CUSTOMER NOTIFICATION

SUD-TT-0125-1-E

June 10, 2002

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IE-789862-NS-EM1

Preliminary User's Manual

1st edition, June 2002

INTRODUCTION

Product Overview

The IE-789862-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.

- μPD789862 Subseries: μPD789862, 78E9862

Target Readers

This manual is intended for engineers who will use the IE-789862-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-789862-NS-EM1, refer to not only this manual (supplied with the IE-789862-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	IE-78K0S-NS-A User's Manual	IE-789862-NS-EM1 User's Manual
• Basic specifications • System configuration • External interface functions	• Basic specifications • System configuration • External interface functions	• General • Part names • Installation • Differences between target devices and target interface circuits

Purpose

This manual's purpose is to explain various debugging functions that can be performed when using the IE-789862-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 (a 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-789862-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 Document The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Document Name	Document Number	
	Japanese	English
IE-78K0S-NS	U13549J	U13549E
IE-78K0S-NS-A	U15207J	U15207E
IE-789862-NS-EM1	SUD-TT-0125-1	This manual
ID78K Series Integrated Debugger Ver.2.30 or Later Operation (Windows™ Based)	U15185J	U15185E
μPD789862 Subseries	U15852J	U15852E

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

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1 GENERAL

The IE-789862-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 78K0S Series of 8-bit single-chip microcontrollers.

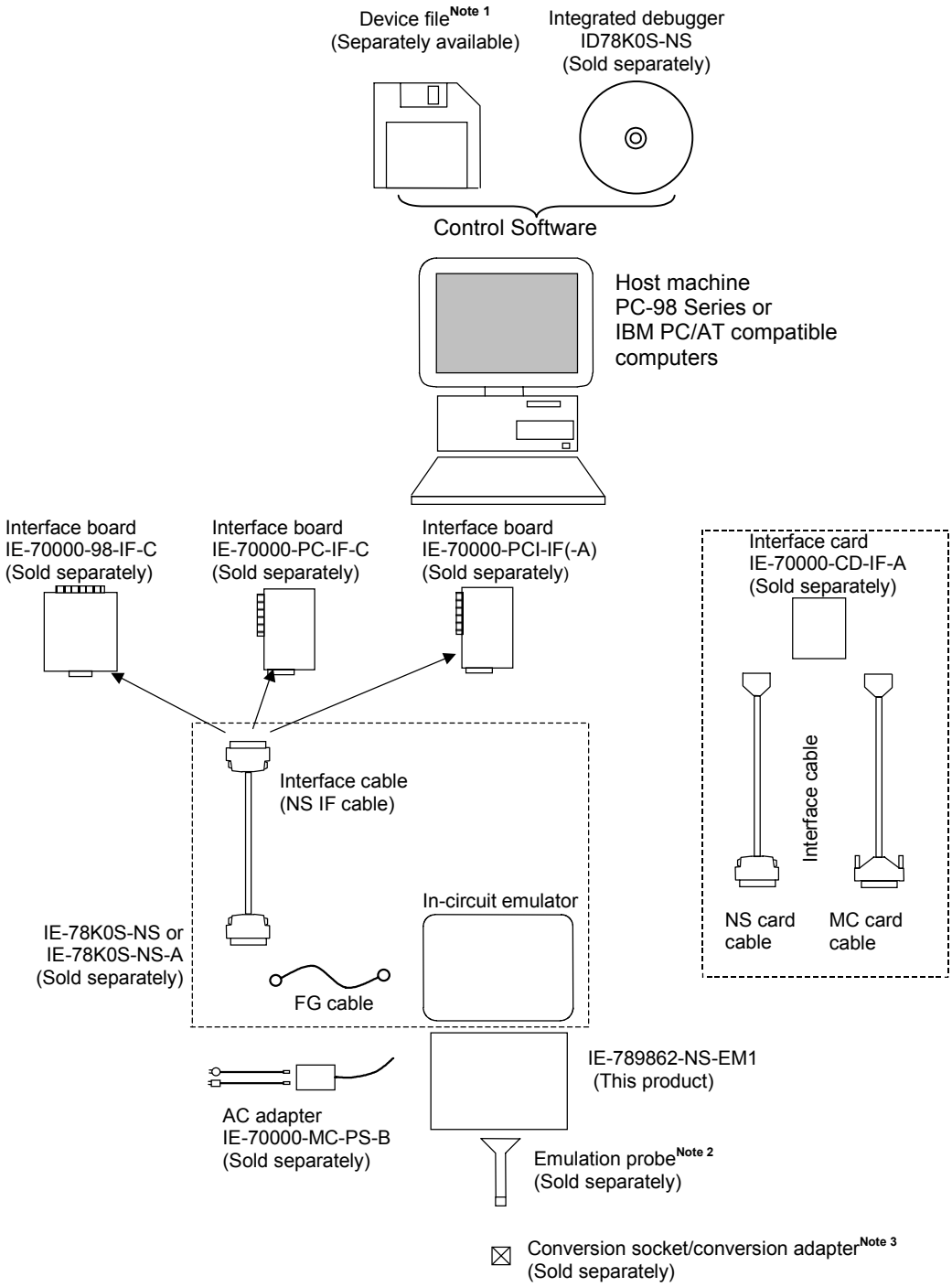
This chapter describes the IE-789862-NS-EM1 system configuration and basic specifications.

- Target device
  - μPD789862 Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-789862-NS-EM1 system configuration.

Figure 1-1. System Configuration



Notes 1. The device file is as follows.

μSXXXXDF789862: μPD789862 Subseries

2. The emulation probe is as follows.

NP-30MC: 30-pin plastic SSOP (probe length: 200 mm; MC type)

NP-30MC is a product of Naito Densei Machida Mfg. Co., Ltd.

Contact: Naito Densei Machida Mfg. Co., Ltd. (TEL: 045-475-4191)

3. The conversion socket and conversion adapter are as follows.

NSPACK30BK: For 30-pin plastic SSOP (MC type)

YSPACK30BK: For 30-pin plastic SSOP (MC type)

YQGUIDE: Screw for NSPACK30BK and YSPACK30BK

NSPACK30BK, YSPACK30BK, and YQGUIDE are products of Tokyo Eletech Corporation.

For further information, contact: Daimaru Kogyo, Ltd.

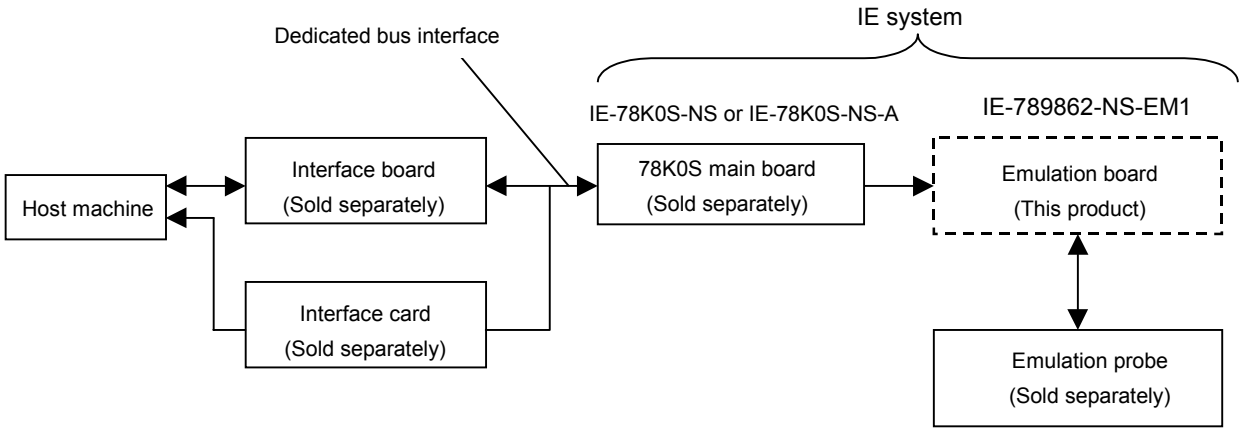
Tokyo Electronics Department (TEL +81-3-3820-7112)

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

1.2 Hardware Configuration

Figure 1-2 shows the IE-789862-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The IE-789862-NS-EM1's basic specifications are listed in Table 1-1.

Table 1-1. Basic Specifications

Parameter	Description
Target device	μPD789862 Subseries
System clock	1.000 to 5.000 MHz
System clock supply	Internal: Mounted on the emulation board (5 MHz) or mounted by user on the parts board External: Pulse input from the target system via an emulation probe
Target interface voltage	V_{DD} = 1.8 V to 5.5 V (Same as the target device) When target system not connected: Operates @ 5 V internal voltage

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-789862-NS-EM1 main unit.

The packing box contains the emulation board (IE-789862-NS-EM1), package details, user's manual, and guarantee card.

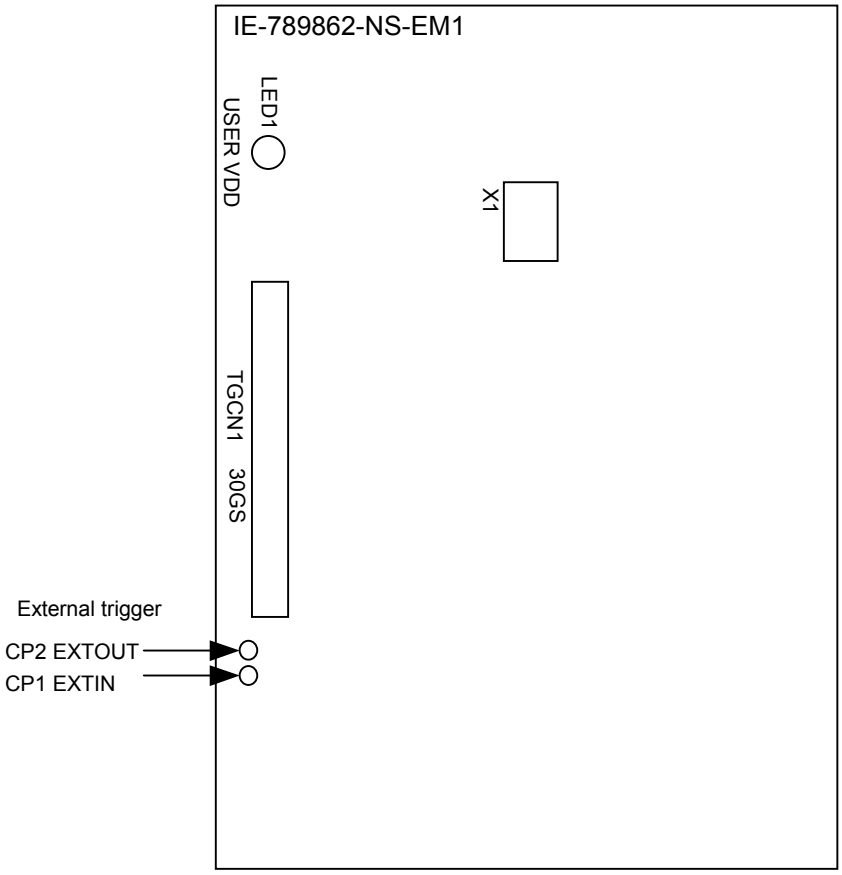
If there are any missing or damaged items, please contact an NEC sales representative.

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

2.1 Names of Parts on Board

Figure 2-1 shows the names of the parts on the probe board.

Figure 2-1. Names of Parts on IE-789862-NS-EM1 Board



2.2 Initial Settings of Switches and Jumpers

Manually-switched jumpers and switches are not provided in the IE-789862-NS-EM1.

CHAPTER 3 INSTALLATION

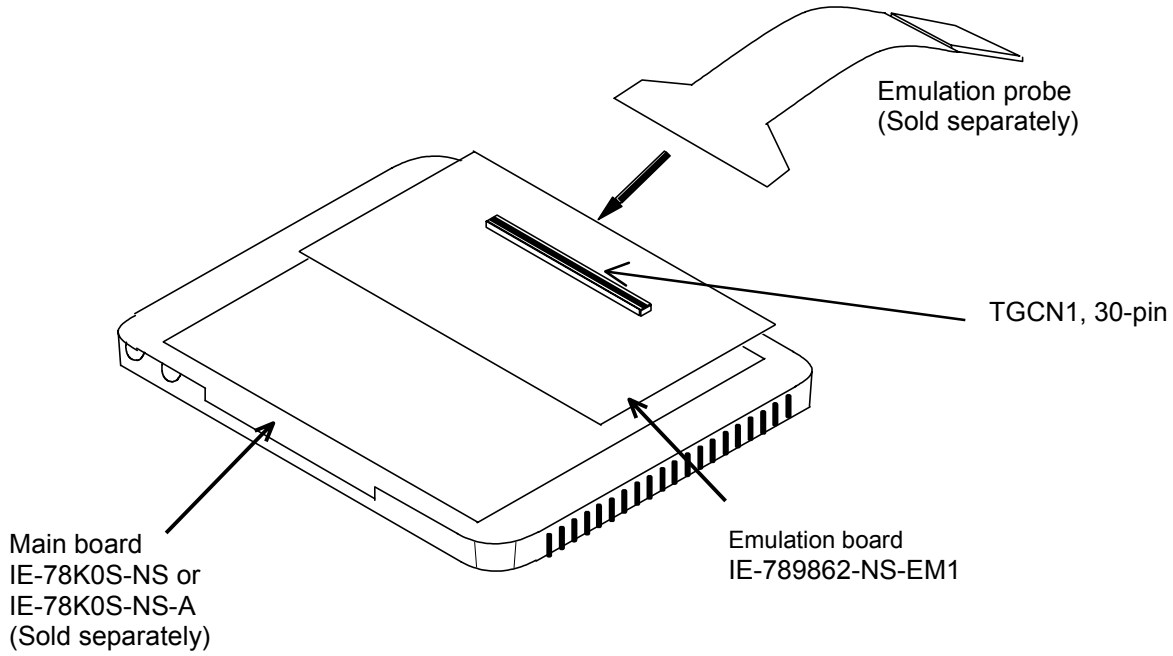
This chapter describes methods for connecting the IE-789862-NS-EM1 to the IE-78K0S-NS or IE-78K0S-NS-A and emulation probe. Mode setting methods are also described.

Caution Connecting or removing parts 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

A connection diagram of the emulation probe and the main board is shown in Figure 3-1.

Figure 3-1. Mounting of Emulation Probe and Main Board



(1) Connection with IE-78K0S-NS-A or IE-78K0S-NS-A main unit

See the IE-78K0S-NS User's Manual (U13549E) or IE-78K0S-NS-A User's Manual (U15207E) for a description of how to connect the IE-789862-NS-EM1 to the IE-78K0S-NS or IE-78K0S-NS-A.

(2) Connection with emulation probe

See the IE-78K0S-NS-A User's Manual (U15207E) or IE-78K0S-NS-A User's Manual (U15207E) for a description of how to connect an emulation probe to the IE-789862-NS-EM1.

On this board, connect the emulation probe to TGCN1.

Caution Incorrect connection may damage the IE system. For more details on connection, see the user's manual for each emulation probe.

3.2 Settings of Switches and Jumpers on Main Board

(1) Setting of IE-78K0S-NS

Before using the IE-789862-NS-EM1, set each jumper and switch of the IE-78K0S-NS as described below. For the positions of the switches and jumpers, refer to the IE-78K0S-NS User's Manual (U13549E).

Table 3-1. Setting of Switches and Jumpers on IE-78K0S-NS

	SW1	SW3	SW4	JP1	JP4
Setting	OFF	All "ON" (fixed)	All "ON" (fixed)	2-3 shorted	1-2 shorted

(2) Setting of IE-78K0S-NS-A

Before using the IE-789862-NS-EM1, set each jumper and switch of the IE-78K0S-NS-A as described below. For the positions of the switches and jumpers, refer to the IE-78K0S-NS-A User's Manual (U15207E).

Table 3-2. Setting of Switches and Jumpers on IE-78K0S-NS-A

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

3.3 Settings of Target Interface Voltage

The IE system can be emulated at the same supply voltage level as that of the target system.

When the target system is not used, the emulator is designed to automatically operate on the internal voltage (5 V).

When debugging is performed at the same voltage level as the target system voltage, voltage that is the same level as the target system voltage is supplied to the IE-789862-NS-EM1 from the V_{DD} pin via the emulation probe, and the voltage is used as a reference voltage for generating a power supply to the target interface.

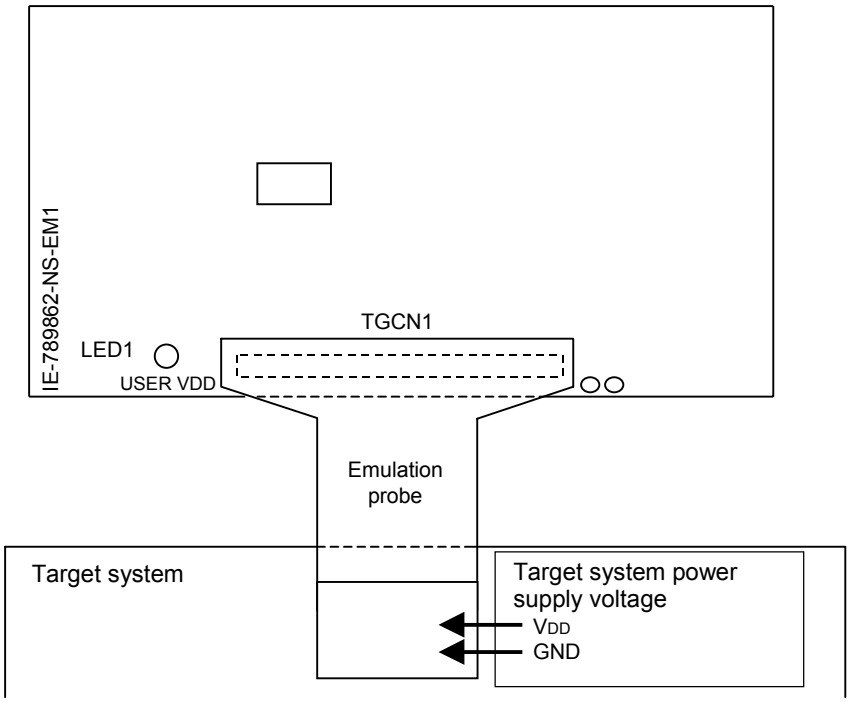
Set the target voltage to 1.8 to 5.5 V. See ID78K0 Series Integrated Debugger User's Manual (U15185E) for details of how to select the supply voltage.

The maximum current that can be consumed by the V_{DD} pin is 1.8 to 5.5 V: 20 mA

Table 3-3. Target Interface Voltage Settings

Target Interface Voltage		Integrated Debugger (ID78K0S-NS)
		Operation Voltage Selection
When the target system is used	1.8 to 5.5 V	Target
When the target system is not used	5 V	Internal

Figure 3-2. Connection of Target System Voltage



Caution Connect the power supply voltage and the target system supply voltage when the power of the IE-78K0S-NS or IE-78K0S-NS-A is off.

3.4 Clock Settings

3.4.1 Outline of clock settings

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

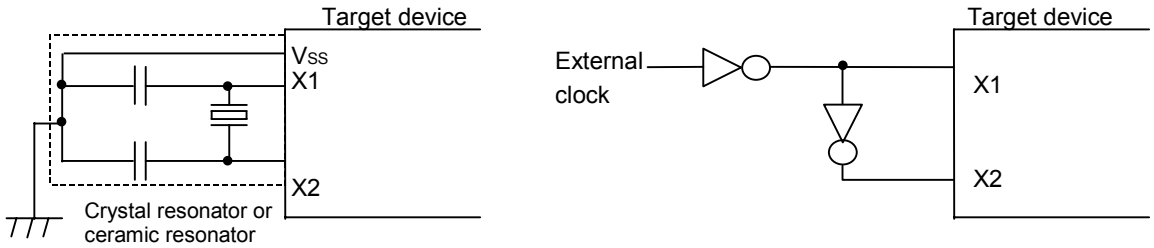
(1) Clock already mounted on emulation board
(2) Clock mounted by user
(3) Pulse input from the target system

If the target system includes a clock oscillator, select either “(1) Clock already mounted on emulation board” or “(2) Clock mounted by user”. For a clock oscillator, 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 3-3. During emulation, the clock oscillator that is mounted on the target system is not used. Instead, the clock that is mounted on the emulation board, which is installed for the IE-78K0S-NS or IE-78K0S-NS-A, is used.
If the target system includes an external clock, select either “(1) Clock already mounted on emulation board”, “(2) Clock mounted by user”, or “(3) Pulse input from the target system”. 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 3-3.

Caution The IE system will hang up if the system clock is not supplied correctly. Input a rectangular pulse from the target system. It is not necessary to input clock to X2 pins. The program does not operate if a crystal or ceramic resonator is connected directly to the X1 pin.

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

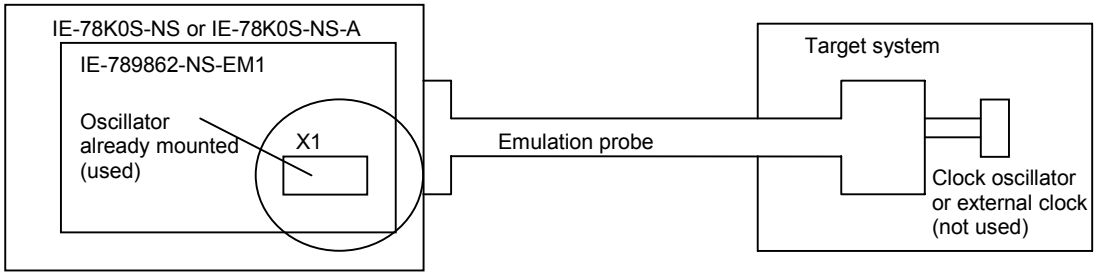
(a) Clock oscillator **(b) External clock**



(1) Clock already mounted on emulation board

The 5.0 MHz crystal oscillator (X1) that is already mounted in the IE-789862-NS-EM1 can be used.

Figure 3-4. When Using Clock Already Mounted on Emulation Board

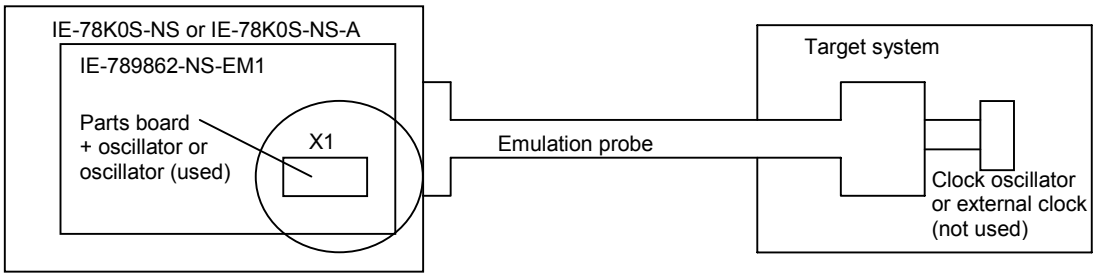


Remark The clock that is supplied by the IE-789862-NS-EM1's oscillator (encircled in the figure) is used.

(2) Clock mounted by user

The user is able to mount any clock supported by the set specifications on the IE-789862-NS-EM1. This method is useful when using a different frequency from that of the pre-mounted clock. Remove the crystal oscillator (X1) that is already mounted on the emulation board, and mount either the parts board on which the resonator to be used is mounted or an oscillator.

Figure 3-5. When Using Clock Mounted by User

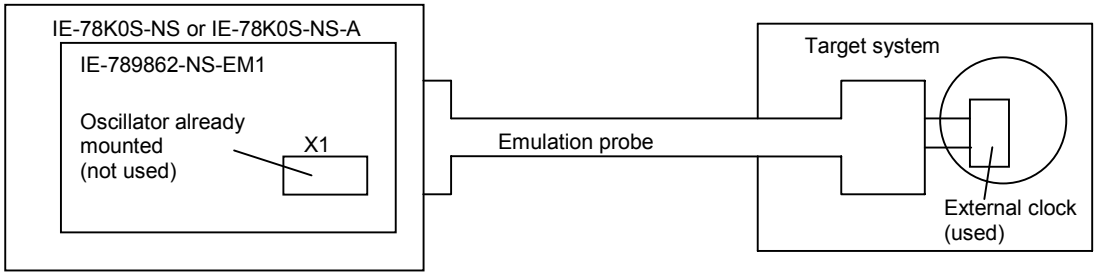


Remark The clock that is supplied by the IE-789862-NS-EM1's oscillator (encircled in the figure) is used.

(3) Inputting a pulse from the target system

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

Figure 3-6. When Using Pulse Input from Target System



Remark The clock that is supplied by the external clock (encircled in the figure) is used.

3.4.2 System clock settings

The settings of the IE-789862-NS-EM1's system clock are shown in Table 3-4.

Table 3-4. System Clock Settings

Frequency of System Clock		IE-789862-NS-EM1 Socket (X1)	ID78K0S-NS CPU Clock Source Selection
(1) Clock already mounted on emulation board	5.0 MHz	Oscillator	Internal
(2) Clock mounted by user	Other than 5.0 MHz	Oscillator or oscillator circuit assembled	
(3) Pulse input from the target system		Oscillator (not used)	External

Caution When using an external clock, open the configuration dialog box when starting the integrated debugger (ID78K0S-NS) and select "External" in the area (Clock) for selecting the CPU's clock source (this selects the user's clock). Emulation using the RC oscillator cannot be performed.

Remark The IE-789862-NS-EM1's factory settings are those listed above under "when using clock already mounted on emulation board".

(1) When using clock already mounted on emulation board

When the IE-789862-NS-EM1 is shipped, a 5.0 MHz crystal oscillator is already mounted in the IE-789862-NS-EM1's X1 socket. When using the factory-set mode settings, there is no need to make any 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) Clock mounted by user

The settings of either (a) or (b) described in the following pages 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 or crystal resonator

♦ Necessary items

- Crystal or ceramic resonator
- Resistor Rx
- Parts board
- Capacitor CA
- Capacitor CB
- Solder kit

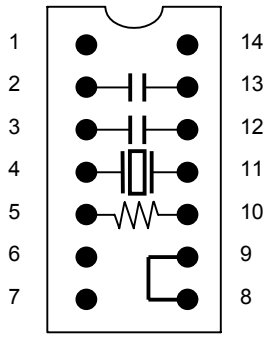
<Procedure>

<1> Prepare a parts board.

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

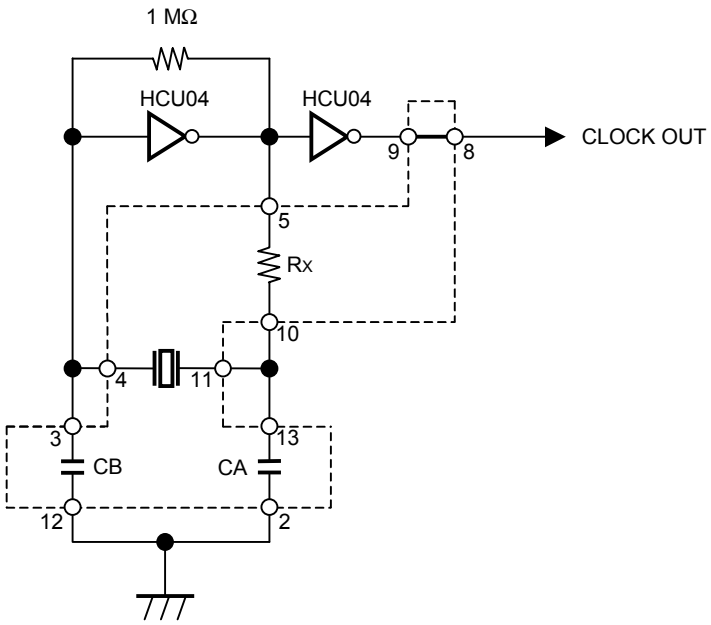
Figure 3-7. Connections on Parts Board

Parts board (X1)



Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Crystal or ceramic resonator
5-10	Resistor Rx
8-9	Shorted

Circuit Diagram



Remark The section enclosed by dotted lines indicates the section to be mounted on the parts board.

<3> Prepare the IE-789862-NS-EM1.

<4> Remove the crystal oscillator that is mounted in the IE-789862-NS-EM1's socket (X1).

<5> Make sure that the parts board is wired as shown in Figure 3-7 above.

<6> Connect the parts board (from <2> above) to the socket (X1) from which the crystal oscillator was removed in <4>. Check the pin 1 mark to make sure the board is mounted in the correct direction.

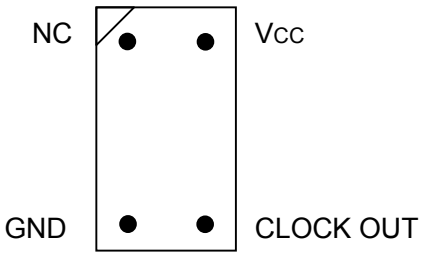
<7> Install the IE-789862-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(b) When using a crystal oscillator

♦ Necessary items

• Crystal oscillator (with pin configuration as shown in Figure 3-8)

Figure 3-8. Crystal Oscillator



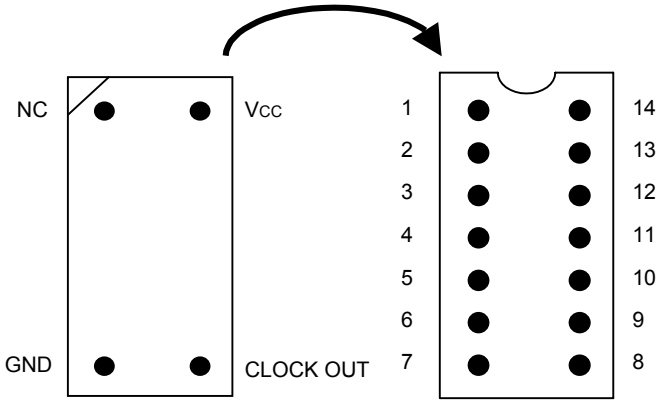
<Procedure>

<1> Prepare the IE-789862-NS-EM1.

<2> Remove the crystal oscillator from the socket (X1) on the IE-789862-NS-EM1.

<3> Mount the new crystal oscillator in the socket (X1) from which the crystal oscillator was removed in <2>. At this time, insert the crystal oscillator pin into the socket pin as indicated below.

Figure 3-9. Correspondence Between Crystal Oscillator and Socket



Crystal Oscillator Pin	Socket Pin No.
NC	1
GND	4
CLOCK OUT	8
VCC	14

<4> Install the IE-789862-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(3) When using a pulse input from the target system

There is no need to make any hardware settings.

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 clock).

3.5 Mask Option Settings

The POC switching circuit, which enables the power-on-clear circuit functions to be controlled by software, is provided in the IE-789862-NS-EM1. Set this circuit ON/OFF using an SFR.

When emulation of the low-voltage detector and power-on-clear circuit detection voltage is performed, it is affected by voltage fluctuation and noise. Therefore, the detected voltage must be checked in the EEPROM product.

3.6 External Trigger

To set an external trigger, connect it to the IE-789862-NS-EM1's check pins EXTOUT and EXTIN.

See the IE-78K0S-NS User's Manual (U13549E) or IE-78K0S-NS-A User's Manual (U15207E) for descriptions of pin characteristics.

See the ID78K Series Integrated Debugger Ver.2.30 or Later Operation User's Manual (Windows™ Based) (U15185E) for descriptions of usage.

(1) EXTOUT

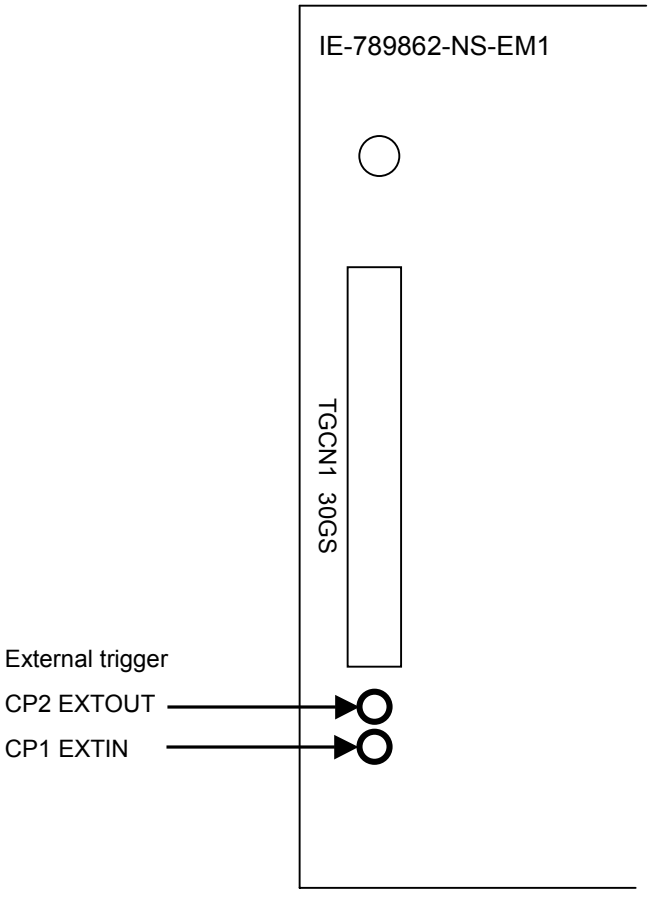
A low-level pulse is output from the IE-789862-NS-EM1's EXTOUT pin for 1.3 μs upon the occurrence of a break event.

Caution Because this is an open-drain output, a pull-up resistor should be connected on the target system.

(1) EXTIN

An event signal can be input from the IE-789862-NS-EM1's EXTIN pin. Input a high-level pulse signal for 2 CPU operating clocks or longer.

Figure 3-10. External Trigger Input Position



CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICES AND TARGET INTERFACE CIRCUITS

This chapter describes differences in electrical characteristics between the target device and the target interface circuit.

The target interface circuit of the IE system consists of an emulation CPU, TTL, CMOS-IC, and other emulation circuits. Differences in electrical characteristics between the target device and the target interface circuit occur due to the existence of a protection circuit.

(1) Signals directly input/output to/from the EVA chip and peripheral EVA chip
(2) Signals input from the target system via a gate
(3) Other signals

The circuits of the IE-789862-NS-EM1 for the signals in (1) to (3) above are shown below.

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

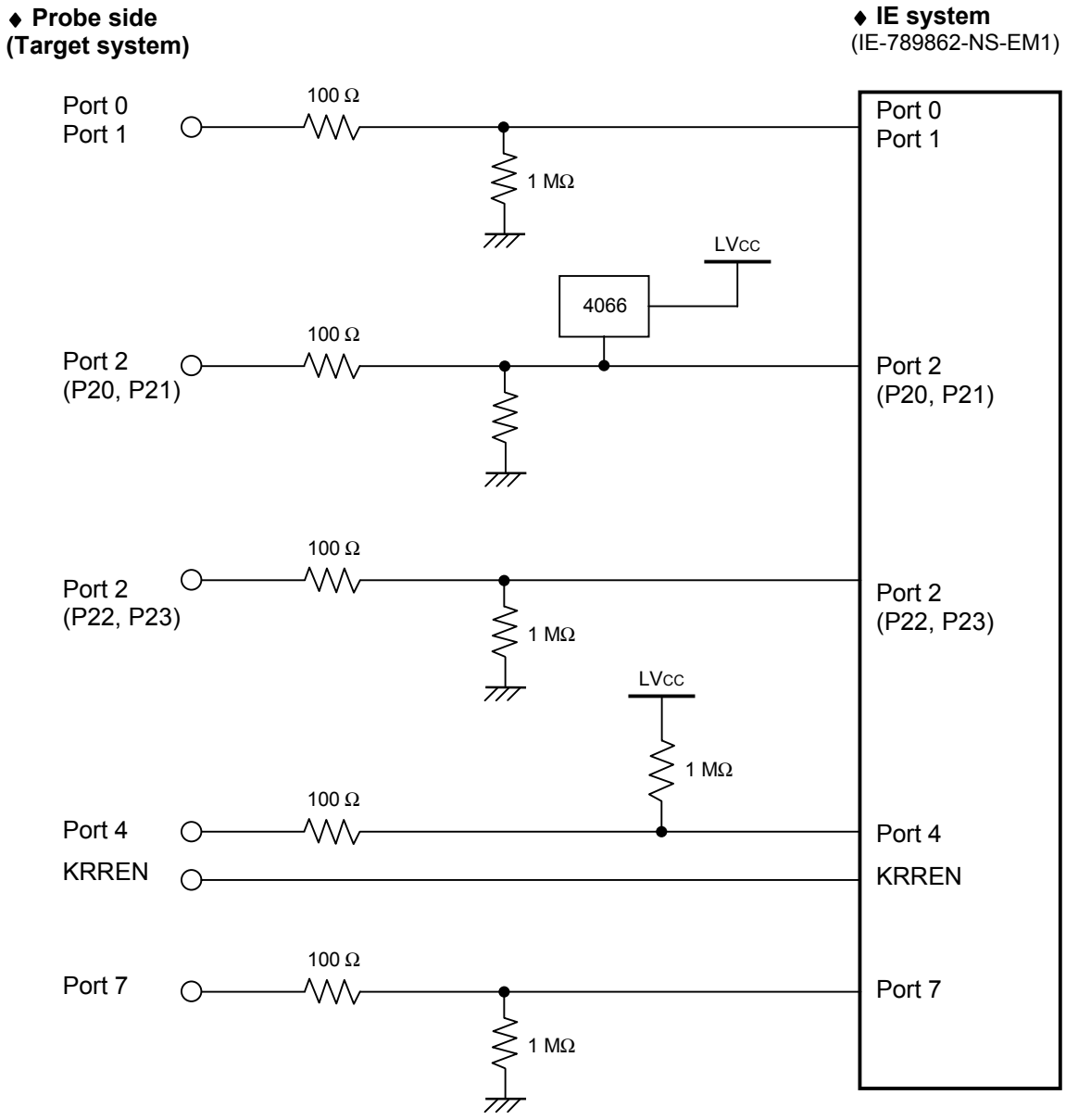
The following signals operate in the same manner as those in the μPD789862 Subseries. A pull-down resistor of 1 MΩ and a 100 Ω resistor are connected in parallel. A 1 MΩ pull-down resistor is connected to signals related to port 0 and 1 in the IE-78K0S-NS and IE-78K0S-NS-A.

Refer to Figure 4-1 Equivalent Circuit of Emulation Circuit (1).

- Signals related to port 0
- Signals related to port 1
- Signals related to port 2
- Signals related to port 4

  A 1 MΩ pull-up resistor is connected.
- KRREN pin
- Signals related to port 7

Figure 4-1. Equivalent Circuit of Emulation Circuit (1)



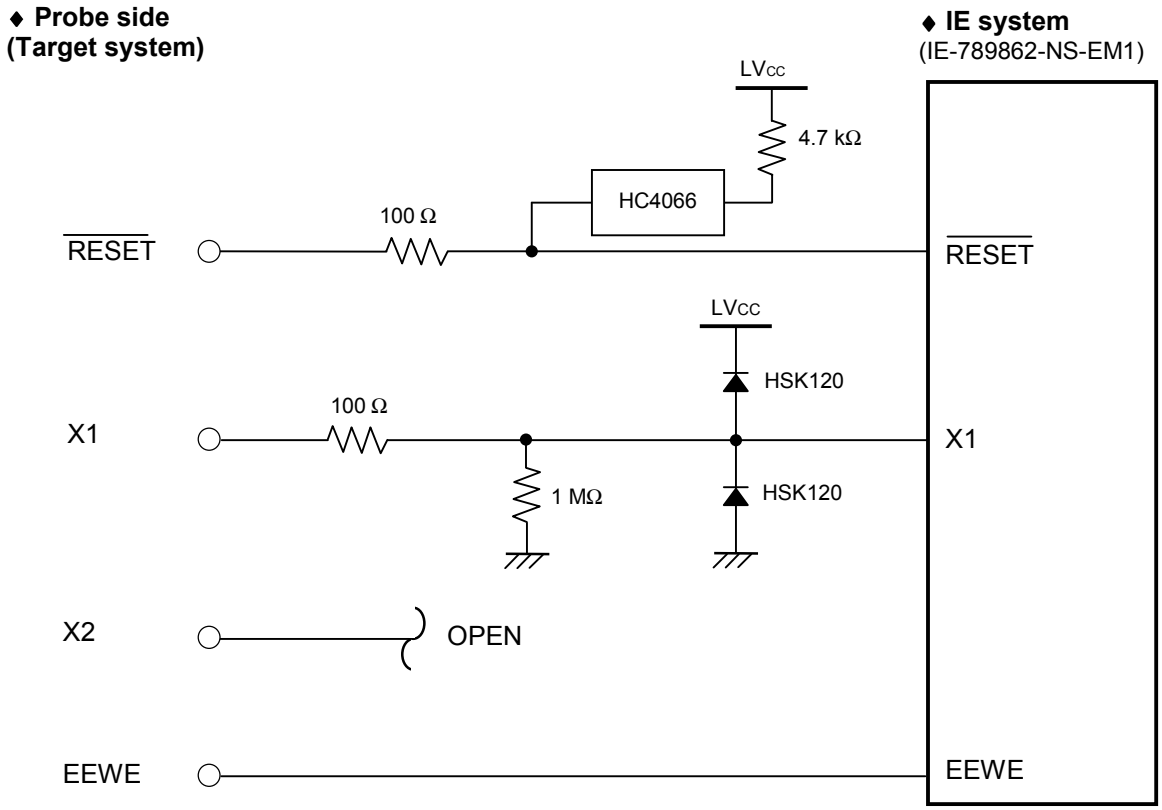
(2) Signals input from the target system via a gate

Since the following signals are input via a gate of the emulation device, their timing shows a delay compared to that of the μPD789862 Subseries. Refer to Figure 4-2 Equivalent Circuit of Emulation Circuit (2).

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

  The IE-789862-NS-EM1 does not use the X2 pin.
- EEWR pin

Figure 4-2. Equivalent Circuit of Emulation Circuit (2)



(3) Other signals

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

- V_{DD} pin

When the target system is not connected, the power supply of the emulation device operates with the internal supply voltage (5 V). When the target system is connected, it operates with the power (LVCC) supplied from the V_{DD} pin via the emulation probe.

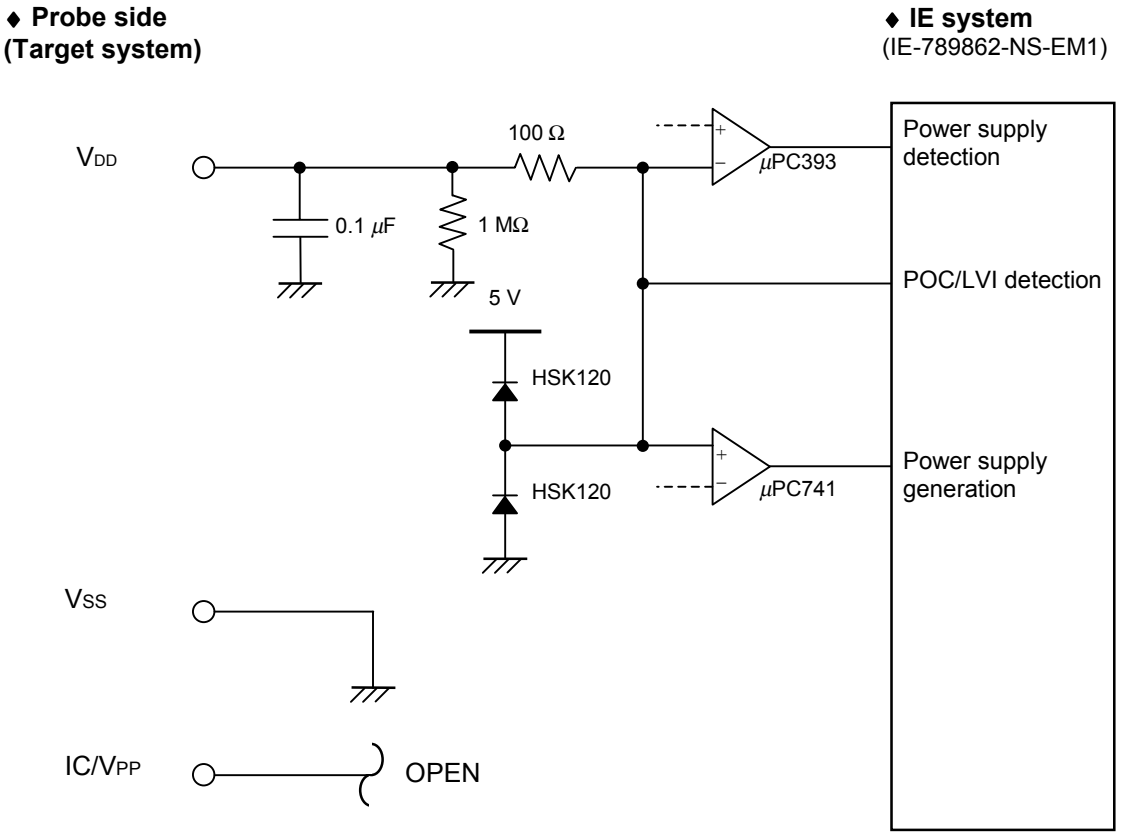
- V_{SS} pin

The V_{SS} pin is connected to GND inside the IE-789862-NS-EM1.

- IC/V_{PP} pin

The IE-789862-NS-EM1 does not use the IC/V_{PP} pin.

Figure 4-3. Equivalent Circuit of Emulation Circuit (3)



CHAPTER 5 CAUTIONS

This chapter describes differences between the target device and the IE system specifications.

The emulation circuit of the IE system consists of an emulation CPU, TTL, CMOS-IC, and other circuits. Therefore, there are differences between the target device and the IE system specifications.

(1) When emulation of the low-voltage detector and power-on-clear circuit detection voltage is performed, it is affected by voltage fluctuation and noise. Therefore, the detected voltage must be checked in the EEPROM product.

(2) When a program that illegally accesses EEPROM is executed in the IE-789862-NS-EM1, an error message is displayed and a break occurs. The conditions for illegally accessing the EEPROM and the displayed error message are described below.

Table 5-1. Illegal Access Condition

Error message: **Unspecified Illegal**	
EEPROM illegal access conditions	
<1>	Write instruction to EEPROM is executed when EWC = 0.
<2>	Write instruction to EEPROM is executed while the clock selected by EEPROM is stopped.
<3>	Write instruction to EEPROM is executed while EEPROM is being written to.
<4>	Read instruction from EEPROM is executed while EEPROM is being written to.
<5>	Instruction is fetched from EEPROM while EEPROM is being written to.
<6>	EWC is set to 0 while EEPROM is being written to.
<7>	Main clock is stopped while EEPROM is being written to.
<8>	Count clock selection of the write time setting timer is changed while EEPROM is being written to.
<9>	RESET is applied while EEPROM is being written to.

(3) The signals related to port 4 are connected to a 1 MΩ pull-up resistor in the IE-789862-NS-EM1. 3Fh is read as the initial value of port 4 under the following conditions.

a) When the target system is not connected

b) When all the P4 pins are left open in the target system

APPENDIX A EMULATION PROBE PIN CORRESPONDENCE TABLE

Table A-1. Pin Correspondence of Emulation Probe

Emulation Probe Pin	CN1 Pin No.	Emulation Probe Pin	CN1 Pin No.
1	58	16	99
2	56	17	63
3	49	18	64
4	55	19	70
5	19	20	69
6	18	21	72
7	22	22	102
8	62	23	71
9	65	24	94
10	66	25	93
11	92	26	30
12	91	27	29
13	98	28	24
14	97	29	23
15	21	30	20

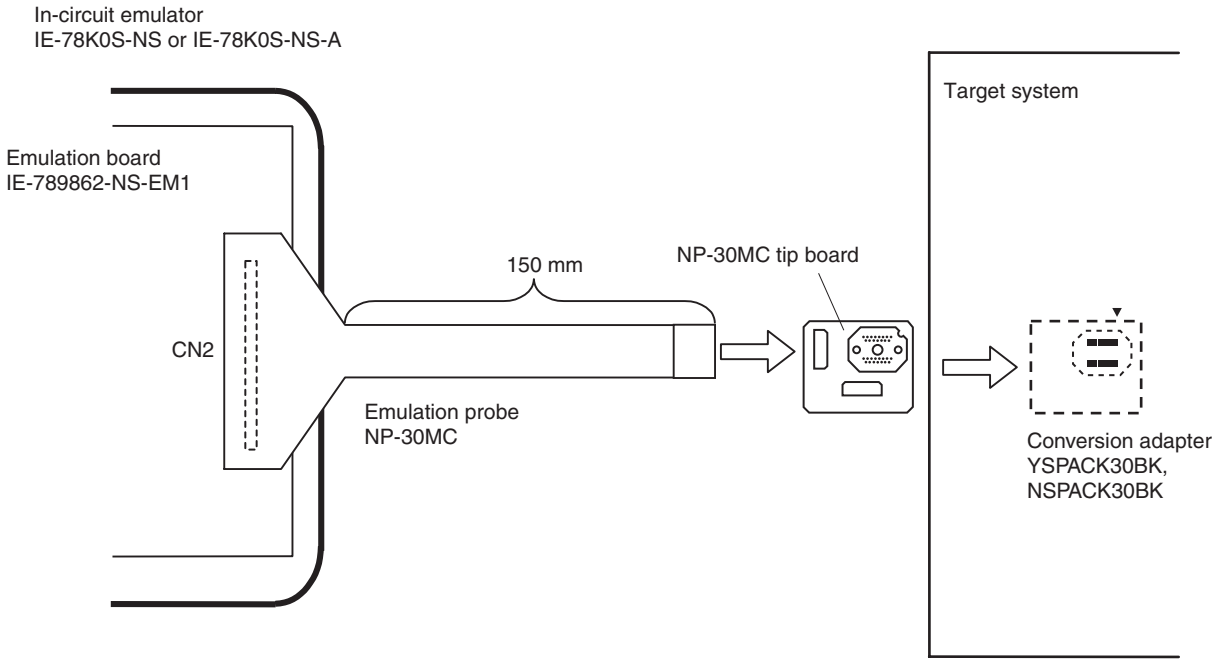
Remarks 1. The emulation probe is the NP-30MC, a product of Naito Densei Machida Mfg. Co., Ltd.

2. The numbers in the Emulation Probe Pin column refer to the pin number of the emulation probe and NP-30MC.

APPENDIX B NOTES ON TARGET SYSTEM DESIGN

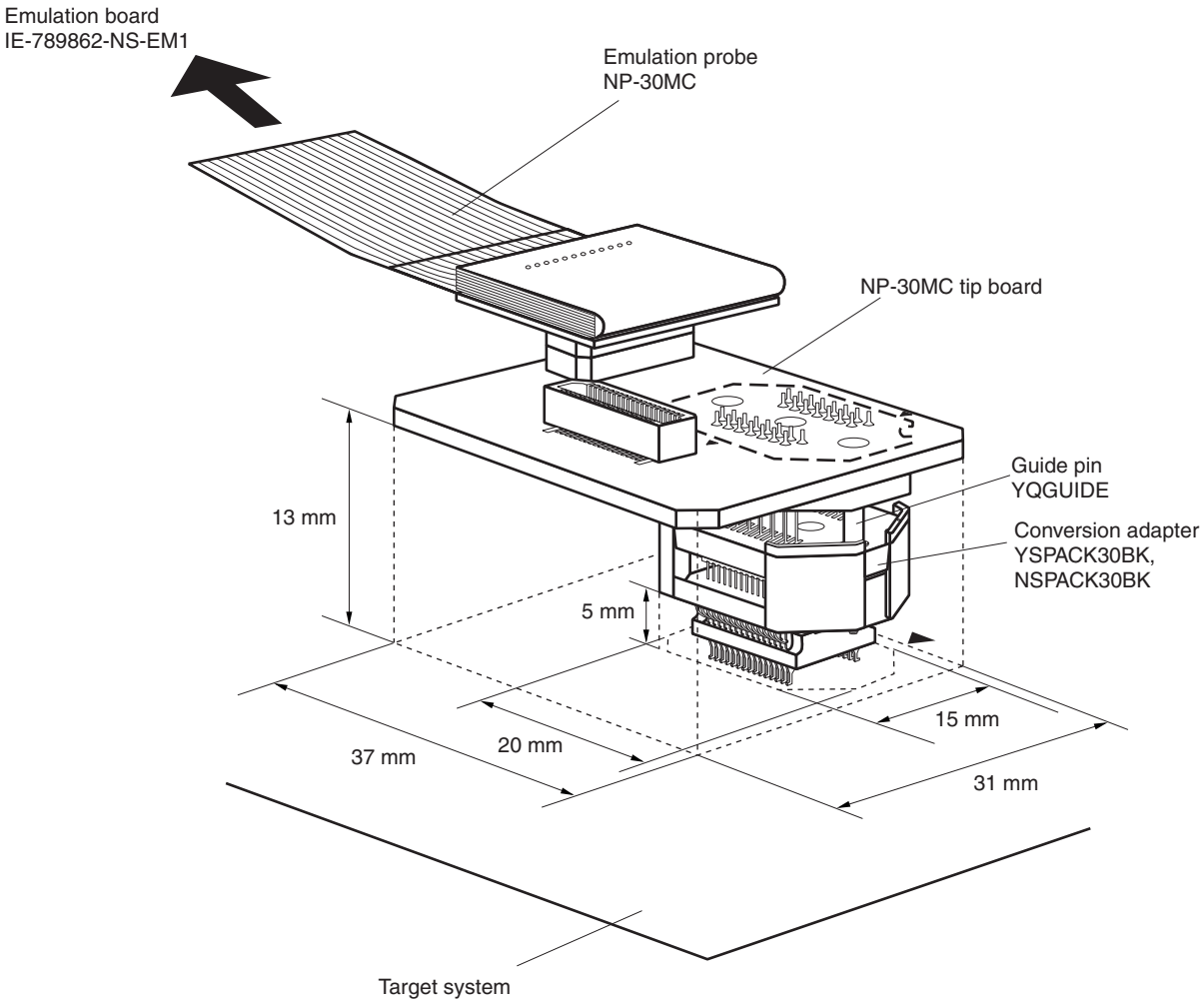
The following shows a diagram of the connection conditions between the emulation probe, conversion connector, and conversion socket. Design your system making allowances for conditions such as the form of parts mounted on the target system as shown below.

Figure B-1. Distance from In-Circuit Emulator to Conversion Socket



Remark NP-30MC is a product of Naito Densei Machida Mfg. Co., Ltd.
YSPACK30BK and NSPACK30BK are products of Tokyo Eletech Corporation.

Figure B-2. Conditions for Target System Connection



Remark NP-30MC is a product of Naito Densei Machida Mfg. Co., Ltd.

YSPACK30BK and NSPACK30BK are products of Tokyo Eletech Corporation.