User's Manual

NEC

IE-789436-NS-EM1

Emulation Board

Target Devices
μPD789426 Subseries
μPD789436 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-789436-NS-EM1 is designed to be used with the IE-78K0S-NS or IE-78K0S-NS-A to debug the following target devices that belong to the 78K/0S Series of 8-bit single-chip microcontrollers.

- μPD789426 Subseries: μPD789425, 789426, 78F9426
- μPD789436 Subseries: μPD789435, 789436, 78F9436

Target Readers   This manual is intended for engineers who will use the IE-789436-NS-EM1 with the IE-78K0S-NS or IE-78K0S-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-789436-NS-EM1, refer to not only this manual (supplied with the IE-789436-NS-EM1) but also the manual that is supplied with the IE-78K0S-NS or IE-78K0S-NS-A.

IE-78K0S-NS
User's Manual

- Basic specifications
- System configuration
- External interface functions

IE-789436-NS-EM1
User's Manual

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

IE-78K0S-NS-A
User's Manual

- Basic specifications
- System configuration
- External interface functions

Purpose   This manual is intended to give users an understanding of the various debugging functions that can be performed when using the IE-789436-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 IE-78K0S-NS or IE-78K0S-NS-A and the IE-789436-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-78K0S-NS In-Circuit Emulator	U13549E
IE-78K0S-NS-A In-Circuit Emulator	U15207E
IE-789436-NS-EM1 Emulation Board	This manual
ID78K Series Integrated Debugger Ver. 2.30 or Later Operation (Windows™ Based)	U15185E
μPD789426, 789436, 789446, 789456 Subseries	U15075E

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

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LIST OF TABLES

CHAPTER 1 GENERAL

This chapter describes the IE-789436-NS-EM1's system configuration and basic specifications.

The IE-789436-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/0S Series of 8-bit single-chip microcontrollers.

- Target device
  - μPD789426 Subseries
  - μPD789436 Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-789436-NS-EM1's system configuration.

Figure 1-1. System Configuration

Debugger
ID78K0S-NS
(sold separately)

Device file[Note 1]
(available separately)

Control software

Host machine
PC-9800 series
or IBM PC/AT™
or compatibles

Interface board
IE-70000-98-IF-C
(sold separately)

Interface board
IE-70000-PC-IF-C
(sold separately)

Interface board
IE-70000-PCI-IF-A
(sold separately)

or

Interface card

Interface cable

NS CARD
Cable

MC CARD
Cable

IE-70000-CD-IF-A
(sold separately)

Interface cable
(NS IF Cable)

IE-78K0S-NS
or
IE-78K0S-NS-A
(sold separately)

In-circuit emulator

FG Cable

IE-789436-NS-EM1
(This product)

AC adapter
IE-70000-MC-PS-B
(sold separately)

Emulation probe[Note 2]
(sold separately)

Conversion adapter[Note 3]
(sold separately)

Notes 1. The device file is as follows.

μS××××DF789456: μPD789426, 789436, 789446, 789456 Subseries

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

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

2. The emulation probes NP-H64GB-TQ, NP-64GK, and NP-H64GK-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 adapters TGC-064SDW 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. Correspondence Between Emulation Probes and Conversion Adapters

Package	Emulation Probe	Conversion Adapter
64-pin plastic LQFP (GB type)	NP-H64GB-TQ (probe length: 400 mm)	TGB-064SDW
64-pin plastic TQFP (GK type)	NP-64GK (probe length: 200 mm)	TGK-064SBW
	NP-H64GK-TQ (probe length: 400 mm)	

1.2 Hardware Configuration

Figure 1-2 shows the IE-789436-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration
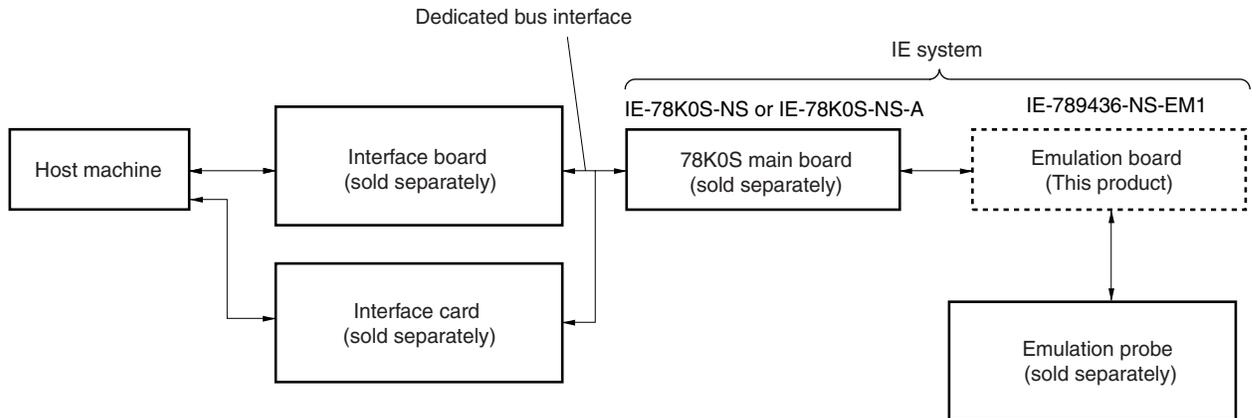
1.3 Basic Specifications

The IE-789436-NS-EM1's basic specifications are listed in Table 1-2.

Table 1-2. Basic Specifications

Parameter	Description
Target device	μPD789426, 789436 Subseries
System clock	Main system clock: 1.000 to 5.000 MHz Subsystem clock: 32.768 kHz
Main system clock supply	External: Clock input from the target system via an emulation probe Internal: Clock mounted on the emulation board (5.0 MHz) or clock mounted on the parts board by the user
Subsystem clock supply	External: Clock input from the target system via an emulation probe Internal: Clock mounted on the emulation board (32.768 kHz) or clock mounted on the parts board by the user
Target interface voltage	V_{DD} = 1.8 to 5.5 V (same as the target device) The IE-789418-NS-EM1 operates on the internal power supply (5 V) when not connected to the target system.

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-789436-NS-EM1 main unit.

The packing box contains the emulation board (IE-789436-NS-EM1), 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 shows the part names of the IE-789436-NS-EM1.

Figure 2-1. IE-789436-NS-EM1 Part Names
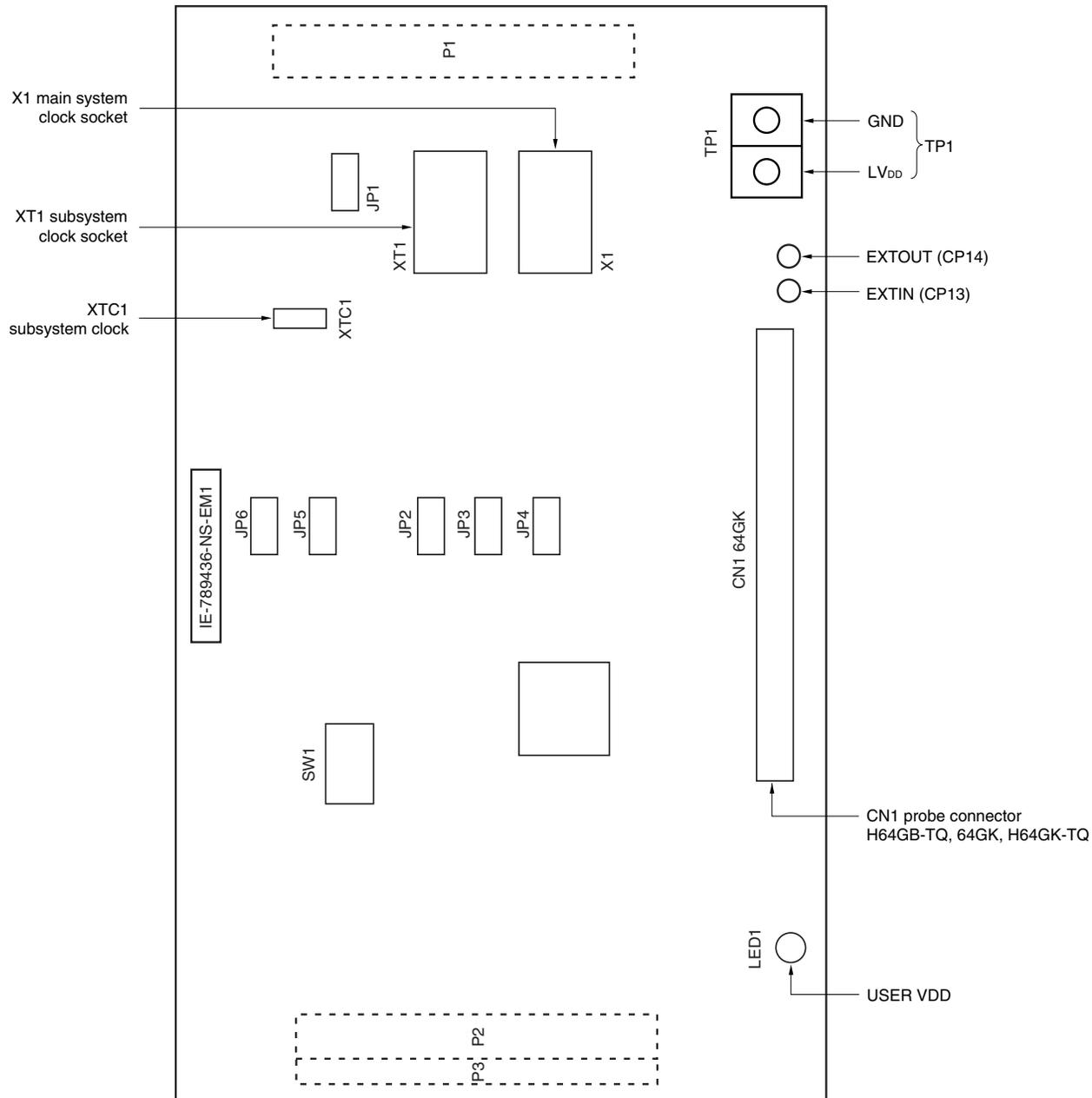
2.2 Initial Settings of Switches and Jumpers

Table 2-1 shows the initial settings of the switches and jumpers on the IE-789436-NS-EM1.

For the setting of JP1, refer to **3.4 Clock Settings**.

For the setting of SW1, refer to **3.5 Mask Option Settings**.

Use the IE-789436-NS-EM1 with jumpers JP2 to JP6 set to the initial settings.

Table 2-1. Initial Settings of Switches and Jumpers

	JP1	SW1			
		1	2	3	4
Initial setting	2 and 3 shorted	OFF	OFF	OFF	OFF

	JP2	JP3	JP4	JP5	JP6
Initial setting	1 and 2 shorted (Fixed)	1 and 2 shorted (Fixed)	1 and 2 shorted (Fixed)	1 and 2 shorted (Fixed)	1 and 2 shorted (Fixed)

CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-789436-NS-EM1 to the IE-78K0S-NS or IE-78K0S-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-78K0S-NS or IE-78K0S-NS-A main unit
See the **IE-78K0S-NS User's Manual (U13549E)**[Note] for a description of how to connect the IE-789436-NS-EM1 to the IE-78K0S-NS.

Note When using the IE-78K0S-NS-A, refer to the **IE-78K0S-NS-A User's Manual (U15207E)**.

(2) Connection with emulation probe
See the **IE-78K0S-NS User's Manual (U13549E)**[Note] for a description of how to connect an emulation probe to the IE-789436-NS-EM1.
On this board, connect the emulation probe to CN1.

Note When using the IE-78K0S-NS-A, refer to the **IE-78K0S-NS-A User's Manual (U15207E)**.

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

Emulation probe
(sold separately)

CN1 64GK
H64GK-TQ
H64GB-TQ

IE-789436-NS-EM1

Main board of IE-78K0S-NS (sold separately) or
IE-78K0S-A (sold separately)
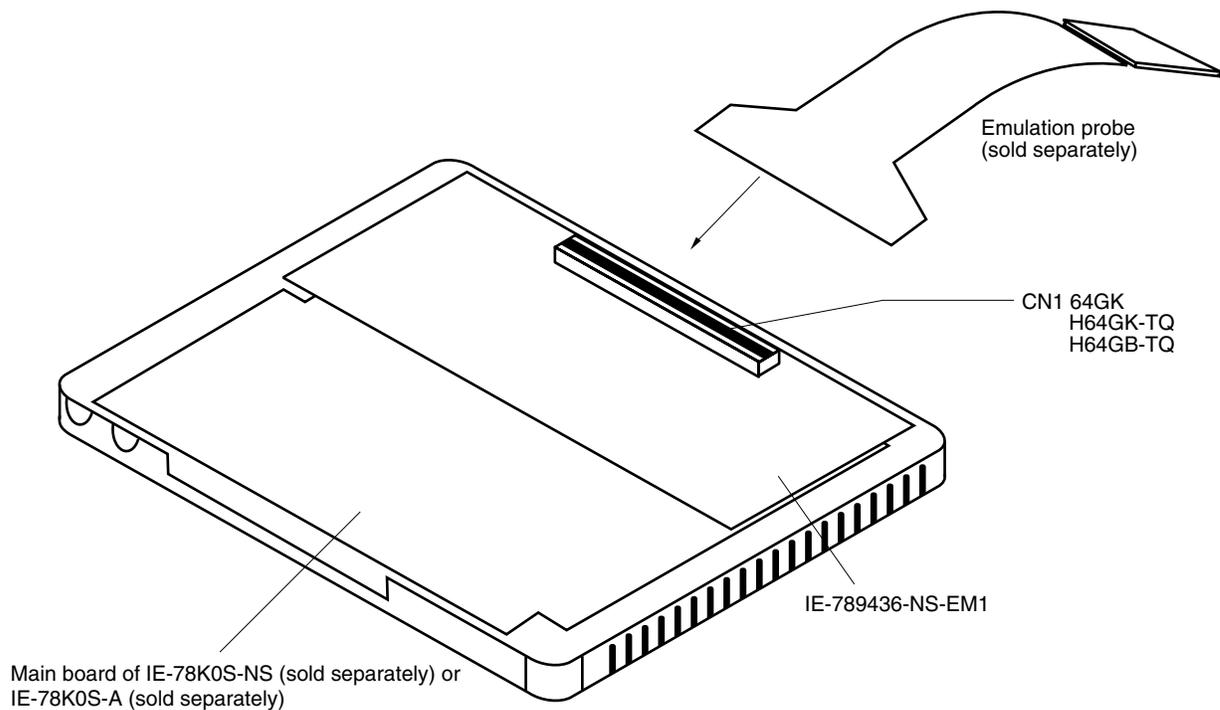
3.2 Switch and Jumper Settings on Main Unit

(1) Switch and jumper settings on the IE-78K0S-NS

When using the IE-789436-NS-EM1, set the switches and jumpers on the IE-78K0S-NS as shown below.

For details of these switch and jumper settings, refer to the **IE-78K0S-NS User's Manual (U13549E)**.

Caution **If the jumpers and switches are set incorrectly, the board may be damaged.**

Table 3-1. Switch and Jumper Settings on IE-78K0S-NS

	SW1	SW3	SW4	JP1	JP4
Setting	OFF	All switches ON	All switches ON	2 to 3 shorted	1 to 2 shorted

(2) Switch and jumper setting on IE-78K0S-NS-A

When using the IE-789436-NS-EM1, set the switches and jumpers on the IE-78K0S-NS-A as shown below. For the position of the switches and jumpers, refer to the **IE-78K0S-NS-A User's Manual (U15207E)**.

Caution **If the jumpers and switches are set incorrectly, the board may be damaged.**

Table 3-2. Switch and Jumper Settings on IE-78K0S-NS-A

	SW1	JP1	JP3
Setting	OFF	1 and 2 shorted	Shorted (fixed)

3.3 Setting Power Supply Voltage of Target Interface

In the IE system, emulation is possible with a voltage of the same level as the power supply voltage of the target system.

When the target system is not connected, the IE system automatically operates with the emulator's internal power supply (5 V). When debugging with a voltage that is the same level as that of the target system, supply the same voltage as that of the target system to the TP1 terminal pin of the IE-789436-NS-EM1 (the same applies when the voltage is 5 V). Set the target voltage to between 1.8 and 5.0 V. For how to select the operating power supply, refer to the **ID78K Series Ver.2.30 or Later Operation Windows-Based User's Manual (U15185E)**.

- Maximum current consumption of TP1
     1.8 to 5.0 V: Approximately 100 mA

Table 3-3. Setting Power Supply of Target Interface

Power Supply of Target Interface (LV$_{CC}$)		Integrated Debugger (ID78K0S-NS)
		Operating Power Supply Selection
When connecting target system	1.8 to 5.0 V	Target
When not connecting target system	5 V	Internal

Figure 3-2. Connecting TP1 and Target System Power Supply Voltage
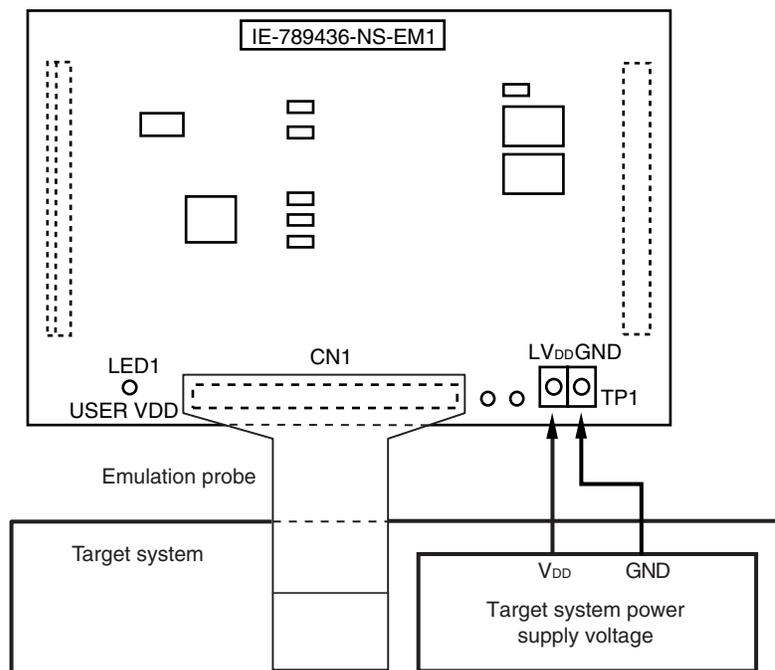
Caution **Before connecting TP1 on the board and the target system power supply voltage, turn off the power to the IE-78K0S-NS or IE-78K0S-NS-A.**

Remark The V$_{DD}$ pin on the target system is exclusively used to control LED1 (USER VDD) that monitors whether the power supply of the target system is connected in the IE-789436-NS-EM1.

3.4 Clock Settings

3.4.1 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)   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 a 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 3-3. 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 for the IE-78K0S-NS or IE-78K0S-NS-A is used.

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

Caution   The IE system will be hung-up if the main system clock is not supplied normally. Moreover, be sure to input a rectangular wave as the pulse from the target system. There is no need to supply a clock to the X2 and XT2 pins. The IE system does not operate if the crystal resonator is connected to X1 (main system clock) and XT1 (subsystem clock).

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

(a) Clock oscillator

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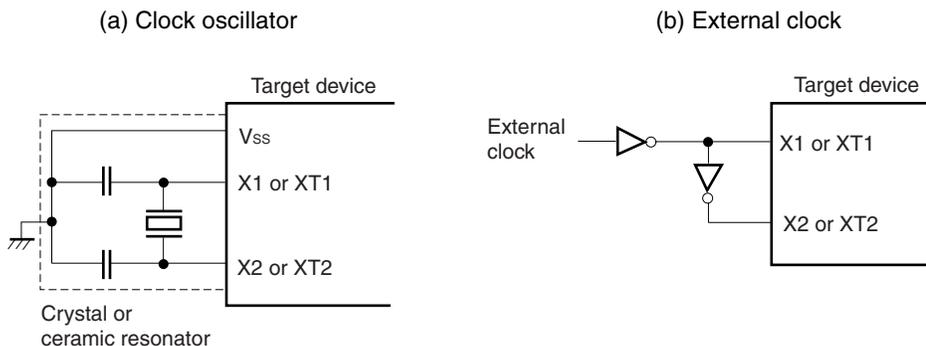
(1) Clock that is already mounted on emulation board

The crystal oscillator mounted on the IE-789436-NS-EM1 can be used.

(a) For main system clock

A crystal oscillator (X1) is already mounted on the emulation board. Its frequency is 5.0 MHz.

Figure 3-4. When Using Clock That Is Already Mounted on Emulation Board (Main System Clock)
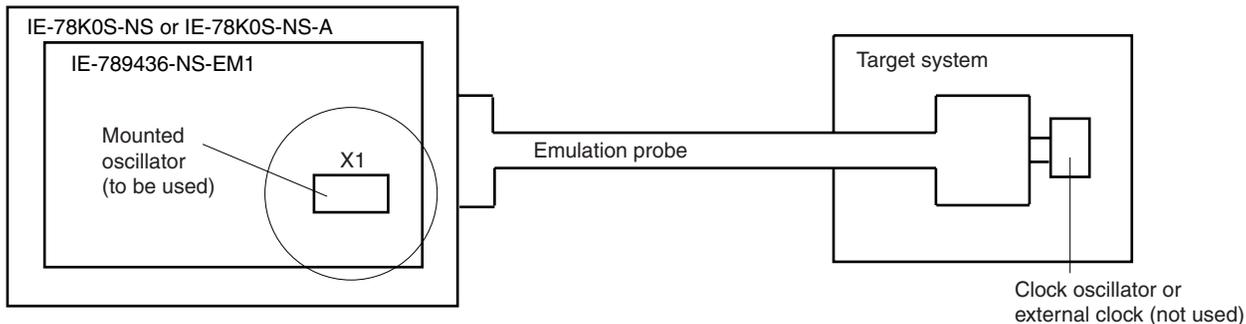
> **Remark** The clock that is supplied by the IE-789436-NS-EM1's oscillator (encircled in the figure) is used.

(b) For subsystem clock

A crystal resonator (XTC1) is already mounted on the emulation board. Its frequency is 32.768 kHz.

Figure 3-5. When Using Clock That Is Already Mounted on Emulation Board (Subsystem Clock)
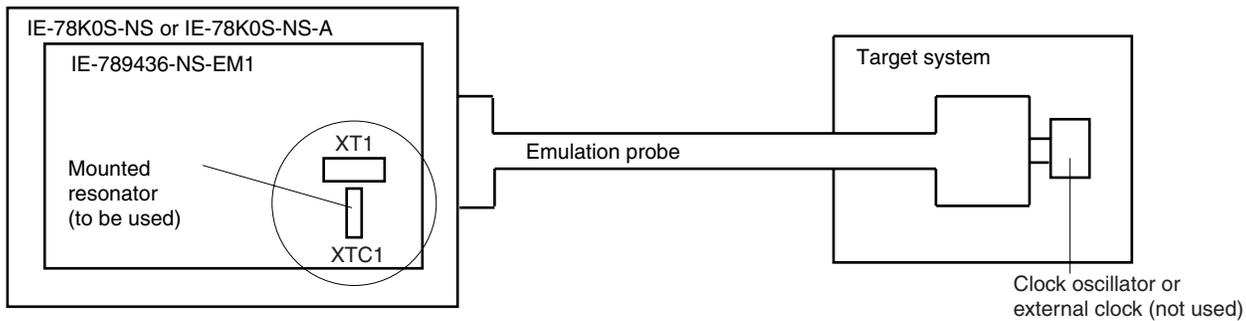
> **Remark** The clock that is supplied by the IE-789436-NS-EM1's resonator (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-789436-NS-EM1. This method is useful when using a different frequency from that of the pre-mounted clock.

(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.

Figure 3-6. When Using User-Mounted Clock (Main System Clock)
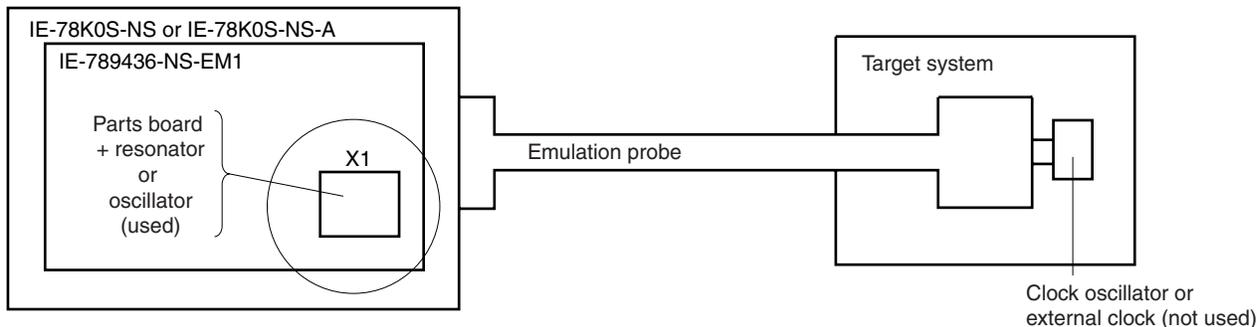
> **Remark** The clock that is supplied by the parts board with a resonator or the oscillator on the IE-789436-NS-EM1 (encircled in the figure) is used.

(b) For subsystem clock

Remove the parts board (XT1) 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 3-7. When Using User-Mounted Clock (Subsystem Clock)
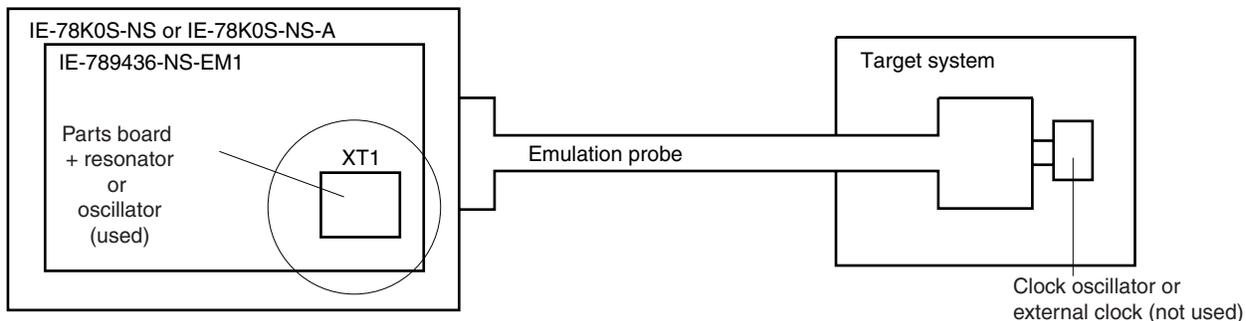
> **Remark** The clock that is supplied by the resonator of the IE-789436-NS-EM1 (encircled in the figure) or the oscillator is used.

(3) Pulse input from target system

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

Figure 3-8. When Using Pulse of Target System
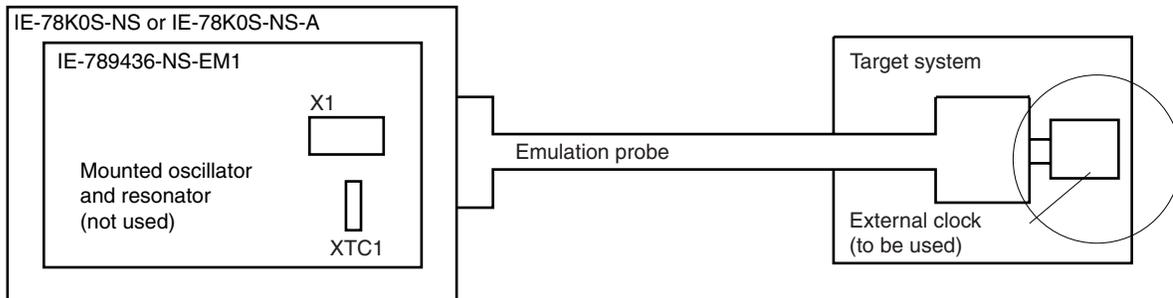
> **Remark** The pulse supplied by the target system's external clock (encircled in the figure) is used.

3.4.2 Main system clock settings

Table 3-4 shows the main system clock settings of the IE-789436-NS-EM1. The following shows the settings of the IE-789436-NS-EM1 when the main system clocks in (1) to (3) are used.

Table 3-4. Main System Clock Settings

Frequency of Main System Clock		IE-789436-NS-EM1	CPU Clock Source Selection (ID78K0S-NS)
		X1 Socket	
(1) When using clock that is already mounted on emulation board	5.0 MHz	Oscillator used	Internal
(2) When using clock mounted by user	Other than 5.0 MHz	Oscillator assembled by user	
(3) When pulse is input from target system		Oscillator (not used)	External

> **Caution** **When using an external clock, open the configuration dialog box when starting the integrated debugger (ID78K0S-NS) and select "External" in the area (Clock) for selecting the CPU's clock source (this selects the user clock).**

> **Remark** When the IE-789436-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-789436-NS-EM1 is shipped, a 5.0 MHz crystal oscillator is already mounted in the IE-789436-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 (ID78K0S-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 (ID78K0S-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   • Capacitor CA
  • Ceramic resonator or crystal resonator   • Capacitor CB
  • Resistor Rx   • Solder kit

<Steps>

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

Figure 3-9. Connections on Parts Board (Main System Clock)

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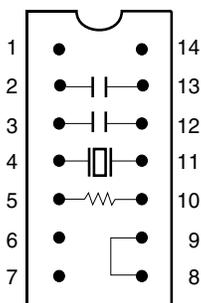
Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Ceramic resonator or crystal resonator
5-10	Resistor Rx
8-9	Shorted

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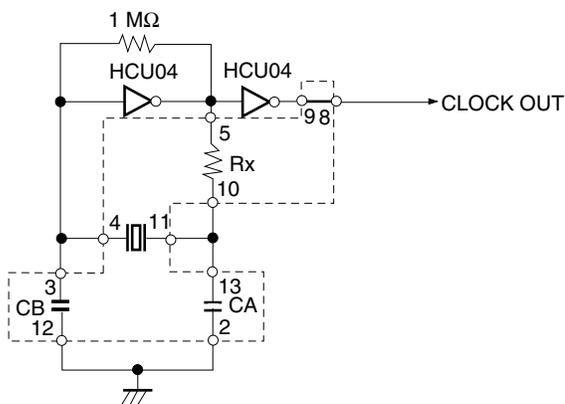
Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

<2> Prepare the IE-789436-NS-EM1.

<3> Remove the crystal oscillator that is mounted in the IE-789436-NS-EM1's socket (the socket marked as X1).

<4> Connect the parts board (from <1> above) to the socket (X1) 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 3-9 above.

<6> Install the IE-789436-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(b) When using a crystal oscillator

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-10)

Figure 3-10. Crystal Oscillator (Main System Clock)

<Steps>
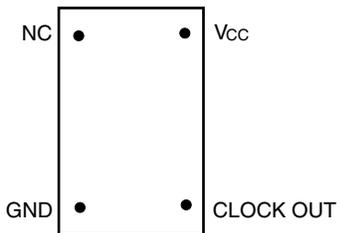
<1> Prepare the IE-789436-NS-EM1.

<2> Remove the crystal oscillator that is mounted in the IE-789436-NS-EM1's X1 socket.

<3> Mount a crystal oscillator 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 3-11. Pin Alignment of Crystal Oscillator and Socket (Main System Clock)

Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
V$_{CC}$	14
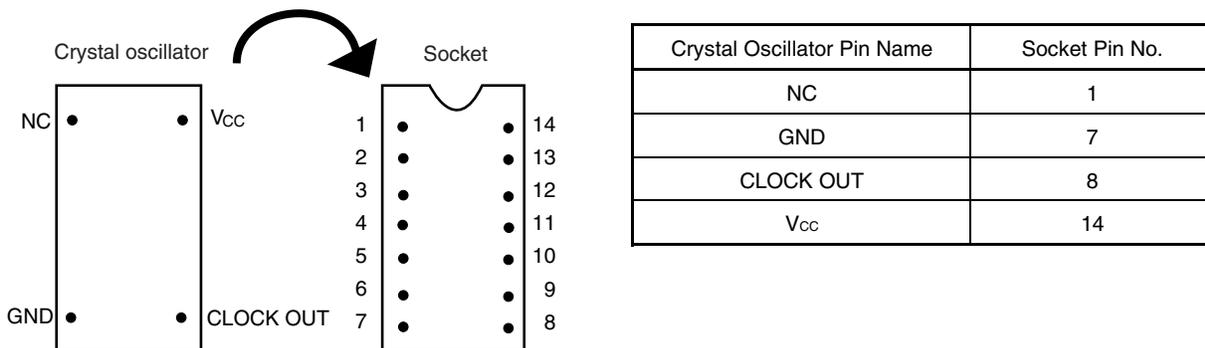
<4> Install the IE-789436-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(3) When pulse is input from target system

No hardware settings are required for this situation.

When starting the integrated debugger (ID78K0S-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).

3.4.3 Subsystem clock settings

Table 3-5 shows the subsystem clock settings of the IE-789436-NS-EM1. The following shows the settings of the IE-789436-NS-EM1 when the subsystem clocks in (1) to (3) are used.

Table 3-5. Subsystem Clock Settings

Frequency of Subsystem Clock to Be Used		IE-789436-NS-EM1	
		XT1 Socket	JP1
(1) When using clock (XTC1) that is already mounted on emulation board	32.768 kHz	6 and 8 shorted	Short 2 to 3 side
(2) When using clock mounted by user	Other than 32.768 kHz	Oscillator assembled by user	
(3) When pulse is input from target system		Not used	Short 1 to 2 side

Caution **Jumper JP1, 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-78K0S-NS or IE-78K0S-NS-A.**

Remark When the IE-789436-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-789436-NS-EM1 is shipped, a 32.768 kHz crystal resonator (XTC1) and the parts board (XT1) on which pins 6 and 8 are shorted are already mounted on the IE-789436-NS-EM1. Short the 2 to 3 side on the IE-789436-NS-EM1's jumper (JP1). There is no need to make any other settings via the integrated debugger (ID78K0S-NS).

(2) When using the clock mounted by user

Perform the settings described under either (a) or (b), depending on the type of clock to be used. Short the 2 to 3 side on the IE-789436-NS-EM1's jumper (JP1).

There is no need to make any other settings via the integrated debugger (ID78K0S-NS).

(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-789436-NS-EM1.

<2> Solder the ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequency) onto the supplied parts board (XT1) (as shown below).

Figure 3-12. Connections on Parts Board (Subsystem Clock)

Parts board (XT1)

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

Circuit diagram

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

<3> Make sure that the parts board (XT1) is wired as shown in Figure 3-12.

<4> Install the IE-789436-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(b) When using a crystal oscillator

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-13)

Figure 3-13. Crystal Oscillator (Subsystem Clock)

<Steps>
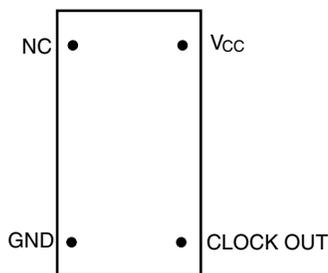
<1> Prepare the IE-789436-NS-EM1.

<2> Remove the parts board that is mounted in the IE-789436-NS-EM1's XT1 socket.

<3> Mount the crystal oscillator prepared by the user in the XT1 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 3-14. Pin Alignment of Crystal Oscillator and Socket (Subsystem Clock)

Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
V_{CC}	14
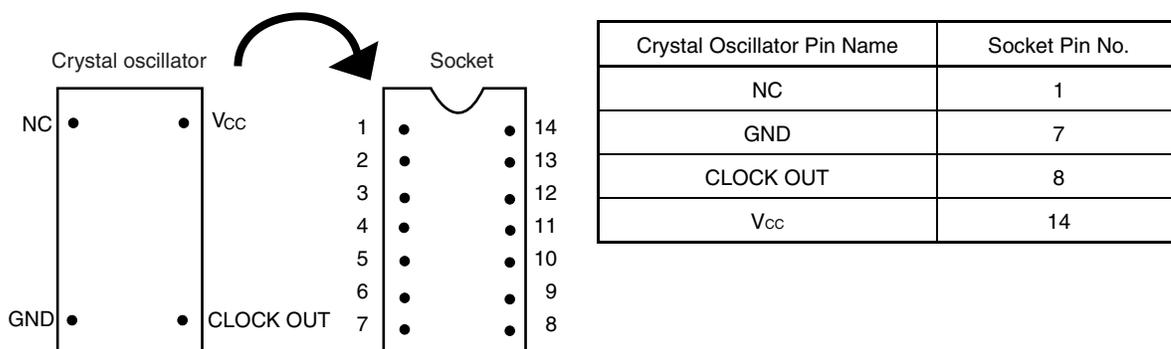
<4> Install the IE-789436-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(3) When inputting pulse from target system

Short the 1 to 2 side on the IE-789436-NS-EM1's jumper (JP1). There is no need to make any settings via the integrated debugger (ID78K0S-NS).

3.5 Mask Option Settings

By setting the DIP switch (SW1) in the IE-789436-NS-EM1, a 33 kΩ pull-up resistor can be connected to P50 to P53 by mask option.

Use the mask option setting dialog box of the integrated debugger (ID78K0S-NS) to set the mask option. When reading a project file, however, setting is not required. The results of reading a project file are reflected in the mask option setting dialog box.

For the usage method, refer to the **ID78K Series Ver.2.30 or Later Operation Windows Based Use's Manual (U15185E)**.

Table 3-6. Mask Option Setting

	SW1			
	1	2	3	4
Connected to:	P50	P51	P52	P53

When the DIP switch is ON, the corresponding pin is pulled-up by the target interface supply voltage (LVcc). When it is OFF, the corresponding pull-up resistor is disconnected. Set the DIP switch to OFF for ports that do not exist.

Figure 3-15. Mask Option Setting
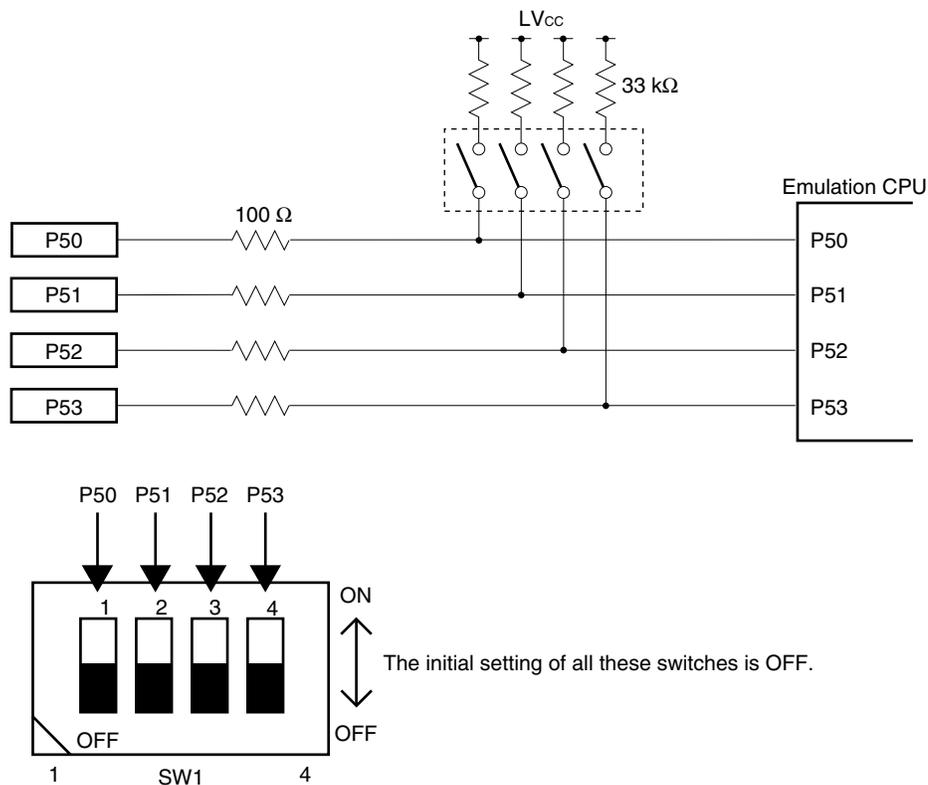
3.6   External Trigger

To set up an external trigger, connect it to the IE-789436-NS-EM1's check pins EXTOUT and EXTIN as shown below.

See the **IE-78K0S-NS User's Manual (U13549E)** or **IE-78K0S-NS-A User's Manual (U15207E)** for the usage methods and pin characteristics.

(1) EXTOUT

Outputs a low level from the EXTOUT pin on the IE-789436-NS-EM1 for 1.3 μs upon the occurrence of a break event.

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

(2) EXTIN

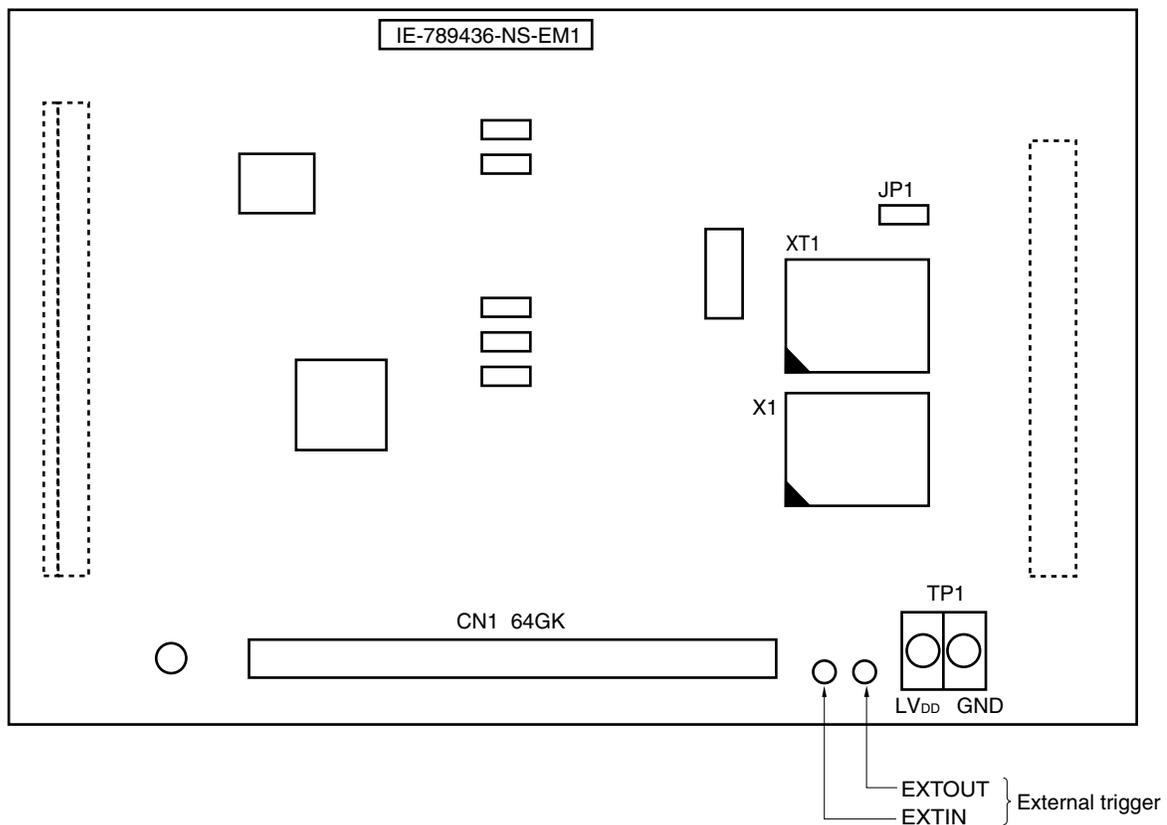An event signal can be input from the EXTIN pin on the IE-789436-NS-EM1. Input a high-level pulse signal for 2 CPU operation clocks or more.

Figure 3-16. External Trigger Input Position

CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICE AND TARGET INTERFACE CIRCUIT

This chapter describes the differences between the electrical characteristics of the target device and the electrical characteristics 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 proved.

(1) Signals directly input to or output from the emulation CPU

(2) Signals input from the target system via a gate

(3) Other signals

The circuits of the IE-789436-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 directly input to or output from the emulation CPU

Refer to **Figure 4-1 Equivalent Circuit 1 of Emulation Circuit**. The following signals operate the same as in the μPD789426, μPD789436 Subseries.

- S0 to S4
- COM0 to COM3
- CAPH, CAPL
- V_{LC0} to V_{LC2}
- Signals related to port 6, AV_{DD}, AV_{SS}
- Signals related to port 7
- Signals related to port 8

Note that for the following signals, a 1 MΩ pull-down resistor and a 100 Ω resistor are connected in series. Signals related to ports 0 and 1 are connected to a 1 MΩ pull-down resistor in the IE-78K0S-NS or IE-78K0S-NS-A.

- Signals related to port 0
- Signals related to port 1
- Signals related to port 2
- Signals related to port 3

A 33 kΩ pull-up resistor is connected to the following signals by setting the switch.

- Signals related to port 5

Figure 4-1. Equivalent Circuit 1 of Emulation Circuit
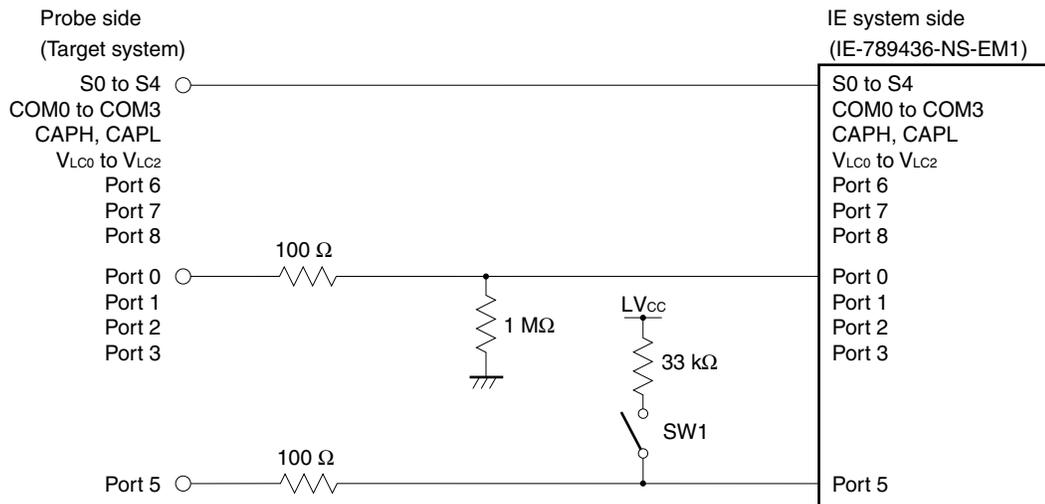
(2) Signals input from the target system via a gate

Since the following signals are input via a gate, their timing shows a delay compared to the μPD789426, 789436 Subseries. Refer to **Figure 4-2 Equivalent Circuit 2 of Emulation Circuit**.

- $\overline{\text{RESET}}$ signal
- Signals related to clock input

    The X2 and XT2 pins are not used in the IE-789436-NS-EM1.

Figure 4-2. Equivalent Circuit 2 of Emulation Circuit
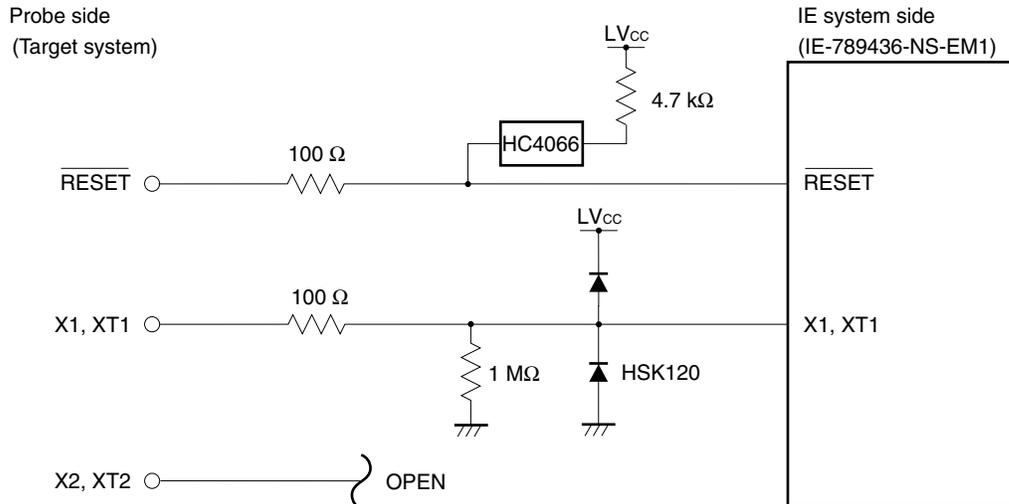
(3) Other signals

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

- V$_{DD}$ pin

  The power supply of the emulation CPU operates on the internal power supply voltage (5 V) when the target system is not connected, and on the voltage supplied from the power voltage supply pin (TP1) (LV$_{CC}$) when the target system is connected. In the IE-789436-NS-EM1, the V$_{DD}$ pin of the target system is exclusively used for controlling LED1 (USER VDD), which monitors whether the power of the target system is on.

- V$_{SS}$ pin

  The V$_{SS}$ pin is connected to GND in the IE-789436-NS-EM1.

- IC/V$_{PP}$ pin

  The IC/V$_{PP}$ pin is not used in the IE-789436-NS-EM1.

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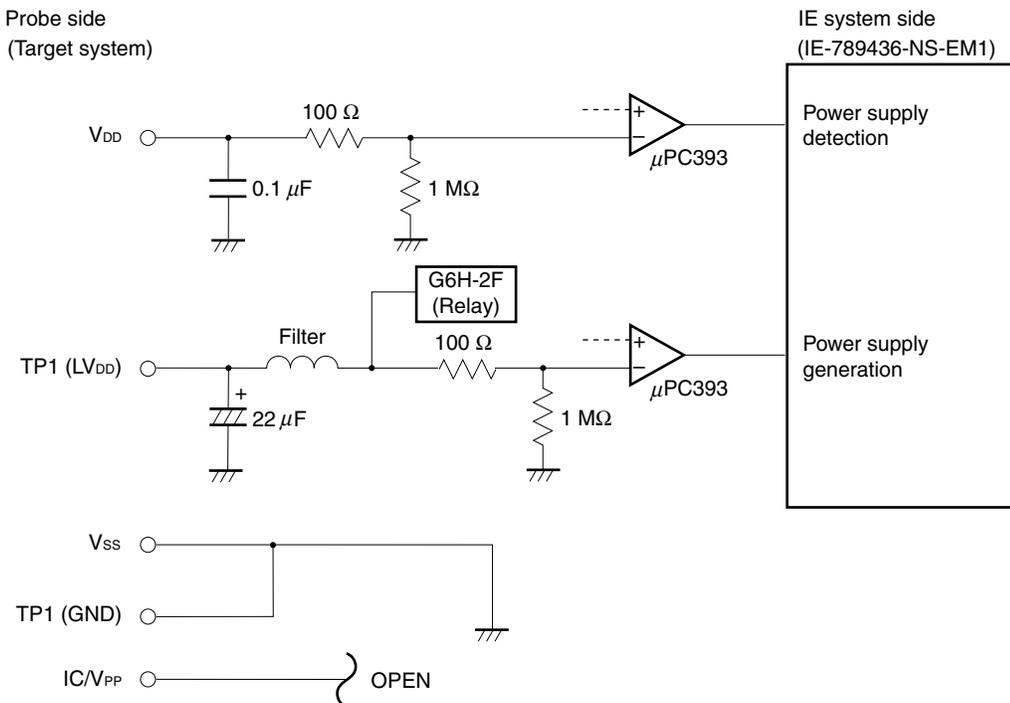
APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. NP-64GK, NP-H64GK-TQ, and NP-H64GB-TQ Pin Assignments

Emulation Probe	CN1 Pin No.	Emulation Probe	CN1 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-64GK, NP-H64GK-TQ, and NP-H64GB-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

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-H64GB-TQ, NP-64GK, and NP-H64GK-TQ are products of Naito Densei Machida Mfg. Co., Ltd., and TGB-064SDP 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-H64GB-TQ	TGB-064SDP	370 mm
NP-64GK	TGK-064SBW	170 mm
NP-H64GK-TQ		370 mm

**Figure B-1. Distance Between In-Circuit Emulator and Conversion Socket/Conversion Adapter
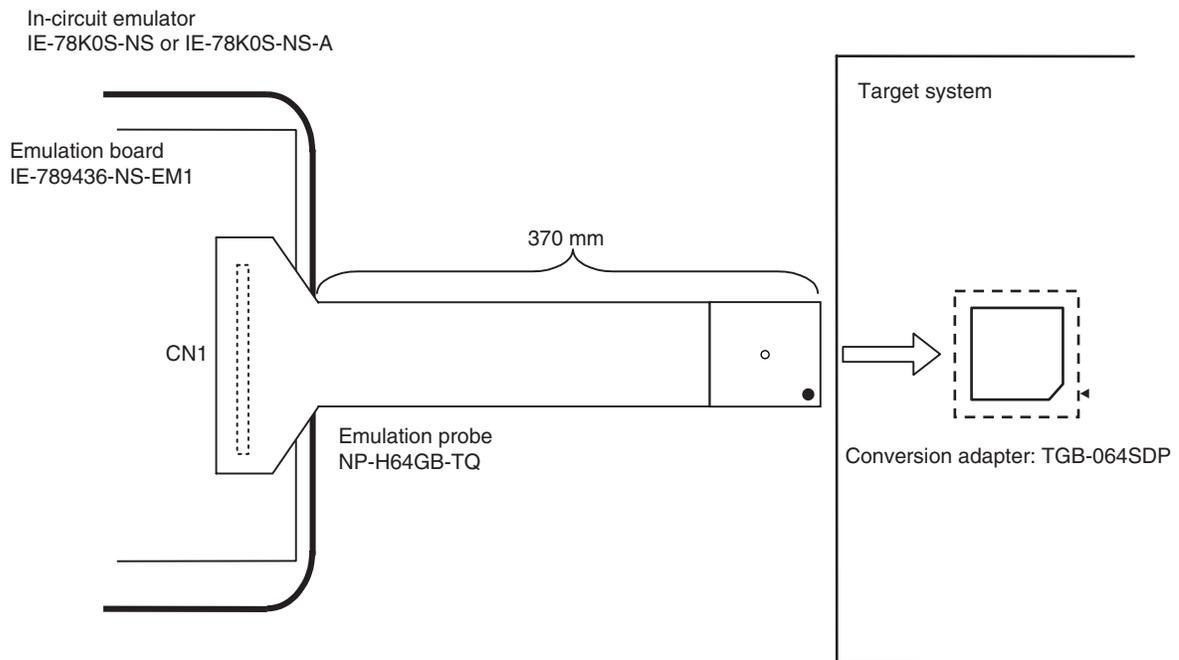(When 64GB Is Used)**

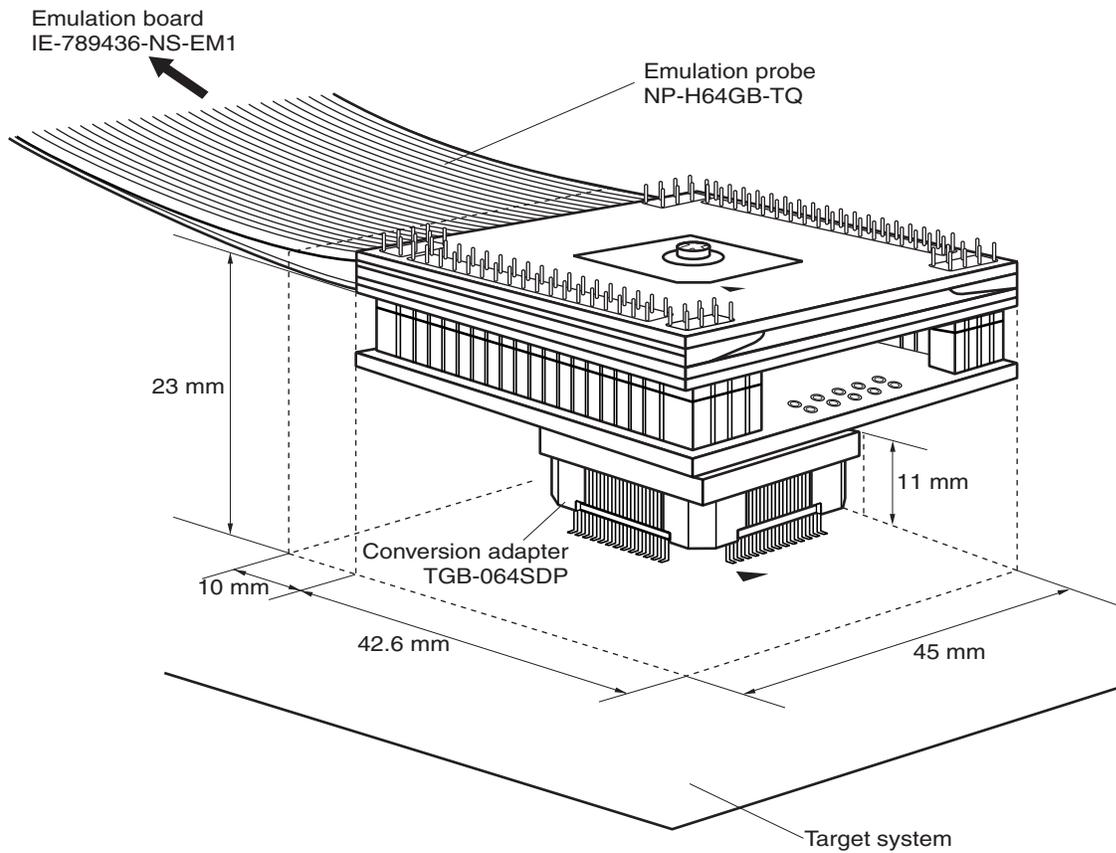**Figure B-2. Connection Condition of Target System (When NP-H64GB-TQ Is Used)**

Emulation board
IE-789436-NS-EM1

Emulation probe
NP-H64GB-TQ

23 mm

11 mm

Conversion adapter
TGB-064SDP

10 mm

42.6 mm

45 mm

Target system

Figure B-3. Distance Between In-Circuit Emulator and Conversion Adapter (When 64GK Is Used)

In-circuit emulator
IE-78K0S-NS or IE-78K0S-NS-A

Target system

Emulation board
IE-789436-NS-EM1

170 mm[Note]

CN1

Emulation probe
NP-64GK, NP-H64GK-TQ

Conversion adapter: TGK-064SBW
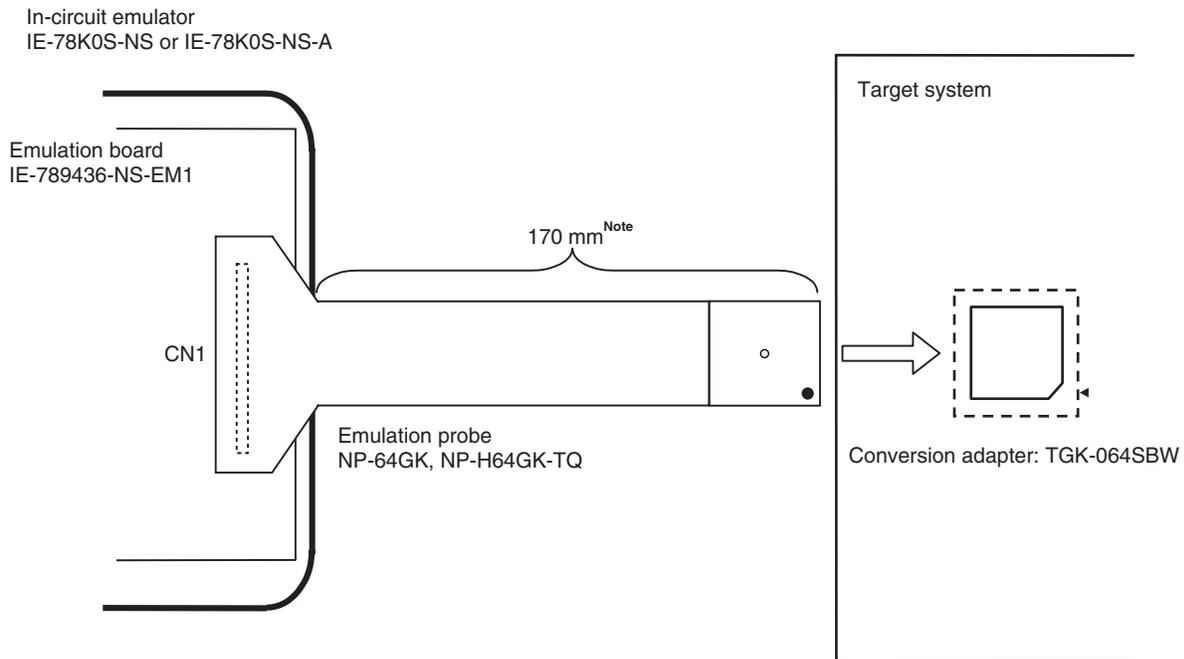
Note   Distance when NP-64GK is used. When NP-H64GK-TQ is used, the distance is 370 mm.

Figure B-4. Connection Condition of Target System (When NP-64GK Is Used)

Emulation board
IE-789436-NS-EM1

Emulation probe
NP-64GK

21.95 mm

Conversion adapter
TGK-064SBW

10.95 mm

25 mm

Pin 1

16.4 mm

16.4 mm

40 mm

34 mm

Target system

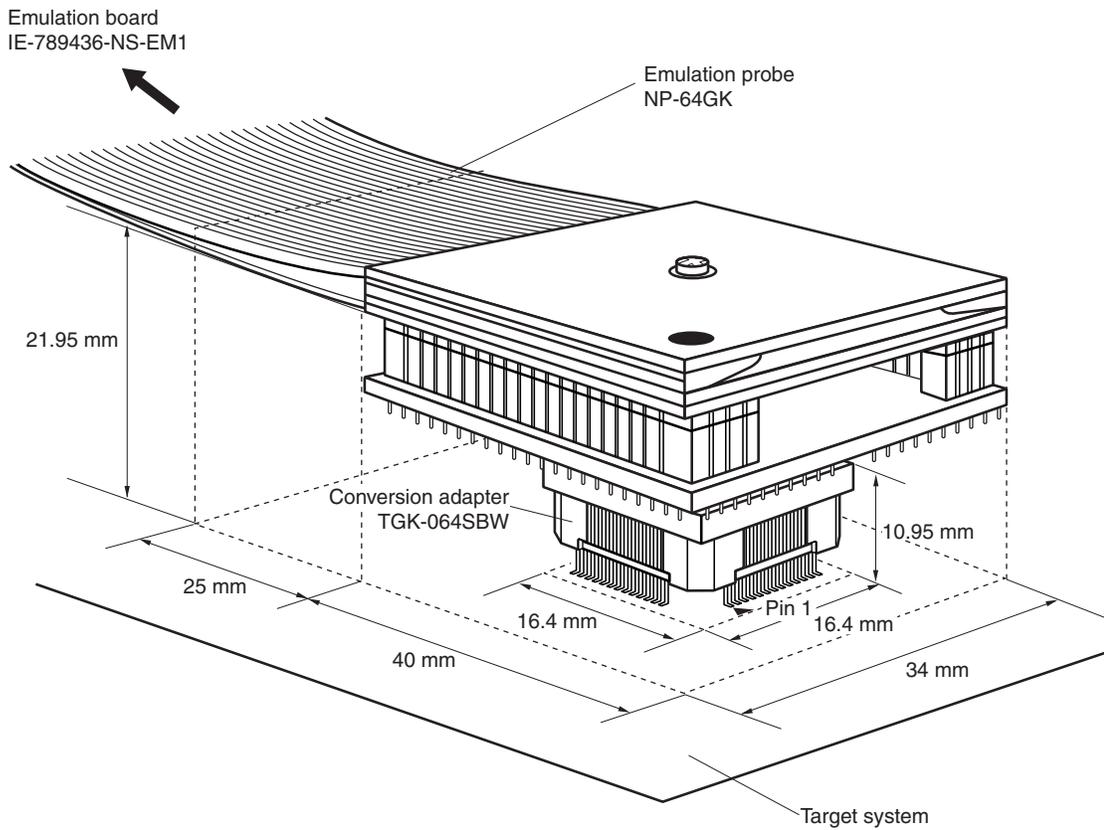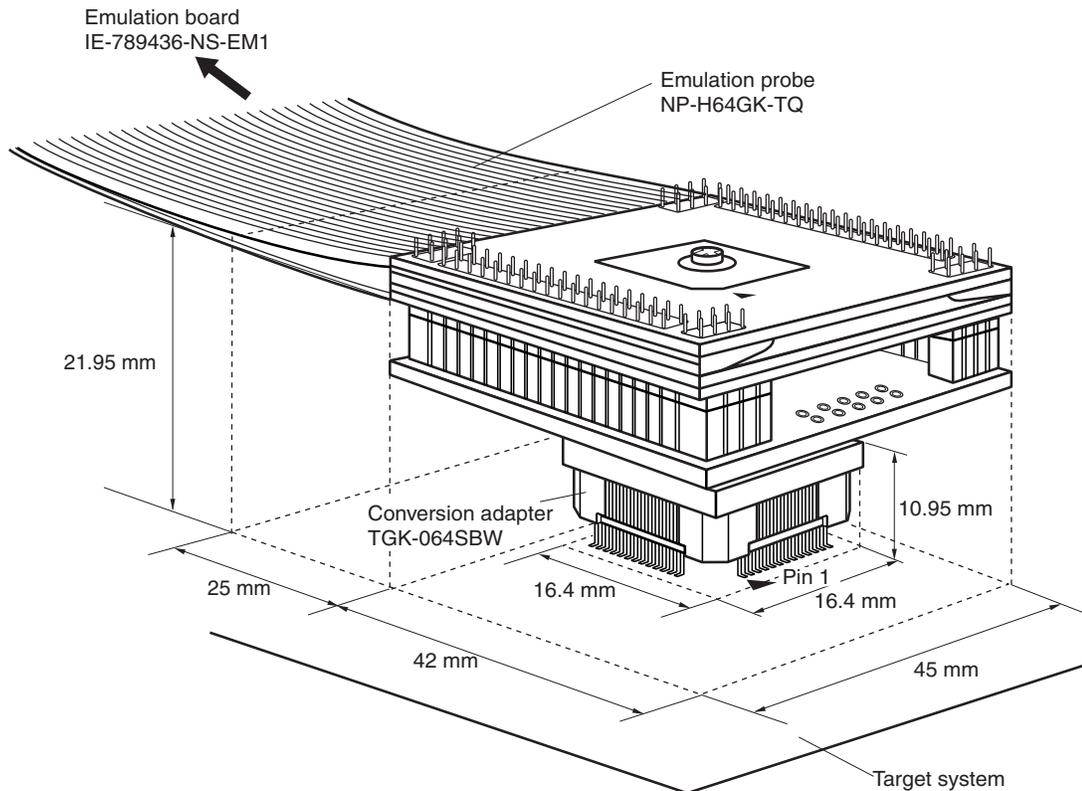**Figure B-5. Connection Condition of Target System (When NP-H64GK-TQ Is Used)**

Emulation board
IE-789436-NS-EM1

Emulation probe
NP-H64GK-TQ

21.95 mm

Conversion adapter
TGK-064SBW

10.95 mm

25 mm

Pin 1

16.4 mm

16.4 mm

42 mm

45 mm

Target system

[MEMO]

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