

CUSTOMER NOTIFICATION

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IE-784976-NS-EM1

Preliminary User's Manual

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Major Revisions in 2nd Edition

Page	Description
2, 7, 11	Addition of target devices
11	Modification of low-voltage support range
19	Correction of Table 3-1. Main System Clock Settings (Correction of JP1 setting when external clock used)
19	Addition of factory settings
23	Modification of target voltage range
25	Addition of 3.5 Port 5 ↔ SIO2 Switching
27	Addition of AVSS pin IE system side equivalent circuit
28	Modification of PORT5 equivalent circuit
32	Additions of Restrictions

Major Revisions in 3rd Edition

Page	Description
4	Deletion of 3.5 Port 5 ↔ SIO2 Switching
5	Deletion of Figure 3-9 Position of Switches 1 to 3
6	Deletion of Table 3-2 Switch 1 to 3 Settings
13	Deletion of “Switches for switching port function ↔ SIO2 function SW1 to SW3”
16	Modification of description on 3.2 Clock Settings
20	Modification of description in “Items to be prepared” from “Parts board (supplied with IE-78K4-NS)” to “Parts board”
24	Modification of description on 3.4 External Trigger
25	Deletion of 3.5 Port 5 ↔ SIO2 Switching
27	Modification of Figure 4-2 Equivalent Circuit of Emulation Circuit 2
31	Deletion of Restrictions 2

INTRODUCTION

Product Overview

The IE-784976-NS-EM1 is designed to be used with the IE-78K4-NS to debug the following target devices that belong to the 78K/IV Series of 16-bit single-chip microcontrollers.

- μ PD784976 Subseries: μ PD784975, 784976, 78F4976
- μ PD784976A Subseries: μ PD784975A, 784976A, 78F4976A

Target Readers

This manual is intended for engineers who will use the IE-784976-NS-EM1 with the IE-78K4-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-784976-NS-EM1, refer to not only this manual (supplied with the IE-784976-NS-EM1) but also the manual that is supplied with the IE-78K4-NS.

IE-78K4-NS User's Manual

- Basic specifications
- System configuration
- External interface functions

IE-784976-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-784976-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-78K4-NS and the IE-784976-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

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CHAPTER 1 GENERAL

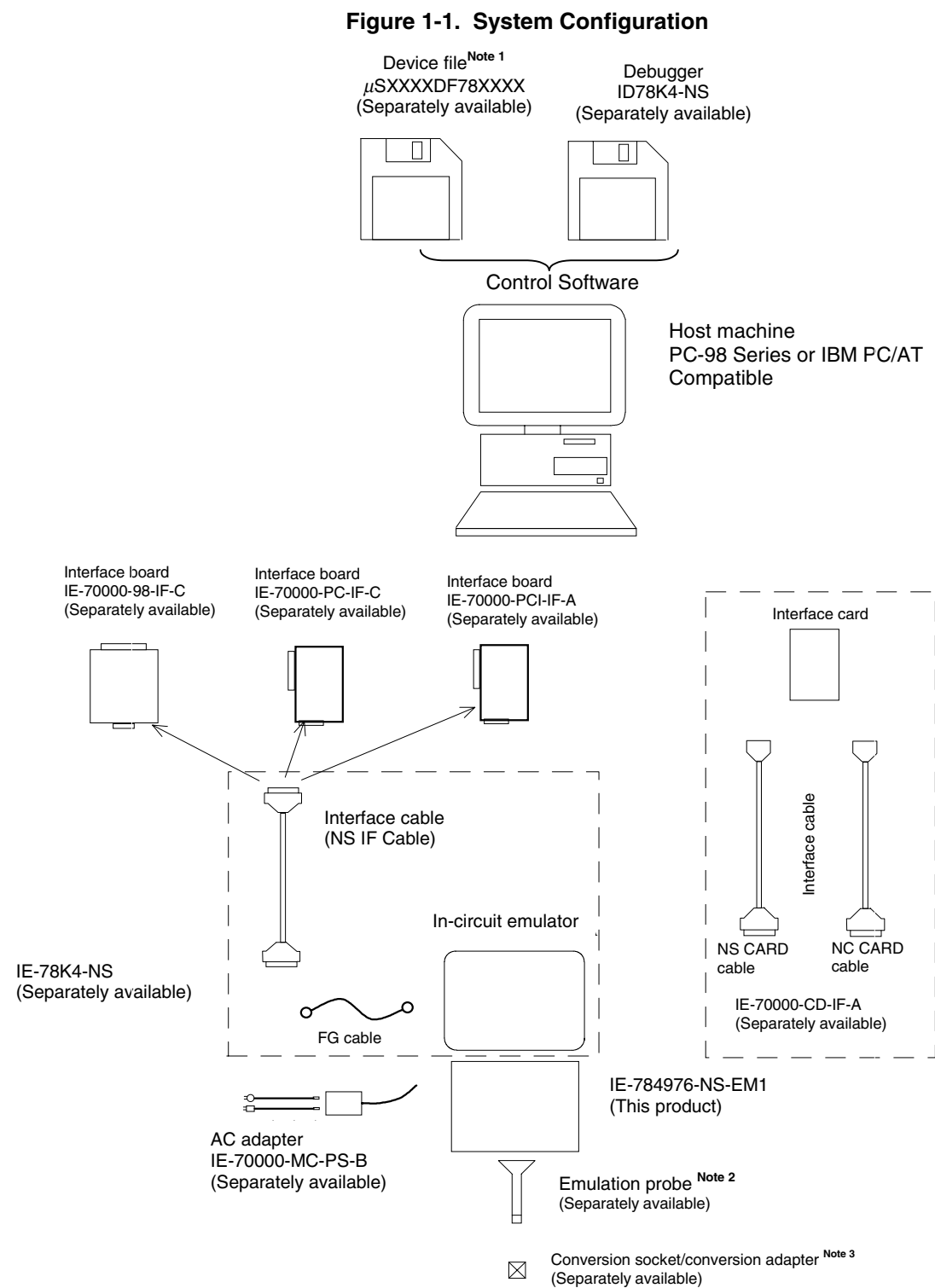
The IE-784976-NS-EM1 is a development tool for efficient debugging of hardware or software when using one of the following target devices that belong to the 78K/IV Series of 16-bit single-chip microcontrollers.

This chapter describes the IE-784976-NS-EM1 system configuration and basic specifications.

- Target device
 - μ PD784976 Subseries
 - μ PD784976A Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-784976-NS-EM1 system configuration.



Notes 1. The device file is as follows.

μ SxxxxDF784976: μ PD784976 Subseries and μ PD784976A Subseries

2. The emulation probe is as follows.

NP-100GF: 100-pin plastic QFP

NP-100GF is a product of Naito Densei Machida Mfg. Co. Ltd.

Contact: Naito Densei Machida Mfg. Co. Ltd. (TEL: 044-822-3813)

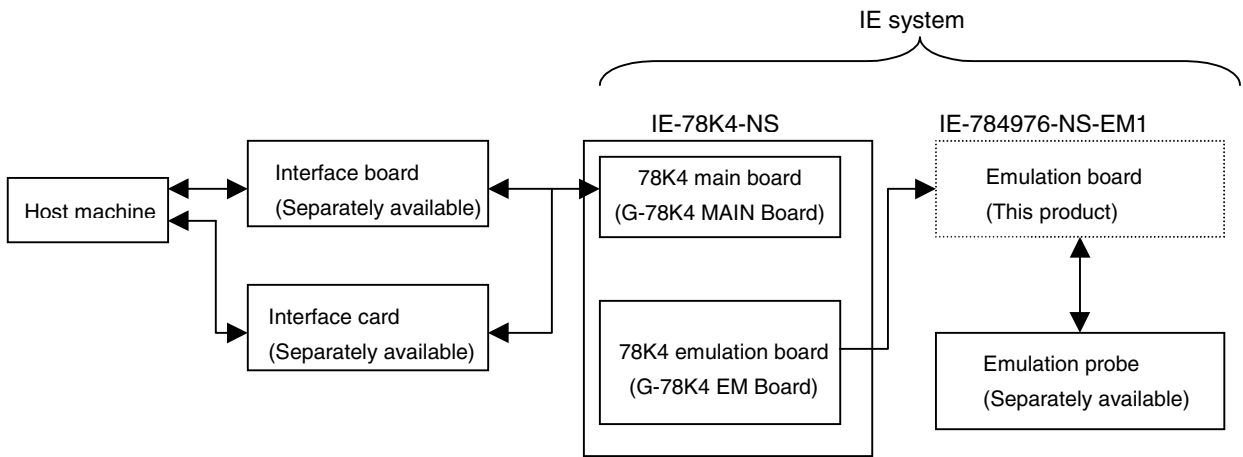
3. The conversion socket /conversion adapter is as follows.

EV-9200GF-100: For 100-pin plastic QFP (GF-3BA type)

1.2 Hardware Configuration

Figure 1-2 shows the IE-784976-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The IE-784976-NS-EM1's basic specifications are listed in Table 1-1.

Table 1-1. Basic Specifications

Parameter	Description
Target device	μ PD784976 Subseries, μ PD784976A Subseries
System clock	12.5 MHz Max.
Clock supply	External: Input via an emulation probe from the target system Internal: Mounted on emulation board (25 MHz), or mounted on the board by the user
Low-voltage support	4.5 to 5.25 V

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-784976-NS-EM1 main unit.

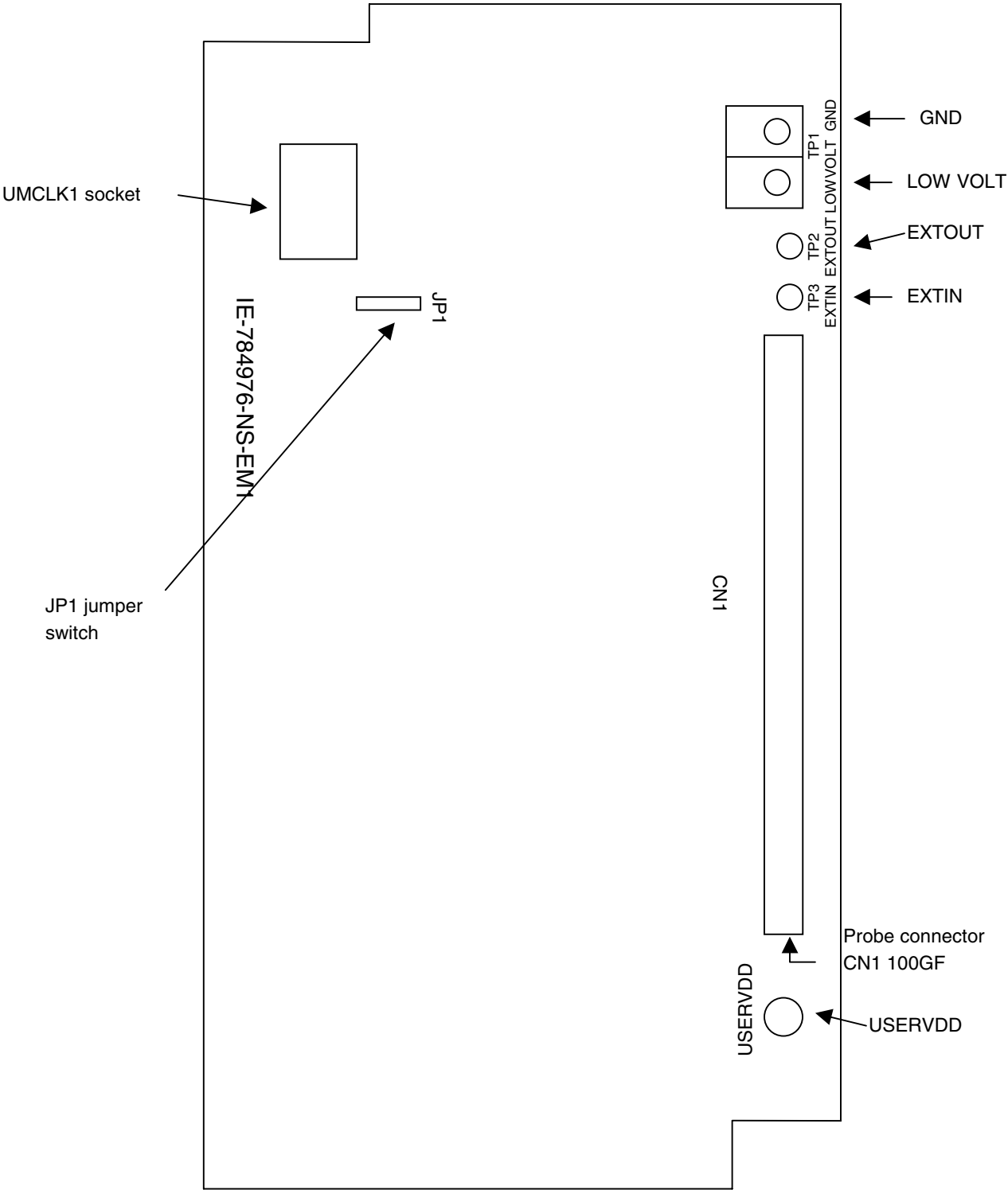
The packing box contains the emulation board (IE-784976-NS-EM1).

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 Board

Figure 2-1. IE-784976-NS-EM1 Part Names



CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-784976-NS-EM1 to the IE-78K4-NS and emulation probe. 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-78K4-NS main unit

See the IE-78K4-NS User's Manual (U13356E) for a description of how to connect the IE-784976-NS-EM1 to the IE-78K4-NS.

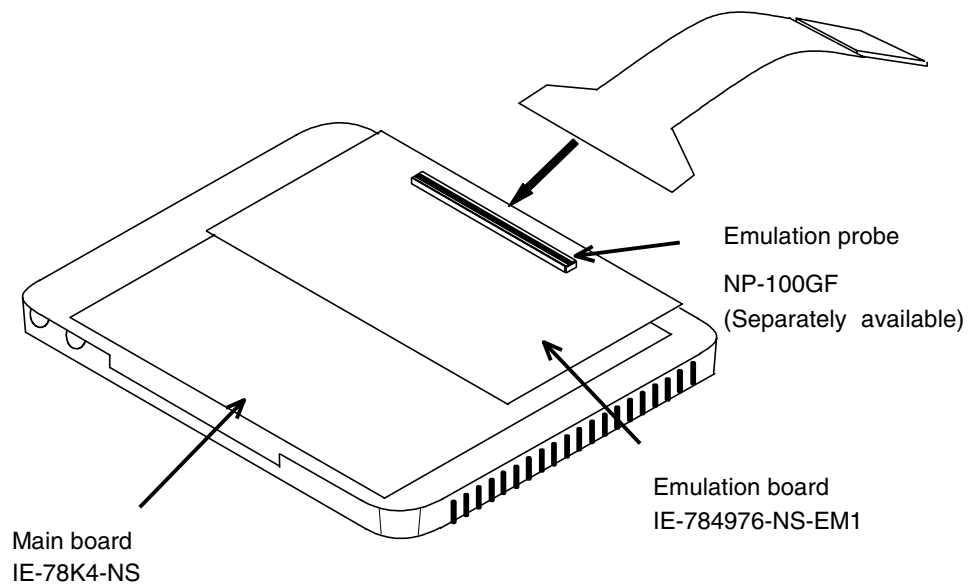
(3) Connection with emulation probe

See the IE-78K4-NS User's Manual (U13356E) for a description of how to connect an emulation probe to the IE-784976-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.

Figure 3-1. Mounting 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

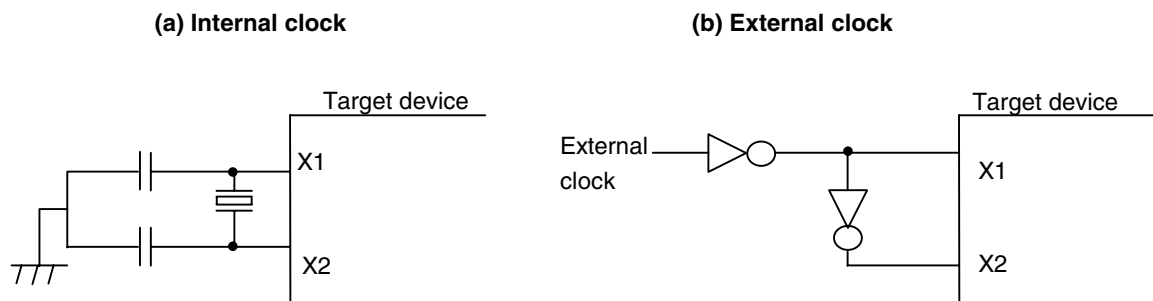
If the target system includes a clock oscillator, select either “(1) Clock that is already mounted on emulation board” or “(2) Clock that is mounted by user”. For a clock oscillator, the target device is connected to a crystal or ceramic resonator and the target device’s internal oscillator is used. 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 installed for the IE-78K4-NS is used.

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

A clock is supplied from outside of the target device as an external clock.

An example of the external circuit is shown in part (b) of Figure 3-2.

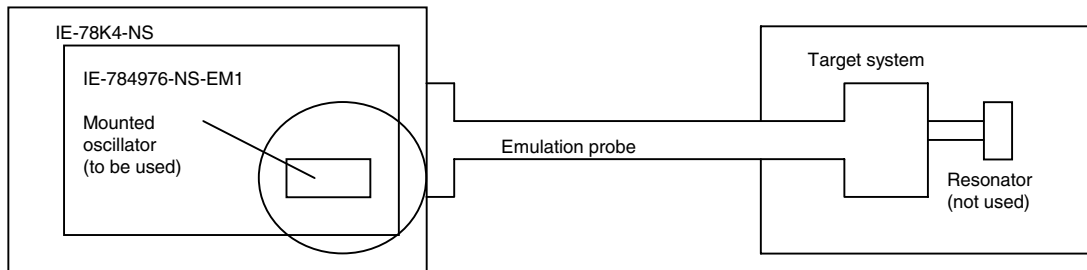
Figure 3-2. External Circuits Used as System Clock Oscillator



(1) Clock that is already mounted on emulation board

A crystal oscillator is already mounted on the emulation board. Its frequency is 25 MHz.

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

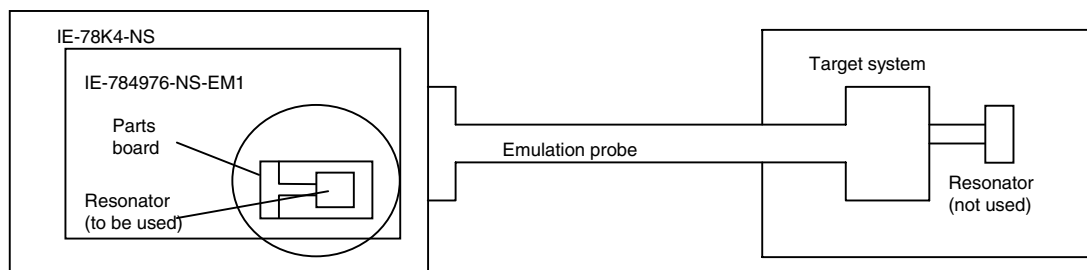


Remark The clock that is supplied by the IE-784976-NS-EM1's oscillator (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-784976-NS-EM1. First mount the resonator on the parts board, then attach the parts board to the IE-784976-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

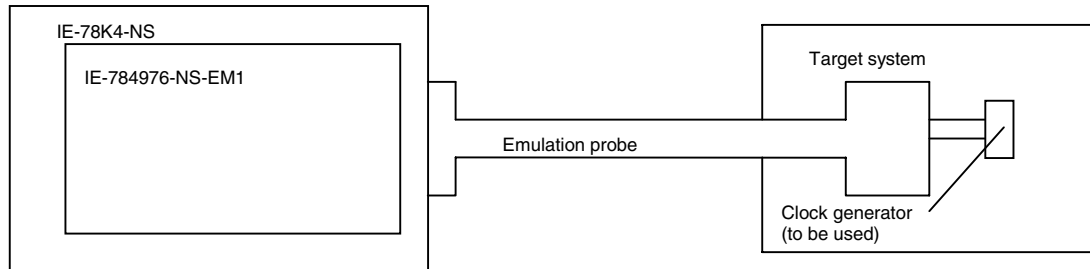


Remark The clock that is supplied by the IE-784976-NS-EM1's oscillator (encircled in the figure) is used.

(3) External clock

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

Figure 3-5. When Using an External Clock



3.2.2 Main system clock settings

Table 3-1. Main System Clock Settings

Clock Supply Method	Frequency of Supplied Clock	Frequency of Main System Clock	IE-784976-NS-EM1		CPU Clock Source Selection (ID)
			JP1	Parts Board (UMCLK)	
When using clock that is already mounted on emulation board	25 MHz	12.5 MHz	1-2 (Not used)	Oscillator	Internal
When using clock mounted by user	25 MHz Max.	X1/2	1-2 (Not used)	Oscillator assembled by user	
When using external clock	25 MHz Max.	Through rate (X1)	2-3	Oscillator not used	External
		Division rate (X1/2)	1-2		

[Factory settings]

1 and 2 of JP1 are shorted at factory shipment.

Caution When using an external clock, open the configuration dialog box when starting the integrated debugger (ID78K4-NS) and select “External” in the area (Clock) for selecting the CPU’s clock source (this selects the user’s clock).

Remark The IE-784976-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-784976-NS-EM1 is shipped, a 25MHz crystal oscillator is already mounted in the IE-784976-NS-EM1’s UMCLK socket. When using the factory-set mode settings, there is no need to make any other hardware settings.

When starting the integrated debugger (ID78K4-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 (ID78K4-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

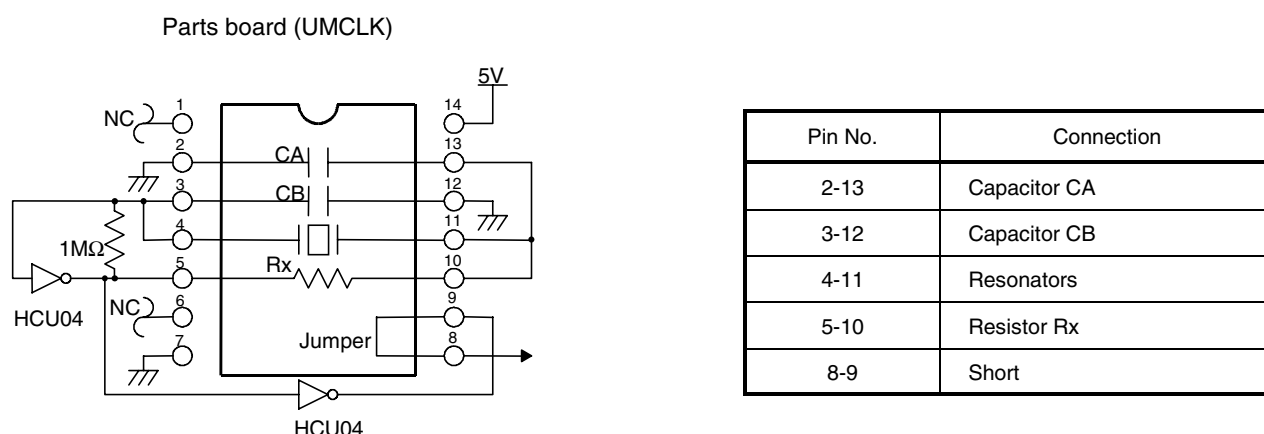
- Items to be prepared

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

<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)



Remark NC: No Connection.

- <2> Prepare the IE-784976-NS-EM1.

- <3> Remove the crystal oscillator that is mounted in the IE-784976-NS-EM1’s socket (the socket marked as UMCLK).

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

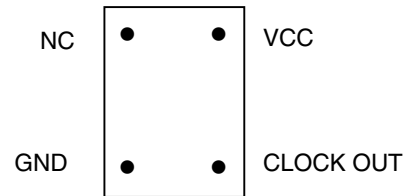
- <5> Make sure that the parts board mounted in the UMCLK socket on the emulation board is wired as shown in Figure 3-6 above.

- <6> Install the IE-784976-NS-EM1 in the IE-78K4-NS.

(b) When using a crystal oscillator

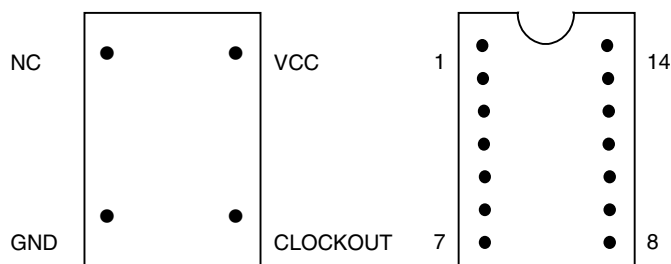
- Items to be prepared
 - Crystal oscillator (see pin layouts shown in Figure 3-7)

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



<Steps>

- <1> Prepare the IE-784976-NS-EM1.
- <2> Remove the crystal oscillator that is mounted in the IE-784976-NS-EM1's socket (the socket marked as UMCLK).
- <3> Connect the crystal oscillator (from <2> above) to the socket (UMCLK) from which the crystal oscillator was removed. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.



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

- <4> Install the IE-784976-NS-EM1 in the IE-78K4-NS.

(3) When using external clock

When starting the integrated debugger (ID78K4-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).

<Steps>

<1> Prepare the IE-784976-NS-EM1.

<2> Set the external clock by specifying the jumper switch JP1 on the IE-784976-NS-EM1 that supplies clock and the clock oscillation mode. (See **Table 3-1 Main System Clock Setting**)

<3> Install the IE-784976-NS-EM1 in the IE-78K4-NS.

3.3 Low-Voltage Emulation Setting

Low-voltage emulation is possible in the IE system.

When the target system is operating on low voltage (including 5 V), supply the same voltage as the target system to the TP1 terminal pin of the IE-784976-NS-EM1. Set the target voltage between 4.5 V and 5.25 V.

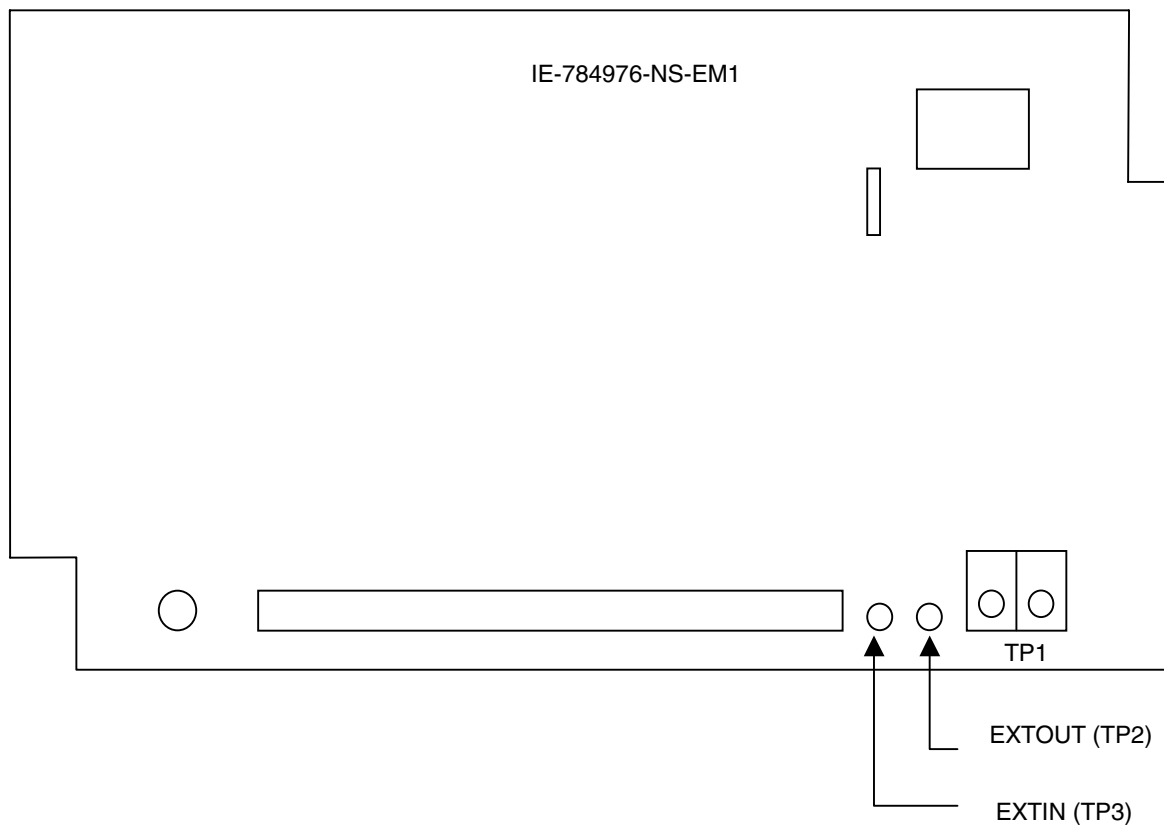
- Maximum current consumption of TP1
300 mA

3.4 External Trigger

To setup an external trigger, connect it to the IE-784976-NS-EM1's check pin, EXTIN pin, and EXTOUT pin as shown below.

See the integrated debugger (ID78K4-NS) user's manual (U12796E) for usages. See the in-circuit emulator (IE-78K4-NS) user's manual (U13356E) for pin characteristics.

Figure 3-8. External Trigger Input Position



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-784976-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-784976-NS-EM1's target interface circuit consists of an emulation CPU, TTL, CMOS-IC, and other emulation circuits.

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 directly input/output to/from the emulation CPU
- (2) Signals input from the target system via a gate
- (3) Other signals

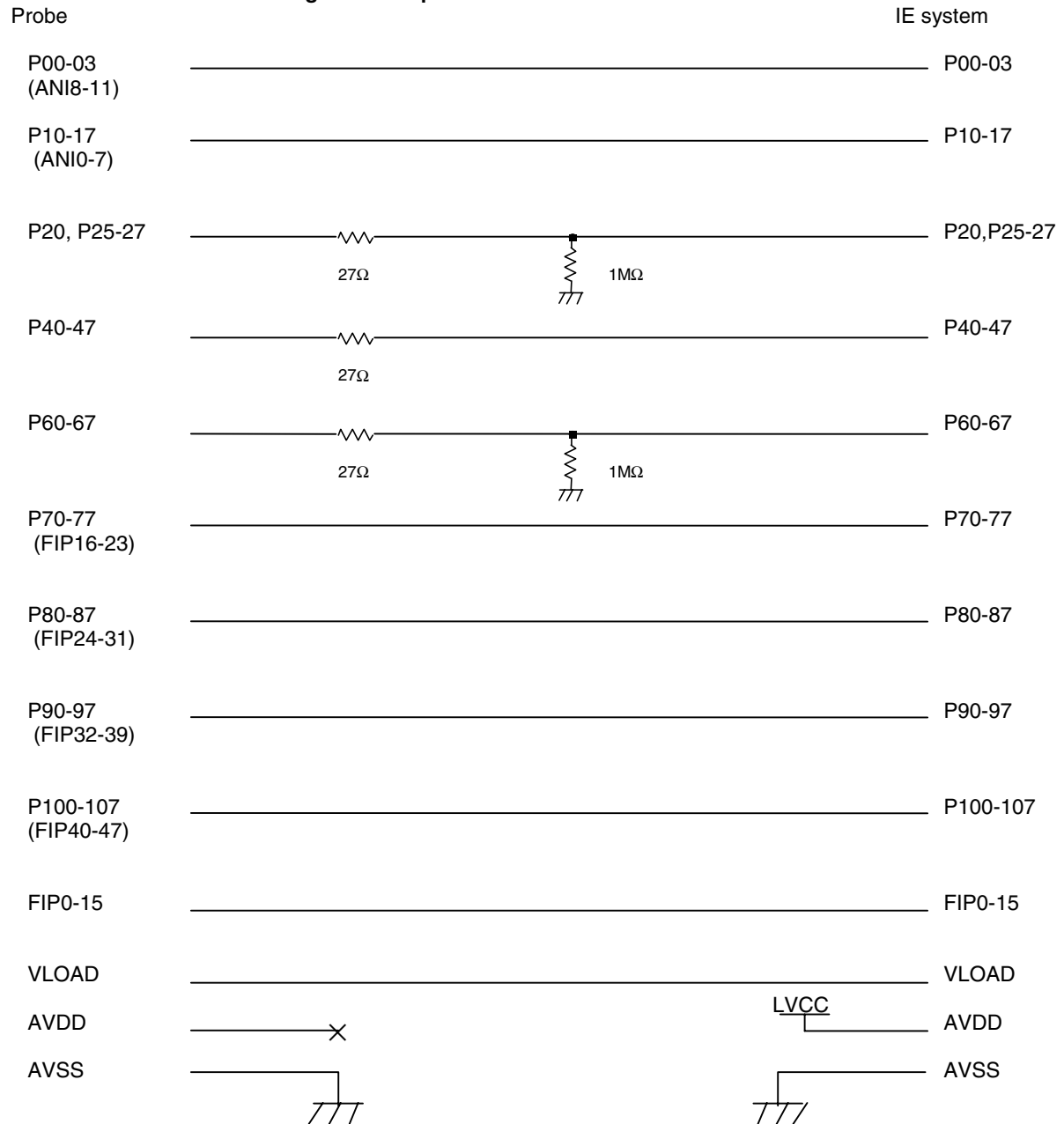
The IE system's circuit is used as follows for signals listed in (1) to (3) above.

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

The following signals perform the same operations as in the μ PD784976 Subseries. For the A/D converter-multiplexed pins and port other than pins multiplexed with FIP, a 1M Ω pull-down resistor and a 27 Ω resistor are inserted in series.

- Signals related to port 0 (A/D converter input)
- Signals related to port 1 (A/D converter input)
- Signals related to port 2
- Signals related to port 4
- Signals related to port 6
- Signals related to port 7 (FIP output)
- Signals related to port 8 (FIP output)
- Signals related to port 9 (FIP output)
- Signals related to port 10 (FIP output)
- Signals related to A/D converter
- Signals related to FIP

Figure 4-1. Equivalent Circuit of Emulation Circuit 1

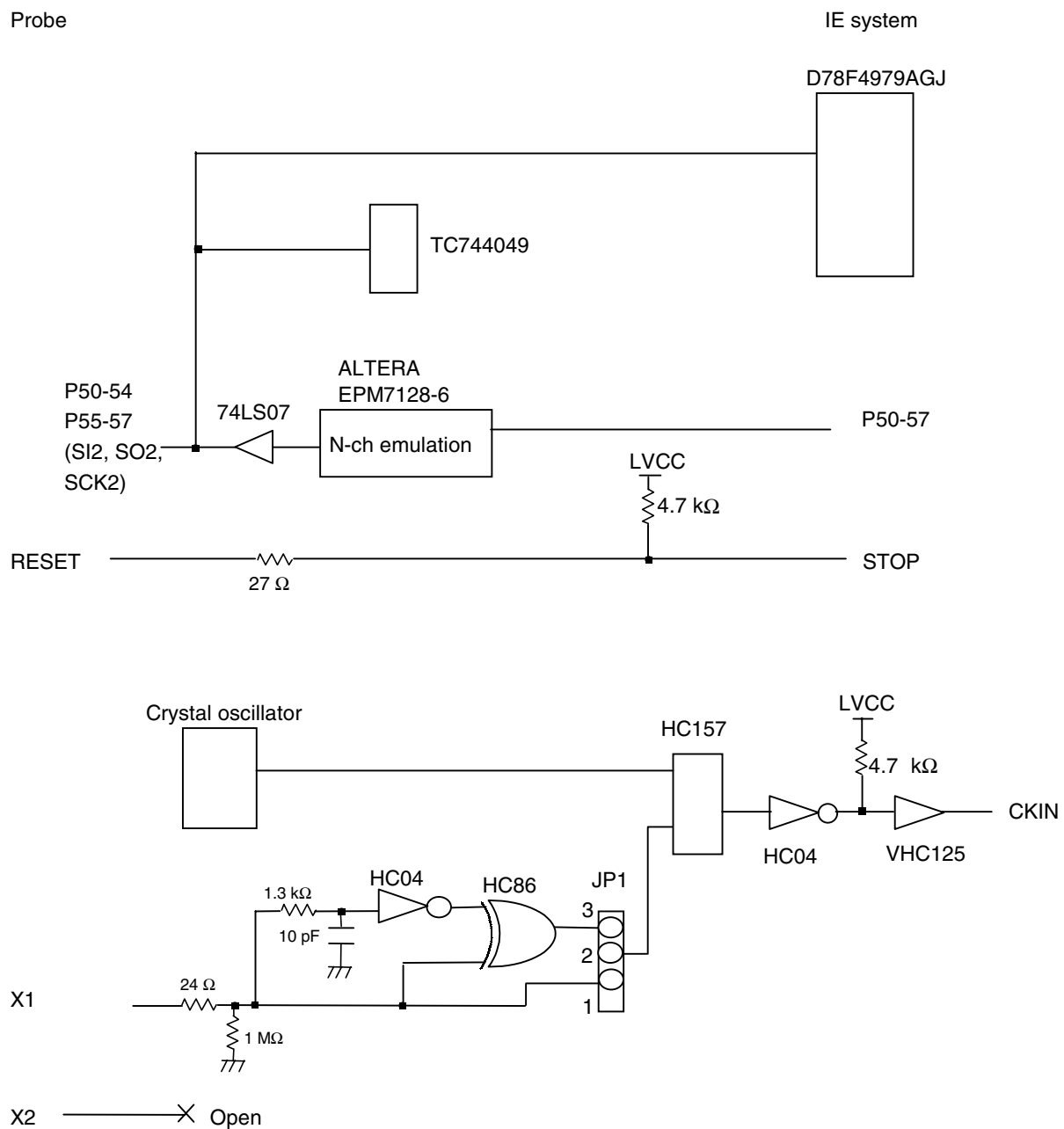


(2) Signals input from the target system via a gate

Since the following signals are input via a gate, their timing shows a delay compared to that of the μ PD784976 Subseries. Their AC characteristics and DC characteristics are therefore different from the μ PD784976 Subseries, making it necessary to observe a stricter timing design than in the case of the μ PD784976 Subseries.

- Signals related to port 5
- RESET signal
- Signals related to clock input

Figure 4-2. Equivalent Circuit of Emulation Circuit 2



(3) Other signals

- **V_{DD} pin**

When the emulation CPU is operating at 5 V, its power is supplied from the internal IE system, but when operating at low voltage, its power is supplied from the low-voltage pin (TP1). The V_{DD} pin of the target system is only used to control the LED (USERV_{DD}) in the IE system that monitors the input of the target system's power supply.

- **V_{SS} pin**

The V_{SS} pin is connected to GND inside the IE system.

APPENDIX EMULATION PROBE PIN CORRESPONDENCE TABLE

Table A-1. NP-100GF Pin Correspondence

Emulation Probe	CN1 Pin No.	Emulation Probe	CN1 Pin No.
1	116	51	6
2	115	52	5
3	87	53	33
4	88	54	34
5	83	55	37
6	84	56	38
7	77	57	43
8	78	58	44
9	73	59	47
10	74	60	48
11	96	61	51
12	70	62	52
13	63	63	57
14	64	64	58
15	61	65	59
16	62	66	60
17	65	67	55
18	66	68	56
19	71	69	49
20	72	70	50
21	75	71	45
22	76	72	46
23	79	73	41
24	80	74	42
25	85	75	35
26	86	76	36
27	89	77	31
28	90	78	32
29	118	79	4
30	117	80	3
31	114	81	8
32	113	82	7
33	108	83	14
34	107	84	13
35	104	85	18
36	103	86	17
37	100	87	22
38	99	88	21
39	94	89	28
40	93	90	27
41	30	91	92
42	29	92	91
43	24	93	98
44	23	94	97
45	20	95	102
46	19	96	101
47	16	97	106
48	15	98	105
49	10	99	112
50	9	100	111

Remarks 1. NP-100GF is a product of Naito Densei Machida Mfg. Co. Ltd.

2. The numbers in the Emulation Probe column refers to the pin number of the emulation probe.

RESTRICTIONS

1. The mask option function is not available for PORT5, PORT7, PORT8, PORT9, and PORT10.