

User's Manual**IE-789418-NS-EM1****Emulation Board**

Target Devices **μ PD789407A Subseries** **μ PD789417A 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 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

Major Revisions in This Edition

| Pages | Description |
|-----------|--|
| pp.44, 46 | Modification of the size on the adapter block in figures B-2 Connection Conditions of Target System (When NP-80GC-TQ Is Used) , B-5 Connection Conditions of Target System (When NP-80GK Is Used) Addition of B-3 Connection Conditions of Target System (When NP-H80GC-TQ Is Used) , B-6 Connection Conditions of Target System (When NP-H80GK-TQ Is Used) |

The mark ★ shows major revised points.

INTRODUCTION

Product Overview

The IE-789418-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 PD789407A Subseries: μ PD789405A, 789406A, 789407A
- μ PD789417A Subseries: μ PD789415A, 789416A, 789417A

Target Readers

This manual is intended for engineers who will use the IE-789418-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-789418-NS-EM1, refer to not only this manual (supplied with the IE-789418-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-789418-NS-EM1
User's Manual

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

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

- Basic specifications
- System configuration
- External interface functions

Purpose

This manual is intended to give users an understanding of the various debugging functions that can be performed when using the IE-789418-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 (real chip) 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-789418-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 | U13549E |
| IE-78K0S-NS-A | U15207E |
| IE-789418-NS-EM1 | This manual |
| ID78K Series Integrated Debugger Ver. 2.30 or Later Operation (Windows™ Based) | U15185E |
| μPD789407A, 789417A Subseries | U13952E |

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

CONTENTS

| | |
|---|-----------|
| CHAPTER 1 GENERAL | 11 |
| 1.1 System Configuration | 12 |
| 1.2 Hardware Configuration | 14 |
| 1.3 Basic Specifications | 15 |
| | |
| CHAPTER 2 PART NAMES | 16 |
| 2.1 Parts of Main Unit | 17 |
| | |
| CHAPTER 3 INSTALLATION | 18 |
| 3.1 Connection | 19 |
| 3.2 Clock Settings | 20 |
| 3.2.1 Overview of clock settings..... | 20 |
| 3.2.2 Main system clock settings..... | 23 |
| 3.2.3 Subsystem clock settings..... | 28 |
| 3.3 Mask Option Setting | 33 |
| 3.3.1 Pull-up resistor..... | 33 |
| 3.3.2 LCD..... | 33 |
| 3.4 Setting Power Supply Voltage of Target Interface | 34 |
| 3.5 External Trigger | 35 |
| 3.6 Switch and Jumper Settings | 36 |
| | |
| CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICES AND TARGET INTERFACE CIRCUITS | 37 |
| | |
| APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE | 41 |
| | |
| APPENDIX B CAUTIONS ON DESIGNING TARGET SYSTEM | 43 |

LIST OF FIGURES

| Figure No. | Title | Page |
|------------|---|------|
| 1-1 | System Configuration | 12 |
| 1-2 | Basic Hardware Configuration..... | 14 |
| 2-1 | IE-789418-NS-EM1 Part Names | 17 |
| 3-1 | Connection of Emulation Probe..... | 19 |
| 3-2 | External Circuits Used as System Clock Oscillator | 20 |
| 3-3 | When Using Clock That Is Already Mounted on Emulation Board (Main System Clock) | 21 |
| 3-4 | When Using Clock That Is Already Mounted on Emulation Board (Subsystem Clock) | 21 |
| 3-5 | When Using User-Mounted Clock (Main System Clock) | 22 |
| 3-6 | When Using User-Mounted Clock (Subsystem Clock) | 22 |
| 3-7 | When Using External Clock..... | 23 |
| 3-8 | Connections on Parts Board (When Using User-Mounted Clock (Main System Clock))..... | 24 |
| 3-9 | Crystal Oscillator (When Using User-Mounted Clock (Main System Clock))..... | 26 |
| 3-10 | Pin Alignment of Crystal Oscillator and Socket | 26 |
| 3-11 | Connections on Parts Board (When Using User-Mounted Clock (Subsystem Clock))..... | 29 |
| 3-12 | Crystal Oscillator (When Using User-Mounted Clock (Subsystem Clock))..... | 31 |
| 3-13 | Pin Alignment of Crystal Oscillator and Socket | 31 |
| 3-14 | Pull-Up Resistor..... | 33 |
| 3-15 | IC7 Pin Configuration | 33 |
| 3-16 | Connection of TP1 and Power Supply Voltage of Target System | 34 |
| 3-17 | External Trigger Input Position | 35 |
| 4-1 | Equivalent Circuit of Emulation Circuit 1 | 39 |
| 4-2 | Equivalent Circuit of Emulation Circuit 2 | 39 |
| 4-3 | Equivalent Circuit of Emulation Circuit 3 | 40 |
| 4-4 | Equivalent Circuit of Emulation Circuit 4 | 40 |
| B-1 | Distance Between In-Circuit Emulator and Conversion Socket (80GC)..... | 43 |
| B-2 | Connection Conditions of Target System (When NP-80GC-TQ Is Used) | 44 |
| B-3 | Connection Conditions of Target System (When NP-H80GC-TQ Is Used)..... | 44 |
| B-4 | Distance Between In-Circuit Emulator and Conversion Adapter (80GK)..... | 45 |
| B-5 | Connection Conditions of Target System (When NP-80GK Is Used)..... | 46 |
| B-6 | Connection Conditions of Target System (When NP-H80GK-TQ Is Used) | 46 |

LIST OF TABLES

| Table No. | Title | Page |
|-----------|--|------|
| 1-1 | Basic Specifications..... | 15 |
| 3-1 | Main System Clock Settings | 23 |
| 3-2 | Subsystem Clock Settings | 28 |
| 3-3 | Switch and Jumper Settings on IE-78K0S-NS..... | 36 |
| 3-4 | Switch and Jumper Settings on IE-78K0S-NS-A | 36 |
| 3-5 | Initial Setting of Jumper on IE-789418-NS-EM1 | 36 |
| A-1 | NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, and NP-H80GK-TQ Pin Assignments | 41 |

CHAPTER 1 GENERAL

The IE-789418-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.

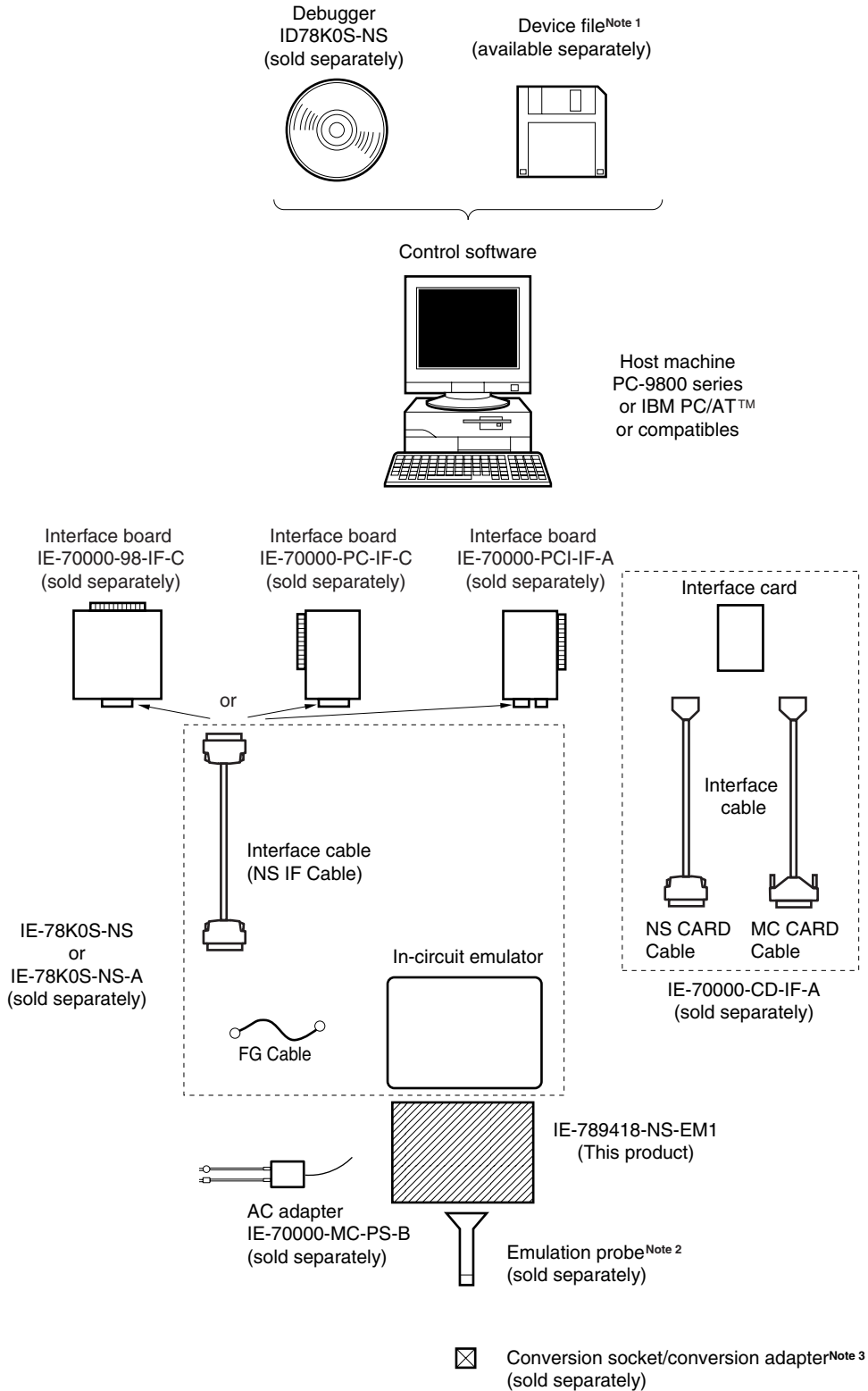
This chapter describes the IE-789418-NS-EM1's system configuration and basic specifications.

- Target device
 - μ PD789407A Subseries
 - μ PD789417A Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-789418-NS-EM1's system configuration.

Figure 1-1. System Configuration



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

μ SxxxxDF789418: μ PD789407A, 789417A 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 are as follows, in accordance with the package.

NP-80GC, NP-80GC-TQ, NP-H80GC-TQ: For 80-pin plastic QFP (GC type)

NP-80GK, NP-H80GK-TQ: For 80-pin plastic TQFP (GK type)

The NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, and NP-H80GK-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 sockets/conversion adapters are as follows, in accordance with the package.

EV-9200GC-80: For 80-pin plastic QFP (GC type: NP-80GC)

TGC-080SBP: For 80-pin plastic QFP (GC type: NP-80GC-TQ, NP-H80GC-TQ)

TGK-080SDW: For 80-pin plastic TQFP (GK type)

The TGC-080SBP and TGK-080SDW are products of TOKYO ELETECH CORPORATION.

For further information, contact Daimaru Kogyo Co., Ltd.

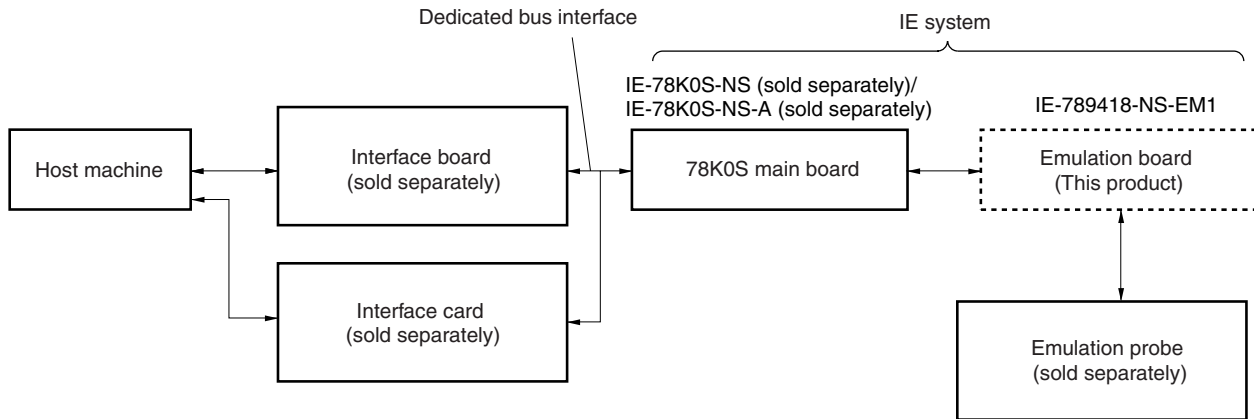
Tokyo Electronics Department (TEL: +81-3-3820-7112)

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

1.2 Hardware Configuration

Figure 1-2 shows the IE-789418-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The IE-789418-NS-EM1's basic specifications are listed in Table 1-1.

Table 1-1. Basic Specifications

| Parameter | Description |
|--------------------------|--|
| Target device | μ PD789407A, 789417A Subseries |
| System clock | 1.0 to 5.0 MHz |
| 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-789418-NS-EM1 main unit.

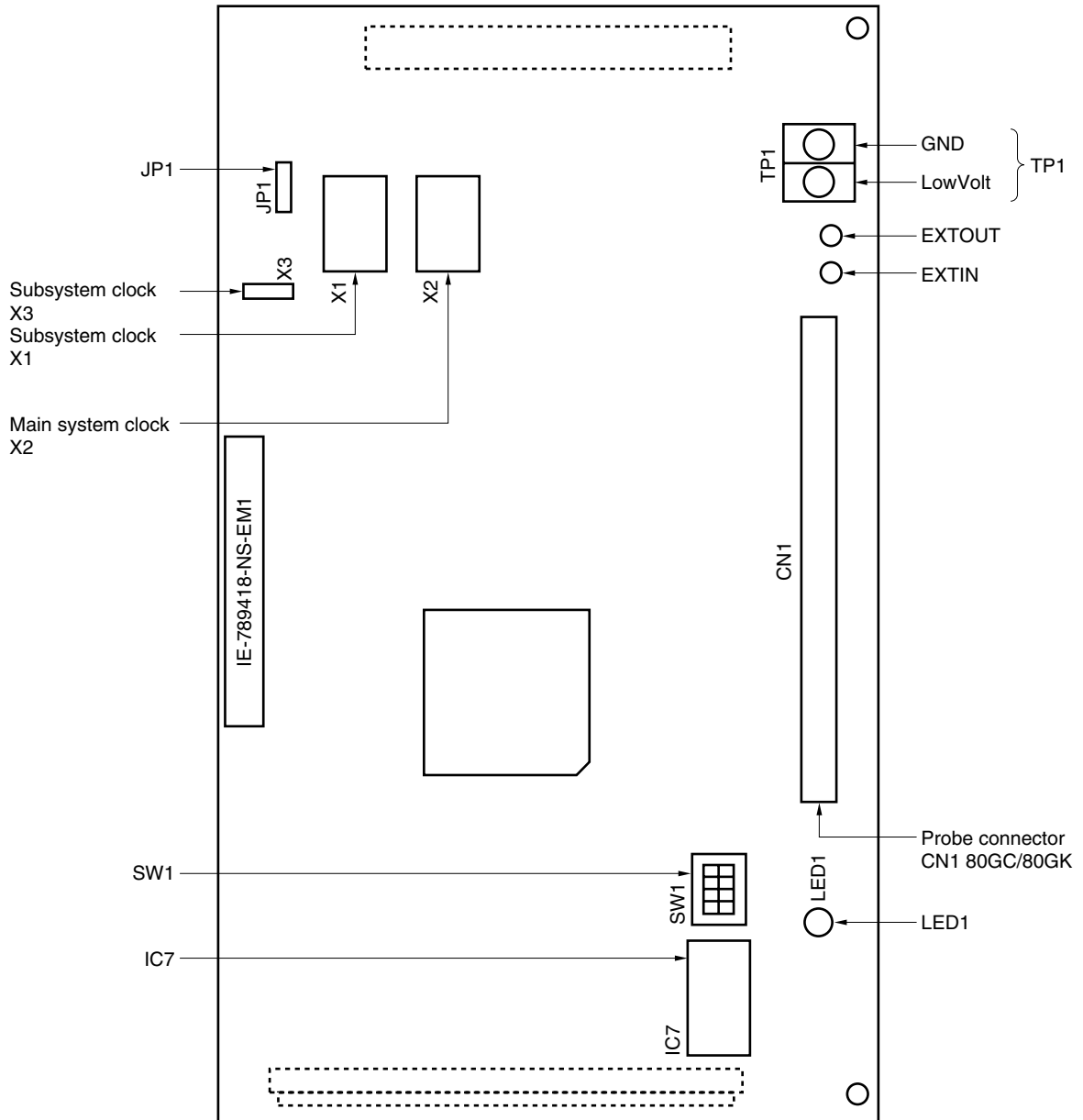
The packing box contains the emulation board (IE-789418-NS-EM1), packing list, user's manual, and guarantee card.

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. IE-789418-NS-EM1 Part Names



CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-789418-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-789418-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-789418-NS-EM1.

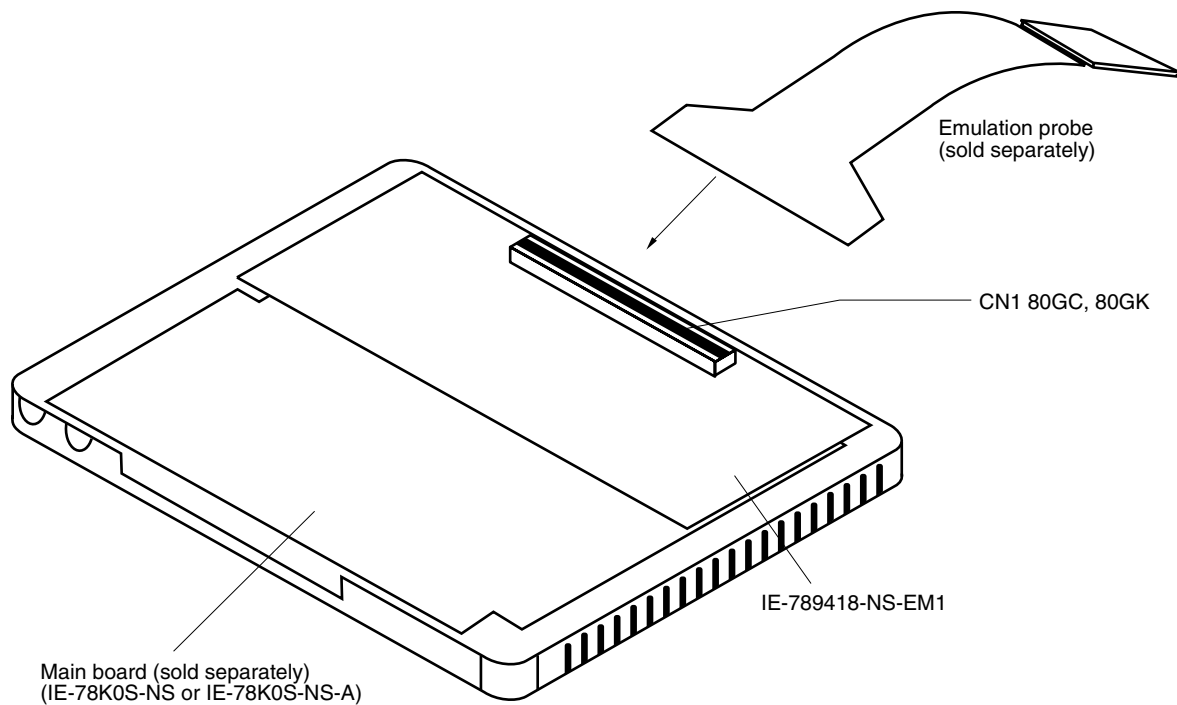
On this board, connect the emulation probe to CN1.

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 Clock Settings

3.2.1 Overview of clock settings

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

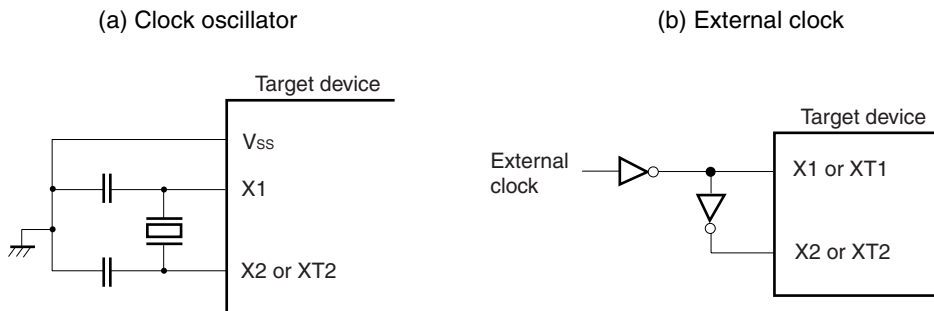
- (1) Clock that is already mounted on emulation board
- (2) Clock that is mounted by user
- (3) Pulse input from target system

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 3-2. During emulation, the oscillator that is mounted on the target system is not used. Instead, the clock that is mounted on the emulation board installed for the IE-78K0S-NS or IE-78K0S-NS-A is used.

If the target system includes an external clock, select **(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 3-2.

Caution The IE system will be hung-up if the main system clock is not supplied normally. Moreover, be sure to input a rectangular wave as the clock from the target. The IE system does not operate if the crystal resonator is connected to X1 (main system clock) and XT1 (subsystem clock).

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

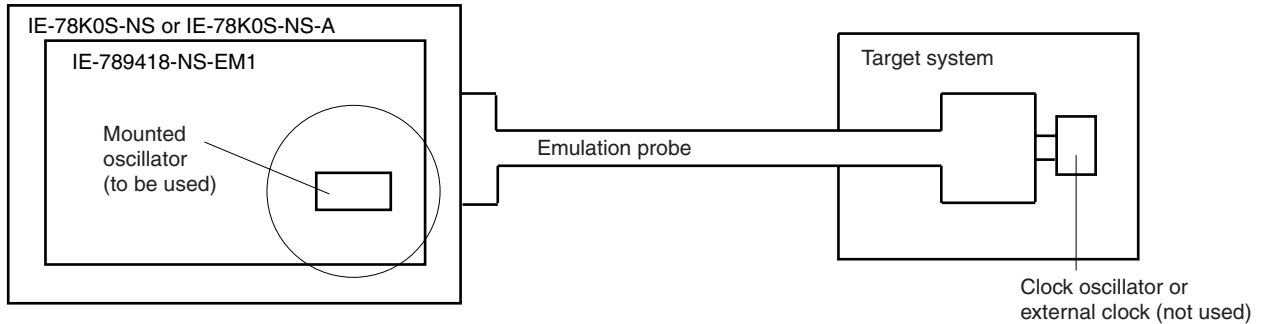


(1) Clock that is already mounted on emulation board

(a) For main system clock

A crystal oscillator (X2) is already mounted on the emulation board. Its frequency is 5.0 MHz.

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

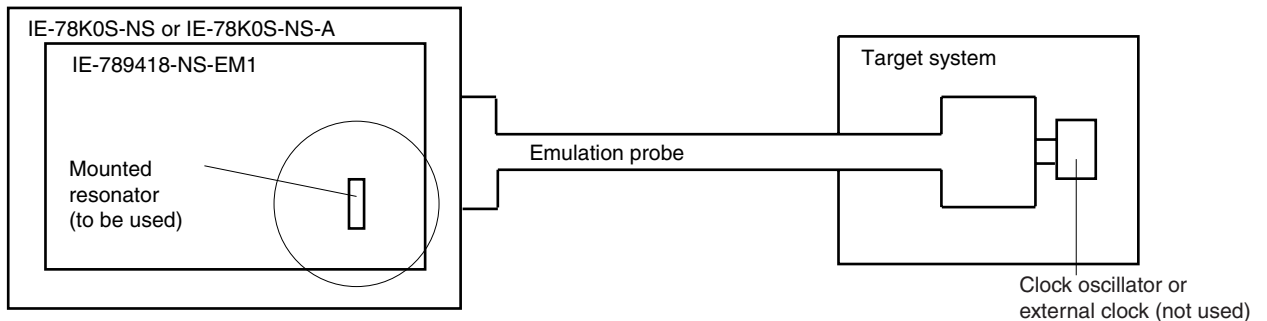


Remark The clock that is supplied by the IE-789418-NS-EM1's oscillator (encircled in the figure) is used.

(b) For subsystem clock

A crystal resonator (X3) is already mounted on the emulation board. Its frequency is 32.768 kHz.

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



Remark The clock that is supplied by the IE-789418-NS-EM1's resonator (encircled in the figure) is used.

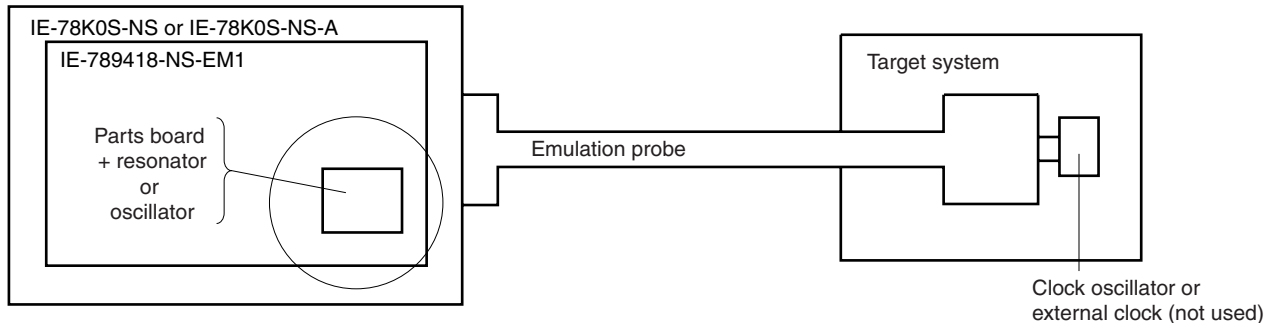
(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-789418-NS-EM1.

(a) For main system clock

Remove the crystal oscillator (X2) that is already mounted on the emulation board, and mount either the parts board on which the resonator to be used is mounted or an oscillator. This method is useful when using a different frequency from that of the pre-mounted clock.

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

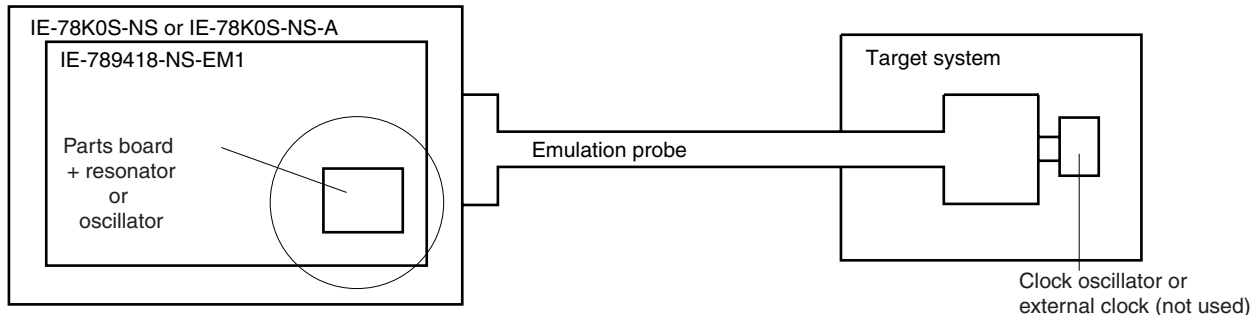


Remark The clock that is supplied by the parts board with a resonator or the oscillator on the IE-789418-NS-EM1 (encircled in the figure) is used.

(b) For subsystem clock

Mount the resonator to be used on the parts board (X1) that is already mounted on the emulation board. Alternatively, remove the parts board and mount an oscillator.

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

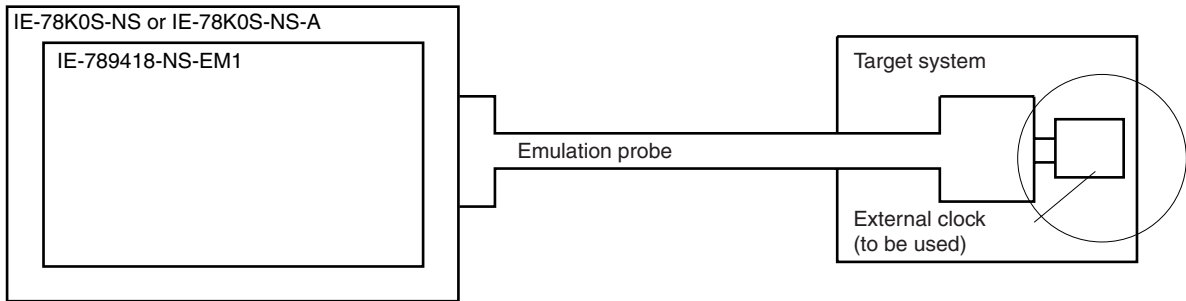


Remark The clock that is supplied by the parts board with a resonator or the oscillator on the IE-789418-NS-EM1 (encircled in the figure) is used.

(3) Pulse input from target system

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

Figure 3-7. When Using External Clock



Remark The clock supplied by the target system’s external clock (encircled in the figure) is used.

3.2.2 Main system clock settings

Table 3-1. Main System Clock Settings

| Frequency of Main System Clock | | IE-789418-NS-EM1 | CPU Clock Source Selection (ID) |
|---|--------------------|------------------------------|---------------------------------|
| | | X2 Socket | |
| When using clock that is already mounted on emulation board | 5.0 MHz | Oscillator used | Internal |
| When using clock mounted by user | Other than 5.0 MHz | Oscillator assembled by user | |
| When pulse is input from target system | | | Oscillator (not used) |

Caution When a pulse is input 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 clock).

Remark When the IE-789418-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-789418-NS-EM1 is shipped, a 5.0 MHz crystal oscillator is already mounted in the IE-789418-NS-EM1’s X2 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

The settings described under either (a) or (b) are required, 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

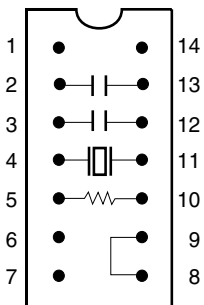
- Items to be prepared
 - Parts board
 - Ceramic resonator or crystal resonator
 - Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

<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).

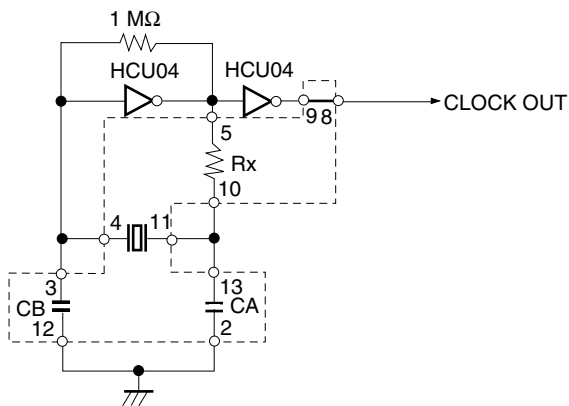
Figure 3-8. Connections on Parts Board (When Using User-Mounted Clock (Main System Clock))

Parts board (X2)



| 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 |

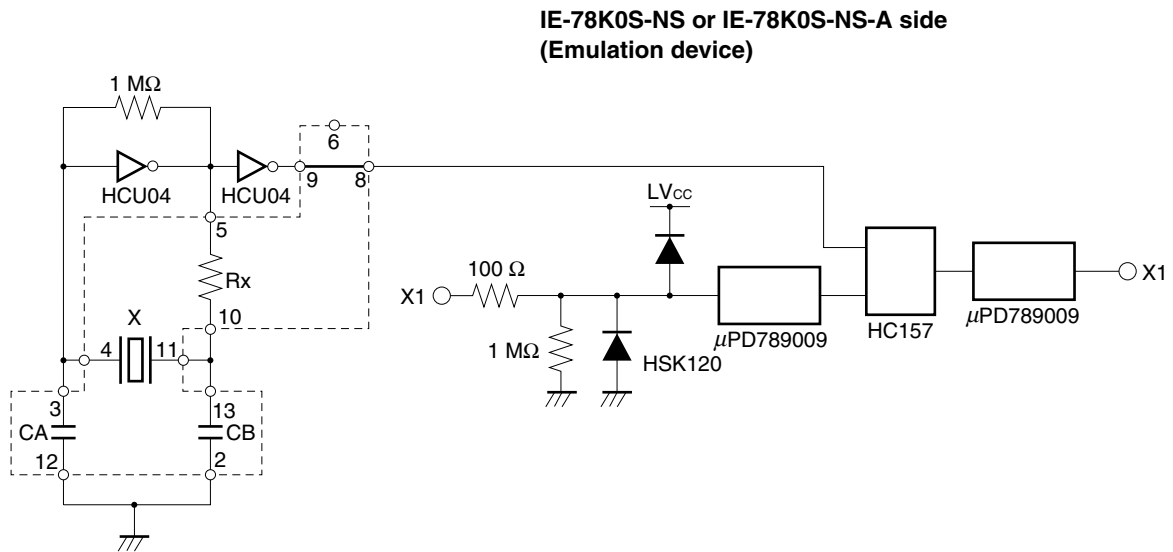
Circuit diagram



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

- <2> Prepare the IE-789418-NS-EM1.
- <3> Remove the crystal oscillator that is mounted in the IE-789418-NS-EM1's socket (the socket marked as X2).
- <4> Connect the parts board (from <1> above) to the socket (X2) from which the crystal oscillator was removed. Check the pin 1 mark to make sure the board is mounted in the correct direction.
- <5> Make sure that the parts board is wired as shown in Figure 3-8 above.
- <6> Install the IE-789418-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.

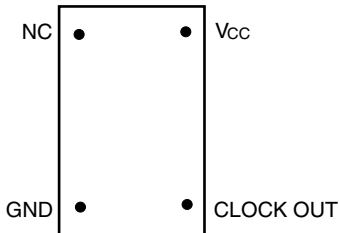


Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

(b) When using a crystal oscillator

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

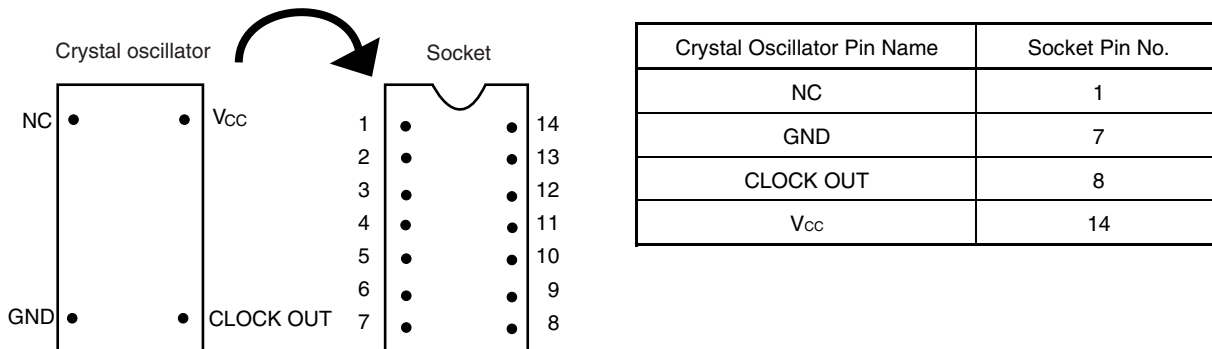
Figure 3-9. Crystal Oscillator (When Using User-Mounted Clock (Main System Clock))



<Steps>

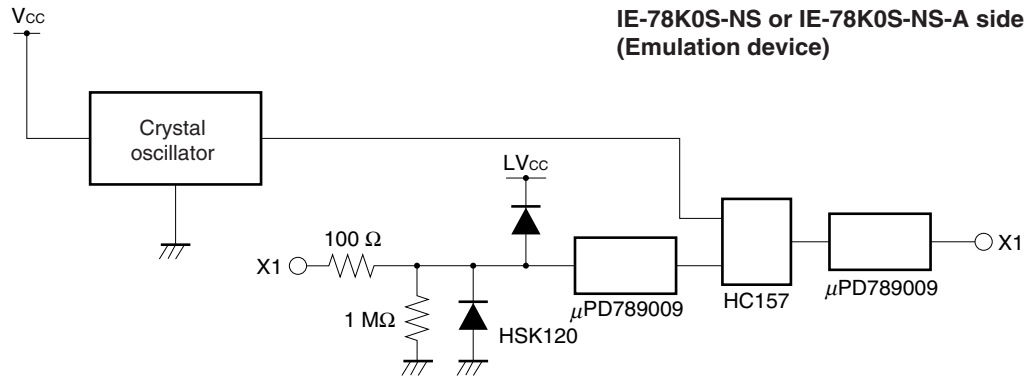
- <1> Prepare the IE-789418-NS-EM1.
- <2> Remove the crystal oscillator that is mounted in the IE-789418-NS-EM1's X2 socket.
- <3> Mount a crystal oscillator in the X2 socket from which the crystal oscillator was removed in <2> above. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

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



- <4> Install the IE-789418-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.



(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).

3.2.3 Subsystem clock settings

Table 3-2. Subsystem Clock Settings

| Frequency of Subsystem Clock to Be Used | | IE-789418-NS-EM1 | |
|--|-----------------------|------------------------------|-------------------|
| | | X1 Socket | JP1 |
| When using clock (X3) that is already mounted on emulation board | 32.768 kHz | 6 and 8 shorted | Short 2 to 3 side |
| When using clock mounted by user | Other than 32.768 kHz | Oscillator assembled by user | |
| When pulse is input from target system | | Not used | Short 1 to 2 side |

Caution Jumper JP1, which is used to select the board's clock or an external clock, should be set only after turning off the power of the IE-78K0S-NS or IE-78K0S-NS-A.

Remark When the IE-789418-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-789418-NS-EM1 is shipped, a 32.768 kHz crystal resonator (X3) and the parts board (X1) on which pins 6 and 8 are shorted are already mounted on the IE-789418-NS-EM1. Short the 2 to 3 side on the IE-789418-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

The settings described under either (a) or (b) are required, depending on the type of clock to be used. Short the 2 to 3 side on the IE-789418-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
 - Parts board
 - Ceramic resonator or crystal resonator
 - Resistor Rx
 - Capacitor CA
 - Capacitor CB
 - Solder kit

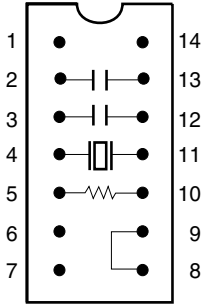
<Steps>

<1> Prepare the IE-789418-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 (X1) (as shown below).

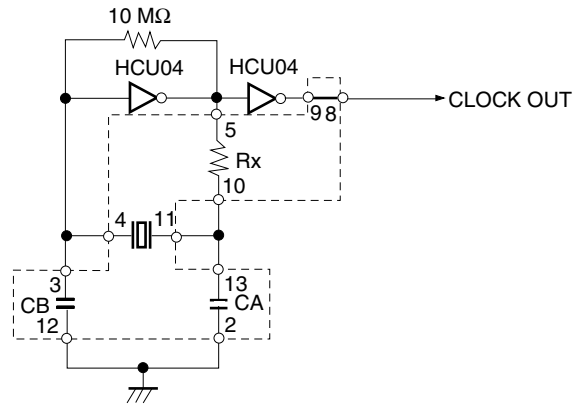
Figure 3-11. Connections on Parts Board (When Using User-Mounted Clock (Subsystem Clock))

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 | Short |

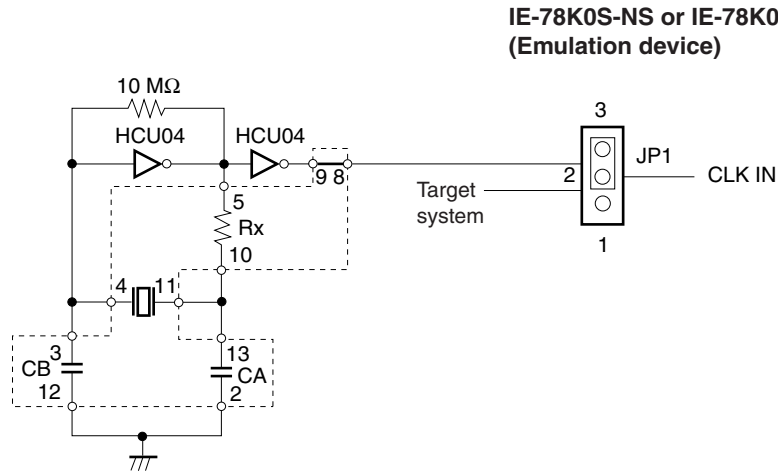
Circuit diagram



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

- <3> Make sure that the parts board (X1) is wired as shown in Figure 3-11.
- <4> Install the IE-789418-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.

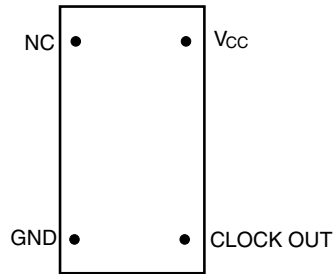


Remark The section enclosed in broken lines indicates parts that are attached to the parts board.

(b) When using a crystal oscillator

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

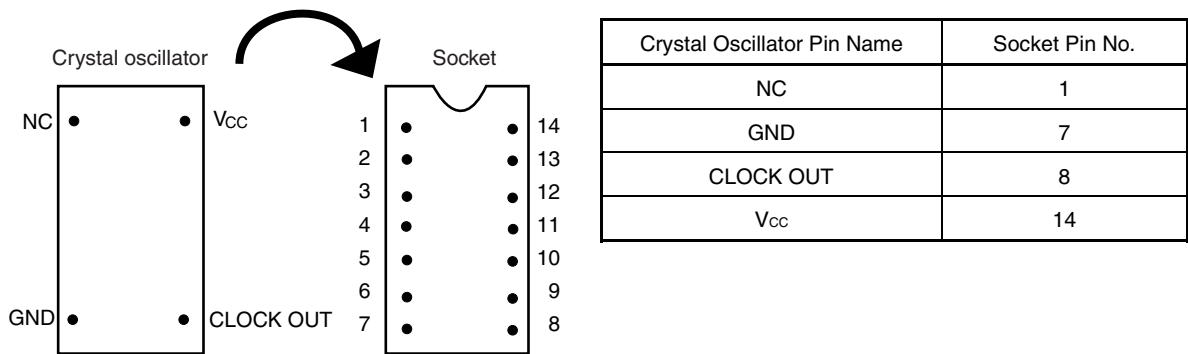
Figure 3-12. Crystal Oscillator (When Using User-Mounted Clock (Subsystem Clock))



<Steps>

- <1> Prepare the IE-789418-NS-EM1.
- <2> Remove the parts board that is mounted in the IE-789418-NS-EM1's X1 socket.
- <3> Mount the crystal oscillator prepared by the user in the X1 socket from which the parts board was removed in <2> above. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

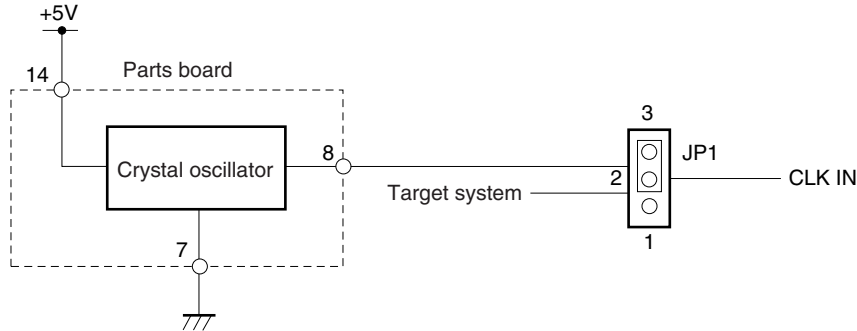
Figure 3-13. Pin Alignment of Crystal Oscillator and Socket



- <4> Install the IE-789418-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 oscillator to the emulation device.

**IE-78K0S-NS or IE-78K0S-NS-A side
(Emulation device)**



(3) When inputting pulse from target system

Short the 1 to 2 side on the IE-789418-NS-EM1's jumper (JP1). There is no need to make any settings via the integrated debugger (ID78K0S-NS).

3.3 Mask Option Setting

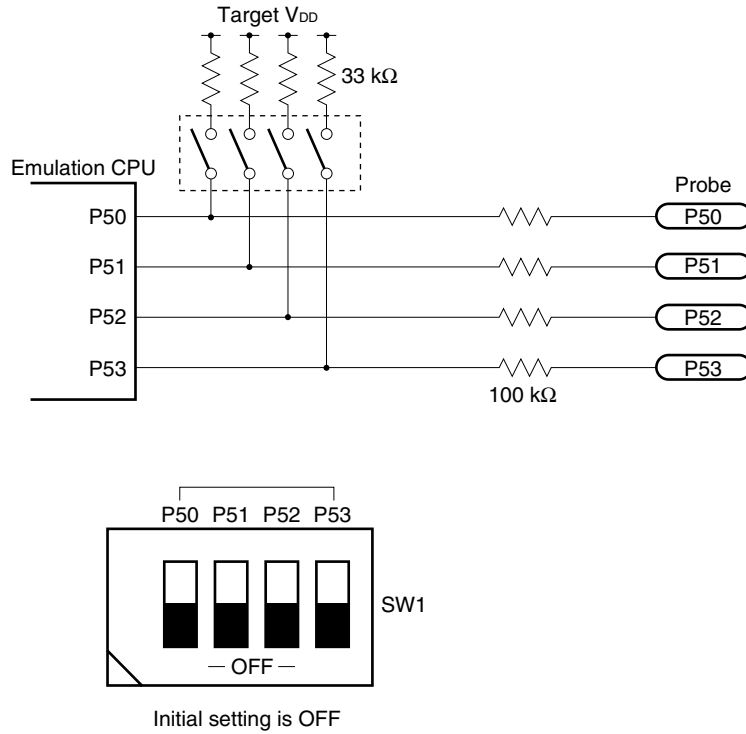
3.3.1 Pull-up resistor

By setting the DIP switch (SW1) in the IE-789418-NS-EM1, a 33 kΩ pull-up resistor can be connected to P50 to P53 as specified by the mask option.

For ports that do not exist in the IE-789418-NS-EM1, set to the DIP switch OFF.

The pull-up resistor is pulled up by the V_{DD} pin of the target socket.

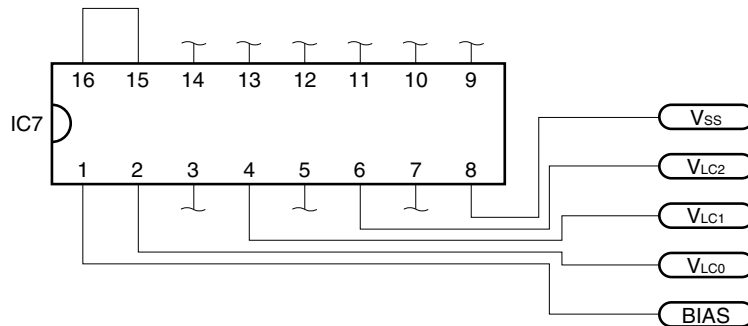
Figure 3-14. Pull-Up Resistor



3.3.2 LCD

In the IE-789418-NS-EM1, a dividing resistor for LCD drive set by a mask option can be mounted on the IC7 parts board.

Figure 3-15. IC7 Pin Configuration



3.4 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.

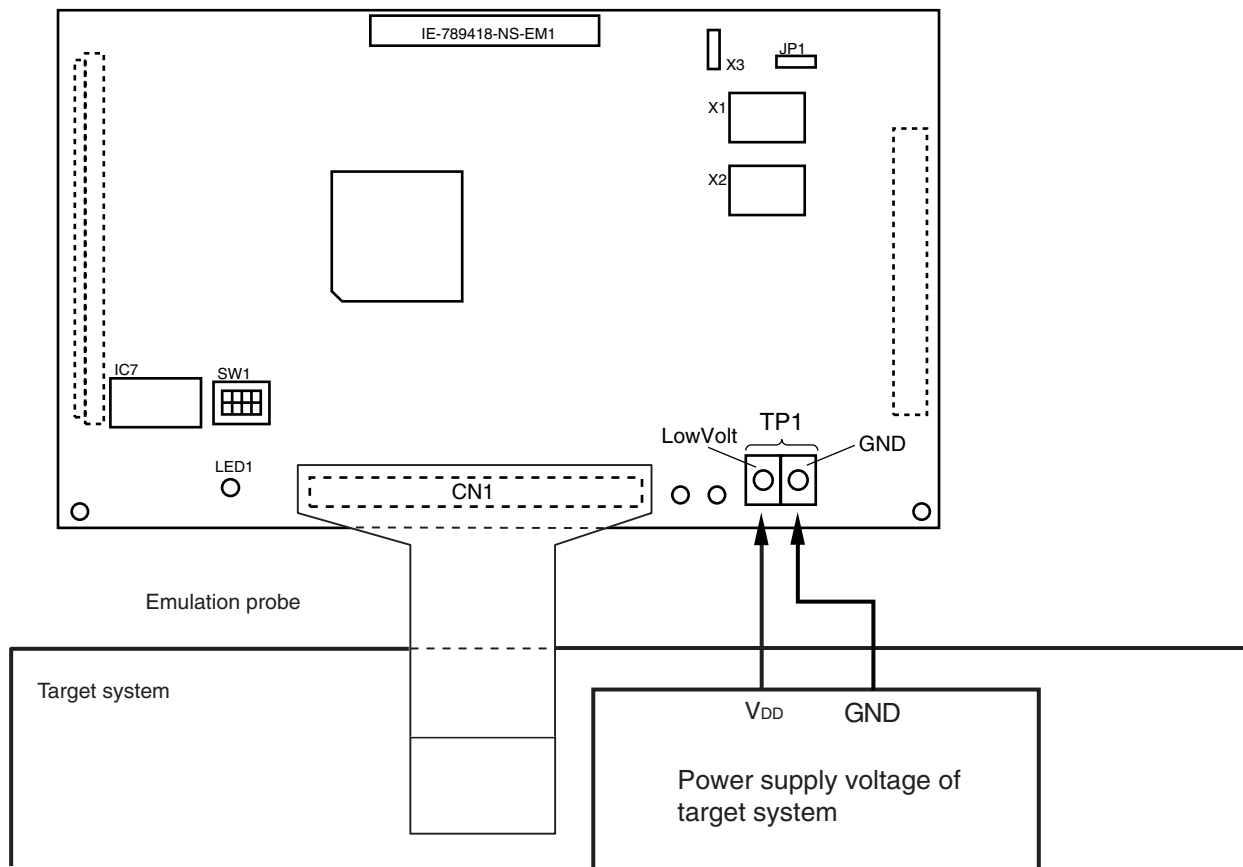
When the target system is not connected, the IE system automatically operates with the emulator's internal power supply (5 V).

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-789418-NS-EM1 (the same applies when the voltage is 5 V).

Set the target voltage to between 1.8 and 5.0 V.

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

Figure 3-16. Connection of TP1 and Power Supply Voltage of Target System



Caution Connect TP1 on the board and the power supply voltage of the target system after turning off the power of the IE-78K0S-NS or IE-78K0S-NS-A.

Remark The V_{DD} pin of the target system is only used for controlling LED1 (TV_{CC}), which monitors whether the power supply of the target system is connected in the IE-789418-NS-EM1.

3.5 External Trigger

To set up an external trigger, connect it to the IE-789418-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, and the **ID78K Series Integrated Debugger Ver. 2.30 or Later Operation (Windows Based) (U15185E)** for the usage methods.

(1) EXTOUT

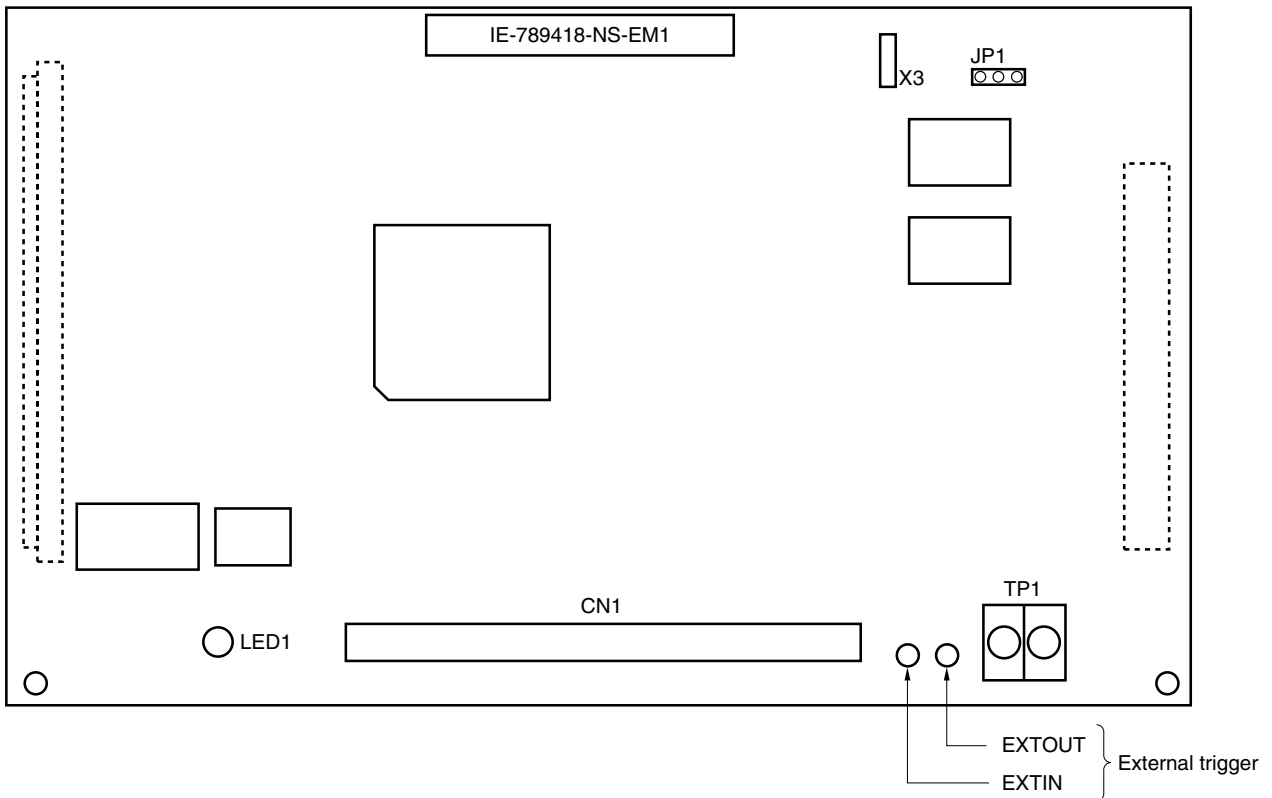
Outputs a low level from the EXTOUT pin on the IE-789418-NS-EM1 for 1.3 μ s upon the occurrence of a break event.

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-789418-NS-EM1. Input a high-level pulse signal for 2 CPU operation clocks or more.

Figure 3-17. External Trigger Input Position



3.6 Switch and Jumper Settings

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

When using the IE-789418-NS-EM1, set the switches and jumpers on the IE-78K0S-NS as shown in Table 3-3. For details of these switch and jumper settings, refer to the **IE-78K0S-NS User’s Manual (U13549E)**.

Table 3-3. 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 |

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

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

When using the IE-789418-NS-EM1, set the switches and jumpers on the IE-78K0S-NS-A as shown in Table 3-4. For the position of the switches and jumpers, refer to the **IE-78K0S-NS-A User’s Manual (U15207E)**.

Table 3-4. Switch and Jumper Settings on IE-78K0S-NS-A

| | | | |
|---------|-----|-----|-----------------|
| | SW1 | JP1 | JP3 |
| Setting | OFF | 1-2 | Shorted (fixed) |

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

(3) Jumper setting on the IE-789418-NS-EM1

The initial setting of jumper on the IE-789418-NS-EM1 is as shown in Table 3-5. For details, refer to **3.2 Clock Settings**.

Table 3-5. Initial Setting of Jumper on IE-789418-NS-EM1

| | |
|---------|----------------|
| | JP1 |
| Setting | 2 to 3 shorted |

CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICES AND TARGET INTERFACE CIRCUITS

This chapter describes differences between the target device's signal lines and the signal lines of the IE-789418-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-789418-NS-EM1's target interface circuit consists of emulation circuits such as an emulation CPU, TTL, and CMOS-IC.

When the IE system is connected with the target system for debugging, the IE system performs emulation so as to operate as the actual target device would operate in the target system.

However, some minor differences exist since the operations are performed via the IE system's emulation.

- (1) Signals input to or output from the EVA chip and the peripheral EVA chip
- (2) Signals input from the target system via a gate
- (3) Analog signals
- (4) Other signals

The IE-789418-NS-EM1's circuit is used as follows for signals listed in (1) to (4) above.

(1) Signals input to or output from the EVA chip and peripheral EVA chip

The following signals perform the same operations as in the μ PD789407A, 789417A Subseries. However, a 1 M Ω pull-down resistor and 100 Ω resistor are inserted in series. Refer to **Figure 4-1 Equivalent Circuit of Emulation Circuit 1**.

- Signals related to port 0
- Signals related to port 2
- Signals related to port 4
- Signals related to port 5

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

Since the following signals are input via a gate, their signals show a delay compared to the μ PD789407A, 789417A Subseries. Refer to **Figure 4-2 Equivalent Circuit of Emulation Circuit 2**.

- $\overline{\text{RESET}}$ signal
- Signals related to X1, XT1

(3) Analog signals

Because the following signals input/output analog signals, special processing is not performed in the IE-789418-NS-EM1.

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

- AV_{DD}
- AV_{REF}
- S0 to S15
- COM0 to COM3
- Port 6
- Port 8
- Port 9
- V_{LC0} to V_{LC2}
- BIAS

(4) Other signals

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

- V_{DD0} and V_{DD1} pins

The emulation CPU operates on the internal power supply (5 V) of the IE-789418-NS-EM1 when not connected to the target system, and operates on the voltage supplied from the voltage supply pin (TP1) when connected to the target system.

The V_{DD0} and V_{DD1} pins of the target system are used only to control the LED (TV_{CC}) that indicates whether the target system's power is on or off.

- V_{SS0}, V_{SS1}, and AV_{SS} pins

The V_{SS0}, V_{SS1}, and AV_{SS} pins are connected to GND in the IE-789418-NS-EM1.

- TEST/V_{PP} pin

The TEST/V_{PP} pin is not used in the IE-789418-NS-EM1.

- X2 and XT2 pins

The X2 and XT2 pins are not used in the IE-789418-NS-EM1.

Figure 4-1. Equivalent Circuit of Emulation Circuit 1

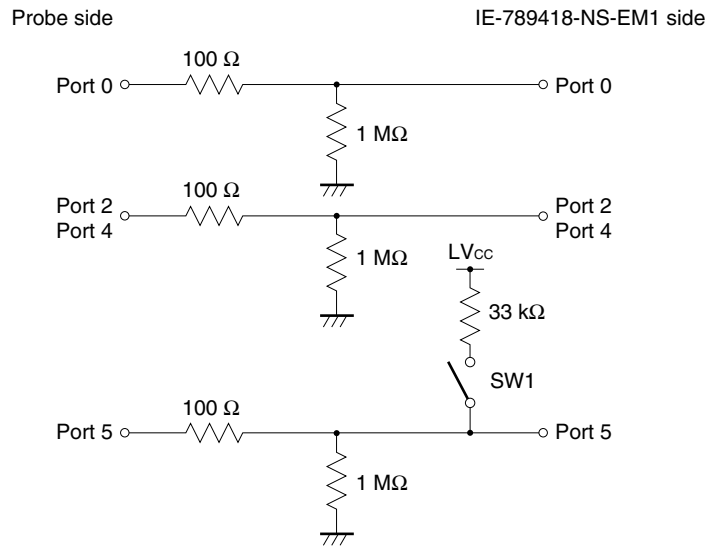


Figure 4-2. Equivalent Circuit of Emulation Circuit 2

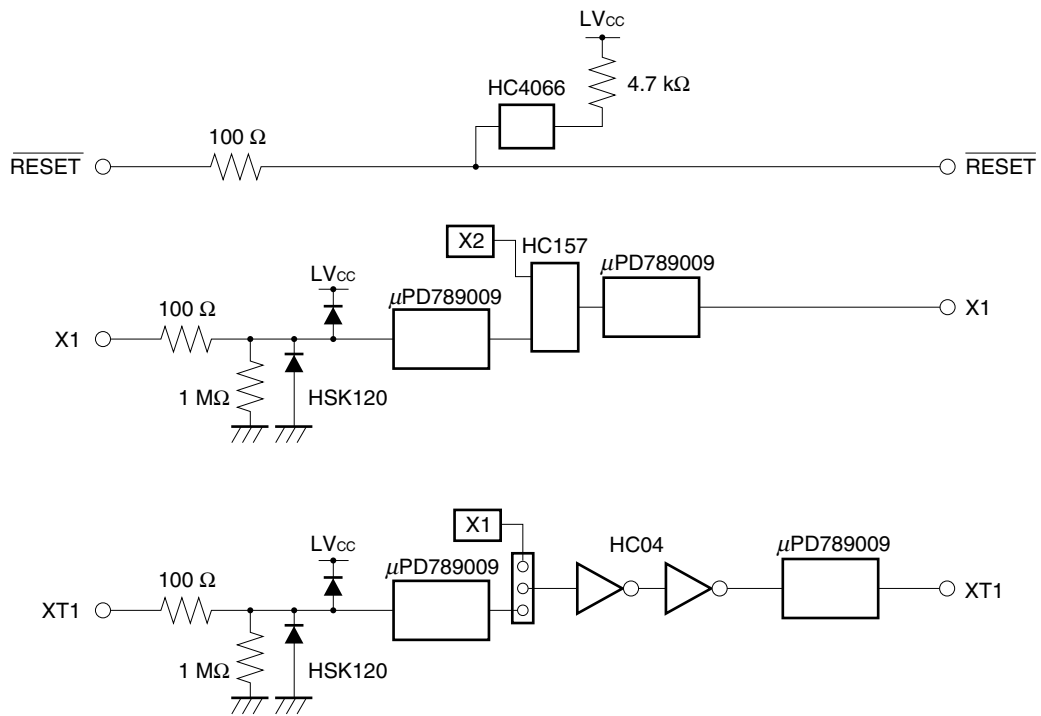


Figure 4-3. Equivalent Circuit of Emulation Circuit 3

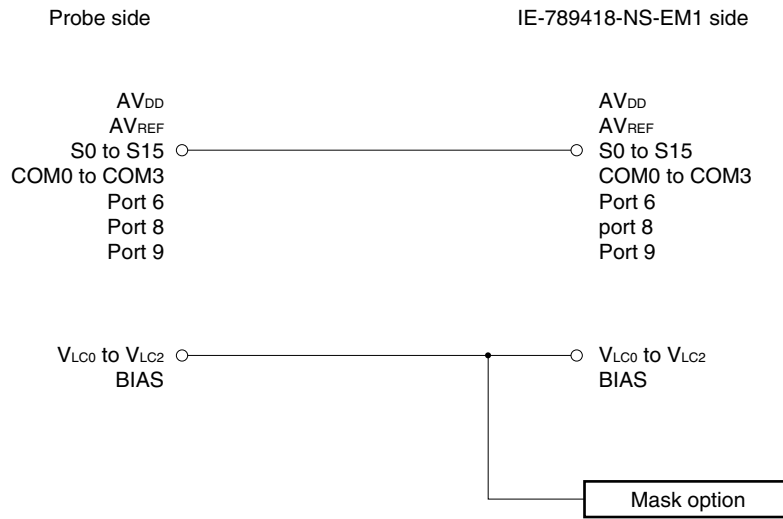
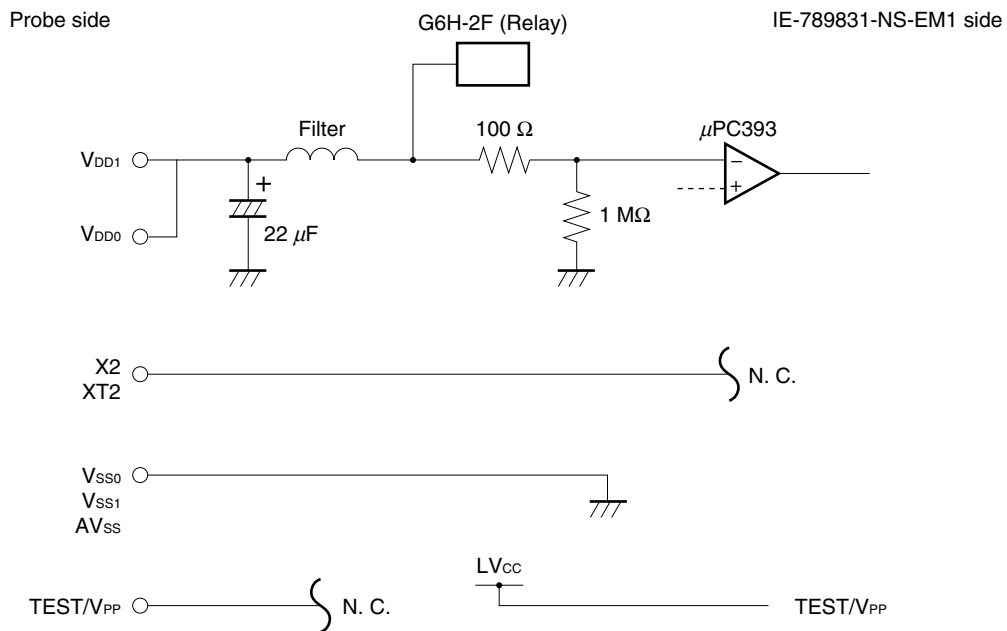


Figure 4-4. Equivalent Circuit of Emulation Circuit 4



APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, and NP-H80GK-TQ Pin Assignments (1/2)

| Emulation Probe | CN1 Pin No. | Emulation Probe | CN1 Pin No. |
|-----------------|-------------|-----------------|-------------|
| 1 | 114 | 33 | 56 |
| 2 | 113 | 34 | 49 |
| 3 | 108 | 35 | 50 |
| 4 | 107 | 36 | 45 |
| 5 | 104 | 37 | 46 |
| 6 | 103 | 38 | 41 |
| 7 | 100 | 39 | 42 |
| 8 | 99 | 40 | 35 |
| 9 | 94 | 41 | 8 |
| 10 | 93 | 42 | 7 |
| 11 | 30 | 43 | 14 |
| 12 | 29 | 44 | 13 |
| 13 | 24 | 45 | 18 |
| 14 | 23 | 46 | 17 |
| 15 | 20 | 47 | 22 |
| 16 | 19 | 48 | 21 |
| 17 | 16 | 49 | 28 |
| 18 | 15 | 50 | 27 |
| 19 | 10 | 51 | 92 |
| 20 | 9 | 52 | 91 |
| 21 | 37 | 53 | 98 |
| 22 | 43 | 54 | 97 |
| 23 | 44 | 55 | 102 |
| 24 | 47 | 56 | 101 |
| 25 | 48 | 57 | 106 |
| 26 | 51 | 58 | 105 |
| 27 | 52 | 59 | 112 |
| 28 | 57 | 60 | 111 |
| 29 | 58 | 61 | 83 |
| 30 | 59 | 62 | 77 |
| 31 | 60 | 63 | 78 |
| 32 | 55 | 64 | 73 |

- Remarks**
1. The NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, and NP-H80GK-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.

Table A-1. NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, and NP-H80GK-TQ Pin Assignments (2/2)

| Emulation Probe | CN1 Pin No. | Emulation Probe | CN1 Pin No. |
|-----------------|-------------|-----------------|-------------|
| 65 | 74 | 73 | 66 |
| 66 | 69 | 74 | 71 |
| 67 | 70 | 75 | 72 |
| 68 | 63 | 76 | 75 |
| 69 | 64 | 77 | 76 |
| 70 | 61 | 78 | 79 |
| 71 | 62 | 79 | 80 |
| 72 | 65 | 80 | 85 |

- Remarks**
1. The NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, and NP-H80GK-TQ are products of Naito Densai Machida Mfg. Co., Ltd.
 2. The numbers in the “Emulation probe” column indicate the corresponding pin number on the emulation probe tip.

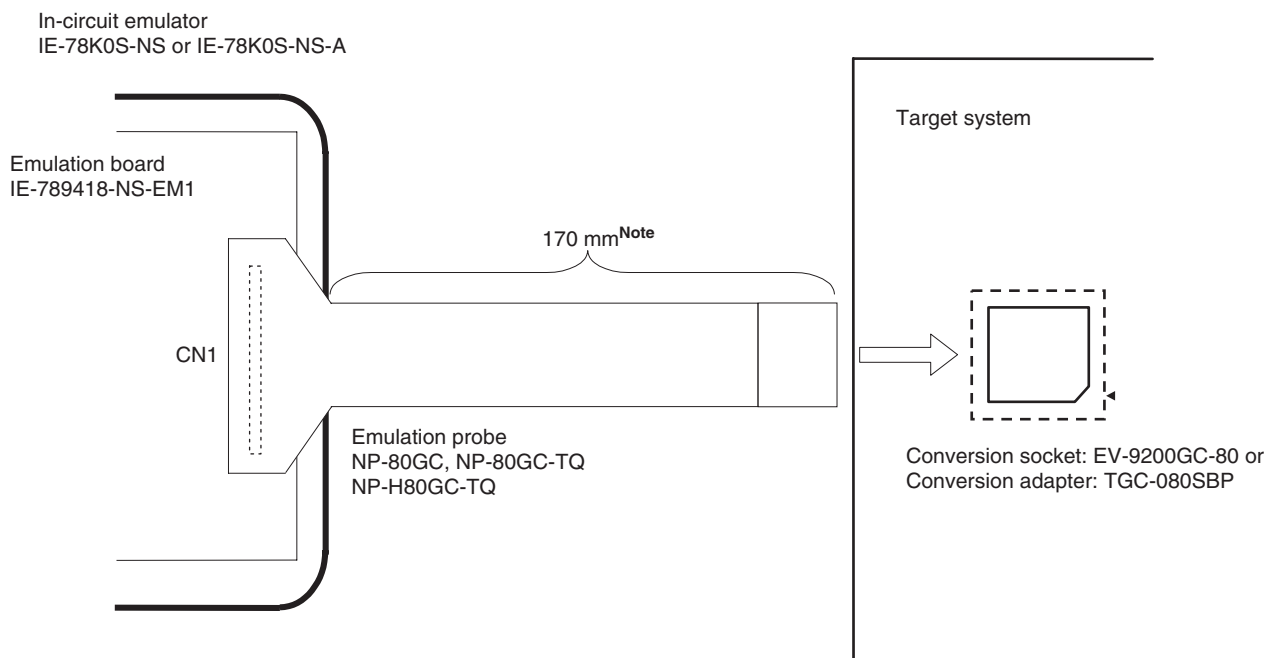
APPENDIX B CAUTIONS ON DESIGNING TARGET SYSTEM

Figures B-1 to B-6 show the conditions when connecting the emulation probe to the conversion adapter or conversion socket. Follow the configuration below and consider the shape of parts to be mounted on the target system when designing a system.

Of the products described in this chapter, the NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK and NP-H80GK-TQ are products of Naito Densai Machida Mfg. Co., Ltd, and the TGC-080SBP and TGC-080SDW are products of TOKYO ELETECH CORPORATION.

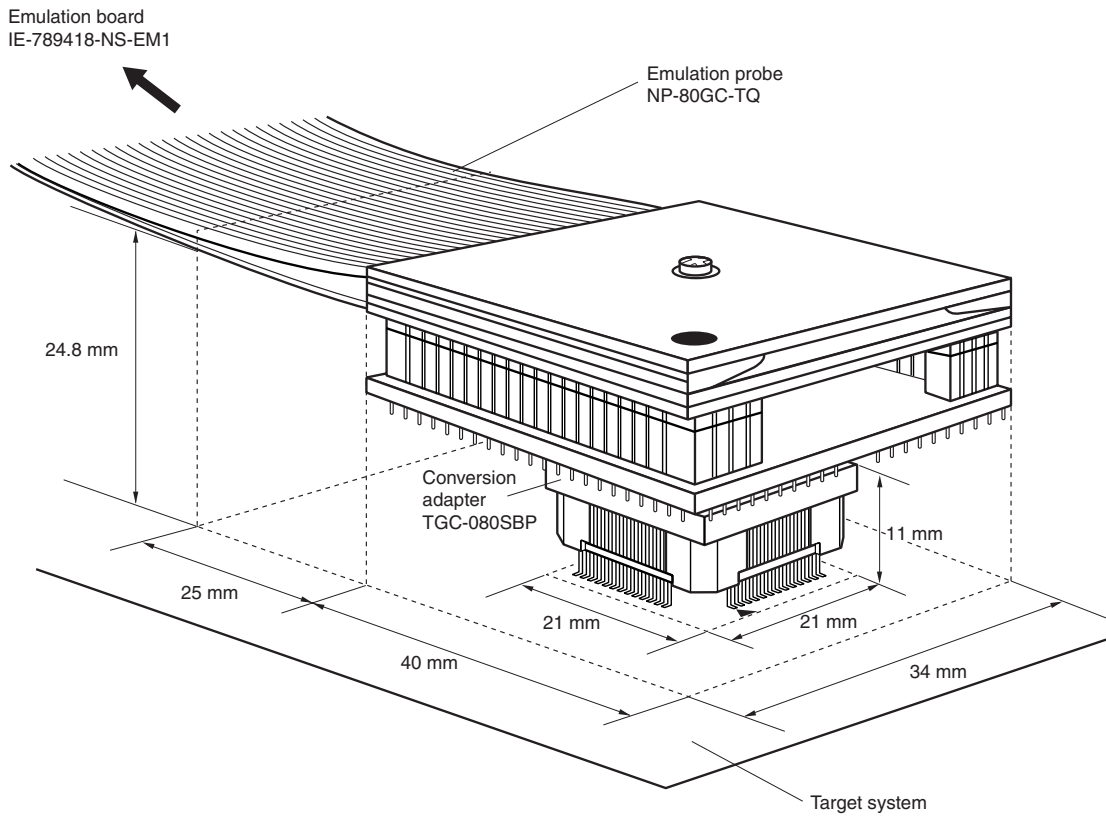
(1) NP-80GC, NP-80GC-TQ, NP-H80GC-TQ

Figure B-1. Distance Between In-Circuit Emulator and Conversion Socket (80GC)

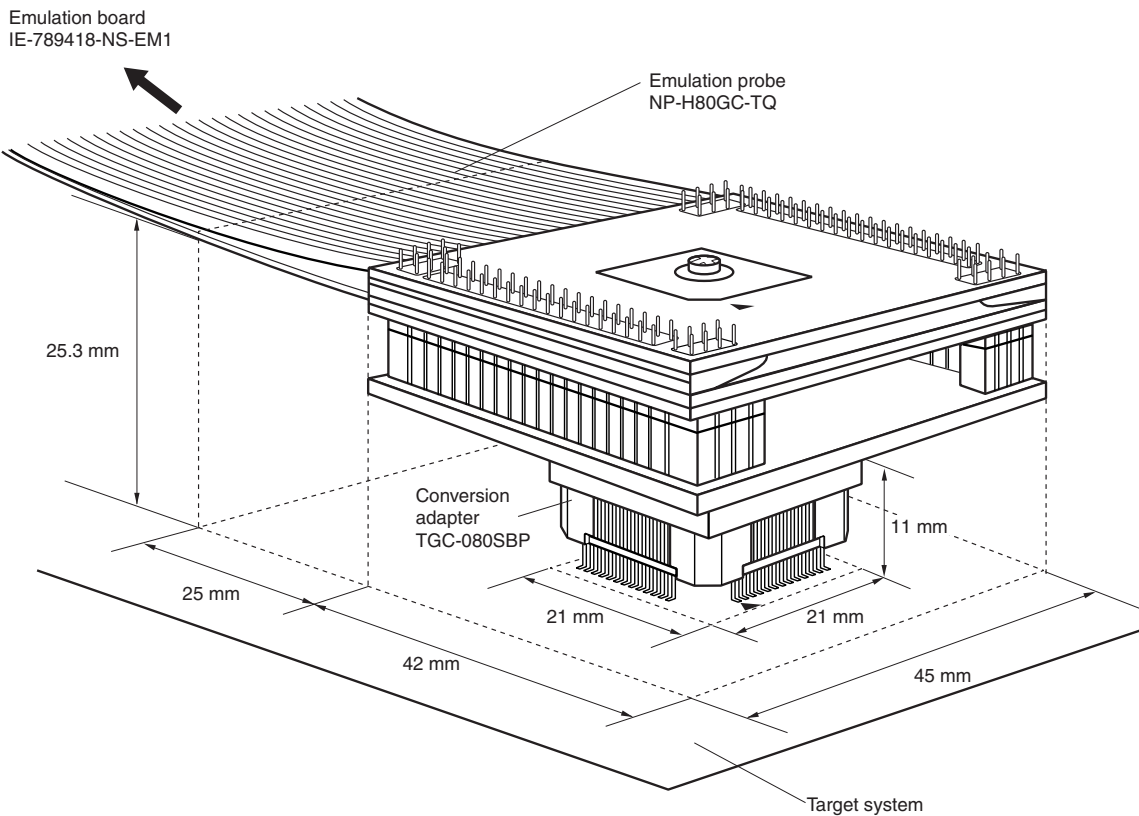


Note When NP-H80GB-TQ is used, the distance is 370 mm.

★ **Figure B-2. Connection Conditions of Target System (When NP-80GC-TQ Is Used)**

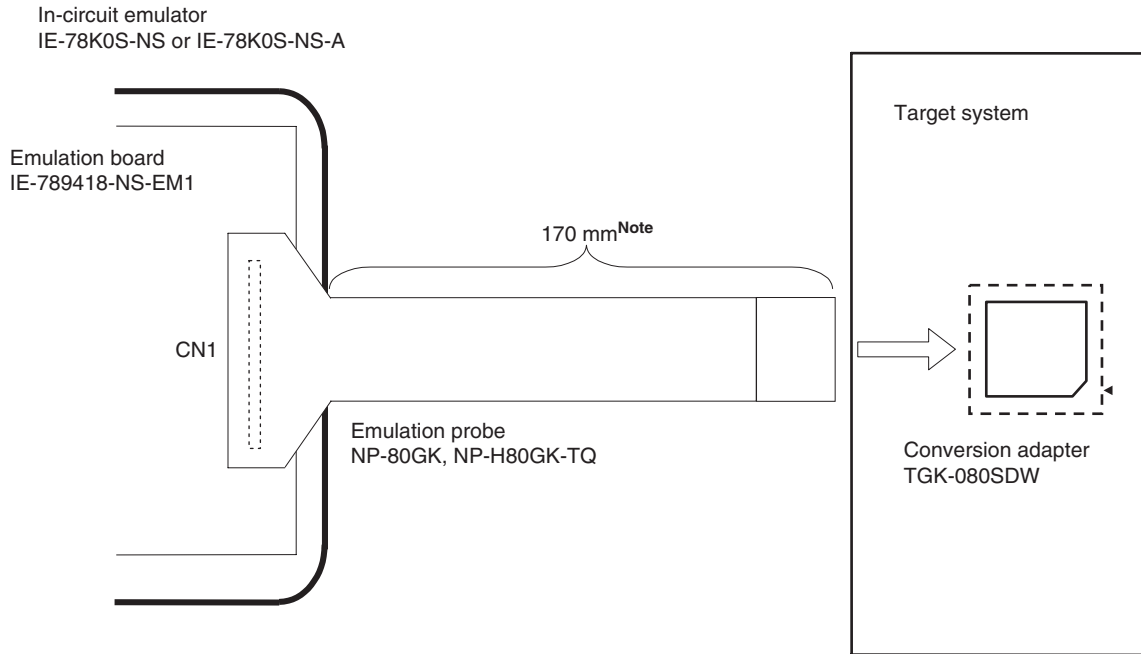


★ **Figure B-3. Connection Conditions of Target System (When NP-H80GC-TQ Is Used)**



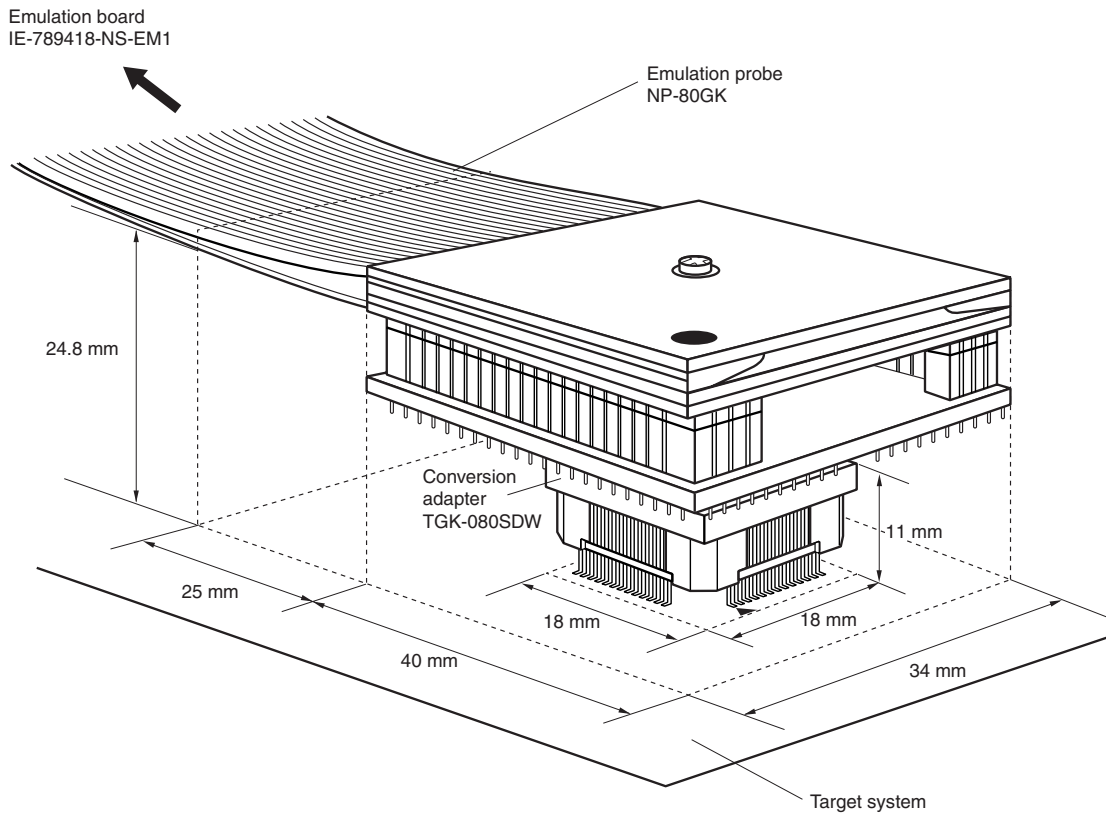
(2) NP-80GK, NP-H80GK-TQ

Figure B-4. Distance Between In-Circuit Emulator and Conversion Adapter (80GK)

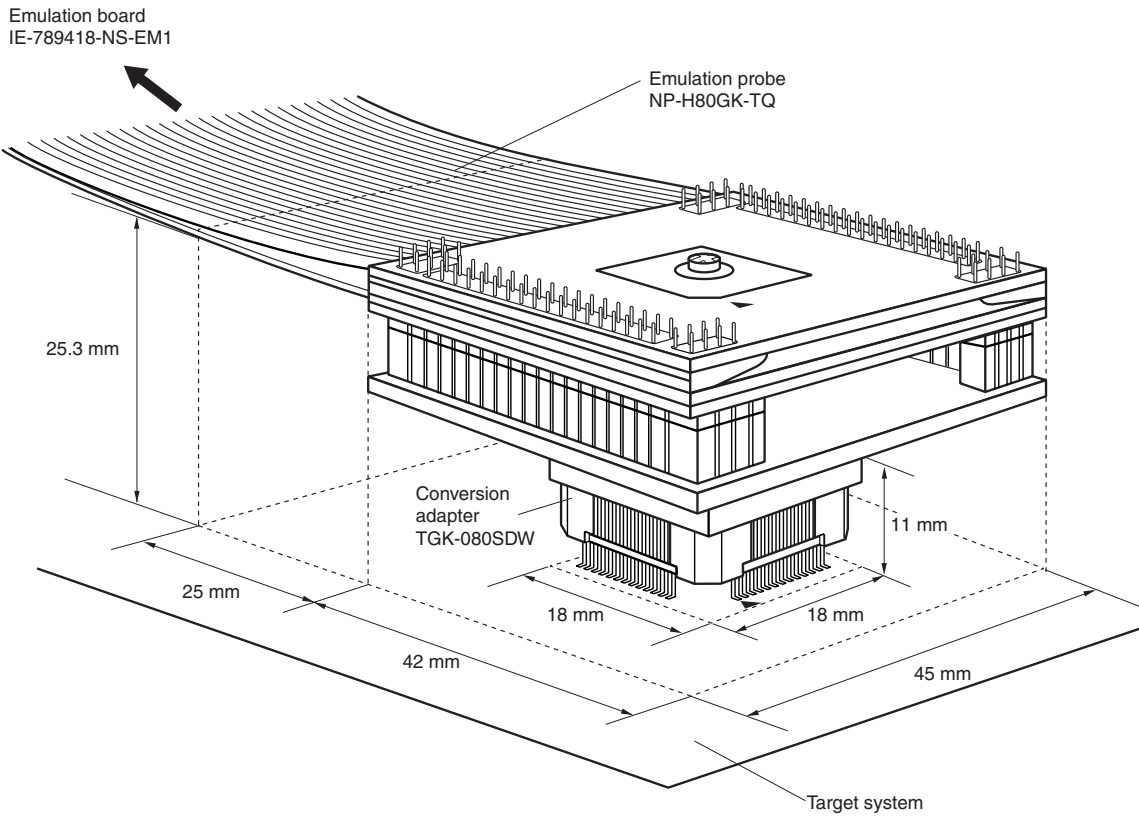


Note When NP-H80GK is used, the distance is 370 mm.

★ **Figure B-5. Connection Conditions of Target System (When NP-80GK Is Used)**



★ **Figure B-6. Connection Conditions of Target System (When NP-H80GK-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"/> |