

User's Manual

IE-784937-NS-EM1

Emulation Board

Target devices

μ PD784938A Subseries

[MEMO]

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- Product release schedule
- Availability of related technical literature
- Development environment specifications (for example, specifications for third-party tools and components, host computers, power plugs, AC supply voltages, and so forth)
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INTRODUCTION

Product Overview

The IE-784937-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 PD784938A Subseries: μ PD784935A, 784936A, 784937A, 784938A, 78F4938A

Target Readers

This manual is intended for engineers who will use the IE-784937-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-784937-NS-EM1, refer to not only this manual (supplied with the IE-784937-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-784937-NS-EM1 User's Manual

- General
- Part names
- Installation
- Differences between target devices and target interface circuits
- Restrictions
- Cautions

Purpose

This manual's purpose is to explain various debugging functions that can be performed when using the IE-784937-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-784937-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 No.
IE-78K4-NS In-Circuit Emulator		U13356E
IE-784937-NS-EM1 Emulation Board		This manual
ID78K Series Integrated Debugger Ver. 2.30 or Later Windows™ Based	Operation	U15185E
μPD784938A Subseries	Hardware	U15609E

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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CHAPTER 1 GENERAL

The IE-784937-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.

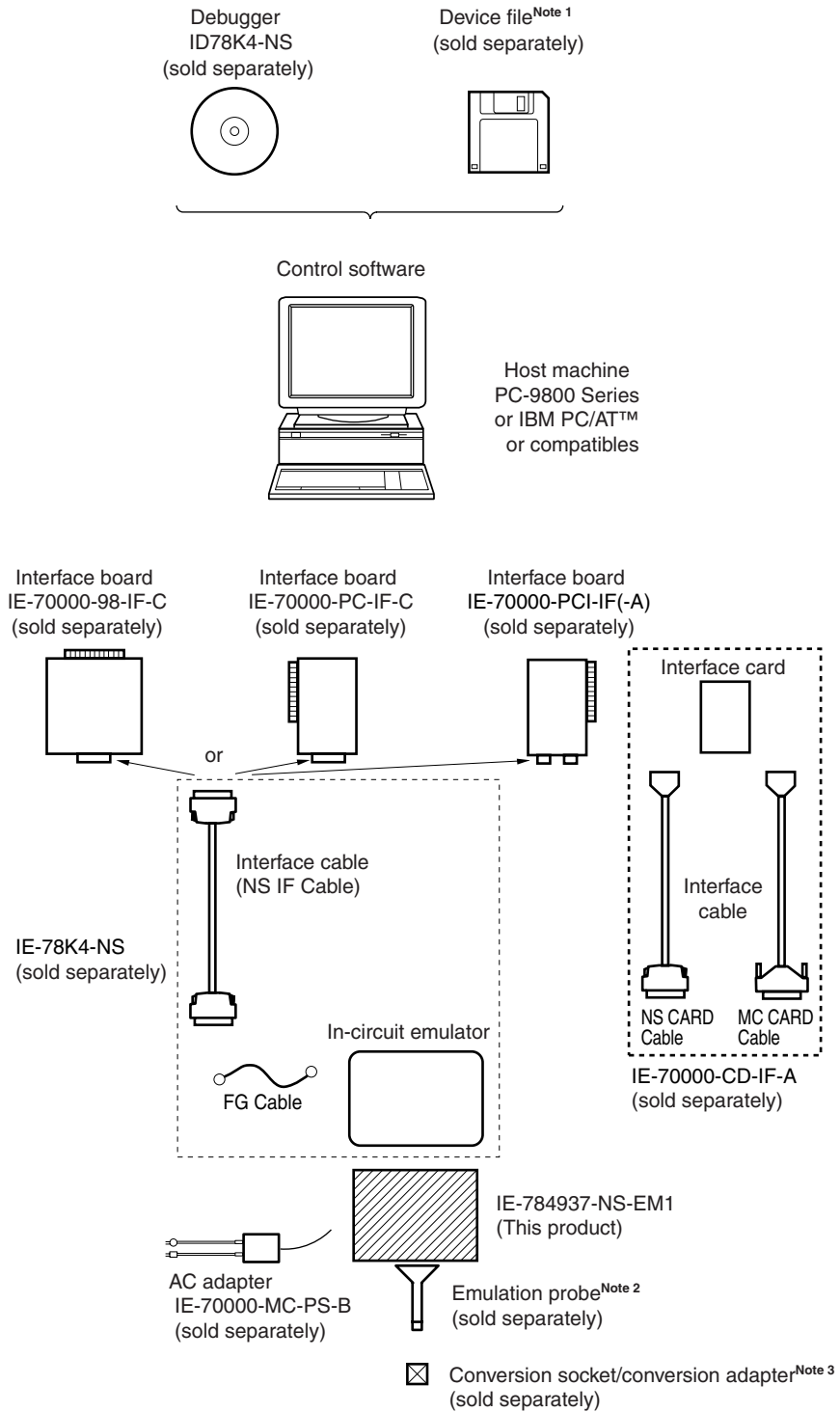
This chapter describes the IE-784937-NS-EM1's system configuration and basic specifications.

- Target devices
 - μ PD784938A Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-784937-NS-EM1's system configuration.

Figure 1-1. System Configuration



Notes 1. The device file is as follows.

μ SxxxxDF784937: μ PD784938A Subseries

The device file can be downloaded from the website of NEC Electronics (<http://www.necel.com/micro/>).

2. The emulation probes NP-100GF, NP-100GF-TQ, and NP-H100GF-TQ are products of Naito Densai Machida Mfg. Co., Ltd.

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

3. The conversion adapter TGF-100RBP 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)

Table 1-1 shows the correspondence between emulation probes and conversion adapters that are sold separately.

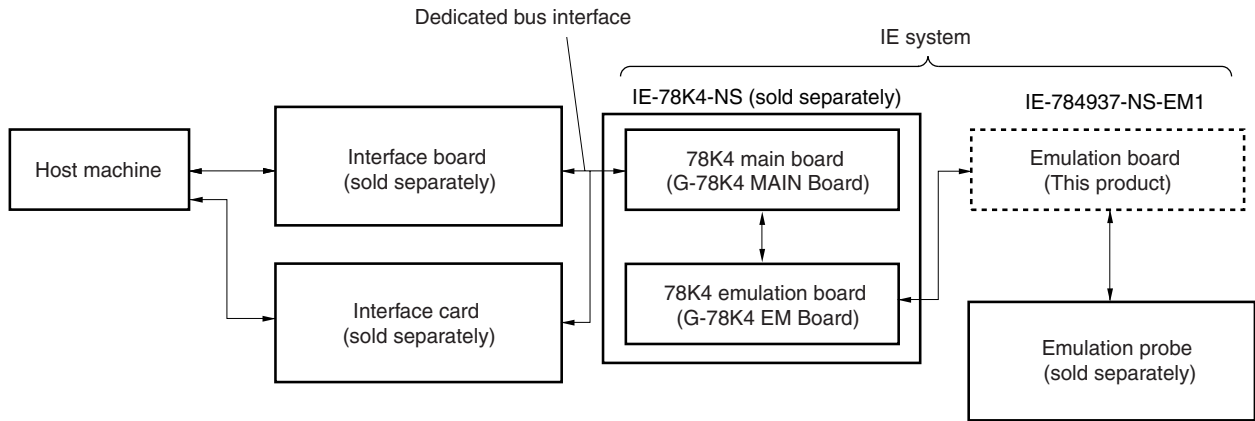
Table 1-1. Correspondence Between Emulation Probes and Conversion Adapters

Package	Emulation Probe	Conversion Adapter
100-pin plastic QFP (GF-3BA type)	NP-100GF (Probe length: 200 mm)	EV-9200GF-100
	NP-100GF-TQ (Probe length: 200 mm)	TGF-100RBP
	NP-H100GF-TQ (Probe length: 400 mm)	

1.2 Hardware Configuration

Figure 1-2 shows the IE-784937-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The IE-784937-NS-EM1's basic specifications are listed in Table 1-1.

Table 1-2. Basic Specifications

Parameter	Description
Target device	μ PD784935A, 784936A, 784937A, 784938A, 78F4938A Subseries
System clock	12.58 MHz
Main system clock supply	External: Input via an emulation probe from the target system Internal: Mounted on emulation board (12.58 MHz), or mounted on the board by the user
Timer clock supply	External: Input via an emulation probe from the target system Internal: Mounted on emulation board (32.768 kHz), or mounted on the board by the user
Low-voltage support	2.7 to 5.5 V (at 6.29 MHz operation) 4.5 to 5.5 V (at 12.58 MHz operation)

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-784937-NS-EM1 main unit.

The packing box contains the emulation board (IE-784937-NS-EM1), 4937 PROBE Board (GC), and 4937 PROBE Board (GF).

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-784937-NS-EM1 Part Names

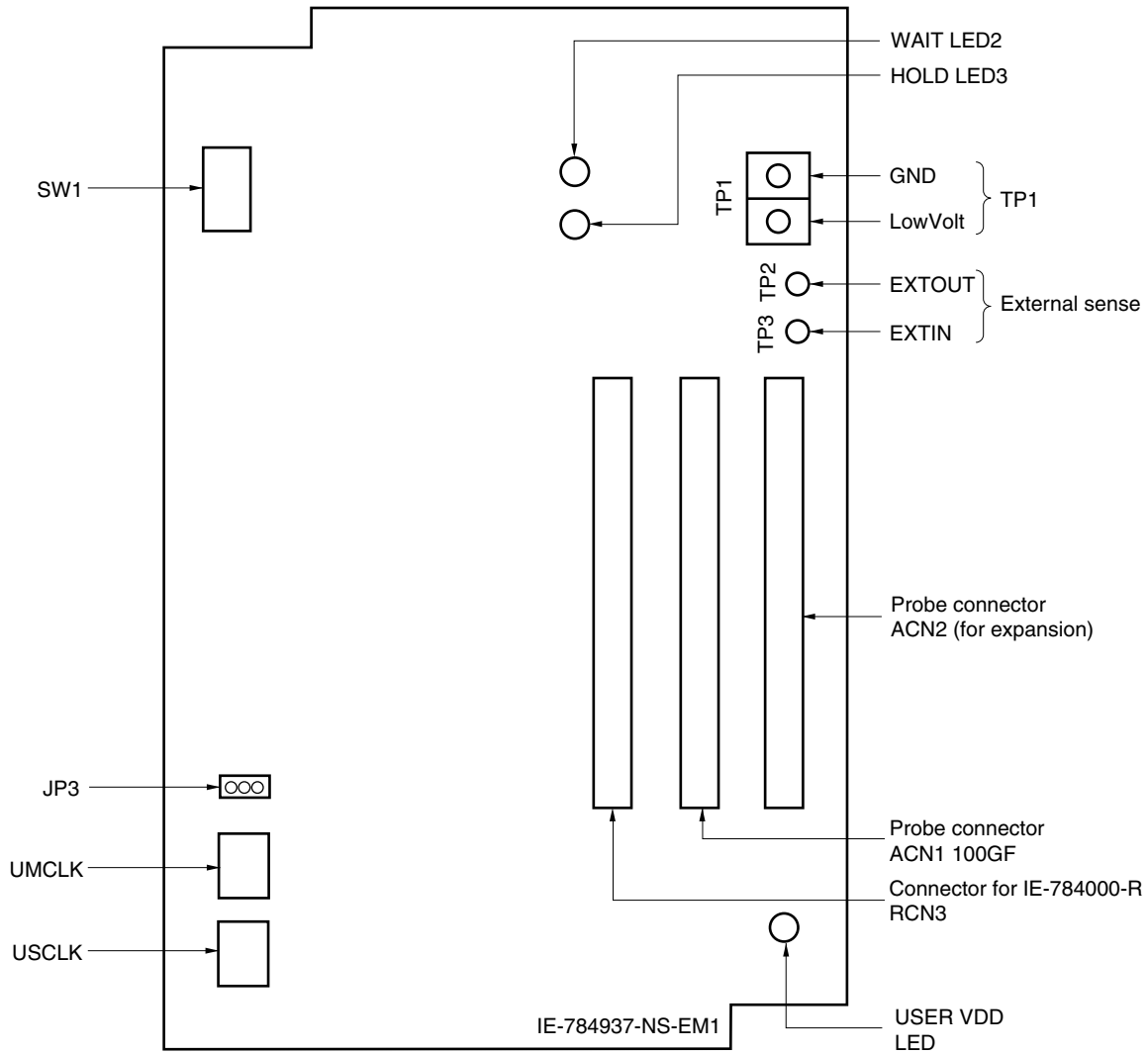
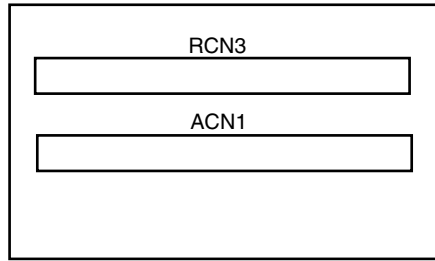
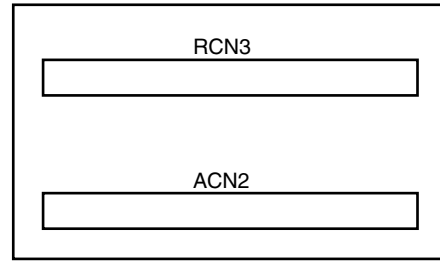


Figure 2-2. 4937 PROBE Board Part Names

(a) 4937 PROBE Board (GF)



(b) 4937 PROBE Board (GC)



Caution The 4937 PROBE Board (GF) is used when the IE-784937-NS-EM1 and IE-78K4-R-EX3 are combined to connect to the IE-784000-R. The 4937 PROBE Board (GF) is not used for connection with the IE-78K4-NS, the 4937 PROBE Board (GC) is used for expansion.

CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-784937-NS-EM1 to the IE-78K4-NS, 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-78K4-NS main unit

See the IE-78K4-NS User's Manual (U13356E) for a description of how to connect the IE-784937-NS-EM1 to the IE-78K4-NS.

(2) 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-784937-NS-EM1.

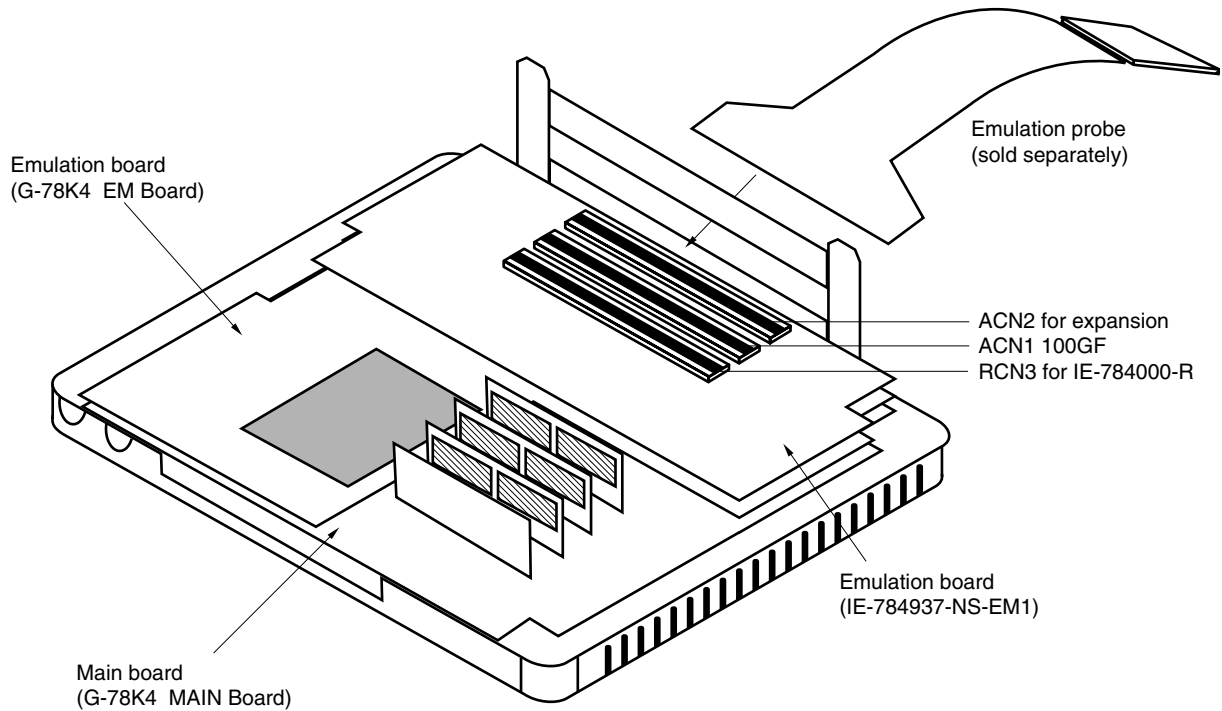
Connect the emulation probe to ACN1 on this board.

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 connection method.

2. Do not use ACN2, which is for expansion.

Figure 3-1. Connection of Emulation Probe



(3) Mounting 4937 PROBE Board

The 4937 PROBE Board need not be mounted when the IE-78K4-NS is used.

Mount the 4937 PROBE Board when using the IE-784000-R. Refer to **CHAPTER 6 CAUTIONS**.

3.2 Selection of Emulator Main Unit

JP3 in the IE-784937-NS-EM1 must be set in accordance with the emulator main unit to be used as follows.

Using IE-784937-NS-EM1 in combination with IE-78K4-NS: Short 1 and 2 (shipment setting)

Using IE-784000-R in combination with IE-784937-NS-EM1 and IE-78K4-R-EX3: Short 2 and 3

3.3 Clock Settings

3.3.1 Overview of clock settings

The main system clock to be used during debugging can be selected from (1) to (3) below, and the timer clock from (1) and (2) below.

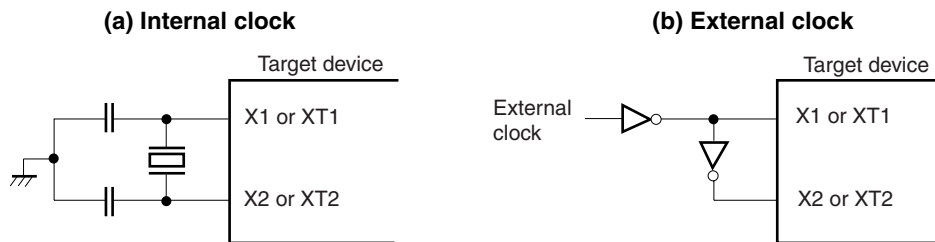
- (1) Clock that is already mounted on emulation board
- (2) Clock that is mounted by user
- (3) External clock

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-78K4-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.

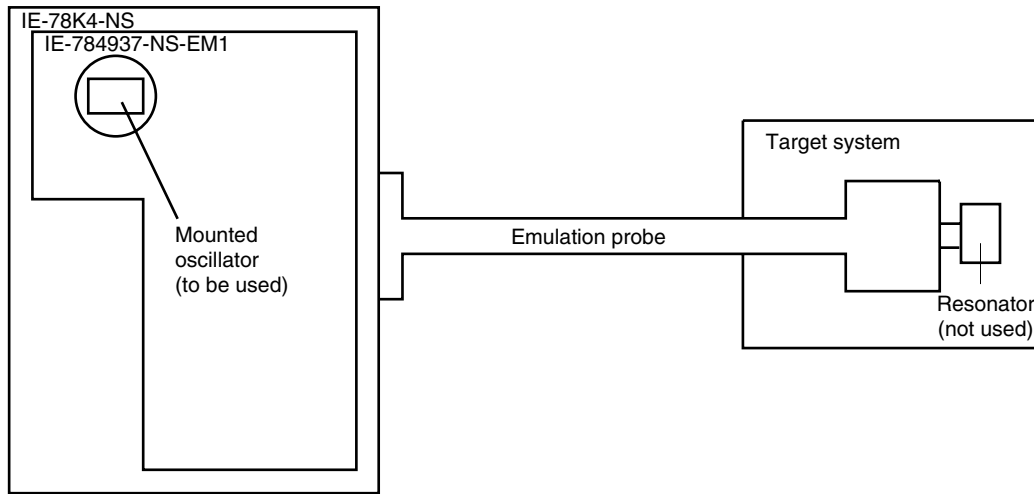
Figure 3-2. External Circuits Used as System Clock Oscillator



(1) Clock that is already mounted on emulation board

A crystal oscillator is already mounted on the emulation board. Its frequency is 12.58 MHz.

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

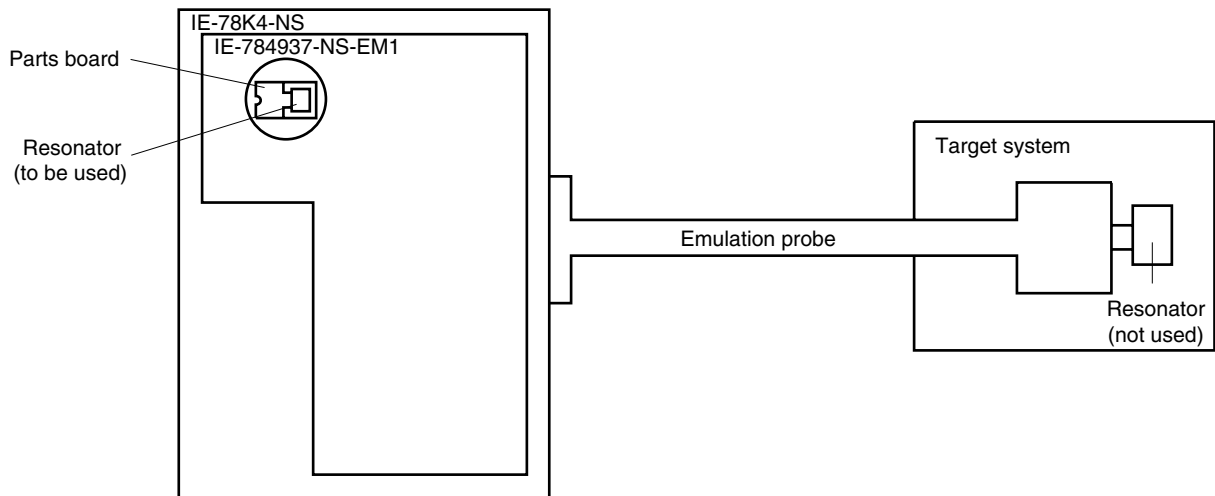


Remark The clock that is supplied by the IE-784937-NS-EM1's oscillator (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-784937-NS-EM1. First mount the resonator on the parts board, then attach the parts board to the IE-784937-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

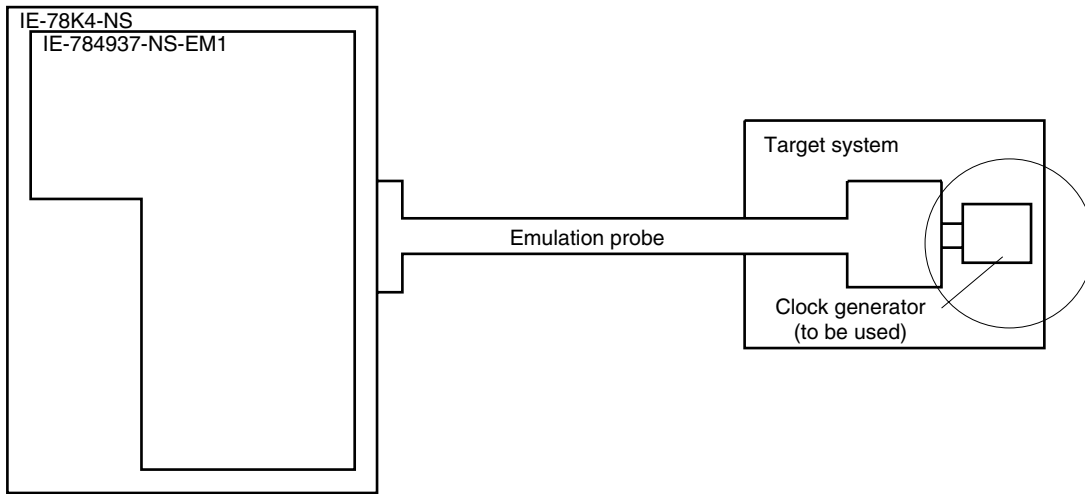


Remark The clock that is supplied by the IE-784937-NS-EM1's resonator (encircled in the figure) is used.

(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.

3.3.2 Main system clock settings

Table 3-1. Main System Clock Settings

Frequency of Main System Clock		IE-784937-NS-EM1	CPU Clock Source Selection (ID78K4-NS)
		Parts Board (UMCLK)	
When using clock that is already mounted on emulation board	12.580 MHz	Oscillator used	Internal
When using clock mounted by user	Other than 12.580 MHz	Oscillator assembled by user	
When using external clock			Oscillator not used

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-784937-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-784937-NS-EM1 is shipped, a 12.580 MHz crystal oscillator is already mounted in the IE-784937-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

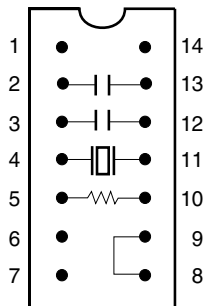
- Parts board
- Ceramic resonator or crystal resonator
- Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

<Steps>

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

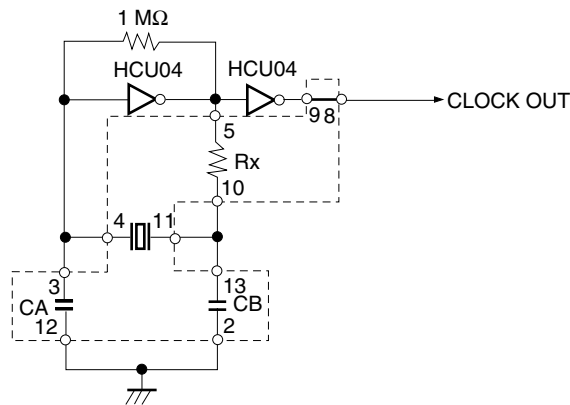
Figure 3-6. Connections on Parts Board (When Using Main System Clock or User-Mounted Clock)

Parts board (UMCLK)



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.

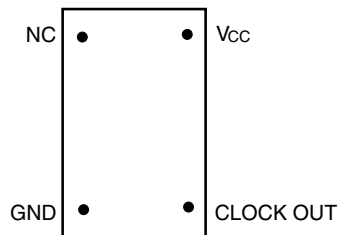
- <2> Prepare the IE-784937-NS-EM1.
- <3> Remove the crystal oscillator that is mounted in the IE-784937-NS-EM1's socket (the socket marked as UMCLK).
- <4> Connect the parts board (from <1> above) to the socket (UMCLK) from which the crystal oscillator was removed (see <3> above). Check the pin 1 mark 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> Connect the IE-784937-NS-EM1 to the IE-78K4-NS.

The above steps configure the 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)

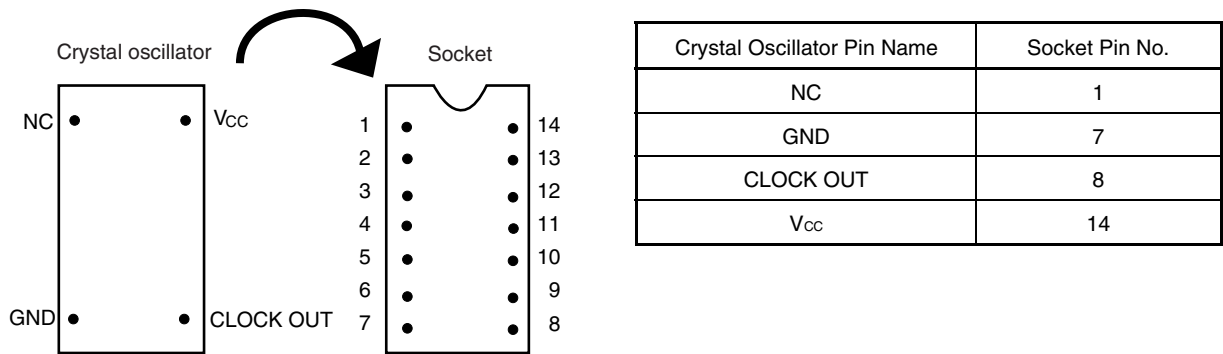
Figure 3-7. Crystal Oscillator (When Using Main System Clock or User-Mounted Clock)



<Steps>

- <1> Prepare the IE-784937-NS-EM1.
- <2> Remove the crystal oscillator that is mounted in the IE-784937-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.

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



<4> Connect the IE-784937-NS-EM1 to the IE-78K4-NS.

The above steps configure the 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 (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).

3.3.3 Timer clock settings

Table 3-2. Timer Clock Settings

Frequency of Timer Clock		IE-784937-NS-EM1
		Parts Board (USCLK)
When using clock that is already mounted on emulation board	32.768 kHz	6 and 8 shorted
When using clock mounted by user	Other than 32.768 kHz	Oscillator assembled by user

Remark The IE-784937-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-784937-NS-EM1 is shipped, a 32.768 kHz crystal resonator is already mounted on the IE-784937-NS-EM1. Pins 6 and 8 on the parts board (USCLK) are shorted. There is no need to make any other settings via the integrated debugger (ID78K4-NS).

(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. There is no need to make any other settings via the integrated debugger (ID78K4-NS).

(a) When using a ceramic resonator or crystal resonator

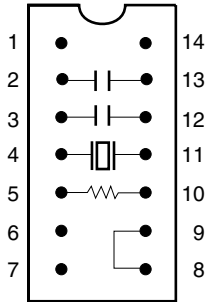
- Items to be prepared
 - Parts board
 - Ceramic resonator or crystal resonator
 - Resistor Rx
 - Capacitor CA
 - Capacitor CB
 - Solder kit

<Steps>

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

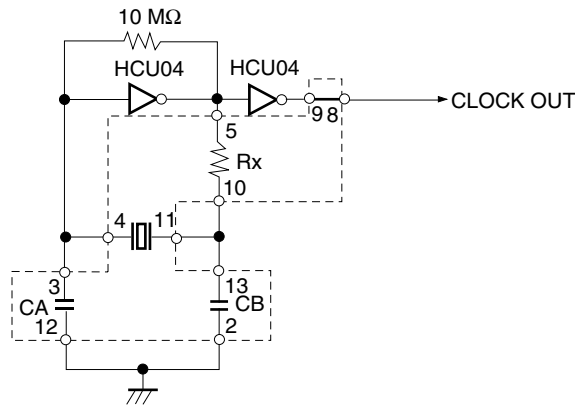
Figure 3-9. Connections on Parts Board (When Using Timer Clock or User-Mounted Clock)

Parts board (USCLK)



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.

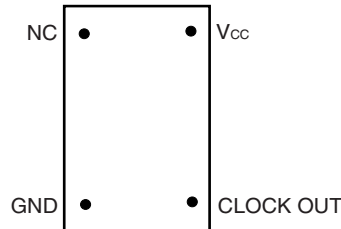
- <2> Prepare the IE-784937-NS-EM1.
- <3> Remove the parts board that is mounted in the IE-784937-NS-EM1's socket (the socket marked as USCLK).
- <4> Connect the parts board (from <1> above) to the socket (USCLK) from which the parts board was removed (see <3> above). Check the pin 1 mark to make sure the board is mounted in the correct direction.
- <5> Connect the IE-784937-NS-EM1 to the IE-78K4-NS.

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

(b) When using a crystal oscillator

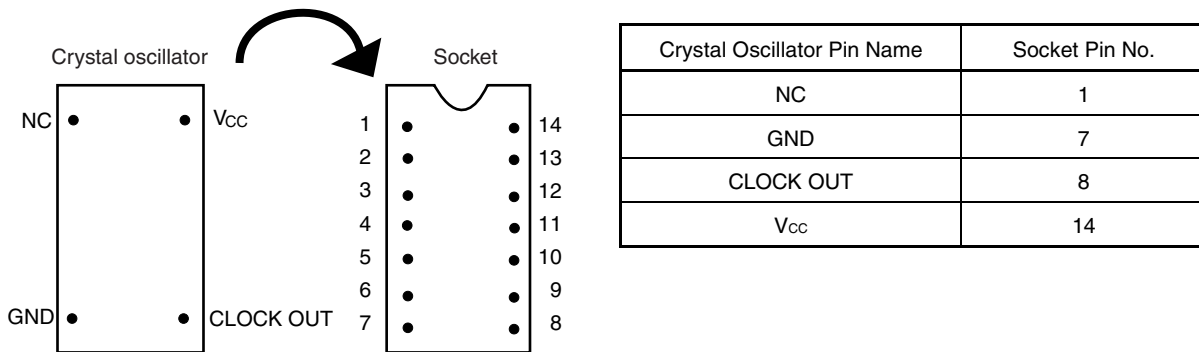
- Items to be prepared
 - Crystal oscillator (see pinouts shown in Figure 3-10)

Figure 3-10. Crystal Oscillator (When Using Timer Clock or User-Mounted Clock)



<Steps>

- <1> Prepare the IE-784937-NS-EM1.
- <2> Remove the parts board that is mounted in the IE-784937-NS-EM1's socket (the socket marked as USCLK).
- <3> Connect the crystal oscillator (from <2> above) to the socket (USCLK) from which the parts board was removed. Insert the crystal oscillator pin into the socket aligning the pins as shown below.



- <4> Connect the IE-784937-NS-EM1 to the IE-78K4-NS.
The above steps configure the circuit and enable supply of the clock from the mounted oscillator to the emulation device.

3.4 Pin Mask Function Settings

3.4.1 NMI interrupt mask setting

By setting switch 1 of the DIP switch (SW1) in the IE-784937-NS-EM1, it is possible to mask the NMI interrupt, which is the alternate function of the P20 pin.

Table 3-3. DIP Switch Setting for NMI Interrupt Mask

Status	DIP Switch Setting
	1 (NMIMSK)
No NMI mask (initial setting)	ON
NMI masked	OFF

Caution Because the NMI interrupt is the alternate function of the P20 pin, this pin cannot operate as the P20 pin when the NMI mask status has been set.

3.4.2 Wait (WAIT)/hold (HOLD) mask function

By setting switches 2 to 4 of the DIP switch (SW1) in the IE-784937-NS-EM1, it is possible to mask the wait (WAIT) and hold (HOLD) alternate functions of the P66 pin in the μ PD784938A Subseries.

Table 3-4. DIP Switch Setting for Wait (WAIT)/Hold (HOLD) Mask Function

Status	DIP Switch Setting		
	2 (WAITMSK)	3 (HOLDMASK)	4 (P66ON)
No mask (initial setting)	OFF	OFF	ON
Hold masked	OFF	ON	OFF
Wait masked	ON	OFF	OFF

Caution Do not set the DIP switch to settings other than those above.

3.4.3 Wait display function setting

By setting switch 5 of the DIP switch (SW1) in the IE-784937-NS-EM1, it is possible to display the status of “waiting” with an LED light.

Table 3-5. DIP Switch Setting for Wait Display Function

Status	DIP Switch Setting
	5 (WAITLED)
Wait (WAIT) status not displayed	OFF
Wait (WAIT) status displayed (initial setting)	ON

Caution When pin P66 is used as a port pin, unless the DIP switch is turned OFF the LED may light up.

3.4.4 Hold display function setting

The IE-784937-NS-EM1 lights the LED during hold to indicate the status. The hold display function can be selected by setting 6 of the DIP switch (SW1).

Table 3-6. DIP Switch Setting for Hold Display Function

Status	DIP Switch Setting
	6 (HOLDLED)
Hold (HOLD) status not displayed (initial setting)	OFF
Hold (HOLD) status displayed	ON

Caution When using the P66 pin as a port, set the DIP switch to OFF. Otherwise, the LED may be lit.

3.5 Low-Voltage Emulation Setting

Low-voltage emulation is possible in the IE system.

When the target system is operating on low voltage, supply the same voltage as the target system to the TP1 terminal pin of the IE-784937-NS-EM1. Set the target voltage between 2.7 and 5.5 V during 6.29 MHz operation and between 4.5 and 5.5 V during 12.58 MHz operation.

- Maximum current consumption of TP1

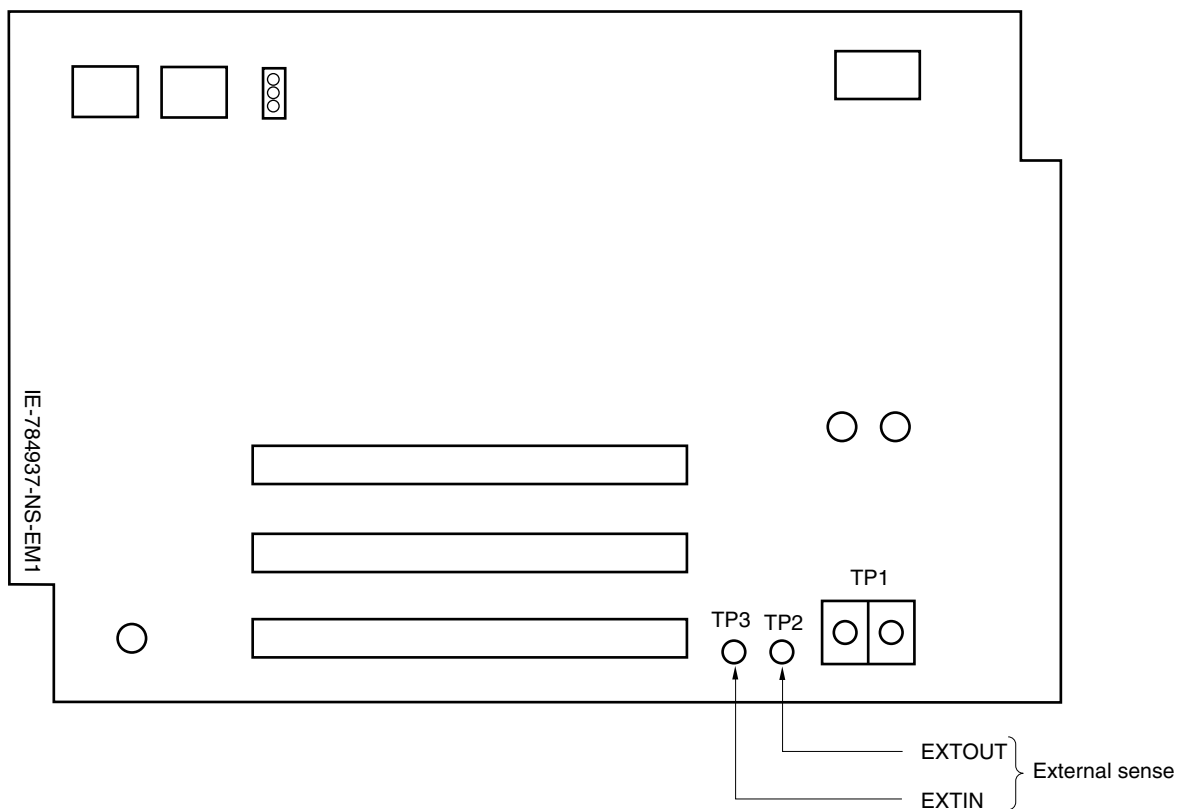
5 V	300 mA
⋮	⋮
2.7 V	250 mA

3.6 External Trigger

To set up an external trigger, connect it to the IE-784937-NS-EM1's check pin, EXTOUT pin, and EXTIN pin as shown below.

For pin characteristics, refer to the **IE-78K4-NS User's Manual (U13356E)**. For usage details, refer to the **ID78K Series Ver.2.30 or Later Windows Based Operation User's Manual (U15185E)**.

Figure 3-11. 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-784937-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-784937-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 PD784938A Subseries. For the signals related to ports excluding port 7 (having alternate function as a pin for A/D converter), however, a 1 M Ω pull-down resistor and 22 Ω resistor are inserted in series.

- Signals related to port 0
- Signals related to port 1
- Signals related to port 2
- Signals related to port 3
- Signals related to port 7 (A/D converter input)
- Signals related to port 9
- Signals related to port 10
- Signals related to PWM
- Signals for ASTB/CLKOUT
- Signals related to IEBus controller
- Signals related to A/D converter
 - AV_{REF1}
 - AV_{SS}
 - AV_{DD}^{Note}

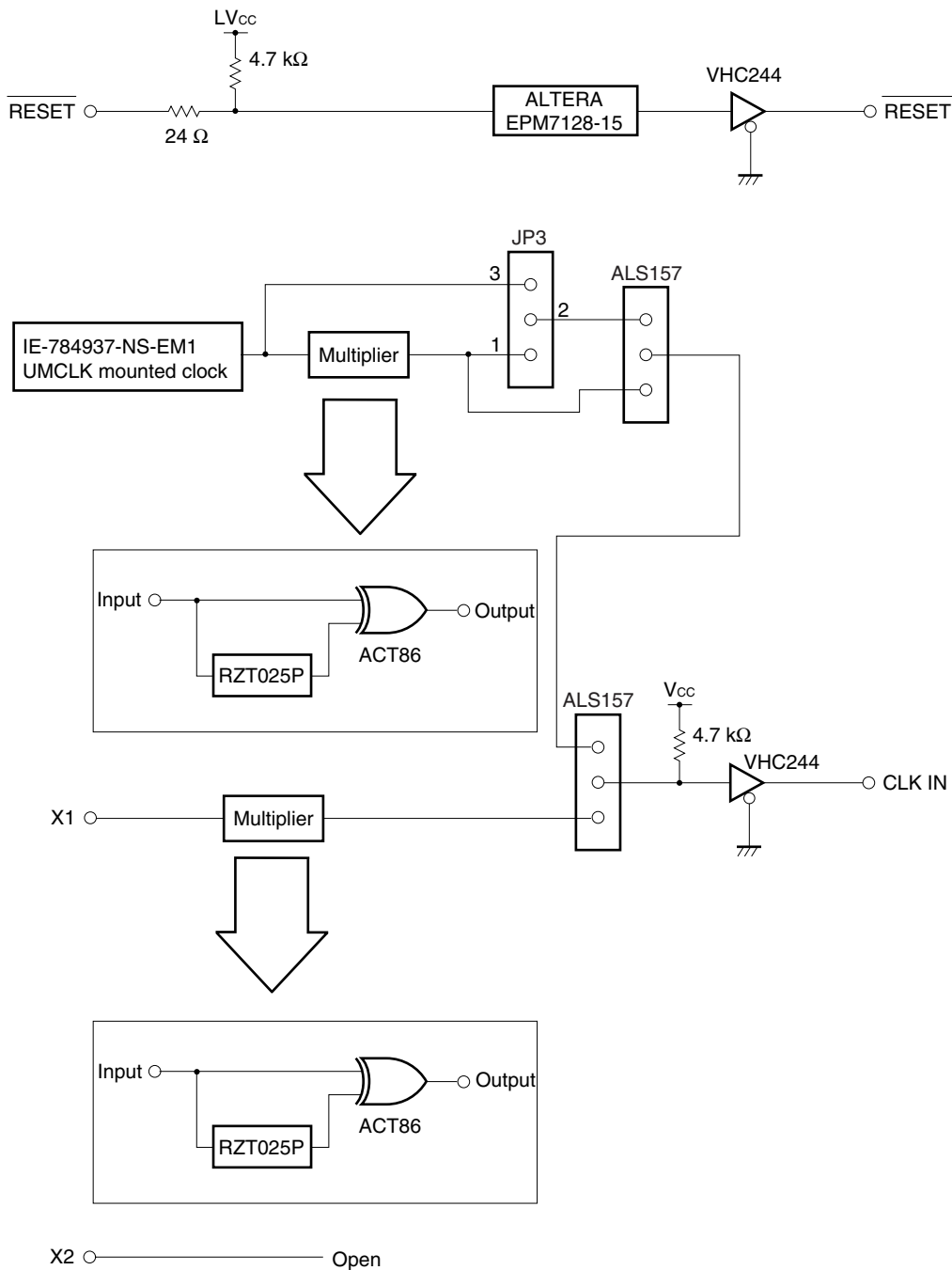
Note The AV_{DD} pin on the target system is not connected to the IE system. Either the power supply of the IE system or the power supply supplied to TP1 is supplied to the AV_{DD} pin of the emulation CPU.

(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 PD784938A Subseries. Their AC characteristics and DC characteristics are therefore different from μ PD784938A Subseries, making it necessary to observe a stricter timing design than in the case of μ PD784938A Subseries.

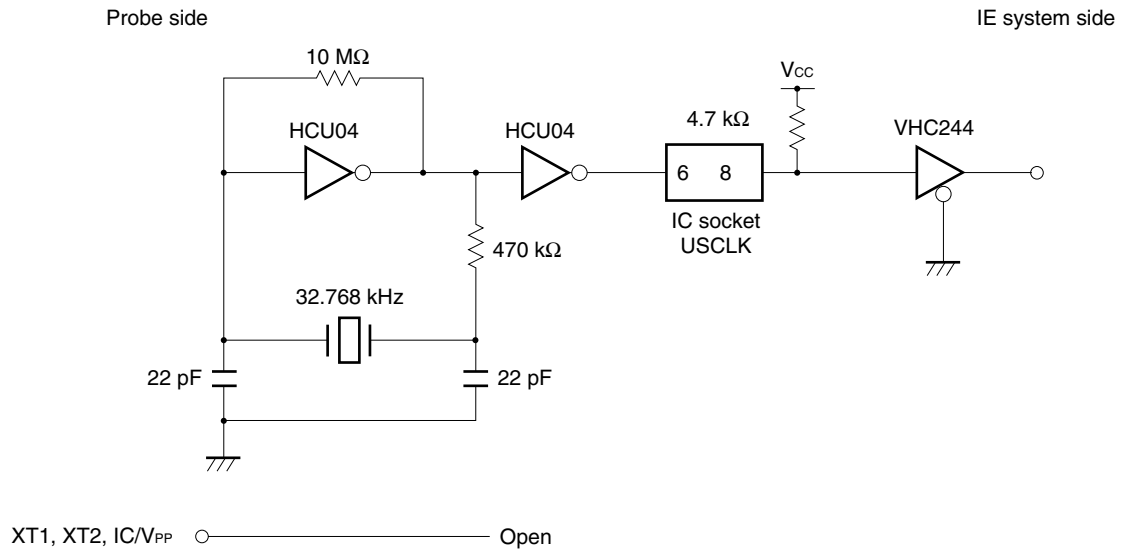
- $\overline{\text{RESET}}$ signal
- Signals related to clock input

Figure 4-2. Equivalent Circuit 2 of Emulation Circuit



Remark When using the IE-784937-NS-EM1 with the IE-78K4-NS, set JP3 with 1 and 2 shorted.

Figure 4-3. Equivalent Circuit 3 of Emulation Circuit

**(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.

CHAPTER 5 RESTRICTIONS

The IE-784937-NS-EM1 has the following restrictions.

- The specification of the STOP mode of the watch timer function is different from that of the target device. When the count clock is selected as the main clock, the timer stops in the target device in STOP mode, however, the timer does not stop in the IE-784937-NS-EM1.

CHAPTER 6 CAUTIONS

When using the IE-784937-NS-EM1, observe the cautions below.

- Set the IE-784937-NS-EM1 as follows when using it in combination with the IE-78K4-R-EX3 in the IE-784000-R. Note that the setting described in 3.1 Installation Procedure (2) of the IE-78K4-R-EX3 User's Manual (U16346E) is not required.

(1) Set JP3 with 2 and 3 shorted.

(2) Mount a crystal oscillator in the UMCLK socket.

A 12.580 MHz crystal oscillator is mounted at shipment.

(3) Set SW1 as shown below.

Use the integrated debugger to manipulate the mask settings of WAIT, HOLD, and NMI.

Table 6-1. SW1 Setting When Using IE-784000-R

SW1	DIP Switch						
	1	2	3	4	5	6	7
Setting	ON	OFF	OFF	ON	OFF	OFF	Note

Note SW1-7 is for setting the internal clock.

Table 6-2. SW1-7 Setting When Using IE-784000-R

SW1-7	Connection of Target System (V _{DD} Detection)	Clock Frequency ^{Note}
ON (initial setting)	Connected	6.290 MHz (divided by 2)
	Not connected	12.580 MHz
OFF	Connected	6.290 MHz (divided by 2)
	Not connected	6.290 MHz (divided by 2)

Note When a 12.580 MHz crystal oscillator is mounted in the UMCLK socket (shipment setting).

(3) Connect the 4937 PROBE Board (GF) to the IE-784937-NS-EM1.

Connect the 4937 PROBE Board (GF) to the IE-784937-NS-EM1, aligning ACN1 and RCN3 on both sides.

Caution The 4937 PROBE Board (GC) is used for expansion. It is not used in normal operation.

APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. NP-100GF, NP-100GF-TQ, NP-H100GF-TQ Pin Assignments (1/2)

Emulation Probe	ACN1 Pin No.	Emulation Probe	ACN1 Pin No.
1	116	34	107
2	115	35	104
3	87	36	103
4	88	37	100
5	83	38	99
6	84	39	94
7	77	40	93
8	78	41	30
9	73	42	29
10	74	43	24
11	69	44	23
12	70	45	20
13	63	46	19
14	64	47	16
15	61	48	15
16	62	49	10
17	65	50	9
18	66	51	6
19	71	52	5
20	72	53	33
21	75	54	34
22	76	55	37
23	79	56	38
24	80	57	43
25	85	58	44
26	86	59	47
27	89	60	48
28	90	61	51
29	118	62	52
30	117	63	57
31	114	64	58
32	113	65	59
33	108	66	60

- Remarks**
1. The NP-100GF, NP-100GF-TQ, and NP-H100GF-TQ are products of Naito Densai 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-100GF, NP-100GF-TQ, NP-H100GF-TQ Pin Assignments (2/2)

Emulation Probe	ACN1 Pin No.	Emulation Probe	ACN1 Pin No.
67	55	84	13
68	56	85	18
69	49	86	17
70	50	87	22
71	45	88	21
72	46	89	28
73	41	90	27
74	42	91	92
75	35	92	91
76	36	93	98
77	31	94	97
78	32	95	102
79	4	96	101
80	3	97	106
81	8	98	105
82	7	99	112
83	14	100	111

- Remarks**
1. The NP-100GF, NP-100GF-TQ, and NP-H100GF-TQ are products 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.

APPENDIX B PROGRAM WAIT CONTROL REGISTER SETTINGS IN IN-CIRCUIT EMULATOR

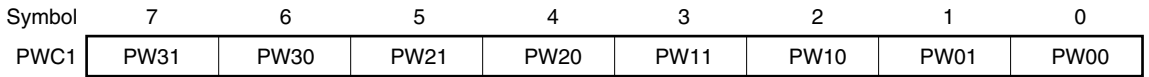
When performing programmable debugging using the in-circuit emulator, wait control must be performed by setting programmable wait control register 1 (PWC1) and programmable wait control register 2 (PWC2).

If an external wait is set for the internal ROM area, the CPU becomes deadlocked.

The deadlock status is cleared only by reset input.

(1) Program wait control register 1 (PWC1) of in-circuit emulator

Address: 0FFC7H After reset: AAH R/W

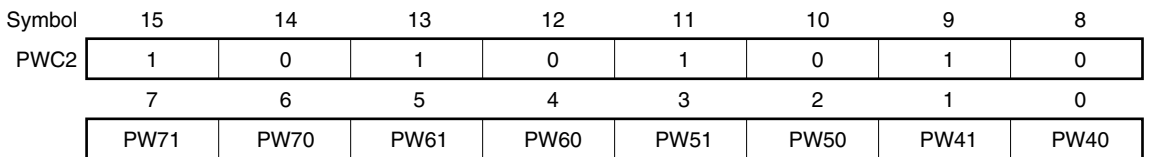


(n = 0 to 3)

Wait Target Address	00C000H	008000H	004000H	000000H
	to	to	to	to
PWn1 PWn0	00FFFFH	00BFFFH	007FFFH	003FFFH
0 0	No address wait insertion			
0 1	1-wait access wait insertion			
1 0	2-wait access wait insertion			
1 1	Access wait insertion for low-level time input to $\overline{\text{WAIT}}$ pin			

(2) Program wait control register 2 (PWC2) of in-circuit emulator

Address: 0FFC8H After reset: AAAAH W



(n = 4 to 7)

Wait Target Address	080000H	040000H	020000H	010000H
	to	to	to	to
PWn1 PWn0	0FFFFFFH	07FFFFFFH	03FFFFFFH	01FFFFFFH
0 0	No address wait insertion			
0 1	1-wait access wait insertion			
1 0	2-wait access wait insertion			
1 1	Access wait insertion for low-level time input to $\overline{\text{WAIT}}$ pin			

Remark Wait cycle insertion is controlled by the entire address space (except peripheral RAM area).

APPENDIX C NOTES ON TARGET SYSTEM DESIGN

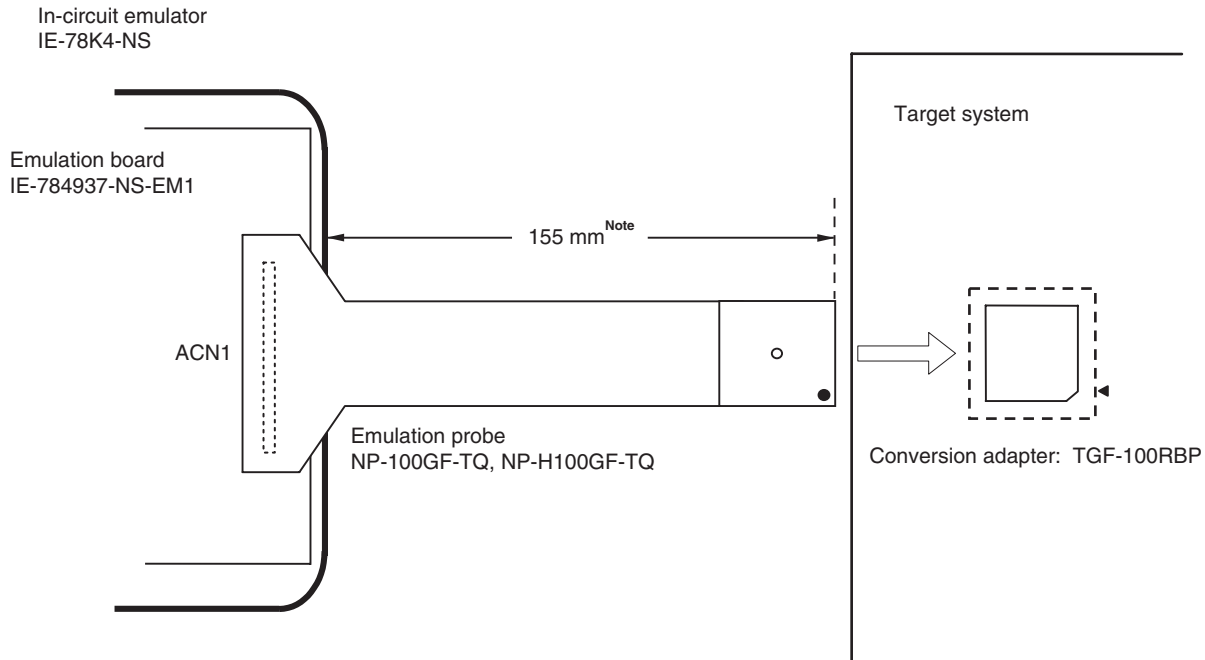
The following shows the conditions when connecting the emulation probe to the conversion adapter. Follow the configuration below and consider the shape of parts to be mounted on the target system when designing a system.

Among the products described in this appendix, NP-100GF-TQ and NP-H100GF-TQ are products of Naito Densetsu Machida Mfg. Co., Ltd, and TGF-100RBP is a product of TOKYO ELETECH CORPORATION.

Table C-1. Distance Between IE System and Conversion Adapter

Emulation Probe	Conversion Adapter	Distance Between IE System and Conversion Adapter
NP-100GF-TQ	TGF-100RBP	155 mm
NP-H100GF-TQ		355 mm

Figure C-1. Distance Between IE System and Conversion Adapter



Note Distance when NP-100GF-TQ is used. When NP-H100GF-TQ is used, the distance is 355 mm.

Figure C-2. Connection Conditions of Target System (When NP-100GF-TQ Is Used)

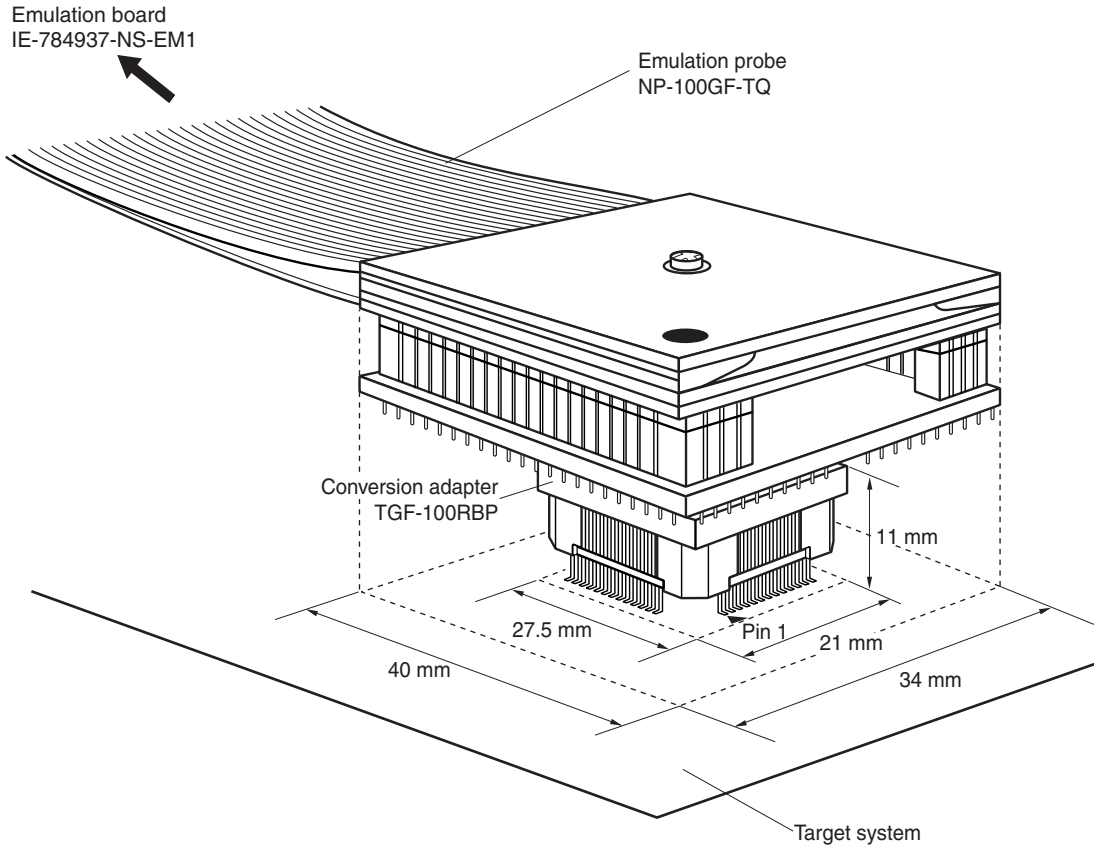


Figure C-3. Connection Conditions of Target System (When NP-H100GF-TQ Is Used)

