

**NEC**

**User's Manual**

# **IE-178018-NS-EM1**

**Emulation Board**

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**Target device**  
**μPD178018 Subseries**

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# INTRODUCTION

## Product Overview

The IE-178018-NS-EM1 is designed to be used with the IE-78K0-NS to debug the following target devices that belong to the 178K Series of 8-bit single-chip microcontrollers.

- $\mu$ PD178018 Subseries:  $\mu$ PD178004, 178006, 178016, 178018, 178P018

## Target Readers

This manual is intended for engineers who will use the IE-178018-NS-EM1 with the IE-78K0-NS to perform system debugging.

Engineers who use this manual are expected to be thoroughly familiar with the target device's functions and use methods and to be knowledgeable about debugging.

## Organization

When using the IE-178018-NS-EM1, refer to not only this manual (supplied with the IE-178018-NS-EM1) but also the manual that is supplied with the IE-78K0-NS.

IE-78K0-NS User's Manual
-----------------------------

- Basic specifications
- System configuration
- External interface functions

IE-178018-NS-EM1 User's Manual
-----------------------------------

- 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-178018-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 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 and the IE-178018-NS-EM1.

## Conventions

Data significance: Higher digits on the left and lower digits on the right

**Note:** Footnote for item marked with **Note** in the text

**Caution:** Information requiring particular attention

**Remark:** Supplementary information

## Related Documents

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

Document Name	Document Number	
	English	Japanese
IE-78K0-NS	To be prepared	U13731J
IE-178018-NS-EM1	This manual	U14012J
ID78K0-NS Integrated Debugger Reference Windows™ Based	U12900E	U12900J
μPD178018 Subseries	U11410E	U11410J

**Caution** The 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-178018-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.

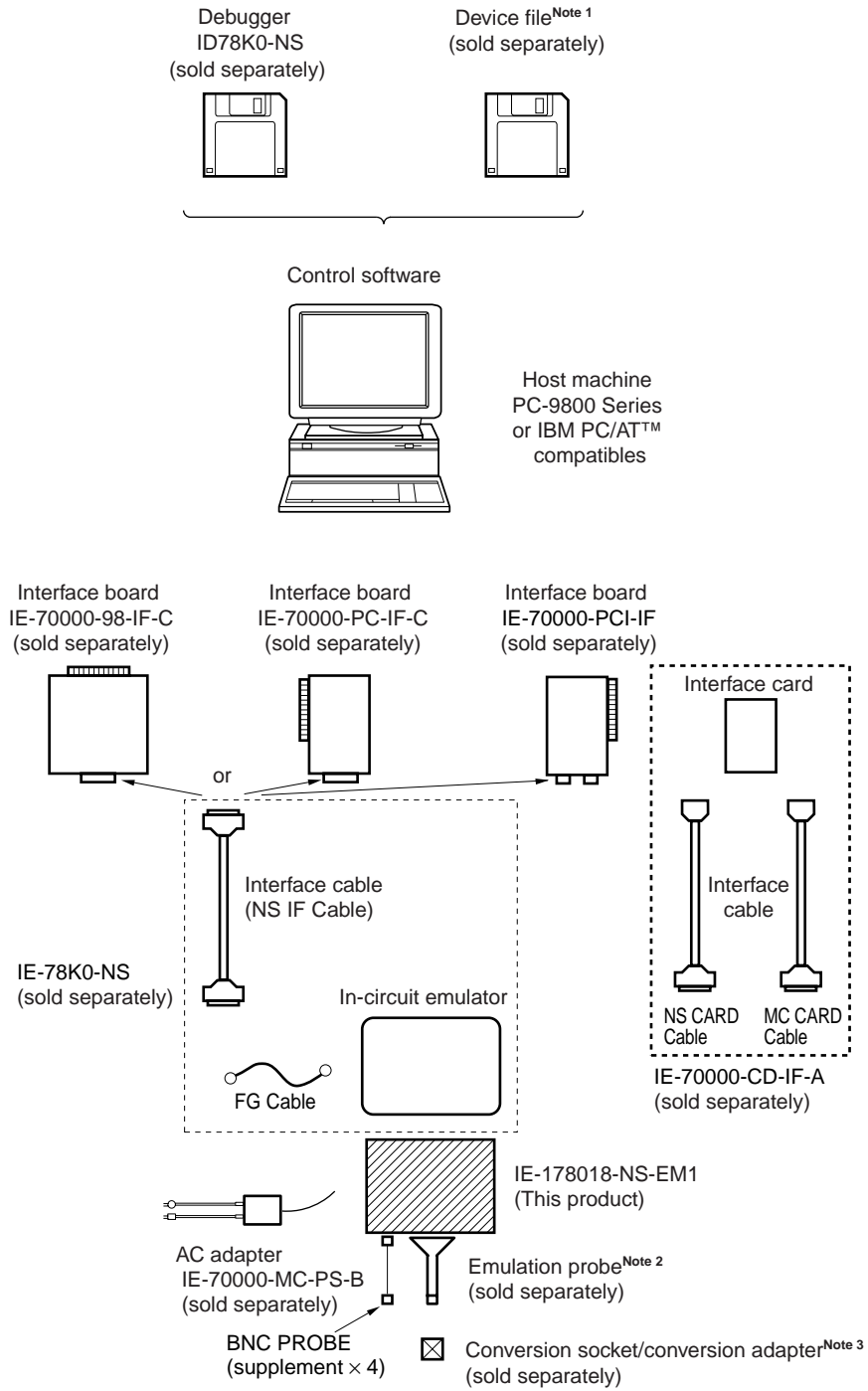
This chapter describes the IE-178018-NS-EM1's system configuration and basic specifications.

- Target device
  - $\mu$ PD178018 Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-178018-NS-EM1's system configuration.

Figure 1-1. System Configuration



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

$\mu$ SxxxxDF178018:  $\mu$  PD178018 Subseries

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

NP-80GC: 80-pin plastic QFP (GC-3B9 type)

NP-80GC-TQ: 80-pin plastic WQFN (KK-T type)

The NP-80GC and NP-80GC-TQ are products of Naitou Densai Machidaseisakusho Co., Ltd.

For further information, contact Naitou Densai Machidaseisakusho 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-3B9 type)

TGC-080SBP: 80-pin plastic WQFN (KK-TQ)

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

For further information, contact Daimaru Kogyo Co., Ltd.

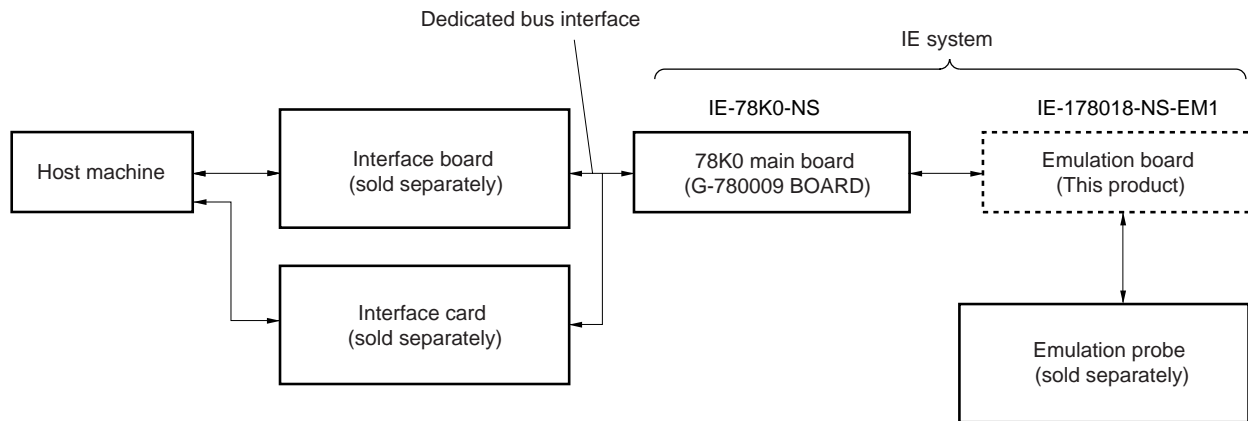
Tokyo Electronics Department (TEL: +81-3-3820-7112)

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

## 1.2 Hardware Configuration

Figure 1-2 shows the IE-178018-NS-EM1's position in the basic hardware configuration.

**Figure 1-2. Basic Hardware Configuration**



### 1.3 Basic Specifications

The IE-178018-NS-EM1's basic specifications are listed in Table 1-1.

**Table 1-1. Basic Specifications**

Parameter	Description
Target device	$\mu$ PD178018 Subseries
System clock	4.5 MHz
Clock supply	External: Input via an emulation probe from the target system Internal: Mounted on emulation board (4.5 MHz), or mounted on the board by the user
Low-voltage support	$V_{DD} = 3.5$ to $5.5$ V (same as target device)

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## CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-178018-NS-EM1 main unit.

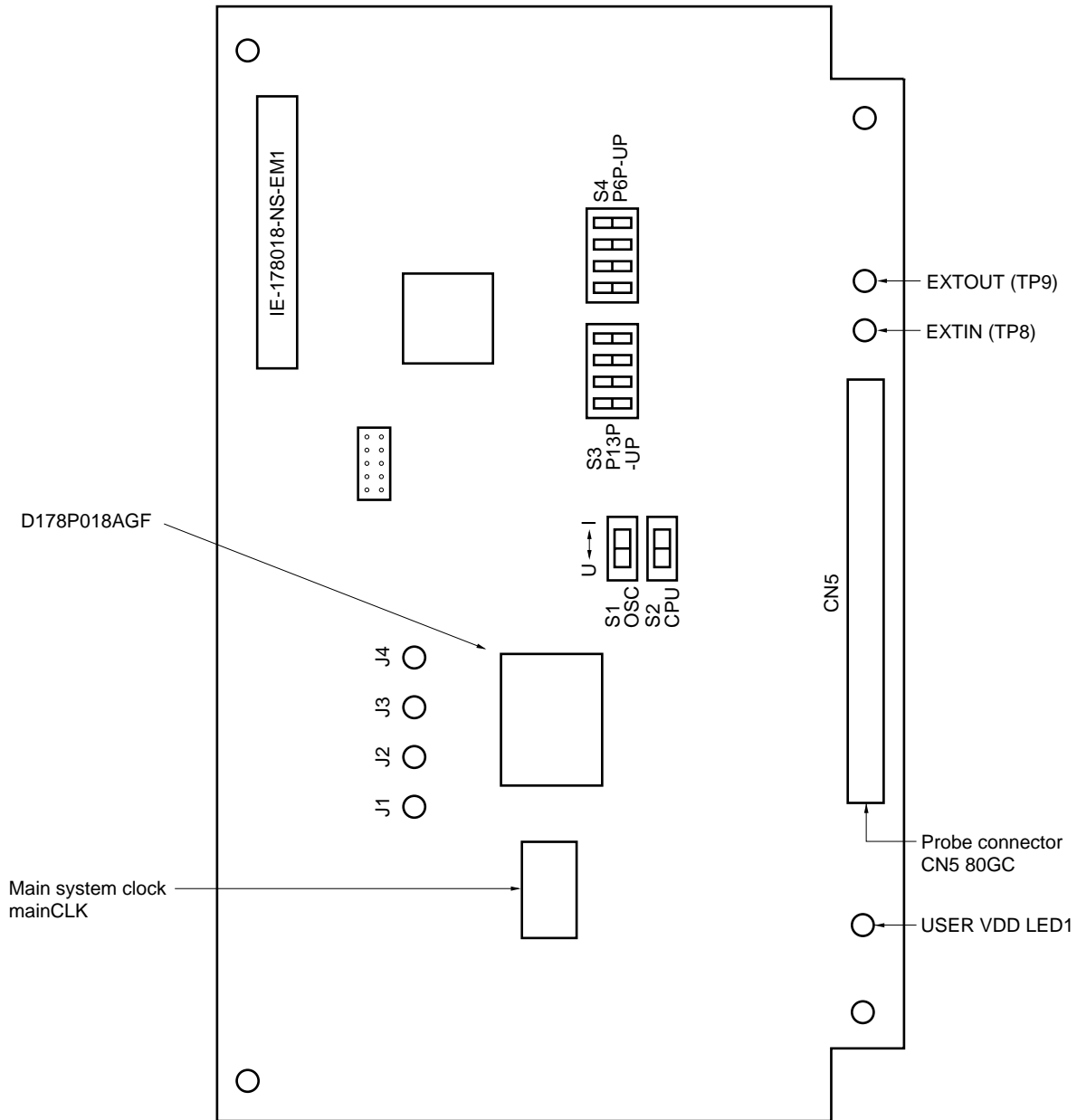
The packing box contains the emulation board (IE-178018-NS-EM1).

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

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

2.1 Parts of Main Unit

Figure 2-1. IE-178018-NS-EM1 Part Names



## CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-178018-NS-EM1 to the IE-78K0-NS, emulation probe, etc. Mode setting methods are also described.

### 3.1 Connection

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

See the IE-78K0-NS User's Manual for a description of how to connect the IE-178018-NS-EM1 to the IE-78K0-NS.

#### (2) Connection with emulation probe

See the IE-78K0-NS User's Manual for a description of how to connect an emulation probe to the IE-178018-NS-EM1.

Connect the emulation probe to CN5.

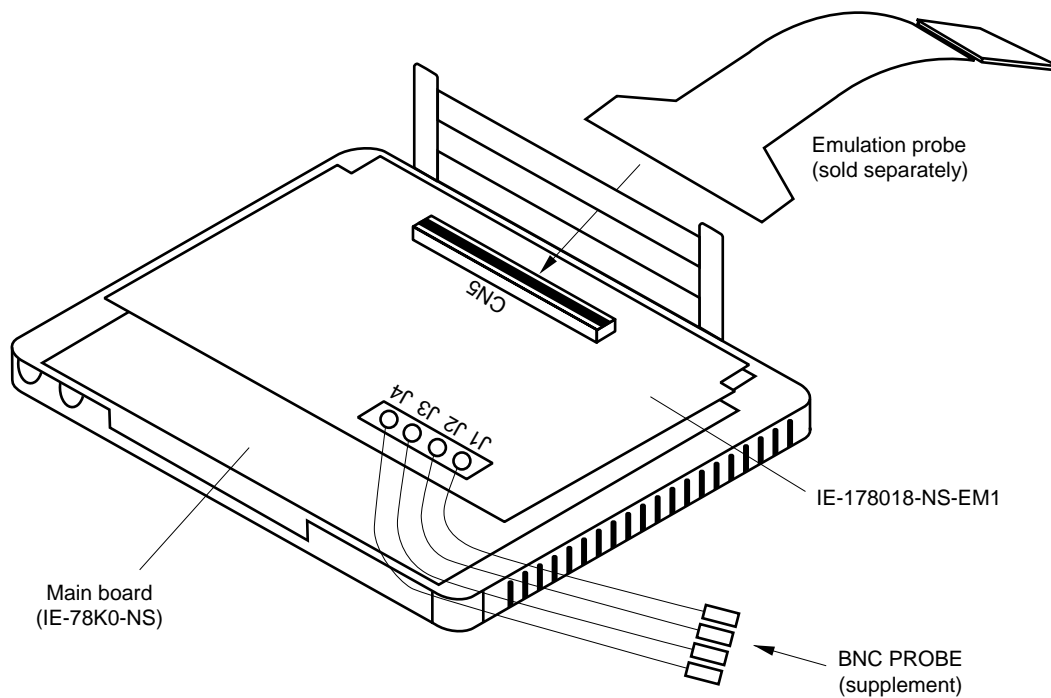
#### (3) Connection with BNC PROBE

Connect supplementary BNC PROBE to the J1 to J4 connectors on the IE-178018-NS-EM1.

**Caution** Use of incorrect connection methods 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.

Figure 3-1. Connection of Emulation Probe



## 3.2 Clock Settings

### 3.2.1 Overview of clock settings

The main system and subsystem clocks 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

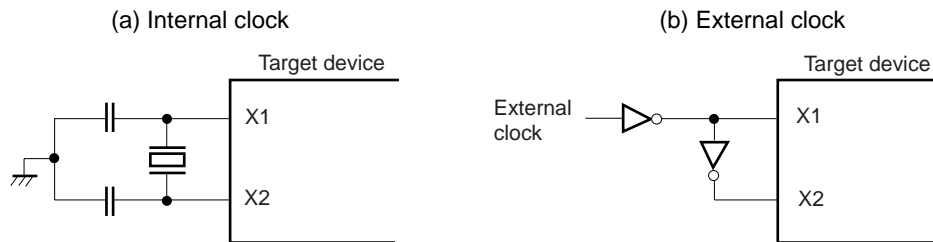
If the target system includes an internal clock, select either “(1) Clock that is already mounted on emulation board” or “(2) Clock that is mounted by user”. For an internal clock, the target device is connected to a resonator and the target device’s internal oscillator is used. An example of the external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

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 main 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 X2 pin.

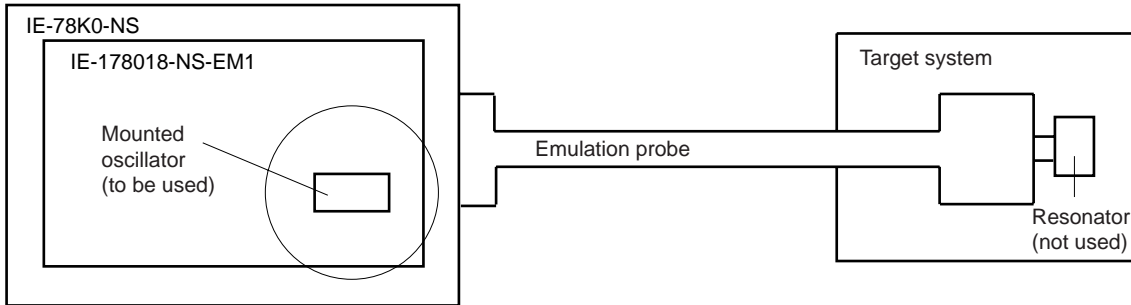
Figure 3-2. External Circuits Used as System Clock Oscillation Circuit



**(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**

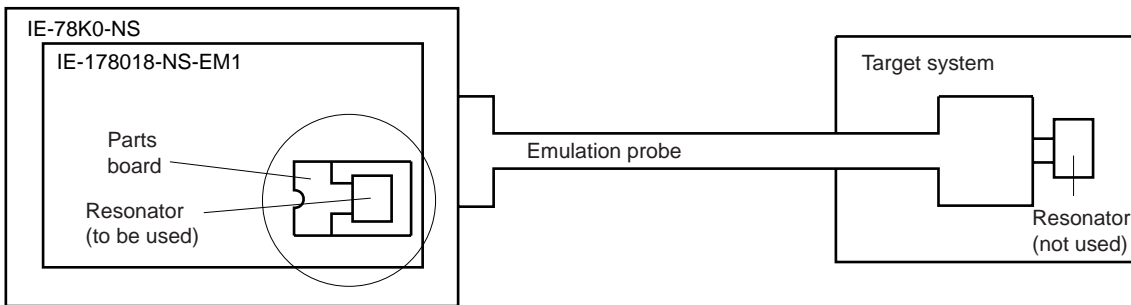


**Remark** The clock that is supplied by the IE-178018-NS-EM1's oscillator (encircled in the figure) is used.

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

The user is able to mount any clock supported by the set specifications on the IE-178018-NS-EM1. First mount the resonator on the parts board, then attach the parts board to the IE-178018-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**

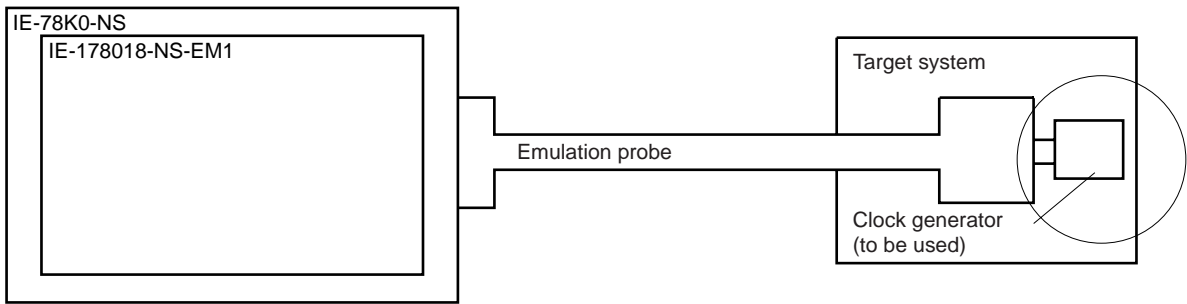


**Remark** The clock that is supplied by the IE-178018-NS-EM1's resonator (encircled in the figure) is used.

**(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 Main system clock settings**

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

Frequency of Main System Clock		IE-178018-NS-EM1	CPU Clock Source Selection (ID)
		Parts Board (mainCLK)	
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

**Caution** When using an external clock, open the configuration dialog 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-178018-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-178018-NS-EM1 is shipped, a 4.5-MHz crystal oscillator is already mounted in the IE-178018-NS-EM1’s mainCLK 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**

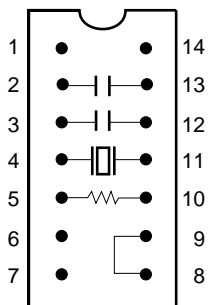
- Items to be prepared
  - Parts board (supplied with IE-78K0-NS)
  - Ceramic resonator or crystal resonator
  - Resistor Rx
  - Capacitor CA
  - Capacitor CB
  - Solder kit

<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).

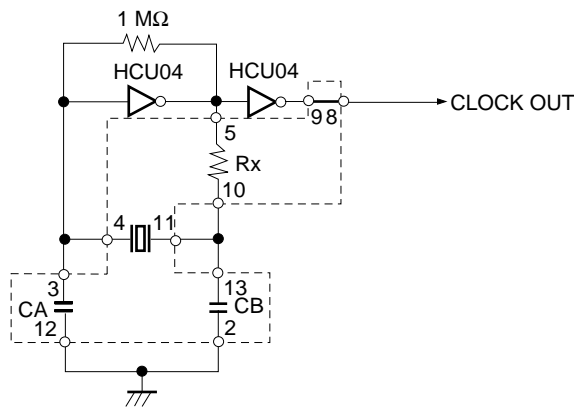
**Figure 3-6. Connections on Parts Board (When Using Main System Clock or User-mounted Clock)**

Parts board (mainCLK)



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

Circuit diagram

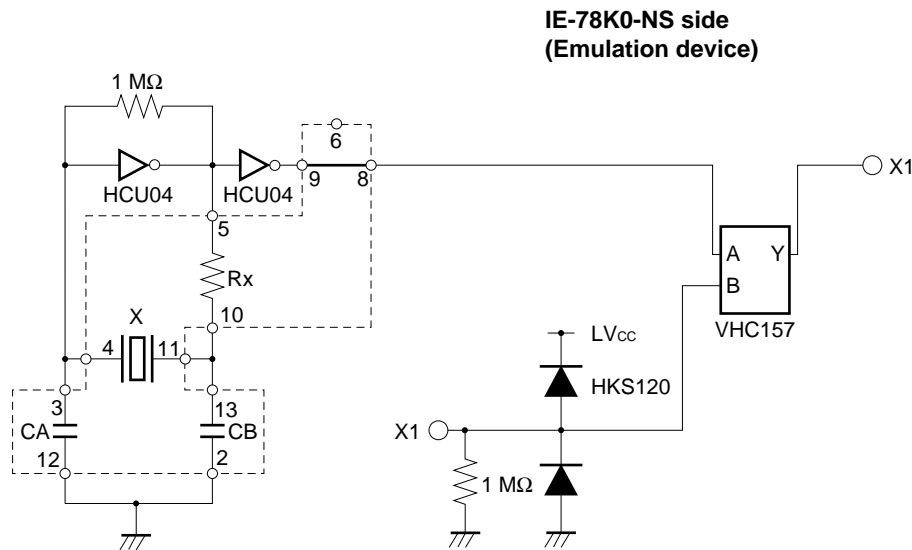


**Remark** The sections enclosed in broken lines indicate parts that are attached to the parts board.



- <2> Prepare the IE-178018-NS-EM1.
- <3> Remove the crystal oscillator that is mounted in the IE-178018-NS-EM1's socket (the socket marked as mainCLK).
- <4> Connect the parts board (from <1> above) to the socket (mainCLK) 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 mounted in the mainCLK socket on the emulation board is wired as shown in Figure 3-6 above.
- <6> Install the IE-178018-NS-EM1 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.

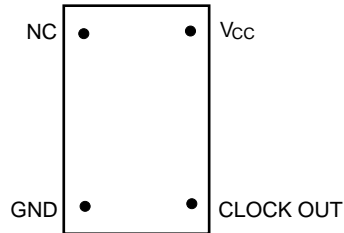


**Remark** The sections enclosed in broken lines indicate parts that are attached to the parts board.

(b) When using a crystal oscillator

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

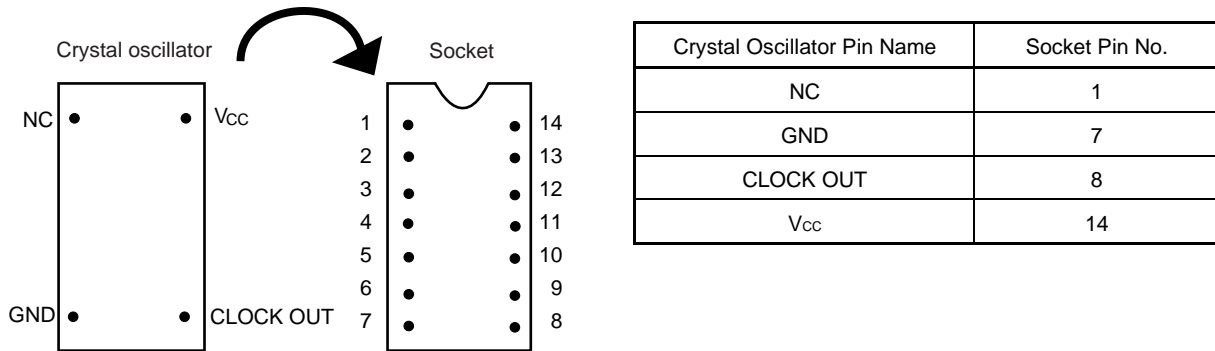
**Figure 3-7. Crystal Oscillator (When Using Main System Clock or User-mounted Clock)**



<Steps>

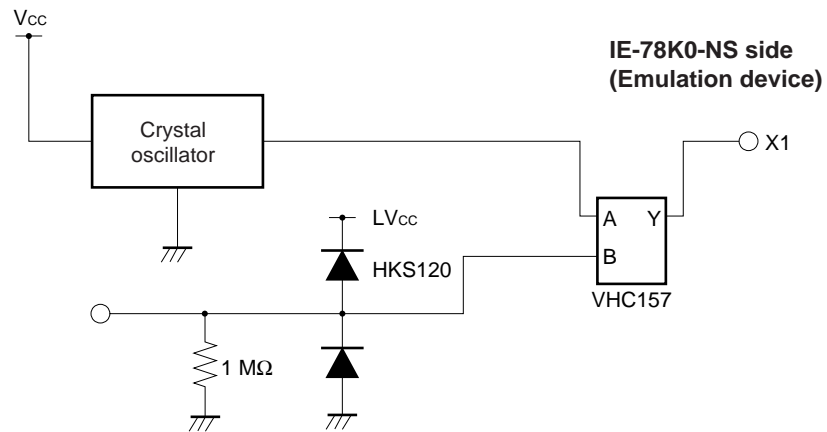
- <1> Prepare the IE-178018-NS-EM1.
- <2> Remove the crystal oscillator that is mounted in the IE-178018-NS-EM1's socket (the socket marked as mainCLK).
- <3> Connect the crystal oscillator (from <2> above) to the socket (mainCLK) from which the crystal oscillator was removed. Insert the crystal oscillator 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-178018-NS-EM1 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.

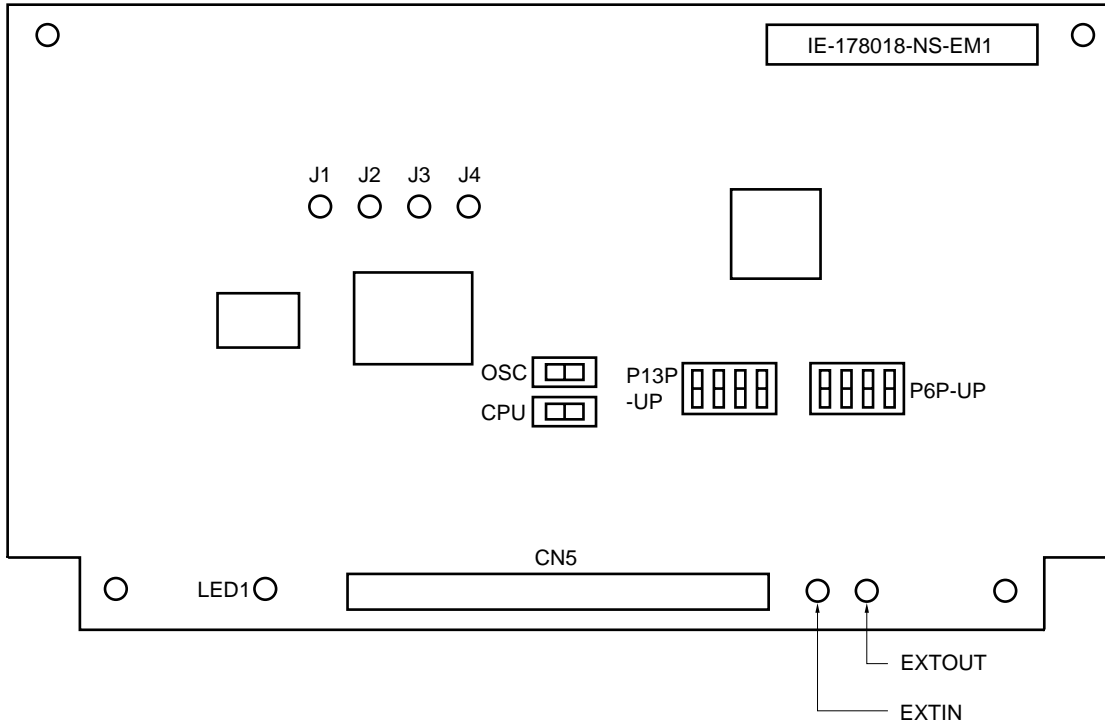
When starting the integrated debugger (ID78K0-NS), open the configuration dialog box and select “External” in the area (Clock) for selecting the CPU’s clock source (this selects the user’s clock).

### 3.3 External Trigger

To set up an external trigger, connect the IE-178018-NS-EM1's check pin, EXTOUT, and EXTIN as shown below.

See the in-circuit emulator (IE-78K0-NS) User's Manual for descriptions of related use methods and pin characteristics.

**Figure 3-9. External Trigger Input Position**



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

When using the IE-178018-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.

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

	JP2	JP3	JP4	JP6	JP7	JP8
Short	2-3	1-2	1-2	3-4	5-6	1-2

### 3.5 Switch Settings on IE-178018-NS-EM1

Set the switch on the IE-178018-NS-EM1 as shown below.

**Table 3-3. Switch Settings on IE-178018-NS-EM1**

Switch	Setting	Meaning	Factory Setting
S1 (OSC)	I side	Connect the internal ICE capacitor for OSC power supply	
	U side	Connect the capacitor on the target for OSC power supply	
S2 (CPU)	I side	Connect the internal ICE capacitor for CPU power supply	
	U side	Connect the capacitor on the target for CPU power supply	
S3 (P13P-UP)	ON	Connect a pull-up resistor to P132 to P134	
	OFF	Do not connect a pull-up resistor to P132 to P134	
S4 (P6P-UP)	ON	Connect a pull-up resistor to P60 to P63	
	OFF	Do not connect a pull-up resistor to P60 to P63	

**Caution** S3-4 is not used.

[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-178018-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-178018-NS-EM1's target interface circuit consists of an emulation CPU, 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 CPU and the  $\mu$ PD178P018
- (2) Signals input to or output from the emulation CPU and the  $\mu$ PD780009
- (3) Other signals

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

### (1) Signals input to or output from the emulation CPU and the $\mu$ PD178P018

- P00 to P06
- P10 to P15
- P20 to P27
- P30 to P37
- P120 to P125
- P132 to P134
- REGCPU
- REGOSC
- EO0, EO1
- AMIFC
- FMIFC
- VCOL
- VCOH

### (2) Signals input to or output from the emulation CPU and the $\mu$ PD780009

- $\overline{\text{RESET}}$
- X1
- P40 to P47
- P50 to P57
- P60 to P67

### (3) Other signals

- USERV<sub>DD</sub>, GND, X2, V<sub>DD</sub>PORT, GNDPLL, V<sub>DD</sub>PLL, V<sub>PP</sub>

Figure 4-1. Equivalent Circuit 1 from Emulation Circuit

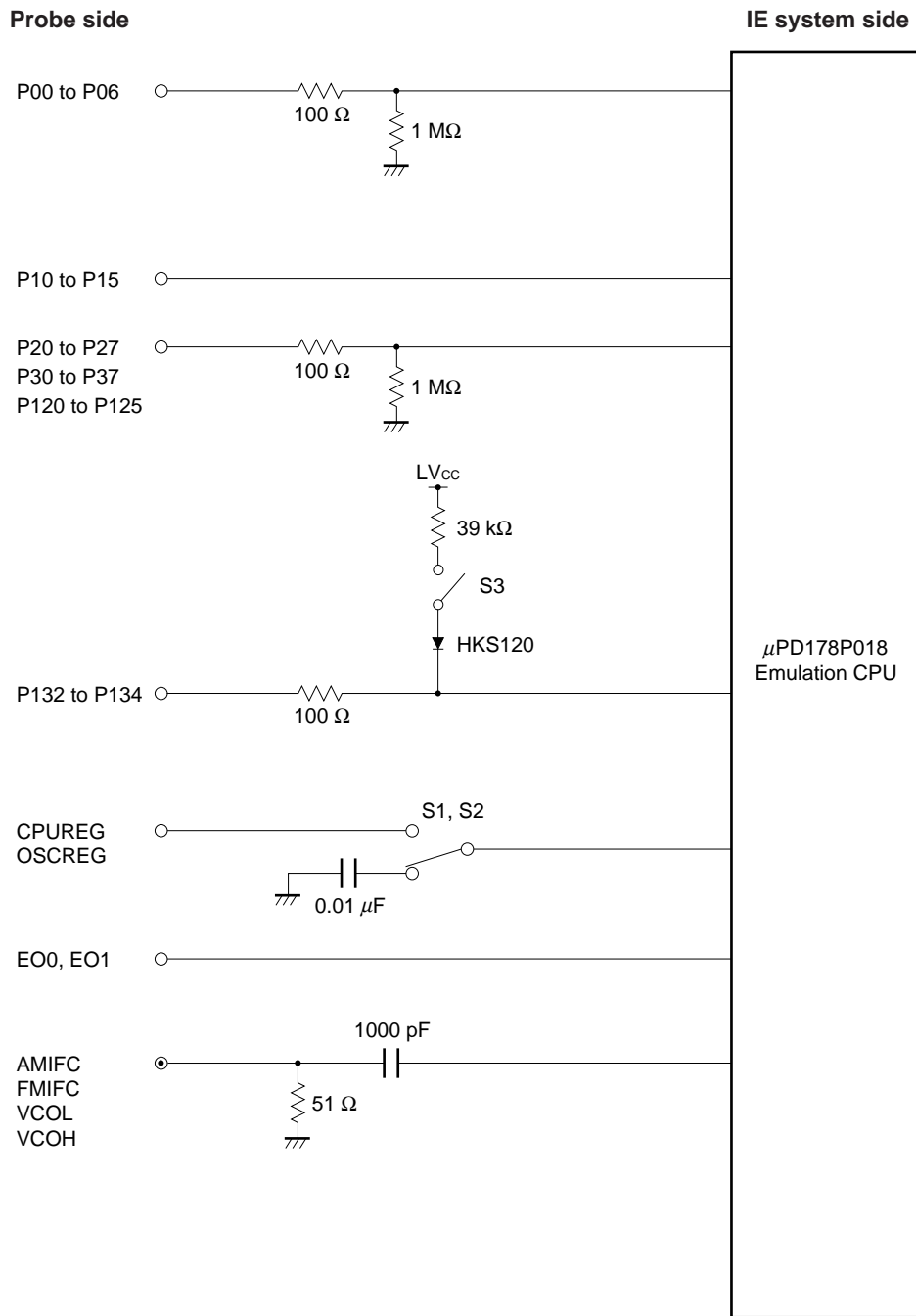
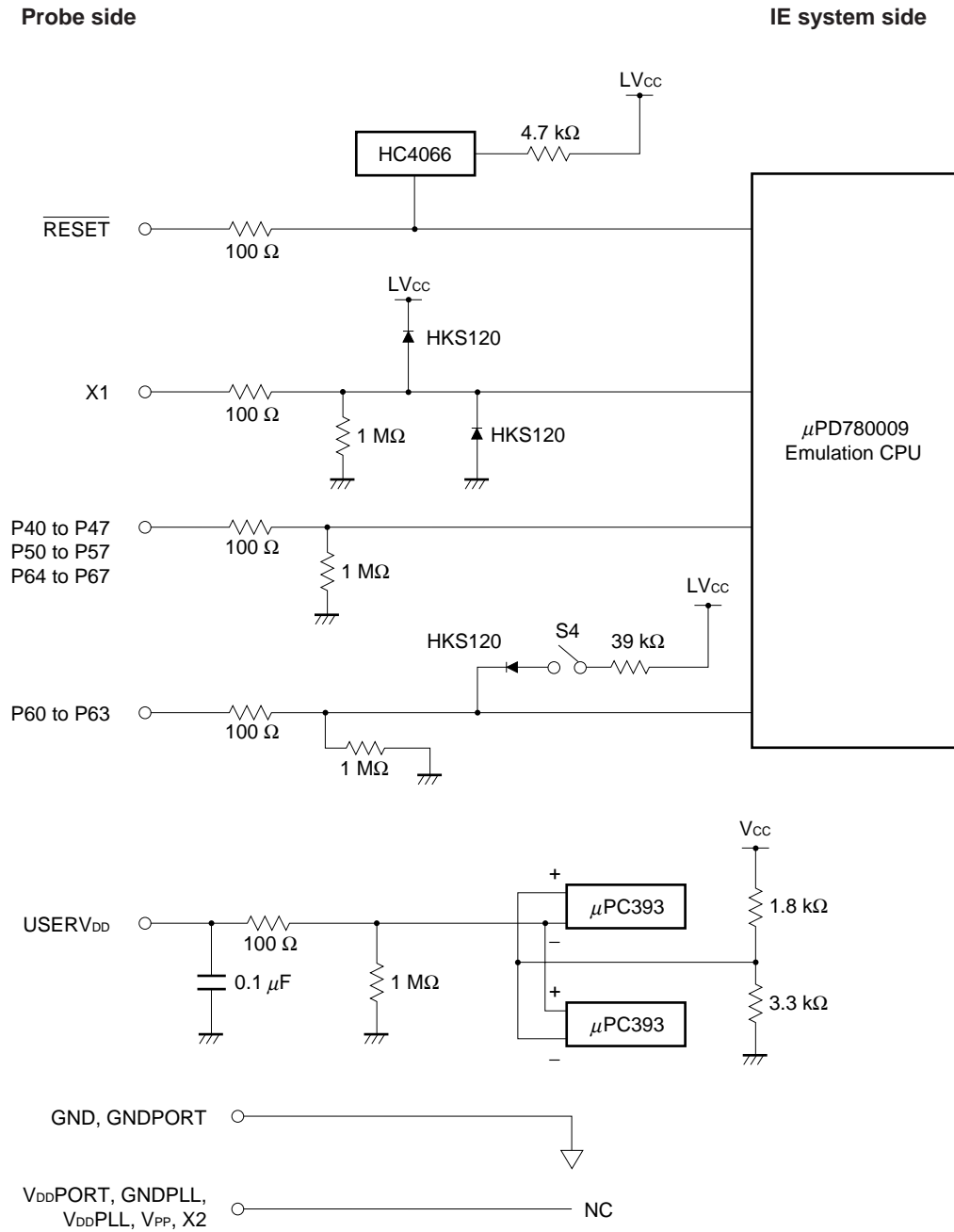




Figure 4-2. Equivalent Circuit 2 from Emulation Circuit



[MEMO]

## APPENDIX EMULATION PROBE PIN ASSIGNMENT TABLE

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

Emulation Probe	CN5 Pin No.	Emulation Probe	CN5 Pin No.
1	114	35	50
2	113	36	45
3	108	37	46
4	107	38	41
5	104	39	42
6	103	40	35
7	100	41	8
8	99	42	7
9	94	43	14
10	93	44	13
11	30	45	18
12	29	46	17
13	24	47	22
14	23	48	21
15	20	49	28
16	19	50	27
17	16	51	92
18	15	52	91
19	10	53	98
20	9	54	97
21	37	55	102
22	43	56	101
23	44	57	106
24	47	58	105
25	48	59	112
26	51	60	111
27	52	61	83
28	57	62	77
29	58	63	78
30	59	64	73
31	60	65	74
32	55	66	69
33	56	67	70
34	49	68	63

- Remarks**
1. The NP-80GC/GC-TQ are products of Naitou Densei Machidaseisakusho 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/GC-TQ Pin Assignments (2/2)**

Emulation Probe	CN5 Pin No.	Emulation Probe	CN5 Pin No.
69	64	75	72
70	61	76	75
71	62	77	76
72	65	78	79
73	66	79	80
74	71	80	85

- Remarks**
1. The NP-80GC/GC-TQ are products of Naitou Densei Machidaseisakusho Co., Ltd.
  2. The numbers in the “Emulation probe” column indicate the corresponding pin number on the emulation probe tip.

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