

User's Manual

IE-789436-NS-EM1

Emulation Board

Target Devices

μPD789426 Subseries

μPD789436 Subseries

[MEMO]

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries.

PC/AT is a trademark of International Business Machines Corporation.

- **The information in this document is current as of July, 2002. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**

- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
- NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.

- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.

- While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.

- NEC semiconductor products are classified into the following three quality grades:

"Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.

"Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

"Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

"Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.

(Note)

(1) "NEC" as used in this statement means NEC Corporation and also includes its majority-owned subsidiaries.

(2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4

Regional Information

Some information contained in this document may vary from country to country. Before using any NEC product in your application, please contact the NEC office in your country to obtain a list of authorized representatives and distributors. They will verify:

- Device availability
- 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)
- Network requirements

In addition, trademarks, registered trademarks, export restrictions, and other legal issues may also vary from country to country.

NEC Electronics Inc. (U.S.)

Santa Clara, California
Tel: 408-588-6000
800-366-9782
Fax: 408-588-6130
800-729-9288

NEC do Brasil S.A.

Electron Devices Division
Guarulhos-SP, Brasil
Tel: 11-6462-6810
Fax: 11-6462-6829

NEC Electronics (Europe) GmbH

Duesseldorf, Germany
Tel: 0211-65 03 01
Fax: 0211-65 03 327

• Sucursal en España

Madrid, Spain
Tel: 091-504 27 87
Fax: 091-504 28 60

• Succursale Française

Vélizy-Villacoublay, France
Tel: 01-30-67 58 00
Fax: 01-30-67 58 99

• Filiale Italiana

Milano, Italy
Tel: 02-66 75 41
Fax: 02-66 75 42 99

• Branch The Netherlands

Eindhoven, The Netherlands
Tel: 040-244 58 45
Fax: 040-244 45 80

• Branch Sweden

Taeby, Sweden
Tel: 08-63 80 820
Fax: 08-63 80 388

• United Kingdom Branch

Milton Keynes, UK
Tel: 01908-691-133
Fax: 01908-670-290

NEC Electronics Hong Kong Ltd.

Hong Kong
Tel: 2886-9318
Fax: 2886-9022/9044

NEC Electronics Hong Kong Ltd.

Seoul Branch
Seoul, Korea
Tel: 02-528-0303
Fax: 02-528-4411

NEC Electronics Shanghai, Ltd.

Shanghai, P.R. China
Tel: 021-6841-1138
Fax: 021-6841-1137

NEC Electronics Taiwan Ltd.

Taipei, Taiwan
Tel: 02-2719-2377
Fax: 02-2719-5951

NEC Electronics Singapore Pte. Ltd.

Novena Square, Singapore
Tel: 253-8311
Fax: 250-3583

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.

- μ PD789426 Subseries: μ PD789425, 789426, 78F9426
- μ PD789436 Subseries: μ PD789435, 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-78K0S-NS-A

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

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.

CONTENTS

CHAPTER 1 GENERAL.....	10
1.1 System Configuration.....	11
1.2 Hardware Configuration	13
1.3 Basic Specifications	14
 CHAPTER 2 PART NAMES	 15
2.1 Parts of Main Unit.....	16
2.2 Initial Settings of Switches and Jumpers	17
 CHAPTER 3 INSTALLATION.....	 18
3.1 Connection	19
3.2 Switch and Jumper Settings on Main Unit	20
3.3 Setting Power Supply Voltage of Target Interface.....	21
3.4 Clock Settings	22
3.4.1 Overview of clock settings	22
3.4.2 Main system clock settings	25
3.4.3 Subsystem clock settings	29
3.5 Mask Option Settings	32
3.6 External Trigger.....	33
 CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICE AND TARGET INTERFACE CIRCUIT	 34
 APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE	 38
 APPENDIX B CAUTIONS ON DESIGNING TARGET SYSTEM	 39

LIST OF FIGURES

Figure No.	Title	Page
1-1	System Configuration	11
1-2	Basic Hardware Configuration	13
2-1	IE-789436-NS-EM1 Part Names.....	16
3-1	Connection of Emulation Probe	19
3-2	Connecting TP1 and Target System Power Supply Voltage	21
3-3	External Circuits Used as System Clock Oscillator	22
3-4	When Using Clock That Is Already Mounted on Emulation Board (Main System Clock)	23
3-5	When Using Clock That Is Already Mounted on Emulation Board (Subsystem Clock)	23
3-6	When Using User-Mounted Clock (Main System Clock)	24
3-7	When Using User-Mounted Clock (Subsystem Clock)	24
3-8	When Using Pulse of Target System.....	25
3-9	Connections on Parts Board (Main System Clock).....	26
3-10	Crystal Oscillator (Main System Clock)	28
3-11	Pin Alignment of Crystal Oscillator and Socket (Main System Clock)	28
3-12	Connections on Parts Board (Subsystem Clock).....	30
3-13	Crystal Oscillator (Subsystem Clock)	31
3-14	Pin Alignment of Crystal Oscillator and Socket (Subsystem Clock)	31
3-15	Mask Option Setting	32
3-16	External Trigger Input Position	33
4-1	Equivalent Circuit 1 of Emulation Circuit.....	35
4-2	Equivalent Circuit 2 of Emulation Circuit.....	36
4-3	Equivalent Circuit 3 of Emulation Circuit.....	37
B-1	Distance Between In-Circuit Emulator and Conversion Adapter (When 64GB Is Used)	39
B-2	Connection Condition of Target System (When NP-H64GB-TQ Is Used)	40
B-3	Distance Between In-Circuit Emulator and Conversion Adapter (When 64GK Is Used)	40
B-4	Connection Condition of Target System (When NP-64GK Is Used).....	41
B-5	Connection Condition of Target System (When NP-H64GK-TQ Is Used)	41

LIST OF TABLES

Table No	Page	Title
1-1	Correspondence Between Emulation Probes and Conversion Adapters	12
1-2	Basic Specifications	14
2-1	Initial Settings of Switches and Jumpers	17
3-1	Switch and Jumper Settings on IE-78K0S-NS.....	20
3-2	Switch and Jumper Settings on IE-78K0S-NS-A.....	20
3-3	Setting Power Supply of Target Interface	21
3-4	Main System Clock Settings.....	25
3-5	Subsystem Clock Settings.....	29
3-6	Mask Option Setting	32
A-1	NP-64GK, NP-H64GK-TQ, and NP-H64GB-TQ Pin Assignments	38
B-1	Distance Between IE System and Conversion Adapter	39

CHAPTER 1 GENERAL

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

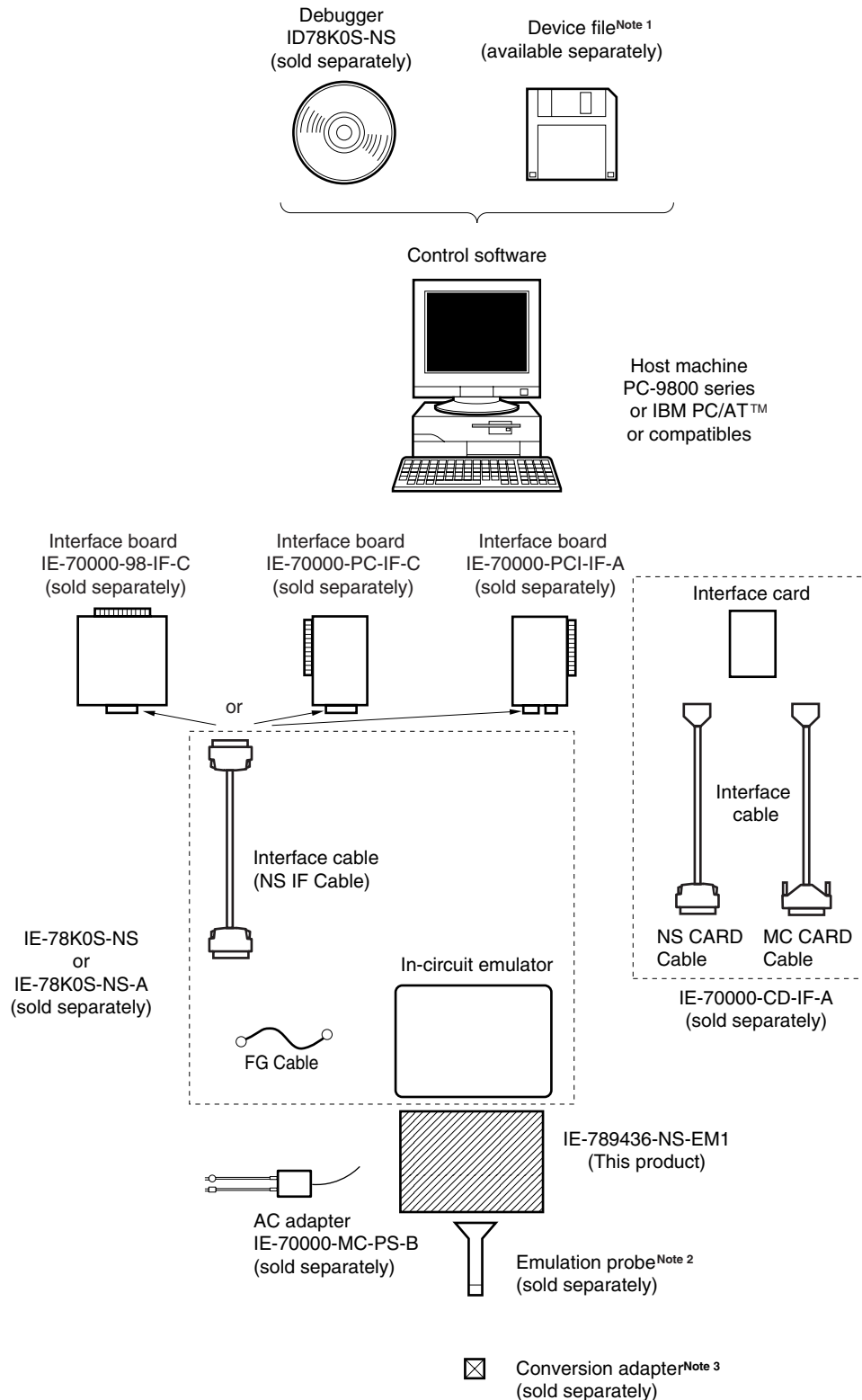
The IE-789436-NS-EM1 is a development tool for efficient debugging of hardware or software when using one of the following target devices that belong to the 78K/0S Series of 8-bit single-chip microcontrollers.

- Target device
 - μ PD789426 Subseries
 - μ PD789436 Subseries

1.1 System Configuration

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

Figure 1-1. System Configuration



Notes 1. The device file is as follows.

μ SxxxxDF789456: μ PD789426, 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 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-064SDW and TGC-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)

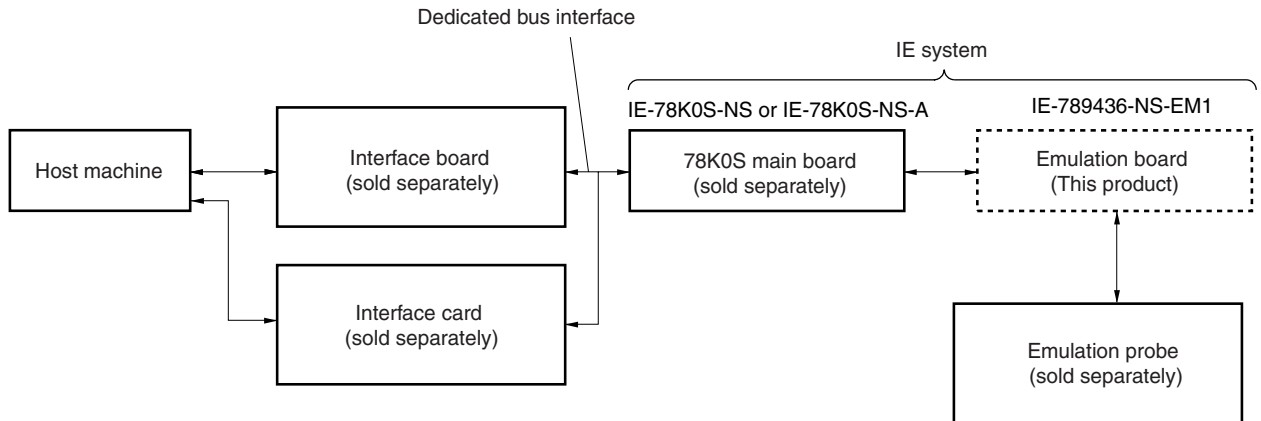
Table 1-1. Correspondence Between Emulation Probes and Conversion Adapters

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	μ PD789426, 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.

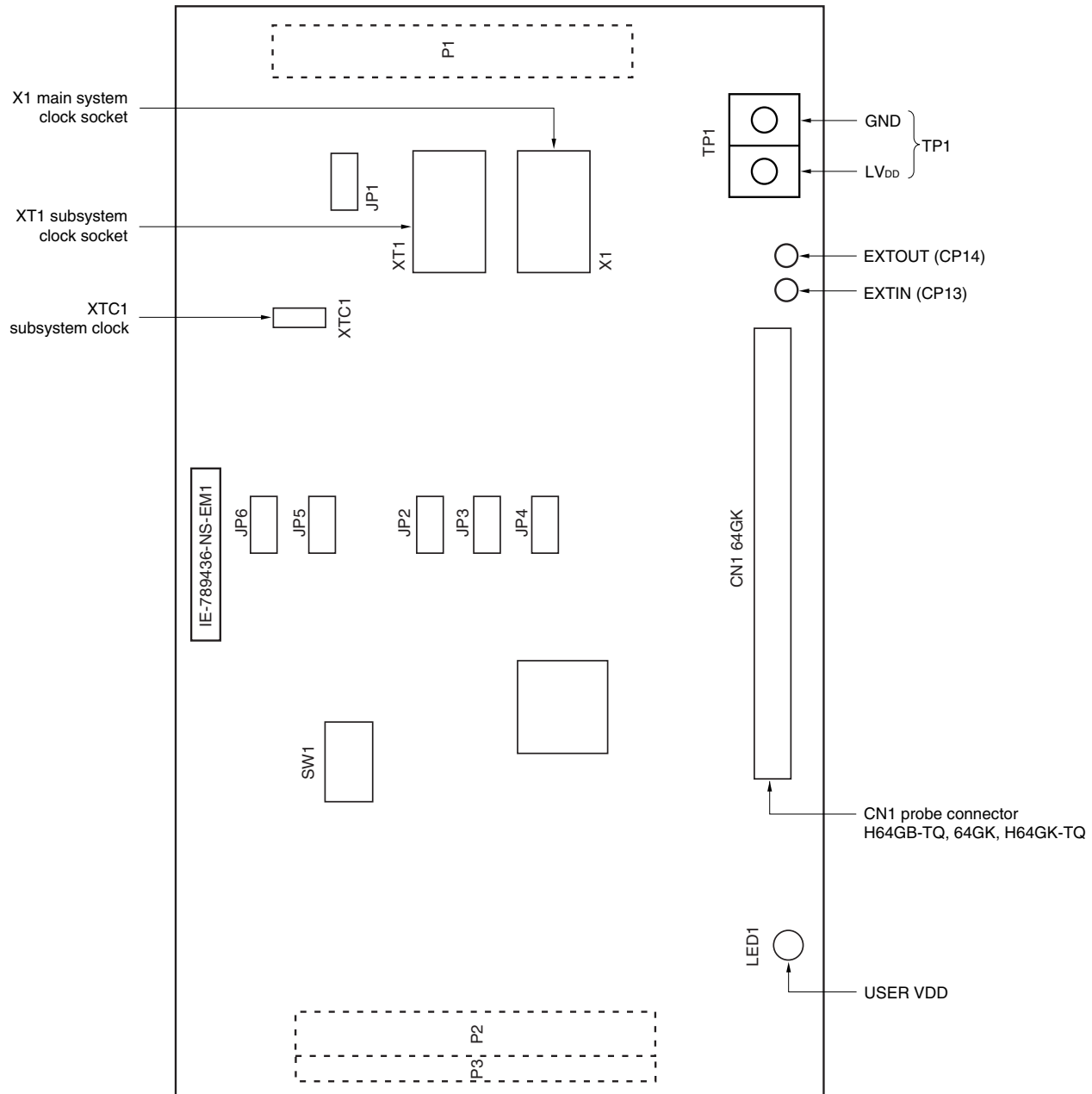
If there are any missing or damaged items, please contact an NEC sales representative.

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)

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.

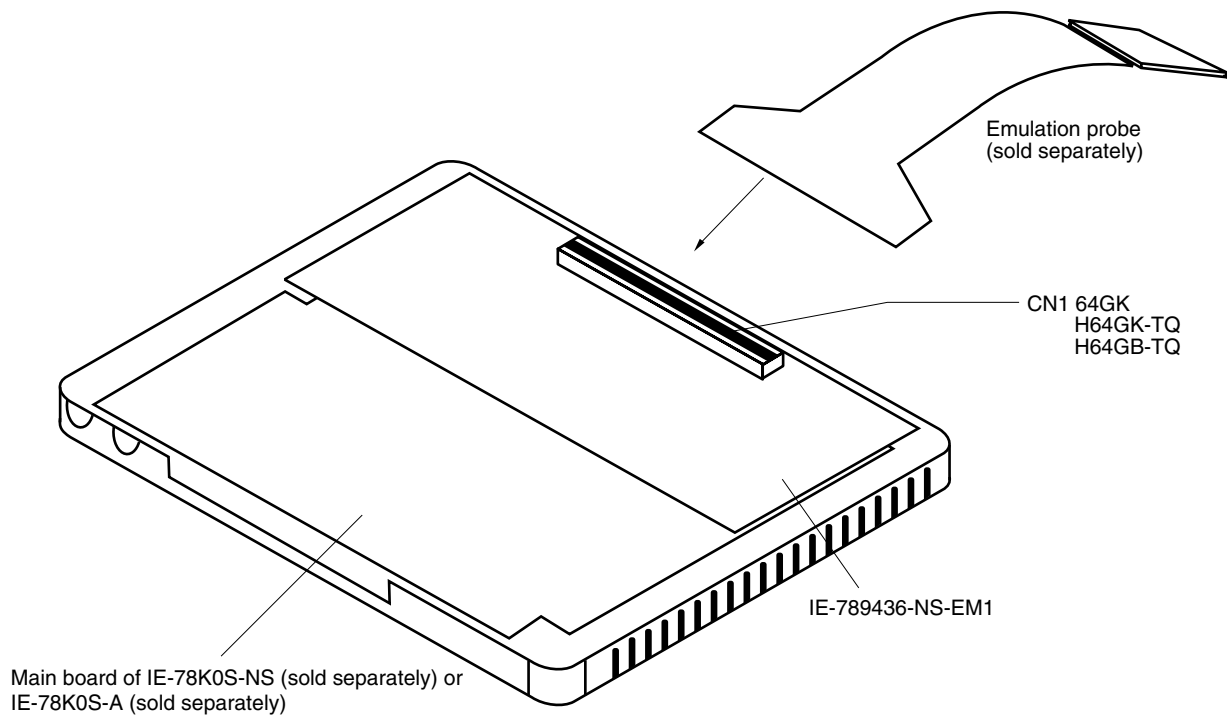
On this board, connect the emulation probe to CN1.

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



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.

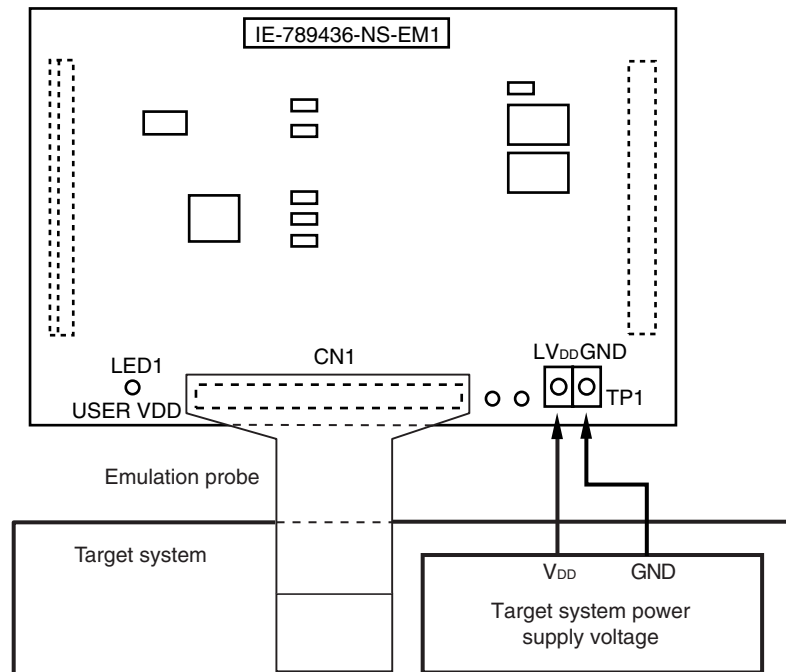
When the target system is not connected, the IE system automatically operates with the emulator's internal power supply (5 V). When debugging with a voltage that is the same level as that of the target system, supply the same voltage as that of the target system to the TP1 terminal pin of the IE-789436-NS-EM1 (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 (LVcc)		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 VDD 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.

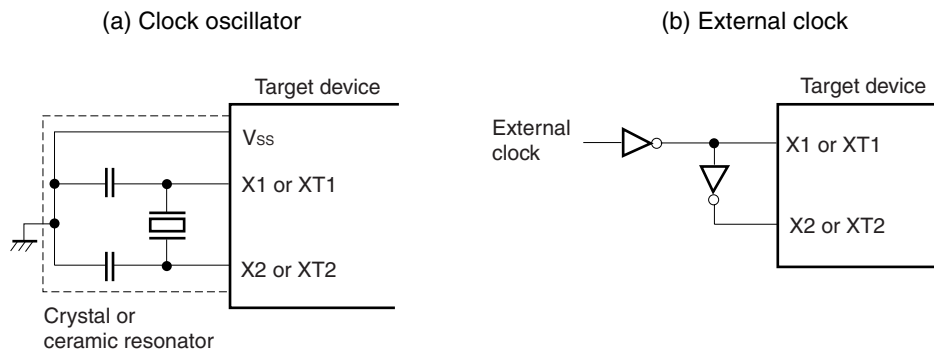
- (1) Clock that is already mounted on emulation board
- (2) Clock that is mounted by user
- (3) Pulse input from target system

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



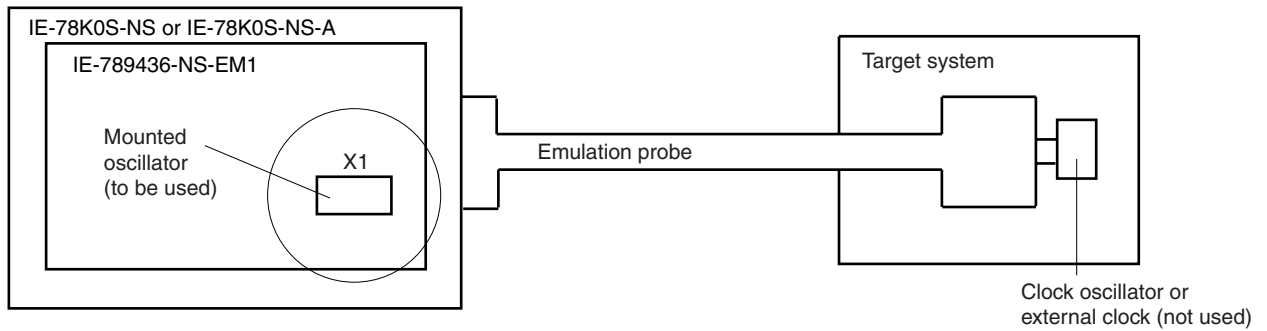
(1) Clock that is already mounted on emulation board

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)

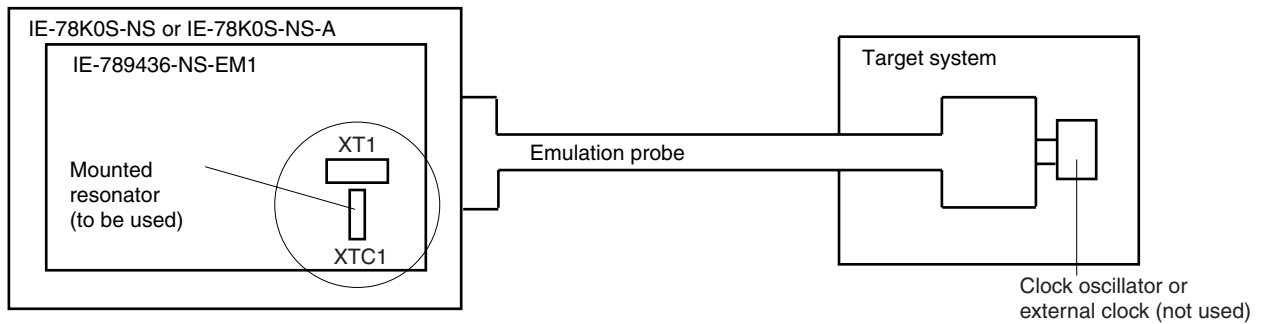


Remark The clock that is supplied by the IE-789436-NS-EM1's oscillator (encircled in the figure) is used.

(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.

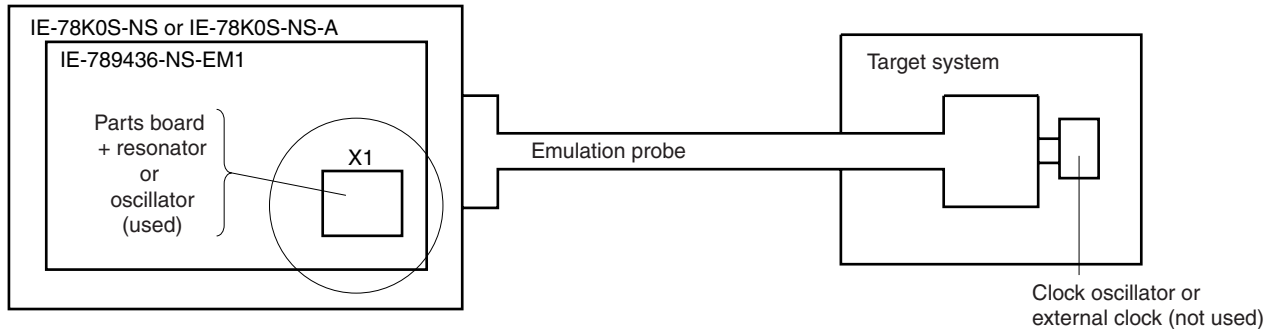
(2) Clock that is mounted by user

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)

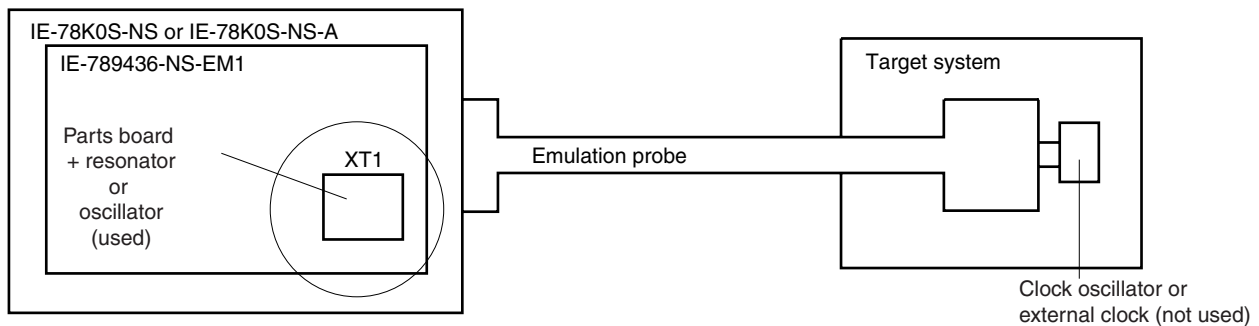


Remark The clock that is supplied by the parts board with a resonator or the oscillator on the IE-789436-NS-EM1 (encircled in the figure) is used.

(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.

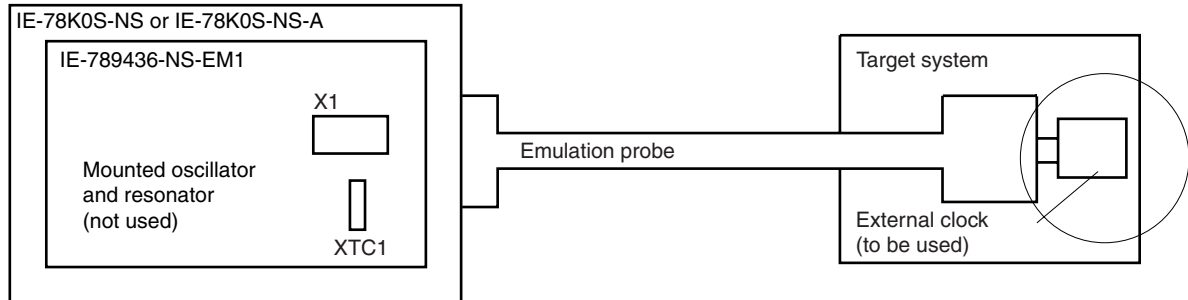
Figure 3-7. When Using User-Mounted Clock (Subsystem Clock)



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

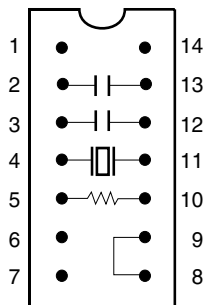
- Parts board
- Ceramic resonator or crystal resonator
- Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

<Steps>

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

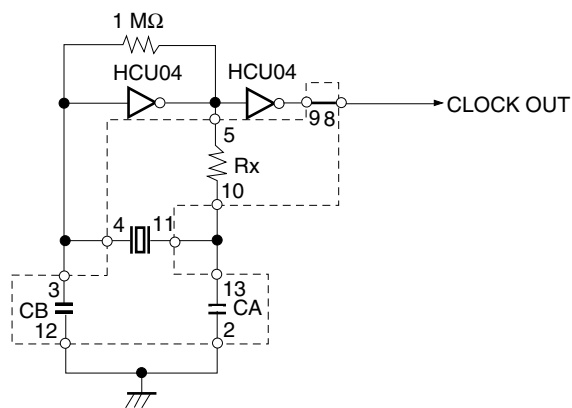
Figure 3-9. Connections on Parts Board (Main System Clock)

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

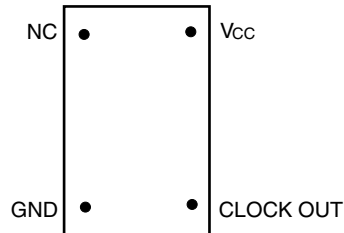


Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

- <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.

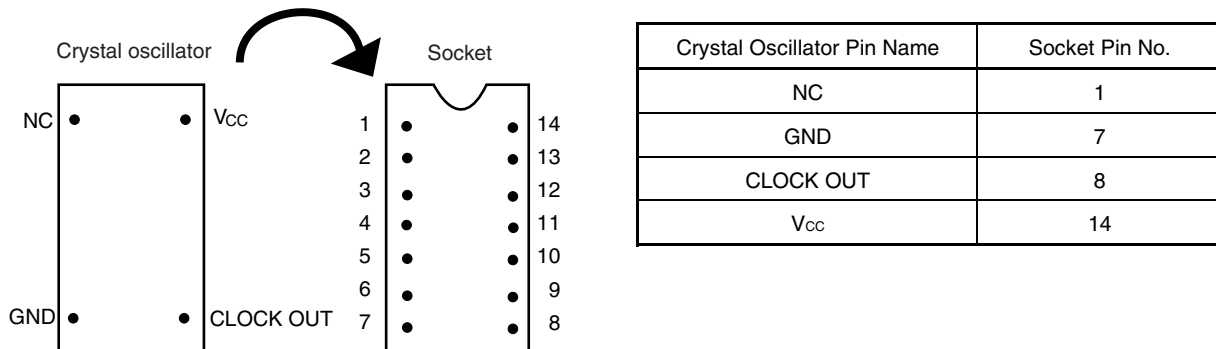
(b) When using a crystal oscillator

- 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)

- <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	Oscillator assembled by user	
(3) When pulse is input from target system	32.768 kHz	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

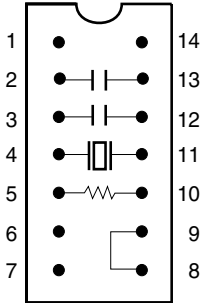
<Steps>

<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).

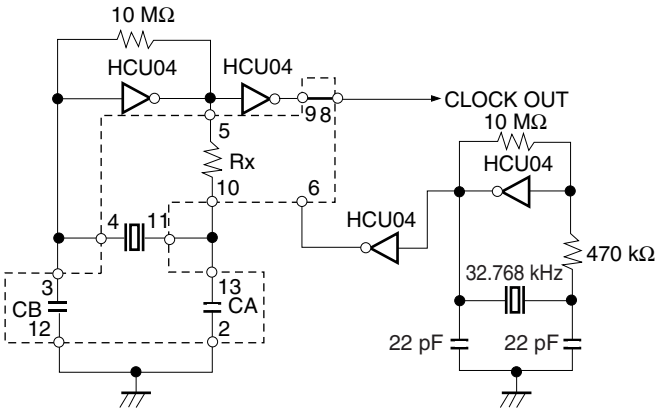
Figure 3-12. Connections on Parts Board (Subsystem Clock)

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



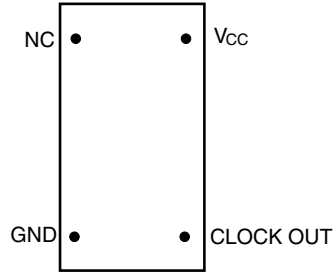
Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

- <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)

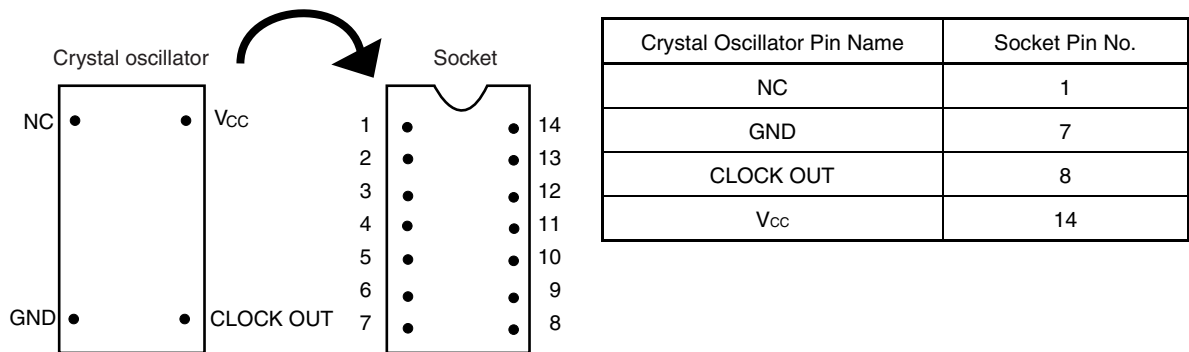
Figure 3-13. Crystal Oscillator (Subsystem Clock)



<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)



- <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 k Ω 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.

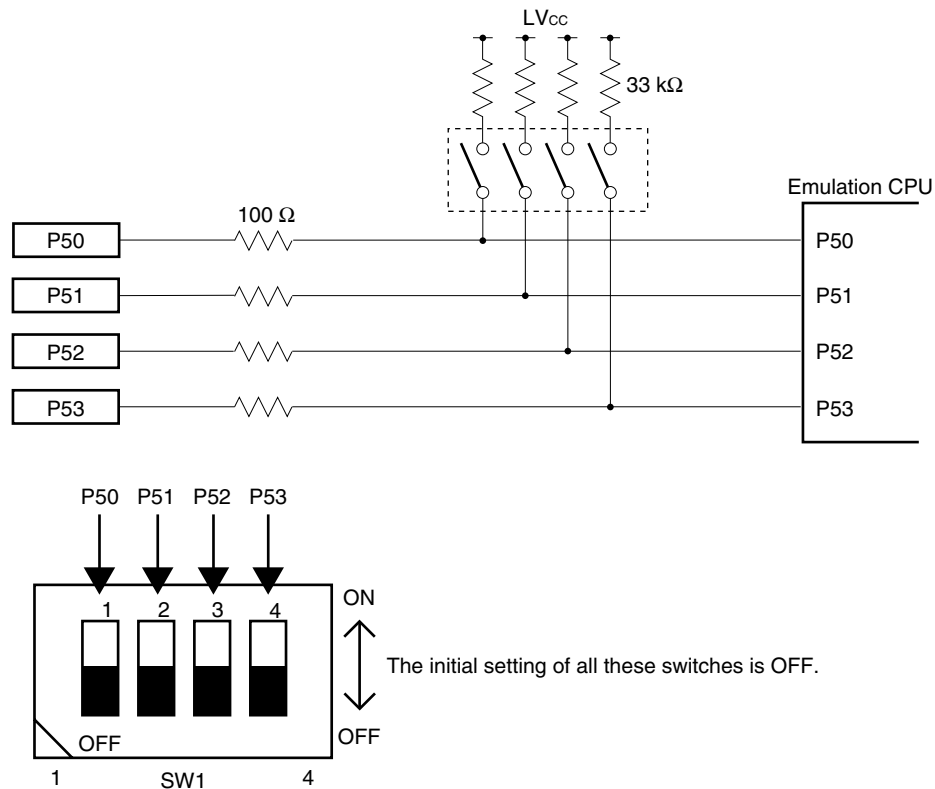
For the usage method, refer to the **ID78K Series Ver.2.30 or Later Operation Windows Based Use's Manual (U15185E)**.

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 (LV_{CC}). 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

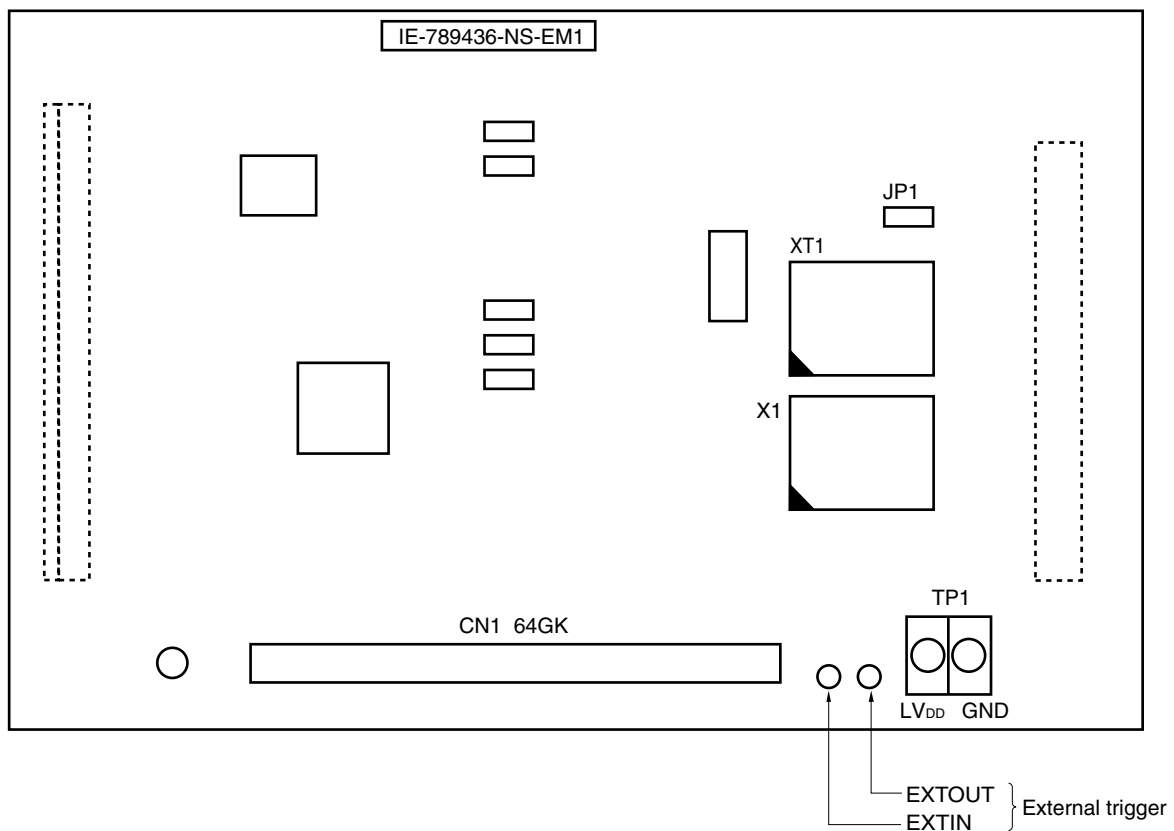
Outputs a low level from the EXTOUT pin on the IE-789436-NS-EM1 for 1.3 μ s upon the occurrence of a break event.

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 provided.

- (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 μ PD789426, μ PD789436 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

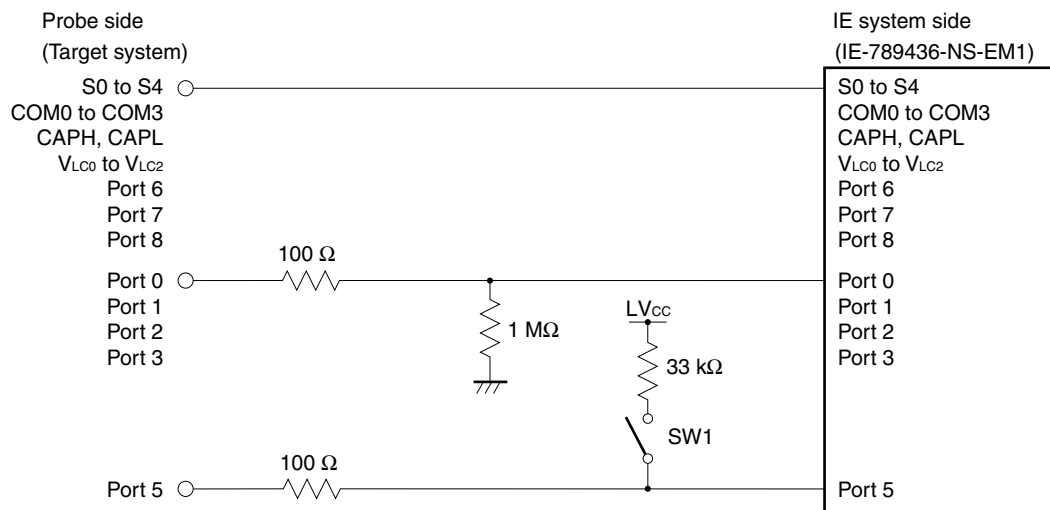
Note that for the following signals, a 1 M Ω pull-down resistor and a 100 Ω resistor are connected in series. Signals related to ports 0 and 1 are connected to a 1 M Ω pull-down resistor in the IE-78K0S-NS or IE-78K0S-NS-A.

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

A 33 k Ω 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



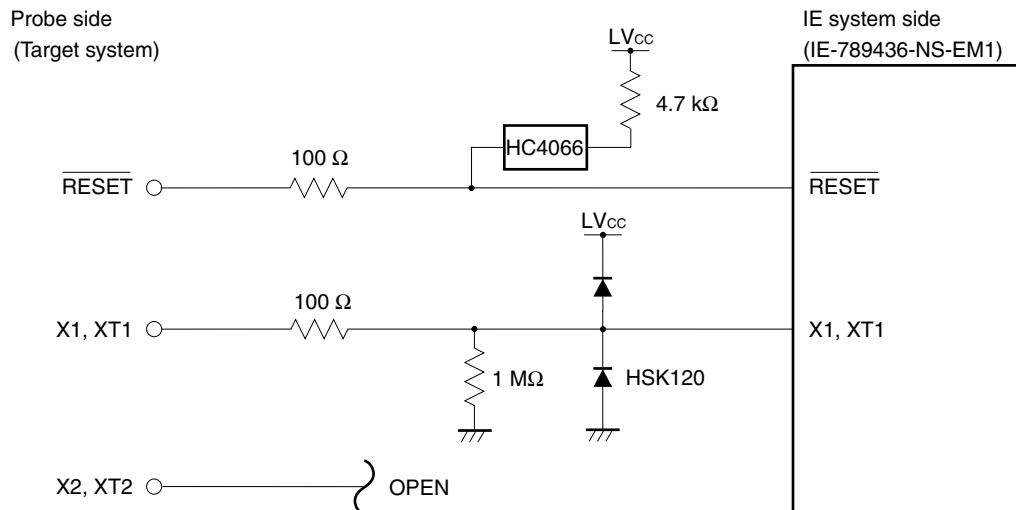
(2) Signals input from the target system via a gate

Since the following signals are input via a gate, their timing shows a delay compared to the μ PD789426, 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

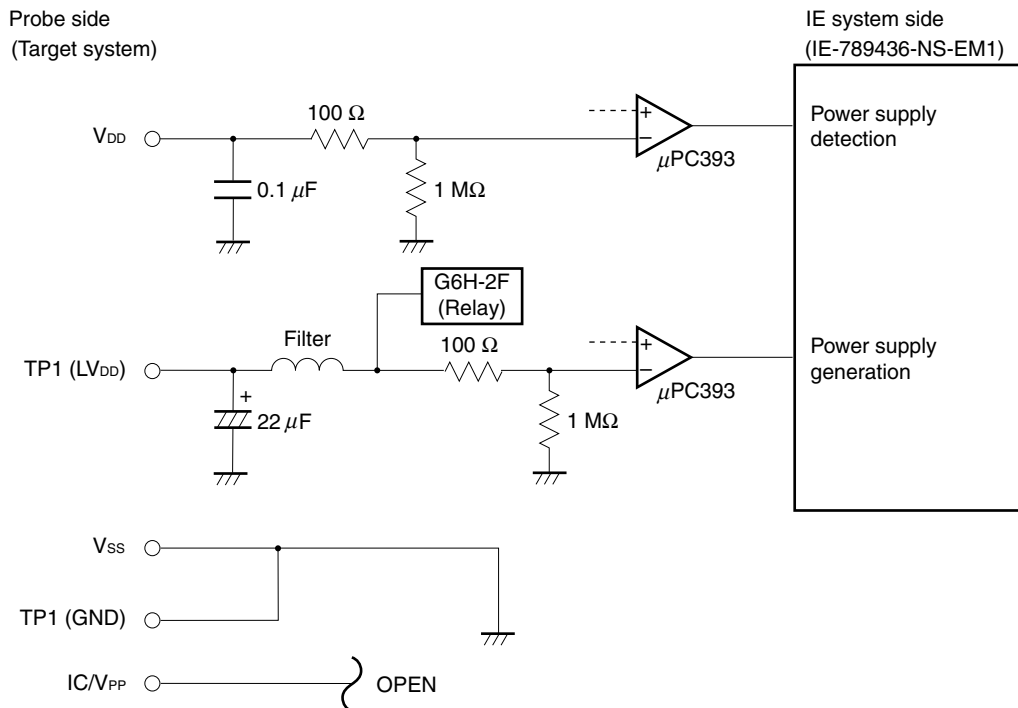


(3) Other signals

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 Densetsu 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)**

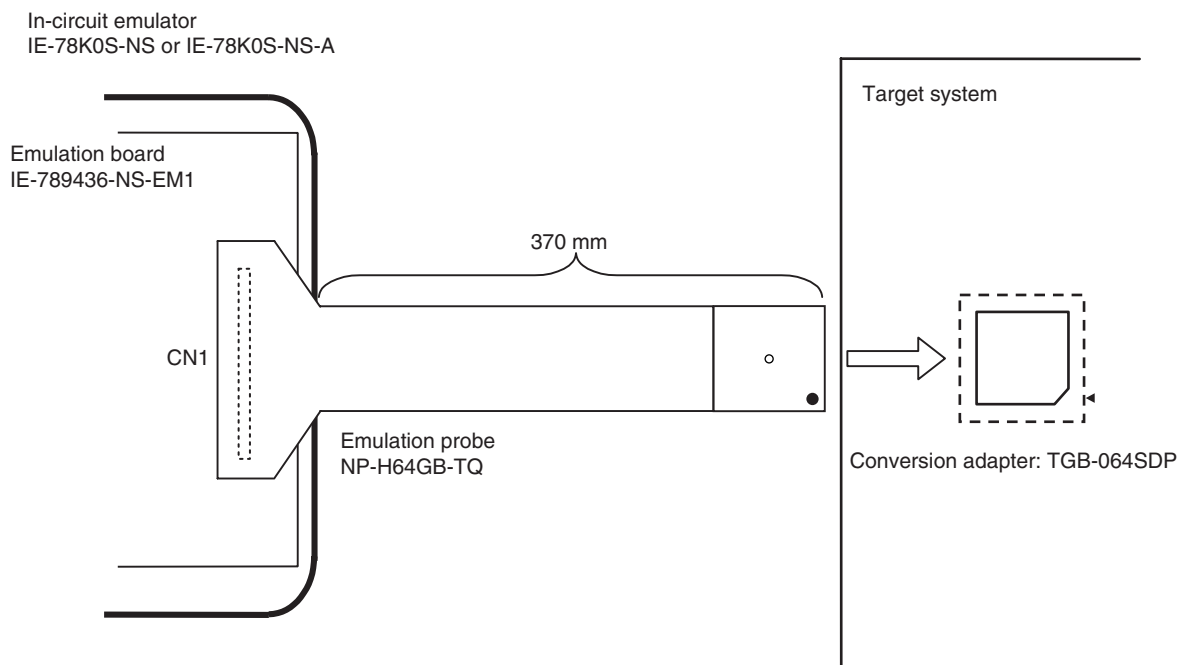


Figure B-2. Connection Condition of Target System (When NP-H64GB-TQ Is Used)

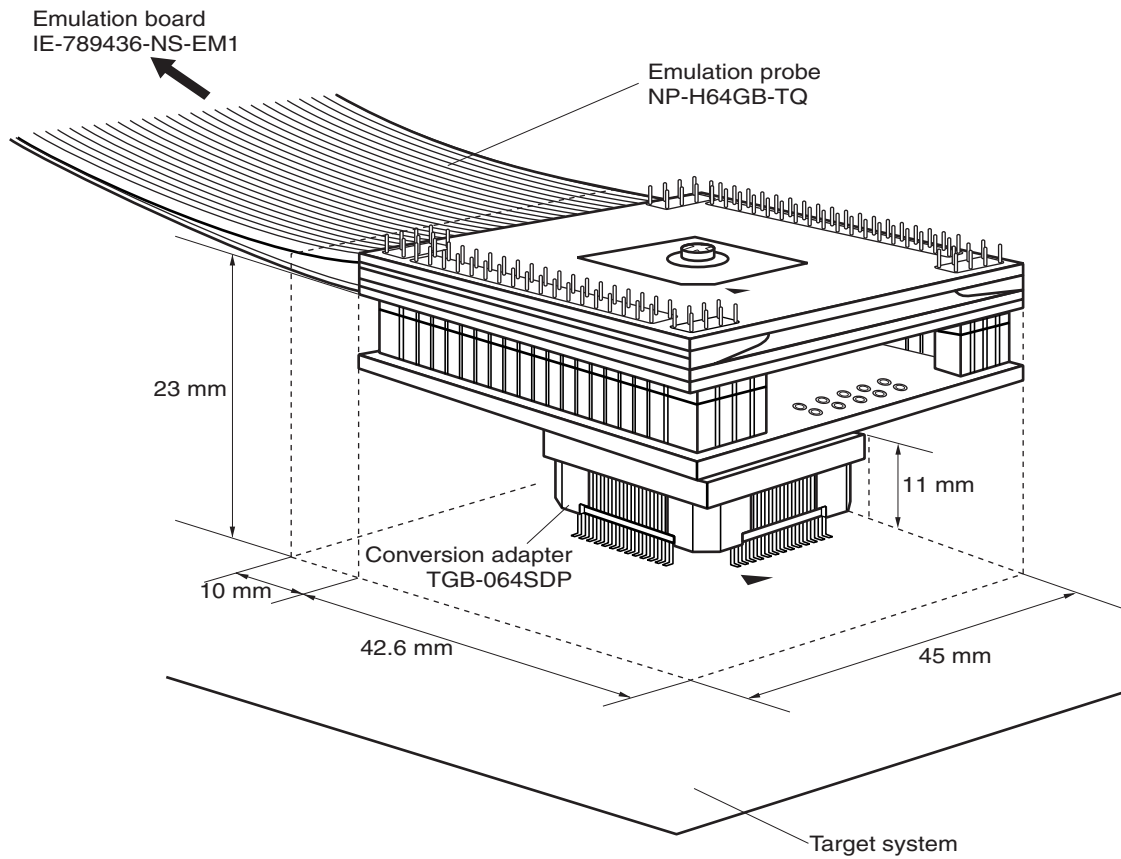
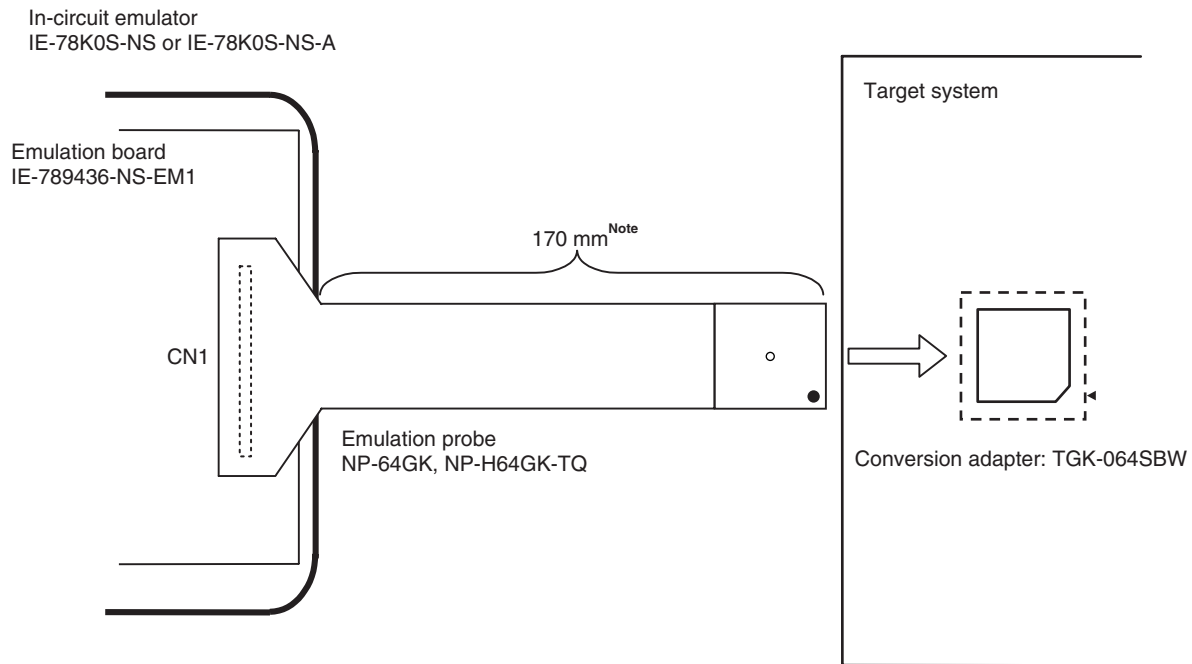


Figure B-3. Distance Between In-Circuit Emulator and Conversion Adapter (When 64GK Is Used)



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)

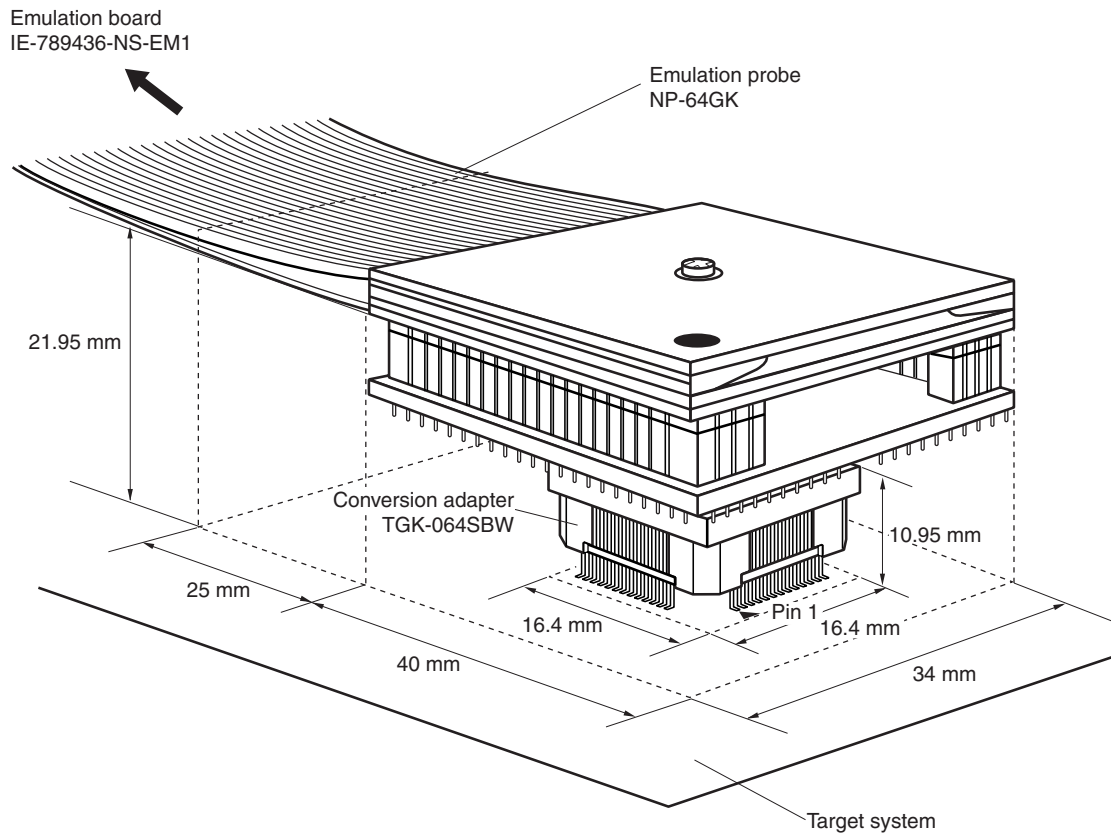
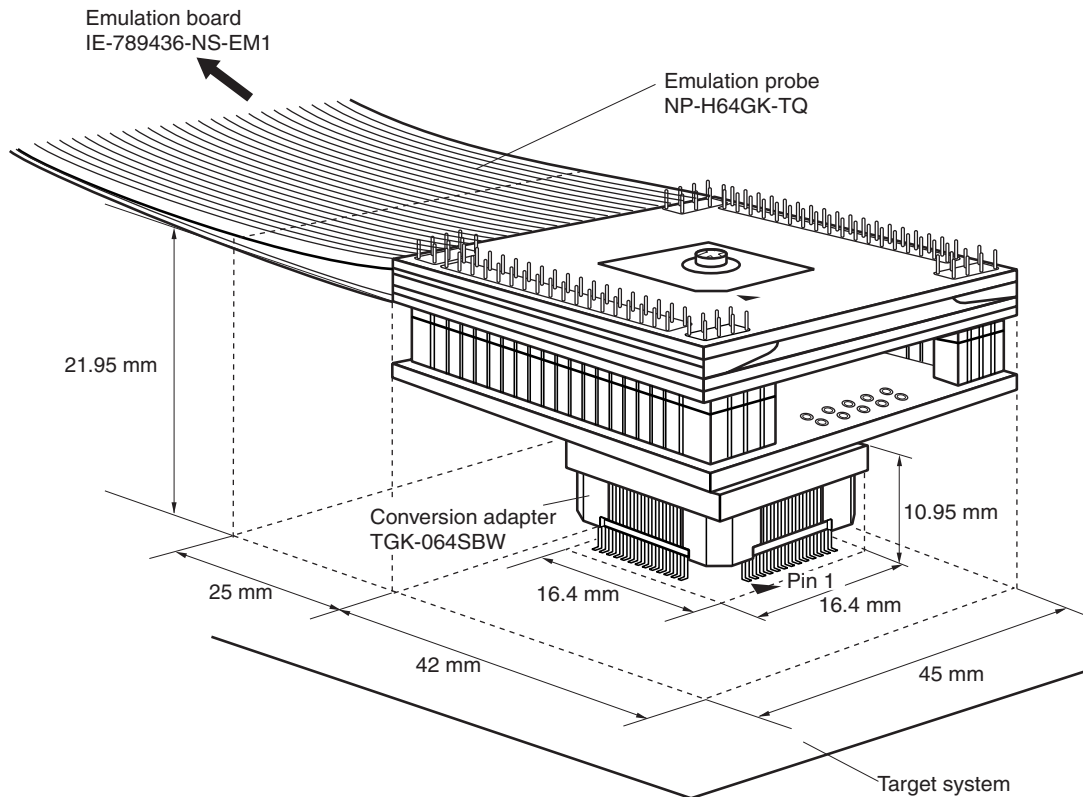


Figure B-5. Connection Condition of Target System (When NP-H64GK-TQ Is Used)



[MEMO]

Facsimile Message

From:

Name

Company

Tel.

FAX

Address

Although NEC has taken all possible steps to ensure that the documentation supplied to our customers is complete, bug free and up-to-date, we readily accept that errors may occur. Despite all the care and precautions we've taken, you may encounter problems in the documentation. Please complete this form whenever you'd like to report errors or suggest improvements to us.

Thank you for your kind support.

North America

NEC Electronics Inc.
Corporate Communications Dept.
Fax: +1-800-729-9288
+1-408-588-6130

Hong Kong, Philippines, Oceania

NEC Electronics Hong Kong Ltd.
Fax: +852-2886-9022/9044

Taiwan

NEC Electronics Taiwan Ltd.
Fax: +886-2-2719-5951

Europe

NEC Electronics (Europe) GmbH
Market Communication Dept.
Fax: +49-211-6503-274

Korea

NEC Electronics Hong Kong Ltd.
Seoul Branch
Fax: +82-2-528-4411

Asian Nations except Philippines

NEC Electronics Singapore Pte. Ltd.
Fax: +65-250-3583

South America

NEC do Brasil S.A.
Fax: +55-11-6462-6829

P.R. China

NEC Electronics Shanghai, Ltd.
Fax: +86-21-6841-1137

Japan

NEC Semiconductor Technical Hotline
Fax: +81- 44-435-9608

I would like to report the following error/make the following suggestion:

Document title: _____

Document number: _____ Page number: _____

If possible, please fax the referenced page or drawing.

Document Rating	Excellent	Good	Acceptable	Poor
Clarity	☐	☐	☐	☐
Technical Accuracy	☐	☐	☐	☐
Organization	☐	☐	☐	☐