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# **User's Manual**

# **IE-178054-NS-EM1**

## **Emulation Board**

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## **Target Devices** **μPD178054 Subseries**

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### Major Revisions in This Edition

Pages	Description
pp.38, 39	Modification of the size on the adapter block in figures <b>B-2. Connection Conditions of Target System (When Using NP-80GC-TQ)</b> , <b>B-3. Connection Conditions of Target System (When Using NP-H80GC-TQ)</b> .

The mark ★ shows major revised points.

INTRODUCTION

**Product Overview**      The IE-178054-NS-EM1 is designed to be used with the IE-78K0-NS or IE-78K0-NS-A to debug the following target devices that belong to the 178K Series of 8-bit single-chip microcontrollers.

- $\mu$ PD178054 Subseries:  $\mu$ PD178053, 178054, 178F054

**Target Readers**      This manual is intended for engineers who will use the IE-178054-NS-EM1 with the IE-78K0-NS or IE-78K0-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-178054-NS-EM1, refer to not only this manual (supplied with the IE-178054-NS-EM1) but also the manual that is supplied with the IE-78K0-NS or IE-78K0-NS-A.  
The IE-78K0-NS used in combination with the IE-78K0-NS-PA is functionally equivalent to the IE-78K0-NS-A. As necessary therefore, read IE-78K0-NS + IE-78K0-NS-PA for IE-78K0-NS-A in this document.

IE-78K0-NS or IE-78K0-NS-A User’s Manual	IE-178054-NS-EM1 User’s Manual
<ul style="list-style-type: none"><li>• Basic specifications</li><li>• System configuration</li><li>• External interface functions</li></ul>	<ul style="list-style-type: none"><li>• General</li><li>• Part names</li><li>• Installation</li><li>• Differences between target devices and target interface circuits</li></ul>

**Purpose**      This manual is intended to give users an understanding of the various debugging functions that can be performed when using the IE-178054-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.
Emulation gate array	This is the gate array block in the emulator that is used to execute user-generated programs.
Target device	This is device (real chip) that is the target for emulation.
Target system	This includes the target program and the hardware provided by the user. When defined narrowly, it includes only the hardware.
IE system	This refers to the combination of the IE-78K0-NS or IE-78K0-NS-A and the IE-178054-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 document may include preliminary versions. However, preliminary versions are not marked as such.

Document Name	Document Number
IE-78K0-NS	U13731E
IE-78K0-NS-A	U14889E
IE-178054-NS-EM1	This manual
ID78K Series Integrated Debugger Ver. 2.30 or Later Operation (Windows™ Based)	U15185E
μPD178054 Subseries	U15104E

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

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## CHAPTER 1 GENERAL

The IE-178054-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 178K Series of 8-bit single-chip microcontrollers.

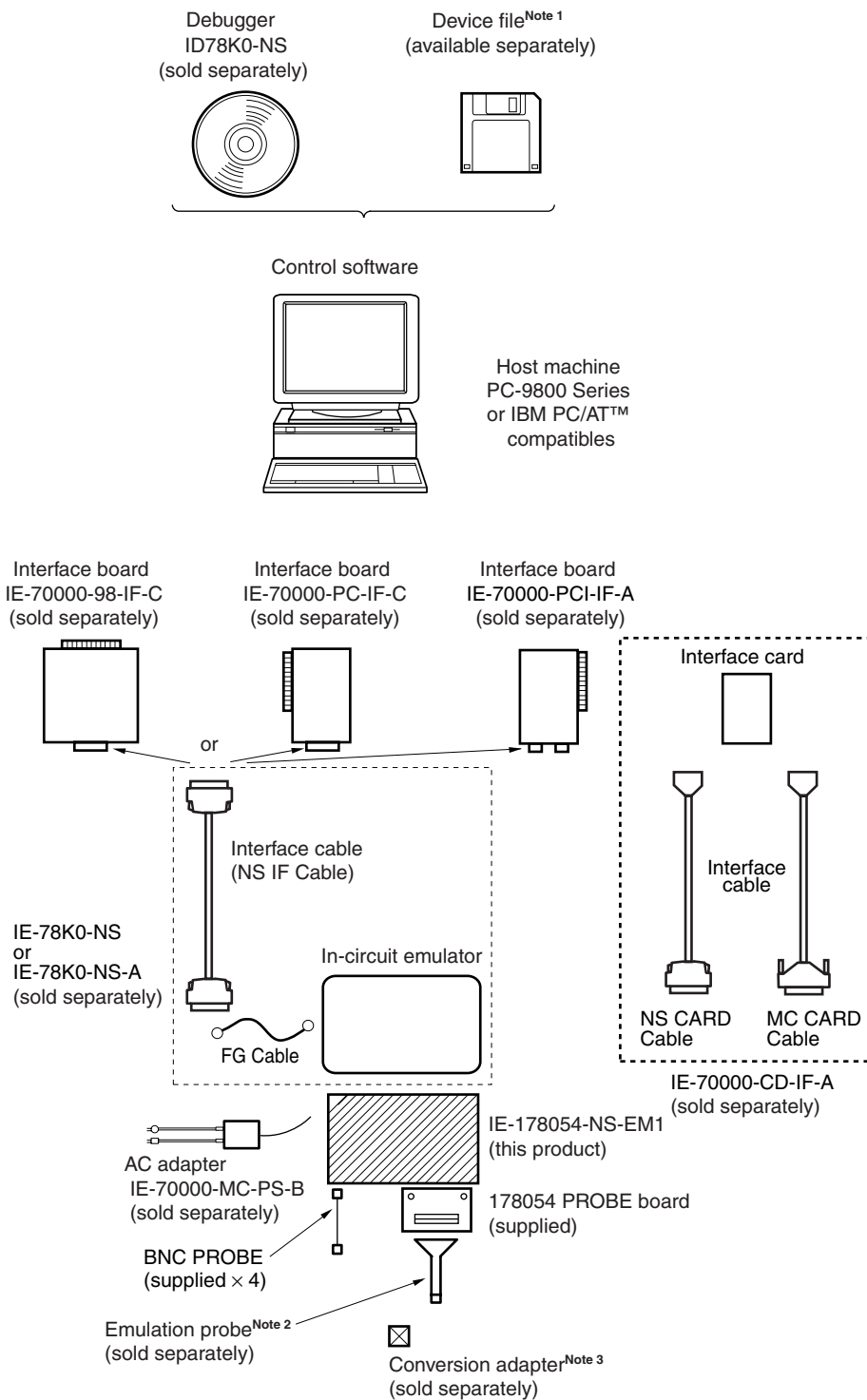
This chapter describes the IE-178054-NS-EM1's system configuration and basic specifications.

- Target devices
  - $\mu$ PD178054 Subseries

## 1.1 System Configuration

Figure 1-1 illustrates the IE-178054-NS-EM1's system configuration.

**Figure 1-1. System Configuration**



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

$\mu$ SxxxxDF178054:  $\mu$ PD178054 Subseries

The device file can be downloaded from the NEC Electron Devices Web site  
(URL: <http://www.ic.nec.co.jp/micro>).

**2.** The emulation probes are as follows, in accordance with the package.

NP-80GC-TQ: TQ-type probe for 80-pin plastic QFP (GC type)

NP-H80GC-TQ: TQ-type long probe for 80-pin plastic QFP (GC type)

The NP-80GC-TQ and NP-H80GC-TQ are products of Naito Densei Machida Mfg. Co., Ltd.

For further information, contact Naito Densei Machida Mfg. Co., Ltd. (TEL: +81-45-475-4191).

**3.** The conversion adapter is as follows, in accordance with the package.

TGC-080SBP: For 80-pin plastic QFP (QC type)

The TGC-080SBP is a product of TOKYO ELETECH CORPORATION.

For further information, contact Daimaru Kogyo, Ltd.

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

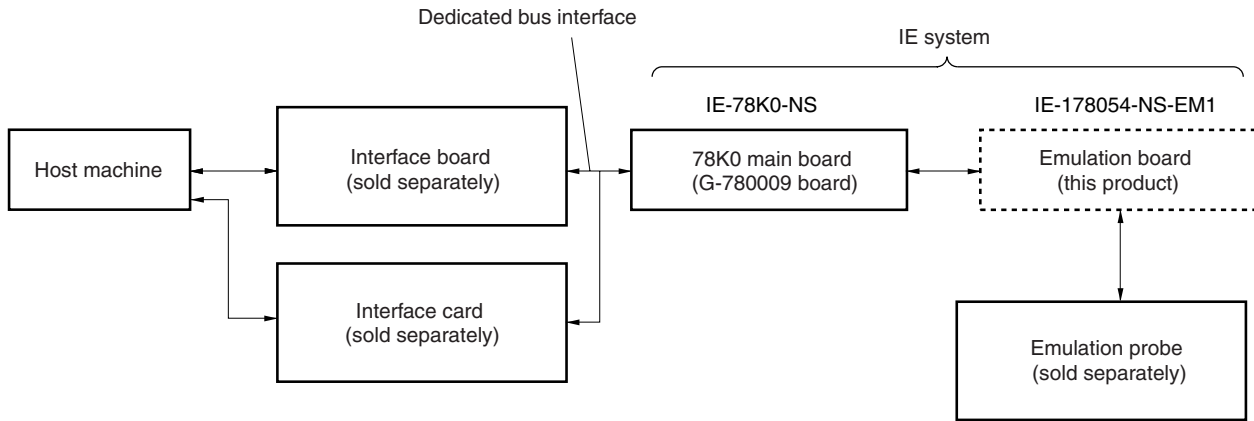
Osaka Electronics Department (TEL: +81-6-6244-6672)

Package	Emulation Probe	Conversion Adapter
80-pin plastic QFP (GC type)	NP-80GC-TQ	TGC-080SBP
	NP-H80GC-TQ	

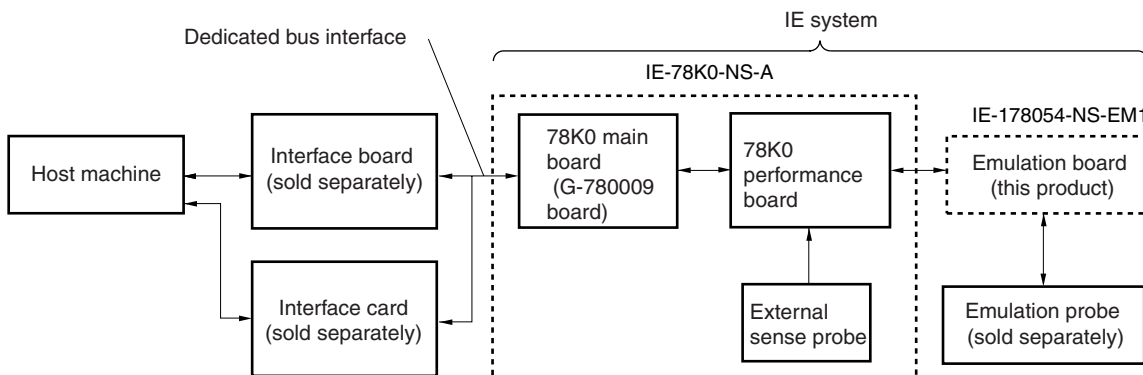
## 1.2 Hardware Configuration

Figures 1-2 and 1-3 show the IE-178054-NS-EM1's position in the basic hardware configuration.

**Figure 1-2. Basic Hardware Configuration (When Using IE-78K0-NS)**



**Figure 1-3. Basic Hardware Configuration (When Using IE-78K0-NS-A)**



### 1.3 Basic Specifications

The IE-178054-NS-EM1's basic specifications are listed in Table 1-1.

**Table 1-1. Basic Specifications**

Parameter	Description
Target device	$\mu$ PD178054 Subseries
System clock	4.5 MHz
Clock supply	External: Input via an emulation probe from the target system Internal: Clock mounted on emulation board (4.5 MHz), or clock mounted on parts board by user
Low-voltage support	$V_{DD} = 3.5$ to $5.5$ V (same as target device)

## CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-178054-NS-EM1 main unit.

The packing box contains the emulation board (IE-178054-NS-EM1).

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-178054-NS-EM1 Part Names

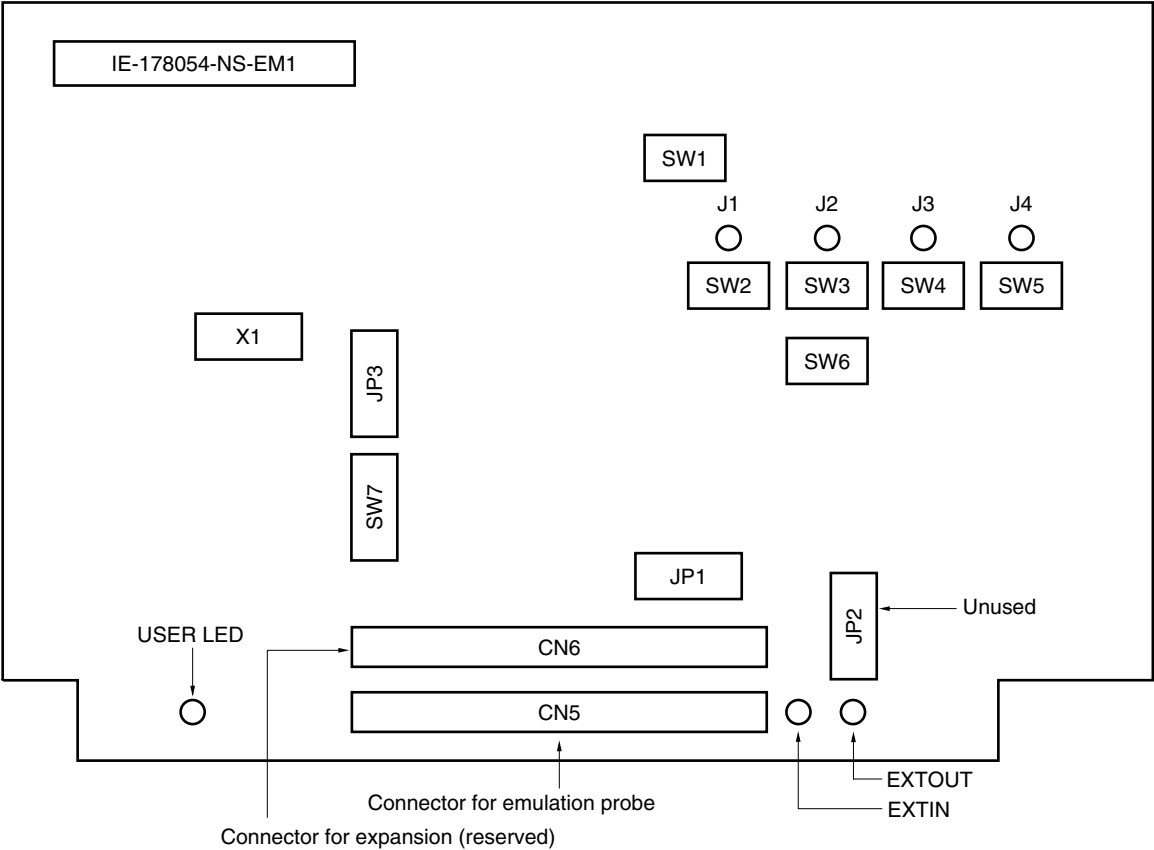
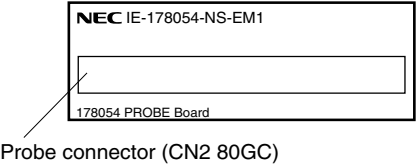


Figure 2-2. 178054 PROBE Board



## CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-178054-NS-EM1 to the IE-78K0-NS or IE-78K0-NS-A, emulation probe, etc. Mode setting methods are also described.

**Caution** Connecting or removing components to or from the target system, or making switch or other setting changes must be carried out after the power supply to both the IE system and the target system has been switched OFF.

### 3.1 Connection

#### (1) Connection with IE-78K0-NS or IE-78K0-NS-A main unit

See **IE-78K0-NS User's Manual (U13731E)** for a description of how to connect the IE-178054-NS-EM1 to the IE-78K0-NS. See **IE-78K0-NS-A User's Manual (U14889E)** for a description of how to connect the IE-178054-NS-EM1 to the IE-78K0-NS-A.

#### (2) Connection with emulation probe

See the manual of the in-circuit emulator to be used (**IE-78K0-NS User's Manual (U13731E)** or **IE-78K0-NS-A User's Manual (U14889E)**) for a description of how to connect the emulation probe to the IE-178054-NS-EM1. Connect the emulation probe to CN2 on the 178054 PROBE board.

#### (3) Connection with 178054 PROBE board

Connect CN5 of the IE-178054-NS-EM1 and CN1 of the 178054 PROBE board, aligning pin 1 of each.

#### (4) Connection with BNC PROBE

Connect the supplied BNC PROBE to the J1 to J4 connectors on the IE-178054-NS-EM1. Signals corresponding to J1 to J4 are as follows. Connect to amplify inputs from the target system.

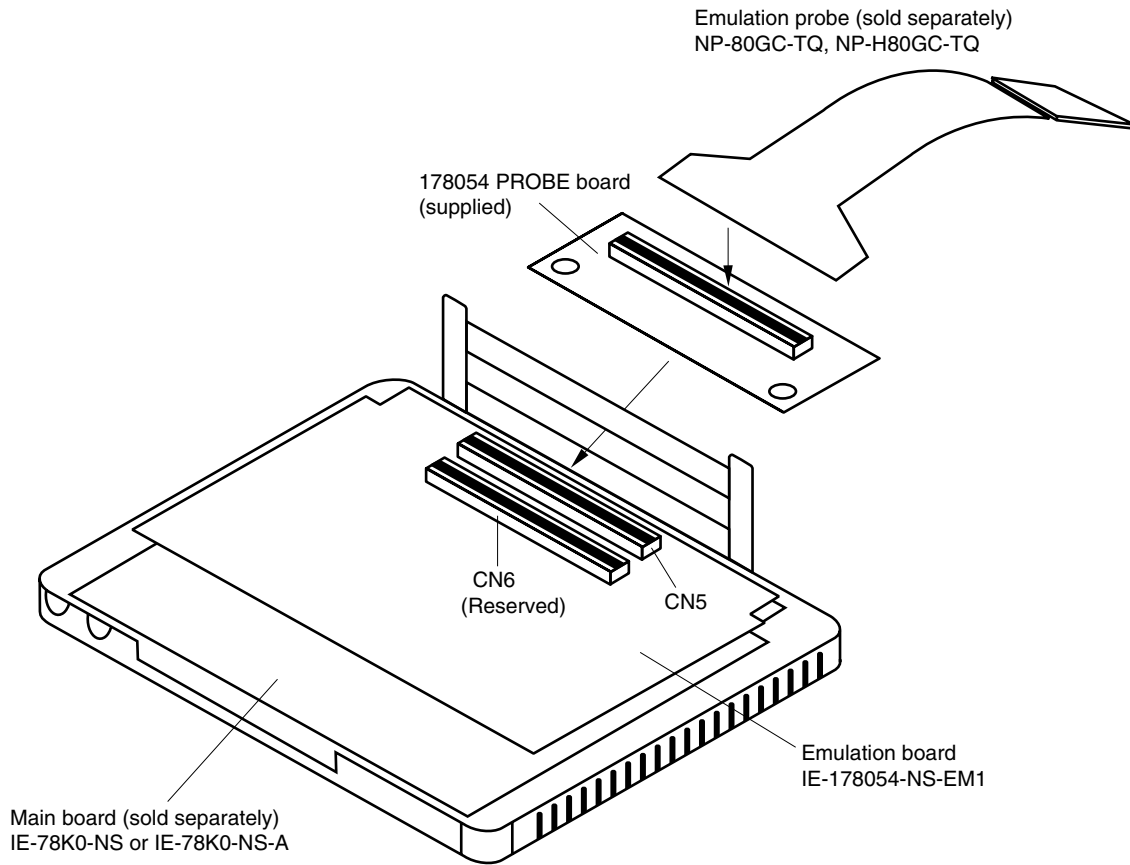
J1: VCOL  
J2: VCOH  
J3: FMIFC  
J4: AMIFC

#### **Cautions** 1. Incorrect connection may damage the IE system.

Be sure to read the emulation probe's user's manual for a detailed description of the correct connection method.

#### 2. Do not use CN6 as this connector is for expansion.

Figure 3-1. Connection of Emulation Probe



## 3.2 Clock Settings

### 3.2.1 Overview of clock settings

The 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

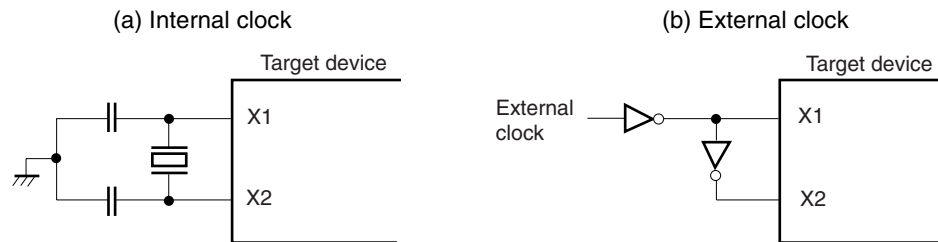
If the target system includes an internal clock, select either **(1) Clock that is already mounted on emulation board** or **(2) Clock that is mounted by user**. For an internal clock, the target device is connected to a resonator and the target device's internal oscillator is used. An example of the 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 which is connected to the IE-78K0-NS or IE-78K0-NS-A 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.

**Caution** The IE system will be hung-up if the system clock is not supplied normally. Moreover, be sure to input a rectangular wave as the clock from the target. There is no need to supply a clock to the X2 pin.

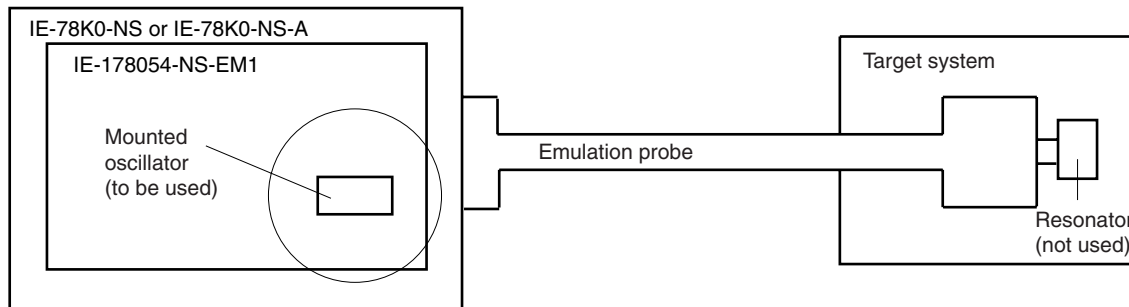
Figure 3-2. External Circuits Used as System Clock Oscillator



**(1) Clock that is already mounted on emulation board**

A crystal oscillator is already mounted on the emulation board. Its frequency is 4.5 MHz.

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

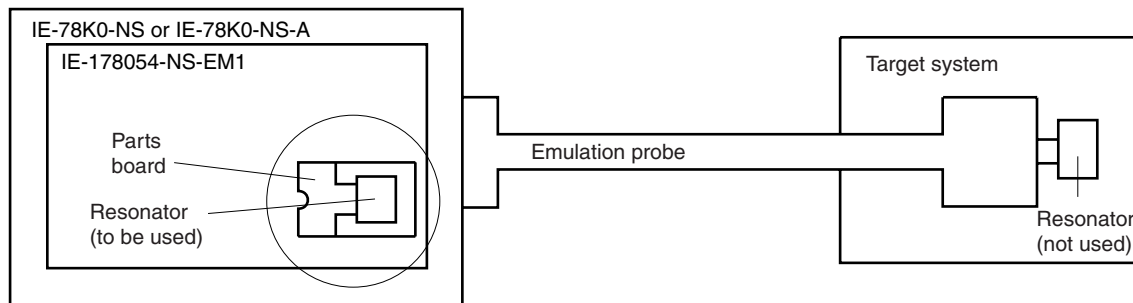


**Remark** The clock that is supplied by the IE-178054-NS-EM1's oscillator (encircled in the figure) is used.

**(2) Clock that is mounted by user**

The user is able to mount any clock supported by the set specifications on the IE-178054-NS-EM1. First mount the resonator on the parts board, then attach the parts board to the IE-178054-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**

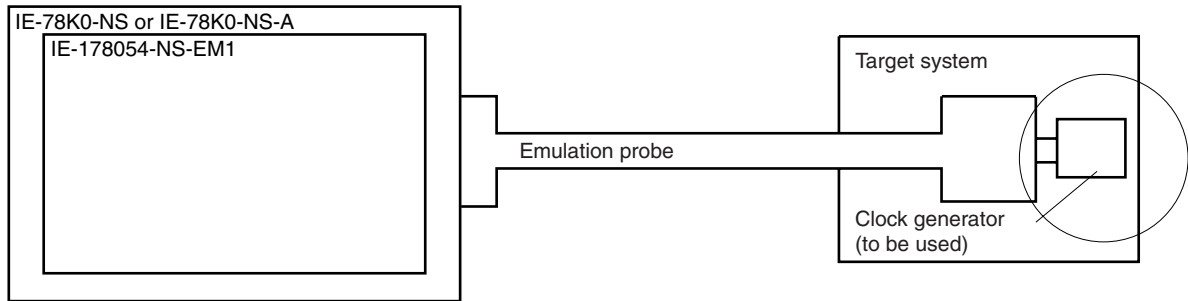


**Remark** The clock that is supplied by the IE-178054-NS-EM1's resonator (encircled in the figure) is used.

**(3) External clock**

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

**Figure 3-5. When Using an External Clock**



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

### 3.2.2 System clock settings

**Table 3-1. System Clock Settings**

Frequency of System Clock		IE-178054-NS-EM1	CPU Clock Source Selection (ID)
		Parts Board (X1)	
When using clock that is already mounted on emulation board	4.5 MHz	Oscillator used	Internal
When using clock mounted by user	Other than 4.5 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** The IE-178054-NS-EM1’s factory settings are those listed above under “when using clock that is already mounted on emulation board”.

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

When the IE-178054-NS-EM1 is shipped, a 4.5 MHz crystal oscillator is already mounted in the IE-178054-NS-EM1’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**

Set as described under either (a) or (b), according to 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

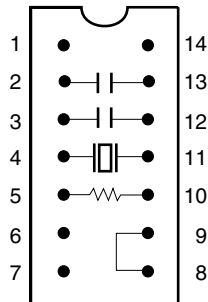
- Parts board
- Ceramic resonator or crystal resonator
- Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

## &lt;Steps&gt;

- <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).

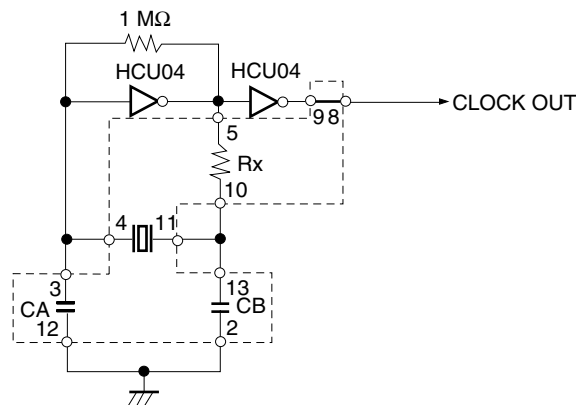
**Figure 3-6. Connections on Parts Board (When Using User-Mounted Clock)**

Parts board (X1)



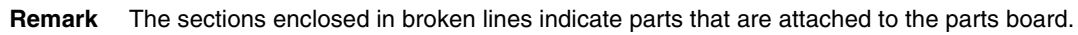
Pin No.	Connection
2 to 13	Capacitor CB
3 to 12	Capacitor CA
4 to 11	Ceramic resonator or crystal resonator
5 to 10	Resistor Rx
8 to 9	Shorted

Circuit diagram



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

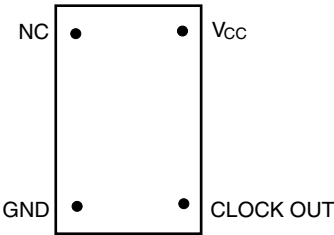
- The above steps configure the following circuit and enable supply of the clock from the mounted resonator to the emulation device.



(b) When using a crystal oscillator

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

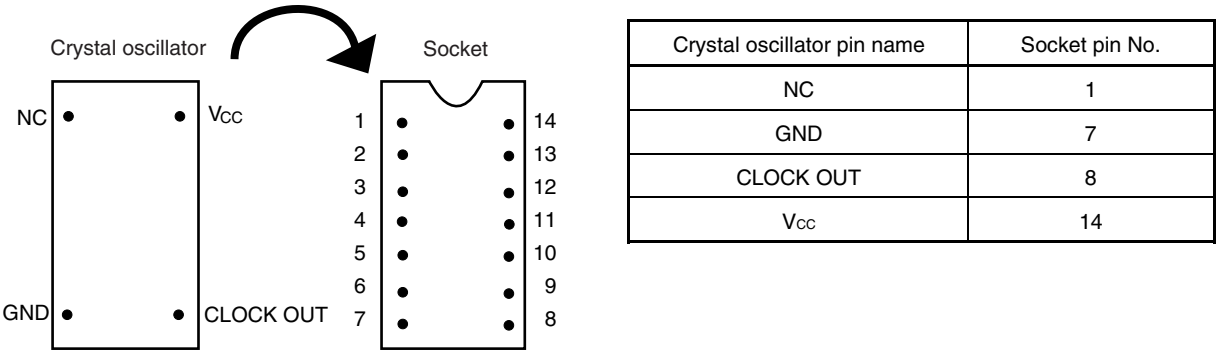
Figure 3-7. Crystal Oscillator (When Using User-Mounted Clock)



<Steps>

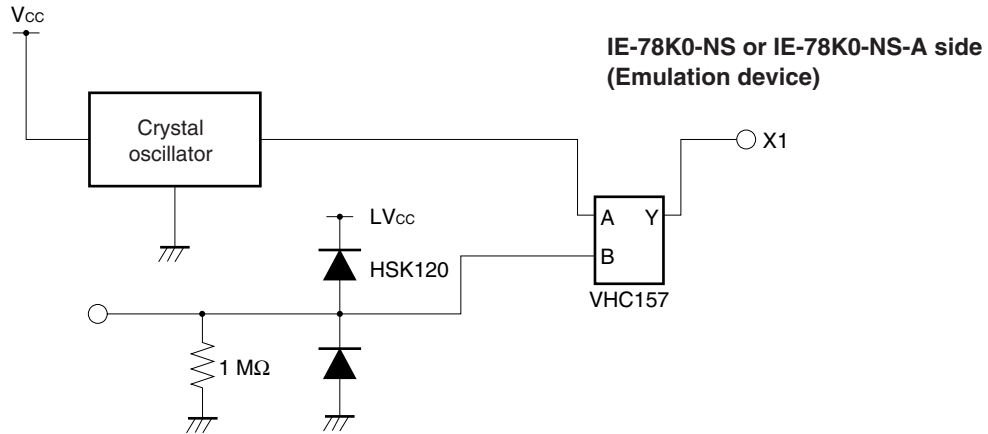
- <1> Prepare the IE-178054-NS-EM1.
- <2> Remove the crystal oscillator that is mounted in the IE-178054-NS-EM1's socket (the socket marked as X1).
- <3> Connect the crystal oscillator (from <2> above) to the socket (X1) from which the crystal oscillator was removed. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

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



- <4> Install the IE-178054-NS-EM1 in the IE-78K0-NS or IE-78K0-NS-A.

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



### (3) When using external clock

No hardware settings are required for this situation.

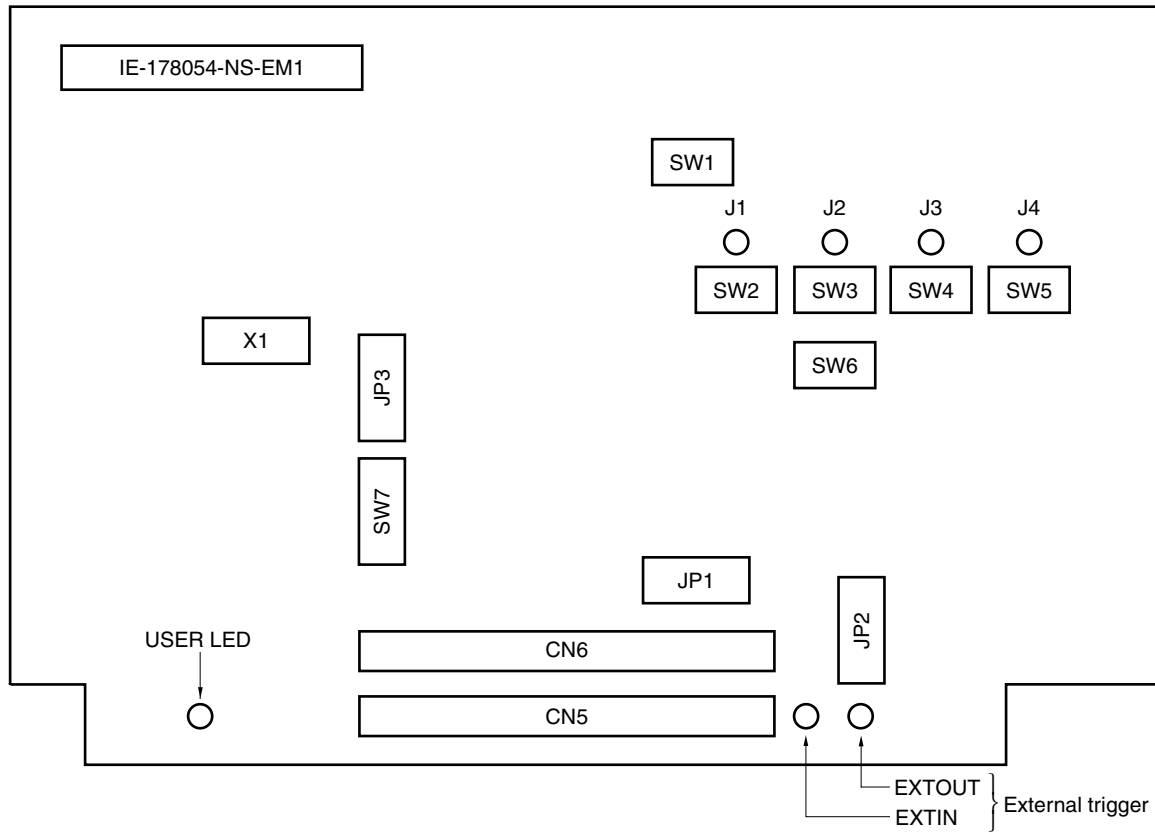
When starting the integrated debugger (ID78K0-NS), open the configuration dialog box and select “External” in the area (Clock) for selecting the CPU’s clock source (this selects the user’s clock).

### 3.3 External Trigger

To set up an external trigger, connect it to the IE-178054-NS-EM1's check pins EXTOUT and EXTIN as shown below.

See the **ID78K Series Integrated Debugger Ver. 2.30 or Later Operation User's Manual (Windows Based) (U15185E)** for the usage method, and the **IE-78K0-NS User's Manual (U13731E)** or **IE-78K0-NS-A User's Manual (U14889E)** for the pin characteristics.

Figure 3-9. External Trigger Input Position



### 3.4 Jumper Settings on IE-78K0-NS

When using the IE-178054-NS-EM1, set the jumpers on the IE-78K0-NS as shown below.  
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	1 to 2 shorted

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

### 3.5 Jumper Settings on IE-78K0-NS-A

When using the IE-178054-NS-EM1, set the jumpers on the IE-78K0-NS-A as shown below.  
For details of these jumper settings, refer to the **IE-78K0-NS-A User's Manual (U14899E)**.

**Table 3-3. Jumper Settings of G-780009 Board of IE-78K0-NS-A**

	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	1 to 2 shorted

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

**Table 3-4. Jumper Settings of G-78K0H Option Board of IE-78K0-NS-A**

	JP2
Setting	2 to 3 shorted

### 3.6 Jumper Settings on IE-178054-NS-EM1

Set the jumpers on the IE-178054-NS-EM1 as follows (factory settings).  
Do not change the jumper settings.

**Table 3-5. Jumper Settings on IE-178054-NS-EM1**

	JP1	JP2	JP3
Setting	1 to 2 shorted	2 to 3 shorted	1 to 2 shorted

### 3.7 Switch Settings on IE-178054-NS-EM1

Set the switches on the IE-178054-NS-EM1 as shown below.

**Table 3-6. Switch Settings on IE-178054-NS-EM1**

Switch	Signal Name	Setting	Meaning	Factory Setting
SW1	–	PORT side	Do not change from the factory setting (target device selected)	PORT side
SW2	VCOL	AMP side	Via the amplifier of this product	AMP side
		NO AMP side	Not via the amplifier of this product	
SW3	VCOH	AMP side	Via the amplifier of this product	AMP side
		NO AMP side	Not via the amplifier of this product	
SW4	FMIFC	AMP side	Via the amplifier of this product	AMP side
		NO AMP side	Not via the amplifier of this product	
SW5	AMIFC	AMP side	Via the amplifier of this product	AMP side
		NO AMP side	Not via the amplifier of this product	
SW6	–	124 side	Do not change from the factory setting (pin selected)	124 side
SW7	REGOSC, REGCPU	I side	Pins are processed <sup>Note</sup> on this product (processed on the I side normally)	I side
		U side	Pins are processed on the target system	

**Note** Connect to GND via a capacitor (0.1  $\mu$ F).

### 3.8 Low-Voltage Emulation Setting

When the target system is operating on low voltage, supply the same voltage as the target system to the TP1 terminal pin on the main board (G-780009 board) of the IE-78K0-NS or IE-78K0-NS-A (this is unnecessary when target system is operating on 5 V).

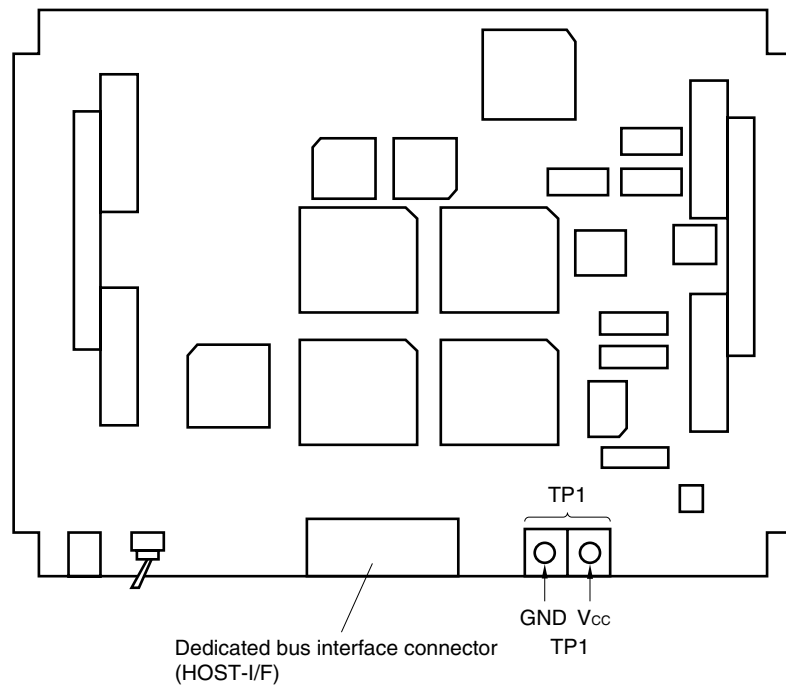
Set the supply voltage of the target system to between 3.5 V and 5.0 V.

**Caution** To emulate at 4.5 V or lower, first start at 5 V, and then lower the target system voltage.

**Table 3-7. Supply Voltage and Maximum Current Consumption**

Supply Voltage to TP1	Maximum Current Consumption of TP1
3.5 V to 5.0 V	300 mA

**Figure 3-10. Main Board (G-780009 Board) of IE-78K0-NS or IE-78K0-NS-A**



## 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-178054-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-178054-NS-EM1's target interface circuit consists of an emulation CPU, emulation gate array, TTL, CMOS-IC, and other components.

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

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

- (1) Signals input to or output from the emulation gate array ( $\mu$ PD7880)
- (2) Signals input to or output from the emulation gate array ( $\mu$ PD7883)
- (3) Signals input or output from the emulation CPU ( $\mu$ PD178F054)
- (4) Signals input or output from the emulation CPU ( $\mu$ PD780009)
- (5) Other signals

The IE system's circuit is used as follows for the signals listed in (1) to (5) above.

**(1) Signals input to or output from the emulation gate array ( $\mu$ PD7880)**

See **Figure 4-1 Equivalent Circuit 1 of Emulation Circuit.**

- P57 to P50
- P67 to P60

**(2) Signals input to or output from the emulation gate array ( $\mu$ PD7883)**

See **Figure 4-2 Equivalent Circuit 2 of Emulation Circuit.**

- P47 to P40

**(3) Signals input to or output from the emulation CPU ( $\mu$ PD178F054)**

See **Figure 4-3 Equivalent Circuit 3 of Emulation Circuit.**

- P06 to P00
- P15 to P10
- P37 to P30
- P77 to P70
- P125 to P120
- P132 to P130
- EO1, EO0
- REGCPU, REGOSC
- J1 to J4 (AMIFC, FMIFC, VCOL, VCOH)

**(4) Signals input to or output from the emulation CPU ( $\mu$ PD780009)**

See **Figure 4-4 Equivalent Circuit 4 of Emulation Circuit.**

- X1
- $\overline{\text{RESET}}$

(5) Other signals

See Figure 4-5 Equivalent Circuit 5 of Emulation Circuit.

- GND, GNDPORT
- $V_{DD}$
- $V_{DDPORT}$ ,  $V_{DDPLL}$ , GNDPLL
- IC/ $V_{PP}$
- X2
- AMIFC, FMIFC, VCOL, VCOH

Figure 4-1. Equivalent Circuit 1 of Emulation Circuit



Figure 4-2. Equivalent Circuit 2 of Emulation Circuit



Figure 4-3. Equivalent Circuit 3 of Emulation Circuit

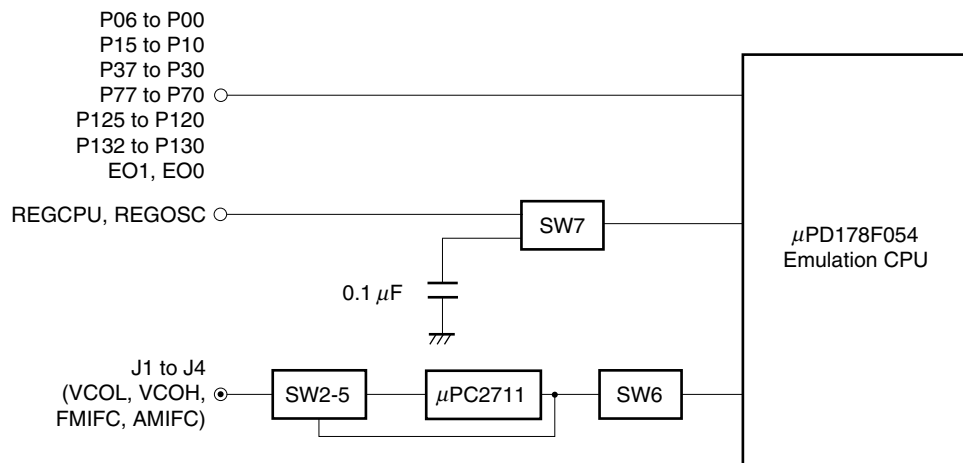


Figure 4-4. Equivalent Circuit 4 of Emulation Circuit

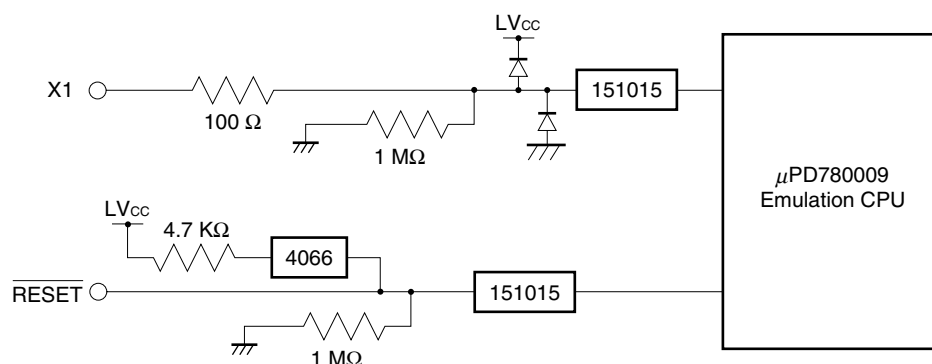
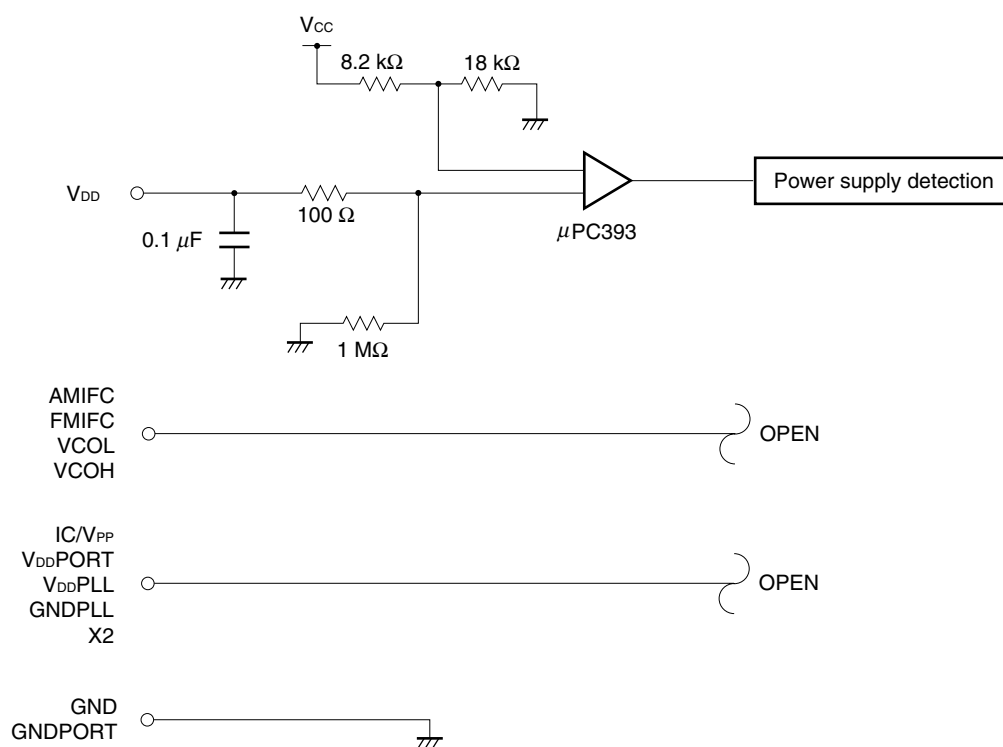


Figure 4-5. Equivalent Circuit 5 of Emulation Circuit



## CHAPTER 5 RESTRICTIONS

The restrictions on the IE-178054-NS-EM1 are described in this chapter.

If 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 (When Target Board Is Not Connected)**

	Emulator	Target CPU
Initial value of port	Undefined	00H

## APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

**Table A-1. NP-80GC-TQ and NP-H80GC-TQ Pin Assignments**

Emulation Probe	CN2 Pin No.	Emulation Probe	CN2 Pin No.
1	114	41	8
2	113	42	7
3	108	43	14
4	107	44	13
5	104	45	18
6	103	46	17
7	100	47	22
8	99	48	21
9	94	49	28
10	93	50	27
11	30	51	92
12	29	52	91
13	24	53	98
14	23	54	97
15	20	55	102
16	19	56	101
17	16	57	106
18	15	58	105
19	10	59	112
20	9	60	111
21	37	61	83
22	43	62	77
23	44	63	78
24	47	64	73
25	48	65	74
26	51	66	69
27	52	67	70
28	57	68	63
29	58	69	64
30	59	70	61
31	60	71	62
32	55	72	65
33	56	73	66
34	49	74	71
35	50	75	72
36	45	76	75
37	46	77	76
38	41	78	79
39	42	79	80
40	35	80	85

- Remarks**
1. The NP-80GC-TQ and NP-H80GC-TQ are products of Naito Densetsu Machida Mfg. Co., Ltd.
  2. The numbers in the “Emulation Probe” column indicate the corresponding pin number on the emulation probe tip.
  3. The numbers in the “CN2 Pin No.” column indicate the corresponding pin number of CN2 on the 178054 PROBE board.

## APPENDIX B NOTES ON TARGET SYSTEM DESIGN

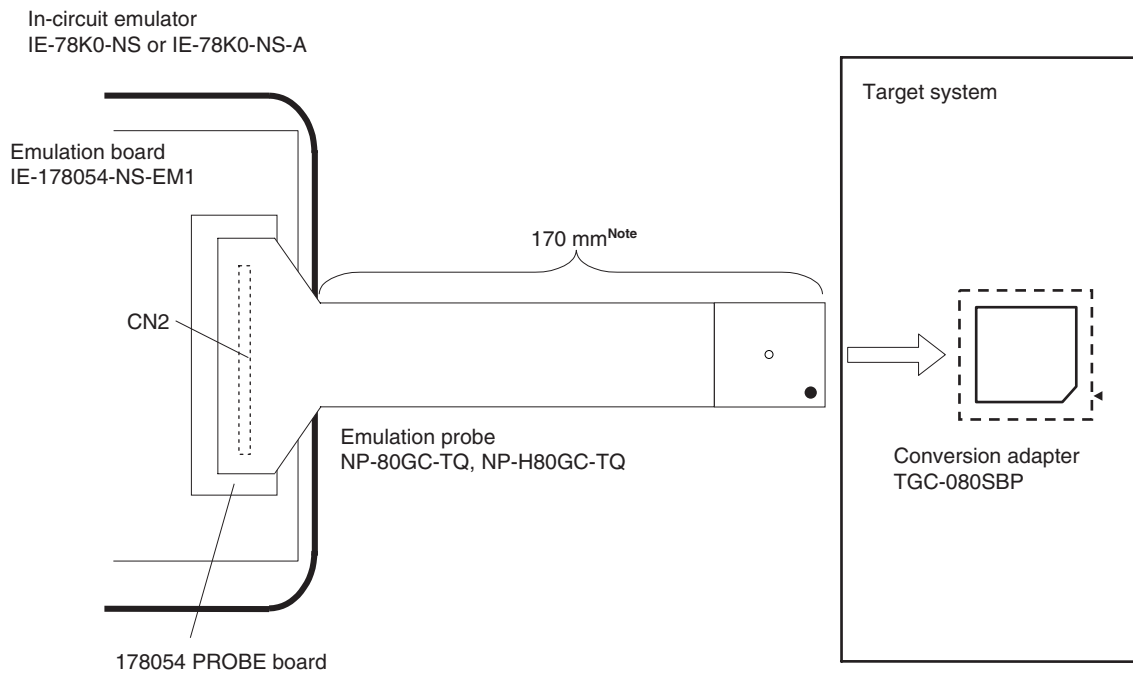
The following shows a diagram of the connection conditions between the emulation probe and conversion adapter. Design your system making allowances for conditions such as the shape of parts mounted on the target system, as shown below.

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

**Table B-1. Distance Between IE System and Conversion Adapter**

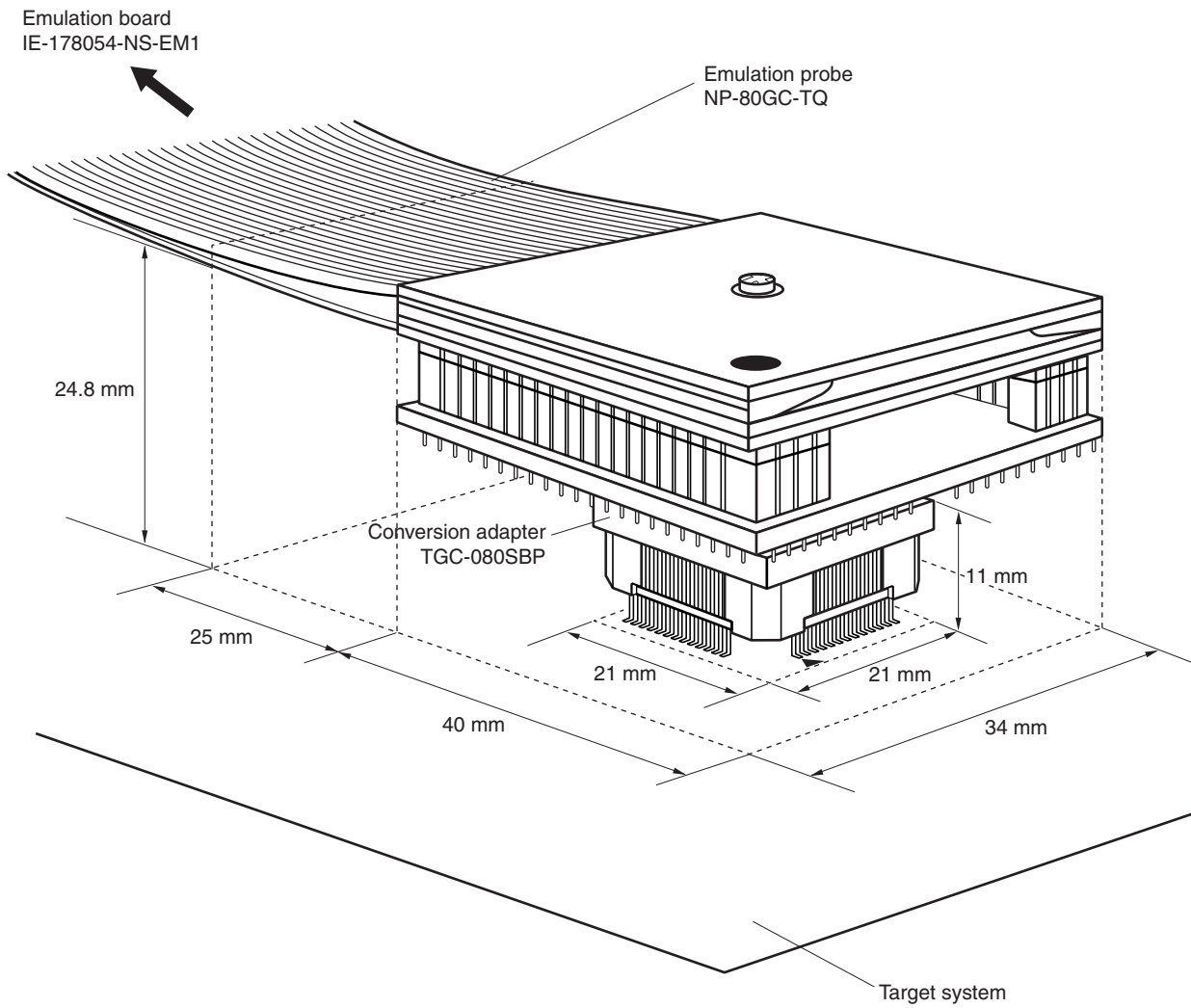
Emulation Probe	Conversion Adapter	Distance Between IE System and Conversion Adapter
NP-80GC-TQ	TGC-080SBP	170 mm
NP-H80GC-TQ		370 mm

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

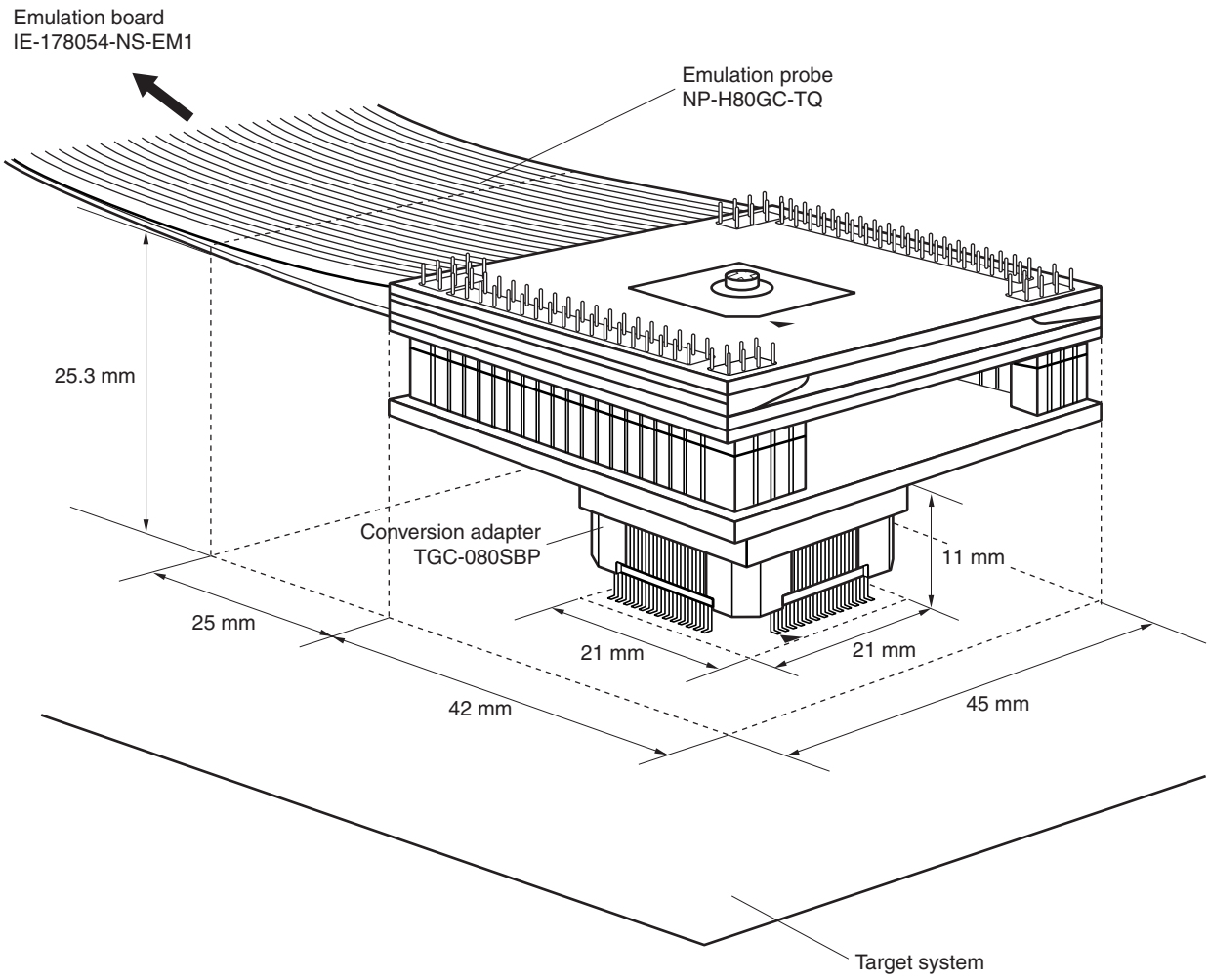


**Note** Distance when using NP-80GC-TQ. This is 370 mm when using NP-H80GC-TQ.

★

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

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



[MEMO]

**[MEMO]**

[MEMO]

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