P126, P123 to P120
- P131 to P130
- AV<sub>DD</sub>, AV<sub>REF0</sub>, AV<sub>REF1</sub>, AV<sub>SS</sub>

Figure 4-2. Equivalent Circuit 2 of Emulation Circuit

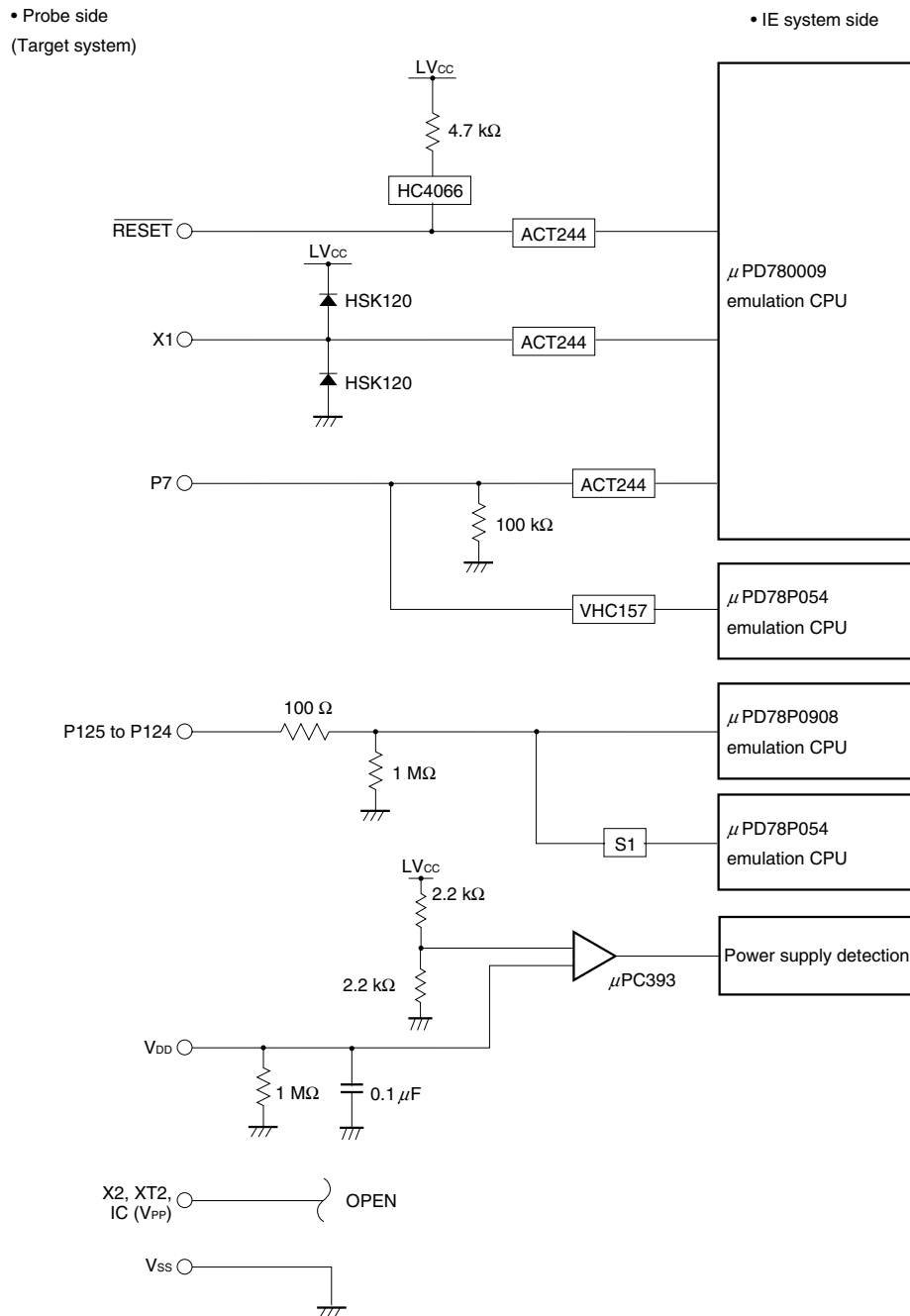


(3) Other signals

Refer to Figure 4-3 Equivalent Circuit 3 of Emulation Circuit.

- $\overline{\text{RESET}}$
- X1
- P07
- P125 to P124
- V<sub>DD</sub>
- X2, XT2, IC (V<sub>PP</sub>)
- V<sub>SS</sub>

Figure 4-3. Equivalent Circuit 3 of Emulation Circuit



## APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

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

Emulation Probe	CN6 Pin No.	Emulation Probe	CN6 Pin No.
1	114	34	49
2	113	35	50
3	108	36	45
4	107	37	46
5	104	38	41
6	103	39	42
7	100	40	35
8	99	41	8
9	94	42	7
10	93	43	14
11	30	44	13
12	29	45	18
13	24	46	17
14	23	47	22
15	20	48	21
16	19	49	28
17	16	50	27
18	15	51	92
19	10	52	91
20	9	53	98
21	37	54	97
22	43	55	102
23	44	56	101
24	47	57	106
25	48	58	105
26	51	59	112
27	52	60	111
28	57	61	83
29	58	62	77
30	59	63	78
31	60	64	73
32	55	65	74
33	56	66	69

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

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

- Remarks**
1. NP-80GC, NP-80GC-TQ, and NP-H80GC-TQ are products of Naito Densetsu Machida Mfg. Co., Ltd.
  2. The numbers in the “Emulation probe” column indicate the corresponding pin number on the emulation probe tip.

## APPENDIX B NOTES ON TARGET SYSTEM DESIGN

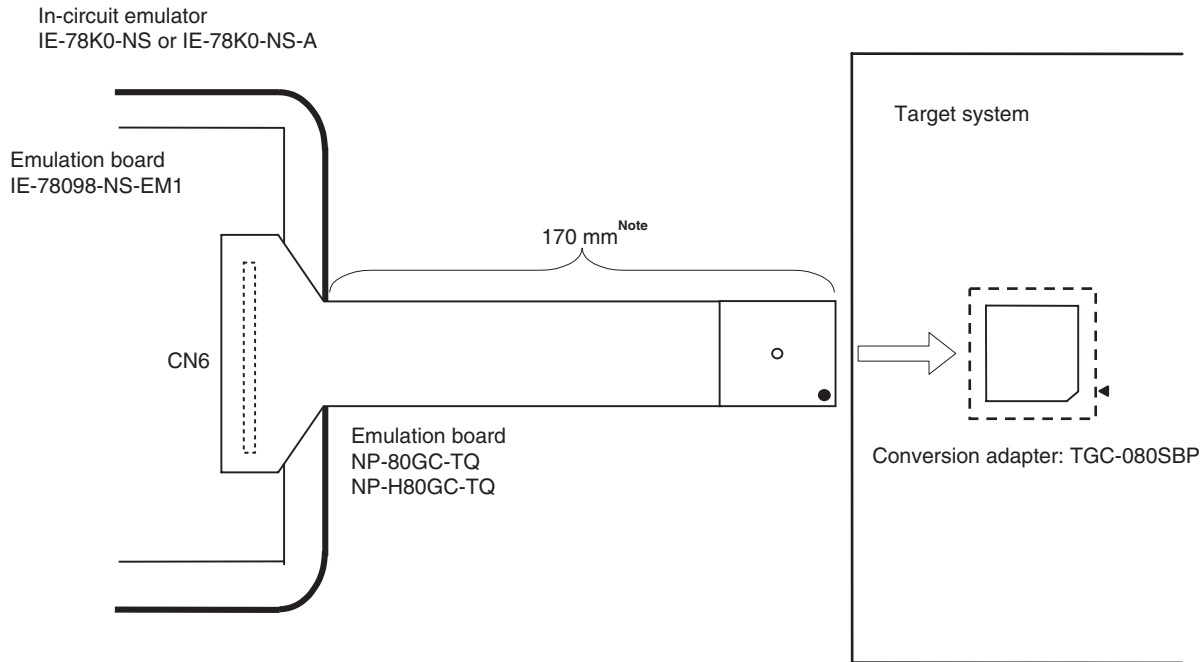
The following shows the conditions when connecting the emulation probe to the conversion adapter. Follow the configuration below and consider the shape of parts to be mounted on the target system when designing a system.

Among the products described in this appendix, NP-80GC-TQ and NP-H80GC-TQ are products of Naito Densai Machida Mfg. Co., Ltd, and TGC-080SBP is a product of TOKYO ELETECH CORPORATION.

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

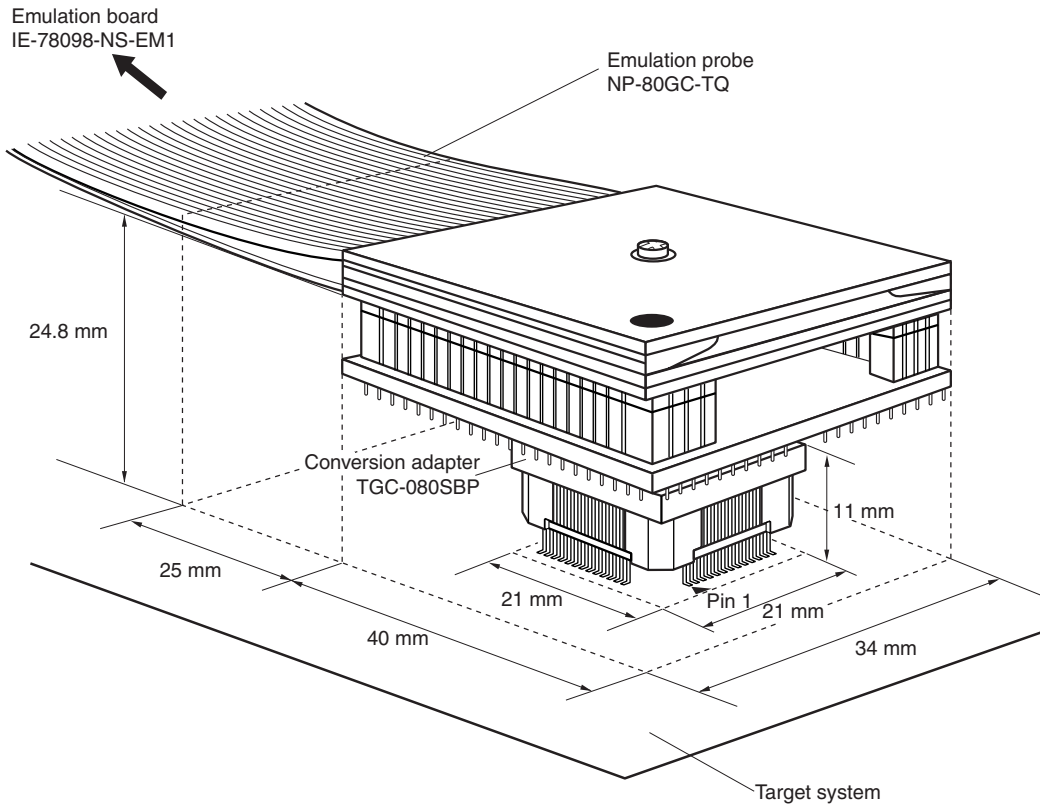
Emulation Probe	Conversion Adapter	Distance Between IE System and Conversion Adapter
NP-80GC-TQ	TGC-080SBP	170 mm
NP-H80GC-TQ		370 mm

**Figure B-1. Distance Between In-Circuit Emulator 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 Conditions of Target System (When NP-80GC-TQ Is Used)**



**Figure B-3. Connection Conditions of Target System (When NP-H80GC-TQ Is Used)**

