

**NEC**

**User's Manual**

# **IE-780078-NS-EM1**

**Emulation Board**

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**Target Devices**

**$\mu$ PD780078 Subseries**

**$\mu$ PD780078Y Subseries**

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[MEMO]

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- If the product was disassembled, altered, or repaired by the customer
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- 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.

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- 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-780078-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.

- $\mu$ PD780078 Subseries:  $\mu$ PD780076, 780078, 78F0078
- $\mu$ PD780078Y Subseries:  $\mu$ PD780076Y, 780078Y, 78F0078Y

### Target Readers

This manual is intended for engineers who will use the IE-780078-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-780078-NS-EM1, refer to not only this manual (supplied with the IE-780078-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. 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
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- Basic specifications
- System configuration
- External interface functions

IE-780078-NS-EM1 User's Manual
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- 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-780078-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 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-780078-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

## How to Read This Manual

It is assumed that the readers of this manual have general knowledge in the fields of electrical engineering, logic circuits, and microcontrollers.

To understand the overall functions and usages of the IE-780078-NS-EM1

→ Read this manual according to the **CONTENTS**.

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-780078-NS-EM1 Emulation Board	This manual
ID78K0-NS Ver. 2.52 Integrated Debugger Operation	U16488E
μPD780078, 780078Y Subseries	U14260E

**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-780078-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-780078-NS-EM1's system configuration and basic specifications.

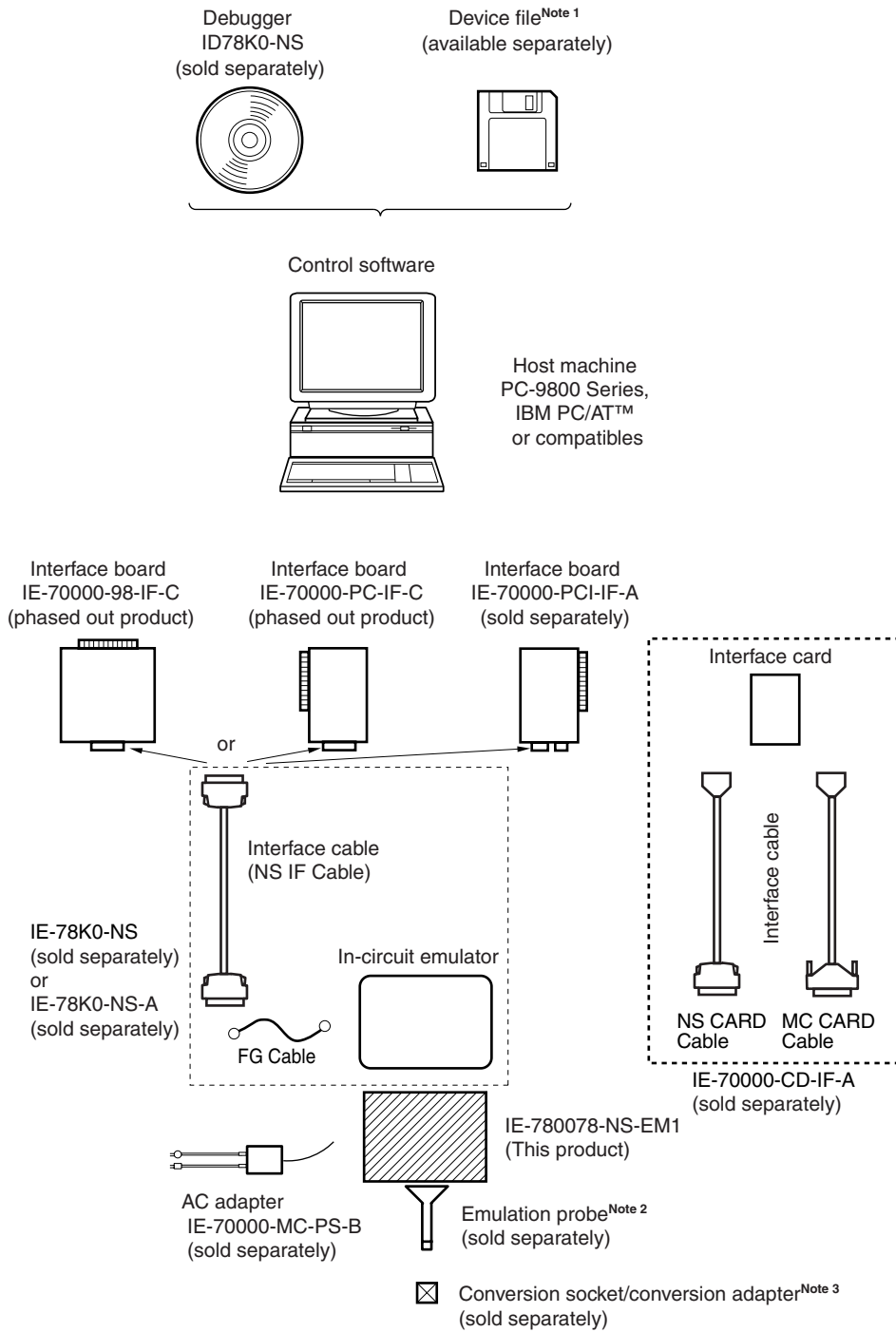
- Target devices
  - $\mu$ PD780078 Subseries
  - $\mu$ PD780078Y Subseries

## 1.1 System Configuration

Figure 1-1 illustrates the IE-780078-NS-EM1's system configuration.

★

**Figure 1-1. System Configuration**



- Notes**
1. The device file is as follows, in accordance with the subseries.  
 $\mu$ SxxxxDF780078:  $\mu$ PD780078, 780078Y Subseries  
 Obtain device files from the NEC Electronics website.  
 ([http://www.necel.com/micro/index\\_e.html](http://www.necel.com/micro/index_e.html))
  2. The emulation probes NP-64GC, NP-64GC-TQ, NP-H64GC-TQ, NP-64GK, and NP-H64GK-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 adapters TGC-064SAP and TGK-064SBW are products 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)

Table 1-1 shows the correspondence between the emulation probes and conversion sockets/conversion adapters that are sold separately.

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

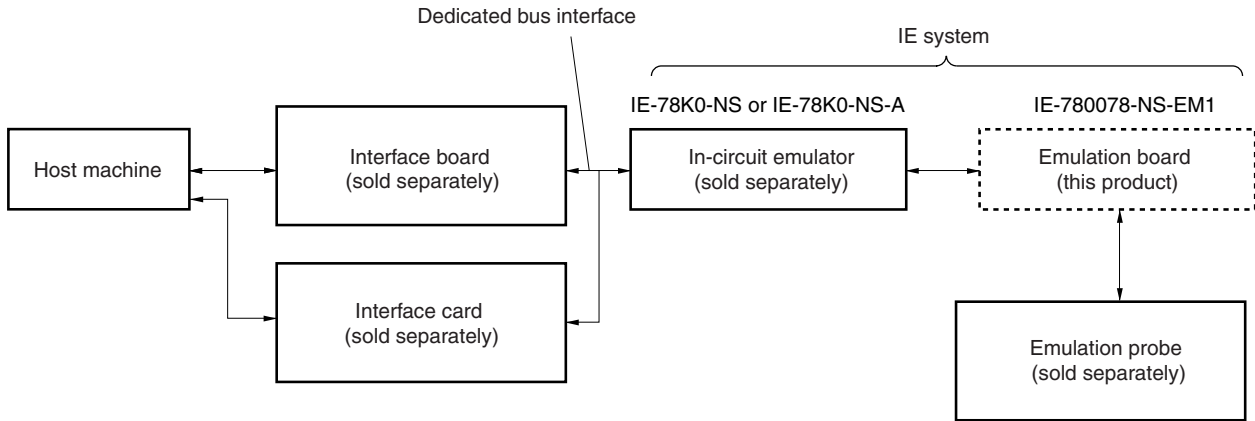
Package	Emulation Probe	Conversion Socket/Conversion Adapter
64-pin plastic QFP	NP-64GC (probe length: 200 mm)	EV-9200GC-64
	NP-64GC-TQ (probe length: 200 mm) NP-H64GC-TQ (probe length: 400 mm)	TGC-064SAP
64-pin plastic TQFP	NP-64GK (probe length: 200 mm) NP-H64GK-TQ (probe length: 400 mm)	TGK-064SBW

## 1.2 Hardware Configuration

Figure 1-2 shows the IE-780078-NS-EM1's position in the basic hardware configuration.

★

**Figure 1-2. Basic Hardware Configuration**



### 1.3 Basic Specifications

The IE-780078-NS-EM1's basic specifications are listed in Table 1-2.

**Table 1-2. Basic Specifications**

Parameter	Description
Target device	$\mu$ PD780078, 780078Y Subseries
System clock	12.0 MHz
Main 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 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 board by the user
Low voltage support	V <sub>DD</sub> = 1.8 to 5.5 V (same as the target device)

★

## CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-780078-NS-EM1 main unit.

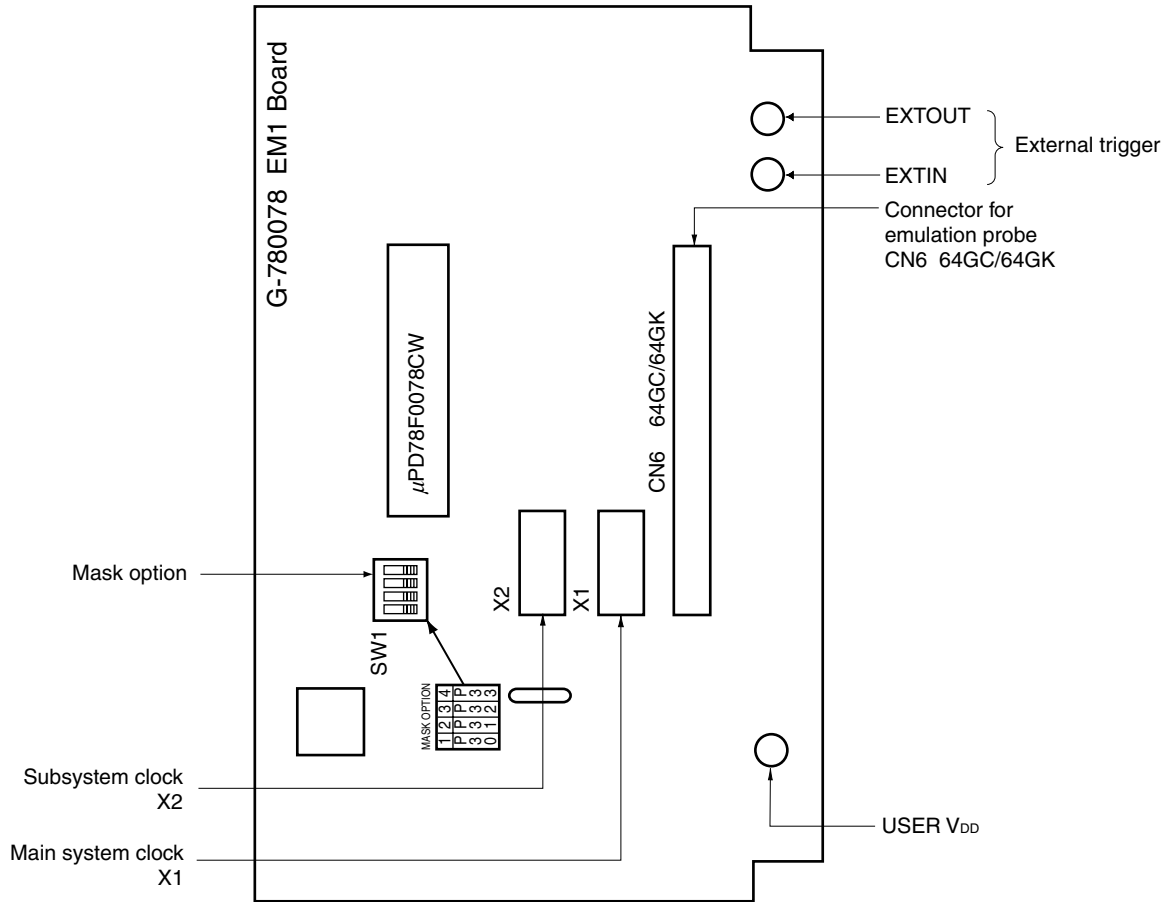
The packing box contains the emulation board (IE-780078-NS-EM1), packing list, user's manual, and guarantee card.

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. IE-780078-NS-EM1 Part Names



## CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-780078-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-780078-NS-EM1 to the IE-78K0-NS.

See the **IE-78K0-NS-A User's Manual (U14889E)** for a description of how to connect the IE-780078-NS-EM1 to the IE-78K0-NS-A.

#### (2) Connection with emulation probe

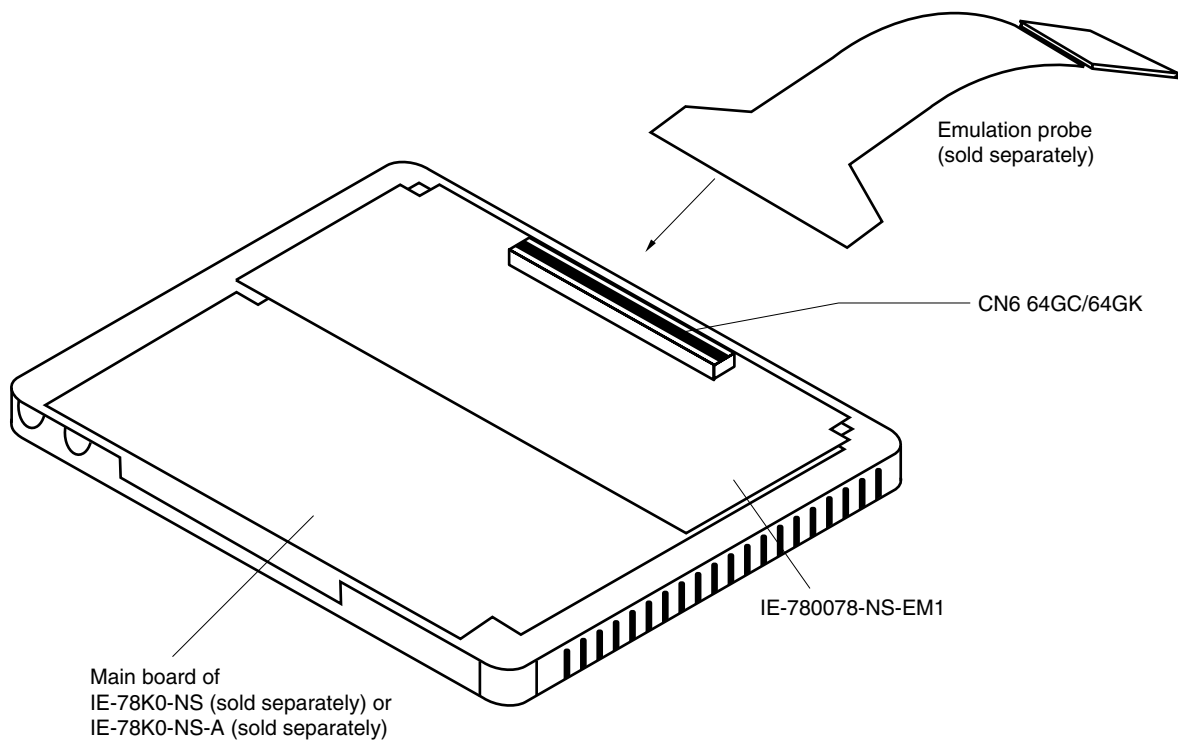
See the **IE-78K0-NS User's Manual (U13731E)** or **IE-78K0-NS-A User's Manual (U14889E)** for a description of how to connect an emulation probe to the IE-780078-NS-EM1.

Connect the emulation probe (NP-64GC, NP-64GC-TQ, NP-H64GC-TQ, NP-64GK, and NP-H64GK-TQ) 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



## 3.2 Clock Settings

### 3.2.1 Overview of clock settings

The main system and subsystem clocks 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**

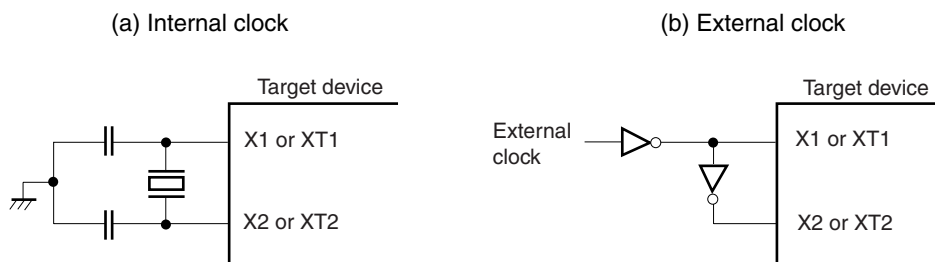
If the target system includes an internal clock, select either **(1) Clock that is already mounted on emulation board** or **(2) Clock that is mounted by user**. For an internal clock, a resonator is connected to the target device and the target device's internal oscillation circuit is used. An example 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 main 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 connected to X1 (main system clock) and XT1 (subsystem clock).

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

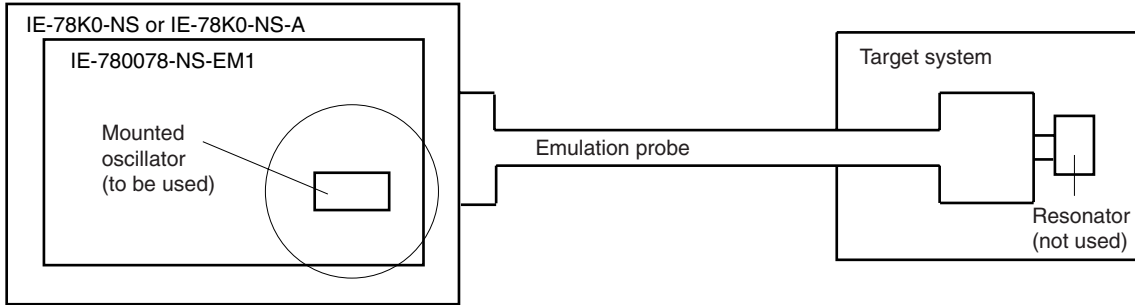


(1) Clock that is already mounted on emulation board

(a) For main system clock

A crystal oscillator (X1) 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 (Main System Clock)**

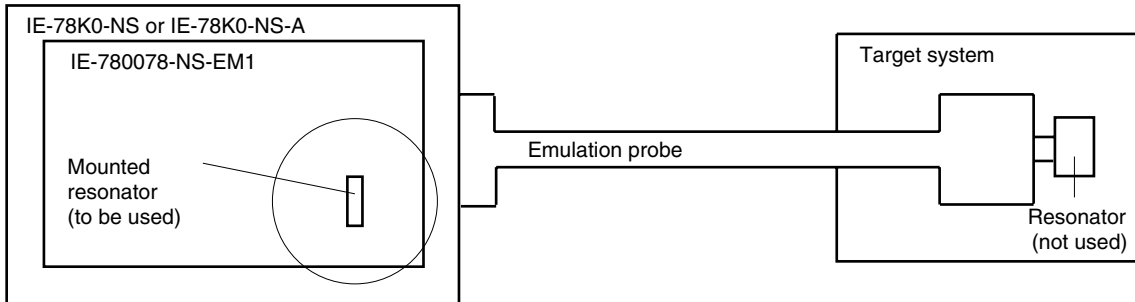


**Remark** The clock that is supplied by the IE-780078-NS-EM1's oscillator (encircled in the figure) is used.

(b) For subsystem clock

A crystal resonator (XT1) 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 IE-780078-NS-EM1's resonator (encircled in the figure) is used.

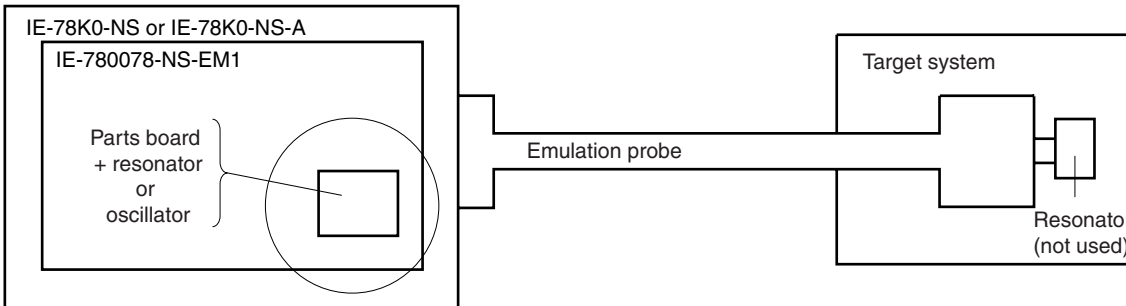
**(2) Clock that is mounted by user**

The user is able to mount any clock supported by the set specifications on the IE-780078-NS-EM1.

**(a) For main system clock**

Remove the crystal oscillator (X1) 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 3-5. When Using User-Mounted Clock (Main System Clock)**

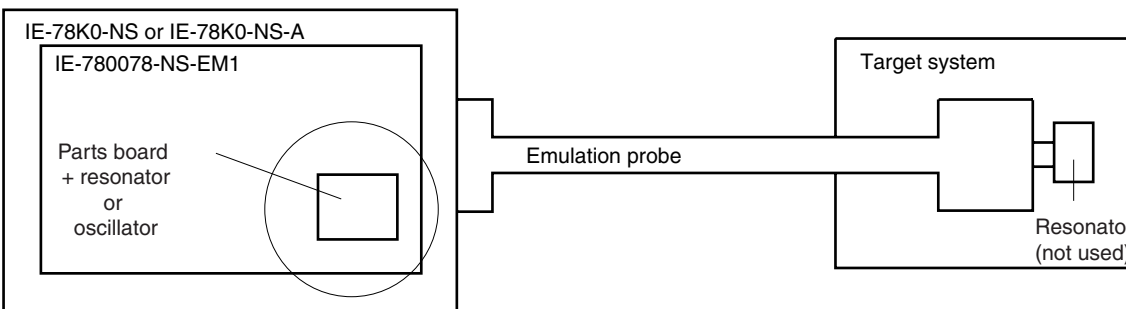


**Remark** The clock that is supplied by the IE-780078-NS-EM1's resonator or oscillator (encircled in the figure) is used.

**(b) For subsystem clock**

Mount the resonator to be used on the parts board (X2) that is already mounted on the emulation board. Alternatively, remove the parts board and mount an oscillator.

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

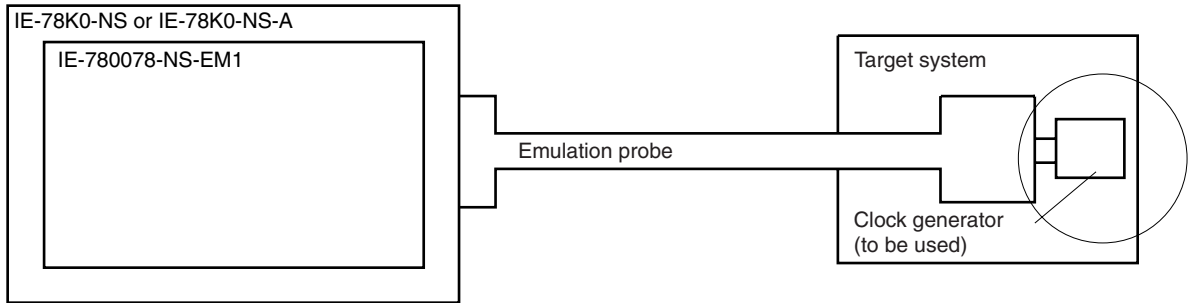


**Remark** The clock that is supplied by the IE-780078-NS-EM1's resonator or oscillator (encircled in the figure) is used.

**(3) External clock**

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

**Figure 3-7. When Using 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-780078-NS-EM1	
		X1 Socket	CPU Clock Source Selection (ID78K0-NS)
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)	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** When the IE-780078-NS-EM1 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-780078-NS-EM1 is shipped, an 8.38 MHz crystal oscillator is already mounted in the IE-780078-NS-EM1’s X1 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**

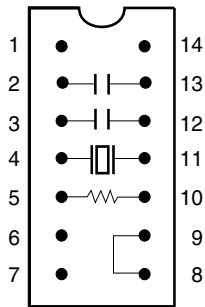
- Items to be prepared
  - Parts board
  - Ceramic resonator or crystal resonator
  - Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

<Steps>

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

**Figure 3-8. Connections on Parts Board (When Using Main System Clock or User-Mounted Clock)**

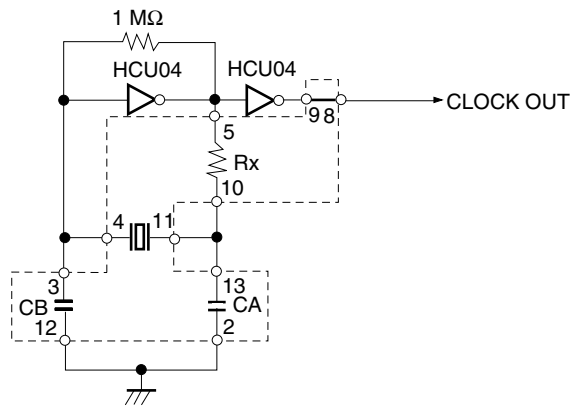
Parts board (X1)



(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

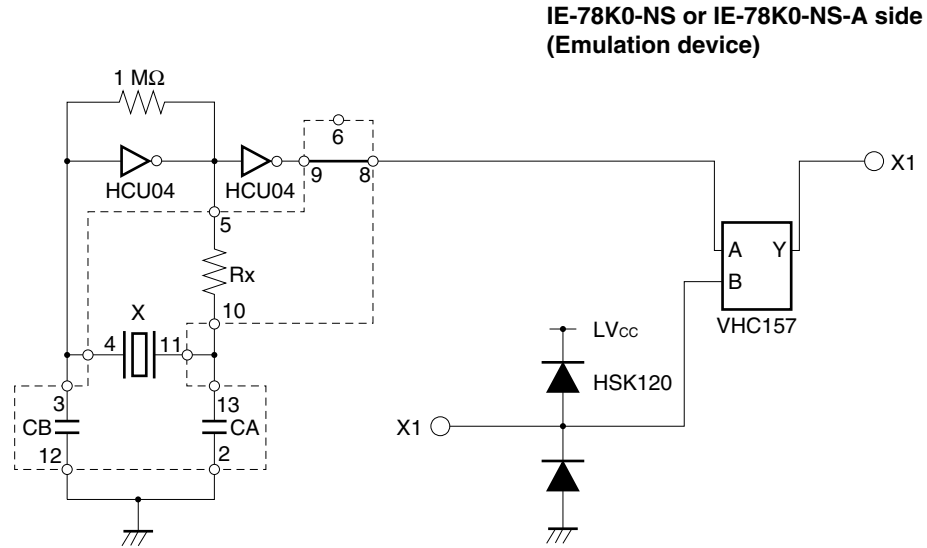
Circuit diagram



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

- <2> Prepare the IE-780078-NS-EM1.
- <3> Remove the crystal oscillator that is mounted in the IE-780078-NS-EM1'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 3-8 above.
- <6> Connect the IE-780078-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.

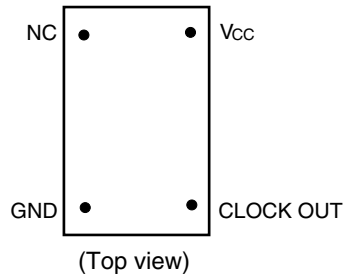


**Remark** The sections enclosed in broken lines indicate parts that are attached to the parts board.

(b) When using a crystal oscillator

- Items to be prepared
- ★ ● Crystal oscillator (pins are as shown in Figure 3-9, V<sub>cc</sub>: +5 V, CLOCK OUT: CMOS level)

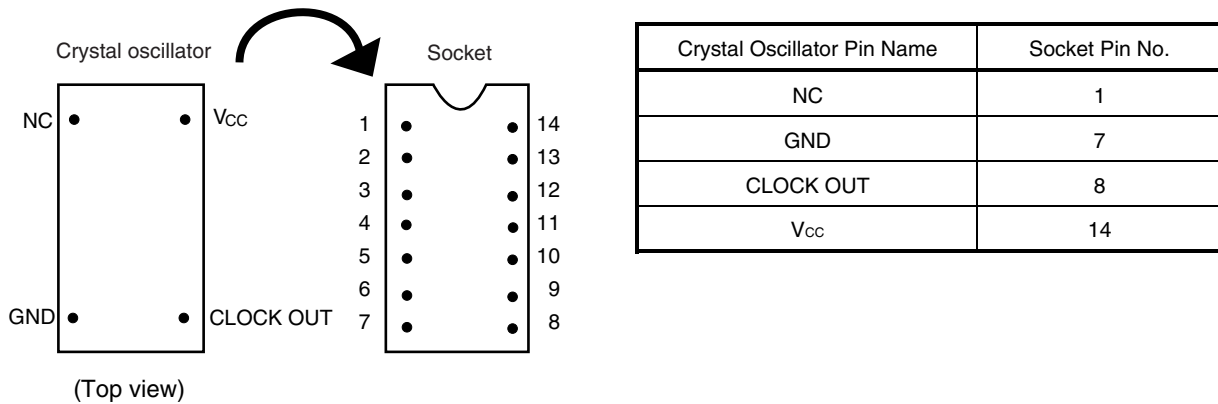
**Figure 3-9. Crystal Oscillator (When Using Main System Clock or User-Mounted Clock)**



<Steps>

- <1> Prepare the IE-780078-NS-EM1.
- <2> Remove the crystal oscillator that is mounted in the IE-780078-NS-EM1's X1 socket.
- <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.

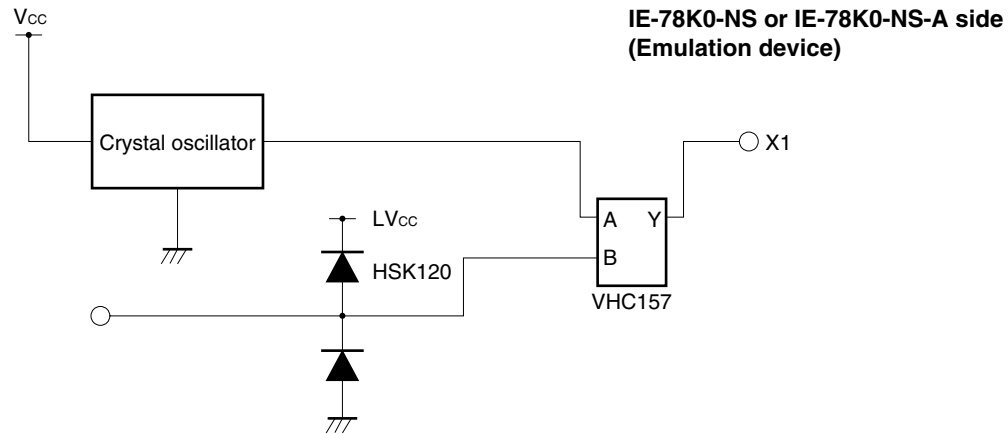
**Figure 3-10. Pin Alignment of Crystal Oscillator and Socket**



- <4> Connect the IE-780078-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).

3.2.3 Subsystem clock settings

Table 3-2. Subsystem Clock Settings

Frequency of Subsystem Clock to Be Used		IE-780078-NS-EM1	IE-78K0-NS or IE-78K0-NS-A
		X2 Socket	JP8
When using clock (XT1) that is already mounted on emulation board	32.768 kHz	6 and 8 shorted	1 and 2 shorted
When using clock mounted by user	Other than 32.768 kHz	Oscillation circuit assembled by user	
When using external clock			Not used

**Caution** Jumper JP8, which is used to select the board’s clock or an external clock, should be set only after turning off the power of the IE-78K0-NS or IE-78K0-NS-A.

**Remark** When the IE-780078-NS-EM1 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-780078-NS-EM1 is shipped, a 32.768 kHz crystal resonator (XT1) and the parts board (X2) on which pins 6 and 8 are shorted are already mounted on the IE-780078-NS-EM1. Short the 1 to 2 side of the jumper (JP8) on the IE-78K0-NS or IE-78K0-NS-A. There is no need to make any other settings via the integrated debugger (ID78K0-NS).

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

The settings described under either (a) or (b) are required, depending on the type of clock to be used. Short 1 and 2 of the jumper (JP8) on the IE-78K0-NS or IE-78K0-NS-A.

For the jumper position, refer to the **IE-78K0-NS User’s Manual (U13731E)** when using the IE-78K0-NS, and refer to the **IE-78K0-NS-A User’s Manual (U14889E)** when using the IE-78K0-NS-A.

There is no need to make any other settings via the integrated debugger (ID78K0-NS).

**(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

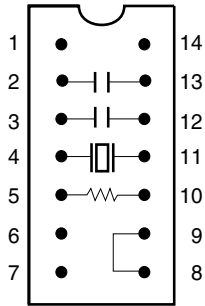
<Steps>

<1> Prepare the IE-780078-NS-EM1.

<2> Solder the ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequency) onto the parts board (X2) (as shown below).

**Figure 3-11. Connections on Parts Board (When Using Subsystem Clock or User-Mounted Clock)**

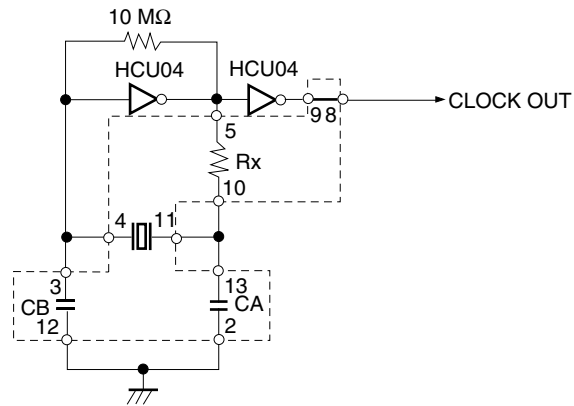
Parts board (X2)



(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

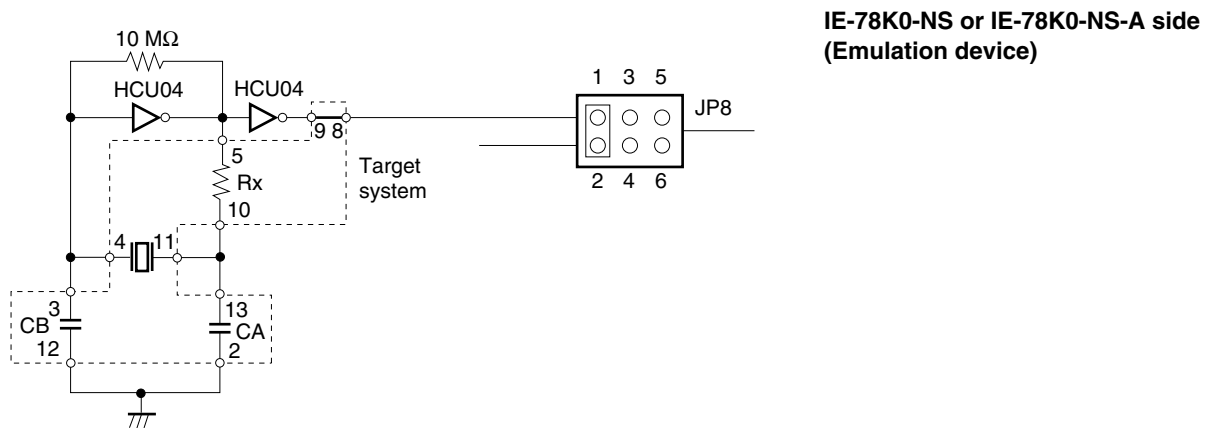
Circuit diagram



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

- <3> Make sure that the parts board (X2) is wired as shown in Figure 3-11.
- <4> Remove the parts board that is mounted in the IE-780078-NS-EM1's X2 socket.
- <5> Connect the parts board from <2> above to the socket from which the parts board (from <4> above) was removed. Check the pin 1 mark to make sure the board is mounted in the correct direction.
- <6> Connect the IE-780078-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.

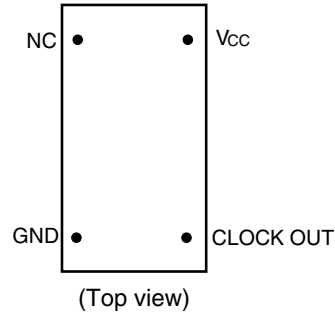


- Remarks**
1. The sections enclosed in broken lines indicate parts that are attached to the parts board.
  2. There is JP8 on the IE-78K0-NS or IE-78K0-NS-A.

(b) When using a crystal oscillator

- ★ ● Items to be prepared
  - Crystal oscillator (pins are shown in Figure 3-12, V<sub>CC</sub>: +5 V, CLOCK OUT: CMOS level)

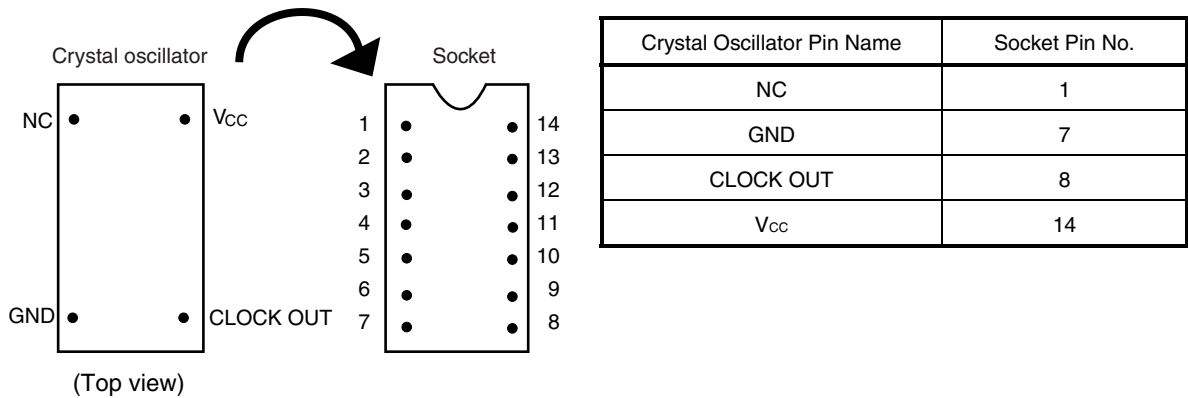
**Figure 3-12. Crystal Oscillator (When Using Subsystem Clock or User-Mounted Clock)**



<Steps>

- <1> Prepare the IE-780078-NS-EM1.
- <2> Remove the parts board that is mounted in the IE-780078-NS-EM1's X2 socket.
- <3> Mount the crystal oscillator prepared by the user in the X2 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.

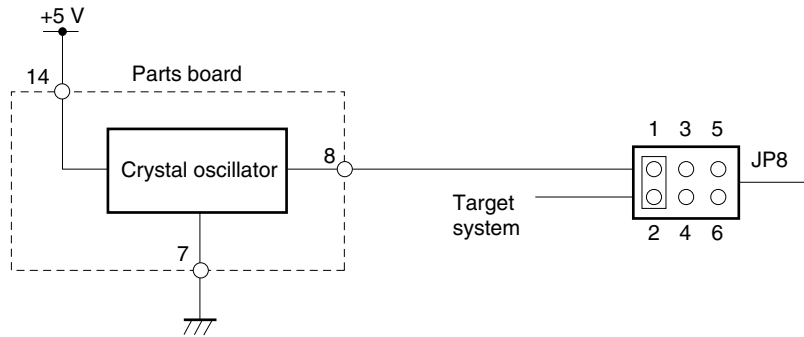
**Figure 3-13. Pin Alignment of Crystal Oscillator and Socket**



- <4> Connect the IE-780078-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 oscillator to the emulation device.

**IE-78K0-NS or IE-78K0-NS-A side  
(Emulation device)**



- Remarks**
1. The sections enclosed in broken lines indicate the parts that are attached to the parts board.
  2. There is JP8 on the IE-78K0-NS or IE-78K0-NS-A.

**(3) When using an external clock**

Short 3 and 4 of the jumper (JP8) on the IE-78K0-NS or IE-78K0-NS-A. There is no need to make any settings via the integrated debugger (ID78K0-NS).

### 3.3 Mask Option Setting

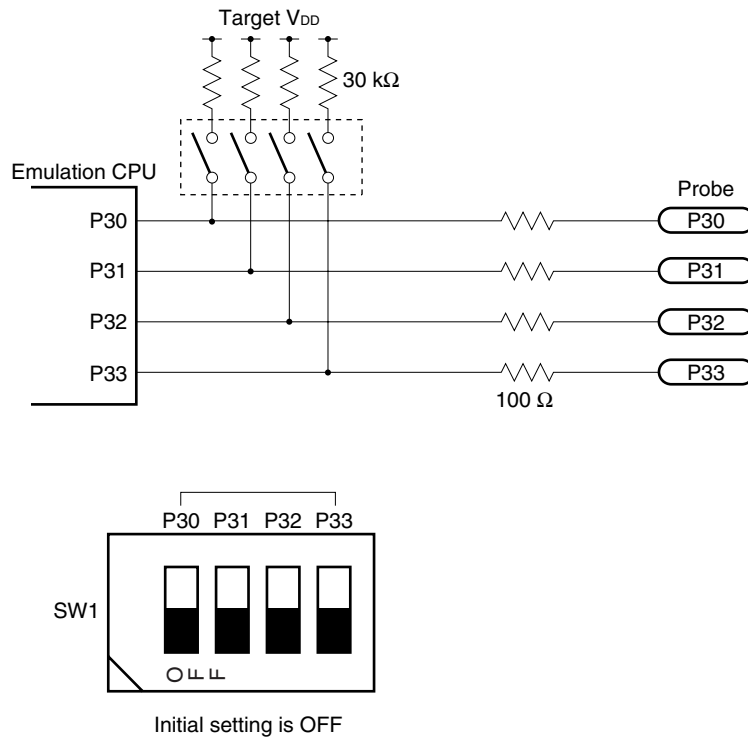
#### 3.3.1 Pull-up resistor

By setting the DIP switch (SW1) in the IE-780078-NS-EM1, a 30 kΩ pull-up resistor can be connected to P30 to P33 as specified by the mask option.

For ports that do not exist in the IE-780078-NS-EM1, set the DIP switch to OFF.

The pull-up resistor is pulled up by the V<sub>DD</sub> pin of the target socket.

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

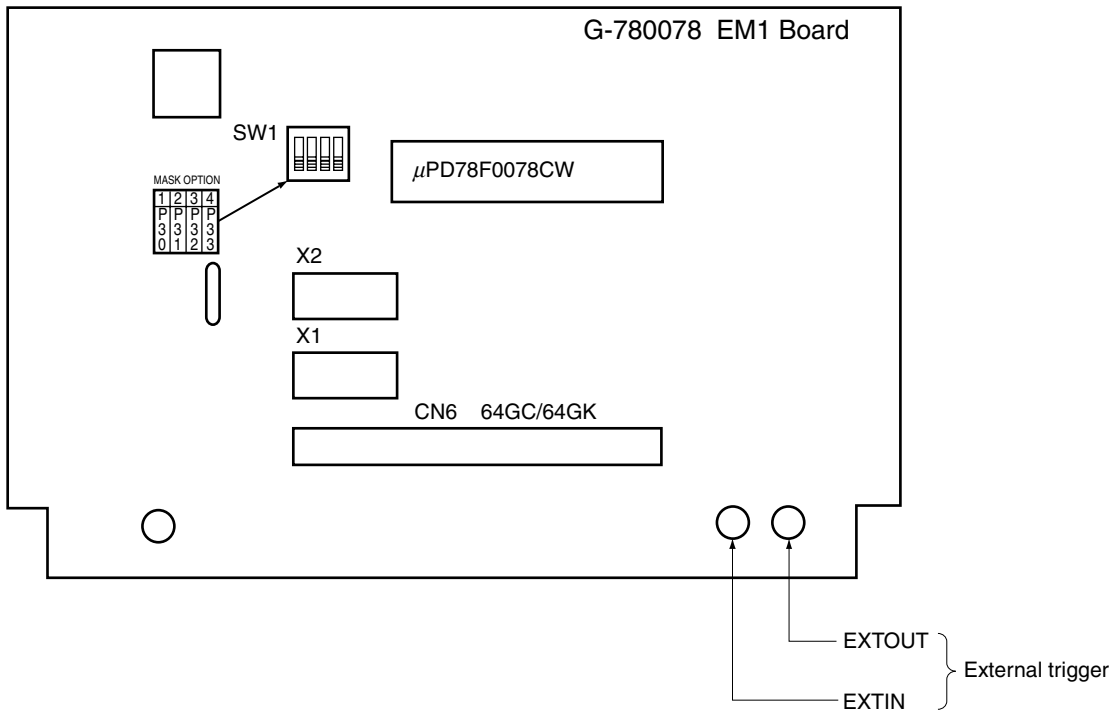


### 3.4 External Trigger

Connect the external trigger to the IE-780078-NS-EM1's check pins EXTOUT and EXTIN as shown below.

See the **ID78K0-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 3-15. External Trigger Input Position





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

When using the IE-780078-NS-EM1 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 3-3. 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	3 and 4 shorted	1 and 2 shorted	1 and 2 shorted

### 3.6 Jumper Settings on IE-78K0-NS-A

When using the IE-780078-NS-EM1 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 3-4. 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	3 and 4 shorted	1 and 2 shorted	1 and 2 shorted

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

	JP2
Setting	2 and 3 shorted

★ 3.7 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 also necessary when target system is operating on 5 V).

Set the supply voltage of the target system to between 1.8 to 5.5 V.

**Table 3-6. Supply Voltage and Maximum Current Consumption**

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

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



## 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-780078-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-780078-NS-EM1'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 and  $\mu$ PD780009
- (2) Signals input or output from the emulation CPU and  $\mu$ PD78F0078
- (3) Other signals

The IE-780078-NS-EM1's circuit is used as follows for signals listed in (1) to (3) above.

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

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

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

### (2) Signals input or output from the emulation CPU and $\mu$ PD78F0078

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

- P03 to P00
- P25 to P20
- P36 to P30
- P75 to P70
- P17 to P10
- $AV_{REF}$ ,  $AV_{SS}$
- P80

### (3) Other signals

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

- $V_{DD0}$ ,  $V_{DD1}$ ,  $V_{SS0}$ ,  $V_{SS1}$ , X1, X2, XT1, XT2,  $\overline{RESET}$ , IC

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

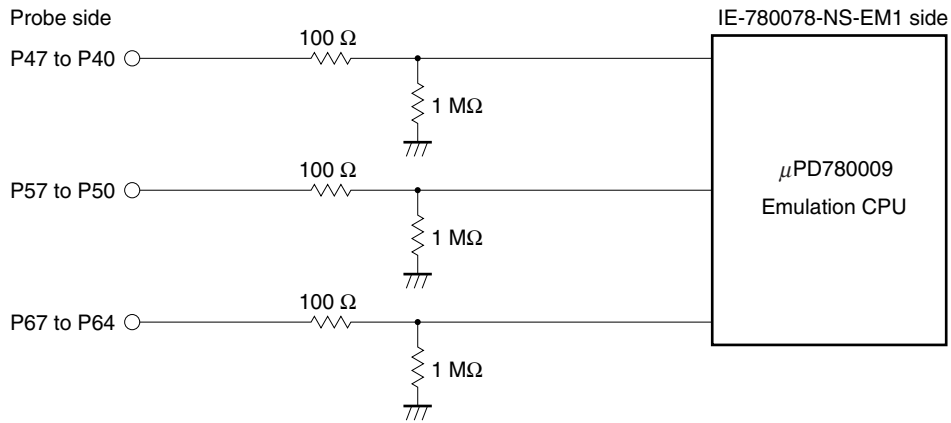


Figure 4-2. Equivalent Circuit of Emulation Circuit (2)

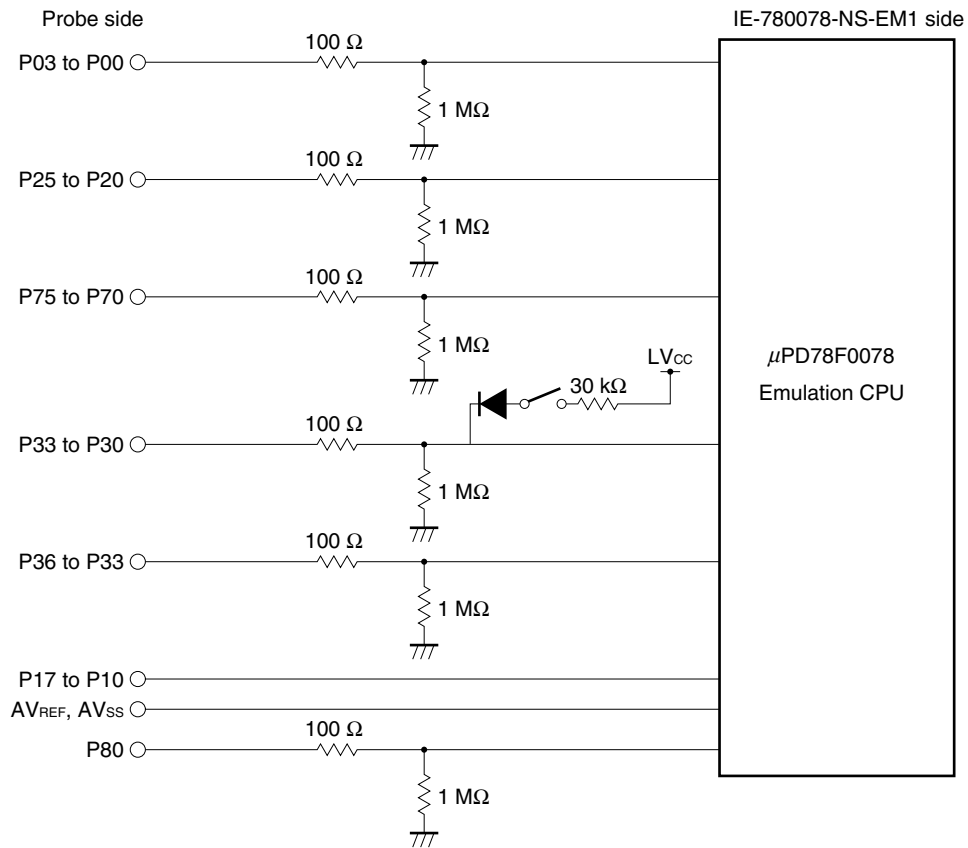
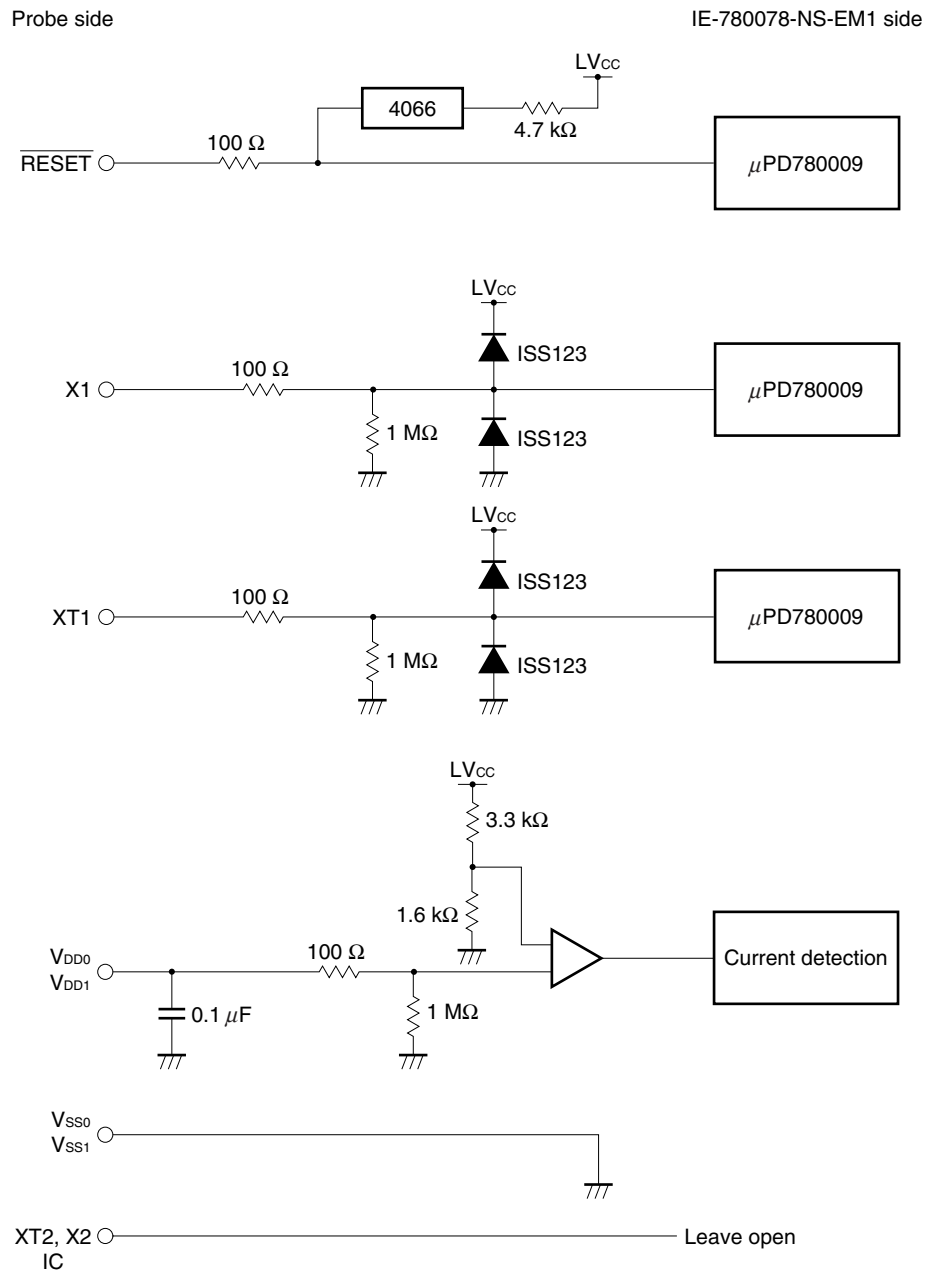


Figure 4-3. Equivalent Circuit of Emulation Circuit (3)



## CHAPTER 5 CAUTIONS ON USE

Observe the following when using the IE-780078-NS-EM1.

- (1) In the external diffusion mode, the read data in address xx24H of the external memory becomes undefined.  
Measures: Use IE-78K0-NS control code L or later, or IE-78K0-NS-A control code E or later. When using products with control codes earlier than the above, set the PM4 register to 00H (port 4 set to output mode).
  
- (2) The value of the interrupt request flag register IF1L (FFE2H) after reset is 04H.  
Measures: After reset, set the IF1L register to 00H.

## APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

**Table A-1. NP-64GC, NP-64GC-TQ, NP-H64GC-TQ, NP-64GK, NP-64GK-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, NP-H64GC-TQ, NP-64GK, and NP-H64GK-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.

## APPENDIX B NOTES ON DESIGNING TARGET SYSTEM

The following shows the conditions when connecting the emulation probe and conversion adapter. Consider the shape of the components to be mounted on the target system and follow the configurations below when designing the system.

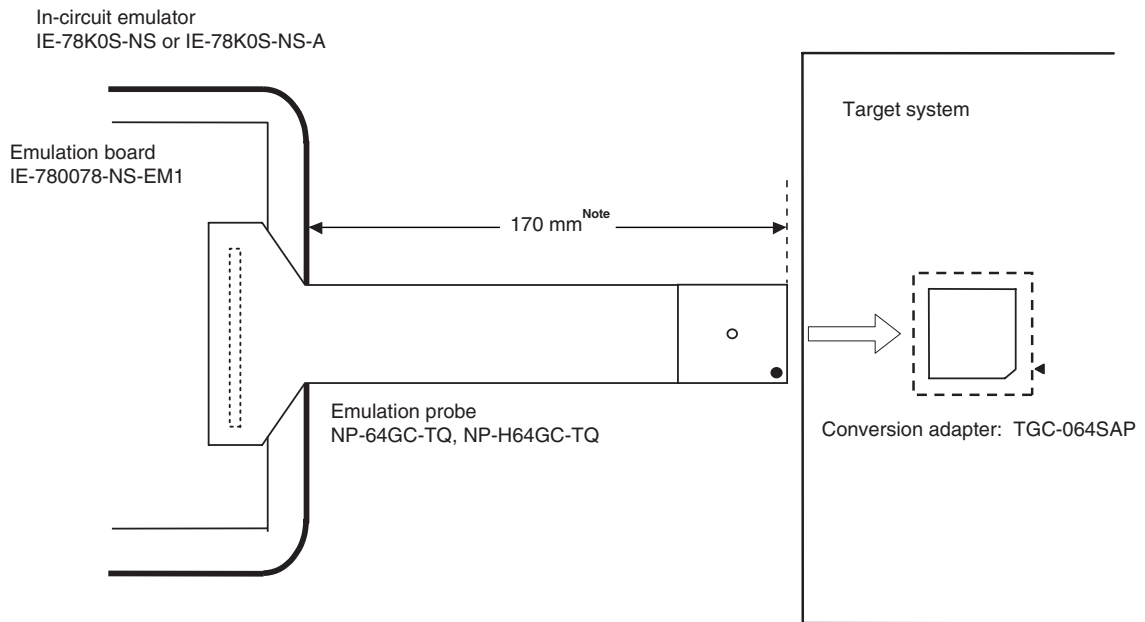
Among the products described in this appendix, NP-64GC-TQ, NP-H64GC-TQ, NP-64GK, and NP-H64GK-TQ are products of Naito Densai Machida Mfg. Co., Ltd. and TGC-064SAP and TGK-064SBW are products of TOKYO ELETECH CORPORATION.

**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-64GK	TGK-064SBW	170 mm
NP-H64GK-TQ		370 mm



**Figure B-1. Distance Between In-Circuit Emulator and Conversion Adapter (64GC)**



**Note** The above distance shows 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 (NP-64GC-TQ)**

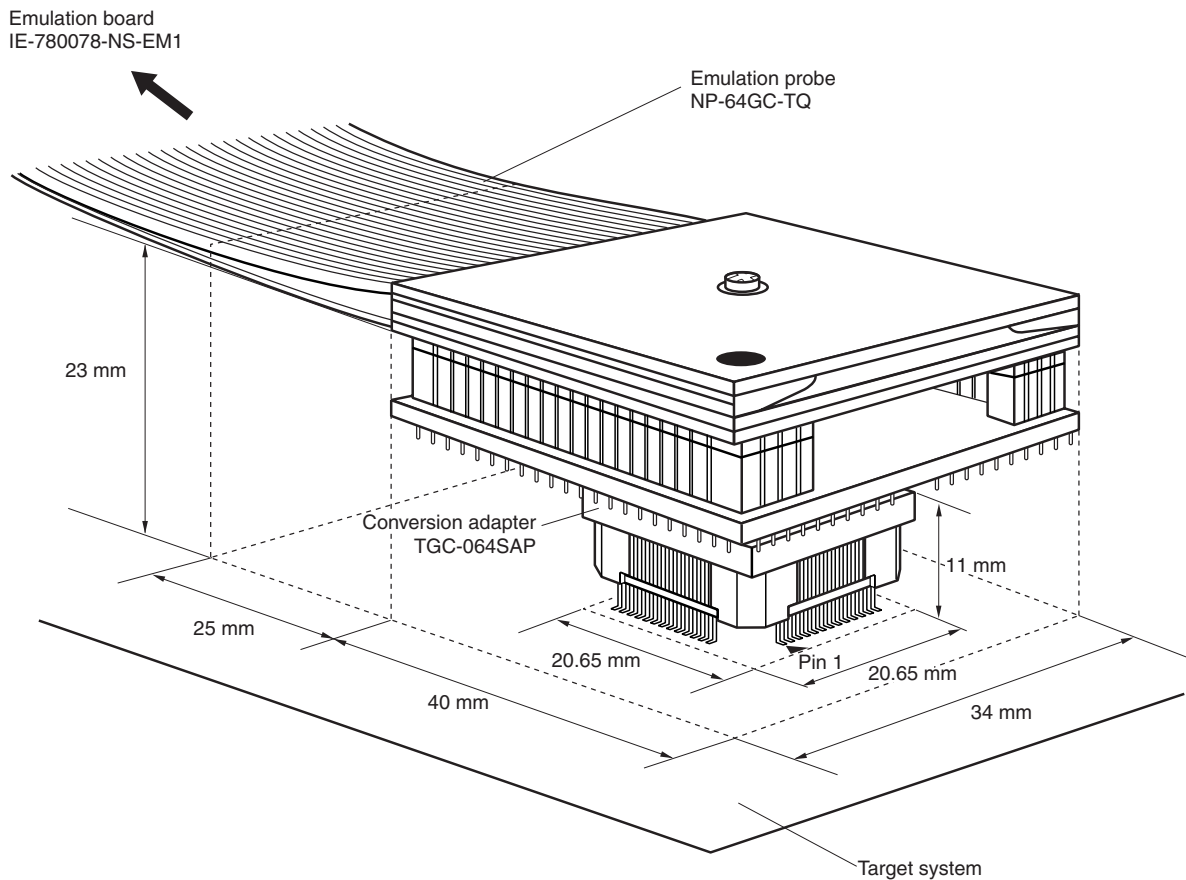
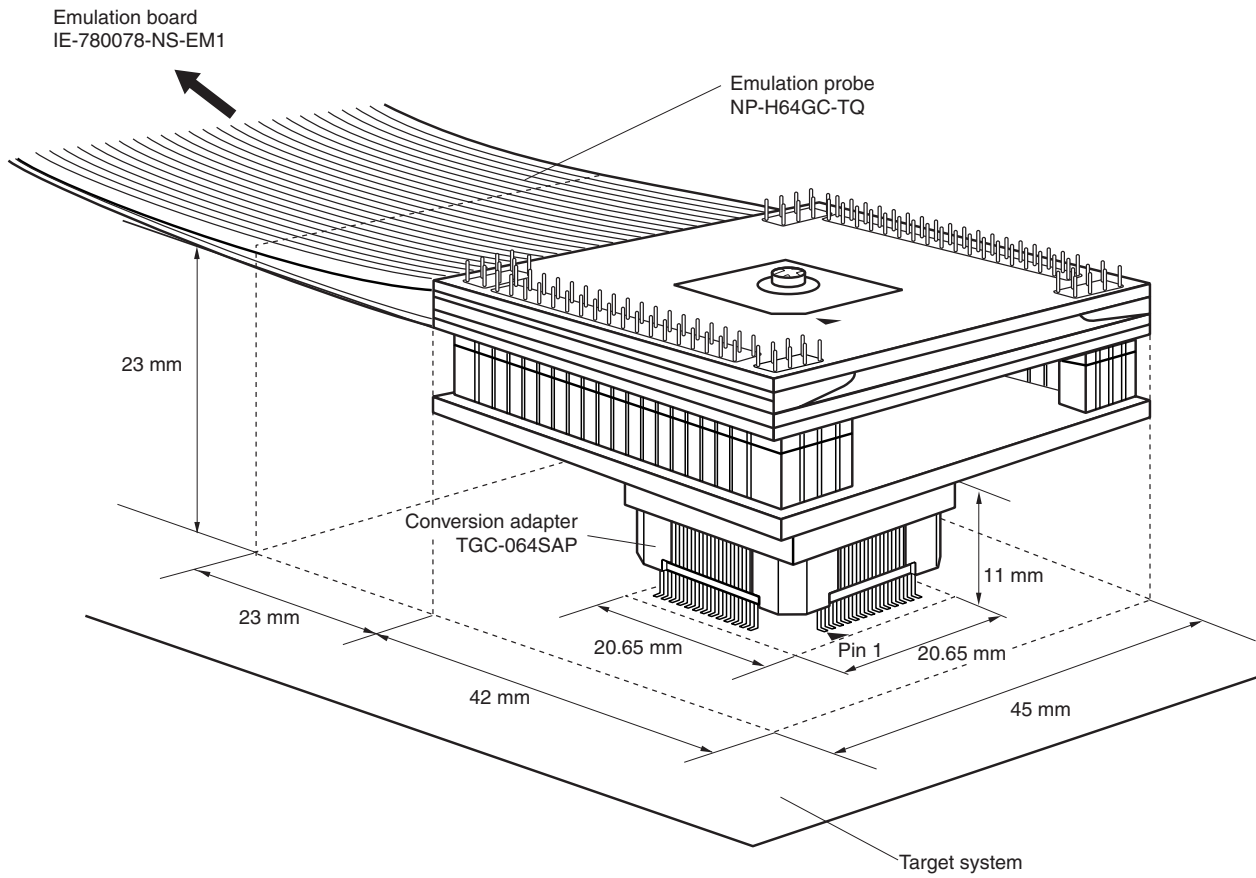
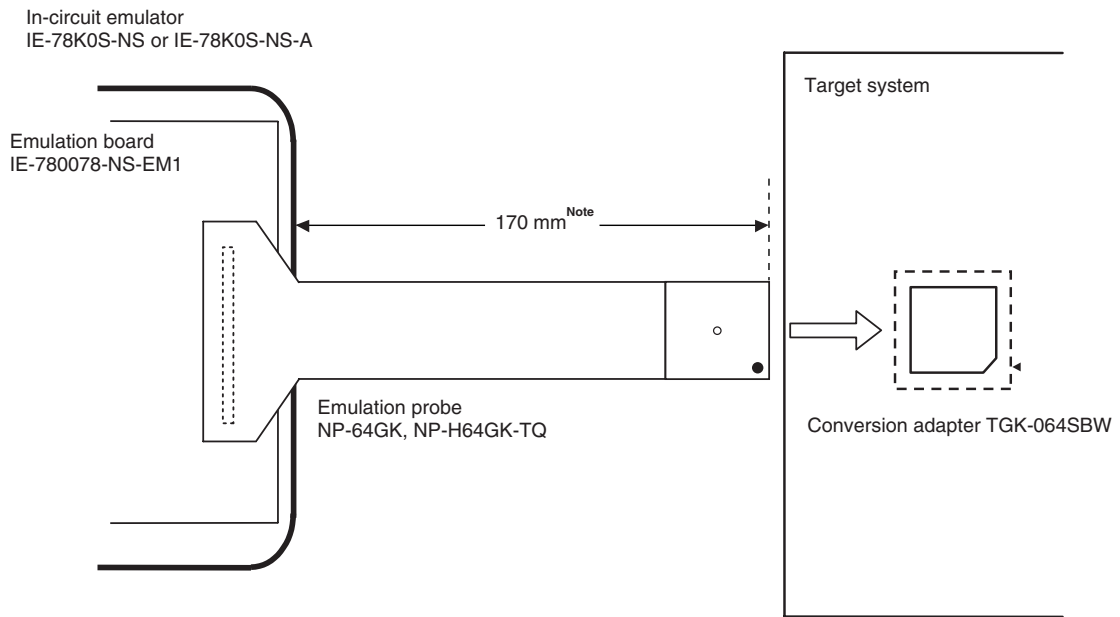


Figure B-3. Connection Conditions of Target System (NP-H64GC-TQ)



**Figure B-4. Distance Between In-Circuit Emulator and Conversion Adapter (64GK)**



**Note** The above distance shows when the NP-64GK is used. When the NP-H64GC-TQ is used, the distance is 370 mm.

**Figure B-5. Connection Conditions of Target System (NP-64GK)**

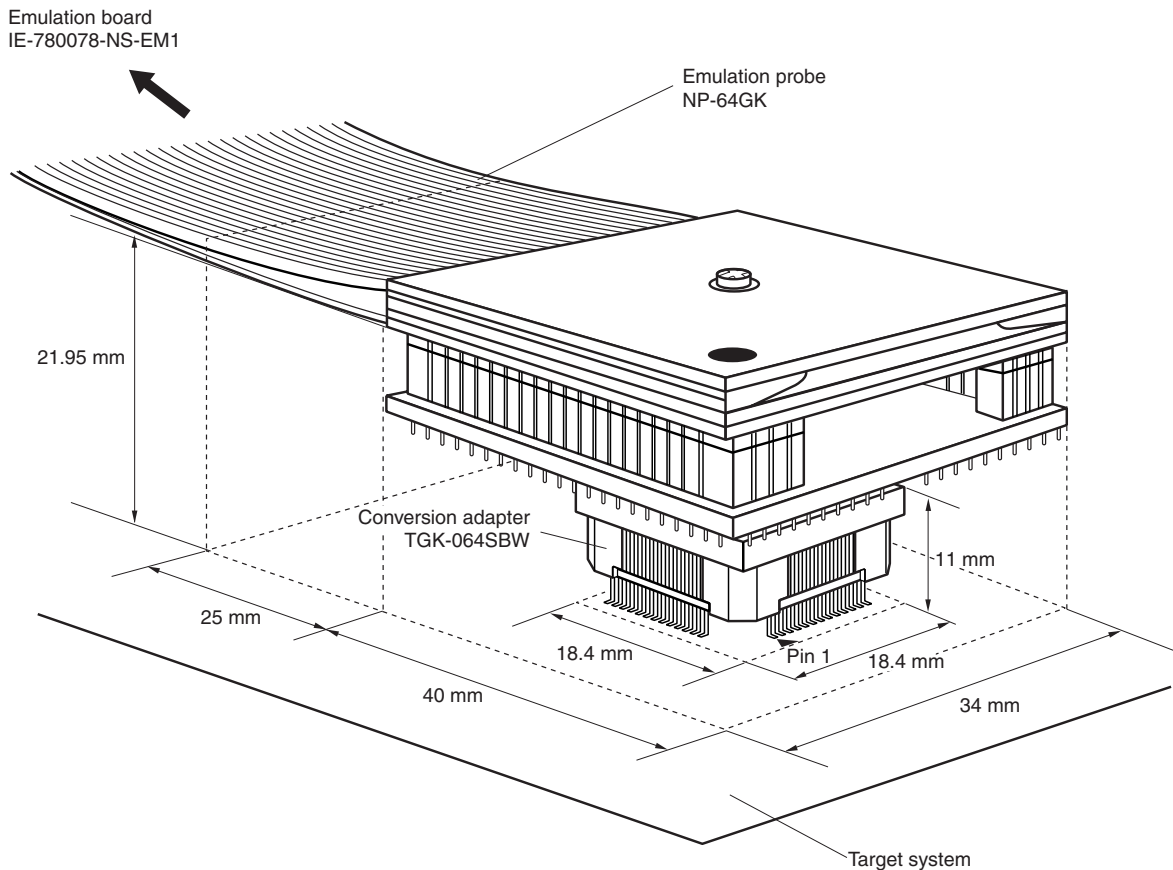
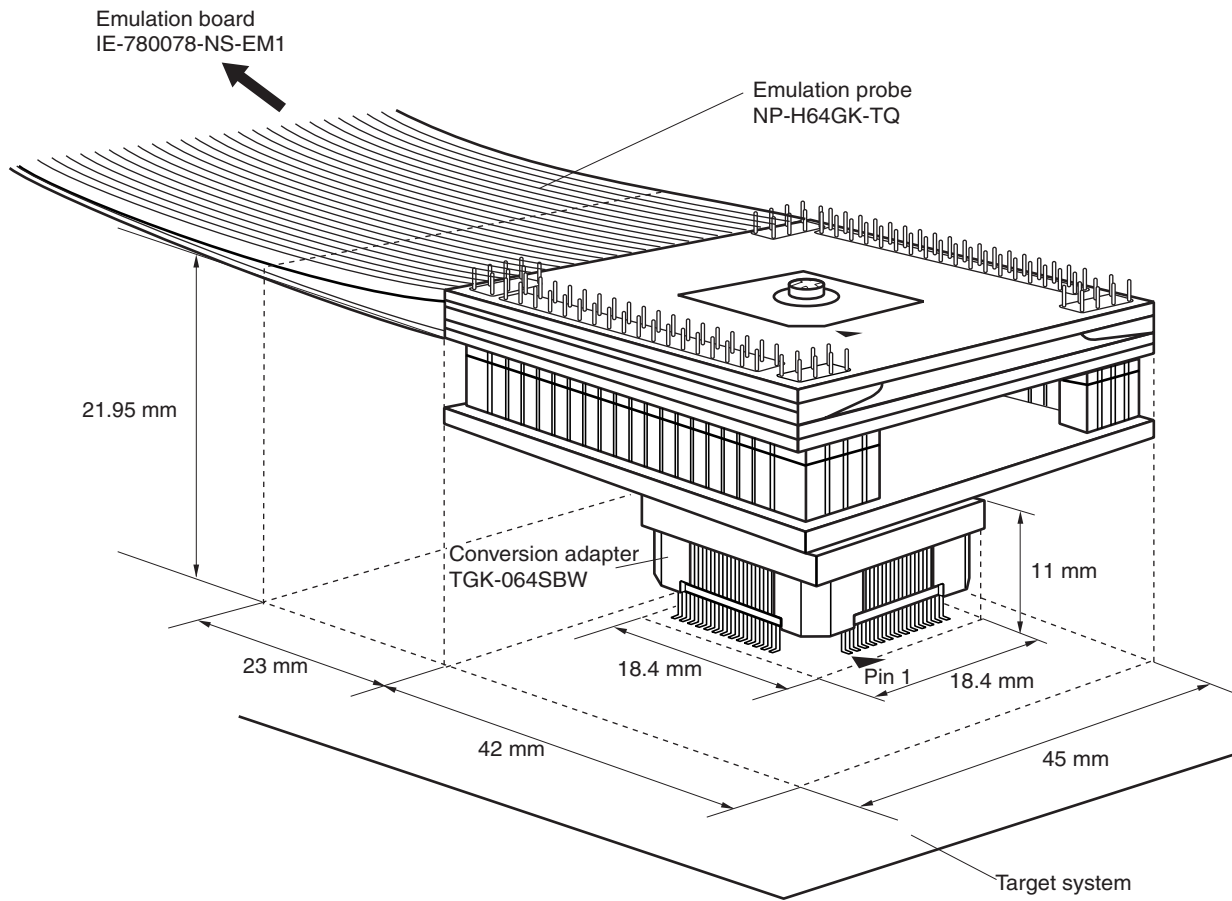


Figure B-6. Connection Conditions of Target System (NP-H64GK-TQ)



## 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 <b>Figures B-2, B-3, B-5, and B-6</b>	<b>APPENDIX B NOTES ON DESIGNING TARGET SYSTEM</b>
3rd edition	Modification of <b>Figures 1-1 System Configuration</b>	<b>CHAPTER 1 GENERAL</b>
	Modification of <b>Figure 1-2 Basic Hardware Configuration</b>	
	Deletion of <b>Figure 1-3 Basic Hardware Configuration (Using IE-78K0-NS-A)</b>	
	Modification of <b>Table 1-2 Basic Specifications</b>	
	<b>3.2.2 Main system clock settings</b> Addition of description on crystal oscillator	<b>CHAPTER 3 INSTALLATION</b>
	<b>3.2.3 Subsystem clock settings</b> Addition of description on crystal oscillator	
	Addition of <b>3.7 Low-Voltage Emulation Setting</b>	