NEC

User's Manual

IE-780233-NS-EM4

Emulation Board

Target Device
μPD780232 Subseries

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INTRODUCTION

Product Overview

The IE-780233-NS-EM4 is designed to be used with the IE-78K0-NS and IE-78K0-NS-P01 to debug the following target device that belongs to the 78K/0 Series of 8-bit single-chip microcontrollers.

- μPD780232 Subseries: μPD780232

Target Readers

This manual is intended for engineers who will use the IE-780233-NS-EM4 with the IE-78K0-NS and IE-78K0-NS-P01 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-780233-NS-EM4, refer to not only this manual (supplied with the IE-780233-NS-EM4) but also the manual that is supplied with the IE-78K0-NS and IE-78K0-NS-P01.

IE-78K0-NS User's Manual	IE-780233-NS-EM4 User's Manual	IE-78K0-NS-P01 User's Manual
• Basic specifications	• General	• Functional outline
• System configuration	• Part names	
• External interface functions	• 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-780233-NS-EM4.

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

Term	Meaning
Emulation device	This is a general term that refers to the device in the emulator that is used to emulate the target device. It includes the emulation CPU.
Emulation CPU	This is the CPU block in the emulator that is used to execute user-generated programs.
Target device	This is the device to be emulated (a real chip).
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-78K0-NS, IE-78K0-NS-P01, and the IE-780233-NS-EM4.

Conventions

Data significance: Higher digits on the left and lower digits on the right
Note: Footnote for item marked with **Note** in the text
Caution: Information requiring particular attention
Remark: Supplementary information

Related Documents The related documents (user's manuals) indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Document Name	Document Number
IE-78K0-NS	U13731E
IE-780233-NS-EM4	This manual
ID78K0-NS Integrated Debugger Reference (Windows™ Based)	U12900E
μPD780232 Subseries	U13364E
IE-78K0-NS-P01	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.

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LIST OF FIGURES

LIST OF TABLES

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CHAPTER 1 GENERAL

The IE-780233-NS-EM4 is a development tool for efficient debugging of hardware or software when using the following target device that belongs to the 78K/0 Series of 8-bit single-chip microcontrollers.

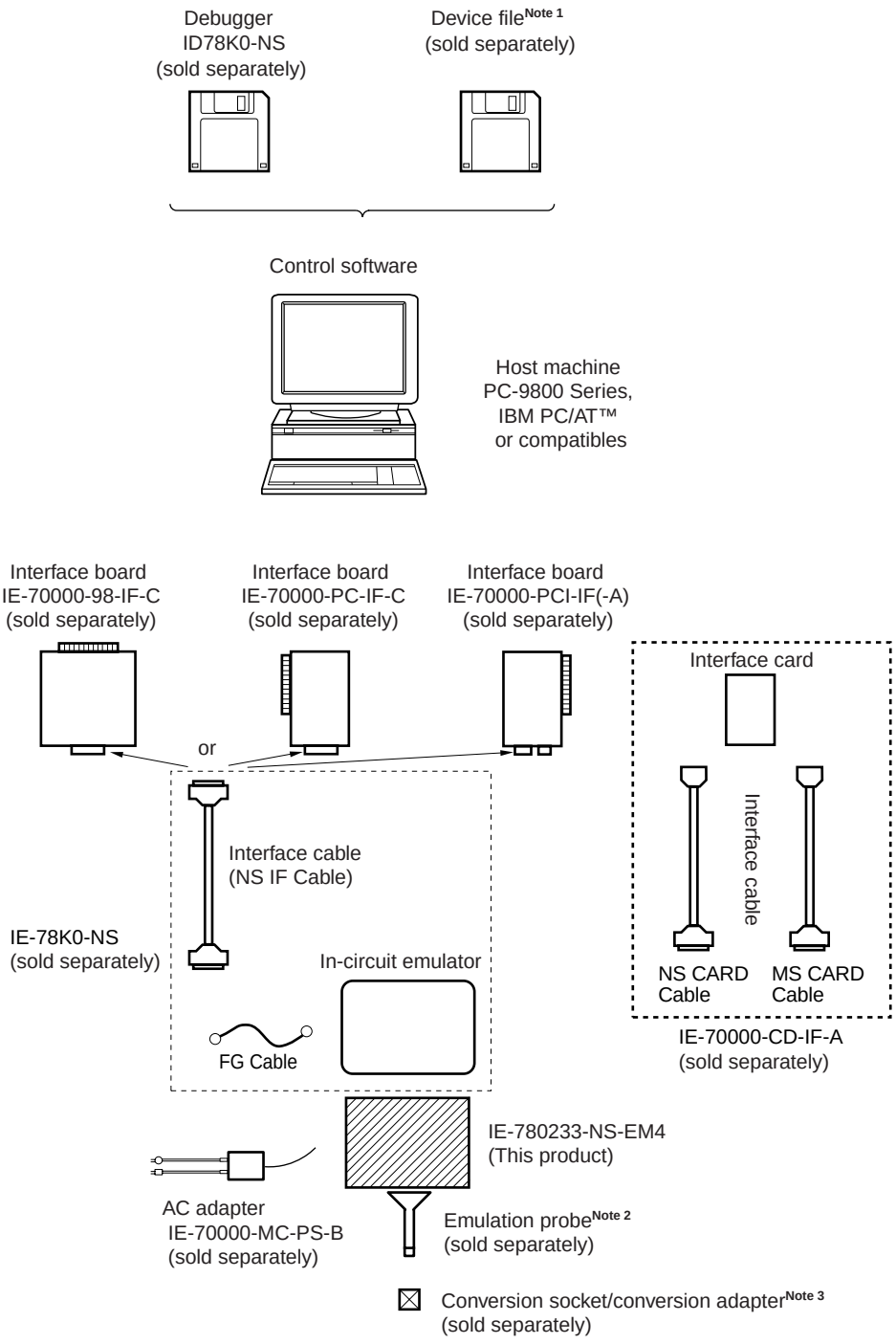
This chapter describes the IE-780233-NS-EM4's system configuration and basic specifications.

- Target device
  - μPD780232 Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-780233-NS-EM4's system configuration.

Figure 1-1. System Configuration



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

μS××××DF780233: μPD780232 Subseries

2. The emulation probe is as follows, in accordance with the package.

NP-80GC: 80-pin plastic QFP (GC type)

The NP-80GC is a product of Naito Densei Machida Mfg. Co., Ltd.

For further information, contact Naito Densei Machida Mfg. Co., Ltd. (TEL: +81-44-822-3813)

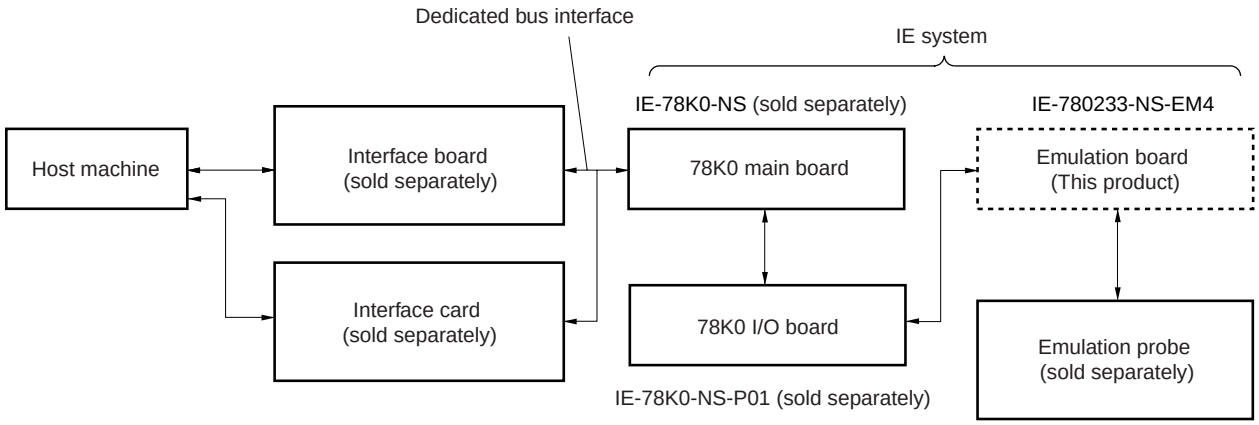
3. The conversion socket/conversion adapter are as follows, in accordance with the package.

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

1.2 Hardware Configuration

Figure 1-2 shows the IE-780233-NS-EM4's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The IE-780233-NS-EM4's basic specifications are listed in Table 1-1.

Table 1-1. Basic Specifications

Parameter	Description
Target device	μPD780232, 78F0233 Subseries
System clock	5.00 MHz
Main system clock supply	External: Input from the target system via an emulation probe Internal: Mounted on the emulation board (5.00 MHz) or mounted on the parts board by the user
Low voltage support	Not provided

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CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-780233-NS-EM4 main unit.

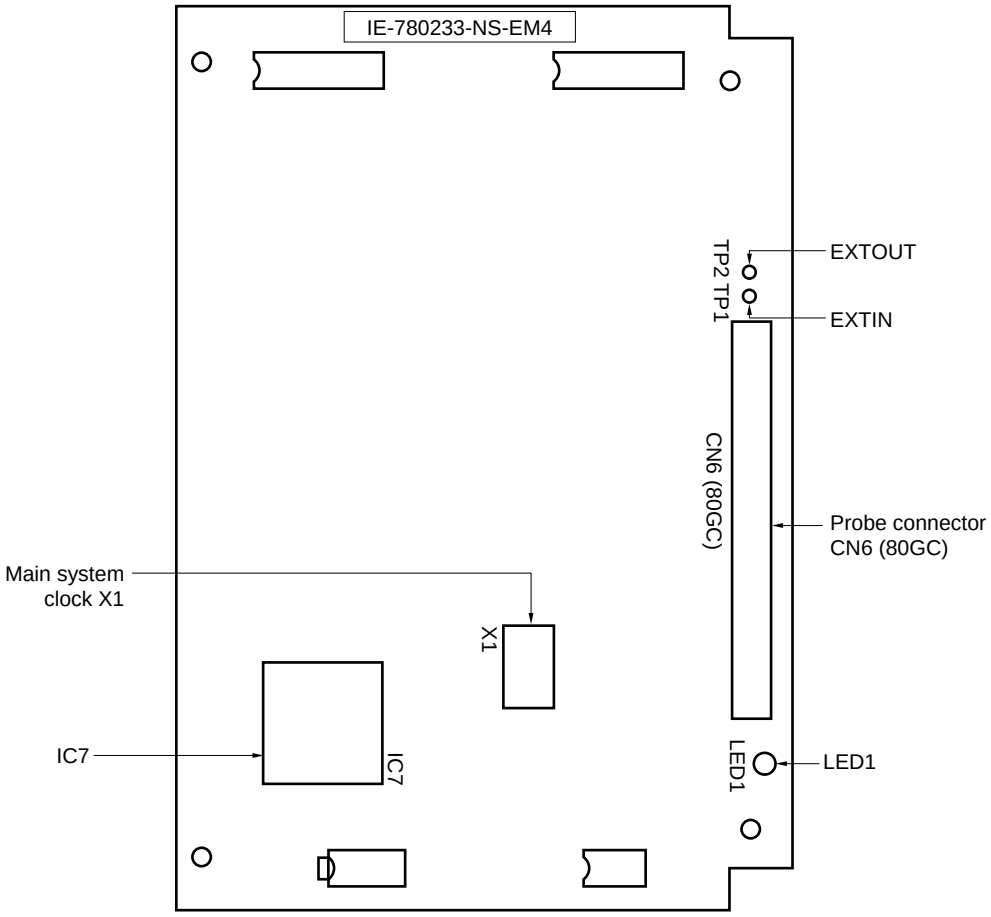
The packing box contains the emulation board (IE-780233-NS-EM4), packing list, user's manual, and guarantee card.

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

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

2.1 Parts of Main Unit

Figure 2-1. IE-780233-NS-EM4 Part Names



CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-780233-NS-EM4 to the IE-78K0-NS, IE-78K0-NS-P01, 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-78K0-NS main unit

See the **IE-78K0-NS User's Manual (U13731E)** for a description of how to connect the IE-780233-NS-EM4 to the IE-78K0-NS.

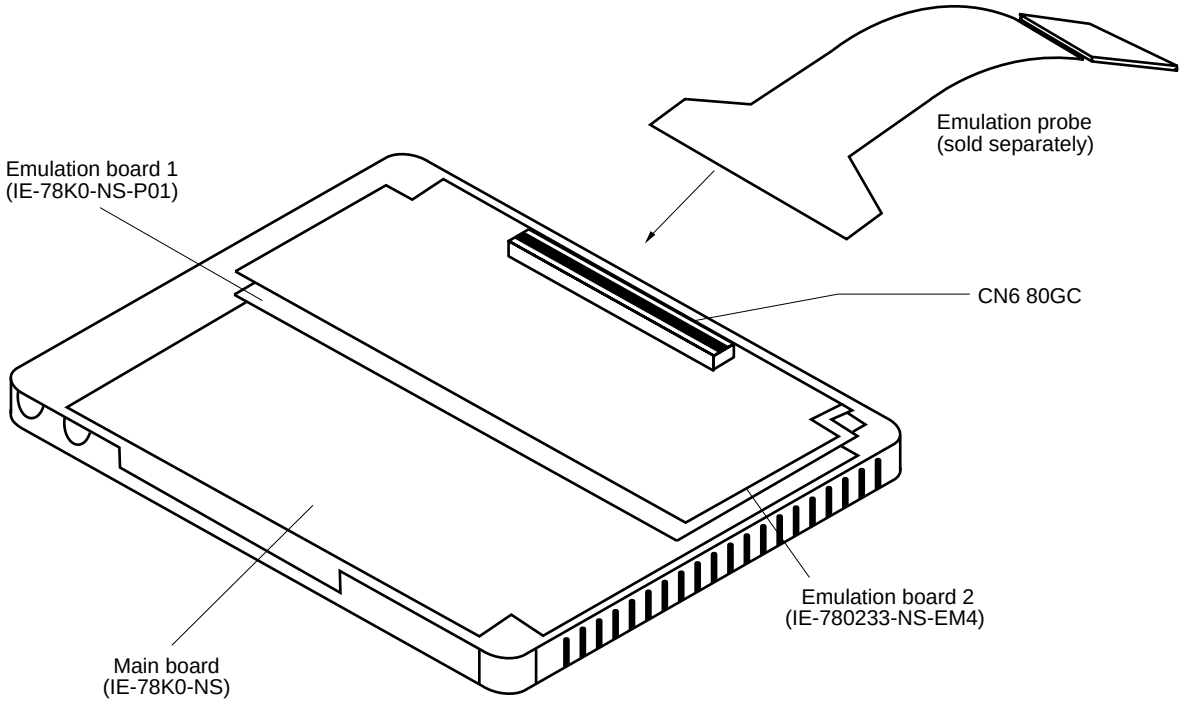
(2) Connection with emulation probe

See the **IE-78K0-NS User's Manual (U13731E)** for a description of how to connect an emulation probe to the IE-780233-NS-EM4.

On this board, connect the emulation probe to CN6.

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, a resonator is connected to the target device and the target device’s internal oscillator is used. An example of the external circuit is shown in part (a) of Figure 3-2. During emulation, the resonator that is mounted on the target system is not used. Instead, the clock that is mounted on the emulation board installed for the IE-78K0-NS is used.

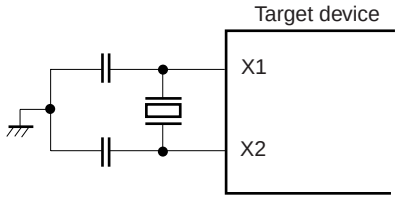
If the target system includes an external clock, select “(3) External clock”.

For an external clock, a clock signal is supplied from outside the target device and the target device’s internal oscillator is not used. An example of the external circuit is shown in part (b) of Figure 3-2.

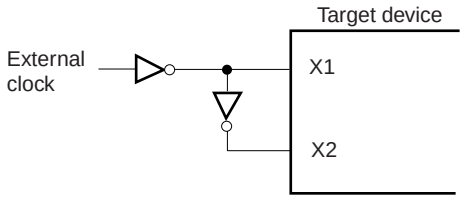
Caution The IE system will be hung-up if the main system clock is not supplied normally. Moreover, be sure to input a rectangular wave as the clock from the target. The IE system does not operate if the crystal resonator is connected to X1 (main system clock).

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

(a) Internal clock



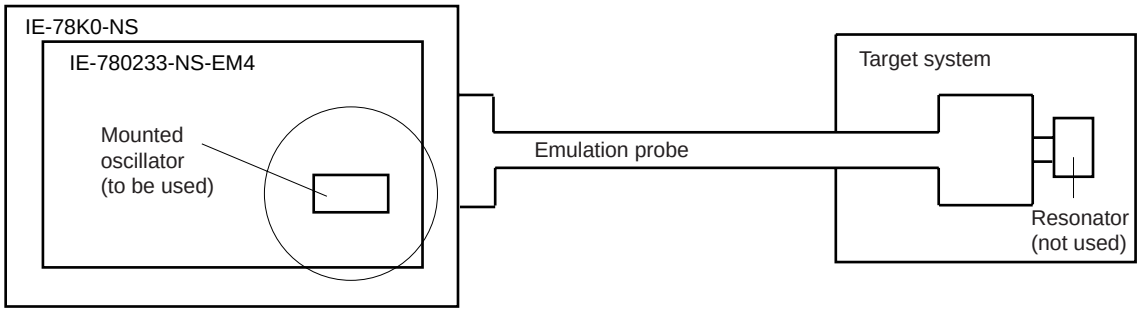
(b) External clock



(1) Clock that is already mounted on emulation board

A crystal oscillator (X1) is already mounted on the emulation board. Its frequency is 5.0 MHz.

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



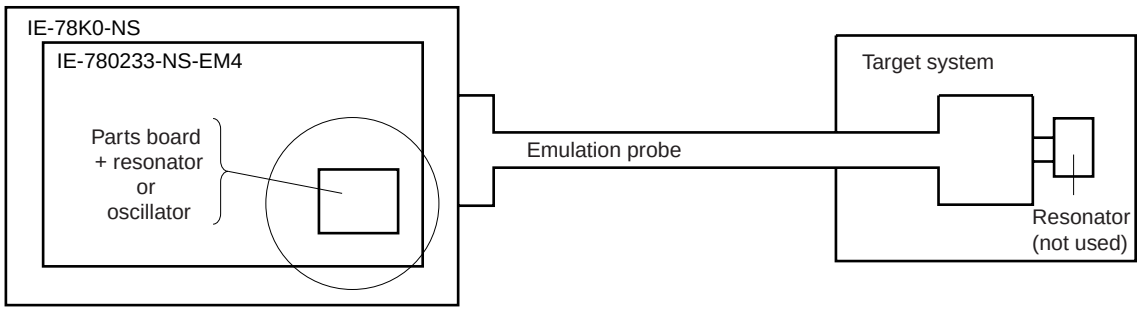
Remark The clock that is supplied by the IE-780233-NS-EM4's oscillator (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-780233-NS-EM4.

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. This method is useful when using a different frequency from that of the pre-mounted clock.

Figure 3-4. When Using User-Mounted Clock

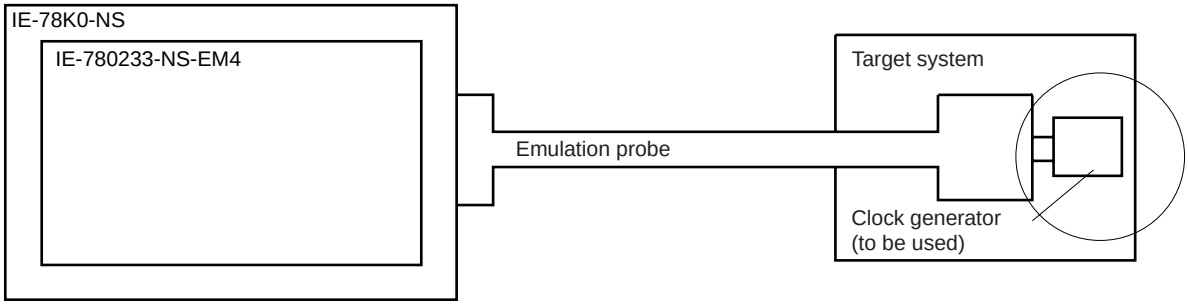


Remark The clock that is supplied by the IE-780233-NS-EM4's resonator or oscillator (encircled in the figure) is used.

(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

Frequency of Main System Clock		IE-780233-NS-EM4 X1 Socket	CPU Clock Source Selection (ID)
When using clock that is already mounted on emulation board	5.0 MHz	Oscillator used	Internal
When using clock mounted by user	Other than 5.0 MHz	Oscillator assembled by user	
When using external clock		Oscillator (not used)	External

Caution When using an external clock, open the configuration dialog box when starting the integrated debugger (ID78K0-NS) and select "External" in the area (Clock) for selecting the CPU's clock source (this selects the user's clock).

Remark When the IE-780233-NS-EM4 is shipped, the settings for "when using clock that is already mounted on emulation board" are preset.

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

When the IE-780233-NS-EM4 is shipped, a 5.0 MHz crystal oscillator is already mounted in the IE-780233-NS-EM4's X1 socket. When using the factory-set mode settings, there is no need to make any other hardware settings.

When starting the integrated debugger (ID78K0-NS), open the configuration dialog box and select "Internal" in the area (Clock) for selecting the CPU's clock source (this selects the emulator's internal clock).

(2) When using clock mounted by user

The settings described under either (a) or (b) are required, depending on the type of clock to be used.

When starting the integrated debugger (ID78K0-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

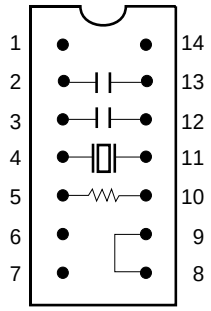
- Items to be prepared
  - Parts board (supplied with IE-78K0-NS)
  - Ceramic resonator or crystal resonator
  - Resistor Rx
  - Capacitor CA
  - Capacitor CB
  - Solder kit

<Steps>

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

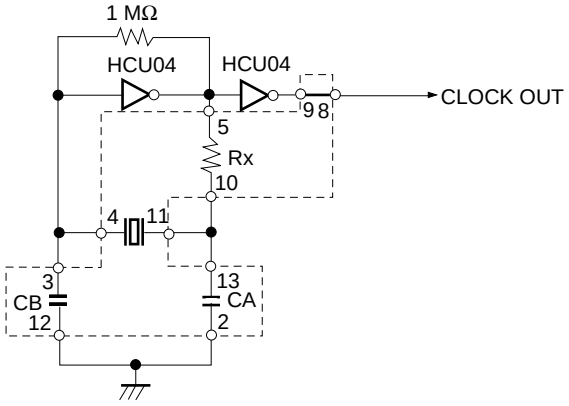
Figure 3-6. Connections on Parts Board (When Using User-Mounted Clock)

Parts board (X1)



Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Ceramic resonator or crystal resonator
5-10	Resistor Rx
8-9	Short

Circuit diagram



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

<2> Prepare the IE-780233-NS-EM4.

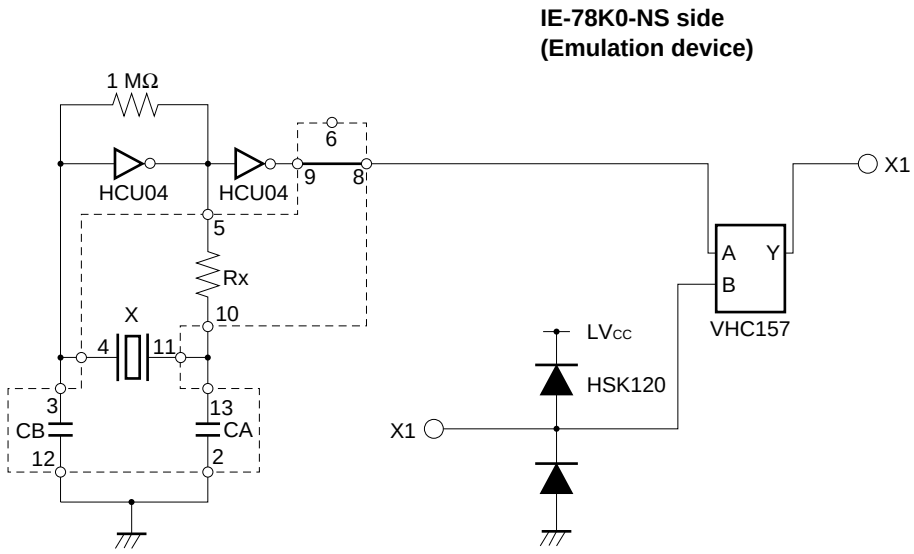
<3> Remove the crystal oscillator that is mounted in the IE-780233-NS-EM4's socket (the socket marked as X1).

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

<5> Make sure that the parts board is wired as shown in Figure 3-6 above.

<6> Install the IE-780233-NS-EM4 in the IE-78K0-NS.

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

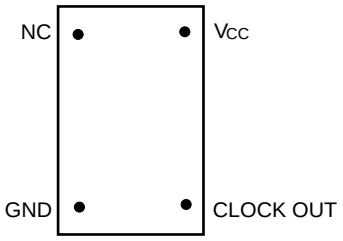


Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

(b) When using a crystal oscillator

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-7)

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



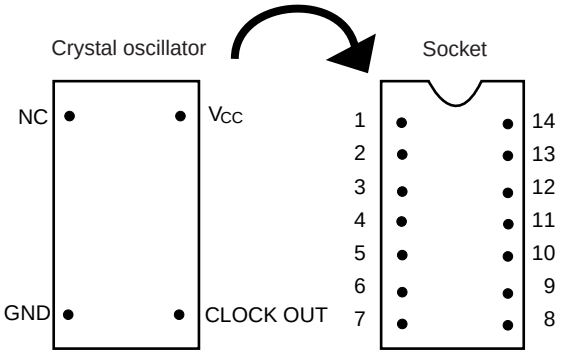
<Steps>

<1> Prepare the IE-780233-NS-EM4.

<2> Remove the crystal oscillator that is mounted in the IE-780233-NS-EM4's X1 socket.

<3> Mount the crystal oscillator prepared by the user in the X1 socket from which the crystal oscillator was removed in <2> above. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

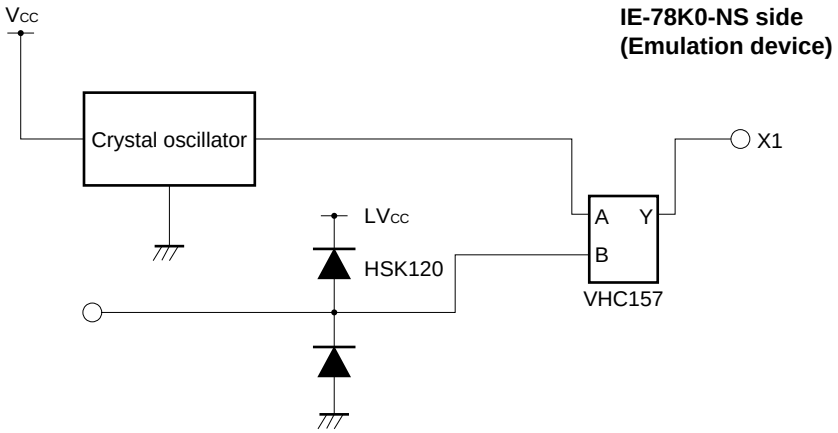
Figure 3-8. Pin Alignment of Crystal Oscillator and Socket



Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
V_{CC}	14

<4> Install the IE-780233-NS-EM4 in the IE-78K0-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

No hardware settings are required for this situation.

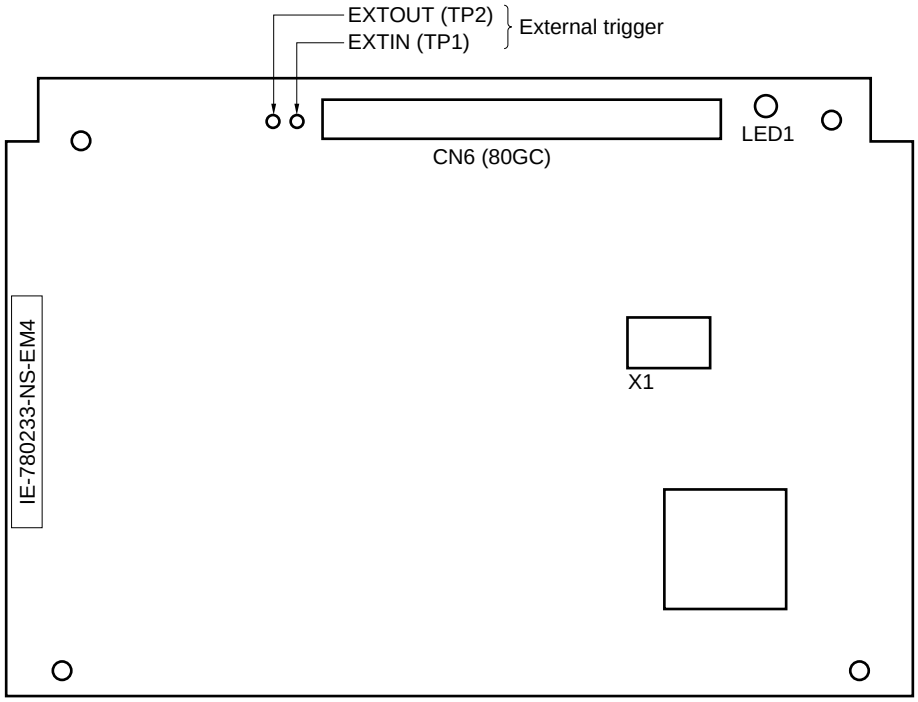
When starting the integrated debugger (ID78K0-NS), open the configuration dialog box and select “External” in the area (Clock) for selecting the CPU’s clock source (this selects the user’s clock).

3.3 External Trigger

To set up an external trigger, connect it to the IE-780233-NS-EM4's check pins EXTOUT and EXTIN as shown below.

See the **ID78K0-NS User's Manual (U12900E)** for descriptions of related use methods and **IE-78K0-NS User's Manual (U13731E)** for pin characteristics.

Figure 3-9. External Trigger Input Position



3.4 IE-78K0-NS Jumper Settings

When using the IE-780233-NS-EM4, set the jumpers on the IE-78K0-NS as shown in Table 3-2.
For details of these jumper settings, refer to the **IE-78K0-NS User's Manual (U13731E)**.

Table 3-2. Jumper Settings on IE-78K0-NS

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 to 3 shorted	1 to 2 shorted	1 to 2 shorted	5 to 6 shorted	1 to 2 shorted	3 to 4 shorted

[MEMO]

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-780233-NS-EM4's target interface circuit.

Although the target device is a CMOS circuit, the IE-780233-NS-EM4's target interface circuit consists of emulation circuits such as an emulation gate array, TTL, and CMOS-IC.

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

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

(1) Signals input/output to/from the emulation gate array and μPD7880
(2) Signals input/output to/from the emulation gate array and μPD7881
(3) Other signals

The IE-780233-NS-EM4's circuit is used as follows for signals listed in (1) to (3) above.

(1) Signals input/output to/from the emulation gate array and μPD7880

Refer to **Figure 4-1 Equivalent Circuit of Emulation Circuit 1**.

- ANI3 to ANI0
- P27/$\overline{\text{SCK3}}$ to P20/$\overline{\text{SCK1}}$
- AV_{SS}
- AV_{REF} (AV_{DD})
- $\overline{\text{RESET}}$
- X1

(2) Signals input/output to/from the emulation gate array and μPD7881

Refer to **Figure 4-2 Equivalent Circuit of Emulation Circuit 2**.

- P02/TI to P00/INTP0
- P37/FIP31 to P30/FIP24
- P47/FIP39 to P40/FIP32
- P57/FIP47 to P50/FIP40
- P64/FIP52 to P60/FIP48
- FIP23 to FIP0
- V_{LOAD}

(3) Other signals

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

- V_{DD0} to V_{DD2}
- V_{SS0}, V_{SS1}
- TEST/V_{PP}
- X2

Figure 4-1. Equivalent Circuit of Emulation Circuit 1

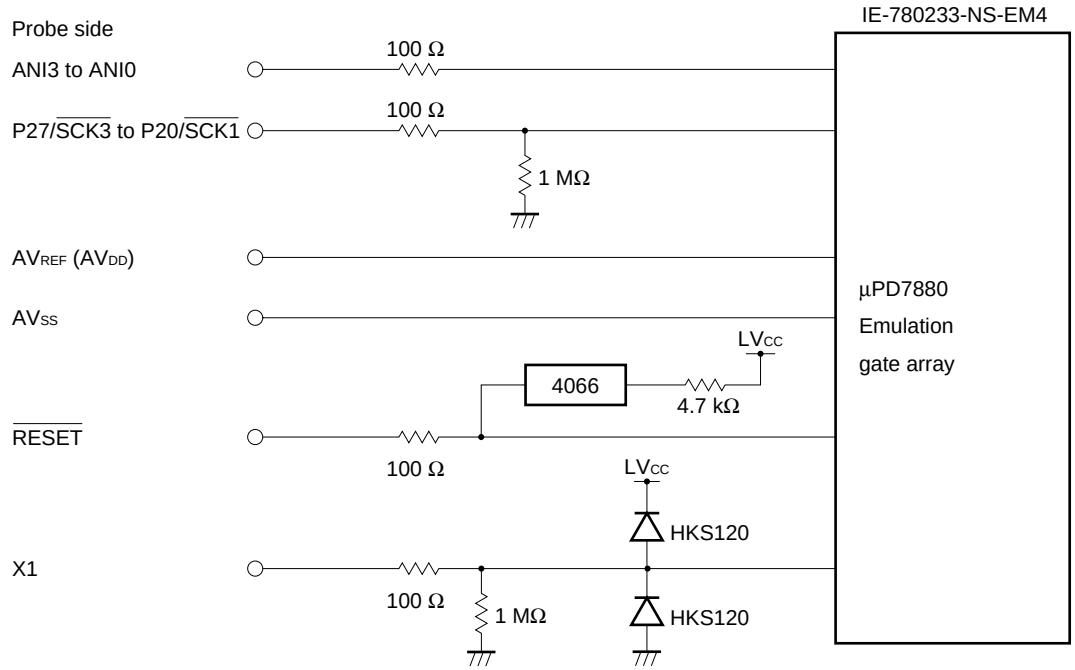


Figure 4-2. Equivalent Circuit of Emulation Circuit 2

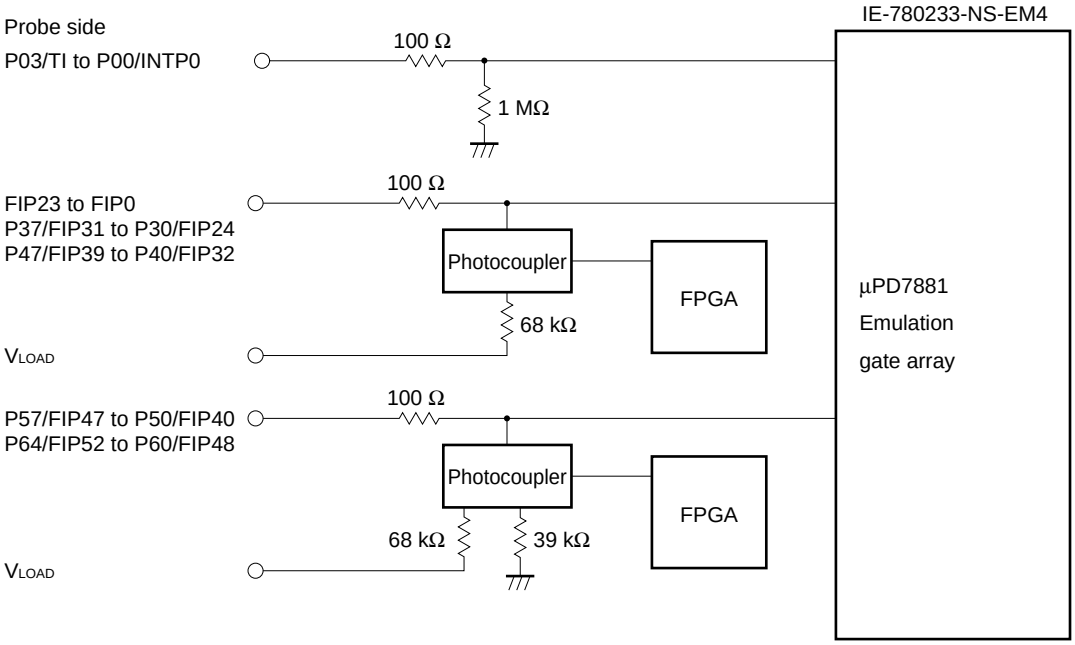
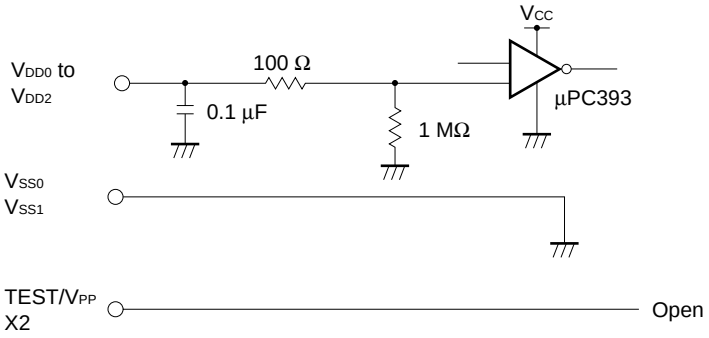


Figure 4-3. Equivalent Circuit of Emulation Circuit 3



[MEMO]

CHAPTER 5 RESTRICTIONS

This chapter describes restrictions in the IE-780233-NS-EM4.

When the IE system is started without connecting the target board, the initial value of each port becomes undefined.

Table 5-1. Initial Value of Each Port

	Emulator	Target CPU
Initial value of each port	Undefined	00H

[MEMO]

APPENDIX EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. NP-80GC Pin Assignments (1/2)

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

Remarks 1. The NP-80GC is a product of Naito Densei Machida Mfg. Co., Ltd.

2. The numbers in the “Emulation Probe” column indicate the corresponding pin number on the emulation probe tip.

Table A-1. NP-80GC Pin Assignments (2/2)

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

Remarks 1. The NP-80GC is a product of Naito Densei Machida Mfg. Co., Ltd.

2. The numbers in the “Emulation Probe” column indicate the corresponding pin number on the emulation probe tip.

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