CUSTOMER NOTIFICATION

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IE-789835-NS-EM1

Preliminary User's Manual

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INTRODUCTION

Product Overview

The IE-789835-NS-EM1 is designed to be used with the IE-78K0S-NS or IE-78K0S-NS-A to debug the following target devices that belong to the 78K0S Series of 8-bit single-chip microcontrollers.

- μPD789835 Subseries: μPD789832, 789833, 789834, 789835, 78F9835

Target Readers

This manual is intended for engineers who will use the IE-789835-NS-EM1 with the IE-78K0S-NS or IE-78K0S-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-789835-NS-EM1, refer to not only this manual (supplied with the IE-789835-NS-EM1) but also the manual that is supplied with the IE-78K0S-NS or IE-78K0S-NS-A.

IE-78K0S-NS User's Manual	IE-78K0S-NS-A User's Manual	IE-789835-NS-EM1 User's Manual
• Basic specifications • System configuration • External interface functions	• Basic specifications • System configuration • External interface functions	• 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-789835-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-78K0S-NS or IE-78K0S-NS-A and the IE-789835-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 Document The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Document Name	Document Number	
	Japanese	English
IE-78K0S-NS	U13549J	U13549E
IE-78K0S-NS-A	U15207J	U15207E
IE-789835-NS-EM1	SUD-TT-0082-1	This manual
ID78K Series Integrated Debugger Ver.2.30 or Later Operation (Windows™ Based)	U15185J	U15185E
μPD789835 Subseries	To be prepared	To be prepared

Caution The related documents listed above are subject to change without notice. Be sure to use the latest version of each document for designing.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1 GENERAL

The IE-789835-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/0S Series of 8-bit single-chip microcontrollers.

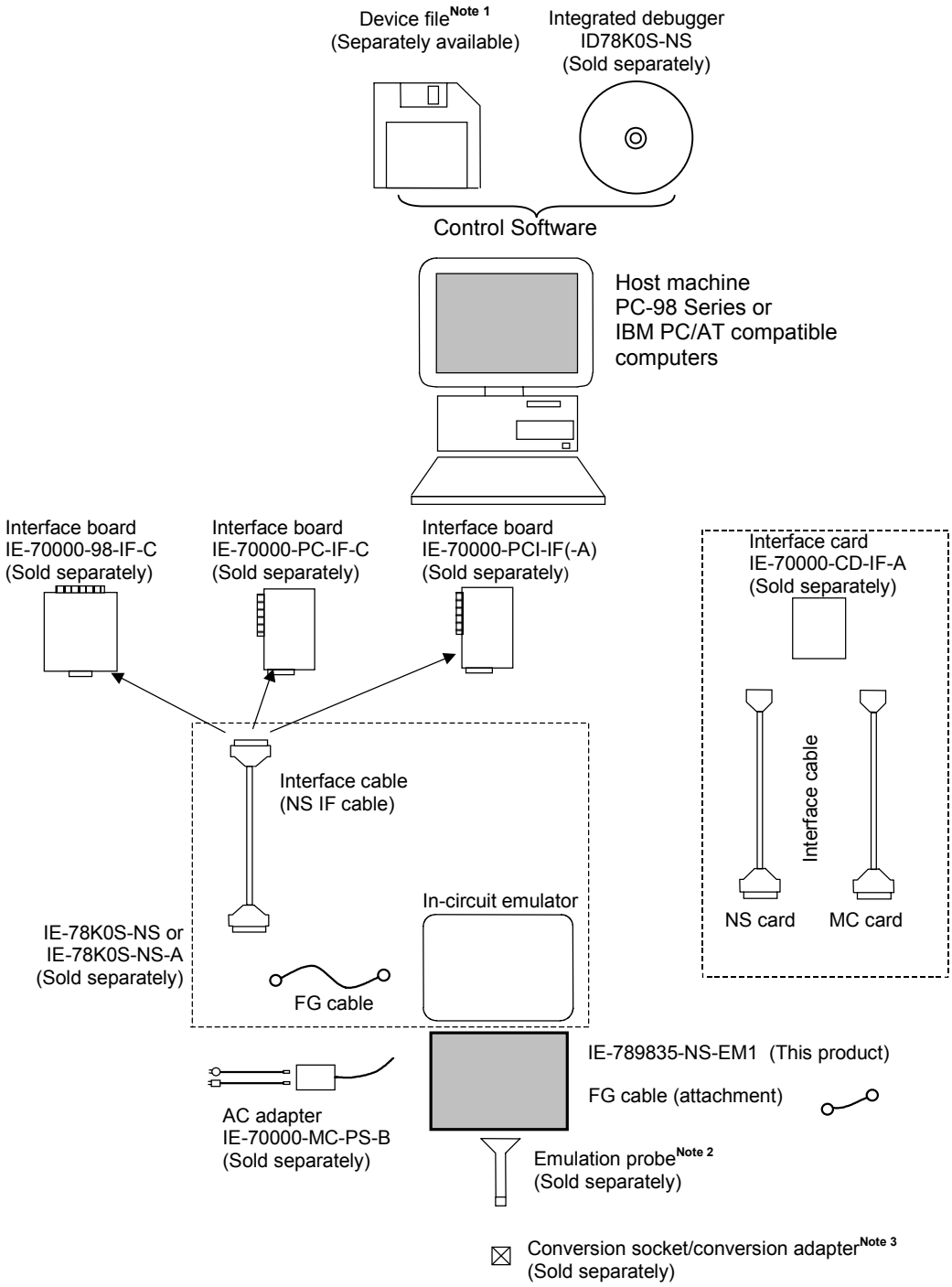
This chapter describes the IE-789835-NS-EM1 system configuration and basic specifications.

- Target device
  - μPD789835 Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-789835-NS-EM1 system configuration.

Figure 1-1. System Configuration



Notes 1. The device file is as follows.

μSXXXXDF789835: μPD789835 Subseries

2. The emulation probe is as follows.

SWEX-144SD-1: 144-pin plastic LQFP (probe length: 315 mm)

SWEX-144SD-1is 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)

3. The conversion socket and conversion adapter are as follows.

NQPACK144SD: For 144-pin plastic LQFP (GJ type)

YQPACK144SD: For 144-pin plastic LQFP (GJ type)

NQPACK144SD and YQPACK144SD are products of Tokyo Eletech Corporation.

For further information, contact: Daimaru Kogyo, Ltd.

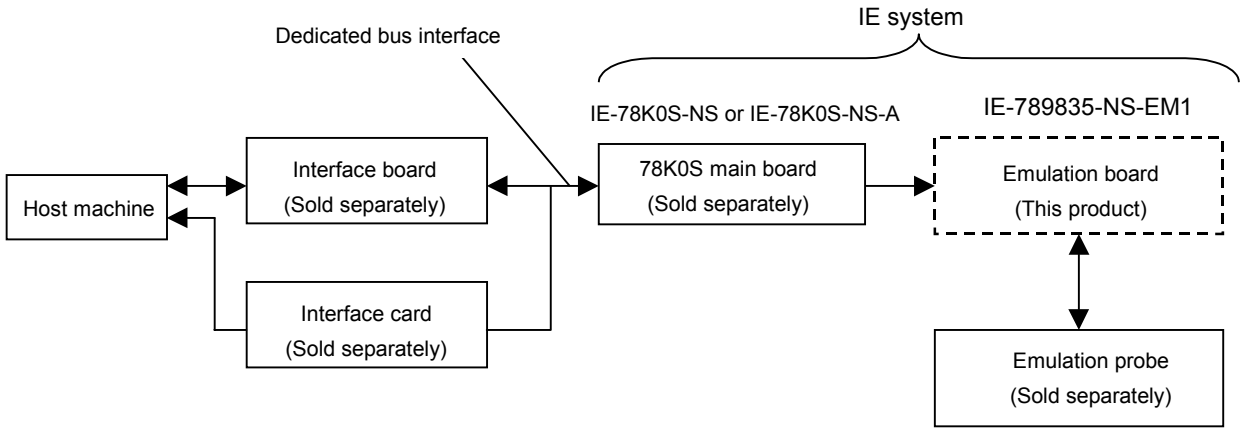
Tokyo Electronics Department (TEL +81-3-3820-7112)

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

1.2 Hardware Configuration

Figure 1-2 shows the IE-789835-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The IE-789835-NS-EM1's basic specifications are listed in Table 1-1.

Table 1-1. Basic Specifications

Parameter	Description
Target device	μPD789835 Subseries
System clock	Main system clock: 1.000 to 5.000 MHz Subsystem clock: 32.768 kHz
System clock supply	Internal: Mounted on the emulation board (5 MHz) or mounted by user on the parts board External: Input from the target system via an emulation probe
Subclock supply	Internal: Mounted on the emulation board (32.768 kHz) or mounted by user on the parts board External: Input from the target system via an emulation probe
Target interface voltage	V_{DD} = 1.8 V to 3.6 V (Same as the target device) When target system not connected: Operates @ 3 V internal voltage

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-789835-NS-EM1 main unit.

The packing box contains the emulation board (IE-789835-NS-EM1), FG cable, package details, user's manual, and guarantee card.

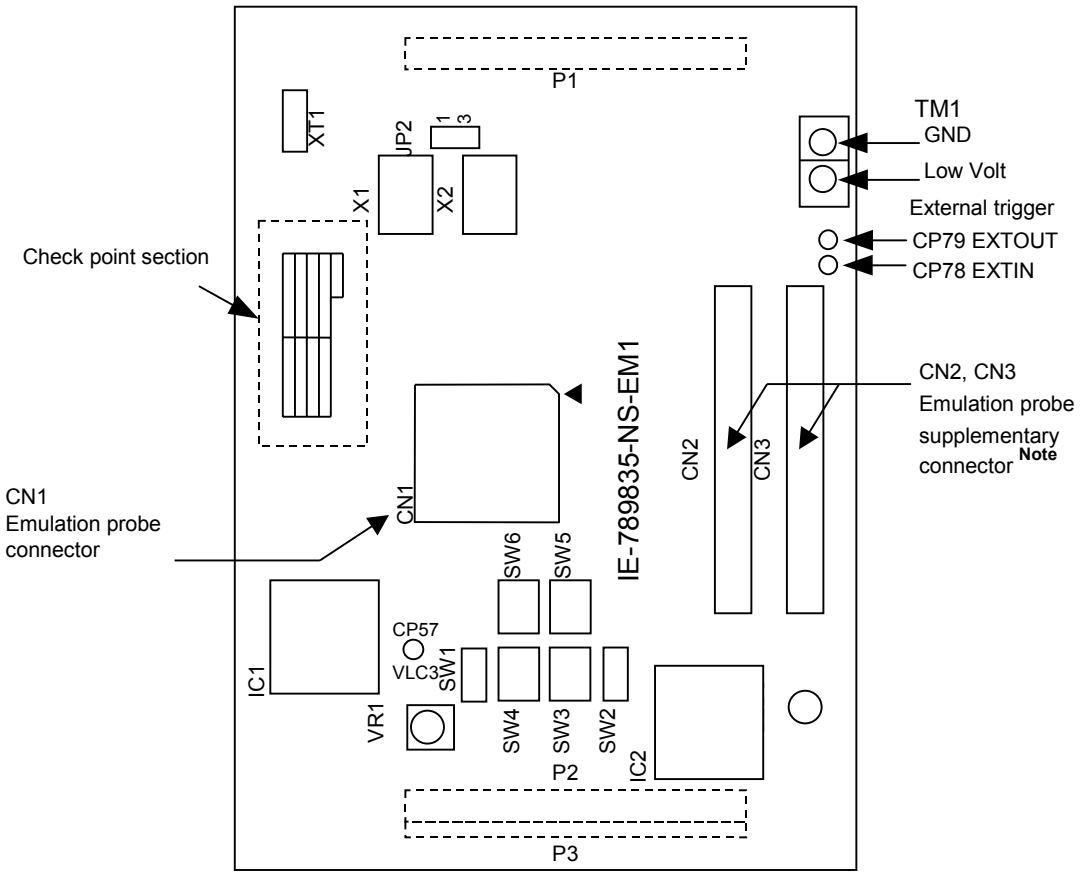
If there are any missing or damaged items, please contact an NEC sales representative.

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

2.1 Names of Parts on Board

Figure 2-1 shows the names of the parts on the probe board.

Figure 2-1. Names of Parts on IE-789835-NS-EM1 Board



Note CN2 and CN3 are not used to connect the emulation probe. These are used as a supplementary emulation probe to check the signals of the CN1 pins. See **APPENDIX A EMULATION PROBE PIN CORRESPONDENCE TABLE.**

2.2 Initial Settings of Switches and Jumpers

Table 2-1 shows the initial settings of jumpers and switches on the IE-789835-NS-EM1.

Refer to **3.4 Clock Settings** for the JP2 setting.

Refer to **3.6 Emulation of LCD** for the SW1 to SW6 setting.

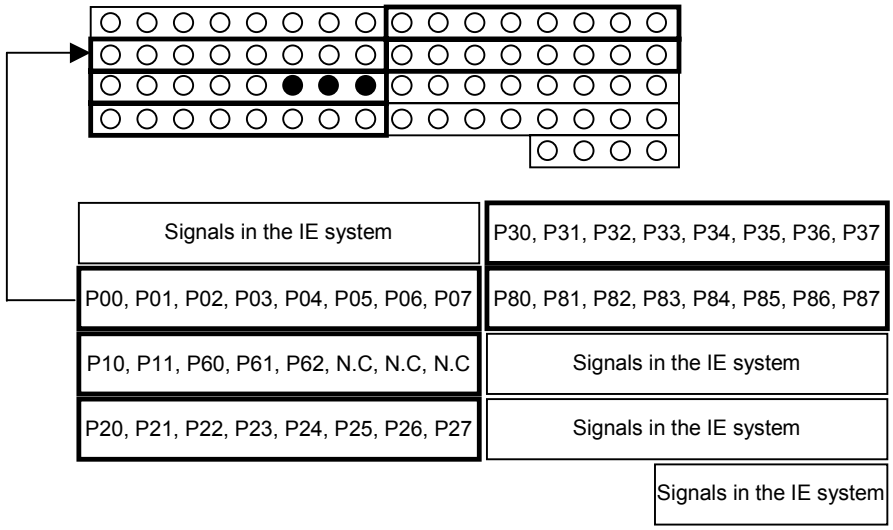
Table 2-1. Initial Settings of Switches and Jumpers

	JP2					
Initial setting	2-3 shorted					
	SW1	SW2	SW3	SW4	SW5	SW6
Initial setting	OFF	ICE	ICE	ICE	ICE	ICE

2.3 Check Point Section

The through holes on the check point section (See **Figure 2-1 Names of Parts on IE-789835-NS-EM1 Board** on page 12) are placed at 2.54 mm vertical and horizontal intervals, and can be used to check the signals of port pins in the IE-789835-NS-EM1.

Figure 2-2. Check Point Section



Caution Do not fetch or connect the signals in the IE system externally; otherwise the IE system may be damaged.

Remark The through hole indicated by ● (N.C) can be connected to any pin.

CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-789835-NS-EM1 to the IE-78K0S-NS or IE-78K0S-NS-A and emulation probe. Mode setting methods are also described.

Caution Connecting or removing parts 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-78K0S-NS-A or IE-78K0S-NS-A main unit

See the IE-78K0S-NS User's Manual (U13549E) or IE-78K0S-NS-A User's Manual (U15207E) for a description of how to connect the IE-789835-NS-EM1 to the IE-78K0S-NS or IE-78K0S-NS-A.

(2) Connection with emulation probe

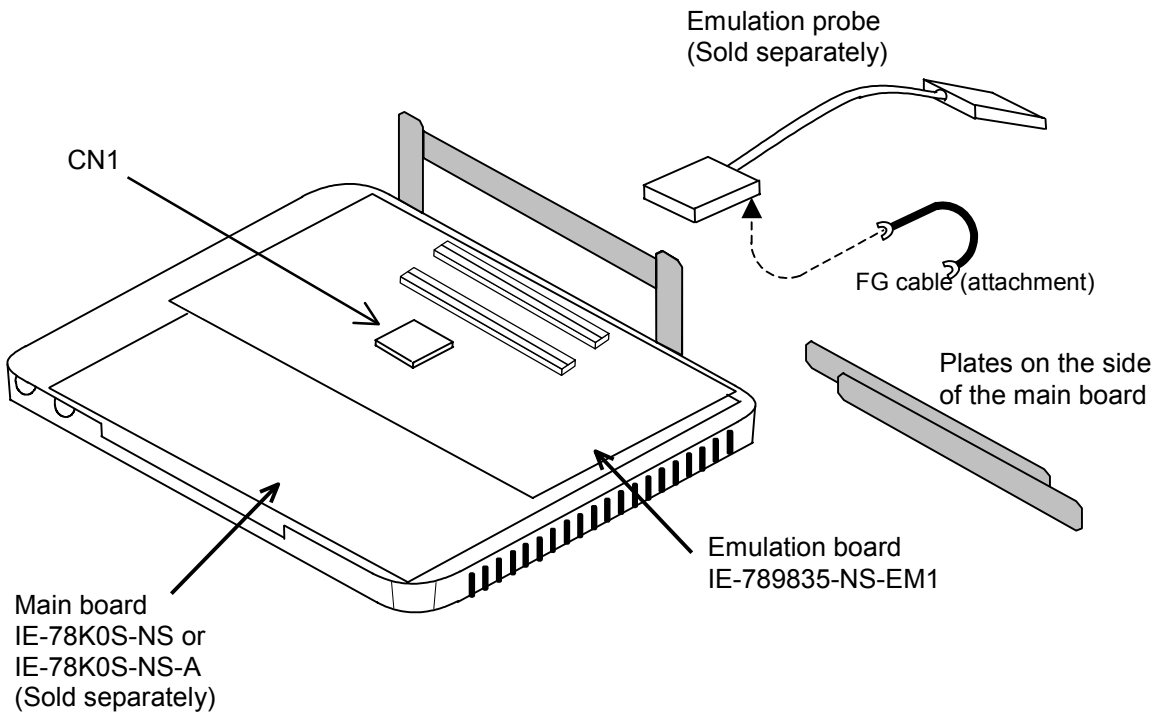
Connect the emulation probe, FG cable and the IE-789835-NS-EM1 as shown below.

On this board, connect the emulation probe to CN1.

<Procedure>

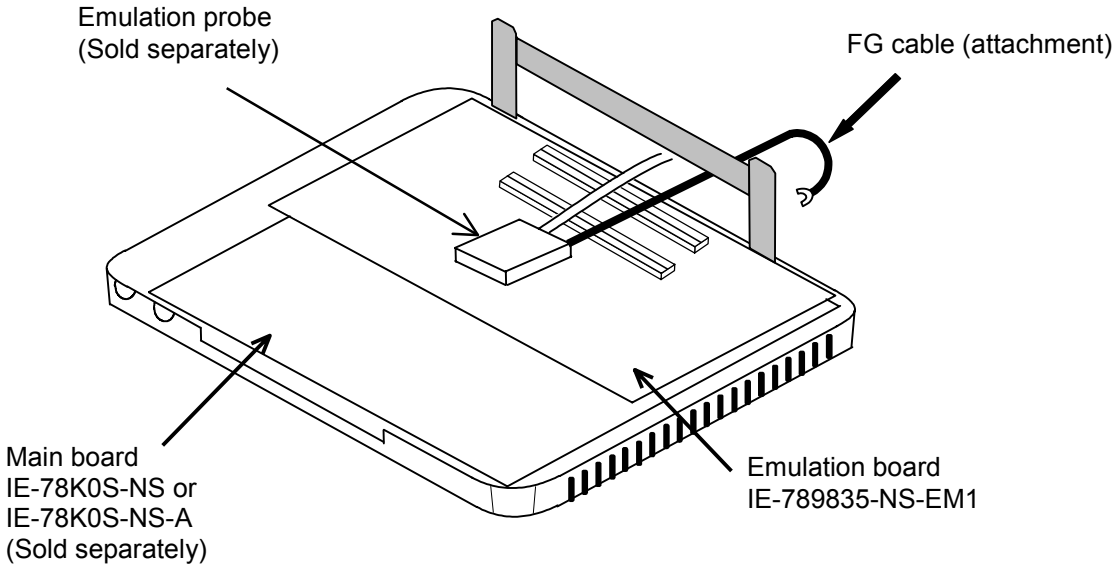
<1> Remove the two plates on the side of the IE-78K0S-NS or IE-78K0S-NS-A main board. Loosen the FG screw on the connector on the IE system side of the emulation probe, connect one side of the FG cable and fix it with the screw.

Figure 3-1. Connection of Emulation Probe (1)



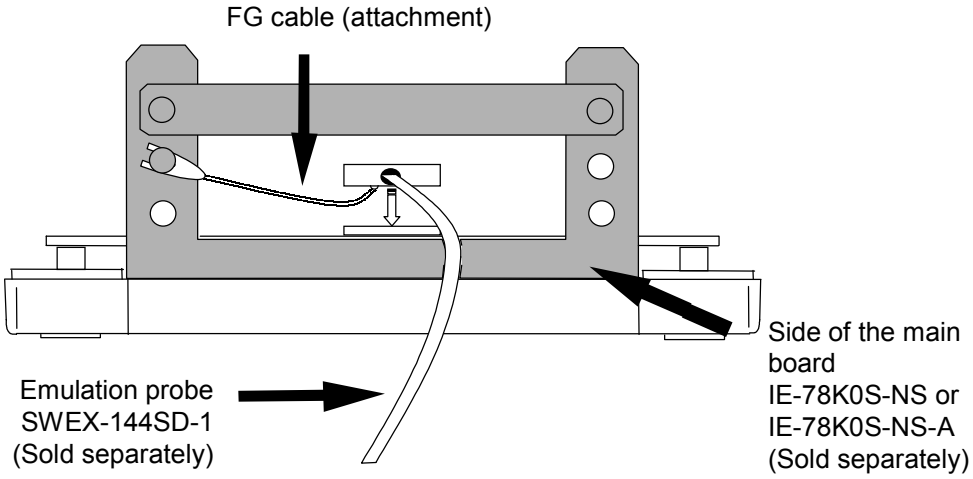
<2> Open the top cover of the IE-78K0S-NS or IE-78K0S-NS-A main board and connect the emulation probe to the IE-789835-NS-EM1 probe connector (CN1).

Figure 3-2. Connection of Emulation Probe (2)



<3> Connect the other side of the FG cable to the emulation probe with the screw on the plate on the side of the IE-78K0S-NS or IE-78K0S-NS-A main board.

Figure 3-3. Connection of Emulation Probe (3)



Caution Incorrect connection may damage the IE system. For more details on connection, see the user's manual for each emulation probe.

3.2 Settings of Switches and Jumpers on Main Board

(1) Setting of IE-78K0S-NS

Before using the IE-789835-NS-EM1, set each jumper and switch of the IE-78K0S-NS as described below. For the positions of the switches and jumpers, refer to the IE-78K0S-NS User's Manual (U13549E).

Table 3-1. Setting of Switches and Jumpers on IE-78K0S-NS

	SW1	SW3	SW4	JP2	JP4
Setting	OFF	All "ON" (fixed)	All "ON" (fixed)	2-3 shorted	1-2 shorted

(2) Setting of IE-78K0S-NS-A

Before using the IE-789835-NS-EM1, set each jumper and switch of the IE-78K0S-NS-A as described below. For the positions of the switches and jumpers, refer to the IE-78K0S-NS-A User's Manual (U15207E).

Table 3-2. Setting of Switches and Jumpers on IE-78K0S-NS-A

	SW1	JP2	JP3
Setting	OFF	1-2 shorted	Shorted (fixed)

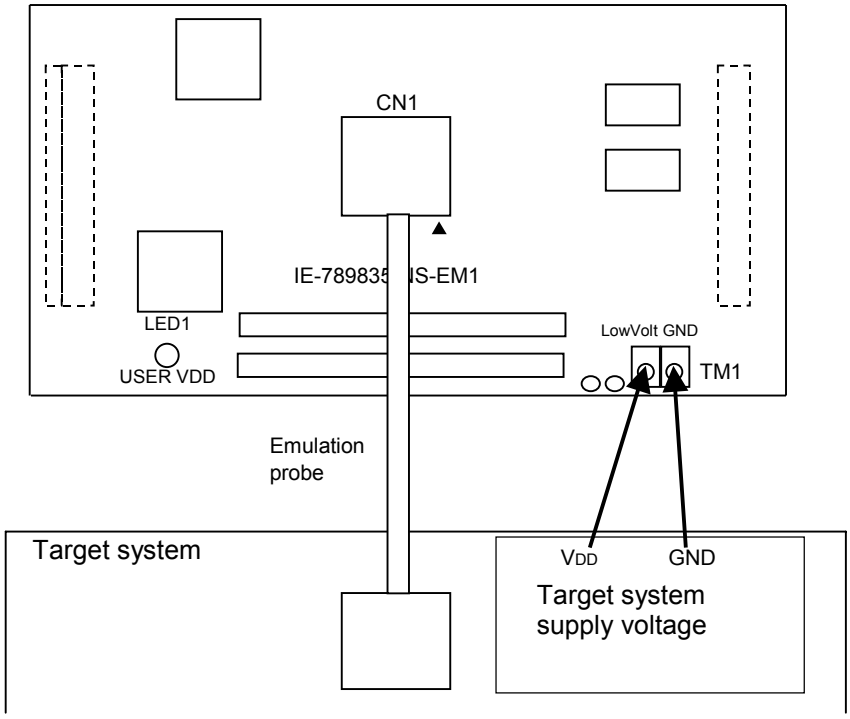
3.3 Settings of Target Interface Voltage

The IE system can be emulated at the same supply voltage level as that of the target system.
When the target system is not used, the emulator is designed to automatically operate on the internal voltage (3 V).
When debugging is performed at the voltage same level as the target system voltage, connect the voltage that is the same level as the target system voltage to the terminal pin (TM1) of the IE-789835-NS-EM1 (also applicable when debugging at 3 V).
See ID78K0 Series Integrated Debugger User's Manual (U15185E) for details of how to select the supply voltage.
The maximum current that can be consumed by TM1 is 3 V: approx.100 mA

Table 3-3. Target Interface Voltage Settings

Target Interface Voltage		Integrated Debugger (ID78K0S-NS)
		Operation Voltage Selection
When the target system is connected	1.8 to 3.6 V	Target
When the target system is not connected	3 V	Internal

Figure 3-4. Connection of TM1 and Target System Voltage



Caution Connect TM1 on the board and the target system supply voltage when the power of the IE-78K0S-NS or IE-78K0S-NS-A is off.

Remark The V_{DD} pin of the target system are only used to control the LED1 that monitors the connection of the target system power supply in the IE-789835-NS-EM1.

3.4 Clock Settings

3.4.1 Outline of clock settings

The system clock to be used during debugging can be selected from (1) to (3) below.

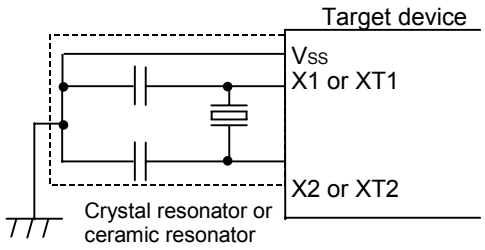
(1) Clock already mounted on emulation board
(2) Clock mounted by user
(3) Pulse input from the target system

If the target system includes a clock oscillator, select either “(1) Clock already mounted on emulation board” or “(2) Clock mounted by user”. For a clock oscillator, 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 Figure 3-5 (a). During emulation, the clock oscillator 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-78K0S-NS or IE-78K0S-NS-A, is used.
If the target system includes an external clock, select either “(1) Clock already mounted on emulation board”, “(2) Clock mounted by user”, or “(3) Pulse input from the target system”. 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 Figure 3-5 (b).

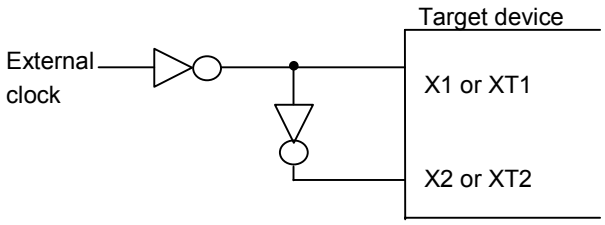
Caution The IE system will hang up if the main system clock is not supplied correctly. Emulation using the RC oscillator cannot be performed. In addition, input a rectangular pulse from the target system. It is not necessary to input clock to X2 and XT2 pins. The program does not operate if a crystal or ceramic resonator is connected directly to X1 or XT1 (in case of subsystem clock).

Figure 3-5. External Circuits Used as System Clock Oscillator

(a) Clock oscillator



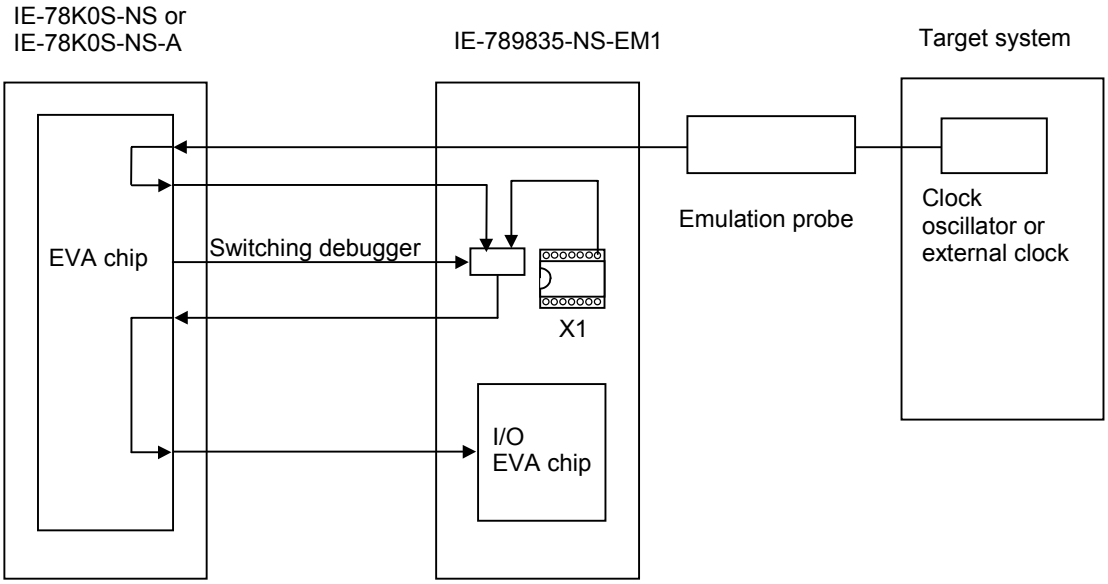
(b) External clock



An outline of the system clock is shown in Figure 3-6.

Figure 3-6. Outline of System Clock

(a) Main system clock



3.4.2 Main system clock settings

The settings of the IE-789835-NS-EM1's main system clock are shown in Table 3-4.

Table 3-4. Main System Clock Settings

Frequency of Main System Clock		IE-789835-NS-EM1	ID78K0S-NS
		Socket (X1)	CPU Clock Source Selection
(1) Clock already mounted on emulation board	5.0 MHz	Oscillator	Internal
(2) Clock mounted by user	Other than 5.0 MHz	Oscillator or oscillator circuit assembled	
(3) Pulse input from the target system		Oscillator (not used)	External

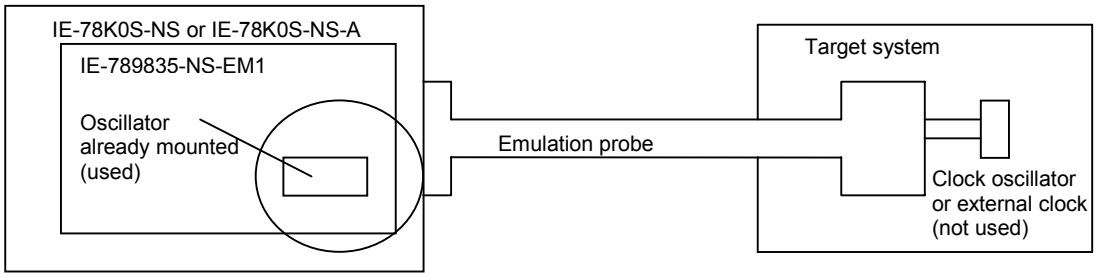
Caution When using an external clock, open the configuration dialog box when starting the integrated debugger (ID78K0S-NS) and select "External" in the area (Clock) for selecting the CPU's clock source (this selects the user's clock). Emulation using the RC oscillator cannot be performed.

Remark The IE-789835-NS-EM1's factory settings are those listed above under "when using clock already mounted on emulation board".

(1) When using clock already mounted on emulation board

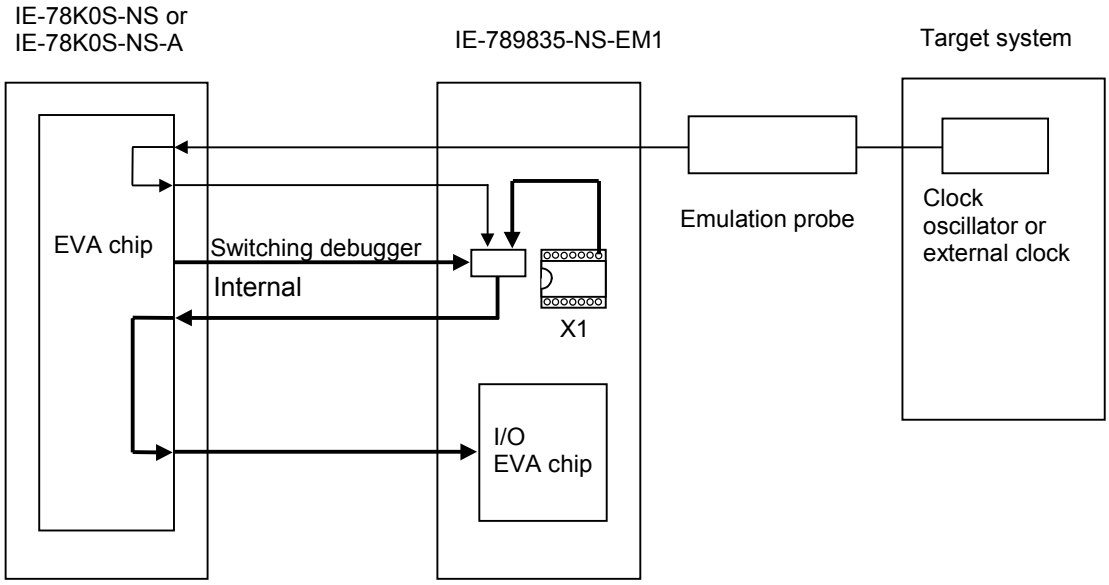
When the IE-789835-NS-EM1 is shipped, a 5.0 MHz crystal oscillator is already mounted in the IE-789835-NS-EM1's X1 socket. When using the factory-set mode settings, there is no need to make any hardware settings. When starting the integrated debugger (ID78K0S-NS), open the configuration dialog box and select "Internal" in the area (Clock) for selecting the CPU's clock source (this selects the emulator's internal clock).

Figure 3-7. When Using Clock Already Mounted on Emulation Board (Main System Clock)



Remark The clock that is supplied by the IE-789835-NS-EM1's oscillator (encircled in the figure) is used.

Outline Diagram



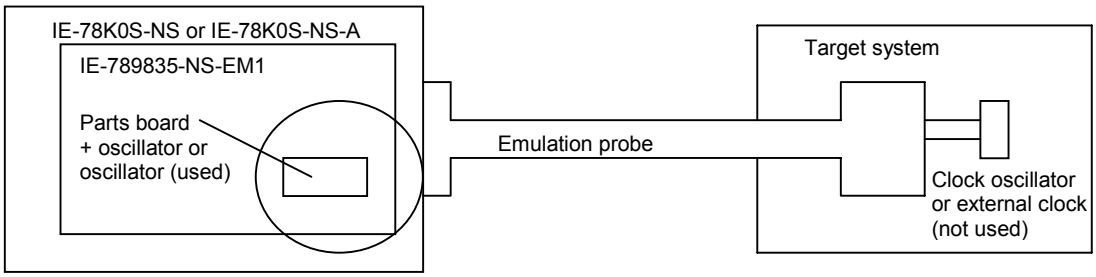
Remark The flow of the clock inside the IE-789835-NS-EM1 is indicated by the bold line.

(2) When using clock mounted by user

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

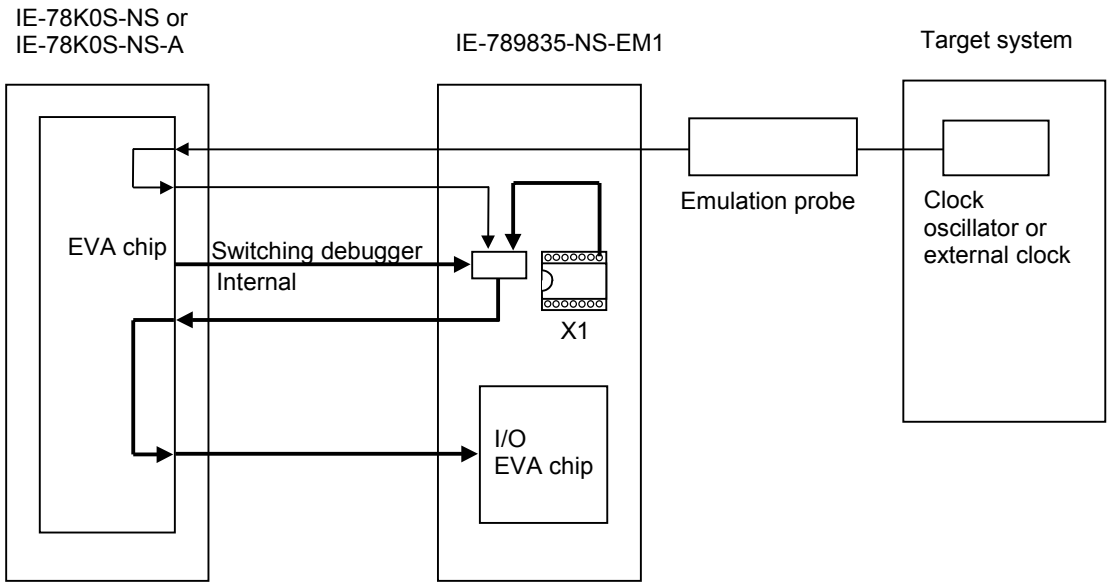
When starting the integrated debugger (ID78K0S-NS), open the configuration dialog box and select “Internal” in the area (Clock) for selecting the CPU’s clock source (this selects the emulator’s internal clock).

Figure 3-8. When Using Clock Mounted by User (Main System Clock)



Remark The clock that is supplied by the IE-789835-NS-EM1’s oscillator (encircled in the figure) is used.

Outline Diagram



Remark The flow of the clock inside the IE-789835-NS-EM1 is indicated by the bold line.

(a) When using a ceramic or crystal resonator

♦ Necessary items

- Crystal or ceramic resonator
- Resistor Rx
- Parts board
- Capacitor CA
- Capacitor CB
- Solder kit

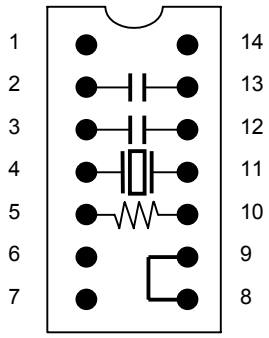
<Procedure>

<1> Prepare a parts board.

<2> Solder the target crystal or ceramic resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequencies) onto the supplied parts board as shown below.

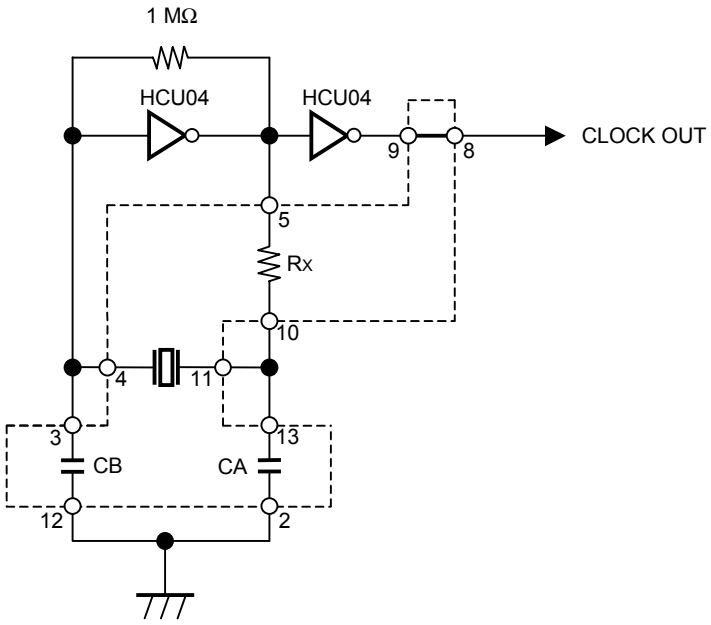
Figure 3-9. Connections on Parts Board (Main System Clock)

Parts board (X1)



Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Crystal or ceramic resonator
5-10	Resistor Rx
8-9	Shorted

Circuit Diagram



Remark The section enclosed by dotted lines indicates the section to be mounted on the parts board.

<3> Prepare the IE-789835-NS-EM1.

<4> Remove the crystal oscillator that is mounted in the IE-789835-NS-EM1's socket (X1).

<5> Make sure that the parts board is wired as shown in Figure 3-9 above.

<6> Connect the parts board (from <2> above) to the socket (X1) from which the crystal oscillator was removed in <4>. Check the pin 1 mark to make sure the board is mounted in the correct direction.

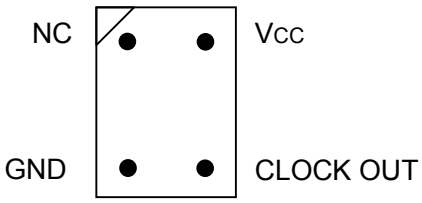
<7> Install the IE-789835-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(b) When using a crystal oscillator

♦ Necessary items

• Crystal oscillator (with pin configuration as shown in Figure 3-10)

Figure 3-10. Crystal Oscillator (Main System Clock)



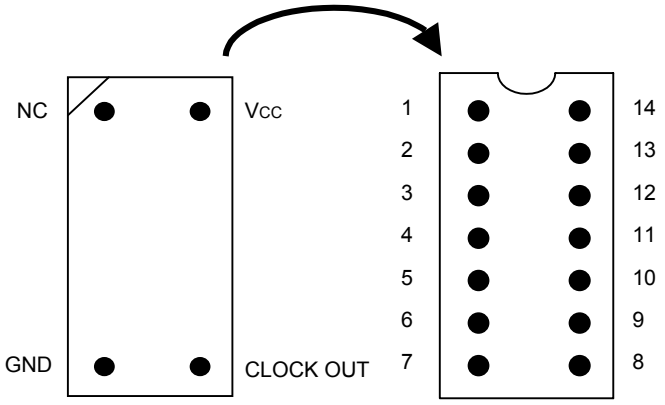
<Procedure>

<1> Prepare the IE-789835-NS-EM1.

<2> Remove the crystal oscillator from the socket (X1) on the IE-789835-NS-EM1.

<3> Mount the new crystal oscillator in the socket (X1) from which the crystal oscillator was removed in <2>. At this time, insert the crystal oscillator pin into the socket pin as indicated below.

Figure 3-11. Correspondence Between Crystal Oscillator and Socket (Main System Clock)



Crystal Oscillator Pin	Socket Pin No.
NC	1
GND	4
CLOCK OUT	8
VCC	14

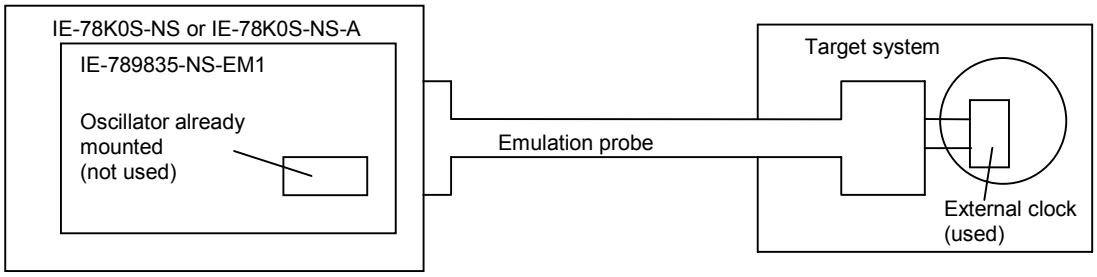
<4> Install the IE-789835-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(3) When using a pulse input from the target system

There is no need to make any hardware settings.

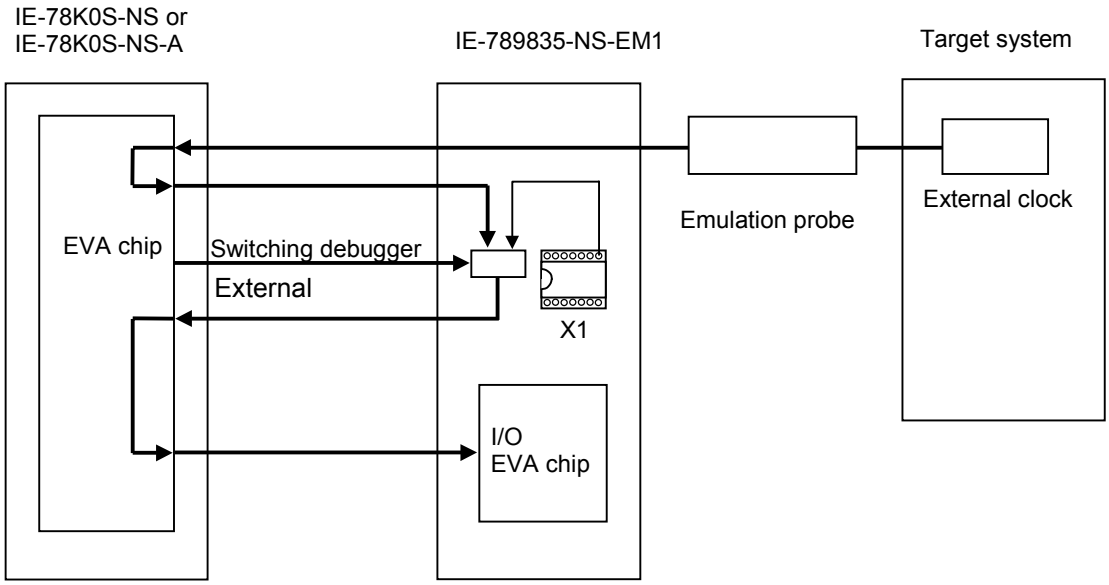
When starting the integrated debugger (ID78K0S-NS), open the configuration dialog box and select “External” in the area (Clock) for selecting the CPU’s clock source (this selects the user clock).

Figure 3-12. When Using Pulse Input from Target System (Main System Clock)



Remark The clock that is supplied by the external clock (encircled in the figure) is used.

Outline Diagram



Remark The flow of the clock inside the IE-789835-NS-EM1 is indicated by the bold line.

3.4.3 Subsystem clock settings

The settings of the IE-789835-NS-EM1's subsystem clock are shown in Table 3-5.

Table 3-5. Subsystem Clock Settings

Frequency of Subsystem Clock		IE-789835-NS-EM1	
		Socket (X2)	Jumper (JP2)
(1) Clock that is already mounted on emulation board (XTC1)	32.768 kHz	6-8 shorted	2-3 shorted
(2) Clock that is mounted by user	Other than 32.768 kHz	Oscillator assembled by user	
(3) Pulse input from the target system		Oscillator not used	1-2 shorted

Caution Set JP2 to switch between the clock on the board and external clock when the power of the IE-78K0S-NS or IE-78K0S-NS-A is off.

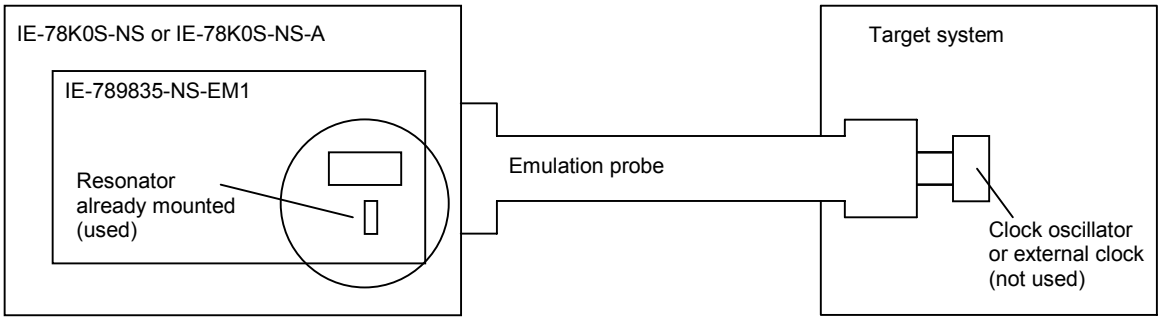
Remark The IE-789835-NS-EM1's factory settings are those listed above under "when using clock already mounted on emulation board".

(1) When using clock already mounted on emulation board

When the IE-789835-NS-EM1 is shipped, a crystal resonator (XTC1) is already mounted on the IE-789835-NS-EM1. When using the factory-set mode settings, there is no need to make any hardware settings. Pins 6 and 8 of the IE-789835-NS-EM1's socket (X2) on the parts board (X2) are shorted. Set the jumper (JP2) to 2-3 shorted.

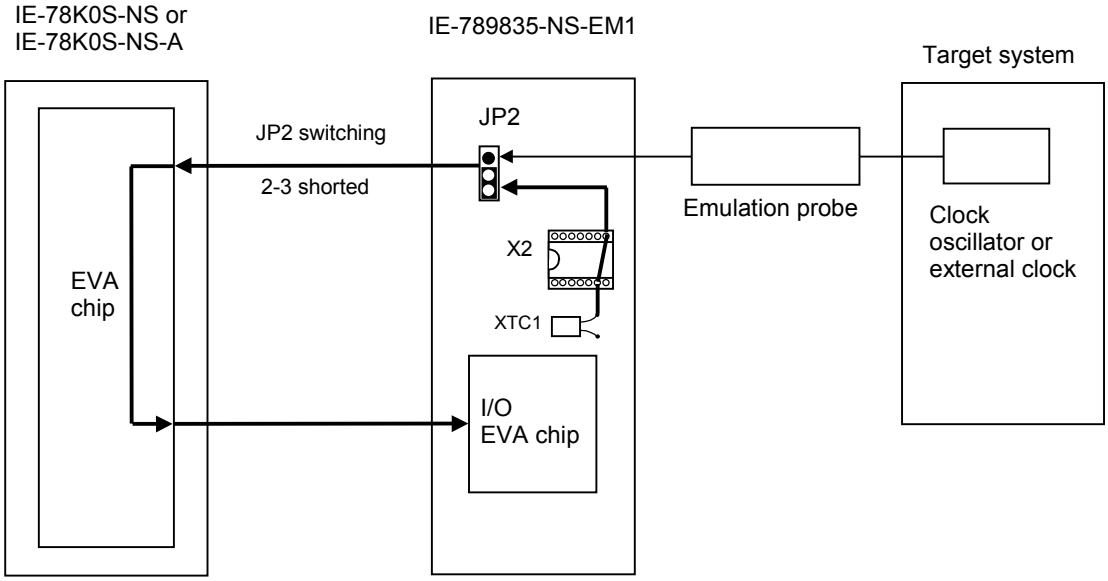
There is no need to make any settings in the integrated debugger (ID78K0S-NS).

Figure 3-13. When Using Clock Already Mounted on Emulation Board (Subsystem Clock)



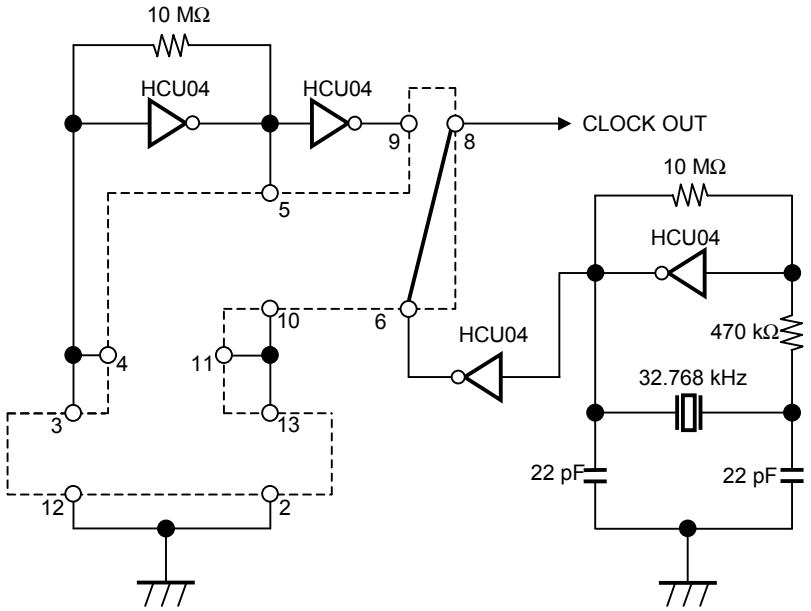
Remark The clock that is supplied by the IE-789835-NS-EM1's resonator (encircled in the figure) is used.

Outline Diagram



Remark The flow of the clock inside the IE-789835-NS-EM1 is indicated by the bold line.

Circuit Diagram



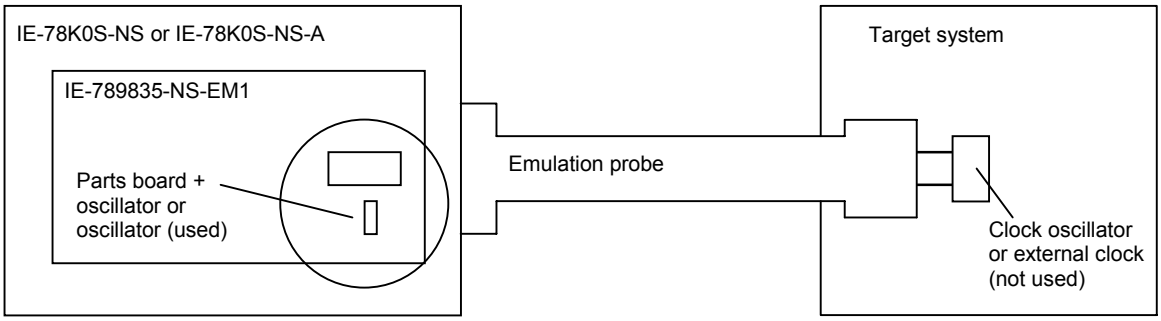
Remark The section enclosed by dotted lines indicates the section to be mounted on the socket (X2).

(2) When using clock mounted by user

The settings of either (a) or (b) described in the following pages are required, depending on the type of clock to be used. Set the jumper (JP2) on the IE-789835-NS-EM1 to 2-3 shorted.

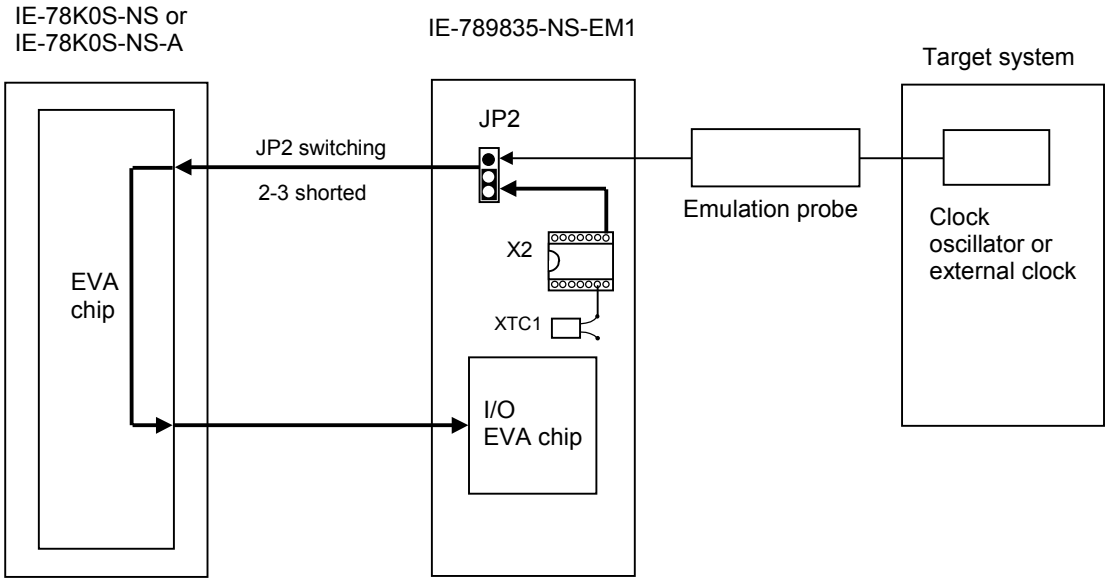
There is no need to make any settings in the integrated debugger (ID78K0S-NS).

Figure 3-14. When Using Clock Mounted by User (Subsystem Clock)



Remark The clock that is supplied by the IE-789835-NS-EM1's oscillator (encircled in the figure) is used.

Outline Diagram



Remark The flow of the clock inside the IE-789835-NS-EM1 is indicated by the bold line.

(a) When using a crystal resonator

♦ Necessary items

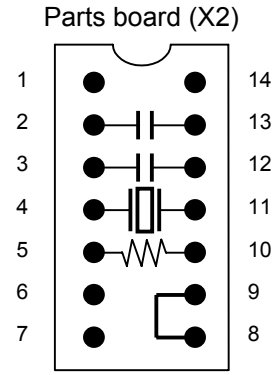
- Crystal resonator
- Resistor Rx
- Parts board
- Capacitor CA
- Capacitor CB
- Solder kit

<Procedure>

<1> Prepare a parts board.

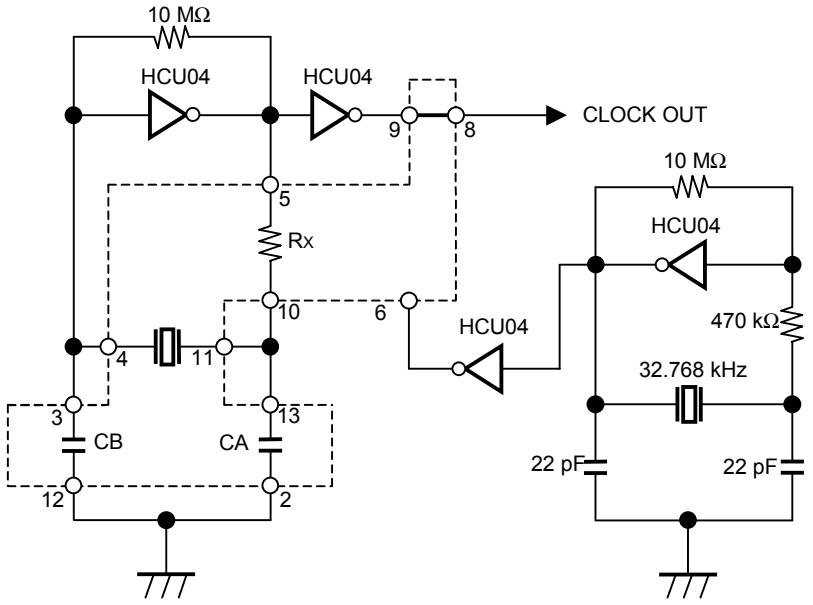
<2> Solder the target crystal resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequencies) onto the supplied parts board as shown below.

Figure 3-15. Connections on Parts Board (Subsystem Clock)



Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Crystal resonator
5-10	Resistor Rx
8-9	Shorted

Circuit Diagram



Remark The section enclosed by dotted lines indicates the section to be mounted on the parts board.

<3> Prepare the IE-789835-NS-EM1.

<4> Remove the jumper that is mounted in the IE-789835-NS-EM1's socket (X2).

<5> Make sure that the parts board is wired as shown in Figure 3-15 above.

<6> Connect the parts board (from <2> above) to the socket (X2) from which the jumper was removed in <4>. Check the pin 1 mark to make sure the board is mounted in the correct direction.

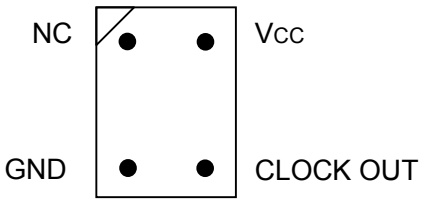
<7> Install the IE-789835-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(b) When using a crystal oscillator

♦ Necessary items

• Crystal oscillator (with pin configuration as shown in Figure 3-16)

Figure 3-16. Crystal Oscillator (Subsystem Clock)



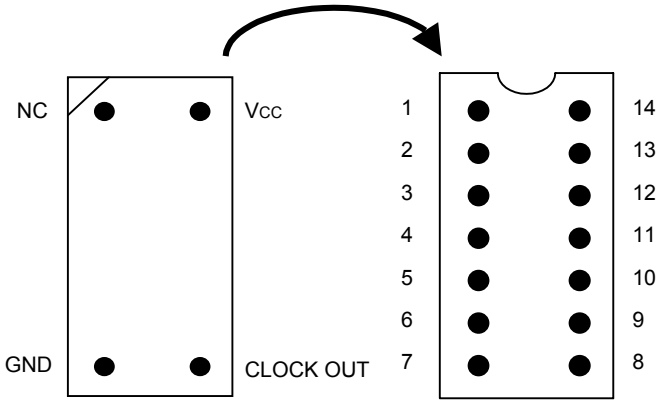
<Procedure>

<1> Prepare the IE-789835-NS-EM1.

<2> Remove the parts board from the socket (X2) on the IE-789835-NS-EM1.

<3> Mount the crystal oscillator in the socket (X2) from which the parts board was removed in <2>. At this time, insert the crystal oscillator pin into the socket pin as indicated below.

Figure 3-17. Correspondence Between Crystal Oscillator and Socket (Subsystem Clock)



Crystal Oscillator Pin	Socket Pin No.
NC	1
GND	4
CLOCK OUT	8
VCC	14

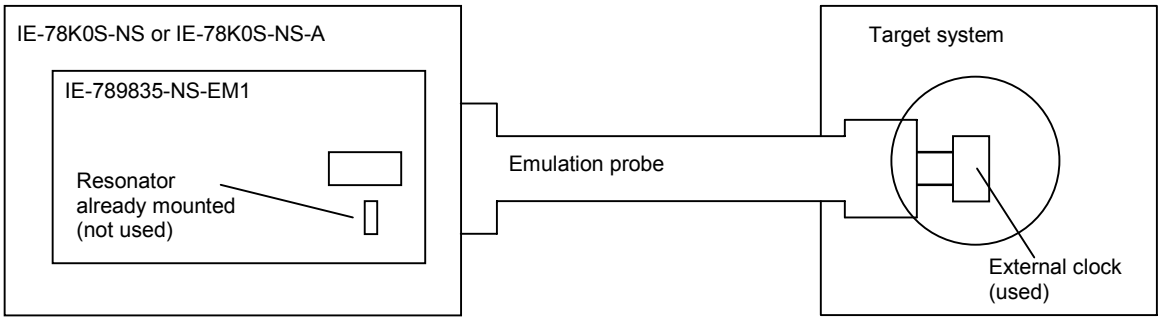
<4> Install the IE-789835-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

(3) When using a pulse input from the target system

Set JP2 on the IE-789835-NS-EM1 to 1-2 shorted.

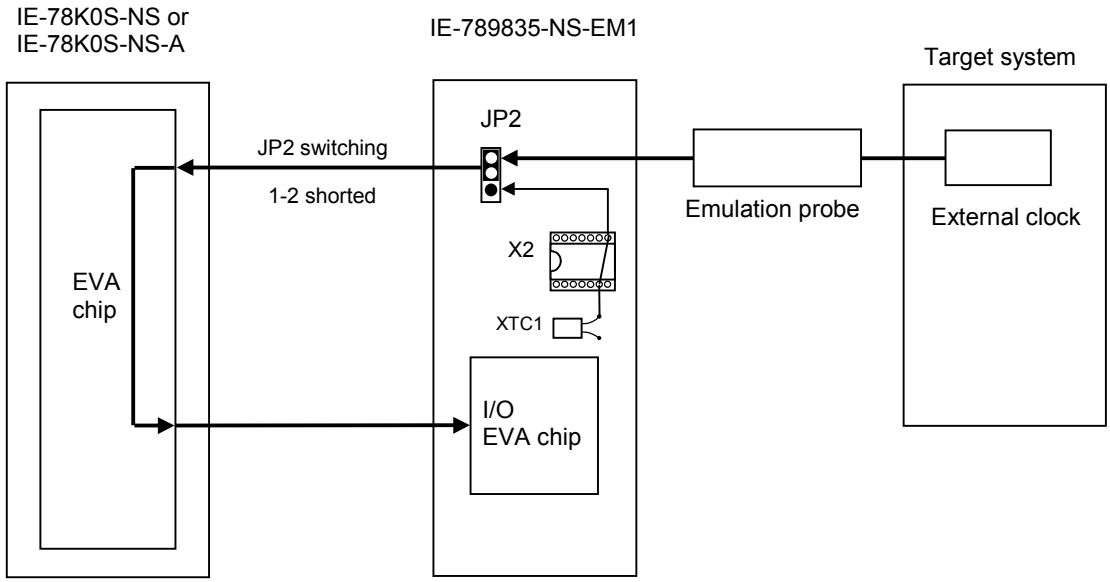
There is no need to make any settings in the integrated debugger (ID78K0S-NS).

Figure 3-18. When Using Pulse Input from Target System (Subsystem Clock)



Remark The external clock that is supplied by the target system (encircled in the figure) is used.

Outline Diagram



Remark The flow of the clock inside the IE-789835-NS-EM1 is indicated by the bold line.

3.5 External Trigger

To set an external trigger, connect it to the IE-789835-NS-EM1's check pin, EXTOUT pin and EXTIN pin.

See the IE-78K0S-NS User's Manual (U13549E) or IE-78K0S-NS-A User's Manual (U15207E) for descriptions of pin characteristics.

See the ID78K Series Integrated Debugger Ver.2.30 or Later Operation User's Manual (Windows™ Based) (U15185E) for descriptions of usage.

(1) EXTOUT

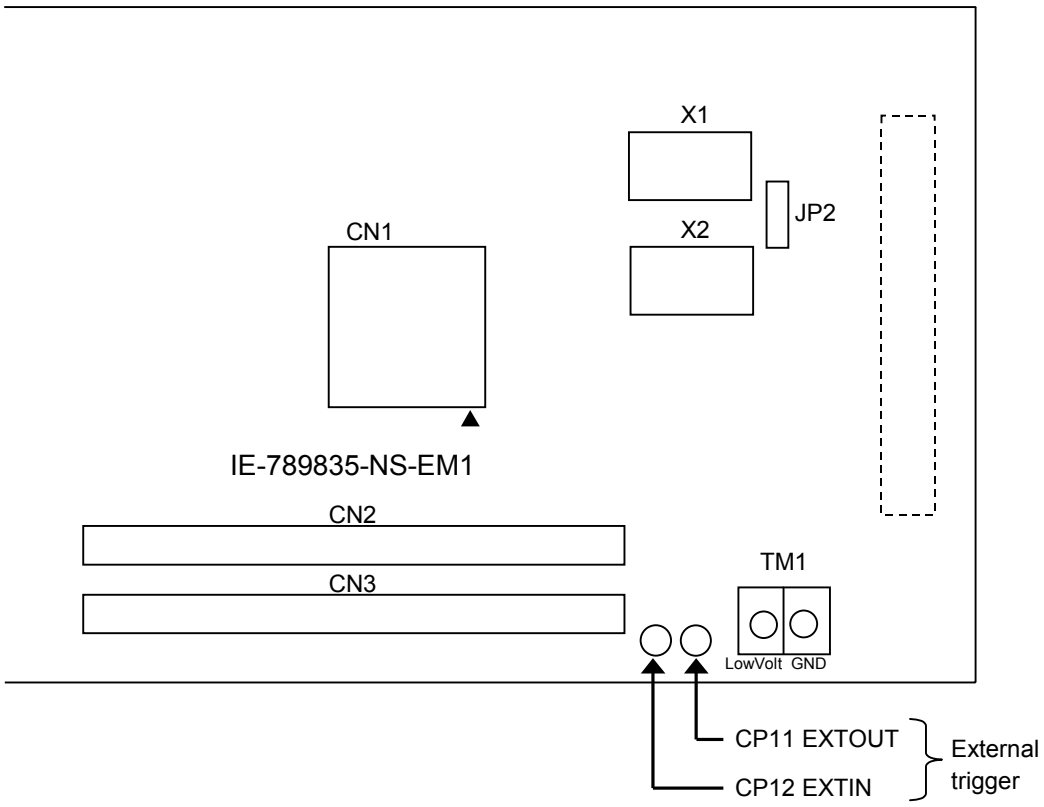
A low-level pulse is output from the IE-789835-NS-EM1's EXTOUT pin for 1.3 μs upon the occurrence of a break event.

Caution Because this is an open-drain output, a pull-up resistor should be connected on the target system.

(1) EXTIN

An event signal can be input from the IE-789835-NS-EM1's EXTIN pin. Input a high-level pulse signal for 2 CPU operating clocks or longer.

Figure 3-19. External Trigger Input Position



3.6 Emulation of LCD

(1) LCD emulation

For LCD emulation, the VLC and CAP signals can be switched to the IE system or target system side and the use of the external booster circuit can be selected by using a switch. The circuit configuration of the IE system is shown in Figure 3-20. The switch setting is shown in Table 3-6.

Figure 3-20. LCD Emulation Circuit

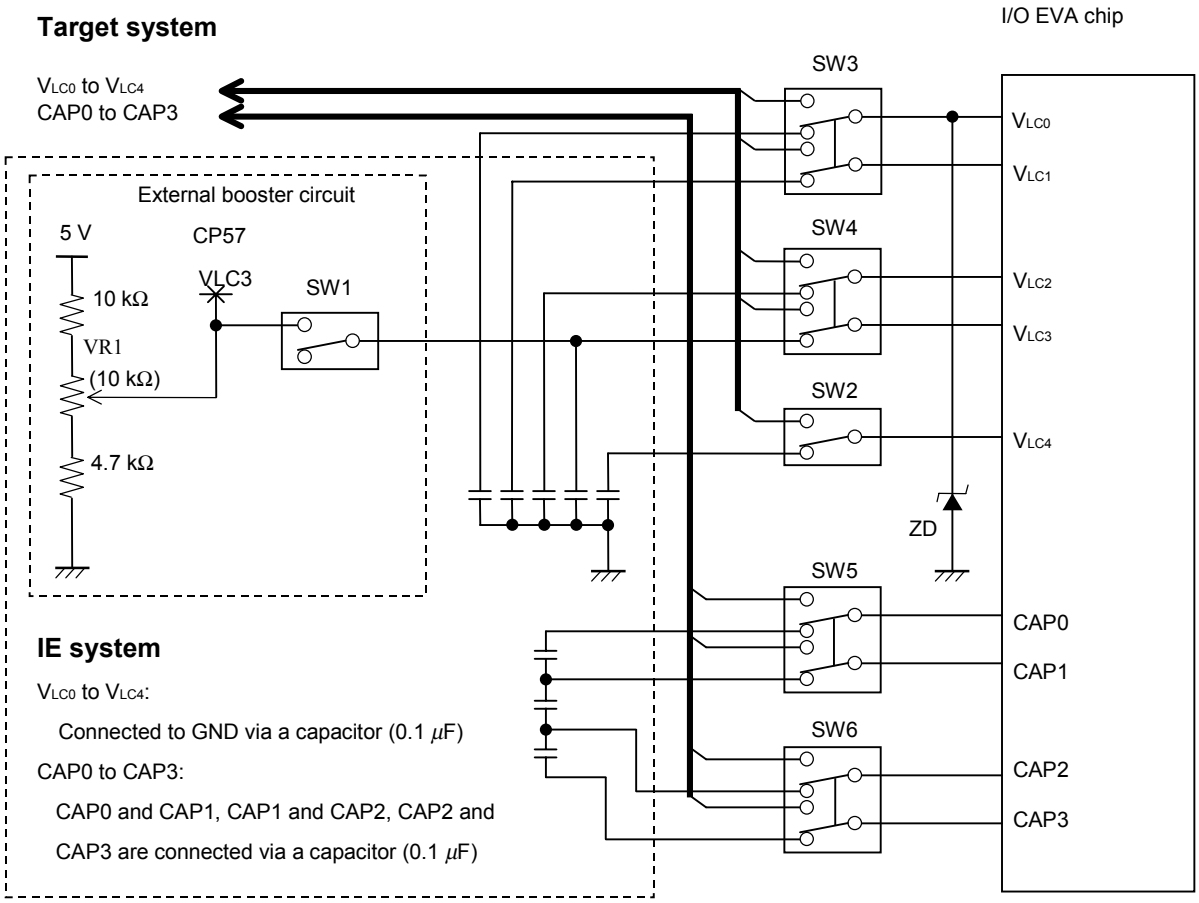


Table 3-6. LCD Switch Settings

Switch (Signal Name)	Setting	Description
SW3 (V_{LC0}, V_{LC1})	ICE side (default)	Connected to the circuit in the IE system.
	USR side	Connected to the target system via the emulation probe.
SW4 (V_{LC2}, V_{LC3})	ICE side (default)	Connected to the circuit in the IE system.
	USR side	Connected to the target system via the emulation probe.
SW2 (V_{LC4})	ICE side (default)	Connected to the circuit in the IE system.
	USR side	Connected to the target system via the emulation probe.
SW5 (CAP0, CAP1)	ICE side (default)	Connected to the circuit in the IE system.
	USR side	Connected to the target system via the emulation probe.
SW6 (CAP2, CAP3)	ICE side (default)	Connected to the circuit in the IE system.
	USR side	Connected to the target system via the emulation probe.

(2) External booster circuit

SW1 of the external booster circuit is set to OFF as the factory setting. The external booster circuit can be connected by switching to ON. The external booster circuit is a circuit to re-boost the reference value set by VLCD00 (FFB3h). VR1 adjusts the V_{LC3} voltage (1.6 to 2.2 V) and boosts the voltage level of the LCD reference voltage (V_{LC0} to V_{LC4}). The V_{LC0} voltage can be adjusted up to a rated value of −0.35 V ±15%.

VR1 is set to V_{LC3} = 2.0 V as the factory setting. The V_{LC3} voltage can be monitored by the check pin (CP57).

Figure 3-21. Variable Resistor of External Booster Circuit

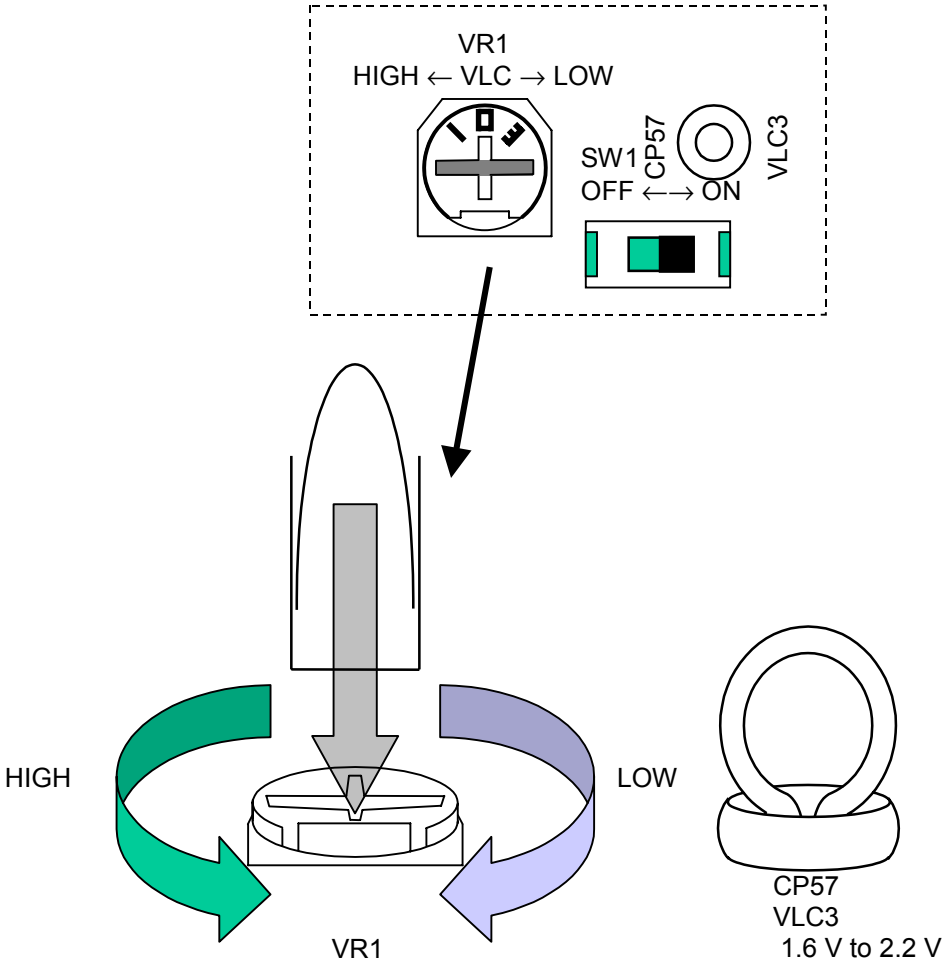


Table 3-7. Switch Settings of External Booster Circuit

Connection of External Booster Circuit	
SW1	ON: Circuit is connected
	OFF: Circuit is disconnected (default)

CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICES AND TARGET INTERFACE CIRCUITS

This chapter describes differences in electrical characteristics between the target device and the target interface circuit.

The target interface circuit of the IE system consists of an emulation CPU, TTL, CMOS-IC, and other emulation circuits. Differences in electrical characteristics between the target device and the target interface circuit occur due to the existence of a protection circuit.

(1) Signals directly input/output to/from the EVA chip and peripheral EVA chip
(2) Signals input from the target system via a gate
(3) Other signals

The circuits of the IE-789835-NS-EM1 for the signals in (1) to (3) above are shown below.

(1) Signals directly input/output to/from the EVA chip and peripheral EVA chip

The following signals operate in the same manner as those in the μPD789835 Subseries. A pull-down resistor of 1 MΩ and a 100 Ω resistor are connected in parallel.

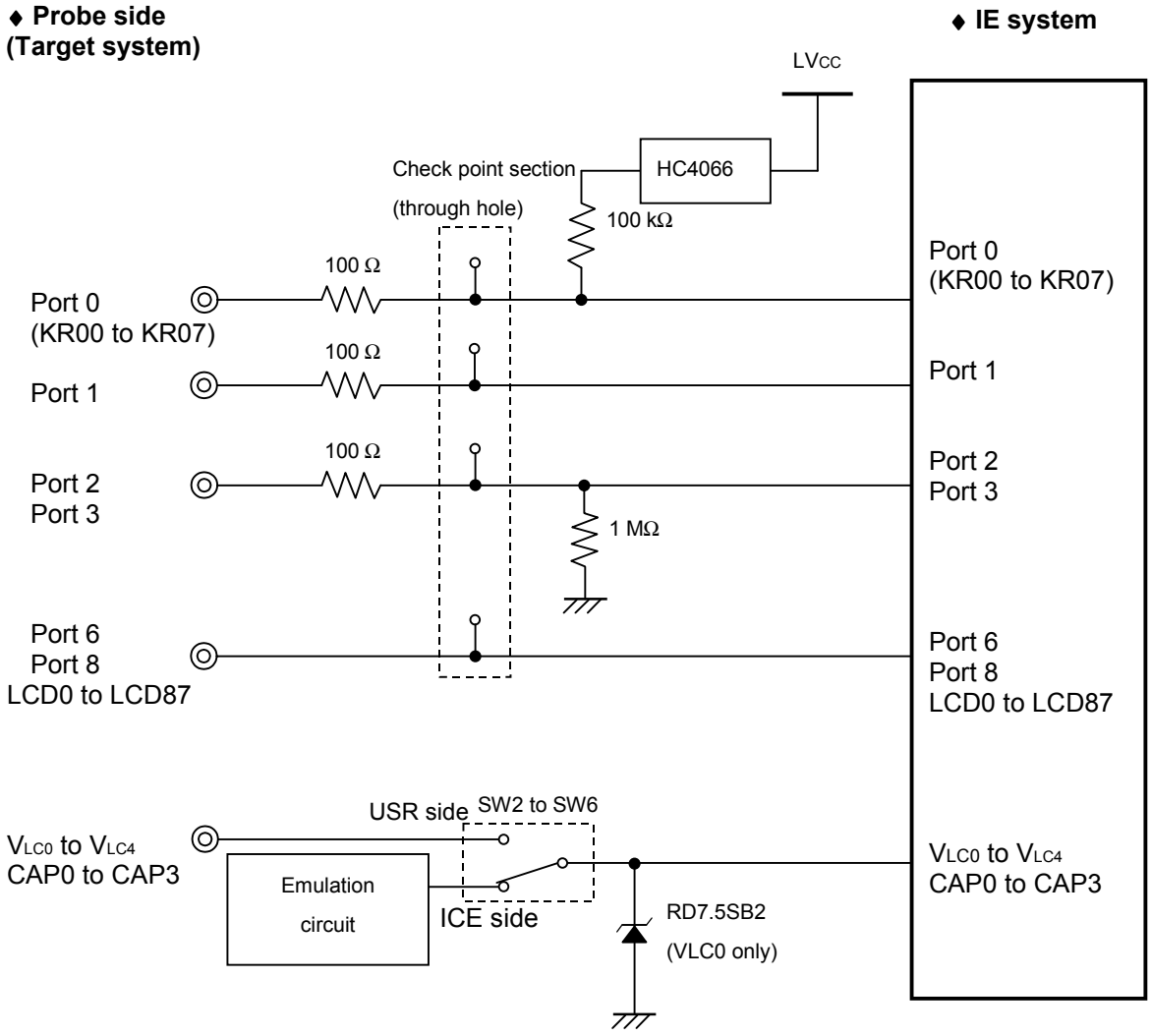
Refer to Figure 4-1 Equivalent Circuit of Emulation Circuit (1).

- Signals related to port 0

  If port 0 is used as a key return detection pin in the IE-789835-NS-EM1, port 0 is pulled up via HC4066.
- Signals related to port 1
- Signals related to port 2
- Signals related to port 3
- Signals related to port 6
- Signals related to port 8
- Signals related to LCD

  V_{LC0} to V_{LC4} and CAP0 to CAP3 are connected to the emulation circuit by switching the slide SW. For V_{LC0}, a 7 V Zener diode is connected to GND to protect the pin.

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 of the emulation device, their timing shows a delay compared to that of the μPD789835 Subseries. Refer to Figure 4-2 Equivalent Circuit of Emulation Circuit (2).

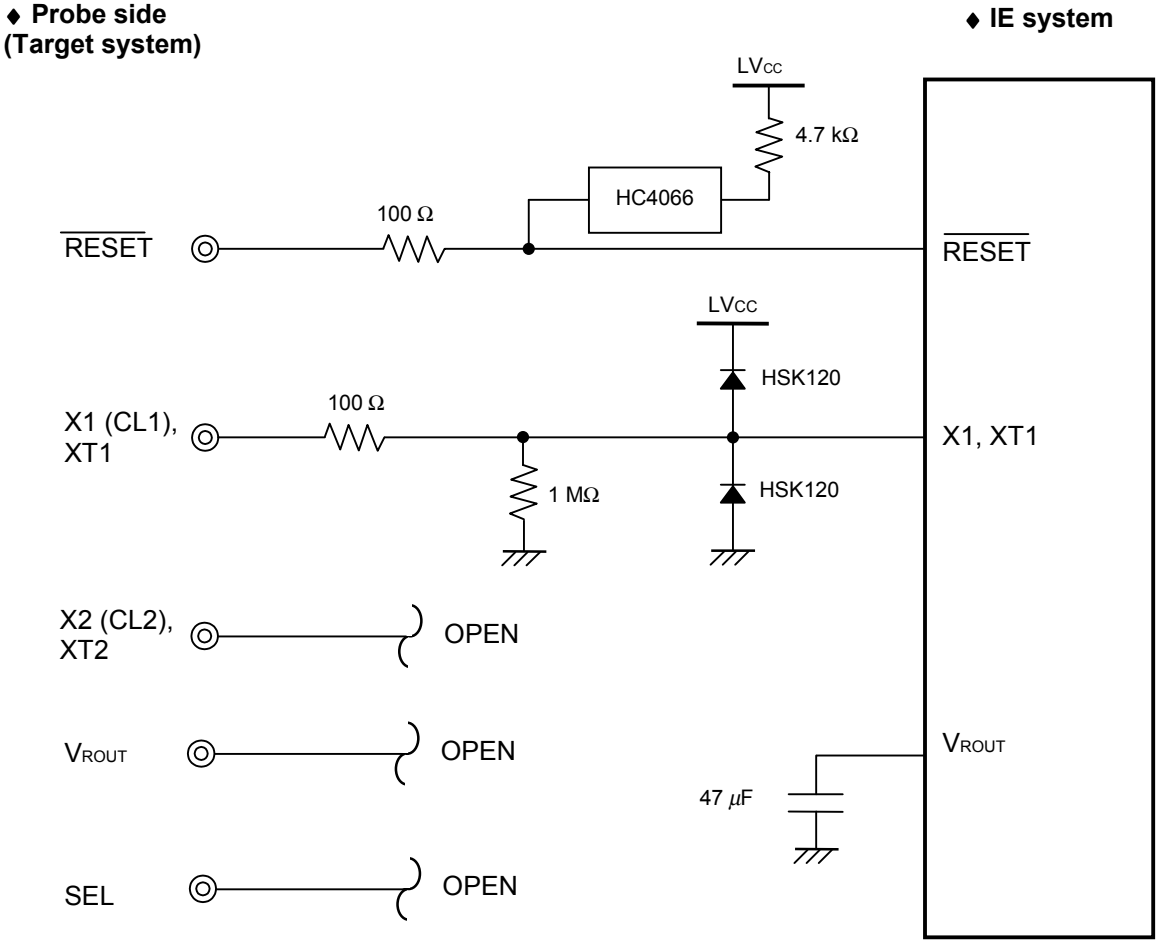
- Signals related to $\overline{\text{RESET}}$
- Signals related to clock input

  The IE-789835-NS-EM1 does not use the X2 (CL2) and XT2 pins.
- SEL pin

  The SEL pin is not used in the IE-789835-NS-EM1. This pin is fixed to ceramic/crystal oscillation in the IE system.
- V_{ROUT} pin

  The V_{ROUT} pin is not used in the IE-789835-NS-EM1. This pin is connected to GND via a 47 μF capacitor in the IE system.

Figure 4-2. Equivalent Circuit of Emulation Circuit (2)



(3) Other signals

Refer to Figure 4-3 Equivalent Circuit of Emulation Circuit (3).

- V_{DD} pin

When the target system is not connected, the power supply of the emulation CPU operates with the internal supply voltage (3 V). When the target system is connected, it operates with the power (LV_{CC}) supplied from the low-voltage supply pin (TM1).

The V_{DD} pin of the target system are only used to control the LED1 that monitors the connection of the target system power supply in the IE-789835-NS-EM1.

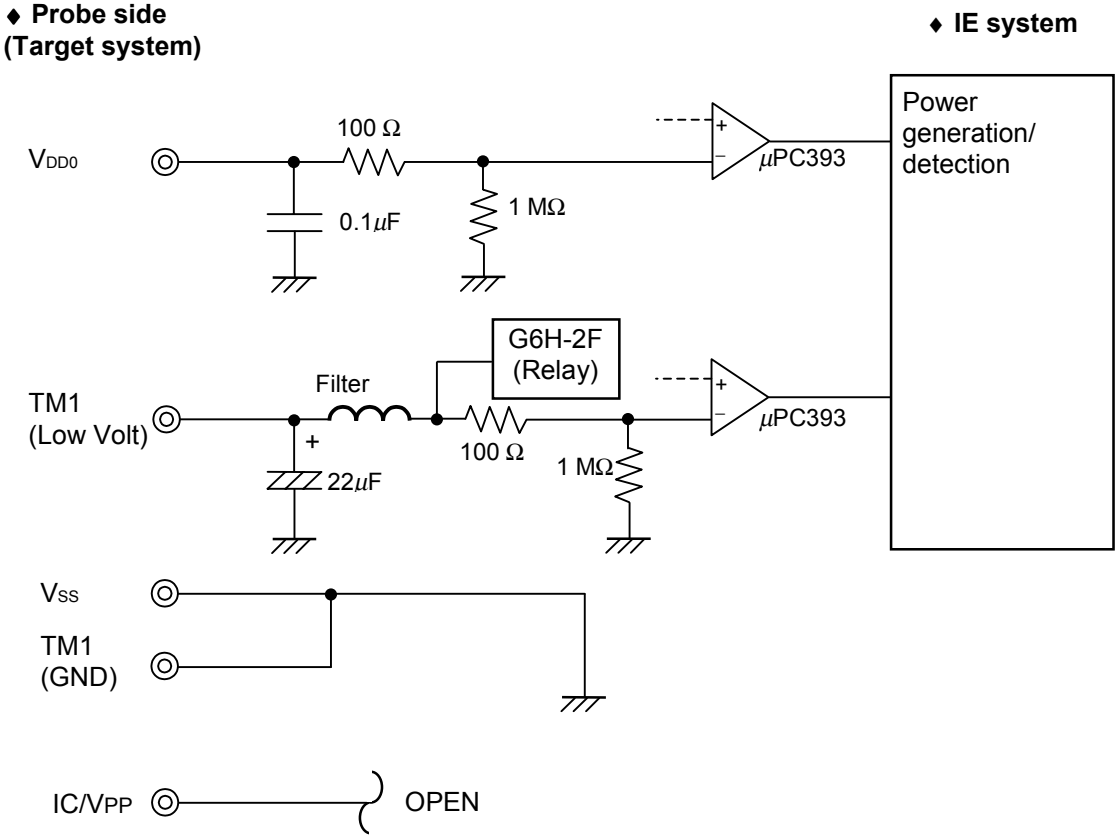
- V_{SS} pin

The V_{SS} pin is connected to GND inside the IE-789835-NS-EM1.

- IC/V_{PP} pin

The IE-789835-NS-EM1 does not use the IC/V_{PP} pin.

Figure 4-3. Equivalent Circuit of Emulation Circuit (3)



CHAPTER 5 CAUTIONS

This chapter describes differences between the target device and the IE system specifications.
The emulation circuit of the IE system consists of an EVA chip, TTL, CMOS-IC, and other circuits. Therefore, there are differences between the target device and the IE system specifications.

- In the IE-789835-NS-EM1, RC oscillator emulation cannot be performed via SEL pin input.
  Since the SEL pin is left open, it does not acknowledge input. This pin is fixed to ceramic/crystal oscillation in the IE system.
  For the oscillator, only the functions described in **3.4 Clock Settings** can be emulated.

- In the IE-789835-NS-EM1, the power supply voltage for the subsystem clock cannot be changed.
  The VROUT0 pin is fixed to VDD (LV_{CC}: 1.8 to 3.6 V). Switching to the V_{ROUT0} voltage is not valid even if PSC00 (FFAFh) is set to 1. This pin is connected to GND via a 47 μF capacitor.

- In the IE-789835-NS-EM1, the voltage level of the LCD reference voltage (V_{LC0} to V_{LC4}) does not satisfy the rated values.
  The V_{LC0} voltage is –0.53 V ±10% of the rated value set as the voltage level of the booster circuit by VLCD00 (FFB3h).
  The V_{LC0} voltage can be adjusted to –0.35 ±15% of the rated value by using the external booster circuit in the IE-789835-NS-EM1. Refer to **3.6 Emulation of LCD** for details of the external booster circuit.

APPENDIX A EMULATION PROBE PIN CORRESPONDENCE TABLE

Table A-1. Pin Correspondence of SWEX-144SD-1 (1/2)

Target System Pin	Pin Number			Target System Pin	Pin Number			Target System Pin	Pin Number		
	CN1	CN2	CN3		CN1	CN2	CN3		CN1	CN2	CN3
1	1	54	–	31	31	94	–	61	61	–	101
2	2	56	–	32	32	96	–	62	62	–	104
3	3	57	–	33	33	97	–	63	63	–	106
4	4	58	–	34	34	98	–	64	64	–	105
5	5	60	–	35	35	100	–	65	65	–	108
6	6	61	–	36	36	101	–	66	66	–	110
7	7	62	–	37	37	102	–	67	67	–	109
8	8	64	–	38	38	104	–	68	68	–	112
9	9	65	–	39	39	105	–	69	69	–	114
10	10	66	–	40	40	106	–	70	70	–	113
11	11	68	–	41	41	108	–	71	71	–	116
12	12	69	–	42	42	109	–	72	72	–	118
13	13	70	–	43	43	110	–	73	73	63	–
14	14	72	–	44	44	112	–	74	74	67	–
15	15	73	–	45	45	113	–	75	75	71	–
16	16	74	–	46	46	114	–	76	76		–
17	17	76	–	47	47	116	–	77	77	79	–
18	18	77	–	48	48	117	–	78	78	83	–
19	19	78	–	49	49	118	–	79	79	87	–
20	20	80	–	50	50	120	–	80	80	–	–
21	21	81	–	51	51	–	90	81	81	95	–
22	22	82	–	52	52	–	89	82	82	–	–
23	23	84	–	53	53	–	92	83	83	103	–
24	24	85	–	54	54	–	94	84	84	107	–
25	25	86	–	55	55	–	93	85	85	111	–
26	26	88	–	56	56	–	96	86	86	115	–
27	27	89	–	57	57	–	98	87	87	–	62
28	28	90	–	58	58	–	97	88	88	–	66
29	29	92	–	59	59	–	100	89	89	–	70
30	30	93	–	60	60	–	102	90	90	–	74

Table A-1. Pin Correspondence of SWEX-144SD-1 (2/2)

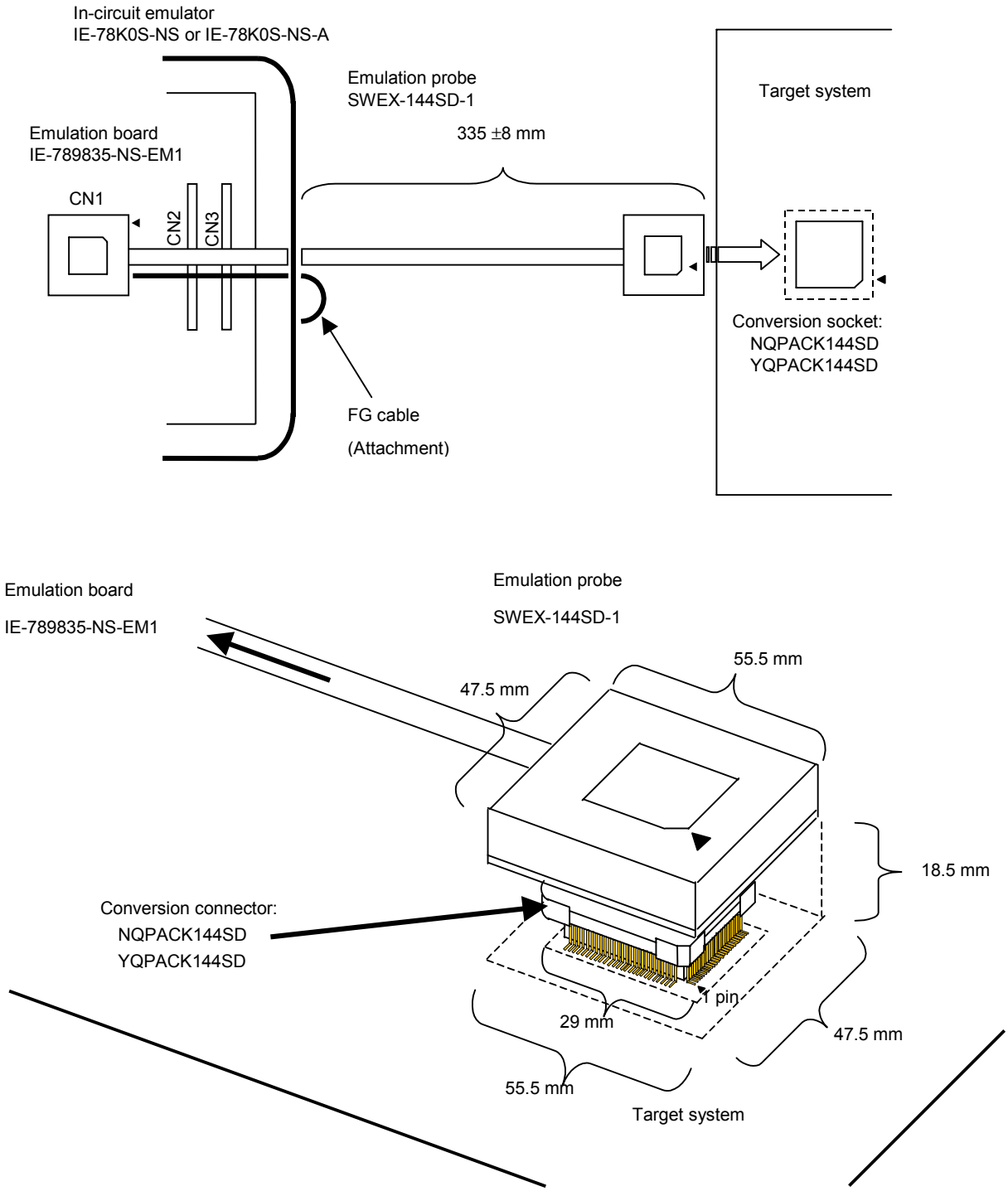
Target System Pin	Pin Number			Target System Pin	Pin Number			Target System Pin	Pin Number		
	CN1	CN2	CN3		CN1	CN2	CN3		CN1	CN2	CN3
91	91	–	46	111	111	6	–	131	131	32	–
92	92	–	50	112	112	5	–	132	132	34	–
93	93	–	54	113	113	8	–	133	133	33	–
94	94	–	58	114	114	10	–	134	134	36	–
95	95	7	–	115	115	9	–	135	135	38	–
96	96	11	–	116	116	12	–	136	136	37	–
97	97	15	–	117	117	14	–	137	137	40	–
98	98	19	–	118	118	13	–	138	138	42	–
99	99	23	–	119	119	16	–	139	139	41	–
100	100	27	–	120	120	18	–	140	140	44	–
101	101	31	–	121	121	17	–	141	141	46	–
102	102	35	–	122	122	20	–	142	142	45	–
103	103	39	–	123	123	22	–	143	143	48	–
104	104	43	–	124	124	21	–	144	144	50	–
105	105	47	–	125	125	24	–				
106	106	51	–	126	126	26	–				
107	107	59	–	127	127	25	–				
108	108	55	–	128	128	28	–				
109	109	1	–	129	129	30	–				
110	110	4	–	130	130	29	–				

Remark SWEX-144SD-1 is a product of Tokyo Eletech Corporation.

APPENDIX B NOTES ON TARGET SYSTEM DESIGN

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

Figure B-1. Conditions for Target System Connection



Remark SWEX-144SD-1, NQPACK144SD, and YQPACK144SD are products of Tokyo Eletech Corporation.