CUSTOMER NOTIFICATION

SUD-TT-0205-1-E

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IE-789860-NS-EM1

Preliminary User's Manual

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Revision History

The control code and revision history are shown below.

Control Code [Note]	Document No.	Description
A, B, C	SUD-T-4599-1-E (Aug. 19, 1999)	Newly created.
D	SUD-TT-0205-1-E (This document)	• Addition of μPD789052, 789062 Subseries as target devices • Addition of description on IE-78K0S-NS-A (main board), addition of APPENDIX B NOTES ON TARGET SYSTEM DESIGN, correction of erroneous description

Note The “control code” is the second digit from the left in the 10-digit serial number in the warranty supplied with the product you purchased (if it has not been upgraded). If the product has been upgraded, a label indicating the new version is attached to the product and the x in V-UP LEVEL x on this label indicates the control code.

INTRODUCTION

Product Overview

The IE-789860-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.

- μPD789860 Subseries: μPD789860, 78E9860
- μPD789861 Subseries: μPD789861, 78E9861
- μPD789052 Subseries: μPD789052
- μPD789062 Subseries: μPD789062

Target Readers

This manual is intended for engineers who will use the IE-789860-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-789860-NS-EM1, refer to not only this manual (supplied with the IE-789860-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-789860-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-789860-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-789860-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-789860-NS-EM1	SUD-TT-0205-1	This manual
ID78K Series Integrated Debugger Ver.2.30 or Later Operation (Windows™ Based)	U15185J	U15185E
μPD789860, 789861 Subseries	U14826J	U14826E
μPD789052, 789062 Subseries	U15861J	To be prepared

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-789860-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.

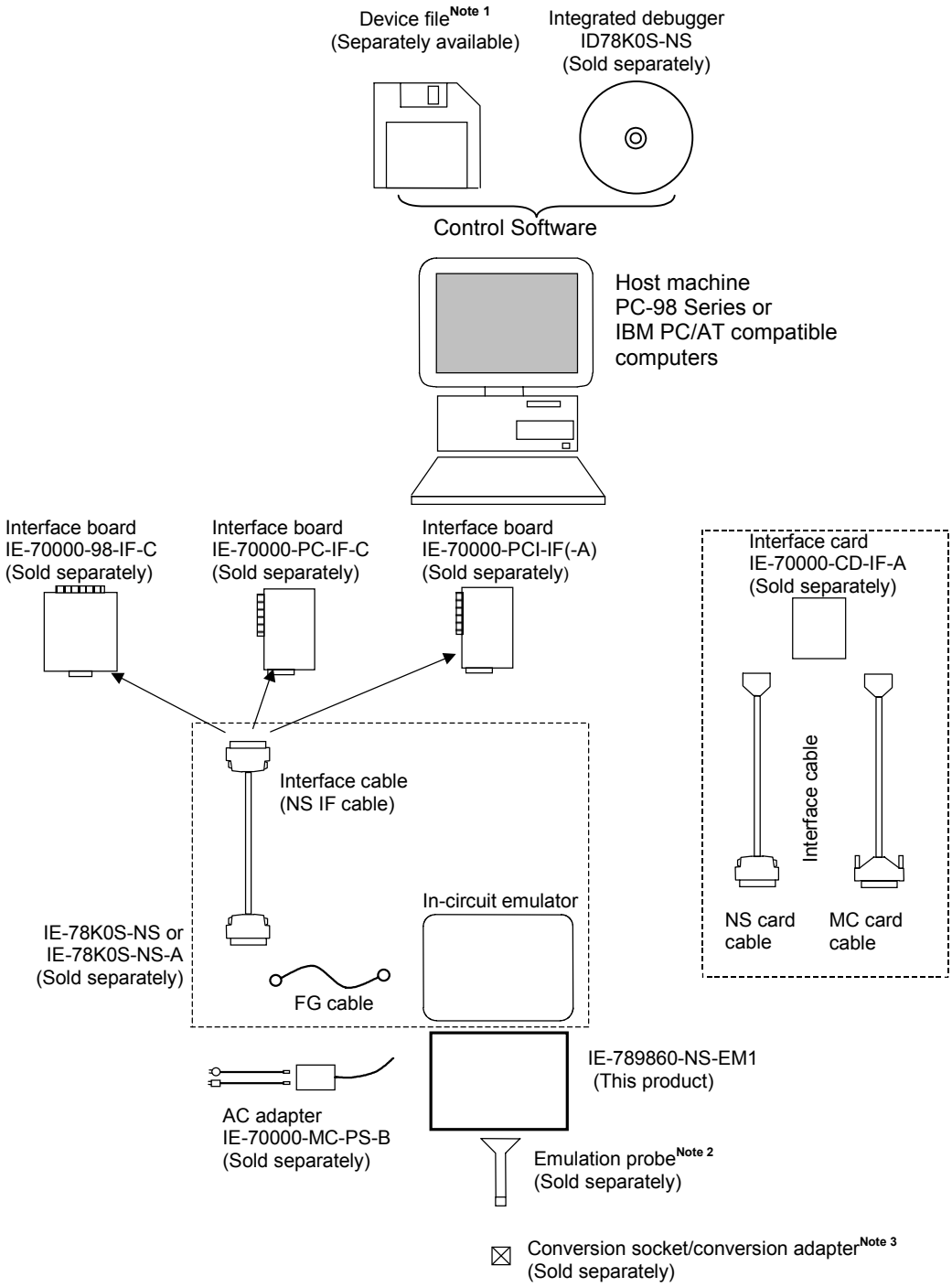
This chapter describes the IE-789860-NS-EM1 system configuration and basic specifications.

- Target device
  - μPD789860 Subseries
  - μPD789861 Subseries
  - μPD789052 Subseries
  - μPD789062 Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-789860-NS-EM1 system configuration.

Figure 1-1. System Configuration



Notes 1. The device files are as follows.

μSXXXXDF789861: μPD789860, 789861 Subseries

μSXXXXDF789062: μPD789052, 789062 Subseries

2. The emulation probe is as follows.

NP-20GS: 20-pin plastic SSOP (probe length: 200 mm; MC type)

NP-20GS is a product of Naito Densei Machida Mfg. Co., Ltd.

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

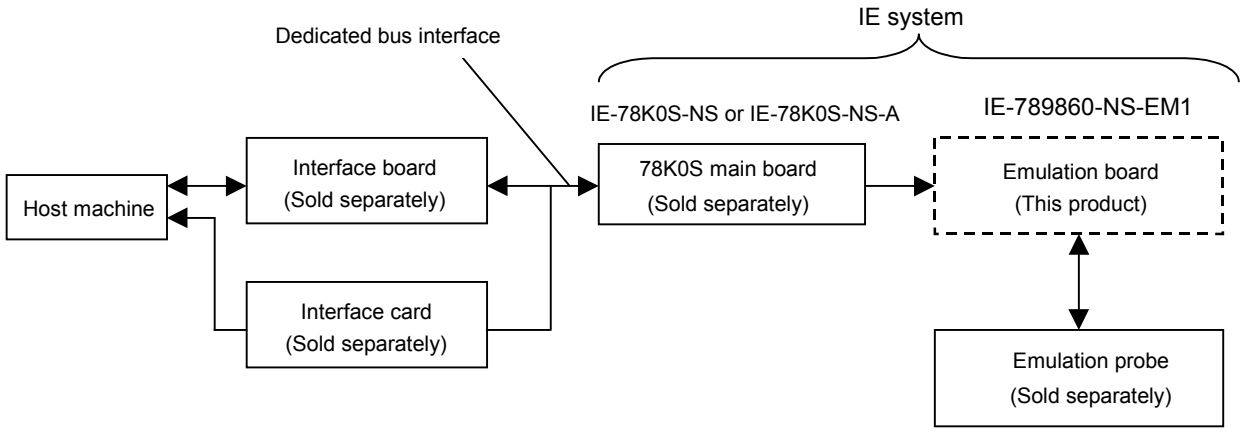
3. The conversion socket and conversion adapter are as follows.

EV-9500GS-20: For 20-pin plastic SSOP (MC type)

1.2 Hardware Configuration

Figure 1-2 shows the IE-789860-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The IE-789860-NS-EM1's basic specifications are listed in Table 1-1.

Table 1-1. Basic Specifications

Parameter	Description
Target device	μPD789860, 789861, 789052, 789062 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-789860-NS-EM1 main unit.

The packing box contains the emulation board (IE-789860-NS-EM1), package details, user's manual, and guarantee card.

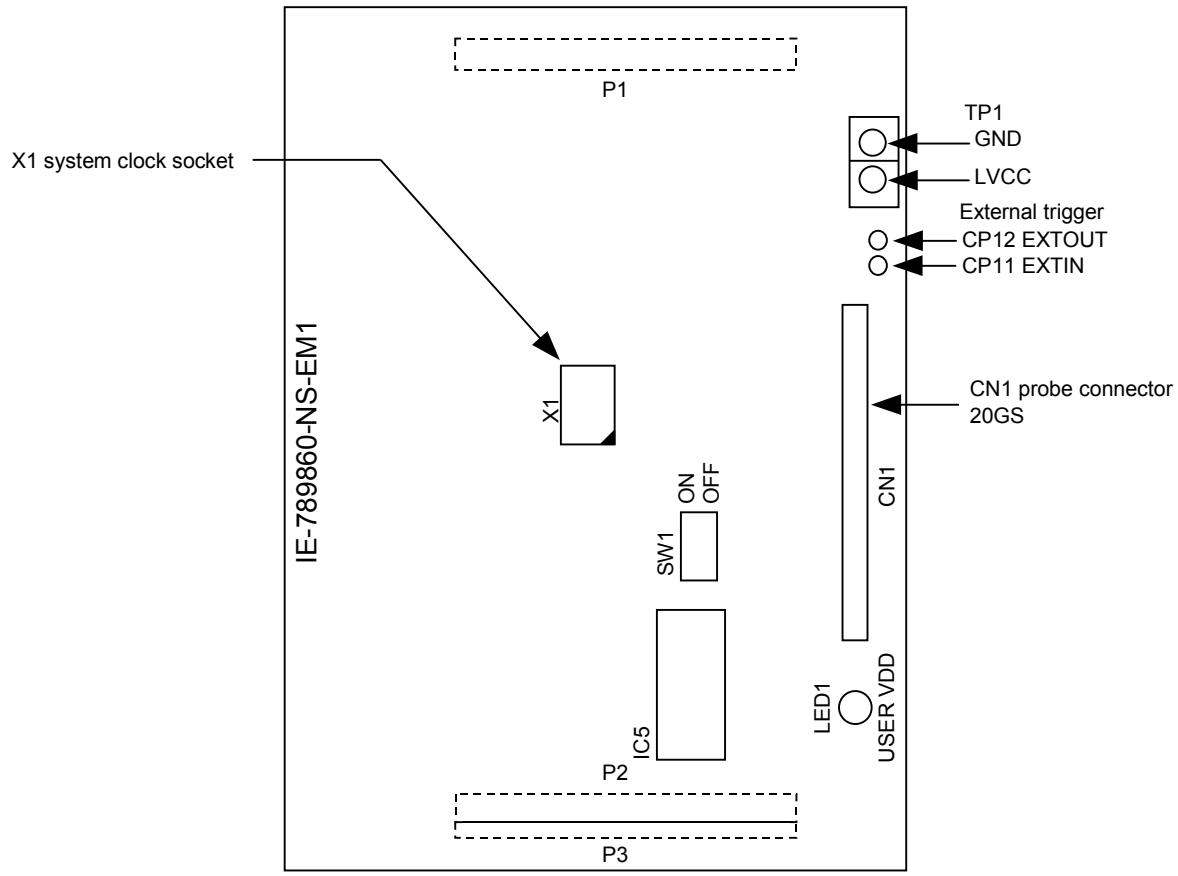
If there are any missing or damaged items, please contact an NEC sales representative.

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-789860-NS-EM1 Board



2.2 Initial Settings of Switches and Jumpers

Table 2-1 shows the initial settings of jumpers and switches on the IE-789860-NS-EM1.

Refer to **3.5 Mask Option Settings** for the JP1 setting.

Table 2-1. Initial Settings of Switches and Jumpers

	SW1			
	1	2	3	4
Initial setting	OFF	OFF	OFF	OFF

CHAPTER 3 INSTALLATION

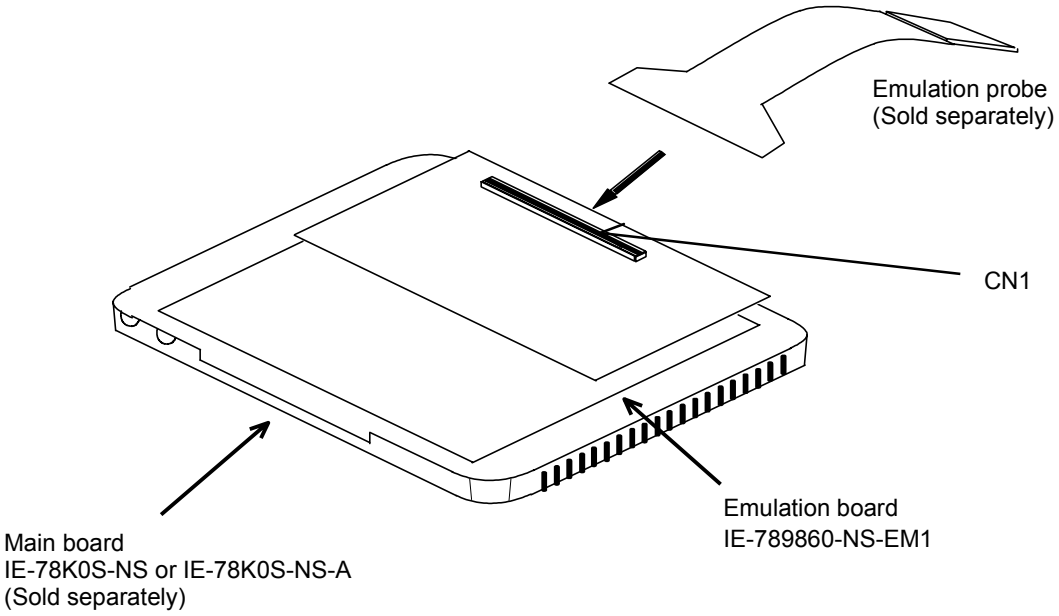
This chapter describes methods for connecting the IE-789860-NS-EM1 to the IE-78K0S-NS or IE-78K0S-NS-A and emulation probe. Mode setting methods are also described.

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-789860-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-789860-NS-EM1.

On this board, connect the emulation probe to CN1.

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-789860-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-789860-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)

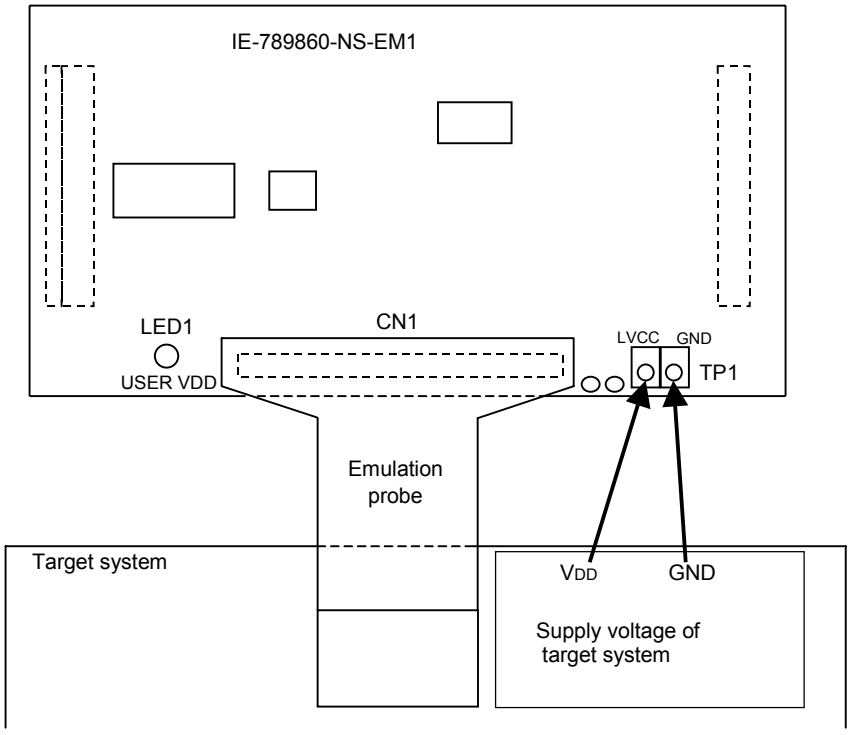
3.3 Settings of Target Interface Voltage

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-789860-NS-EM1 from the TP1 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 ID78K Series Integrated Debugger User's Manual (U15185E) for details of how to select the supply voltage.
The maximum current that can be consumed by TP1 is approx.100 mA at 2.0 V, and approx. 300mA at 5.5 V

Table 3-3. Target Interface Voltage Settings

Target Interface Voltage (LV_{DD})		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 TP1 and Target System Supply Voltage



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

Remark The V_{DD} pin of the target system are only used to control the LED1 that monitors the connection of the target system power supply in the IE-789860-NS-EM1.

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.

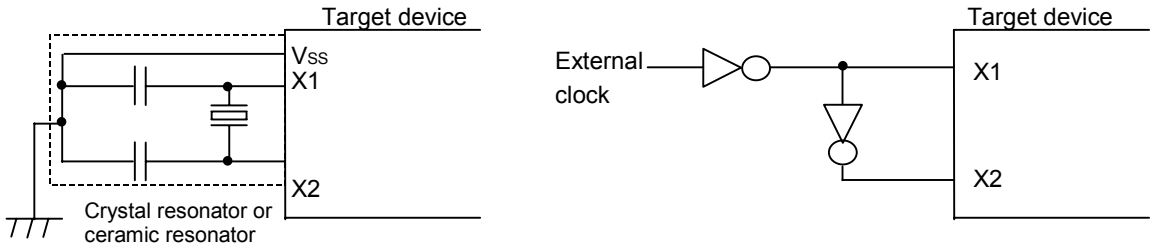
(1) Clock already mounted on emulation board
(2) Clock mounted by user
(3) Pulse input from the target system

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 resonator is connected directly to the X1 pin.
Emulation using the RC oscillator cannot be performed.

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

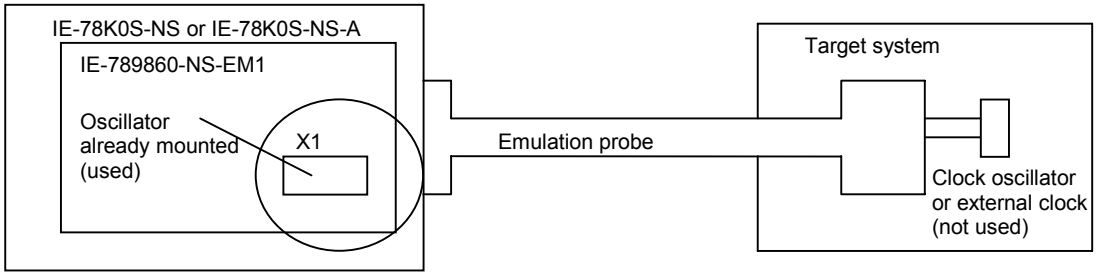
(a) Clock oscillator **(b) External clock**



(1) Clock already mounted on emulation board

The 5.0 MHz crystal oscillator (X1) that is already mounted in the IE-789860-NS-EM1 can be used.

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

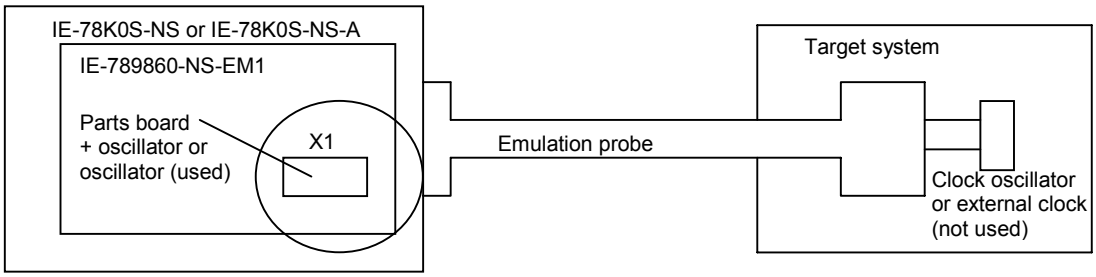


Remark The clock that is supplied by the IE-789860-NS-EM1's oscillator (encircled in the figure) is used.

(2) Clock mounted by user

The user is able to mount any clock supported by the set specifications on the IE-789860-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

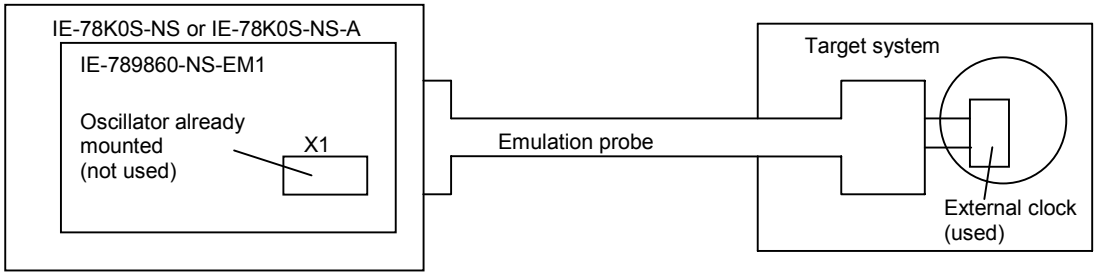


Remark The clock that is supplied by the IE-789860-NS-EM1's oscillator (encircled in the figure) is used.

(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-789860-NS-EM1's system clock are shown in Table 3-4.

Table 3-4. System Clock Settings

Frequency of System Clock		IE-789860-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).

Remark The IE-789860-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-789860-NS-EM1 is shipped, a 5.0 MHz crystal oscillator is already mounted in the IE-789860-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

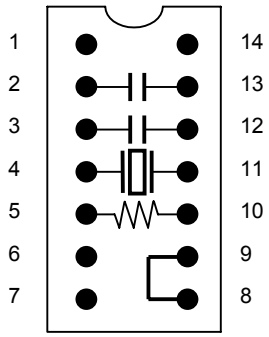
- Ceramic or crystal resonator
- Resistor Rx
- Solder kit
- Capacitor CA
- Capacitor CB

<Procedure>

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

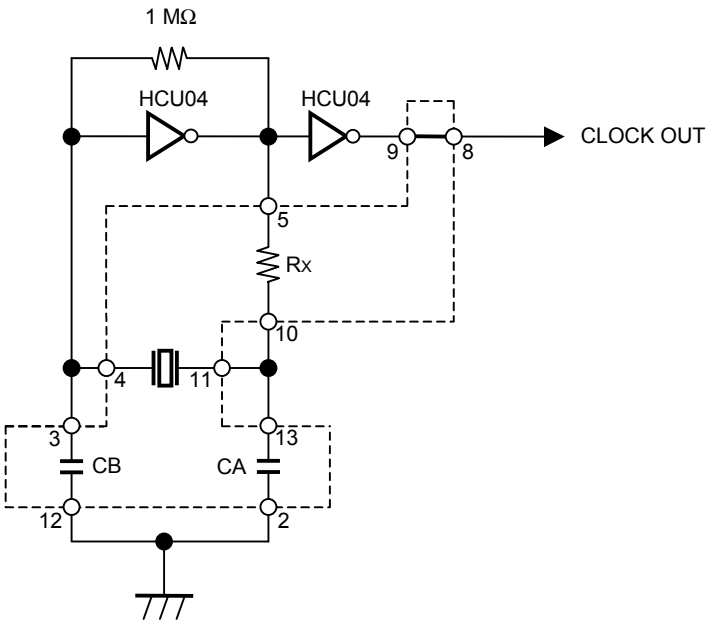
Figure 3-7. Connections on Parts Board

Parts board (X1)



Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Ceramic or crystal 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.

<2> Prepare the IE-789860-NS-EM1.

<3> Remove the crystal oscillator that is mounted in the IE-789860-NS-EM1's socket (X1).

<4> Connect the parts board (<1> above) to the socket (X1) from which the crystal oscillator was removed in <3>. 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 3-7 above.

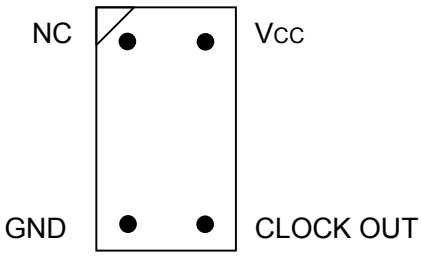
<6> Install the IE-789860-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(b) When using a crystal oscillator

♦ Necessary items

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

Figure 3-8. Crystal Oscillator



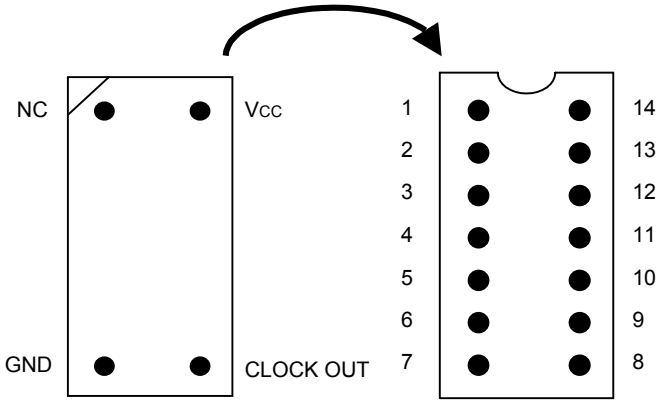
<Procedure>

<1> Prepare the IE-789860-NS-EM1.

<2> Remove the crystal oscillator from the X1 socket on the IE-789860-NS-EM1.

<3> Mount the new crystal oscillator in the X1 socket 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-789860-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

3.5.1 Mask option of port 4

The mask option of port 4 (P40 to P43) can be used to connect a 33 kΩ pull-up resistor using a DIP switch (SW1).

Set the mask options in the mask option setting dialog box of the integrated debugger (ID78K0S-NS). This setting is not necessary when reading a project file because the read contents are reflected in the mask option setting dialog box.

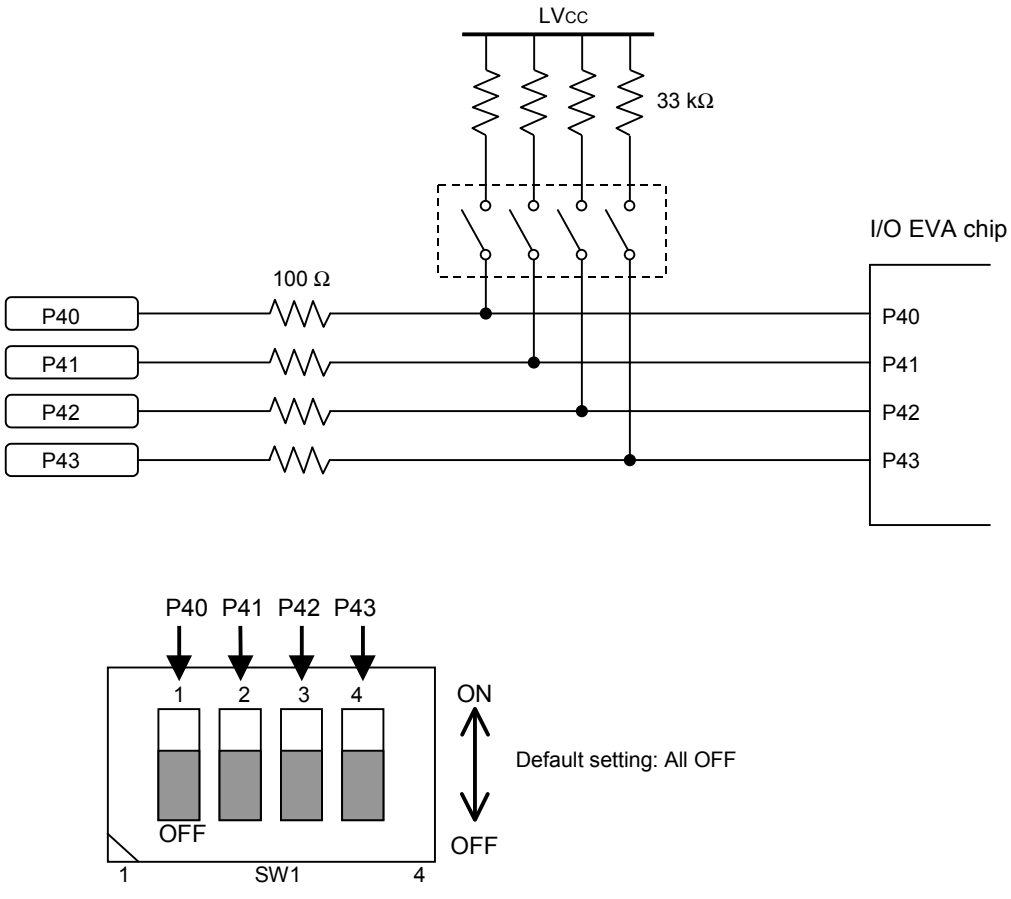
See ID78K0 Series Integrated Debugger Ver. 2.30 or Later User's Manual (U15185E) for details of how to use mask options.

Table 3-5. Port 4 Mask Option Settings

	SW1			
	1	2	3	4
Connected to:	P40	P41	P42	P43

The pull-up resistor is pulled up by the target interface power supply voltage (LV_{CC}) when the DIP switch is on, and disconnected when the DIP switch is off.

Figure 3-10. Port 4 Mask Option Settings



3.5.2 Mask option of POC circuit

The IE-789860-NS-EM1 includes a POC switching circuit, which is used to control the power-on-clear circuit function via software. Set this circuit to 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.

3.5.3 Mask option of oscillation stabilization time wait time

The oscillation stabilization wait time is fixed to $2^7/f_X$ in the IE-789860-NS-EM1. The differences between each product is shown in Table 3-6.

When emulation after STOP mode release by $\overline{\text{RESET}}$ input or reset release using POC is performed, it is affected by voltage fluctuation and noise. Therefore, the result must be checked in the EEPROM product.

Table 3-6. Oscillation Stabilization Time Wait Time in Each Device

	IE-789860-NS-EM1	μPD789052 μPD78E9860	μPD789062 μPD78E9861	μPD789860	μPD789861
The oscillation stabilization wait time after STOP mode release by $\overline{\text{RESET}}$ input or reset release using POC	2^7/fx	2^{15}/fx	2^7/fcc	Selectable from 2^{15}/fx or 2^{17}/fx by mask option	2^7/fcc

3.6 External Trigger

To set an external trigger, connect it to the IE-789860-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

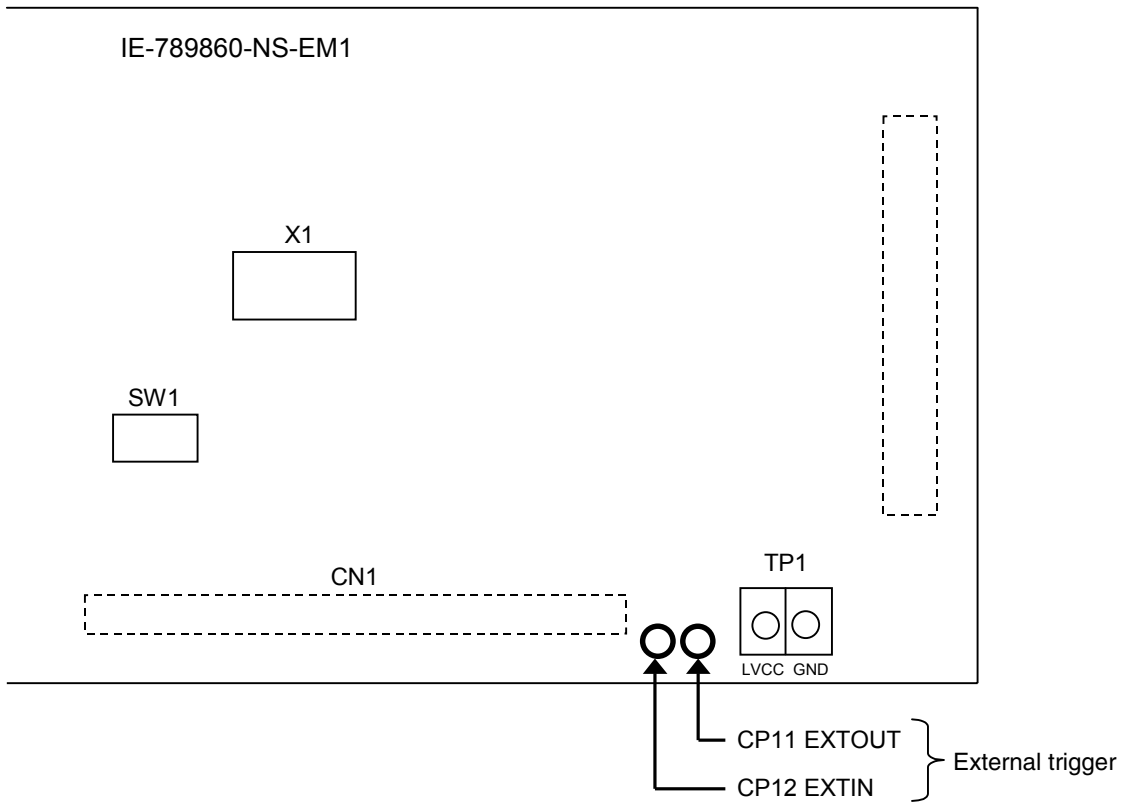
A low-level pulse is output from the IE-789860-NS-EM1's EXTOUT pin for 1.3 μs upon the occurrence of a break event.

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-789860-NS-EM1's EXTIN pin. Input a high-level pulse signal for 2 CPU operating clocks or longer.

Figure 3-11. 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 emulation CPU
(2) Signals input from the target system via a gate
(3) Other signals

The circuits of the IE-789860-NS-EM1 for the signals in (1) to (3) above are shown below. Alternate function pins are treated in the same way. There is no circuit in the IE system.

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

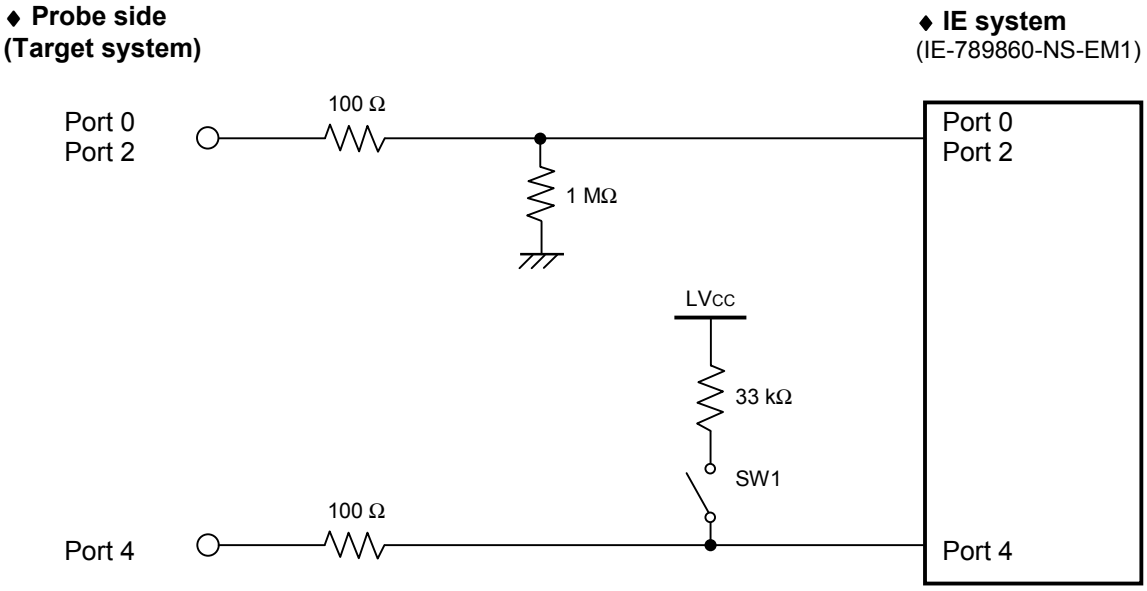
The following signals operate in the same manner as those in the μPD789052, 789062, 789860, 789861 Subseries. A pull-down resistor of 1 MΩ and a 100 Ω resistor are connected in parallel. Refer to Figure 4-1 Equivalent Circuit of Emulation Circuit (1). A 1 MΩ pull-down resistor is connected to signals related to port 0 in the IE-78K0S-NS and IE-78K0S-NS-A.

- Signals related to port 0
- Signals related to port 2

However, a 33 kΩ pull-up resistor is connected to the following signals using the switch (SW1).

- Signals related to port 4

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



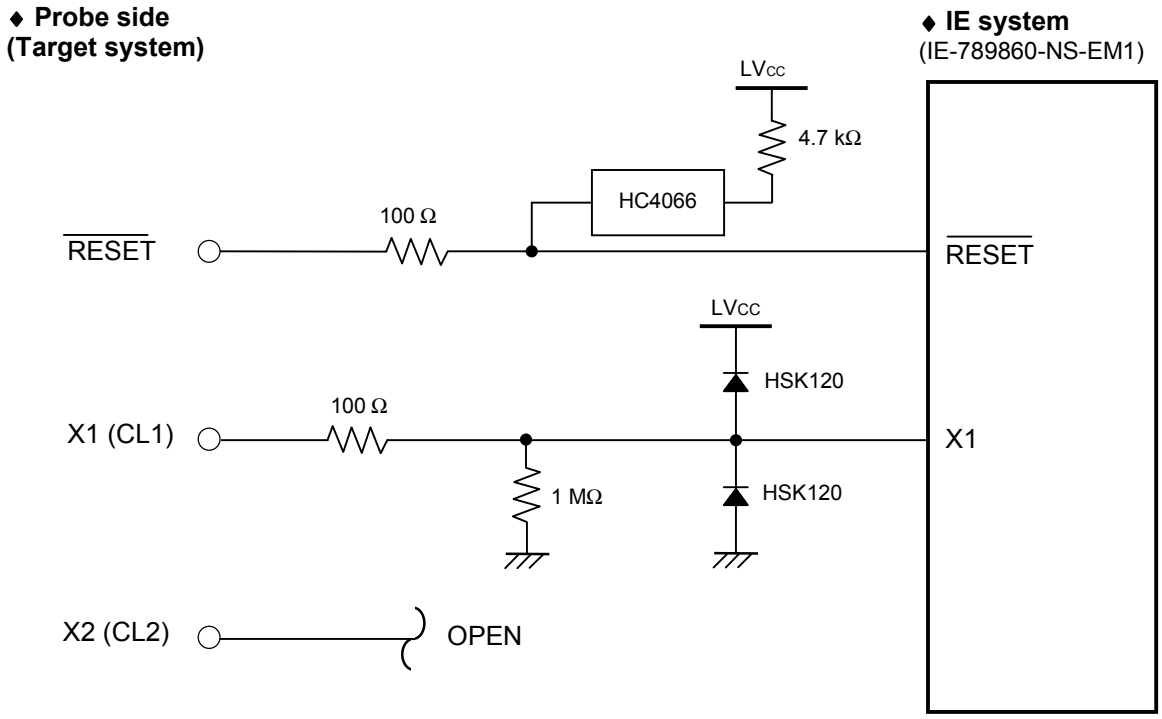
(2) Signals input from the target system via a gate

Since the following signals are input via a gate of the emulation device, their timing shows a delay compared to that of the μPD789052, 789062, 789860, 789861 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-789860-NS-EM1 does not use the X2 (CL2).

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 CPU operates with the internal supply voltage (5 V). When the target system is connected, it operates with the power (LV_{CC}) supplied from the power supply voltage supply pin (TP1). The V_{DD} pin of the target system are only used to control the LED1 (USER VDD) that monitors the connection of the target system power supply in the IE-789860-NS-EM1.

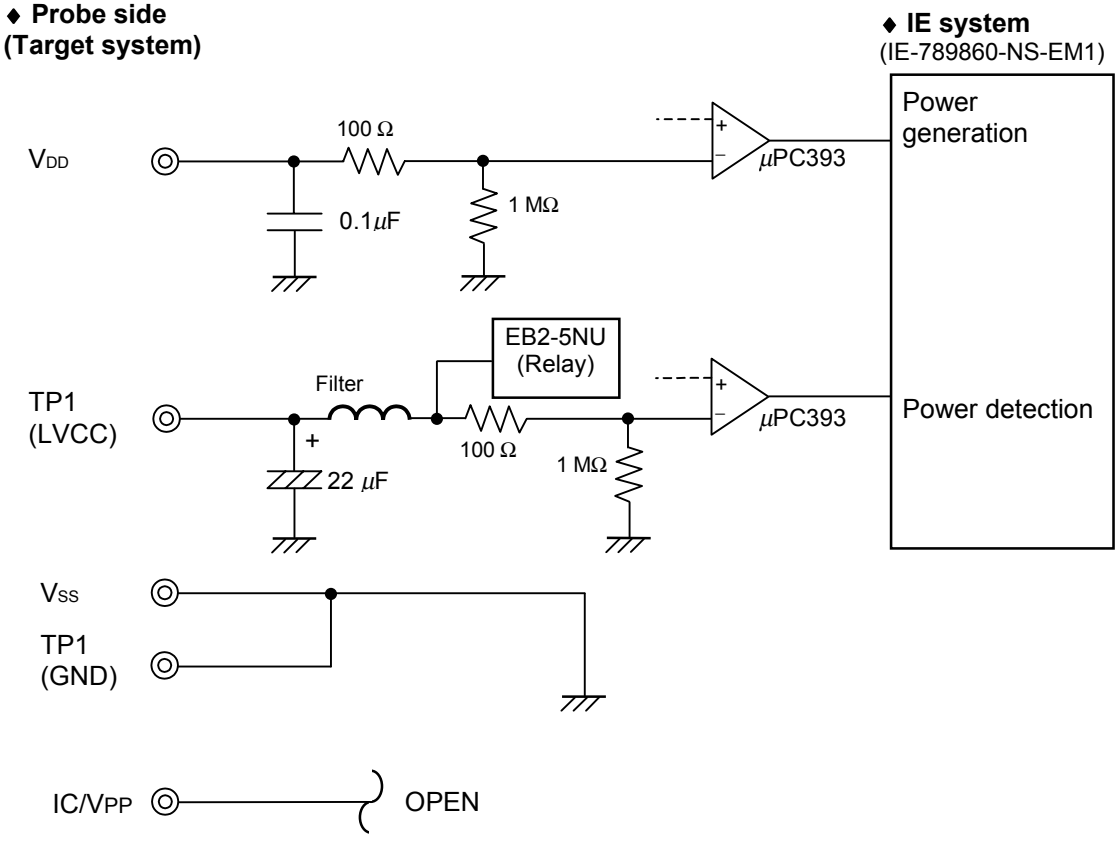
- V_{SS} pin

The V_{SS} pin is connected to GND inside the IE-789860-NS-EM1.

- IC/V_{PP} pin

The IE-789860-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 EVA chip, TTL, CMOS-IC, and other circuits. Therefore, there are differences between the target device and the IE system specifications.

(1) An RC oscillator cannot be emulated by the IE-789860-NS-EM1. Only the oscillator functions described in **3.4 Clock Settings** can be emulated.

(2) 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) When a program that illegally accesses EEPROM is executed in the IE-789860-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.

(4) The IE-789860-NS-EM1 includes a POC switching circuit, which is used to control the power-on-clear circuit function via software. Set this circuit to on/off using an SFR.

(5) The oscillation stabilization wait time after STOP mode release by $\overline{\text{RESET}}$ input or reset release using POC is fixed to $2^7/f_X$ in the IE-789860-NS-EM1. Only the mask option functions described in **3.5 Mask Option Settings** can be emulated.

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	33	11	16
2	32	12	15
3	74	13	14
4	31	14	13
5	75	15	6
6	34	16	5
7	7	17	4
8	8	18	3
9	9	19	17
10	10	20	73

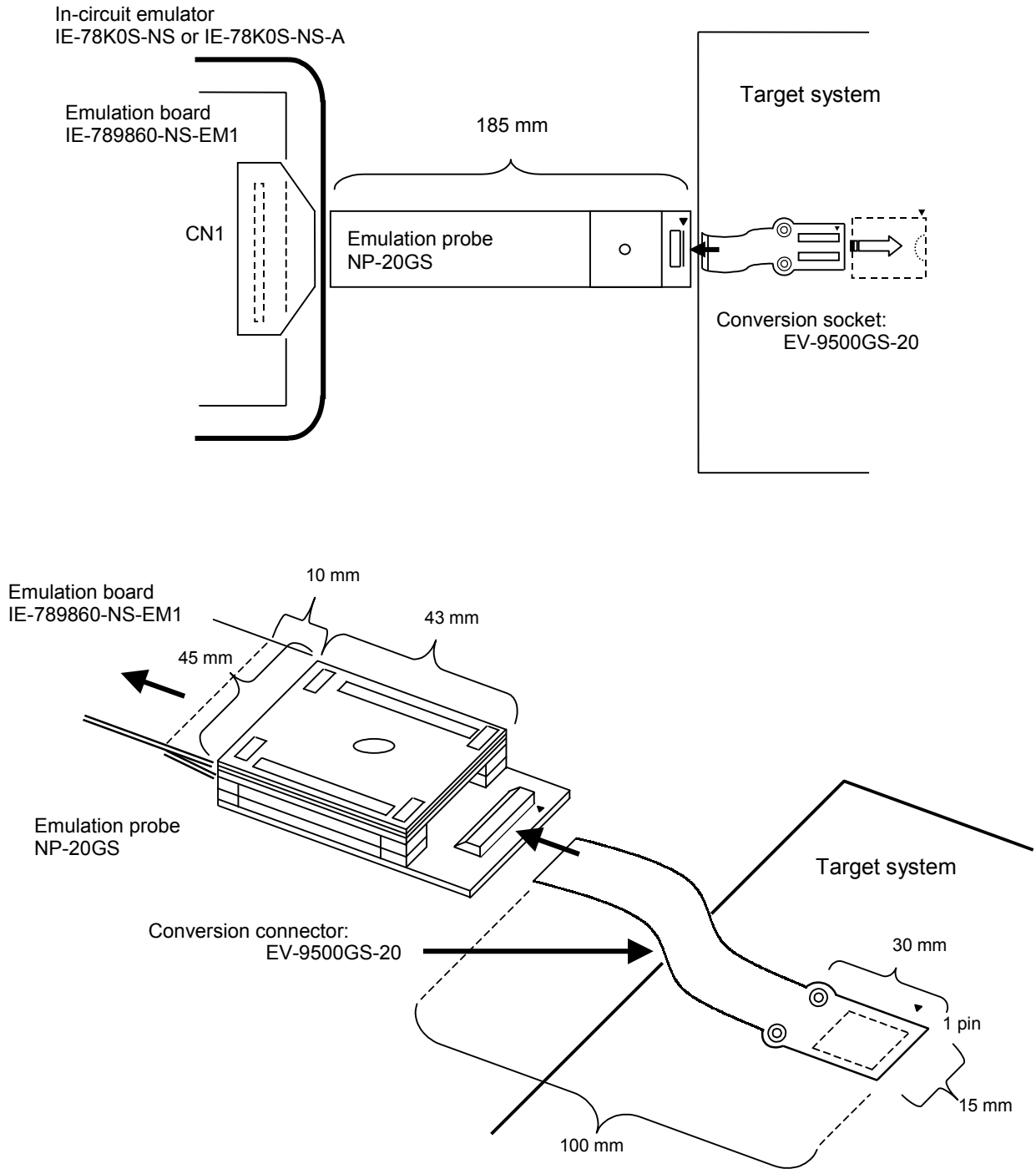
Remarks 1. The emulation probe is the NP-20GS, a product of Naito Densei Machida Mfg. Co., Ltd.

2. The numbers in the Emulation Probe Pin column refer to the pin number of the target system with the NP-20GS and EV-9500GS-20 combined.

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. Conditions for Target System Connection



Remark NP-20GS is a product of Naito Densei Machida Mfg. Co., Ltd.