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RENESAS

User's Manual

IE-789835-NS-EM1

Emulation Board

Target Devices
μPD789835 Subseries

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- Availability of related technical literature
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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 78K/0S 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 usage 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

- Basic specifications
- System configuration
- External interface functions

IE-789835-NS-EM1
User's Manual

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

IE-78K0S-NS-A
User's Manual

- Basic specifications
- System configuration
- External interface functions

Purpose

This manual is intended to give users an understanding of the 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 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 Documents The related documents (user's manuals) indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Document Name	Document Number
IE-78K0S-NS In-Circuit Emulator	U13549E
IE-78K0S-NS-A In-Circuit Emulator	U15207E
IE-789835-NS-EM1 Emulation Board	This manual
ID78K Series Integrated Debugger Ver. 2.30 or Later Operation (Windows™ Based)	U15185E
μPD789835 Subseries	U15559E

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

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CHAPTER 1 GENERAL

The IE-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.

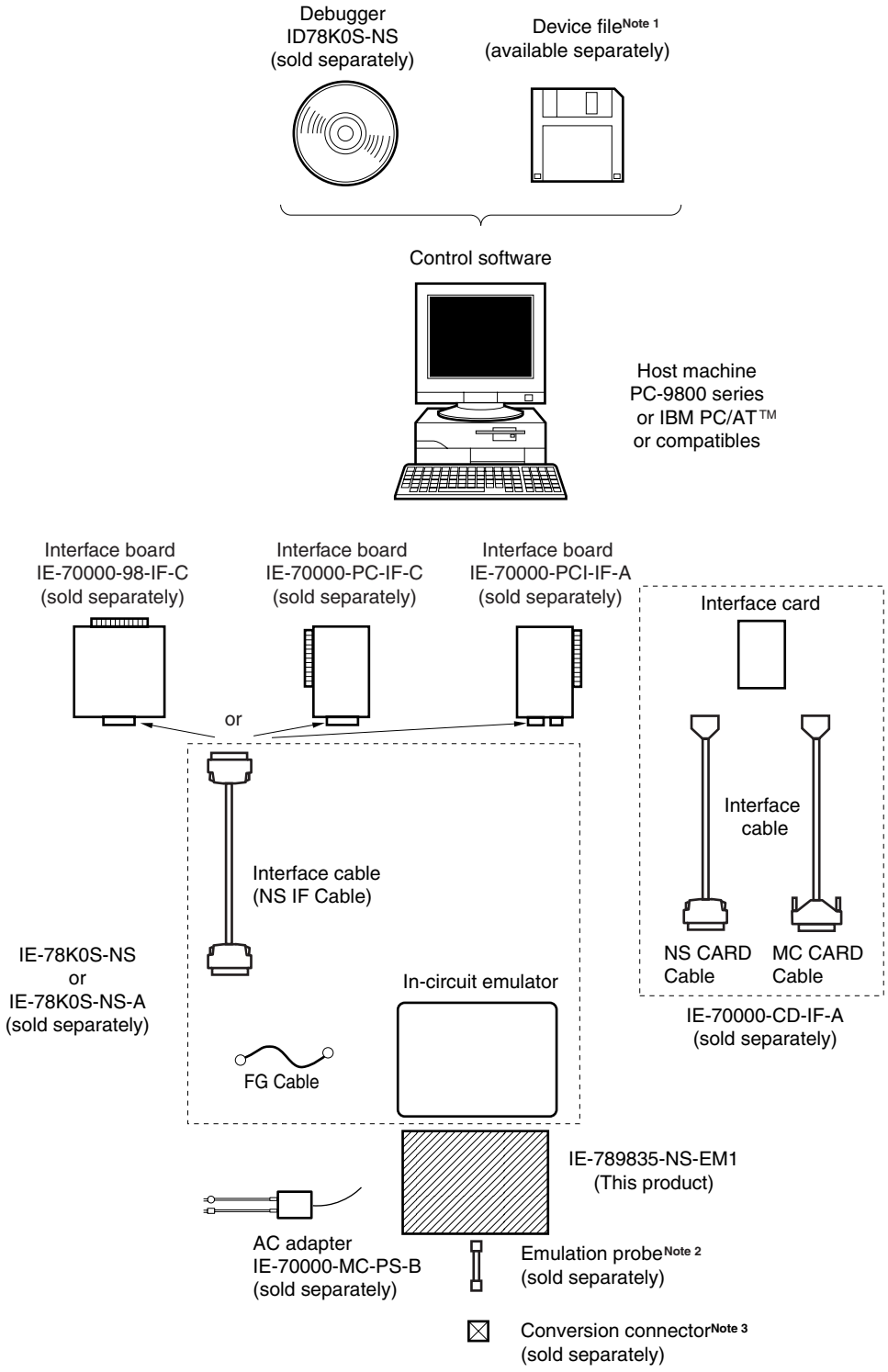
This chapter describes the IE-789835-NS-EM1's system configuration and basic specifications.

- Target device
  - μPD789835 Subseries

1.1 System Configuration

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

Figure 1-1. System Configuration



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

μS××××DF789835: μPD789835 Subseries

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

2. The emulation probe SWEX-144SD-1 is a product of TOKYO ELETECH CORPORATION.

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

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

3. The conversion connectors NQPACK144SD and YQPACK144SD are products of TOKYO ELETECH CORPORATION.

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

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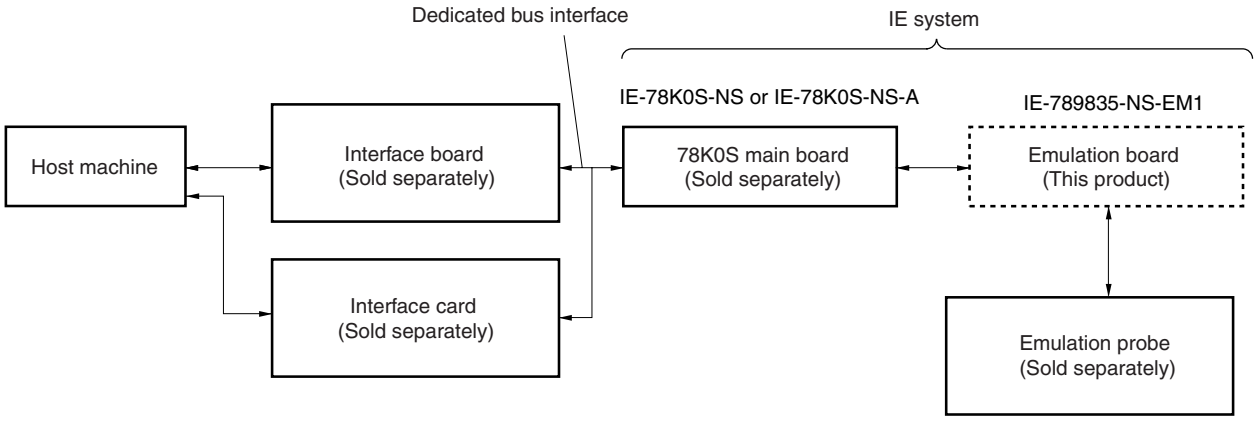
Table 1-1. Correspondence Between Emulation Probe and Conversion Connector

Package	Emulation Probe	Conversion Connector
144-pin plastic LQFP (GJ type)	SWEX-144SD-1 (probe length: 315 mm)	NQPACK144SD YQPACK144SD

1.2 Hardware Configuration

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

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The IE-789835-EM1's basic specifications are listed in Table 1-2.

Table 1-2. Basic Specifications

Parameter	Description
Target device	μPD789835 Subseries
System clock	Main system clock: 1.0 to 5.0 MHz, subsystem clock: 32.768 kHz
Main system clock supply	External: Clock input from the target system via an emulation probe Internal: Clock mounted on the emulation board (5.0 MHz) or clock mounted on the parts board by the user
Subsystem clock supply	External: Clock input from the target system via an emulation probe Internal: Clock mounted on the emulation board (32.768 kHz) or clock mounted on the parts board by the user
Target interface voltage	V_{DD} = 1.8 to 3.6 V (same as the target device) The IE-789835-NS-EM1 operates on the internal power supply (3 V) when not connected to the target system.

CHAPTER 2 PART NAMES

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

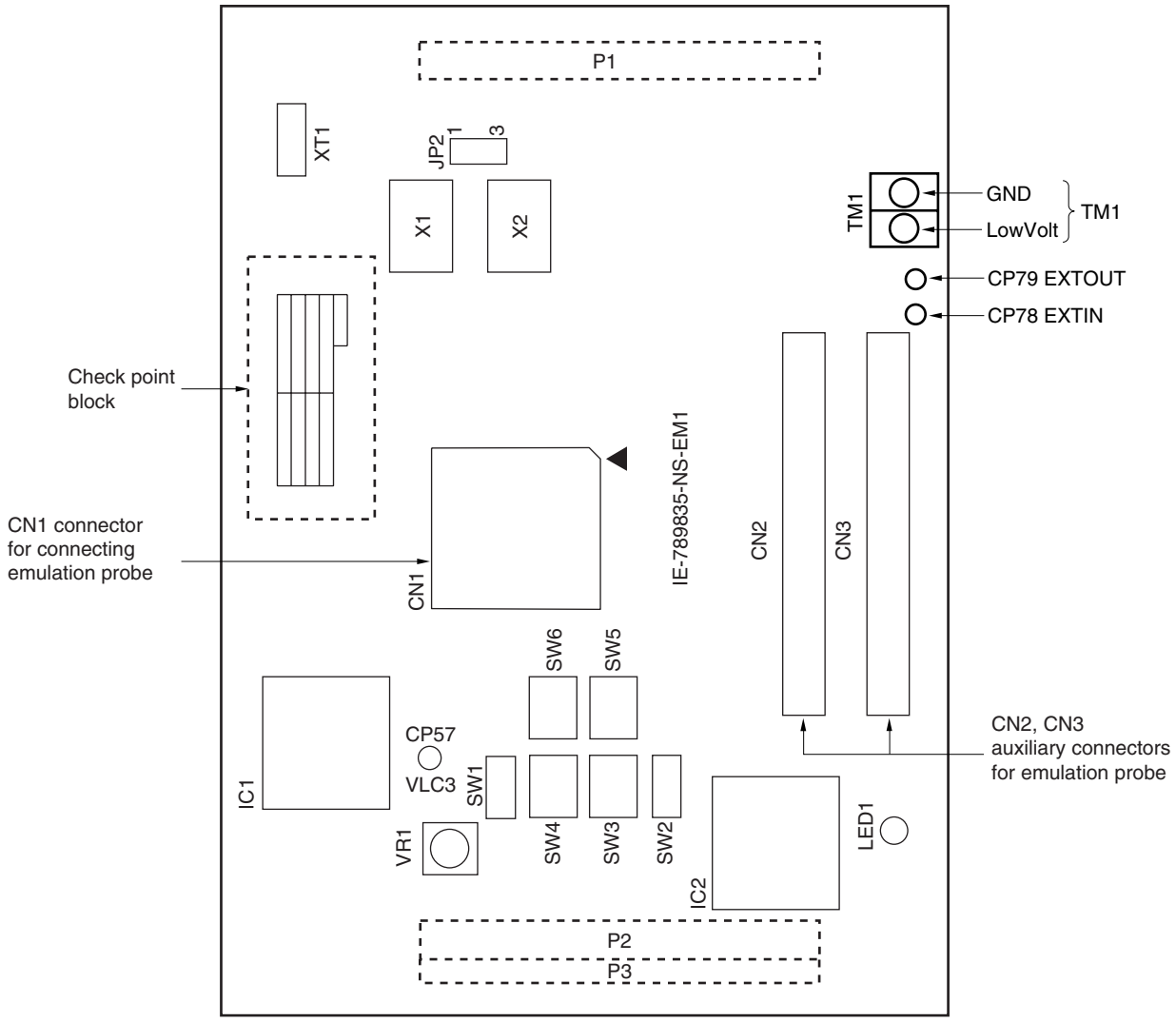
The packing box contains the emulation board (IE-789835-NS-EM1), packing list, user's manual, and guarantee card.

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 Parts of Main Unit

Figure 2-1. IE-789835-NS-EM1 Part Names



Note CN2 and CN3 are not connectors for connecting the emulation probe. These connectors allow confirmation of the signal of each pin of CN1 as support for the emulation probe.
For details, refer to **APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE**.

2.2 Initial Switch and Jumper Settings

The initial switch and jumper settings of the IE-789835-NS-EM1 are shown in Table 2-1.
For the setting of JP2, refer to **3.4 Clock Settings**.
For the settings of SW1 to SW6, refer to **3.6 LCD Emulation**.

Table 2-1. Initial Switch and Jumper Settings

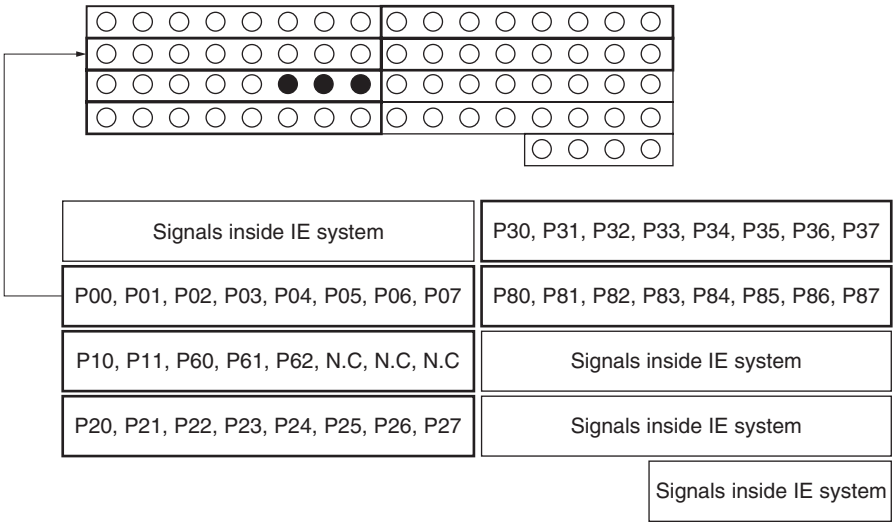
	JP2
Initial setting	2 and 3 shorted

	SW1	SW2	SW3	SW4	SW5	SW6
Initial setting	OFF	ICE side	ICE side	ICE side	ICE side	ICE side

2.3 Check Point Block

The through holes of the check point block (refer to **Figure 2-1 IE-789835-NS-EM1 Part Names**) are provided at intervals of 2.54 mm (1 inch) both vertically and horizontally, allowing confirmation of the signal of each port pin inside the IE-789835-NS-EM1.

Figure 2-2. Check Point Block



Caution Do not connect or capture the signal inside the IE system, or the IE system may be damaged.

Remark The through holes indicated by ● (N.C.) are not connected to any signal.

CHAPTER 3 INSTALLATION

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

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

3.1 Connection

(1) Connection with IE-78K0S-NS or IE-78K0S-NS-A main unit

See the **IE-78K0S-NS User's Manual (U13549E)**[Note] for a description of how to connect the IE-789835-NS-EM1 to the IE-78K0S-NS.

Note When using the IE-78K0S-NS-A, refer to the **IE-78K0S-NS-A User's Manual (U15207E)**.

(2) Connection with emulation probe

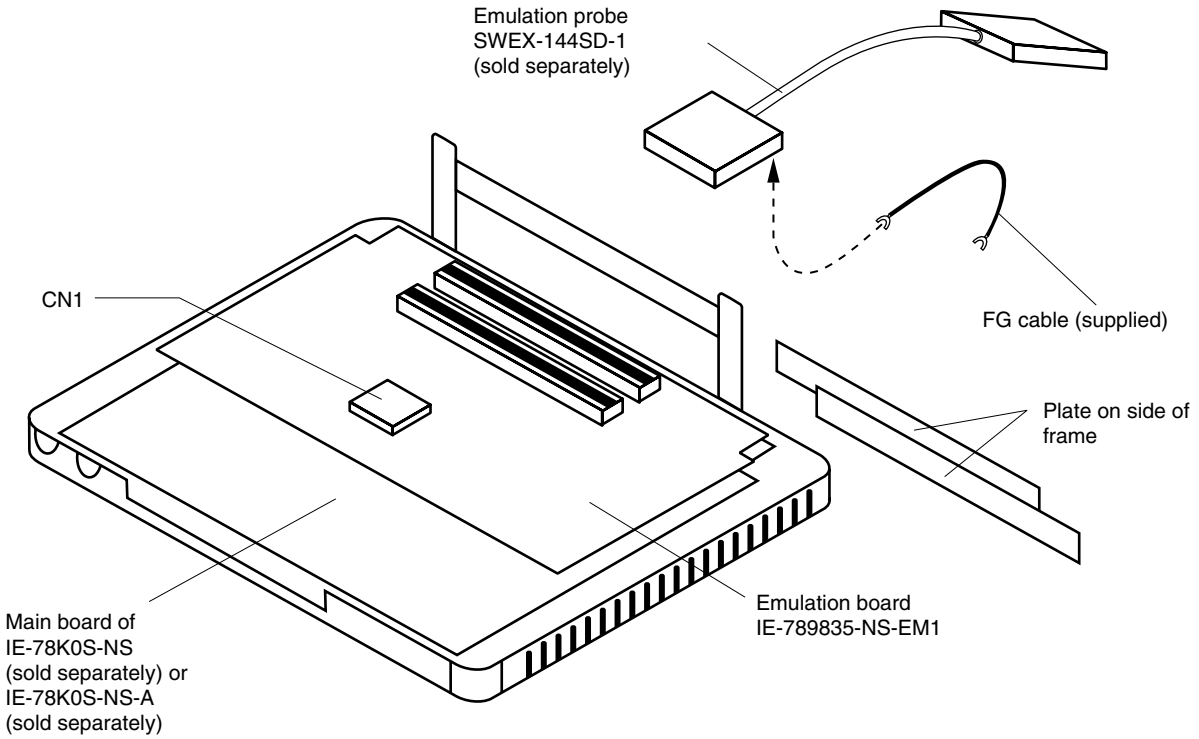
Connect an emulation probe and supplied FG cable to the IE-789835-NS-EM1 as follows.
On this board, connect the emulation probe to CN1.

Caution 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.

<Steps>

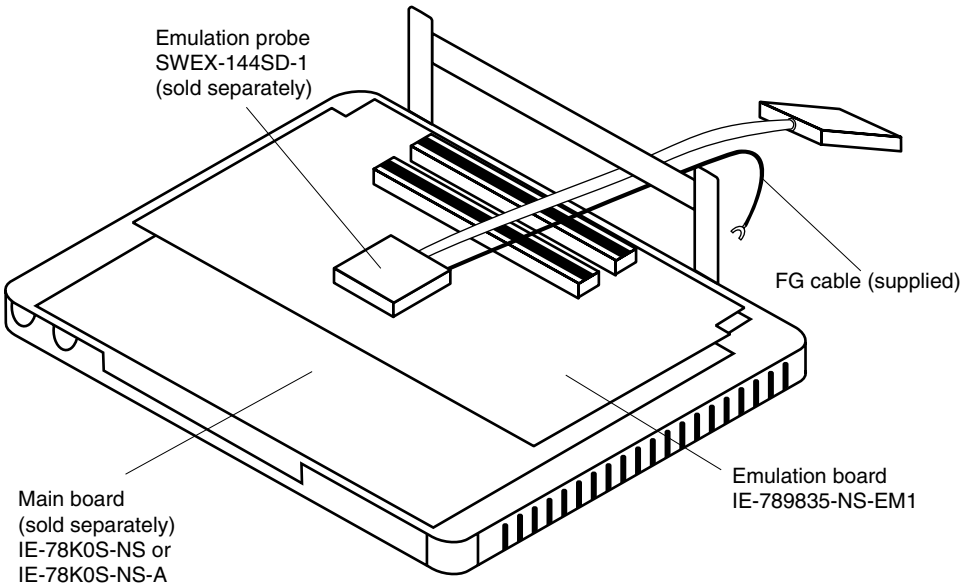
<1> Remove two plates on the side of the IE-78K0S-NS or IE-78K0S-NS-A frame. Loosen one FG screw on the lower side of the connector on the IE system side of the emulation probe, align one end of the FG cable and fix it by securing the FG screw.

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



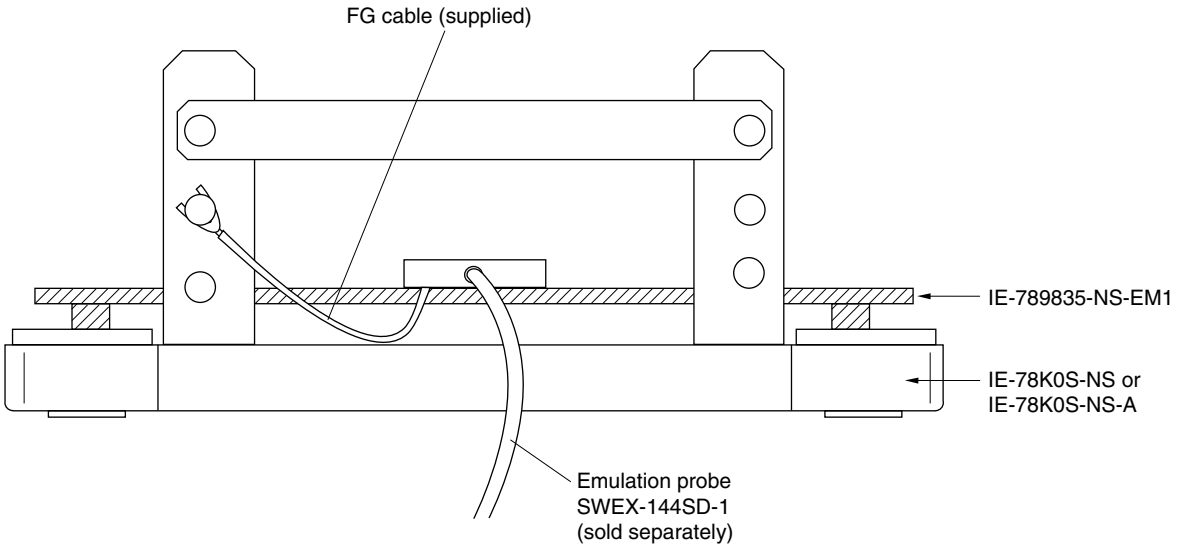
<2> Open the upper side of the IE-78K0S-NS or IE-78K0S-NS-A main unit and connect the emulation probe to the probe connector (CN1) on the IE-789835-NS-EM1.

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



<3> Connect the other end of the FG cable by securing the screw on the plate of the IE-78K0S-NS or IE-78K0S-NS-A frame.

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



3.2 Switch and Jumper Settings of Main Unit

(1) Settings on the IE-78K0S-NS

When using the IE-789835-NS-EM1, set the switches and jumpers on the IE-78K0S-NS as shown in Table 3-1. For details of these switch and jumper settings, refer to the **IE-78K0S-NS User's Manual (U13549E)**.

Table 3-1. Switch and Jumper Settings on IE-78K0S-NS

	SW1	SW3	SW4	JP1	JP4
Setting	OFF	All switches ON (fixed)	All switches ON (fixed)	2 and 3 shorted	1 and 2 shorted

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

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

When using the IE-789835-NS-EM1, set the switches and jumpers on the IE-78K0S-NS-A as shown in Table 3-2. For the position of the switches and jumpers, refer to the **IE-78K0S-NS-A User's Manual (U15207E)**.

Table 3-2. Switch and Jumper Settings on IE-78K0S-NS-A

	SW1	JP1	JP3
Setting	OFF	1-2	Shorted (fixed)

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

3.3 Power Supply Voltage Setting of Target Interface

The IE system allows emulation at the same voltage level as that of the target system.

When the target system is not connected, the system automatically operates on the internal power supply (3 V) of the emulator. When debugging at the same voltage level as that of the target system, supply the TM1 terminal pin of the IE-789835-NS-EM1 with the same voltage as that of the target system (the same applies when the voltage is 3 V).

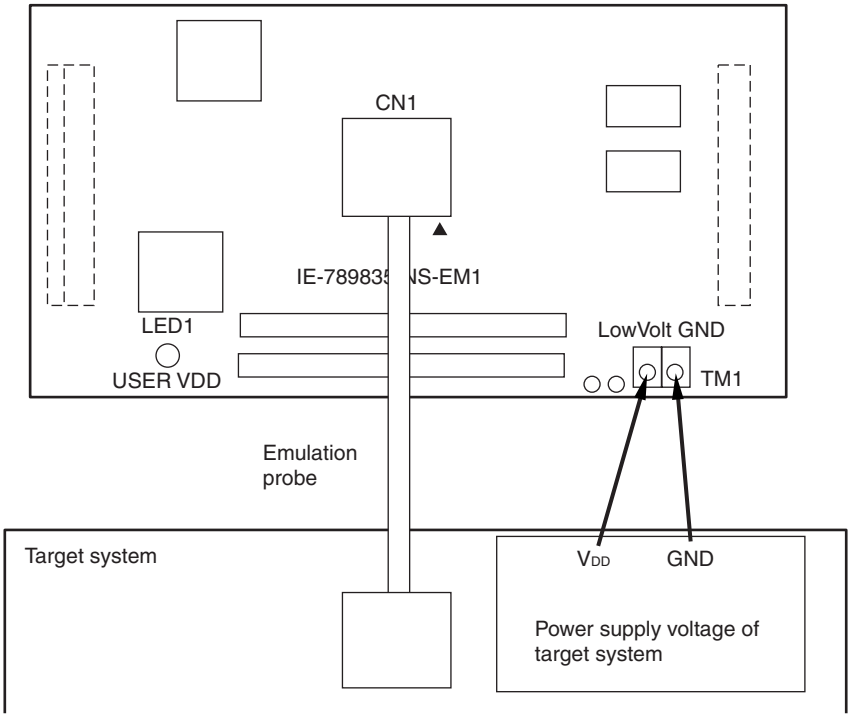
For how to select the operating power supply, refer to the **ID78K Series Ver. 2.30 or Later Operation (Windows Based) User's Manual (U15185E)**.

- Maximum current consumption of TM1 3 V: Approximately 100 mA

Table 3-3. Power Supply Settings of Target Interface

Power Supply of Target Interface		Integrated Debugger (ID78K0S-NS)
		Selected Operating Power Supply
When connecting target system	1.8 to 3.6 V	Target
When not connecting target system	3 V	Internal

Figure 3-4. Connecting TM1 and Power Supply Voltage of Target System



Caution Before connecting TM1 on the board and the power supply voltage of the target system, turn off the power to the IE-78K0S-NS or IE-78K0S-NS-A.

Remark The V_{DD} pin of the target system is exclusively used for the control of LED1 that monitors whether the power supply of the target system is connected in the IE-789835-NS-EM1.

3.4 Clock Settings

3.4.1 Overview of clock settings

The main system and subsystem clocks to be used during debugging can be selected from (1) to (3) below.

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

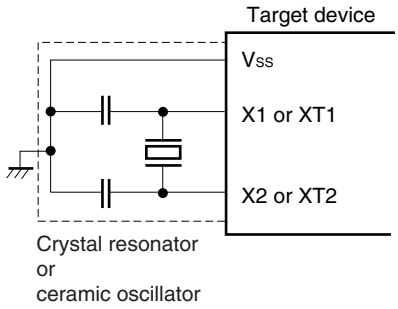
If the target system includes a clock oscillator, select either **(1) Clock that is already mounted on emulation board** or **(2) Clock that is mounted by user**. For a clock oscillator, a resonator is connected to the target device and the target device's internal oscillator is used. An example of the external circuit is shown in part (a) of Figure 3-5. During emulation, the oscillator that is mounted on the target system is not used. Instead, the clock that is mounted on the emulation board installed for the IE-78K0S-NS or IE-78K0S-NS-A is used.

If the target system includes an external clock, select **(1) Clock that is already mounted on emulation board**, **(2) Clock that is mounted by user**, or **(3) Pulse input from target system**. For an external clock, a clock signal is supplied from outside 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 3-5.

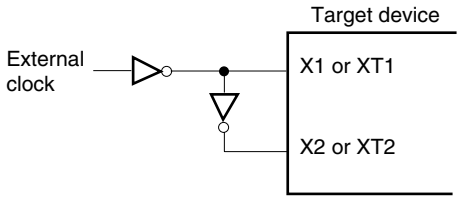
Caution The IE system will be hung-up if the main system clock is not supplied normally. Emulating using the RC oscillator is not possible. Moreover, be sure to input a rectangular wave as the clock from the target. However, there is no need to supply clocks to the X2 and XT2 pins. The IE system does not operate if a crystal resonator or ceramic resonator is directly connected to the X1 or XT1 pin.

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

(a) Clock oscillator



(b) External clock



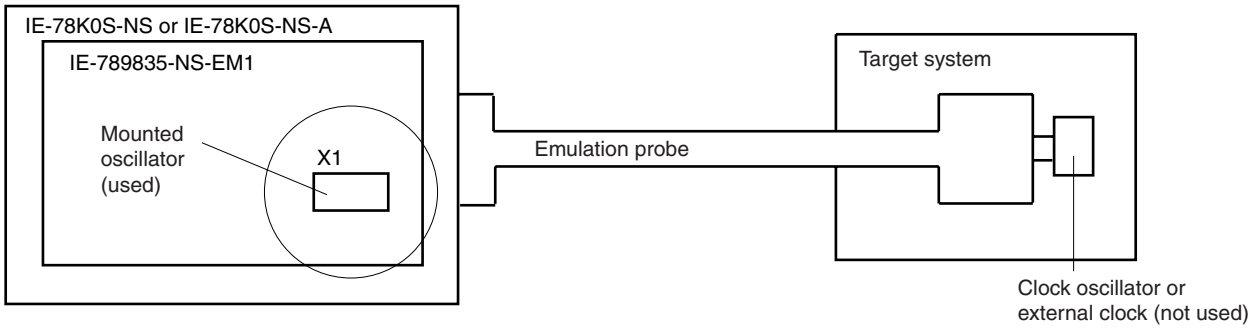
(1) Clock that is already mounted on emulation board

The oscillator mounted on the IE-789835-NS-EM1 can be used.

(a) For main system clock

A crystal oscillator (X1) is already mounted on the emulation board. Its frequency is 5.0 MHz.

Figure 3-6. When Using Clock That Is Already Mounted on Emulation Board (Main System Clock)

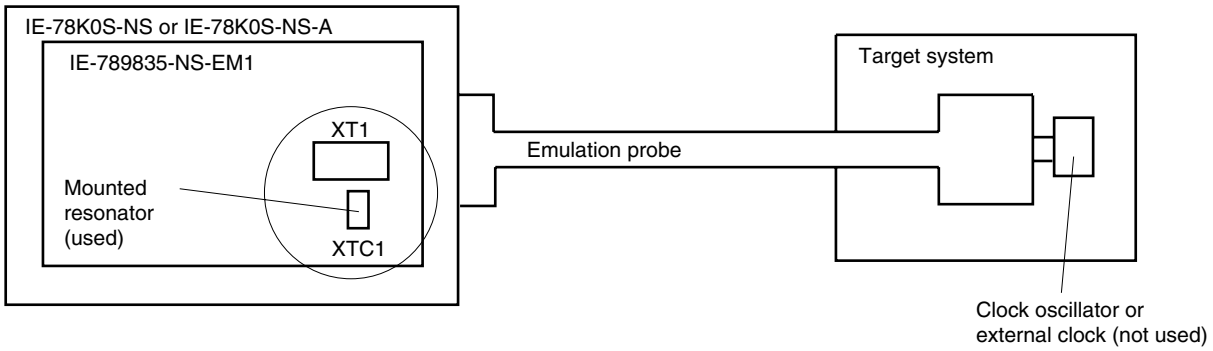


Remark The clock that is supplied by the IE-789835-NS-EM1's oscillator (encircled in the figure) is used.

(b) For subsystem clock

A crystal resonator (XTC1) is already mounted on the emulation board. Its frequency is 32.768 kHz.

Figure 3-7. When Using Clock That Is 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.

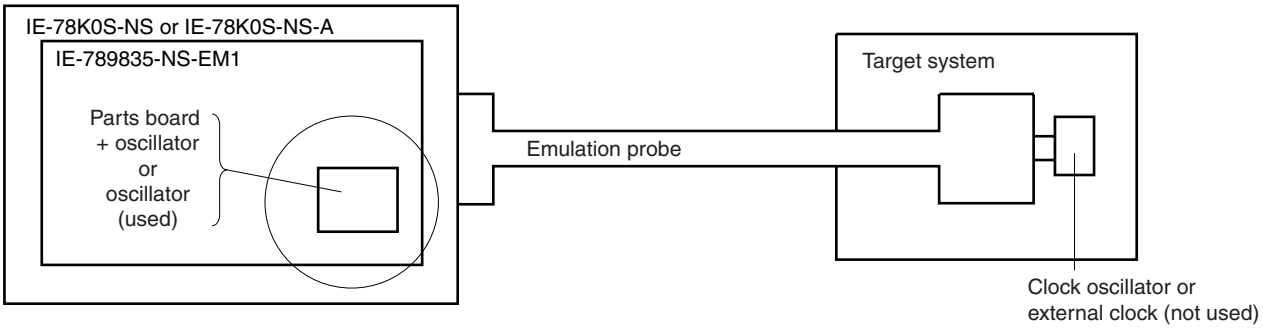
(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-789835-NS-EM1. This is useful when using a different frequency from that of the pre-mounted clock.

(a) For main system clock

Remove the crystal oscillator (X1) that is already mounted on the emulation board, and mount either the parts board on which the resonator to be used is mounted or an oscillator.

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

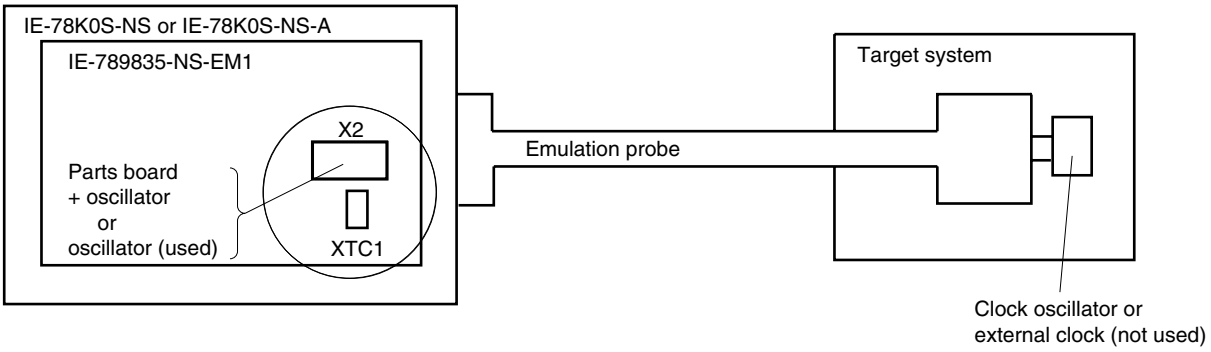


Remark The clock that is supplied by the oscillator on the IE-789835-NS-EM1 (encircled in the figure) is used.

(b) For subsystem clock

Mount the resonator to be used on the parts board (X1) that is already mounted on the emulation board. Alternatively, remove the parts board and mount an oscillator.

Figure 3-9. When Using User-Mounted Clock (Subsystem Clock)

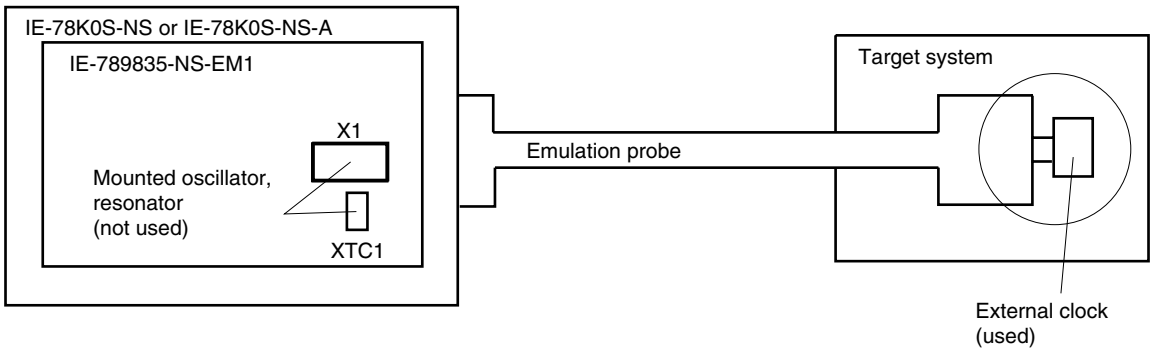


Remark The clock that is supplied by the oscillator on the IE-789835-NS-EM1 (encircled in the figure) is used.

(3) Pulse input from target system

The pulse supplied by an external clock can be used as the main system clock and subsystem clock on the target system via an emulation probe.

Figure 3-10. When Supplying Pulse from Target System



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

3.4.2 Main system clock settings

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

The following shows the respective IE-789835-NS-EM1 settings for the main system clocks used in (1) to (3) in Table 3-4.

Table 3-4. Main System Clock Settings

Frequency of Main System Clock		IE-789835-NS-EM1 X1 Socket	CPU Clock Source Selection (ID78K0S-NS)
(1) When using clock that is already mounted on emulation board	5.0 MHz	Oscillator used	Internal
(2) When using clock mounted by user	Other than 5.0 MHz	Oscillator assembled by user	
(3) When pulse is input from target system		Oscillator (not used)	External

Caution When a pulse is input from the target system, 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 clock). Emulating using the RC oscillator is not possible.

Remark When the IE-789835-NS-EM1 is shipped, the settings for "when using clock that is already mounted on emulation board" are preset.

(1) When using clock that is 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 other 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).

(2) When using clock mounted by user

Perform the settings described under either (a) or (b) 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).

(a) When using a ceramic resonator or crystal resonator

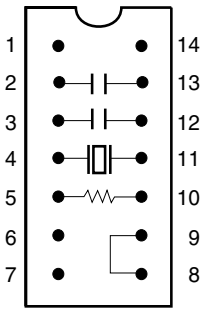
- Items to be prepared
  - Parts board
  - Ceramic resonator or crystal resonator
  - Resistor Rx
  - Capacitor CA
  - Capacitor CB
  - Solder kit

<Steps>

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

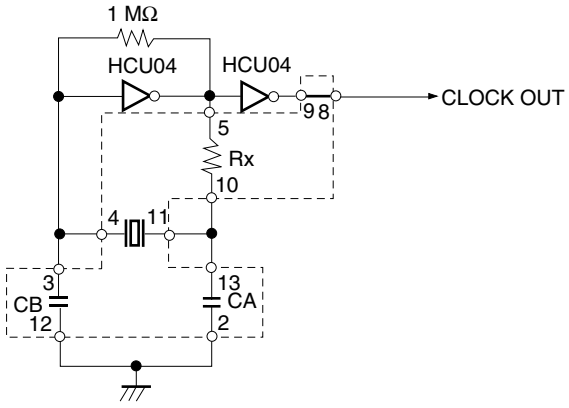
Figure 3-11. Connections on Parts Board (Main System Clock)

Parts board (X1)



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

Circuit diagram



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

<2> Prepare the IE-789835-NS-EM1.

<3> Remove the crystal oscillator that is mounted in the IE-789835-NS-EM1's socket (the socket marked as X1).

<4> Connect the parts board (from <1> above) to the socket (X1) 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 is wired as shown in Figure 3-11.

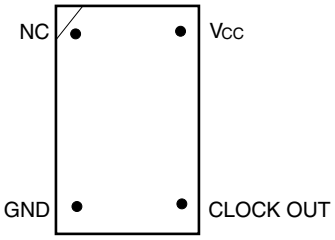
<6> Install the IE-789835-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

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

(b) When using a crystal oscillator

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-12)

Figure 3-12. Crystal Oscillator (Main System Clock)



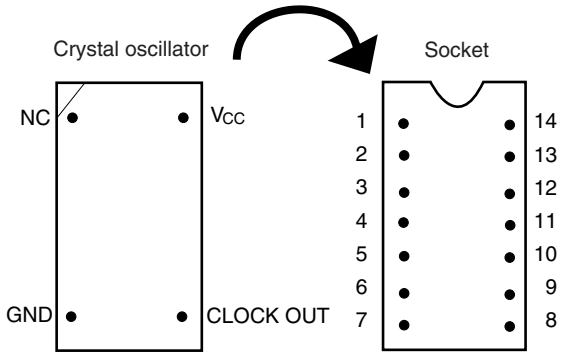
<Steps>

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

<2> Remove the crystal oscillator that is mounted in the X2 socket of the IE-789835-NS-EM1.

<3> Mount a crystal oscillator in the X2 socket from which the crystal oscillator was removed in <2> above. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

Figure 3-13. Pin Alignment of Crystal Oscillator and Socket (Main System Clock)



Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
VCC	14

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

(3) When pulse is input from target system

No hardware settings are required for this situation.

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’s clock).

3.4.3 Subsystem clock settings

The subsystem clock settings of the IE-789835-NS-EM1 are as shown in Table 3-5. The following shows the respective IE-789835-NS-EM1 settings for the subsystem clocks used in (1) to (3) in Table 3-5.

Table 3-5. Subsystem Clock Settings

Frequency of Subsystem Clock to Be Used		IE-789835-NS-EM1	
		X2 Socket	JP2
(1) When using clock (XTC1) that is already mounted on emulation board	32.768 kHz	6 and 8 shorted	Short 2 to 3 side
(2) When using clock mounted by user	Other than 32.768 kHz	Oscillator assembled by user	
(3) When pulse is input from target system		Not used	Short 1 to 2 side

Caution Jumper JP2, which is used to select the board’s clock or an external clock, should be set only after turning off the power of the IE-78K0S-NS or IE-78K0S-NS-A.

Remark When the IE-789835-NS-EM1 is shipped, the settings for “when using clock that is already mounted on emulation board” are preset.

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

When the IE-789835-NS-EM1 is shipped, a 32.768 kHz crystal resonator (XTC1) and the parts board (X2) on which pins 6 and 8 are shorted are already mounted on the IE-789835-NS-EM1. Short the 2 to 3 side on the IE-789835-NS-EM1’s jumper (JP2). There is no need to make any other settings via the integrated debugger (ID78K0S-NS).

(2) When using the clock mounted by user

The settings described under either (a) or (b) are required, depending on the type of clock to be used. Short the 2 to 3 side on the IE-789835-NS-EM1’s jumper (JP2).

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

(a) When using a ceramic resonator or crystal resonator

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

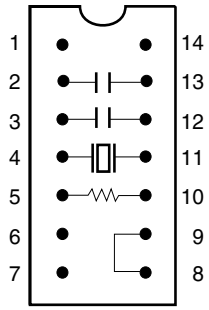
<Steps>

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

<2> Solder the ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequency) onto the supplied parts board (X2) (as shown below).

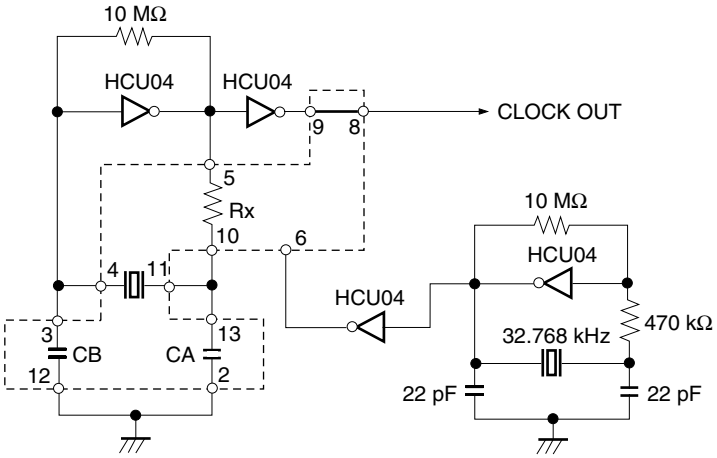
Figure 3-14. Connections on Parts Board (Subsystem Clock)

Parts board (X2)



Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
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.

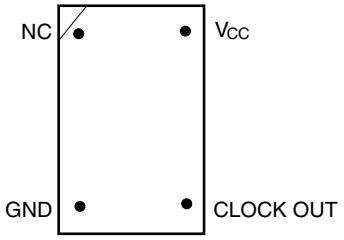
<3> Make sure that the parts board (X2) is wired as shown in Figure 3-14.
<4> Install the IE-789835-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

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

(b) When using a crystal oscillator

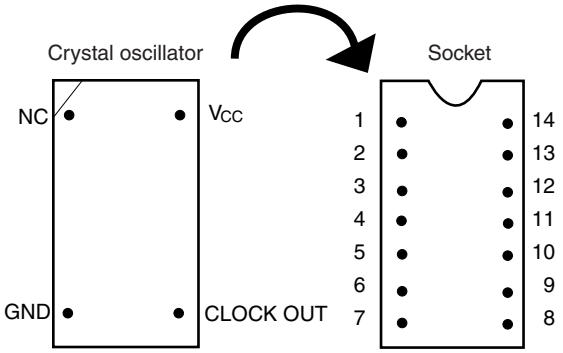
- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-15)

Figure 3-15. Crystal Oscillator (Subsystem Clock)



<Steps>
<1> Prepare the IE-789835-NS-EM1.
<2> Remove the parts board that is mounted in the X2 socket of the IE-789835-NS-EM1.
<3> Mount the crystal oscillator prepared by the user in the X2 socket from which the parts board was removed in <2> above. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

Figure 3-16. Pin Alignment of Crystal Oscillator and Socket



Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
VCC	14

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

(3) When inputting pulse from target system

Short the 1 and 2 side of the jumper (JP2) on the IE-789835-NS-EM1. There is no need to make any settings via the integrated debugger (ID78K0S-NS).

3.5 External Trigger

To set up an external trigger, connect it to the check pins EXTOUT and EXTIN of the IE-789835-NS-EM1 as shown below.

See the **IE-78K0S-NS User's Manual (U13549E)** or **IE-78K0S-NS-A User's Manual (U15207E)** for pin characteristics, and the **ID78K Series Integrated Debugger Ver. 2.30 or Later Operation (Windows Based) User's Manual (U15185E)** for the usage methods.

(1) EXTOUT

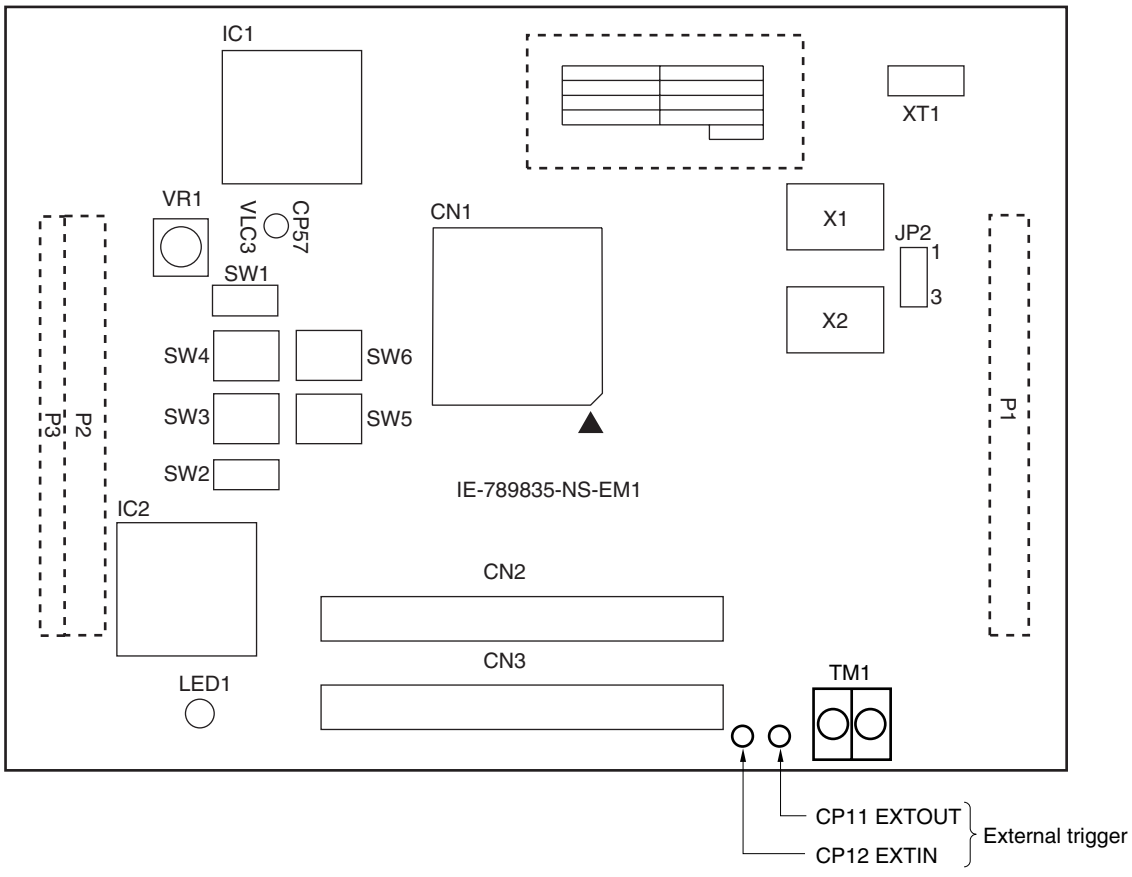
Outputs a low level from the EXTOUT pin on the IE-789835-NS-EM1 for 1.3 μs upon the occurrence of a break event.

Caution Connect a pull-up resistor on the target system since this is an open-drain output.

(2) EXTIN

An event signal can be input from the EXTIN pin on the IE-789835-NS-EM1. Input a high-level pulse signal for 2 CPU operation clocks or more.

Figure 3-17. External Trigger Input Position



3.6 LCD Emulation

(1) LCD emulation

Using the LCD emulation circuit, the VLC and CAP signals can be switched to the IE system side or target system side through switch activation, and an external boost circuit can also be used. The circuit configuration shown in Figure 3-18 is used on the IE system side.

Figure 3-18. LCD Emulation Circuit

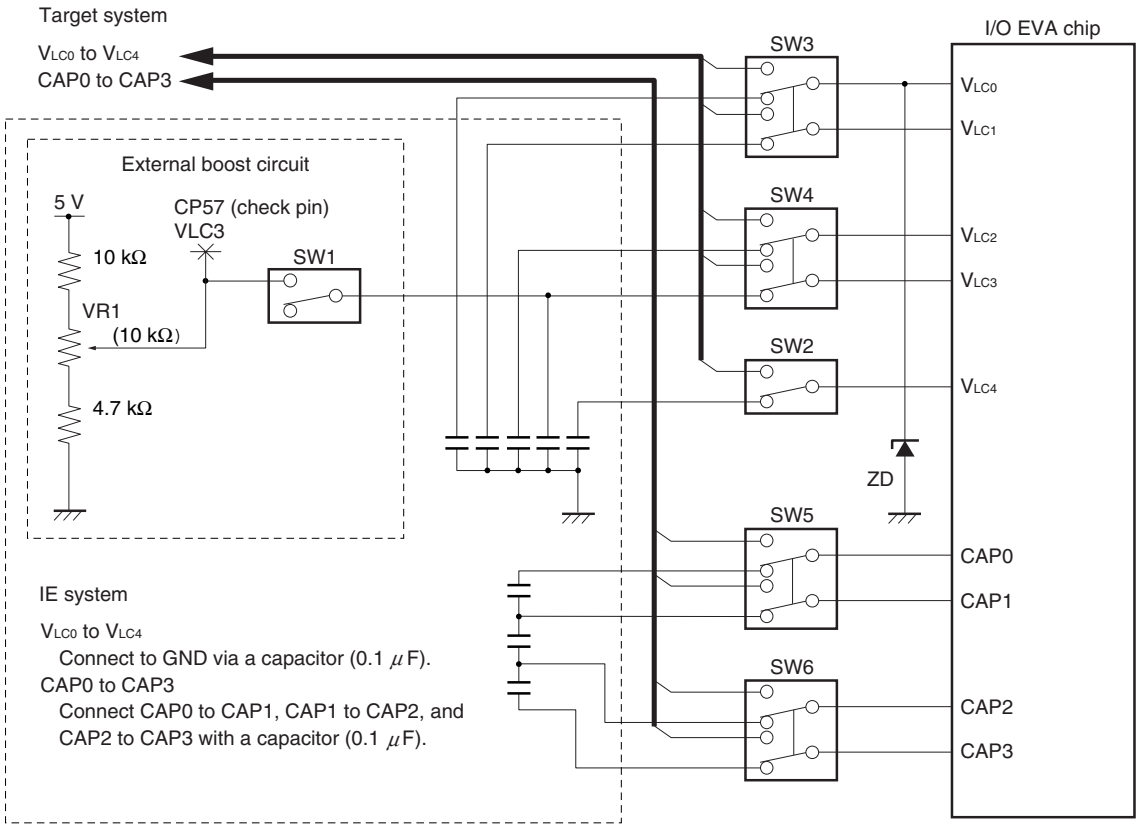


Table 3-6. LCD Switch Settings

Switch (Signal Name)	Setting	Description
SW3 (V_{LC0}, V_{LC1})	ICE side (initial setting)	Connects IE system's internal circuit.
	USR side	Connects to target system via emulation probe.
SW4 (V_{LC2}, V_{LC3})	ICE side (initial setting)	Connects IE system's internal circuit.
	USR side	Connects to target system via emulation probe.
SW2 (V_{LC4})	ICE side (initial setting)	Connects IE system's internal circuit.
	USR side	Connects to target system via emulation probe.
SW5 (CAP0, CAP1)	ICE side (initial setting)	Connects IE system's internal circuit.
	USR side	Connects to target system via emulation probe.
SW6 (CAP2, CAP3)	ICE side (initial setting)	Connects IE system's internal circuit.
	USR side	Connects to target system via emulation probe.

(2) External boost circuit

SW1 of the external boost circuit is set to OFF at shipment, and connection of an external boost circuit is possible by setting this switch to ON. The external boost circuit is a circuit that re-boosts the reference value set to VLCD00 (FFB3H). VR1 is used to adjust the V_{LC3} voltage (1.6 V to 2.2 V) and boost the voltage level of the LCD reference voltage (V_{LC0} to V_{LC4}). The V_{LC0} voltage can be adjusted up to the standard value – 0.35 V ±15%. At shipment, VR1 is set to VLC3 = 2.0 V. The V_{LC3} voltage can be measured with the check pin (CP57).

Figure 3-19. Variable Resistance of External Boost Circuit

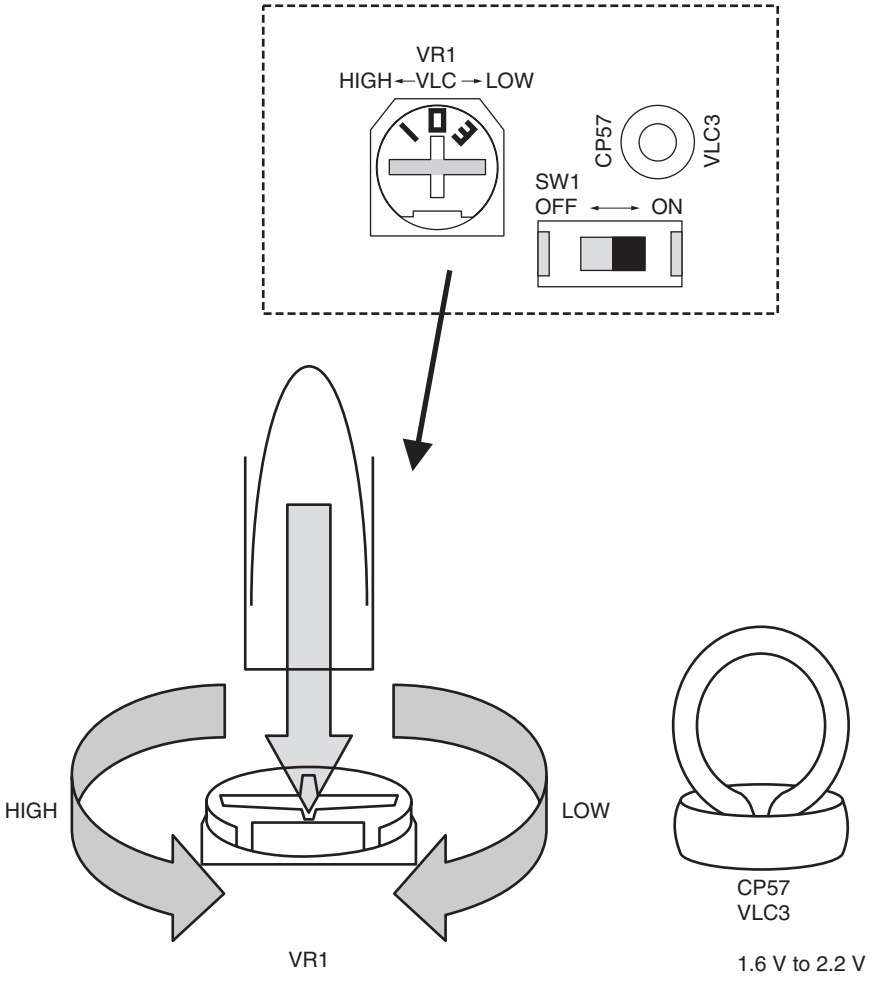


Table 3-7. Switch Settings of External Boost Circuit

SW1	ON: Connect circuit
	OFF: Disconnect circuit (initial setting)

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 system target interface circuit.

The target interface circuit of the IE system realizes emulation through an emulation circuit configuration comprising the emulation CPU, TTL, CMOS-IC, etc. The protective circuit makes the electrical specifications of the IE system different from those of the target device.

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

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

(3) Other signals

The following shows the circuit of the IE-789835-NS-EM1 for the signals in (1) to (3) above. The same applies to alternate pins for which no circuit is provided in the IE system.

(1) Signals input to or output from the emulation CPU

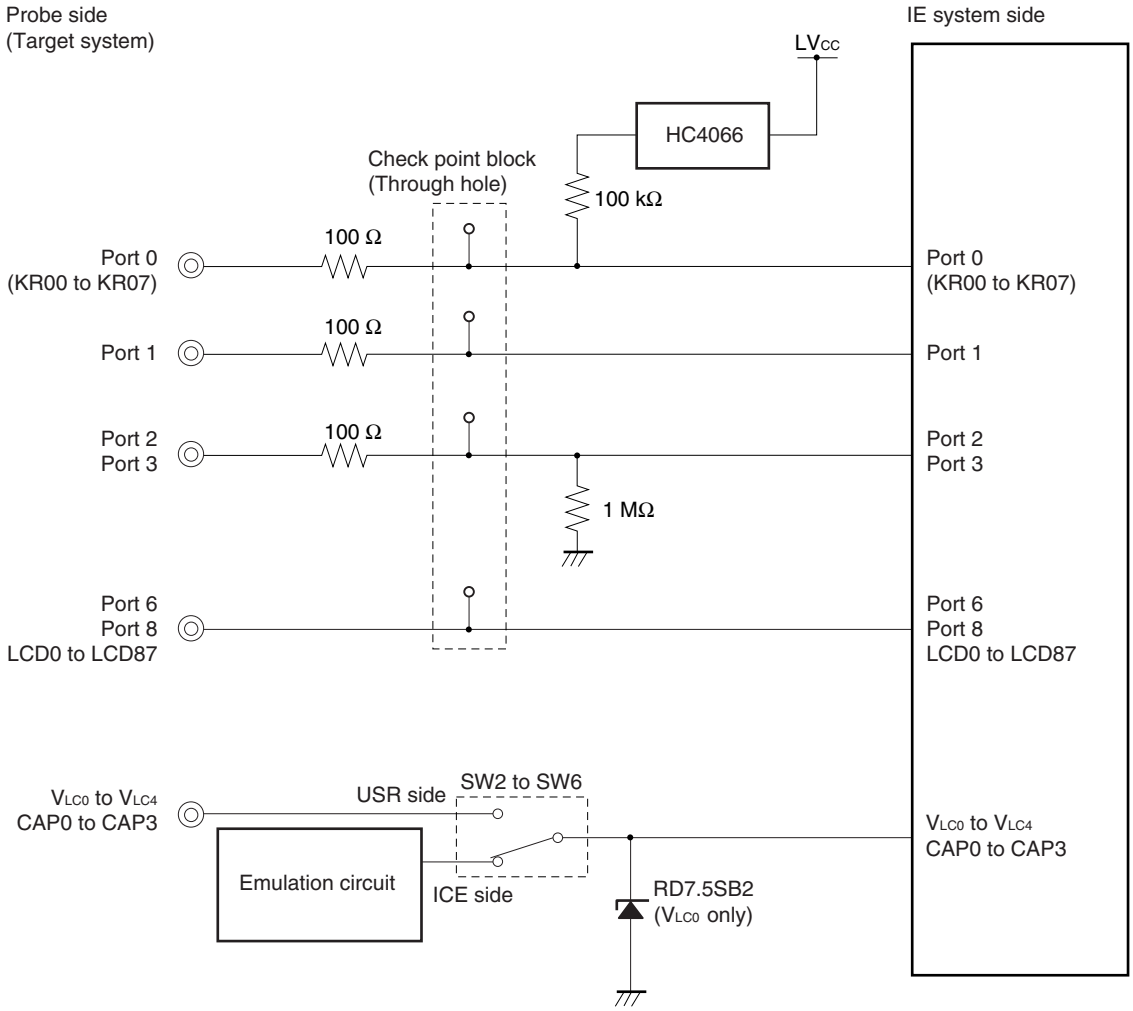
The following signals perform the same operations as in the μPD789835 Subseries. However, a 1 MΩ pull-down resistor and 100 Ω resistor are inserted in series. Refer to **Figure 4-1 Equivalent Circuit of Emulation Circuit 1**.

1 MΩ pull-down resistors are connected to the signals related to port 0 and port 1 inside the IE-78K0S or IE-78K0S-NS-A.

- Signals related to port 0
  When used as pins for detecting key returns, port 0 is pulled up using HC4066 in the IE-789835-NS-EM1.
- 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 slide SW. A Zener diode of 7 V is connected between V_{LC0} and GND to protect the pins.

Figure 4-1. Equivalent Circuit of Emulation Circuit 1

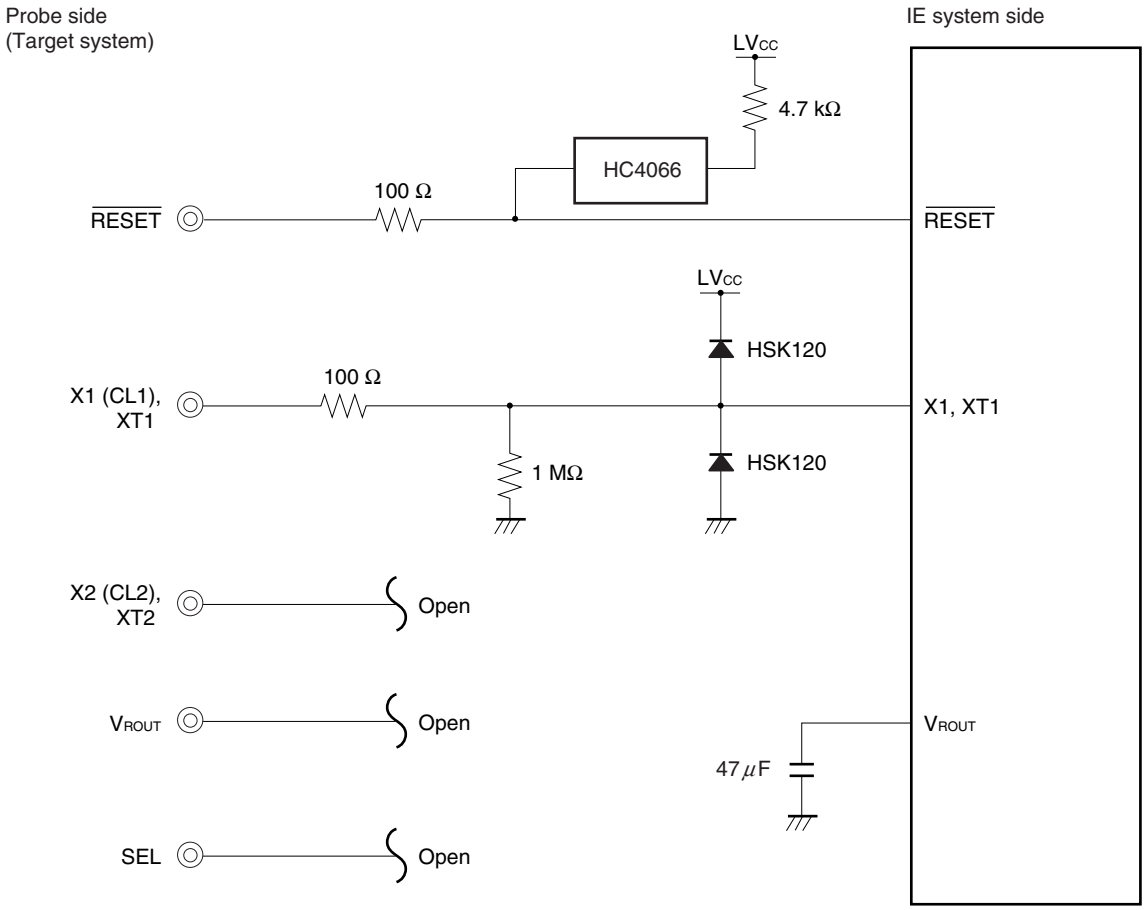


(2) Signals input from the target system via a gate

Since the following signals are input via a gate, their signals show a delay compared to the μPD789835 Subseries. Refer to **Figure 4-2 Equivalent Circuit of Emulation Circuit 2**.

- $\overline{\text{RESET}}$ signal
- Signals related to clock input
  The X2 (CL2) and XT2 pins are not used in the IE-789835-NS-EM1.
- SEL pin
  The SEL pin is not used in the IE-789835-NS-EM1. The IE system is fixed to ceramic/crystal oscillation.
- V_{ROUT} pin
  The V_{ROUT} pin is not used in the IE-789835-NS-EM1. This pin is connected to GND via a capacitor of 47 μF in the IE system.

Figure 4-2. Equipment Circuit of Emulation Circuit 2

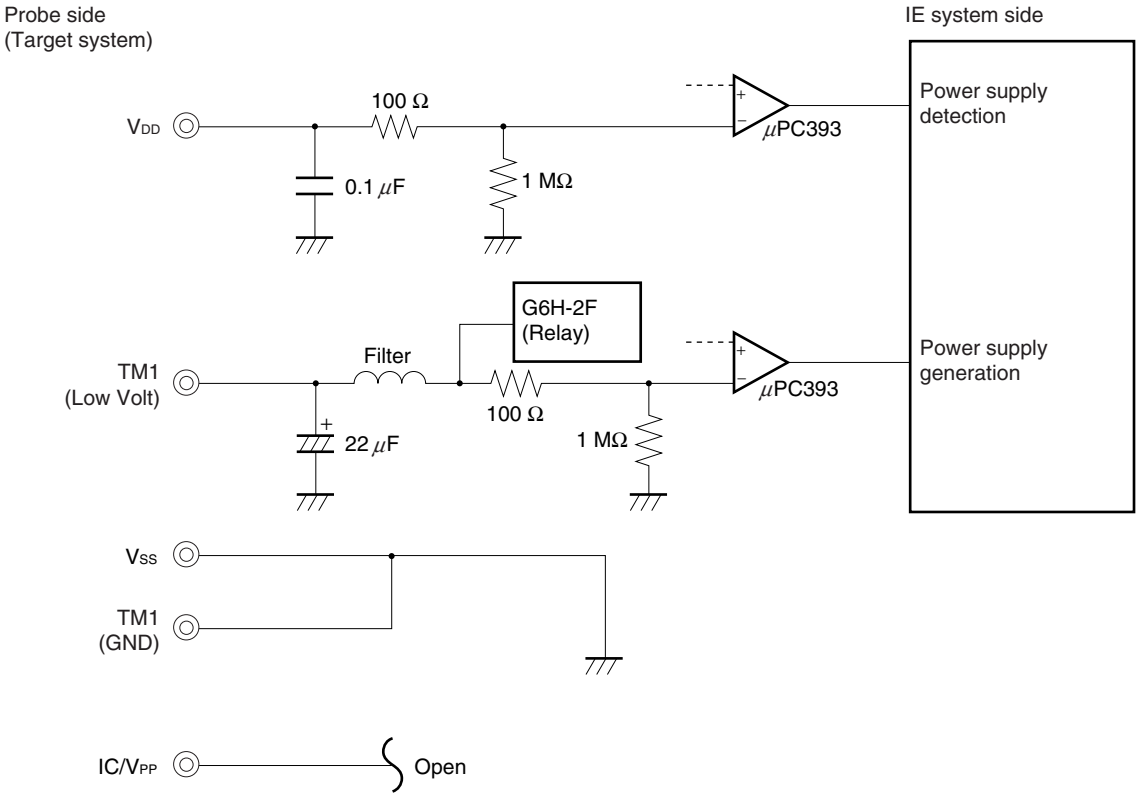


(3) Other signals

Refer to **Figure 4-3 Equivalent Circuit of Emulation Circuit 3**.

- V_{DD} pin
  The emulation CPU operates on the internal power supply (3 V) when not connected to the target system, and operates on the voltage (LV_{CC}) supplied from the low voltage supply pin (TM1) when connected to the target system.
  The V_{DD} pin of the target system is used only to control the LED1 that indicates whether the target system's power is on or off in the IE-789835-NS-EM1.
- V_{SS} pin
  The V_{SS} pin is are connected to GND in the IE-789835-NS-EM1.
- IC/V_{PP} pin
  The IC/V_{PP} pin is not used in the IE-789835-NS-EM1.

Figure 4-3. Equivalent Circuit of Emulation Circuit 3



CHAPTER 5 RESTRICTIONS

This chapter describes the differences between the target device and IE system specifications. The emulation circuit of the IE system is configured of an EVA chip, TTL, CMOS-IC, etc., to realize emulation. Therefore, there are differences between the target device and IE system specifications.

- **Emulating an RC oscillator not possible by SEL pin input in the IE-789835-NS-EM1**
  The SEL pin, which is left open, does not accept input. The IE system is fixed to ceramic/crystal oscillation. Emulating the oscillator is limited to the functions described in **3.4 Clock Settings**.

- **The power supply voltage of the subsystem clock cannot be changed in the IE-789835-NS-EM1**
  The V_{ROUT0} pin is fixed to V_{DD} (L_{VCC}: 1.8 V to 3.6 V). Even if PSC00 (FFAFH) is changed to "1", switching to the V_{ROUT0} voltage will not be enabled. The V_{ROUT0} pin is connected to GND via a capacitor of 0.47 μF in the IE-789835-NS-EM1.

- **The voltage level of the LCD reference voltage (V_{LC0} to V_{LC4}) does not satisfy the specified value in the IE-789835-NS-EM1**
  The V_{LC0} voltage is the specified value (when the voltage level of the boost circuit is set by VLCD00 (FFB3H)) – 0.53 V ±10%.
  The V_{LC0} voltage can be controlled within the range of the specified value – 0.35 V ±15% by using the external boost circuit of the IE-789835-NS-EM1. For the external boost circuit, refer to **3.6 LCD Emulation**.

APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

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

Tip on Target System Side	Pin No.			Tip on Target System Side	Pin No.			Tip on Target System Side	Pin No.		
	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

Remark SWEX-144SD-1 is a product of TOKYO ELETECH CORPORATION.

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

Tip on Target System Side	Pin No.			Tip on Target System Side	Pin No.			Tip on Target System Side	Pin No.		
	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 CAUTIONS ON DESIGNING TARGET SYSTEM

Figures B-1 and B-2 show the conditions when connecting the emulation probe to the conversion connector. Follow the configuration below and consider the shape of parts to be mounted on the target system when designing a system.

SWEX-144SD-1, NQPACK144SD, and YQPACK144SD described in this appendix are products of TOKYO ELETECH CORPORATION.

Figure B-1. Distance Between In-Circuit Emulator and Conversion Connector

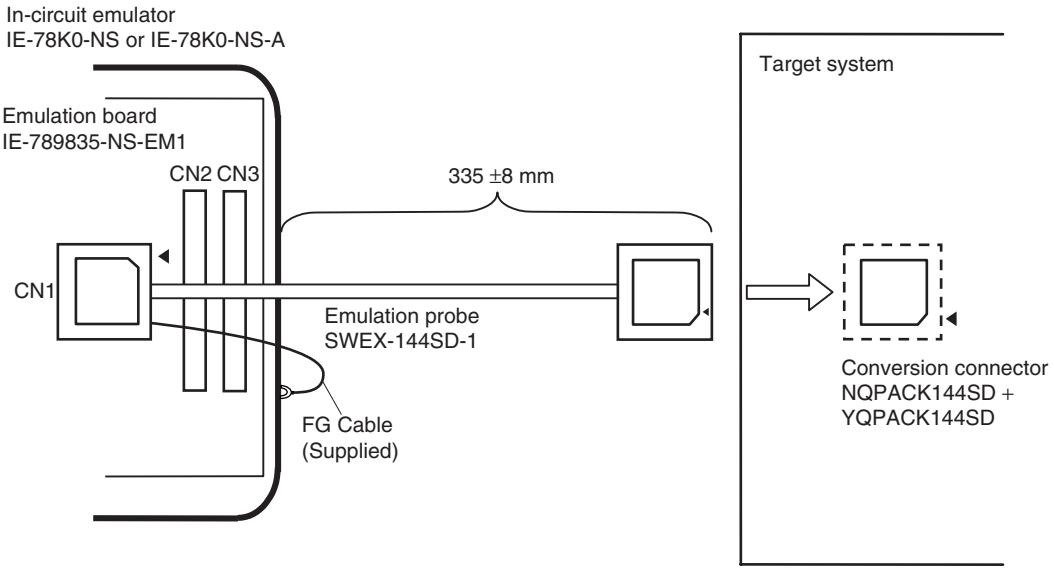
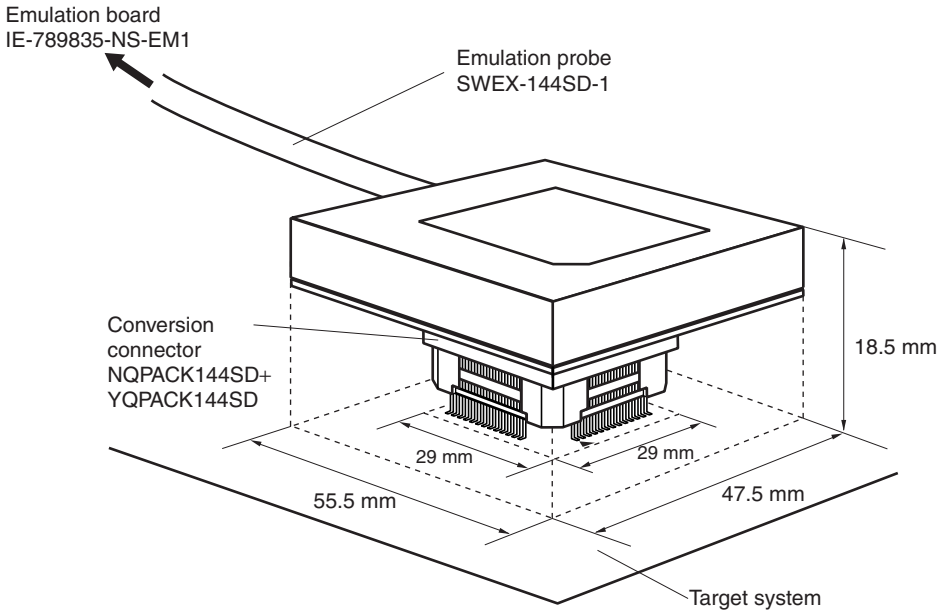


Figure B-2. Connection to Target System



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