

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

Send any inquiries to <http://www.renesas.com/inquiry>.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics 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 Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
 - “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.
 - “High Quality”: 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; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.



User's Manual

IE-789306-NS-EM1

Emulation Board

Target Devices

μ PD789306 Subseries

μ PD789316 Subseries

Document No. U16115EJ2V0UM00 (2nd edition)

Date Published September 2002 N CP(K)

© NEC Corporation 2002

Printed in Japan

[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 August, 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-789306-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 78K0S Series of 8-bit single-chip microcontrollers.

- μ PD789306 Subseries: μ PD789304, 789306, 78F9306
- μ PD789316 Subseries: μ PD789314, 789316, 78F9316

Target Readers

This manual is intended for engineers who will use the IE-789306-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 use methods and to be knowledgeable about debugging.

Organization

When using the IE-789306-NS-EM1, refer to not only this manual (supplied with the IE-789306-NS-EM1) but also the manual that is supplied with the IE-78K0S-NS or IE-78K0S-NS-A.

IE-78K0-NS
User's Manual

- Basic specifications
- System configuration
- External interface functions

IE-789306-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's purpose is to explain various debugging functions that can be performed when using the IE-789306-NS-EM1.

Terminology

The meanings of certain terms used in this manual are listed below.

Term	Meaning
Emulation device	This is a general term that refers to the device in the emulator that is used to emulate the target device. It includes the emulation CPU.
Emulation CPU	This is the CPU block in the emulator that is used to execute user-generated programs.
Target device	This is the device to be emulated.
Target system	This includes the target program and the hardware provided by the user. When defined narrowly, it includes only the hardware.
IE system	This refers to the combination of the IE-78K0S-NS or IE-78K0S-NS-A and the IE-789306-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-789306-NS-EM1 Emulation Board	This manual
ID78K Series Integrated Debugger Ver. 2.30 or Later Operation Windows™ Based	U15185E
μPD789306, 789316 Subseries	U14800E

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 setting	29
3.5 Mask Option Settings	31
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-789306-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 Supplying Pulse from Target System	25
3-9	Connections on Parts Board (Main System Clock).....	26
3-10	Crystal Oscillator (Main System Clock)	27
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 Socket/Conversion Adapter (When 64GC Is Used) ...	39
B-2	Connection Conditions of Target System (When NP-64GC-TQ Is Used).....	40
B-3	Connection Conditions of Target System (When NP-H64GC-TQ Is Used)	40
B-4	Distance Between In-Circuit Emulator and Conversion Socket/Conversion Adapter (When 64GK Is Used) ...	41
B-5	Connection Conditions of Target System (When NP-64GK Is Used)	41
B-6	Connection Conditions of Target System (When NP-H64GK-TQ Is Used)	42

LIST OF TABLES

Table No.	Title	Page
1-1	Correspondence Between Emulation Probes and Conversion Socket/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-64GC, NP-64GC-TQ, NP-H64GC-TQ, NP-64GK, NP-H64GK-TQ Pin Assignments	38
B-1	Distance Between IE System and Conversion Adapter	39

CHAPTER 1 GENERAL

The IE-789306-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.

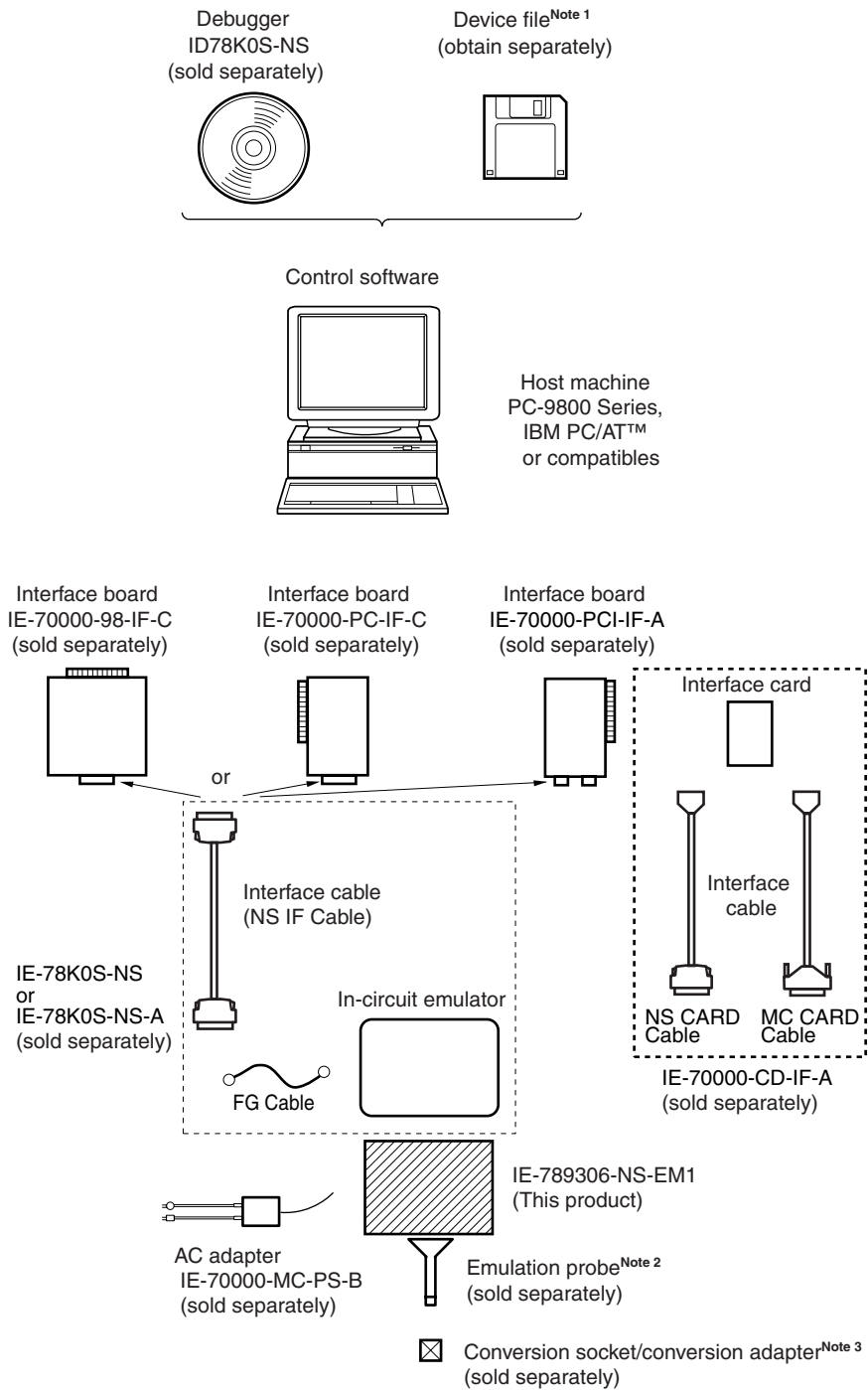
This chapter describes the IE-789306-NS-EM1's system configuration and basic specifications.

- Target devices
 - μ PD789306 Subseries
 - μ PD789316 Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-789306-NS-EM1's system configuration.

Figure 1-1. System Configuration



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

μ SxxxxDF789306: μ PD789306, 789316 Subseries

The device file can be downloaded from the web site of NEC Electron Devices
(<http://www.ic.nec.co.jp/micro/>)

2. The emulation probes NP-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)

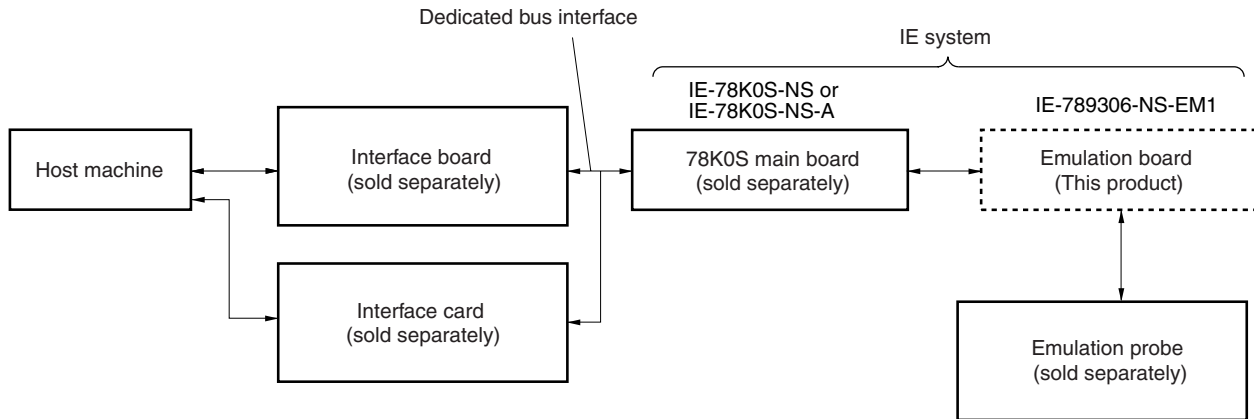
Table 1-1. Correspondence Between Emulation Probes and Conversion Socket/Conversion Adapters

Package	Emulation Probe	Conversion Socket/Conversion Adapter
64-pin plastic QFP (GC type)	NP-64GC (probe length: 200 mm)	EV-9200GC-64
	NP-64GC-TQ (probe length: 200 mm)	TGC-064SAP
	NP-H64GC-TQ (probe length: 400 mm)	
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-789306-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The basic specifications of the IE-789306-NS-EM1 are listed in Table 1-2.

Table 1-2. Basic Specifications

Parameter	Description
Target device	μ PD789306, 789316 Subseries
System clock	Main system clock: 1.0 to 5.0 MHz Subsystem clock: 32.768 kHz
Main system clock supply	External: Input via an emulation probe from the target system The RC oscillator cannot be used while debugging the μ PD789316 Subseries. Only a pulse input by the oscillator from the target system is valid. Internal: Mounted on emulation board (5.0 MHz), or mounted on the parts board by the user
Subsystem clock supply	External: Input via an emulation probe from the target system Internal: Mounted on the emulation board (32.768 kHz), or mounted on the parts board by the user
Target interface voltage	$V_{DD} = 1.8$ to 5.5 V (same as that of target device) Operates on internal power supply (5 V) when target system is not connected

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-789306-NS-EM1 main unit.

The packing box contains the emulation board (IE-789306-NS-EM1), packing list, user's manual, and guarantee card.

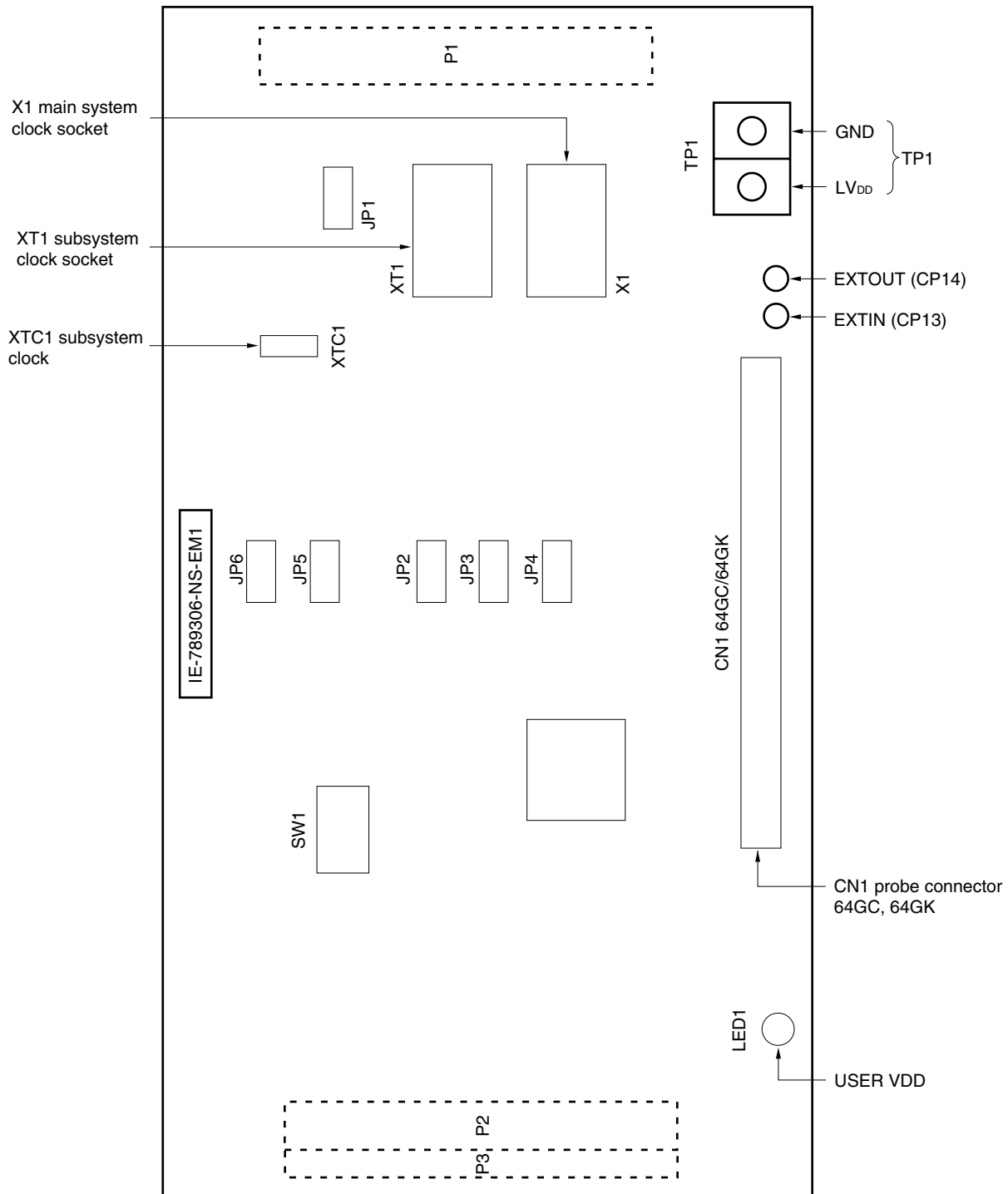
If there are any missing or damaged items, please contact an NEC sales representative.

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-789306-NS-EM1.

Figure 2-1. IE-789306-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-789306-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-789306-NS-EM1 with jumpers JP2 to JP6 set to the initial settings.

Table 2-1. Initial Settings of Switches and Jumpers

	SW1			
	1	2	3	4
Initial setting	OFF	OFF	OFF	OFF

	JP1	JP2	JP3	JP4	JP5	JP6
Initial setting	2 and 3 shorted	2 and 3 shorted (Fixed)	2 and 3 shorted (Fixed)	2 and 3 shorted (Fixed)	2 and 3 shorted (Fixed)	2 and 3 shorted (Fixed)

CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-789306-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)** for a description of how to connect the IE-789306-NS-EM1 to the IE-78K0S-NS^{Note}.

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

(2) Connection with emulation probe

See the **IE-78K0S-NS User's Manual (U13549E)** for a description of how to connect an emulation probe to the IE-789306-NS-EM1^{Note}.

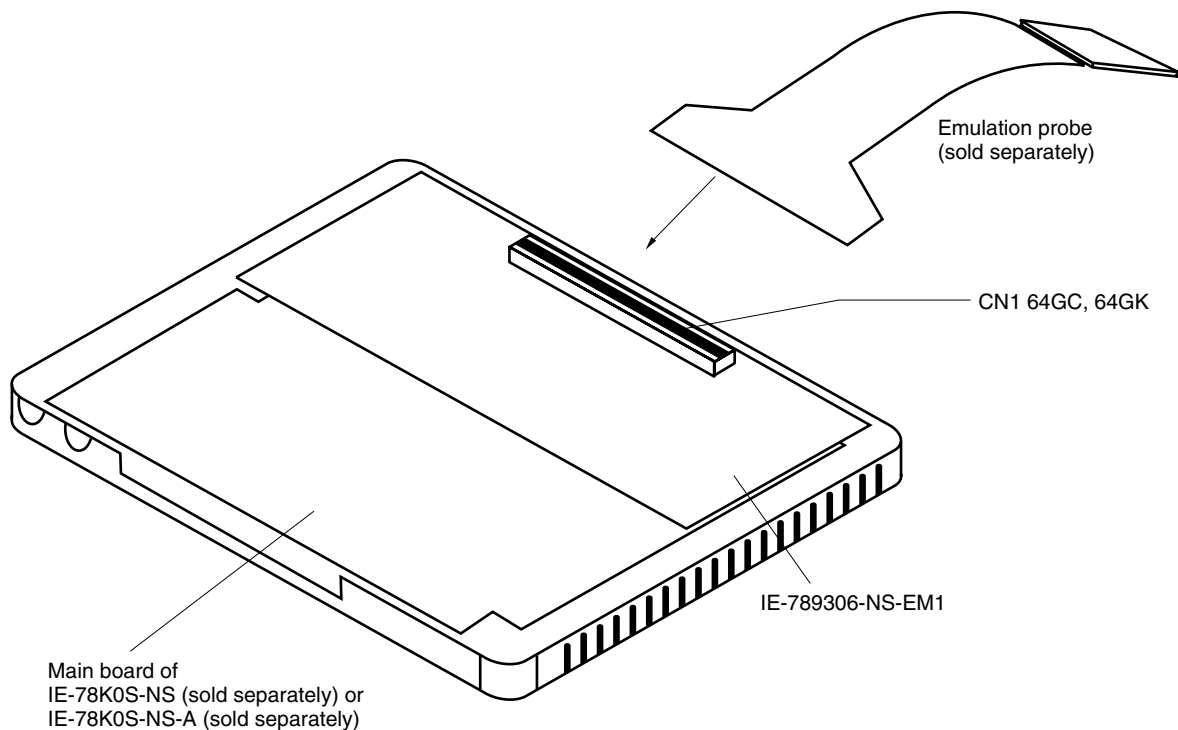
On this board, connect the emulation probe to CN1.

Note When using the IE-78K0S-NS-A, see 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) Settings on the IE-78K0S-NS

When using the IE-789306-NS-EM1, set the switches and jumpers on the IE-78K0S-NS as shown in Table 3-1. For details of these switch and jumper settings, refer to the **IE-78K0S-NS User's Manual (U13549E)**.

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

	SW1	SW3	SW4	JP1	JP4
Setting	OFF	All switches ON (Fixed)	All switches ON (Fixed)	2 and 3 shorted	1 and 2 shorted

Caution Incorrect connection may damage the IE-789306-NS-EM1.

(2) Settings on the IE-78K0S-NS-A

When using the IE-789306-NS-EM1, set the switches and jumpers on the IE-78K0S-NS-A as shown in Table 3-2. For details of these switch and jumper settings, refer to the **IE-78K0S-NS-A User's Manual (U15207E)**.

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

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

Caution Incorrect connection may damage the IE-789306-NS-EM1.

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-789306-NS-EM1 (the same applies when the voltage is 5 V).

Set the target voltage to between 1.8 and 5.0 V.

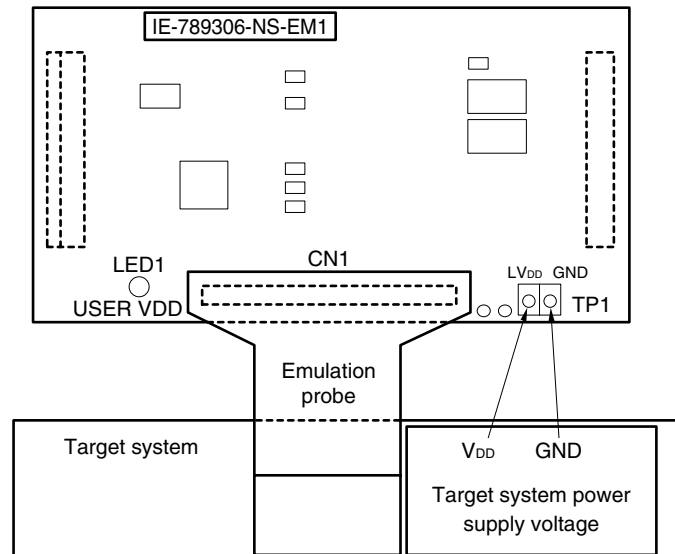
For how to select the operating power supply, refer to the **ID78K Series Ver.2.30 or Later Operation Windows-Based User's Manual (U15185E)**.

- 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 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-789306-NS-EM1.

3.4 Clock Settings

3.4.1 Overview of clock settings

The main system clock and subsystem clock to be used during debugging can be selected from (1) to (3) below.

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

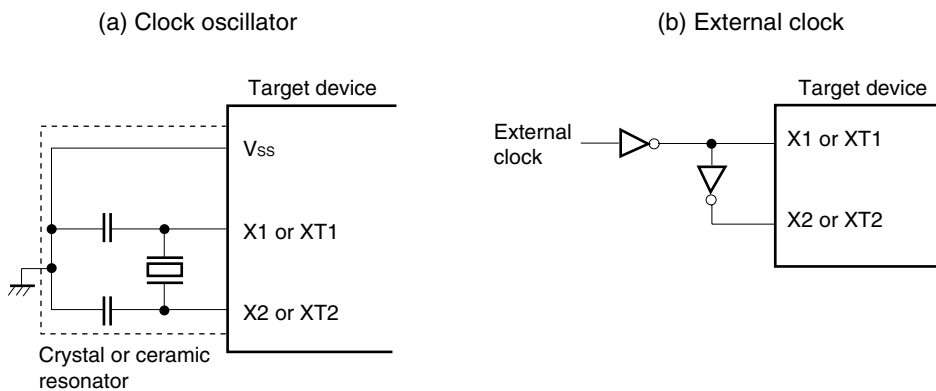
If the target system includes a clock oscillator, select either **(1) Clock that is already mounted on emulation board** or **(2) Clock that is mounted by user**. For the clock oscillator, a resonator is connected to the target device and the target device's internal oscillator is used. An example of the external circuit is shown in part (a) of Figure 3-3. 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 in the IE-78K0S-NS or IE-78K0S-NS-A is used.

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

For the external clock, a clock signal is supplied from outside of the target device and the target device's internal oscillator is not used. An example of the external circuit is shown in part (b) of Figure 3-3.

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. Also, even if a crystal resonator is connected directly to X1 (for the main system clock) or XT1 (for the subsystem clock), the target device will not operate. When emulating the μ PD789316 Subseries, RC oscillation cannot be used.

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



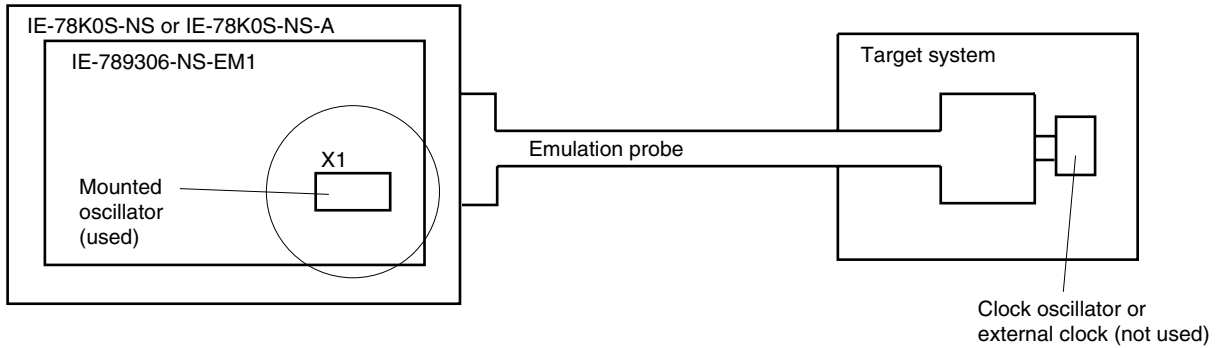
(1) **Clock that is already mounted on emulation board**

The crystal oscillator mounted on the IE-789306-NS-EM1 can be used.

(a) **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)

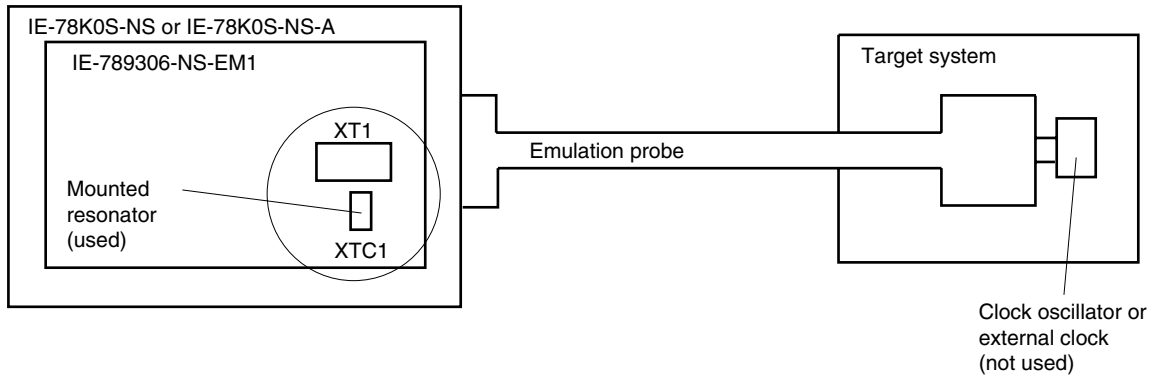


Remark The clock that is supplied by the oscillator of the IE-789306-NS-EM1 (encircled in the figure) is used.

(b) **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 resonator of the IE-789306-NS-EM1 (encircled in the figure) is used.

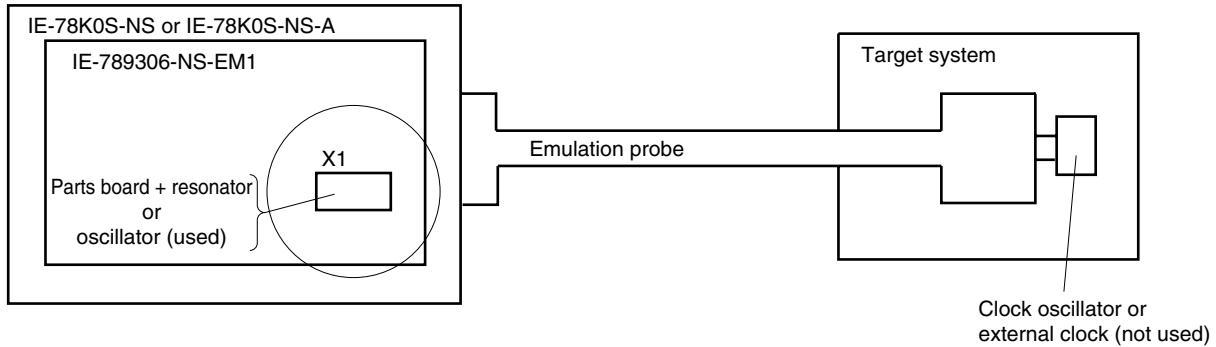
(2) Clock that is mounted by user

The user can mount any clock supported by the set specifications on the IE-789306-NS-EM1. This feature is effective when debugging at a different frequency than the clock already mounted.

(a) Main system clock

Remove the crystal oscillator (X1) that is already mounted on the emulation board, and mount the parts board on which the resonator to be used is mounted or mount the oscillator to be used.

Figure 3-6. When Using User-Mounted Clock (Main System Clock)

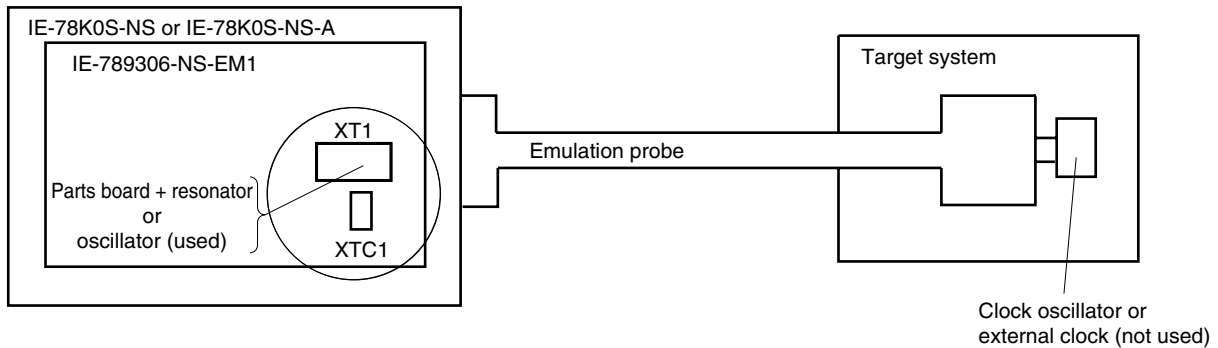


Remark The clock that is supplied by the resonator of the IE-789306-NS-EM1 (encircled in the figure) or the oscillator is used.

(b) 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)

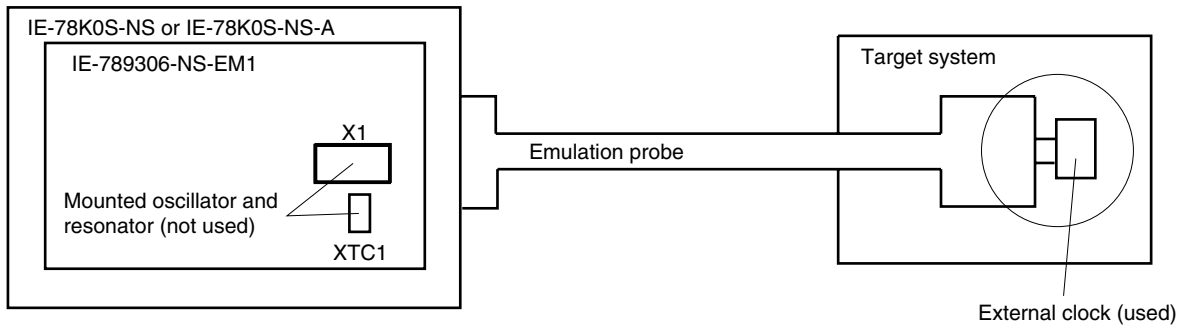


Remark The clock that is supplied by the resonator of the IE-789306-NS-EM1 (encircled in the figure) or the oscillator is used.

(3) Pulse input from target system

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

Figure 3-8. When Supplying Pulse from Target System



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

3.4.2 Main system clock settings

Table 3-4 shows the settings of the IE-789306-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-789306-NS-EM1	
		X1 Socket	CPU Clock Source Selection (ID78K0S-NS)
(1) When using clock that is already mounted on emulation board	5.0 MHz	Oscillator	Internal
(2) When using clock mounted by user	Other than 5.0 MHz	Oscillator configured by user	
(3) When inputting pulse from target system		Oscillator (not used)	External

Caution When inputting a pulse from the target system, open the configuration dialog box when starting the integrated debugger (ID78K0S-NS) and select “External” in the area (Clock) for selecting the CPU’s clock source (this selects the user’s clock).

Remark The factory settings of the IE-789306-NS-EM1 are those listed above under “when using clock that is already mounted on emulation board”.

(1) When using clock that is already mounted on emulation board

When the IE-789306-NS-EM1 is shipped, a 5.0 MHz crystal oscillator is already mounted in the IE-789306-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

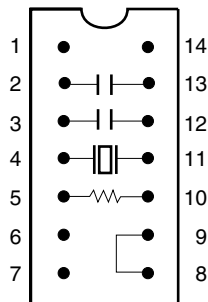
- Items to be prepared
 - Parts board
 - Ceramic resonator or crystal resonator
 - Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

<Steps>

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

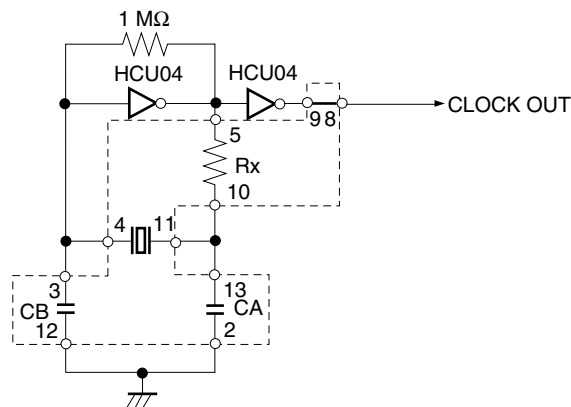
Figure 3-9. Connections on Parts Board (Main System Clock)

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.

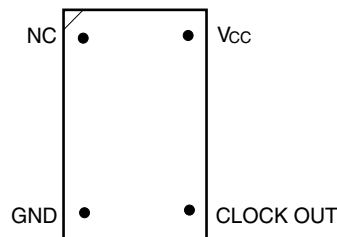
- <2> Prepare the IE-789306-NS-EM1.
- <3> Remove the crystal oscillator that is mounted in the IE-789306-NS-EM1's X1 socket.
- <4> Connect the parts board (from <1> above) to the X1 socket from which the crystal oscillator was removed. Check the pin 1 mark to make sure the board is mounted in the correct direction.
- <5> Make sure that the parts board is wired as shown in Figure 3-9 above.
- <6> Install the IE-789306-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

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

(b) When using a crystal oscillator

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

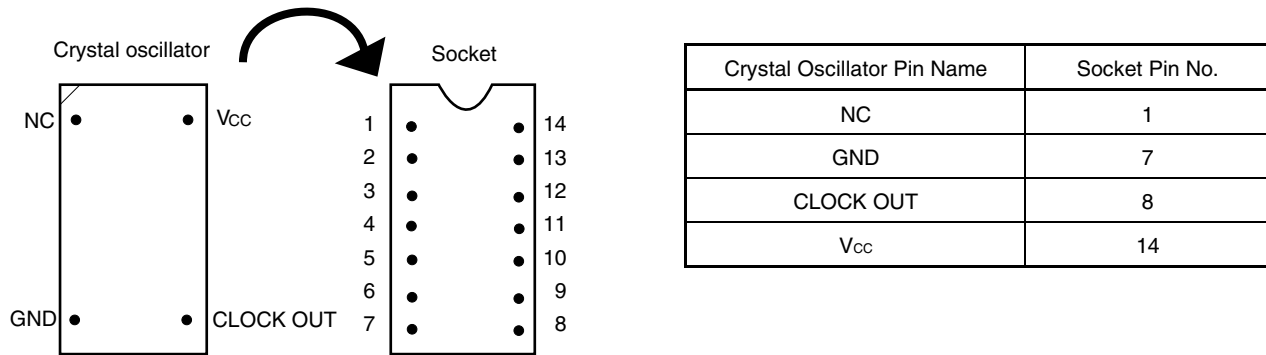
Figure 3-10. Crystal Oscillator (Main System Clock)



<Steps>

- <1> Prepare the IE-789306-NS-EM1.
- <2> Remove the crystal oscillator that is mounted in the IE-789306-NS-EM1's X1 socket.
- <3> Connect a crystal oscillator to the X1 socket from which the crystal oscillator was removed (in <2> above). Insert the pins of the crystal oscillator into the socket aligning the pins as shown in the figure below.

Figure 3-11. Pin Alignment of Crystal Oscillator and Socket (Main System Clock)



<4> Install the IE-789306-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(3) When inputting pulse 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 setting

Table 3-5 shows the settings of the IE-789306-NS-EM1 when the subsystem clocks in (1) to (3) are used.

Table 3-5. Subsystem Clock Settings

Frequency of Subsystem Clock		IE-789306-NS-EM1	
		XT1 Socket	JP1
(1) When using clock (XTC1) that is already mounted on emulation board	32.768 kHz	6 and 8 shorted	2 and 3 shorted
(2) When using clock mounted by user	Other than 32.768 kHz	Oscillator configured by user	1 and 2 shorted
(3) When inputting pulse from target system		Not used	

Caution Before setting JP1 to switch between the clock on the board and external clock, turn off the power of the IE-78K0S-NS or IE-78K0S-NS-A.

Remark The factory settings of the IE-789306-NS-EM1 are those listed above under “when using clock that is already mounted on emulation board”.

(1) When using clock that is already mounted on emulation board

When the IE-789306-NS-EM1 is shipped, a 32.768 kHz crystal resonator (XTC1) and a parts board on which pins 6 and 8 are shorted are already mounted on the IE-789306-NS-EM1. Short 2 and 3 of the jumper (JP1) on the IE-789306-NS-EM1. No settings are required on the integrated debugger (ID78K0S-NS).

(2) When using clock mounted by user

Perform the settings in (a) or (b) below, depending on the type of clock to be used. Short 2 and 3 of the jumper (JP1) on the IE-789306-NS-EM1.

No settings are required on the integrated debugger (ID78K0S-NS).

(a) When using a ceramic resonator or crystal resonator

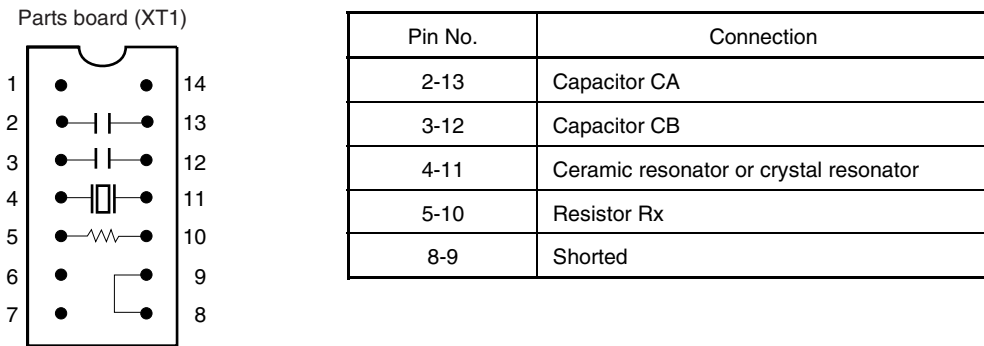
- Items to be prepared
 - Ceramic resonator or crystal resonator
 - Resistor Rx
 - Capacitor CA
 - Capacitor CB
 - Solder kit

<Steps>

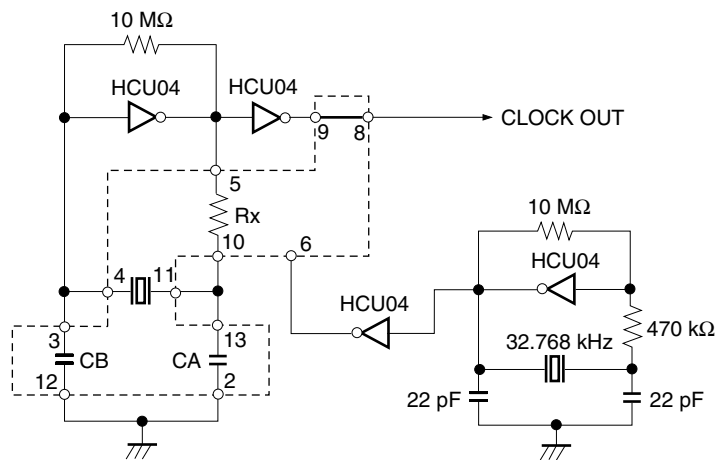
<1> Prepare the IE-789306-NS-EM1.

<2> Solder the target ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequencies) onto the parts board (XT1).

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



Circuit Diagram



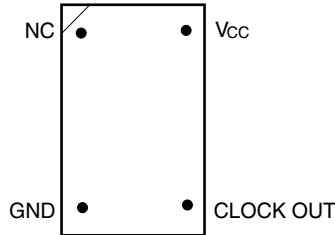
Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

- <3> Make sure that the parts board is wired as shown in Figure 3-12 above.
- <4> Install the IE-789306-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)

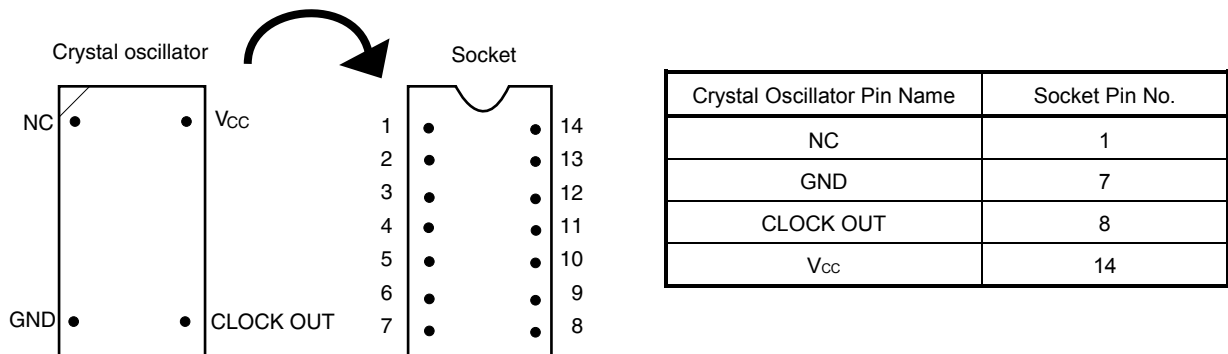
Figure 3-13. Crystal Oscillator (Subsystem Clock)



<Steps>

- <1> Prepare the IE-789306-NS-EM1.
- <2> Remove the parts board that is mounted in the XT1 socket of the IE-789306-NS-EM1.
- <3> Connect a crystal oscillator to the XT1 socket from which the parts board was removed (in <2> above). Insert the crystal oscillator pins into the socket aligning the pins as shown in the figure below.

Figure 3-14. Pin Alignment of Crystal Oscillator and Socket (Subsystem Clock)



- <4> Install the IE-789306-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(3) When inputting pulse from target system

Short 1 and 2 of the jumper (JP1) on the IE-789306-NS-EM1.
 No settings are required on the integrated debugger (ID78K0S-NS).

3.5 Mask Option Settings

By setting the DIP switch (SW1) in the IE-789306-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.

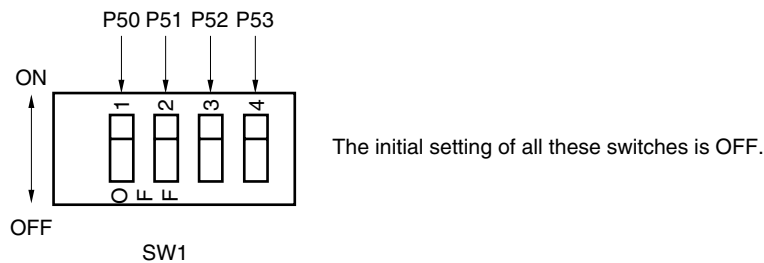
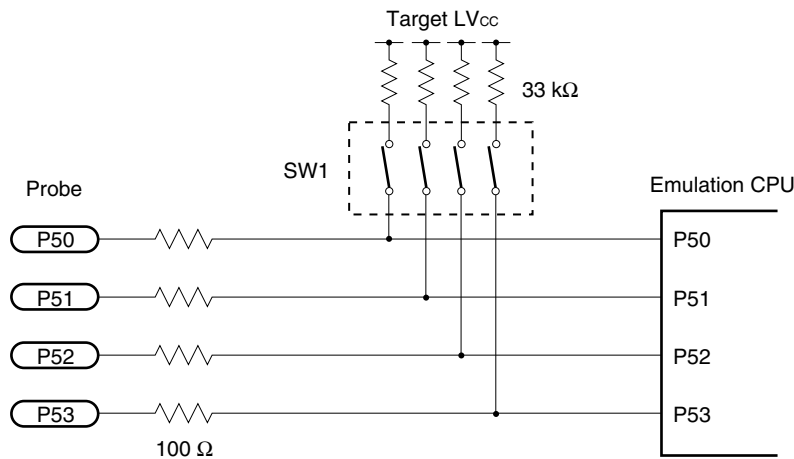
For the usage method, refer to the **ID78K Series Ver.2.30 or Later Operation Windows Based User's Manual (U15185E)**.

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 V_{DD} pin. 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 an external trigger, connect the IE-789306-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 pin characteristics.

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

(1) EXTOUT

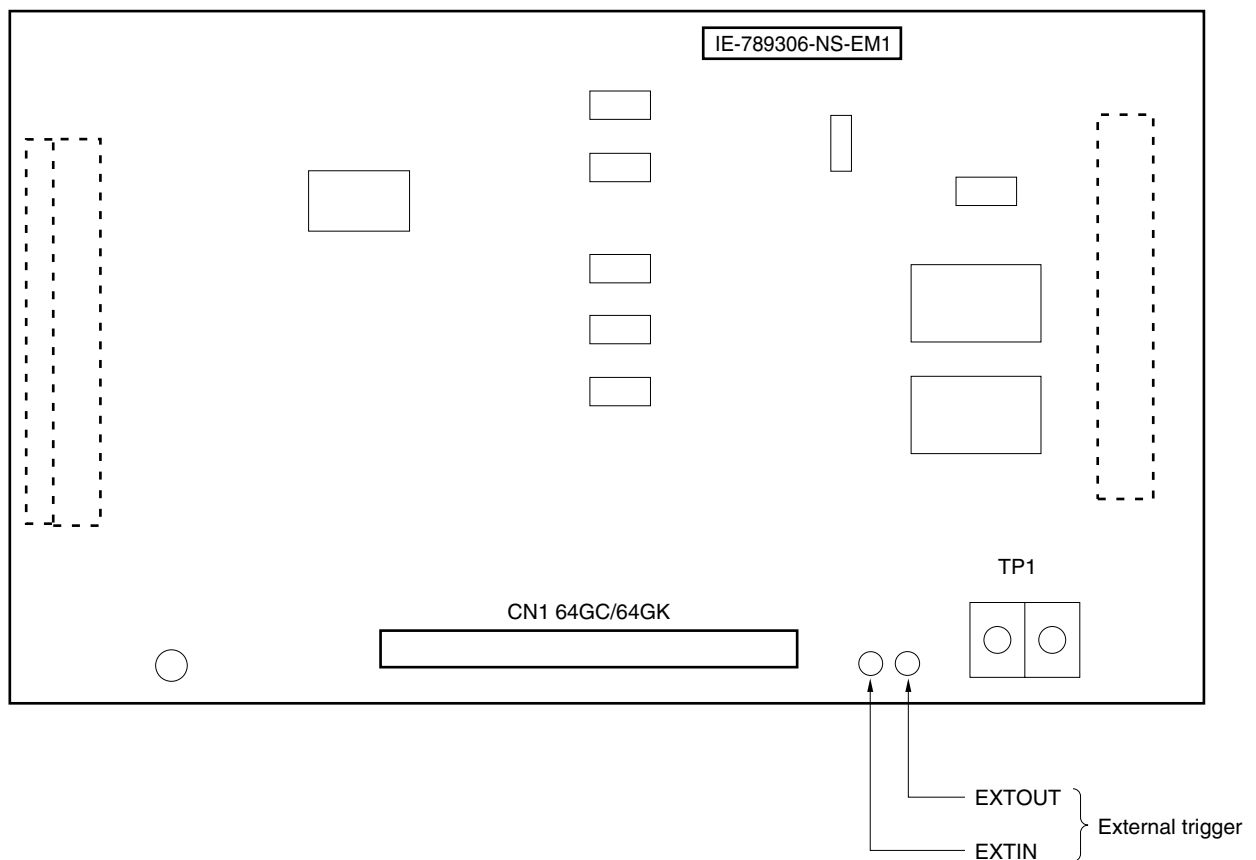
The EXTOUT pin on the IE-789306-NS-EM1 outputs a low level for 1.3 μ s when a break event occurs.

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

(2) EXTIN

An event signal can be input from the EXTIN pin on the IE-789306-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 differences between the target device's signal lines and the signal lines of the target interface circuit of the IE system.

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

- (1) Signals 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-789306-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 PD789306/789316 Subseries.

- S0 to S23
- COM0 to COM3
- CAPH, CAPL
- V_{LC0} to V_{LC2}

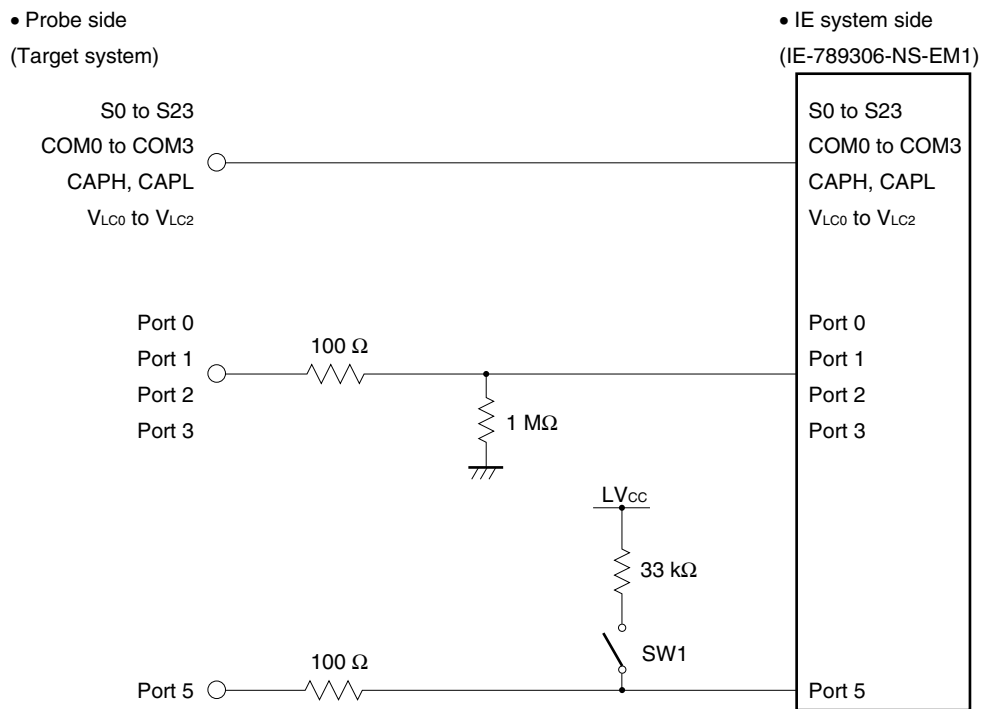
Note that for the following signals, a 1 M Ω pull-down resistor and a 100 Ω resistor are connected in series. Signals related to ports 0 and 1 are connected to a 1 M Ω pull-down resistor in the IE-78K0S-NS or IE-78K0S-NS-A.

- 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



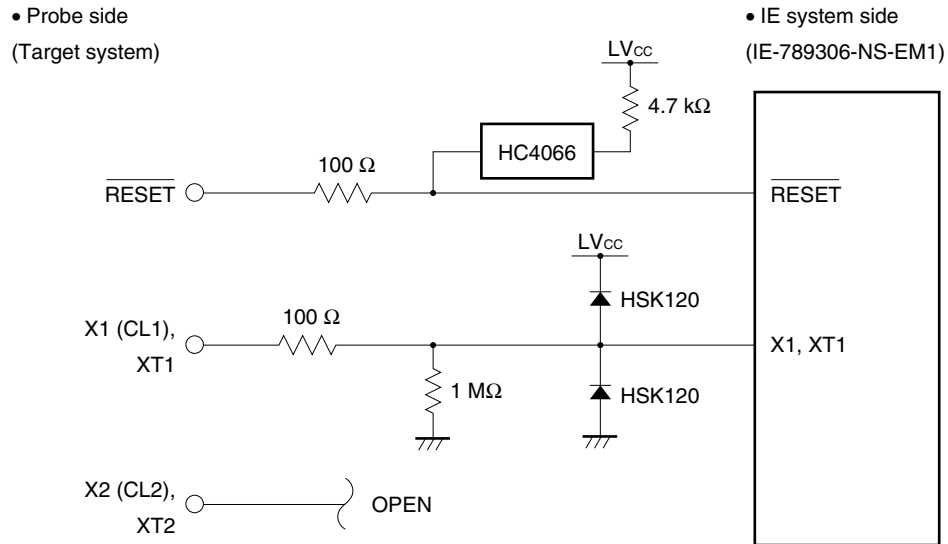
(2) Signals input from the target system via a gate

Since the following signals are input via a gate, their timing shows a delay compared to the μ PD789306/789316 Subseries. Refer to **Figure 4-2 Equivalent Circuit 2 of Emulation Circuit**.

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

The X2 (CL2) and XT2 pins are not used in the IE-789306-NS-EM1.

Figure 4-2. Equivalent Circuit 2 of Emulation Circuit

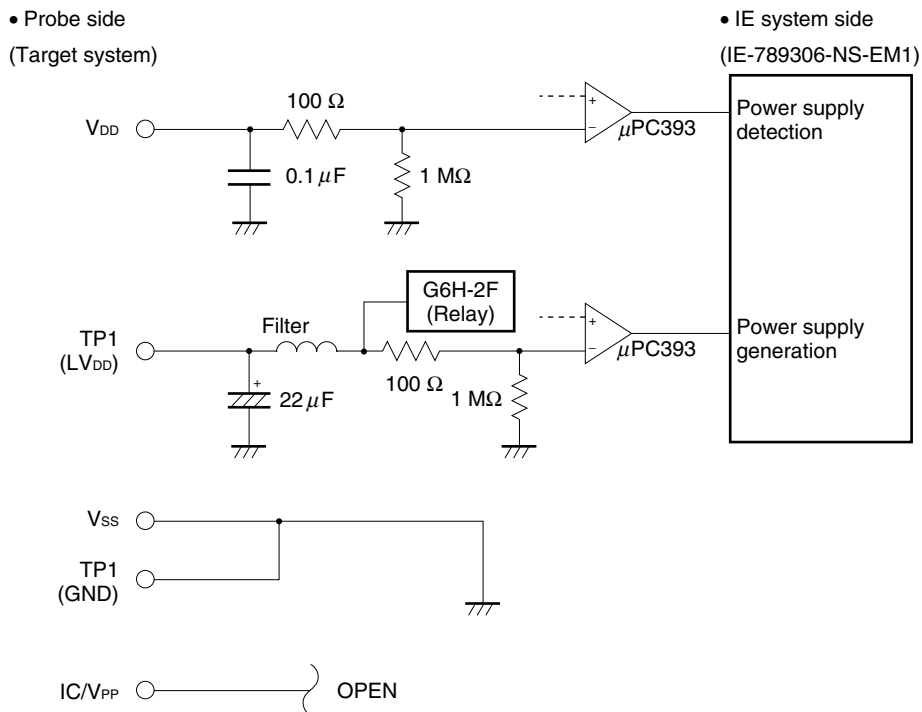


(3) Other signals

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

- VDD 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) (LVCC) when the target system is connected. In the IE-789306-NS-EM1, the VDD pin of the target system is exclusively used for controlling LED1 (USER VDD), which monitors whether the power of the target system is on.
- VSS pin
The VSS pin is connected to GND in the IE-789306-NS-EM1.
- IC/VPP pin
The IC/VPP pin is not used in the IE-789306-NS-EM1.

Figure 4-3. Equivalent Circuit 3 of Emulation Circuit



APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. NP-64GC, NP-64GC-TQ, NP-H64GC-TQ, NP-64GK, NP-H64GK-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**
- NP-64GC, NP-64GC-TQ, NP-H64GC-TQ, NP-64GK, and NP-H64GK-TQ are products of Naito Densei Machida Mfg. Co., Ltd.
 - The numbers in the “Emulation probe” column indicate the corresponding pin number on the emulation probe tip.

APPENDIX B CAUTIONS ON DESIGNING TARGET SYSTEM

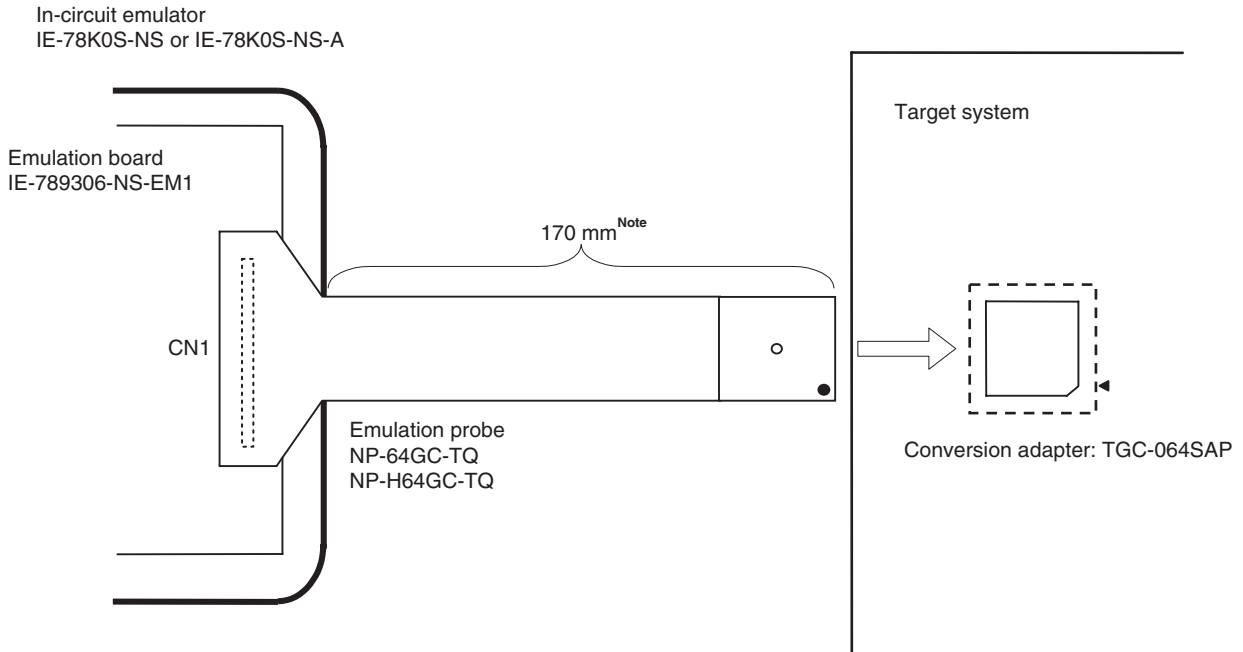
The following shows the conditions when connecting the emulation probe to the conversion adapter. Follow the configuration below and consider the shape of parts to be mounted on the target system when designing a system.

Among the products described in this appendix, NP-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 Socket/Conversion Adapter (When 64GC Is Used)



Note Distance when NP-64GC-TQ is used. When NP-H64GC-TQ is used, the distance is 370 mm.

Figure B-2. Connection Conditions of Target System (When NP-64GC-TQ Is Used)

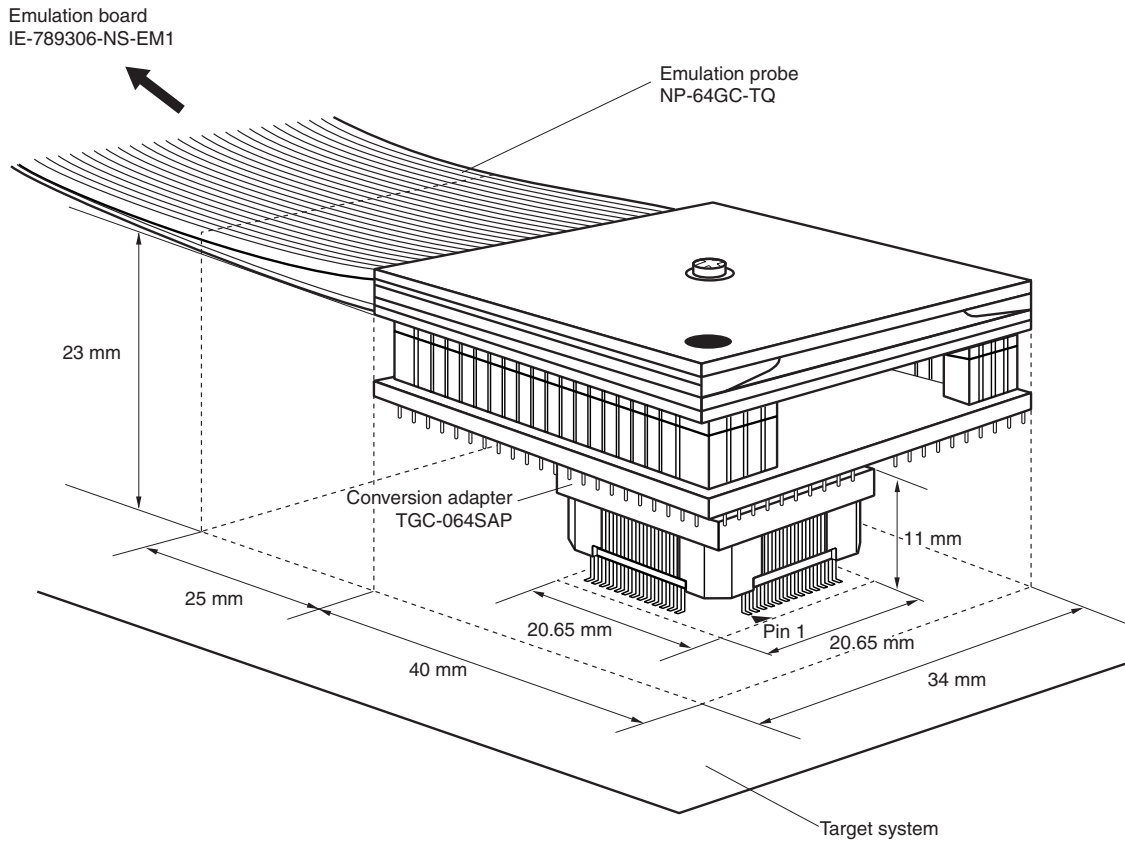


Figure B-3. Connection Conditions of Target System (When NP-H64GC-TQ Is Used)

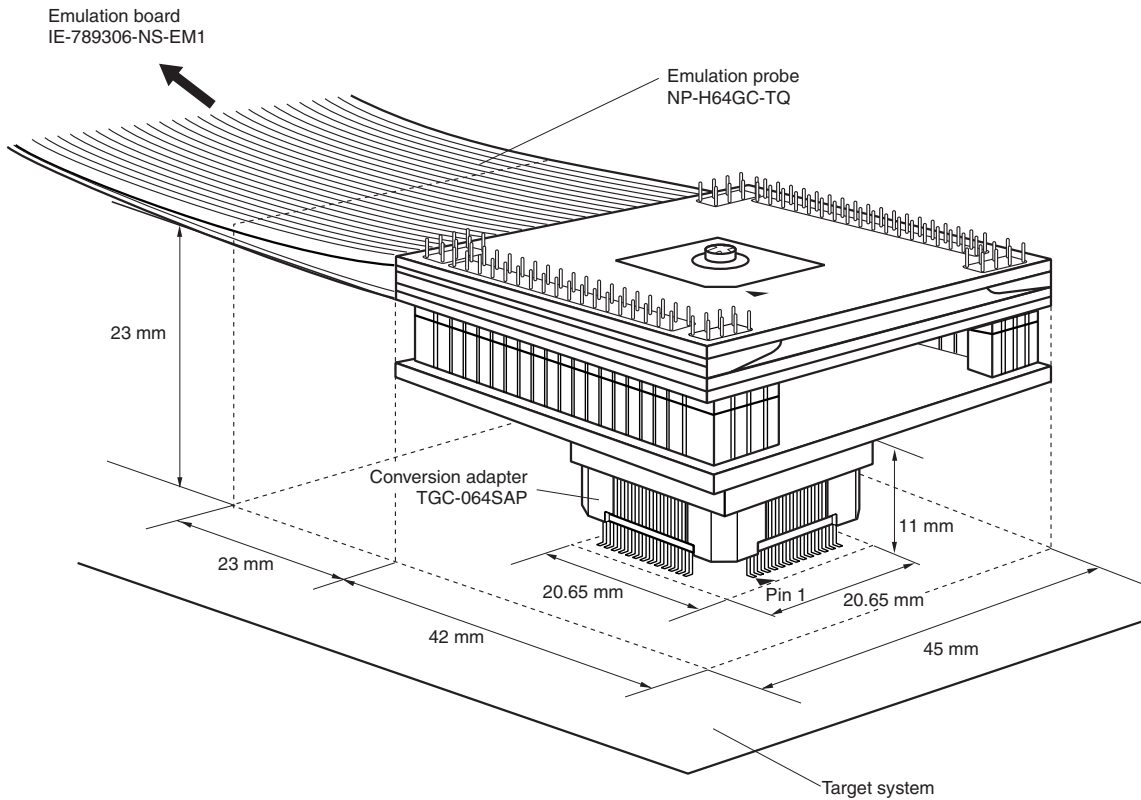
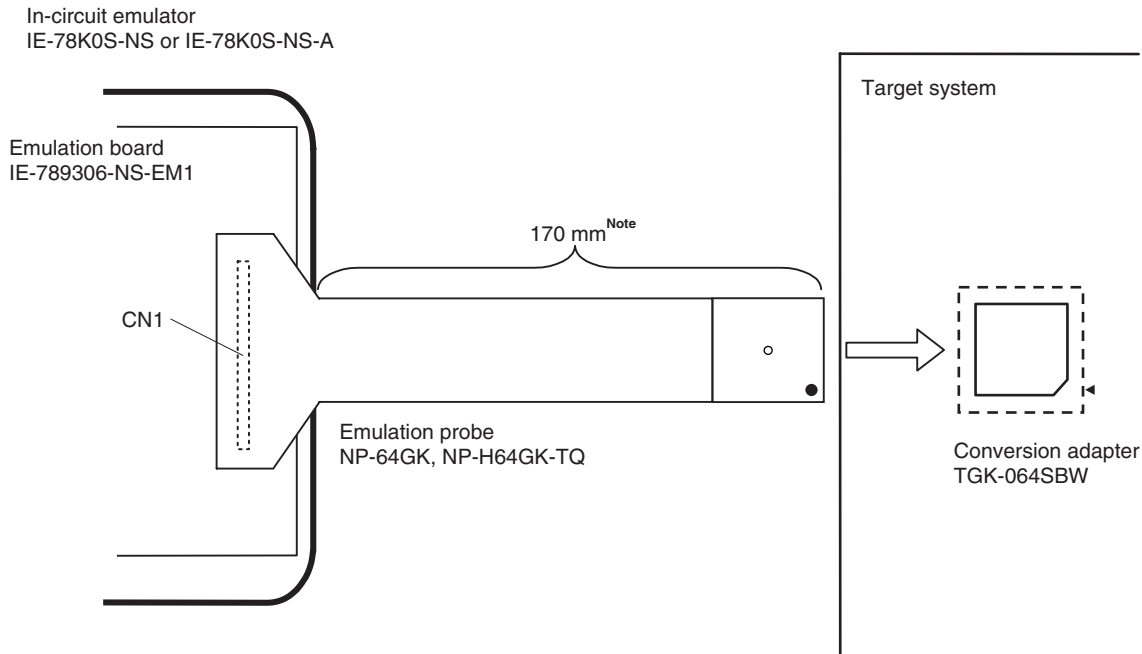


Figure B-4. Distance Between In-Circuit Emulator and Conversion Socket/Conversion Adapter (When 64GK Is Used)



Note Distance when NP-64GK is used. When NP-H64GK-TQ is used, the distance is 370 mm.

Figure B-5. Connection Conditions of Target System (When NP-64GK Is Used)

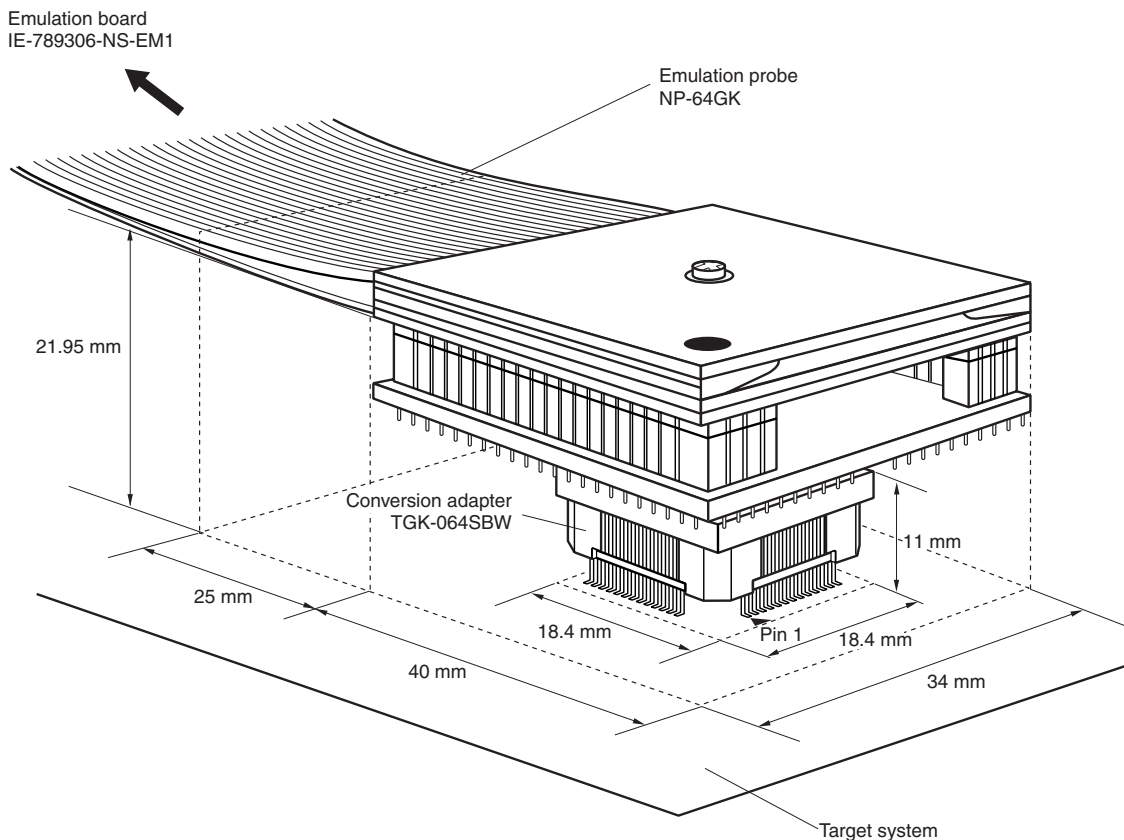
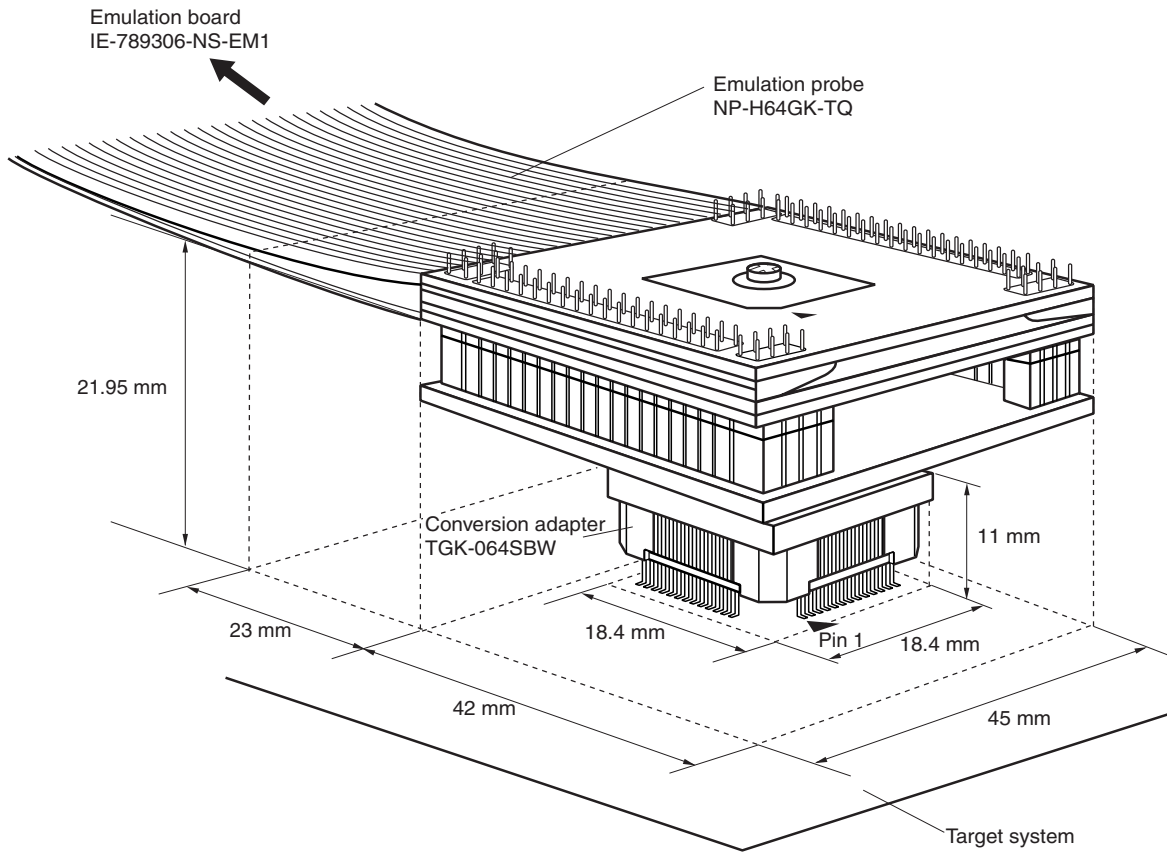


Figure B-6. Connection Conditions of Target System (When NP-H64GK-TQ Is Used)



Facsimile Message

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.

From:

Name

Company

Tel.

FAX

Address

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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technical Accuracy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Organization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>