

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-784976-NS-EM1

Emulation Board

Target Devices

*μ*PD784976 Subseries

*μ*PD784976A 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 October, 2002. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics 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 the prior written consent of NEC Electronics. NEC Electronics assumes no responsibility for any errors that may appear in this document.
- NEC 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 NEC Electronics 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 Electronics 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 a customer's equipment shall be done under the full responsibility of the customer. NEC Electronics assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC Electronics endeavors to enhance the quality, reliability and safety of NEC Electronics 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 Electronics products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment and anti-failure features.
- NEC Electronics products are classified into the following three quality grades: "Standard", "Special" and "Specific".
The "Specific" quality grade applies only to NEC Electronics products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of an NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics 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 Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

(Note)

- (1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.
- (2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).

Regional Information

Some information contained in this document may vary from country to country. Before using any NEC Electronics product in your application, please contact the NEC Electronics 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 America, Inc. (U.S.)

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

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

• Tyskland Filial

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: 6253-8311
Fax: 6250-3583

INTRODUCTION

Product Overview

The IE-784976-NS-EM1 is designed to be used with the IE-78K4-NS to debug the following target devices that belong to the 78K/IV Series of 16-bit single-chip microcontrollers.

- μ PD784976 Subseries: μ PD784975, 78F4976
- μ PD784976A Subseries: μ PD784975A, 78F4976A

Target Readers

This manual is intended for engineers who will use the IE-784976-NS-EM1 with the IE-78K4-NS 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-784976-NS-EM1, refer to not only this manual (supplied with the IE-784976-NS-EM1) but also the manual that is supplied with the IE-78K4-NS.

| |
|-----------------------------|
| IE-78K4-NS User's Manual |
|-----------------------------|

- Basic specifications
- System configuration
- External interface functions

| |
|-----------------------------------|
| IE-784976-NS-EM1 User's Manual |
|-----------------------------------|

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

Purpose

This manual's purpose is to explain various debugging functions that can be performed when using the IE-784976-NS-EM1.

Terminology

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

| Term | Meaning |
|------------------|--|
| Emulation device | This is a general term that refers to the device in the emulator that is used to emulate the target device. It includes the emulation CPU. |
| Emulation CPU | This is the CPU block in the emulator that is used to execute user-generated programs. |
| Target device | This is the device that is the target for emulation. |
| Target system | This includes the target program and the hardware provided by the user. When defined narrowly, it includes only the hardware. |
| IE system | This refers to the combination of the in-circuit emulator (IE-78K4-NS) and the emulation board (IE-784976-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 No. |
|--|-----------|--------------|
| IE-78K4-NS In-Circuit Emulator | | U13356E |
| IE-784976-NS-EM1 Emulation Board | | This manual |
| ID78K Series Integrated Debugger Ver. 2.30 or Later Windows™ Based | Operation | U15185E |
| μPD784976 Subseries | Hardware | U14119E |
| μPD784976A Subseries | Hardware | U15017E |

Caution The related documents listed above are subject to change without notice. Be sure to use the latest version of each document for 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 |
| | |
| CHAPTER 3 INSTALLATION | 17 |
| 3.1 Connection..... | 18 |
| 3.2 Clock Settings..... | 19 |
| 3.2.1 Overview of clock settings | 19 |
| 3.2.2 Main system clock settings | 21 |
| 3.3 Low-Voltage Emulation Setting..... | 25 |
| 3.4 External Trigger | 25 |
| 3.5 Jumper Setting of IE-784976-NS-EM1 | 26 |
| | |
| CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICES AND TARGET INTERFACE CIRCUITS | 27 |
| | |
| CHAPTER 5 RESTRICTIONS | 31 |
| | |
| APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE | 32 |
| | |
| APPENDIX B NOTES ON TARGET SYSTEM DESIGN | 34 |

LIST OF FIGURES

| Figure No. | Title | Page |
|------------|---|------|
| 1-1 | System Configuration | 11 |
| 1-2 | Basic Hardware Configuration..... | 13 |
| 2-1 | IE-784976-NS-EM1 Part Names | 16 |
| 3-1 | Connection of Emulation Probe..... | 18 |
| 3-2 | External Circuits Used as System Clock Oscillator | 19 |
| 3-3 | When Using Clock That Is Already Mounted on Emulation Board | 20 |
| 3-4 | When Using User-Mounted Clock | 20 |
| 3-5 | When Using External Clock..... | 21 |
| 3-6 | Connections on Parts Board (When Using Main System Clock or User-Mounted Clock) | 23 |
| 3-7 | Crystal Oscillator (When Using Main System Clock or User-Mounted Clock)..... | 24 |
| 3-8 | Pin Alignment of Crystal Oscillator and Socket | 24 |
| 3-9 | External Trigger Input Position | 25 |
| 4-1 | Equivalent Circuit 1 of Emulation Circuit | 28 |
| 4-2 | Equivalent Circuit 2 of Emulation Circuit | 29 |
| B-1 | Distance Between IE System and Conversion Adapter | 34 |
| B-2 | Connection Conditions of Target System (When NP-100GF-TQ Is Used)..... | 35 |
| B-3 | Connection Conditions of Target System (When NP-H100GF-TQ Is Used) | 35 |

LIST OF TABLES

| Table No | Title | Page |
|----------|---|------|
| 1-1 | Correspondence Between Emulation Probes and Conversion Socket/Conversion Adapters | 12 |
| 1-2 | Basic Specifications | 14 |
| 3-1 | Main System Clock Settings | 21 |
| 3-2 | Jumper Setting of IE-784976-NS-EM1 | 26 |
| A-1 | NP-100GF, NP-100GF-TQ, NP-H100GF-TQ Pin Assignments | 32 |
| B-1 | Distance Between IE System and Conversion Adapter | 34 |

CHAPTER 1 GENERAL

The IE-784976-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/IV Series of 16-bit single-chip microcontrollers.

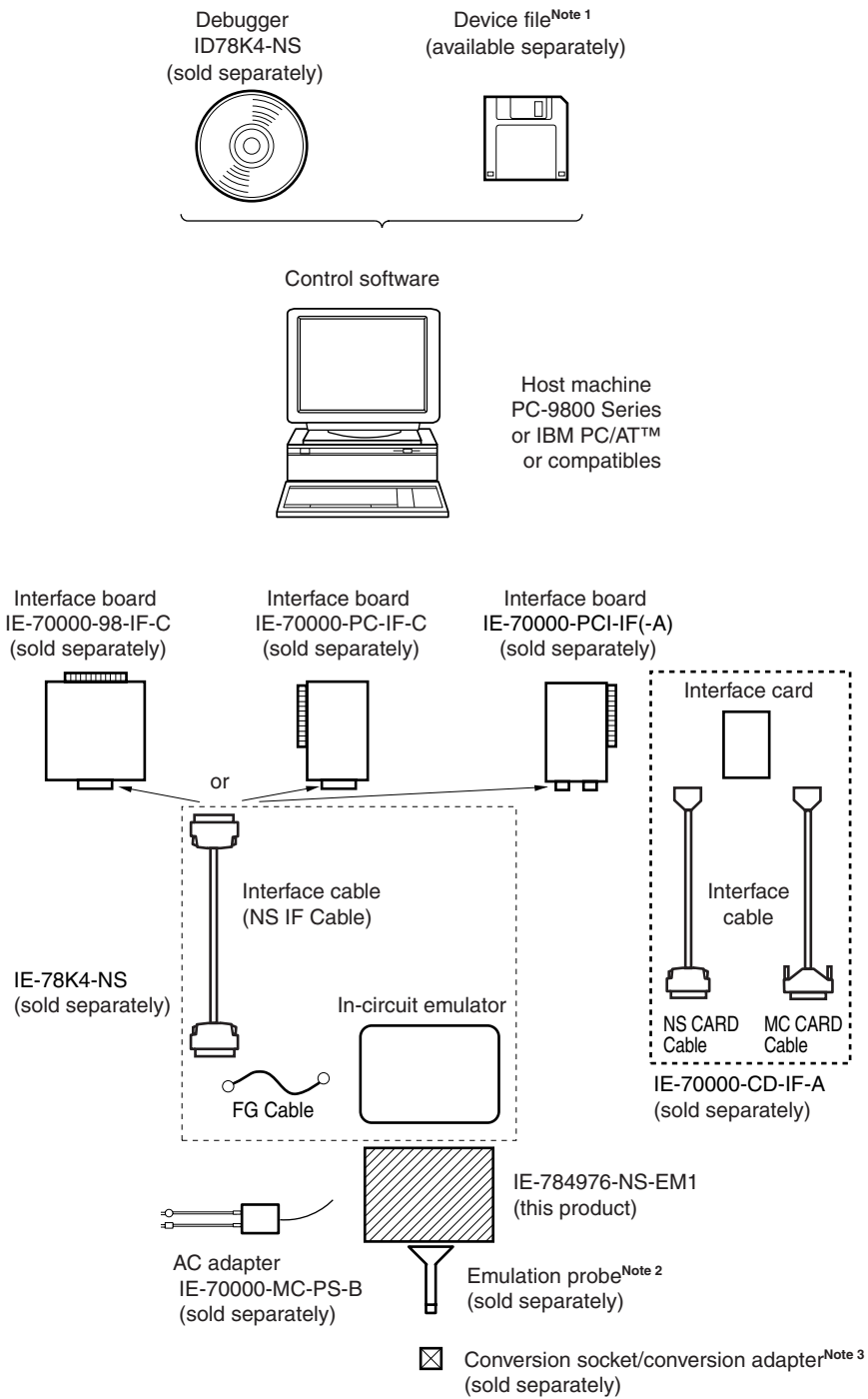
This chapter describes the IE-784976-NS-EM1's system configuration and basic specifications.

- Target devices
 - μ PD784976 Subseries
 - μ PD784976A Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-784976-NS-EM1's system configuration.

Figure 1-1. System Configuration



Notes 1. The device file is as follows.

μ SxxxxDF784976: μ PD784976, 784976A Subseries

The device file can be downloaded from the website of NEC Electronics (<http://www.necel.com/micro/>).

2. The emulation probes, NP-100GF, NP-100GF-TQ, and NP-H100GF-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 adapter, TGF-100RBP is a product 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)

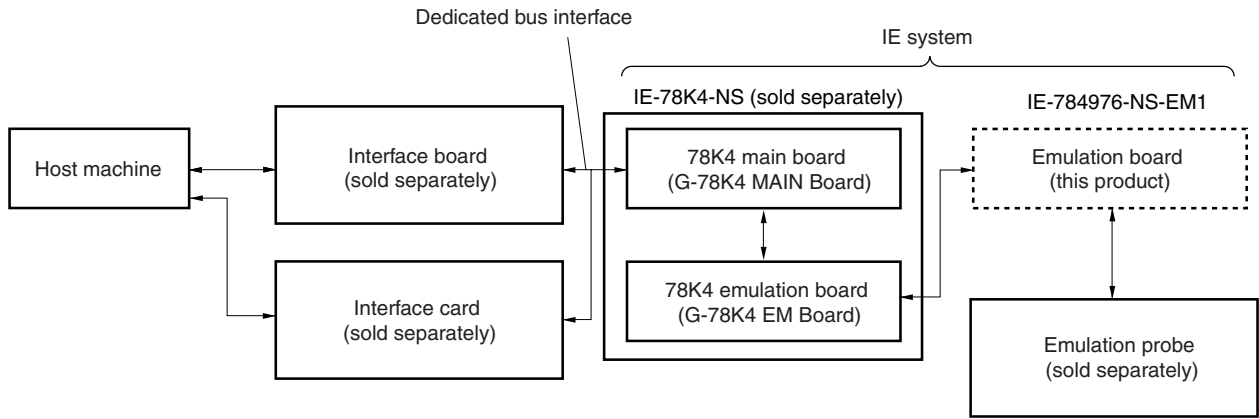
Table 1-1. Correspondence Between Emulation Probes and Conversion Socket/Conversion Adapters

| Package | Emulation Probe | Conversion Socket/Conversion Adapter |
|-------------------------------|-------------------------------------|--------------------------------------|
| 100-pin plastic QFP (GF type) | NP-100GF (Probe length: 200 mm) | EV-9200GF-100 |
| | NP-100GF-TQ (Probe length: 200 mm) | TGF-100RBP |
| | NP-H100GF-TQ (Probe length: 400 mm) | |

1.2 Hardware Configuration

Figure 1-2 shows the IE-784976-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The IE-784976-NS-EM1's basic specifications are listed in Table 1-2.

Table 1-2. Basic Specifications

| Parameter | Description |
|--------------------------|---|
| Target device | μ PD784976, 784976A Subseries |
| System clock | 12.5 MHz |
| Main system clock supply | External: Input via an emulation probe from the target system Internal: Mounted on the emulation board (25 MHz), or mounted on the board by the user |
| Low-voltage support | 4.5 to 5.25 V (same as target device) |

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-784976-NS-EM1 main unit.

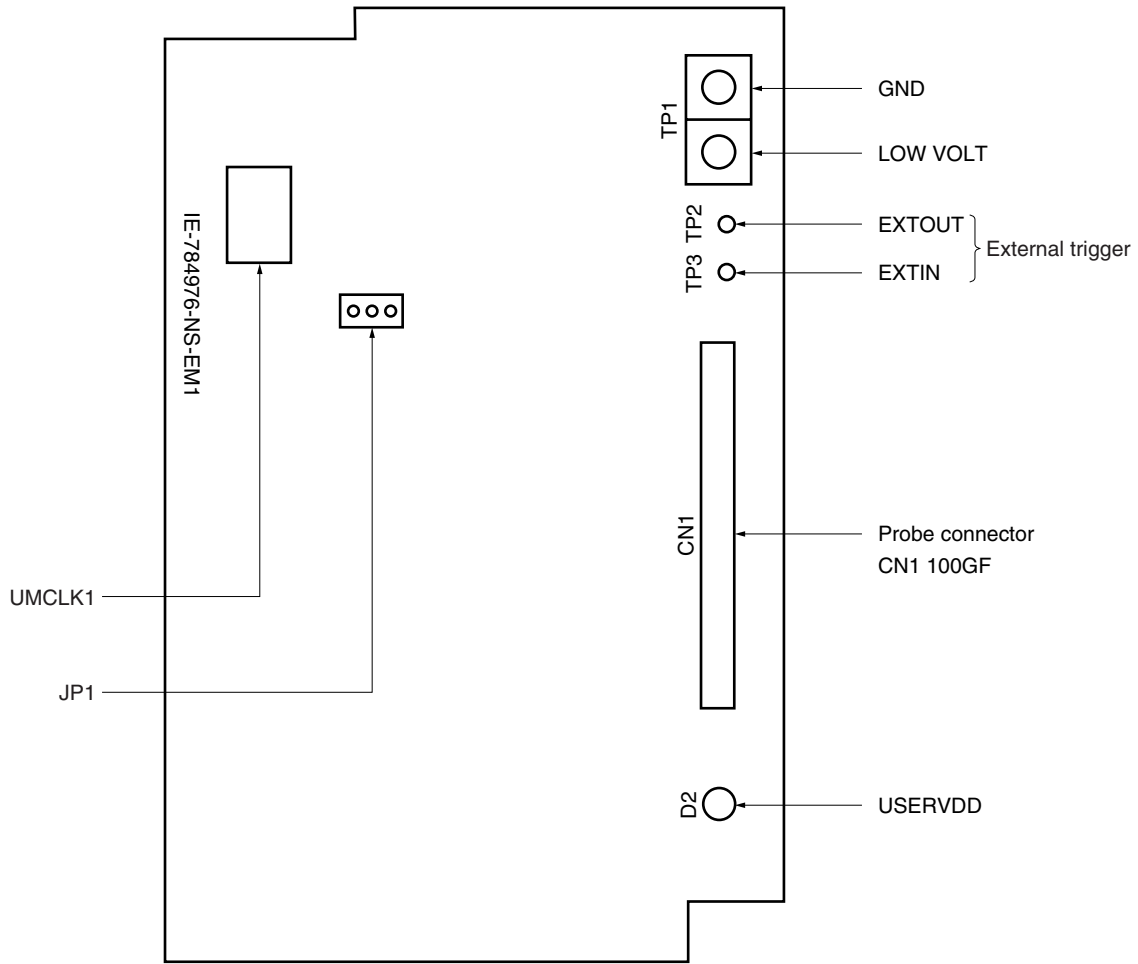
The packing box contains the emulation board (IE-784976-NS-EM1).

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

Fill out and return the guarantee document that comes with the main unit.

2.1 Parts of Main Unit

Figure 2-1. IE-784976-NS-EM1 Part Names



CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-784976-NS-EM1 to the IE-78K4-NS, 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-78K4-NS main unit

See the **IE-78K4-NS User's Manual (U13356E)** for a description of how to connect the IE-784976-NS-EM1 to the IE-78K4-NS.

(2) Connection with emulation probe

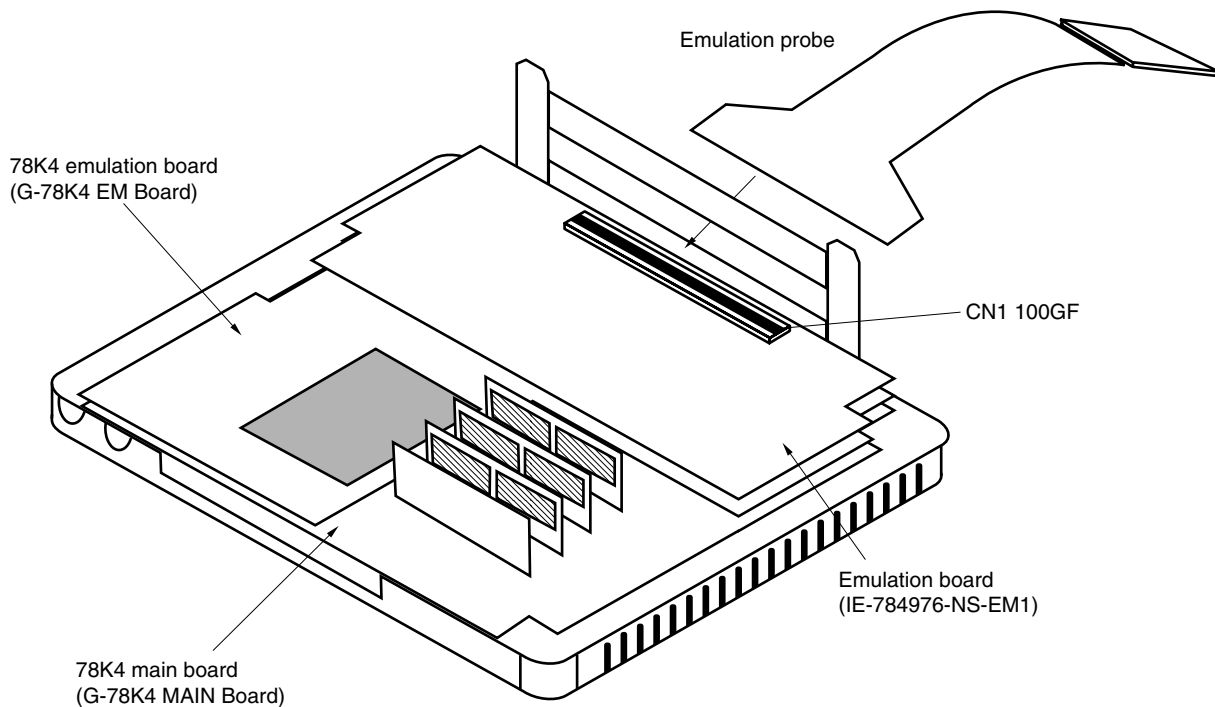
See the **IE-78K4-NS User's Manual (U13356E)** for a description of how to connect an emulation probe to the IE-784976-NS-EM1.

On this board, connect the emulation probe to CN1.

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 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

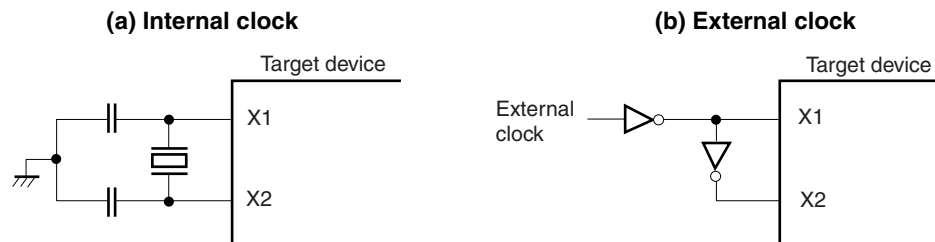
(3) External clock

If the target system includes an internal clock, select either **(1) Clock that is already mounted on emulation board** or **(2) Clock that is mounted by user**. For an internal clock, the target device is connected to a resonator 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 resonator that is mounted on the target system is not used. Instead, the clock that is mounted on the emulation board installed in the IE-78K4-NS is used.

If the target system includes an external clock, select **(3) External clock**.

For an external clock, a clock signal is supplied from outside 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 3-2.

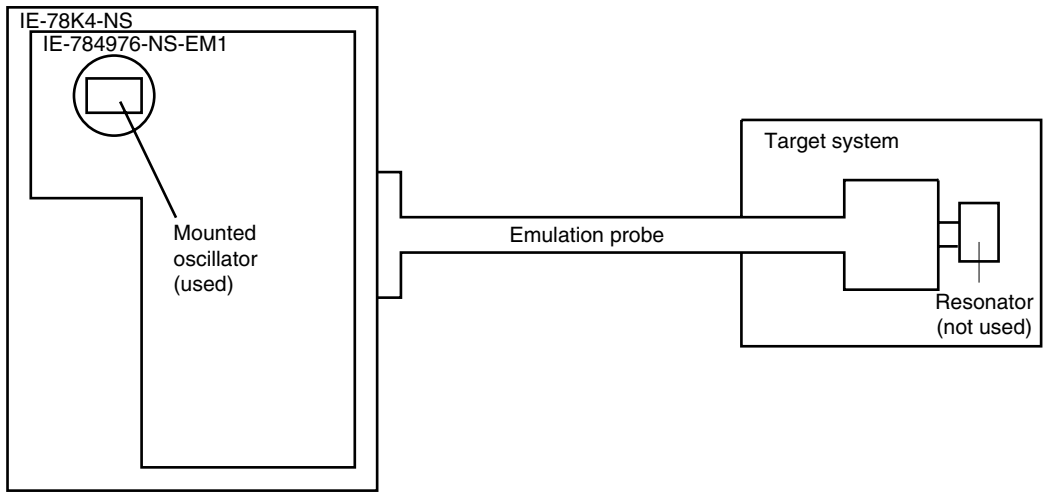
Figure 3-2. External Circuits Used as System Clock Oscillator



(1) Clock that is already mounted on emulation board

A crystal oscillator is already mounted on the emulation board. Its frequency is 25 MHz.

Figure 3-3. When Using Clock That Is Already Mounted on Emulation Board

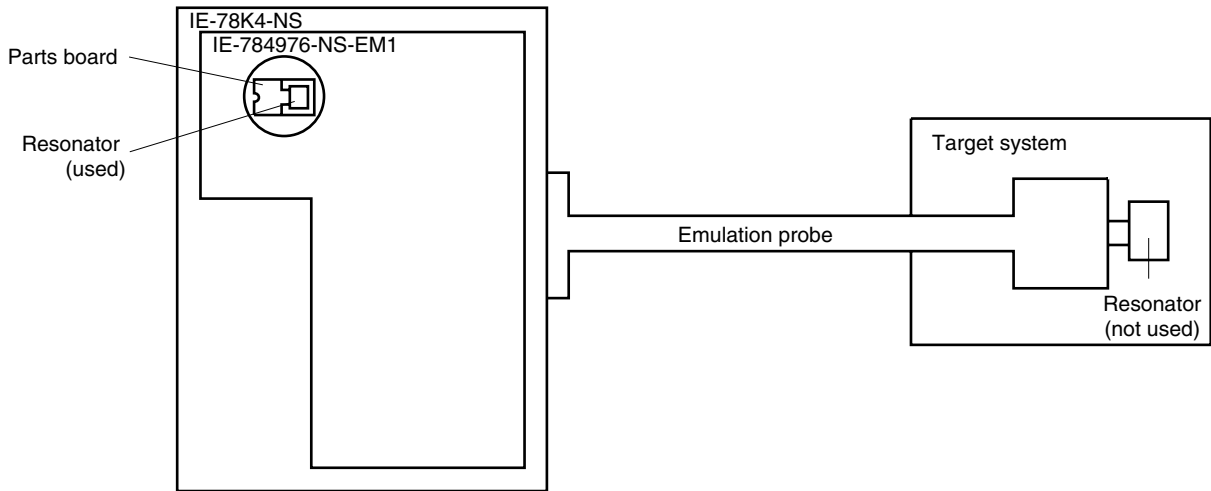


Remark The clock that is supplied by the IE-784976-NS-EM1's oscillator (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-784976-NS-EM1. First mount the resonator on the parts board, then attach the parts board to the IE-784976-NS-EM1. This method is useful when using a different frequency from that of the pre-mounted clock.

Figure 3-4. When Using User-Mounted Clock

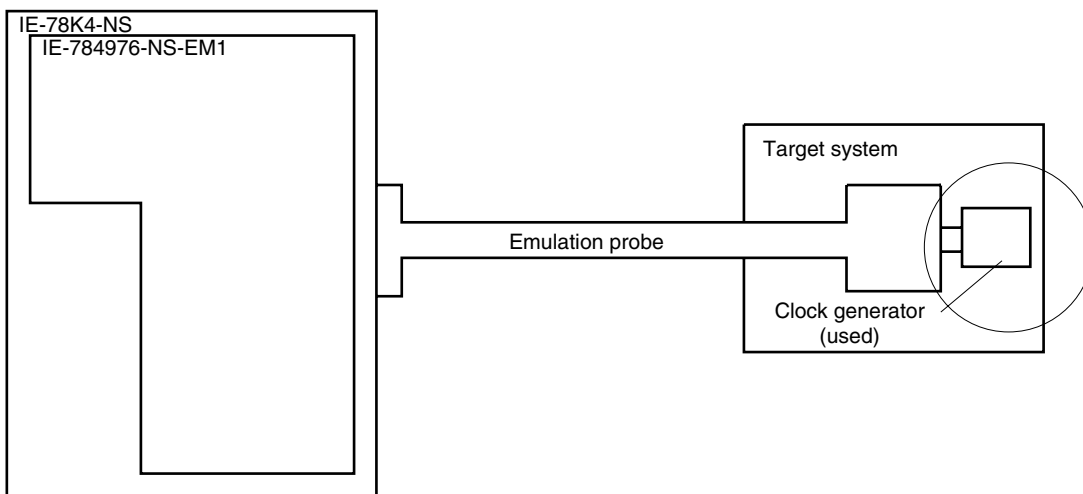


Remark The clock that is supplied by the IE-784976-NS-EM1's resonator (encircled in the figure) is used.

(3) External clock

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

Figure 3-5. When Using External Clock



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

3.2.2 Main system clock settings

Table 3-1. Main System Clock Settings

| Clock Supply Method | Frequency of Supply Clock | Frequency of Main System Clock | IE-784976-NS-EM1 | | CPU Clock Source Selection (ID78K4-NS) |
|---|---------------------------|--------------------------------|----------------------------|------------------------------|--|
| | | | JP1 | Parts Board (UMCLK1) | |
| When using clock that is already mounted on emulation board | 25 MHz | 12.5 MHz | 1 and 2 shorted (not used) | Oscillator | Internal |
| When using clock mounted by user | 25 MHz or lower | 12.5 MHz or lower | 1 and 2 shorted (not used) | Oscillator assembled by user | |
| When using external clock | | Clock-through mode f_x | 1 and 2 shorted | Oscillator (not used) | External |
| | | Division mode $f_x/2$ | 2 and 3 shorted | | |

Caution When using an external clock, open the configuration dialog box when starting the integrated debugger (ID78K4-NS) and select “External” in the area (Clock) for selecting the CPU’s clock source (this selects the user’s clock).

Remark The IE-784976-NS-EM1’s factory settings are those listed above under “when using clock that is already mounted on emulation board” (JP1 = 1 and 2 shorted).

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

When the IE-784976-NS-EM1 is shipped, a 25 MHz crystal oscillator is already mounted in the IE-784976-NS-EM1's UMCLK1 socket. When using the factory-set mode settings, there is no need to make any other hardware settings.

When starting the integrated debugger (ID78K4-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 (ID78K4-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

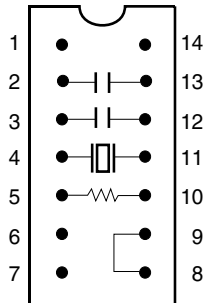
- Parts board
- Ceramic resonator or crystal resonator
- Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

<Steps>

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

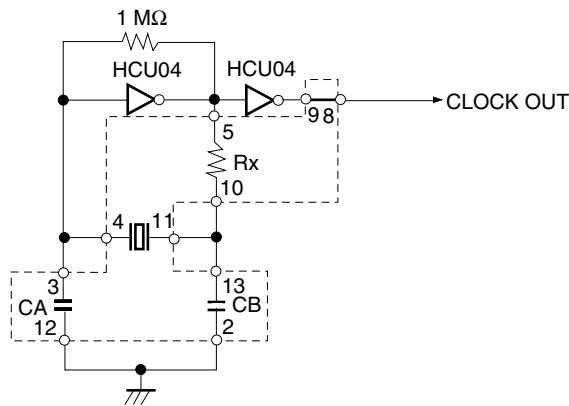
Figure 3-6. Connections on Parts Board (When Using Main System Clock or User-Mounted Clock)

Parts board (UMCLK1)



| Pin No. | Connection |
|---------|--|
| 2-13 | Capacitor CB |
| 3-12 | Capacitor CA |
| 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.

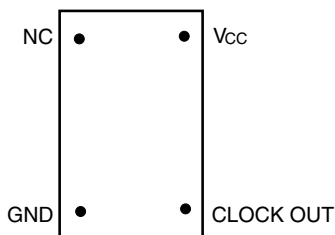
- <2> Prepare the IE-784976-NS-EM1.
- <3> Remove the crystal oscillator that is mounted in the IE-784976-NS-EM1's socket (the socket marked as UMCLK1).
- <4> Connect the parts board (from <1> above) to the socket (UMCLK1) from which the crystal oscillator was removed (see <3> above). Check the pin 1 mark to make sure the board is mounted in the correct direction.
- <5> Make sure that the parts board mounted in the UMCLK1 socket on the emulation board is wired as shown in Figure 3-6 above.
- <6> Connect the IE-784976-NS-EM1 to the IE-78K4-NS.

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 3-7)

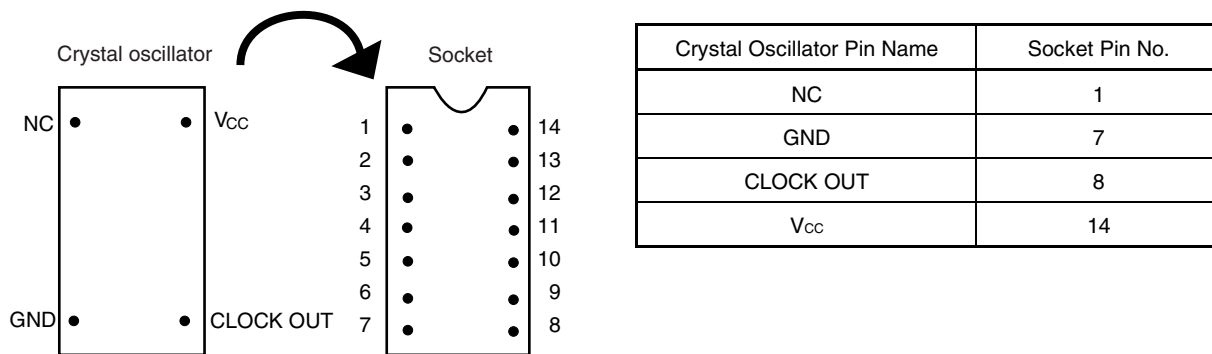
Figure 3-7. Crystal Oscillator (When Using Main System Clock or User-Mounted Clock)



<Steps>

- <1> Prepare the IE-784976-NS-EM1.
- <2> Remove the crystal oscillator that is mounted in the IE-784976-NS-EM1's socket (the socket marked as UMCLK1).
- <3> Connect the crystal oscillator (from <2> above) to the socket (UMCLK1) from which the crystal oscillator was removed. Insert the crystal oscillator pins into the socket aligning the pins as shown in the figure below.

Figure 3-8. Pin Alignment of Crystal Oscillator and Socket



- <4> Connect the IE-784976-NS-EM1 to the IE-78K4-NS.

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

(3) When using external clock

Set JP1 of the IE-784976-NS-EM1 as shown in Table 3-1.

When starting the integrated debugger (ID78K4-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).

3.3 Low-Voltage Emulation Setting

Low-voltage emulation is possible in the IE system.

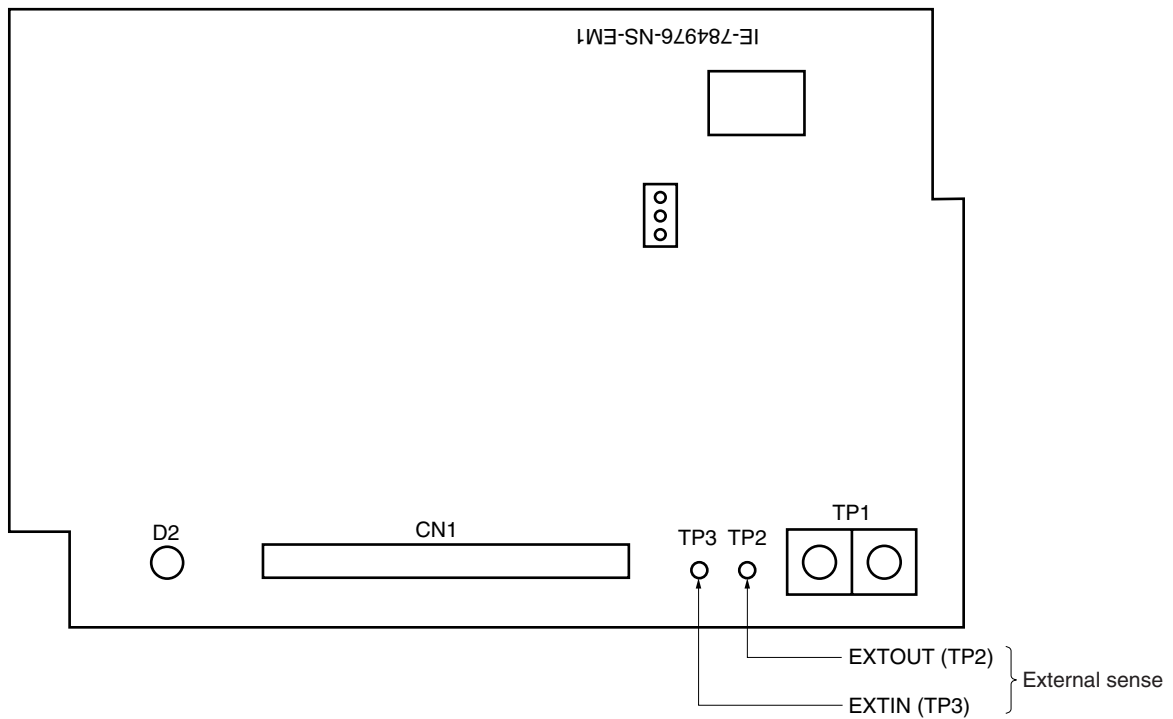
When the target system is operating on low voltage, supply the same voltage as the target system to the TP1 terminal pin of the IE-784976-NS-EM1. Set the target voltage between 4.5 and 5.25 V. The maximum current consumption is 300 mA.

3.4 External Trigger

To set an external trigger, connect the IE-784976-NS-EM1's check pins EXTOUT and EXTIN as shown below.

For pin characteristics, refer to the **IE-78K4-NS User's Manual (U13356E)**, and for usage methods, refer to the **ID78K Series Ver.2.30 or Later Operation User's Manual (Windows Based) (U15185E)**.

Figure 3-9. External Trigger Input Position



3.5 Jumper Setting of IE-784976-NS-EM1

The following shows the jumper setting of JP1 on the IE-784976-NS-EM1.

JP1 is an alternate function in place of SFR register CC (oscillation mode selection register), which cannot be emulated.

Table 3-2. Jumper Setting of IE-784976-NS-EM1

| | Setting | Description | Factory Setting |
|-----|-----------------|--|-----------------|
| JP1 | 1 and 2 shorted | External clock not divided (clock-through) | 1 and 2 shorted |
| | 2 and 3 shorted | External clock divided by 1/2 | |

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-784976-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-784976-NS-EM1's target interface circuit consists of an emulation CPU, TTL, CMOS-IC, and other emulation circuits.

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 directly input/output to/from the emulation CPU
- (2) Signals input from the target system via a gate
- (3) Other signals

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

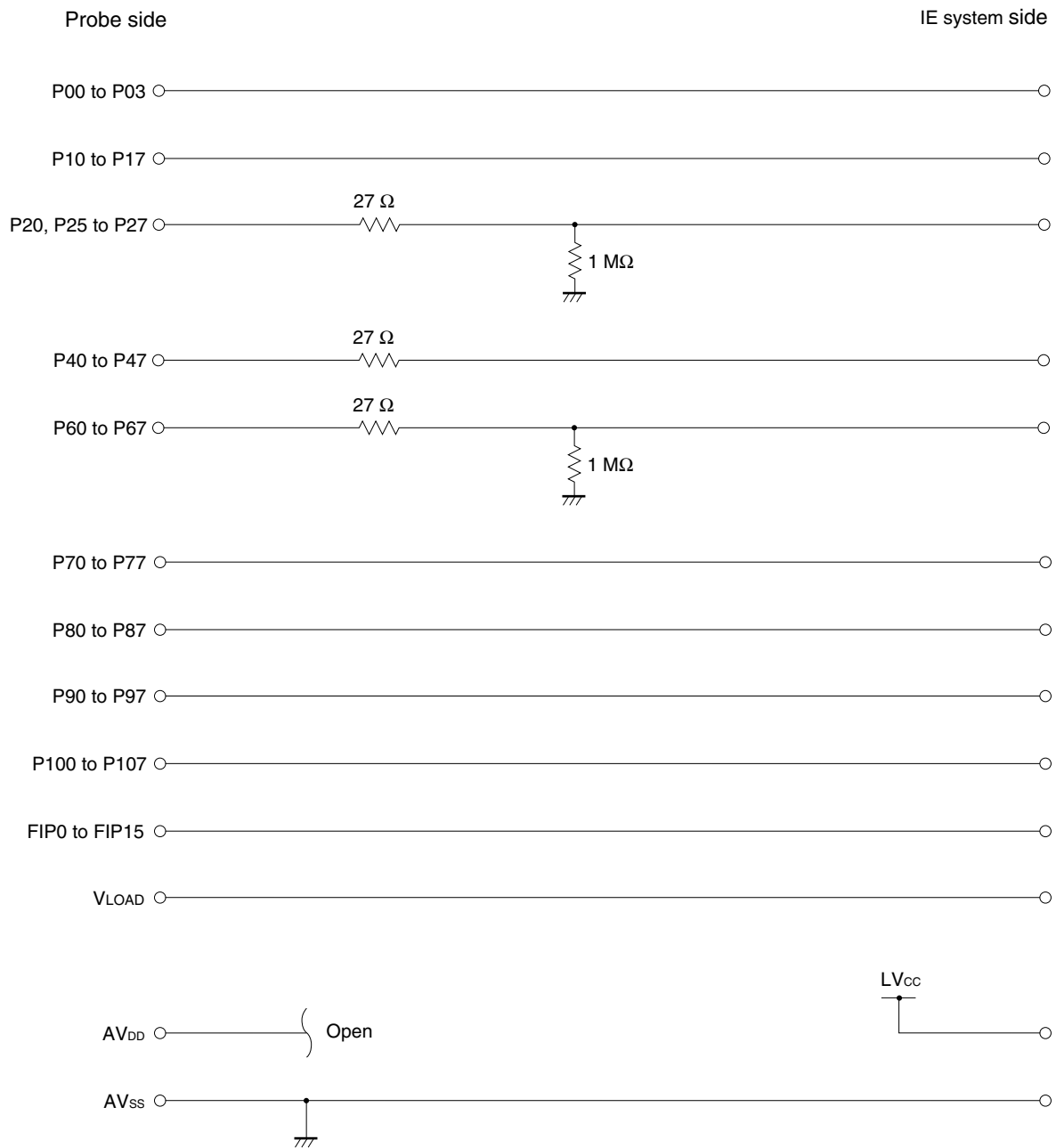
(1) Signals directly input/output to/from the emulation CPU

The following signals perform the same operations as in the μ PD784976 and 784976A Subseries. For the signals related to ports, excluding ports 0, 1, 7, 8, 9, and 10 (having alternate functions as pins for the A/D converter and FIP), however, a 1 M Ω pull-down resistor and 27 Ω resistor are inserted in series.

- Signals related to port 0 (A/D converter input)
- Signals related to port 1 (A/D converter input)
- Signals related to port 2
- Signals related to port 4
- Signals related to port 6
- Signals related to port 7 (FIP output)
- Signals related to port 8 (FIP output)
- Signals related to port 9 (FIP output)
- Signals related to port 10 (FIP output)
- Signals related to A/D converter
 - AV_{SS}
 - AV_{DD}^{Note}
- Signals related to FIP

Note The AV_{DD} pin on the target system is not connected to the IE system. Either the power supply of the IE system or the power supply supplied to TP1 is supplied to the AV_{DD} pin of the emulation CPU.

Figure 4-1. Equivalent Circuit 1 of Emulation Circuit

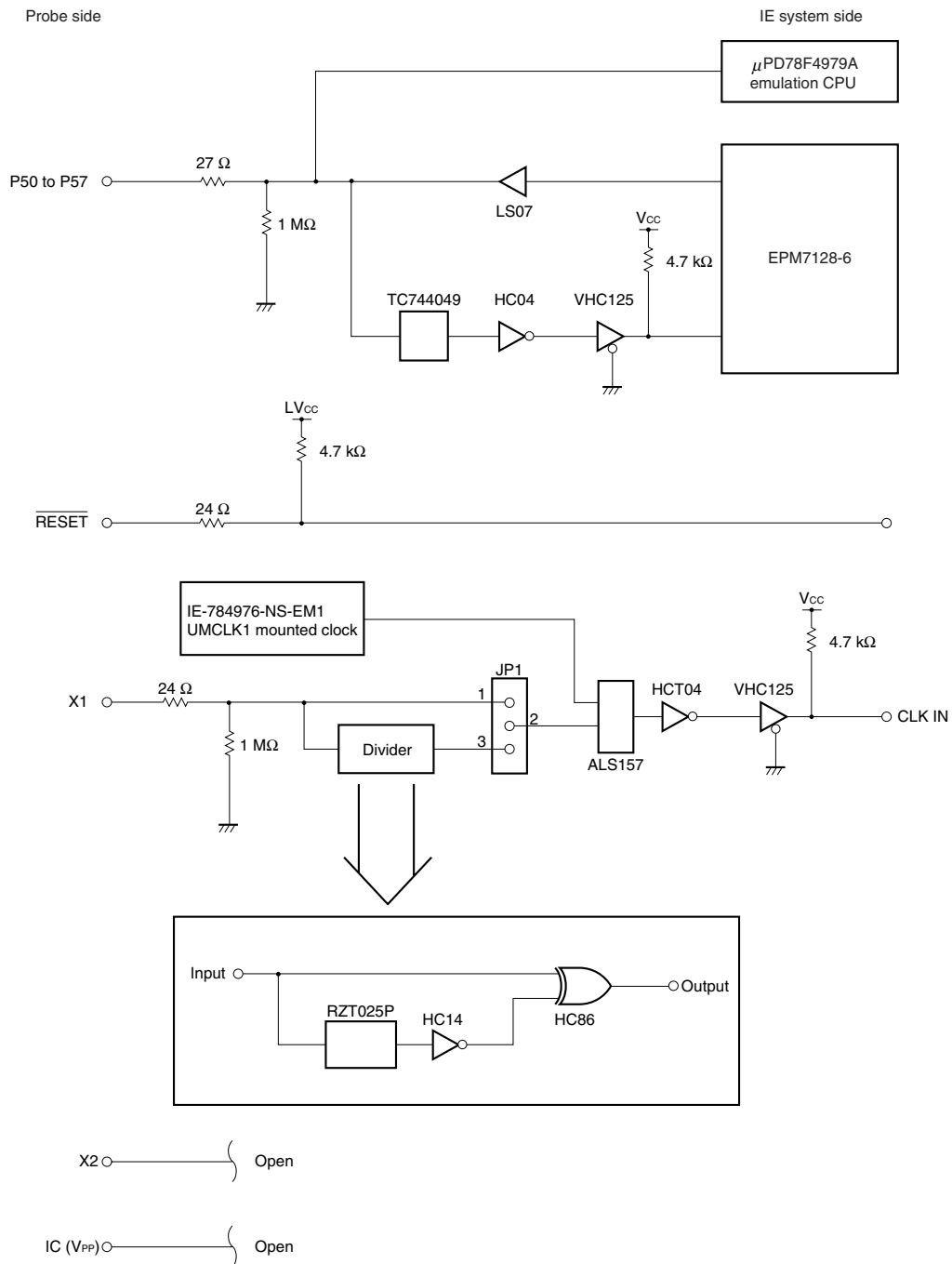


(2) Signals input from the target system via a gate

Since the following signals are input via a gate, their timing shows a delay compared to that of the μ PD784976 and 784976A Subseries. Their AC characteristics and DC characteristics are therefore different from μ PD784976 and 784976A Subseries, making it necessary to observe a stricter timing design than in the case of μ PD784976 and 784976A Subseries.

- Signals related to port 5
- $\overline{\text{RESET}}$ signal
- Signals related to clock input

Figure 4-2. Equivalent Circuit 2 of Emulation Circuit



(3) Other signals

- **V_{DD} pin**

When the emulation CPU is operating at 5 V, its power is supplied from the internal IE system, but when operating at low voltage, its power is supplied from the low-voltage pin (TP1). The V_{DD} pin of the target system is only used to control the LED (USERV_{DD}) in the IE system that monitors the input of the target system's power supply.

- **V_{SS} pin**

The V_{SS} pin is connected to GND inside the IE system.

CHAPTER 5 RESTRICTIONS

The IE-784976-NS-EM1 has the following restrictions.

- SFR register CC (oscillation mode selection register) cannot be emulated.
Preventive measures: Mode selection is possible by setting JP1 on the IE-784976-NS-EM1.
- Mask option functions of ports 5, 7, 8, 9, and 10 are not supported.

APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. NP-100GF, NP-100GF-TQ, NP-H100GF-TQ Pin Assignments (1/2)

| Emulation Probe | CN1 Pin No. | Emulation Probe | CN1 Pin No. |
|-----------------|-------------|-----------------|-------------|
| 1 | 116 | 34 | 107 |
| 2 | 115 | 35 | 104 |
| 3 | 87 | 36 | 103 |
| 4 | 88 | 37 | 100 |
| 5 | 83 | 38 | 99 |
| 6 | 84 | 39 | 94 |
| 7 | 77 | 40 | 93 |
| 8 | 78 | 41 | 30 |
| 9 | 73 | 42 | 29 |
| 10 | 74 | 43 | 24 |
| 11 | 69 | 44 | 23 |
| 12 | 70 | 45 | 20 |
| 13 | 63 | 46 | 19 |
| 14 | 64 | 47 | 16 |
| 15 | 61 | 48 | 15 |
| 16 | 62 | 49 | 10 |
| 17 | 65 | 50 | 9 |
| 18 | 66 | 51 | 6 |
| 19 | 71 | 52 | 5 |
| 20 | 72 | 53 | 33 |
| 21 | 75 | 54 | 34 |
| 22 | 76 | 55 | 37 |
| 23 | 79 | 56 | 38 |
| 24 | 80 | 57 | 43 |
| 25 | 85 | 58 | 44 |
| 26 | 86 | 59 | 47 |
| 27 | 89 | 60 | 48 |
| 28 | 90 | 61 | 51 |
| 29 | 118 | 62 | 52 |
| 30 | 117 | 63 | 57 |
| 31 | 114 | 64 | 58 |
| 32 | 113 | 65 | 59 |
| 33 | 108 | 66 | 60 |

- Remarks**
1. The NP-100GF, NP-100GF-TQ, and NP-H100GF-TQ 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.

Table A-1. NP-100GF, NP-100GF-TQ, NP-H100GF-TQ Pin Assignments (2/2)

| Emulation Probe | CN1 Pin No. | Emulation Probe | CN1 Pin No. |
|-----------------|-------------|-----------------|-------------|
| 67 | 55 | 84 | 13 |
| 68 | 56 | 85 | 18 |
| 69 | 49 | 86 | 17 |
| 70 | 50 | 87 | 22 |
| 71 | 45 | 88 | 21 |
| 72 | 46 | 89 | 28 |
| 73 | 41 | 90 | 27 |
| 74 | 42 | 91 | 92 |
| 75 | 35 | 92 | 91 |
| 76 | 36 | 93 | 98 |
| 77 | 31 | 94 | 97 |
| 78 | 32 | 95 | 102 |
| 79 | 4 | 96 | 101 |
| 80 | 3 | 97 | 106 |
| 81 | 8 | 98 | 105 |
| 82 | 7 | 99 | 112 |
| 83 | 14 | 100 | 111 |

- Remarks**
1. The NP-100GF, NP-100GF-TQ, and NP-H100GF-TQ products of Naito Densai Machida Mfg. Co., Ltd.
 2. The numbers in the “Emulation probe” column indicate the corresponding pin number on the emulation probe tip.

APPENDIX B NOTES ON TARGET SYSTEM DESIGN

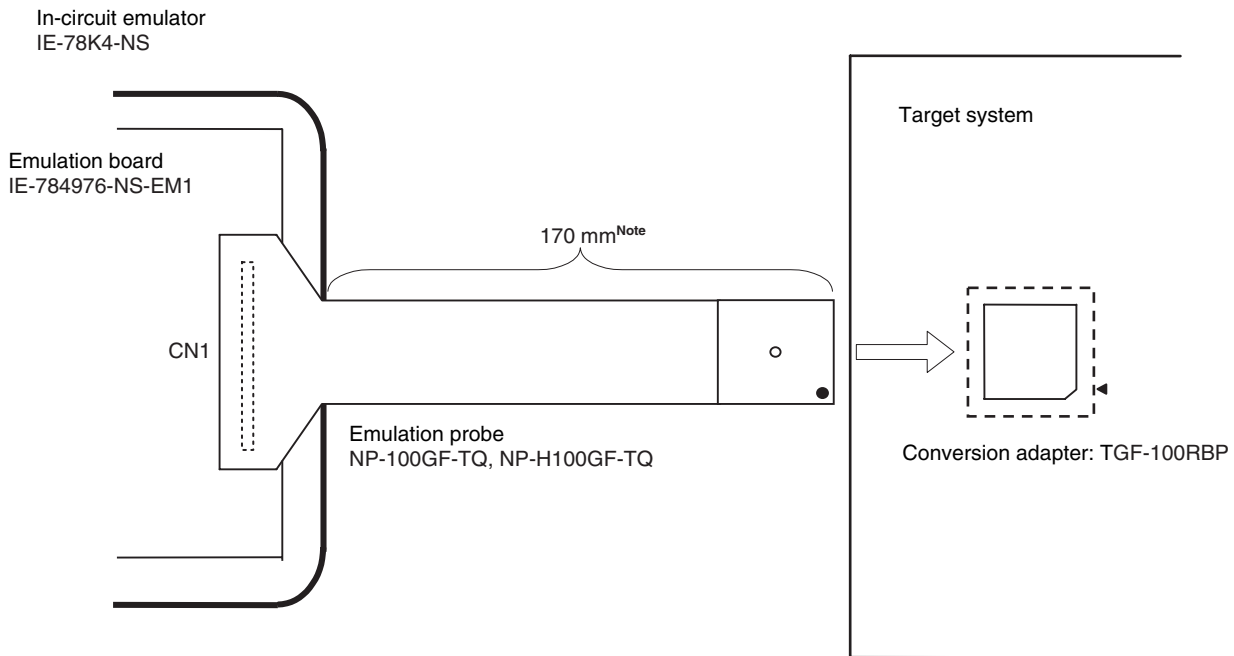
The following shows the conditions when connecting the emulation probe to the conversion adapter. Follow the configuration below and consider the shape of parts to be mounted on the target system when designing a system.

Among the products described in this appendix, NP-100GF-TQ and NP-H100GF-TQ are products of Naito Densai Machida Mfg. Co., Ltd, and TGF-100RBP is a product 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-100GF-TQ | TGF-100RBP | 170 mm |
| NP-H100GF-TQ | | 370 mm |

Figure B-1. Distance Between IE System and Conversion Adapter



Note Distance when NP-100GF-TQ is used. When NP-H100GF-TQ is used, the distance is 370 mm.

Figure B-2. Connection Conditions of Target System (When NP-100GF-TQ Is Used)

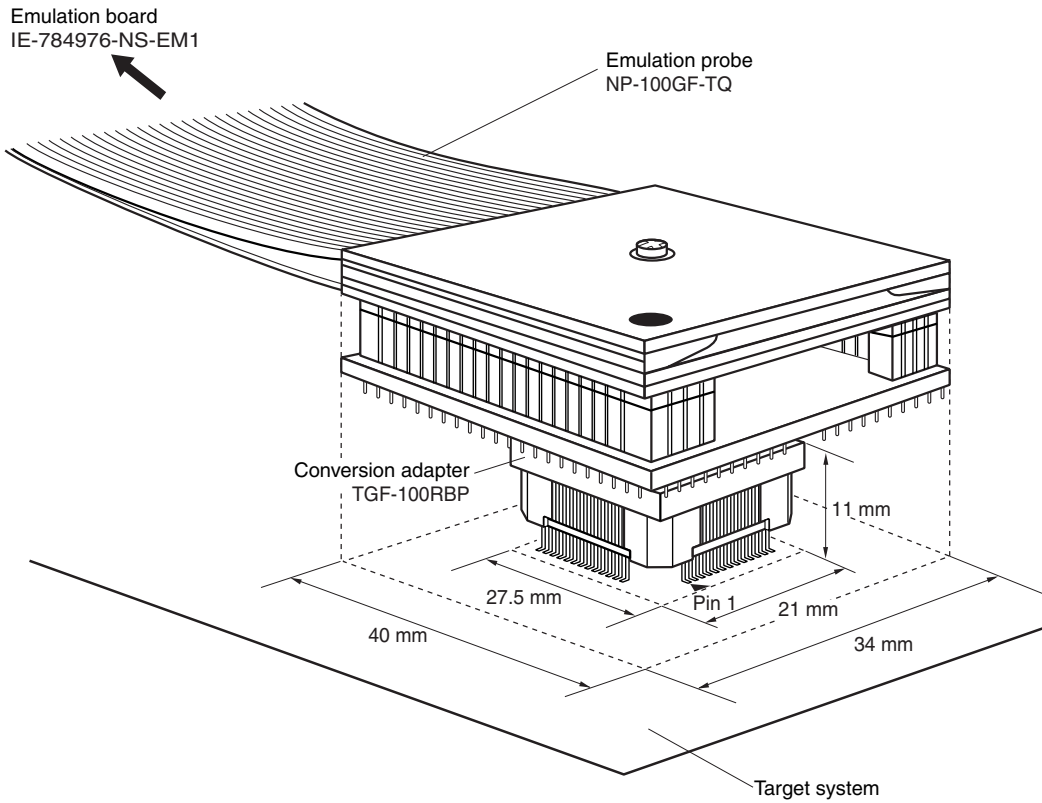


Figure B-3. Connection Conditions of Target System (When NP-H100GF-TQ Is Used)

