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# User's Manual

# IE-789831-NS-EM1

## Emulation Board

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## Target Devices $\mu$ PD789830 Subseries

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## Major Revisions in This Edition

| Page                      | Description  |
|---------------------------|--|
| Throughout                | <ul style="list-style-type: none"> <li>• Addition of IE-78K0S-NS-A as supported in-circuit emulator</li> <li>• Addition of NP-H100GC-TQ as supported emulation probe</li> </ul>  |
| pp. 12, 13                | Figure 1-1 System Configuration <ul style="list-style-type: none"> <li>• Modification of shape of interface cable</li> <li>• Modification of supply medium of the debugger to CD-ROM</li> <li>• Modification of Notes 1 to 3</li> </ul>  |
| p. 13                     | Addition of <b>Table 1-1 Correspondence Between Emulation Probe and Conversion Socket/Conversion Adapter</b>   |
| p. 15                     | Partial modification of <b>Table 1-2 Basic Specifications</b>  |
| p. 20                     | <b>3.2 Switch and Jumper Settings on Main Unit</b> <ul style="list-style-type: none"> <li>• Addition of <b>(2) Settings on the IE-78K0S-NS-A</b></li> </ul>  |
| p. 23 of previous edition | Deletion of <b>3.3 Low-Voltage Emulation Setting</b>   |
| p. 21                     | Addition of <b>3.3 Setting Power Supply Voltage of Target Interface</b>  |
| pp. 22 to 25              | <b>3.4.1 Overview of clock settings</b> <ul style="list-style-type: none"> <li>• Change from “internal clock” in previous edition to “clock oscillator”</li> <li>• <b>Figure 3-3 External Circuits Used as System Clock Oscillator</b><br/>Addition of V<sub>ss</sub> pin in figure of <b>(a) Clock oscillator</b></li> <li>• <b>Figure 3-4 When Using Clock That Is Already Mounted on Emulation Board (Main System Clock) to Figure 3-7 When Using User-Mounted Clock (Subsystem Clock)</b><br/>Change from “resonator” in previous revision to “clock oscillator or external clock” on target system</li> <li>• Change from “clock generator” in previous edition to “external clock” in <b>Figure 3-8 When Supplying Pulse from Target System</b></li> </ul> |
| pp. 39, 40                | Addition of <b>APPENDIX B NOTES ON DESIGNING TARGET SYSTEM</b>   |

The mark ★ shows major revised points.

## INTRODUCTION

### Product Overview

The IE-789831-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.

- $\mu$ PD789830 Subseries:  $\mu$ PD789830, 78F9831

### Target Readers

This manual is intended for engineers who will use the IE-789831-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-789831-NS-EM1, refer to not only this manual (supplied with the IE-789831-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-789831-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's purpose is to explain various debugging functions that can be performed when using the IE-789831-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 to be emulated.   |
| 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 in-circuit emulator (IE-78K0S-NS or IE-78K0S-NS-A) and the emulation board (IE-789831-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-789831-NS-EM1 Emulation Board   | This manual     |
| ID78K Series Integrated Debugger Ver. 2.30 or Later Operation Windows™ Based | U15185E         |
| μPD789830 Subseries  | U13679E         |

**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-789831-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-789831-NS-EM1's system configuration and basic specifications.

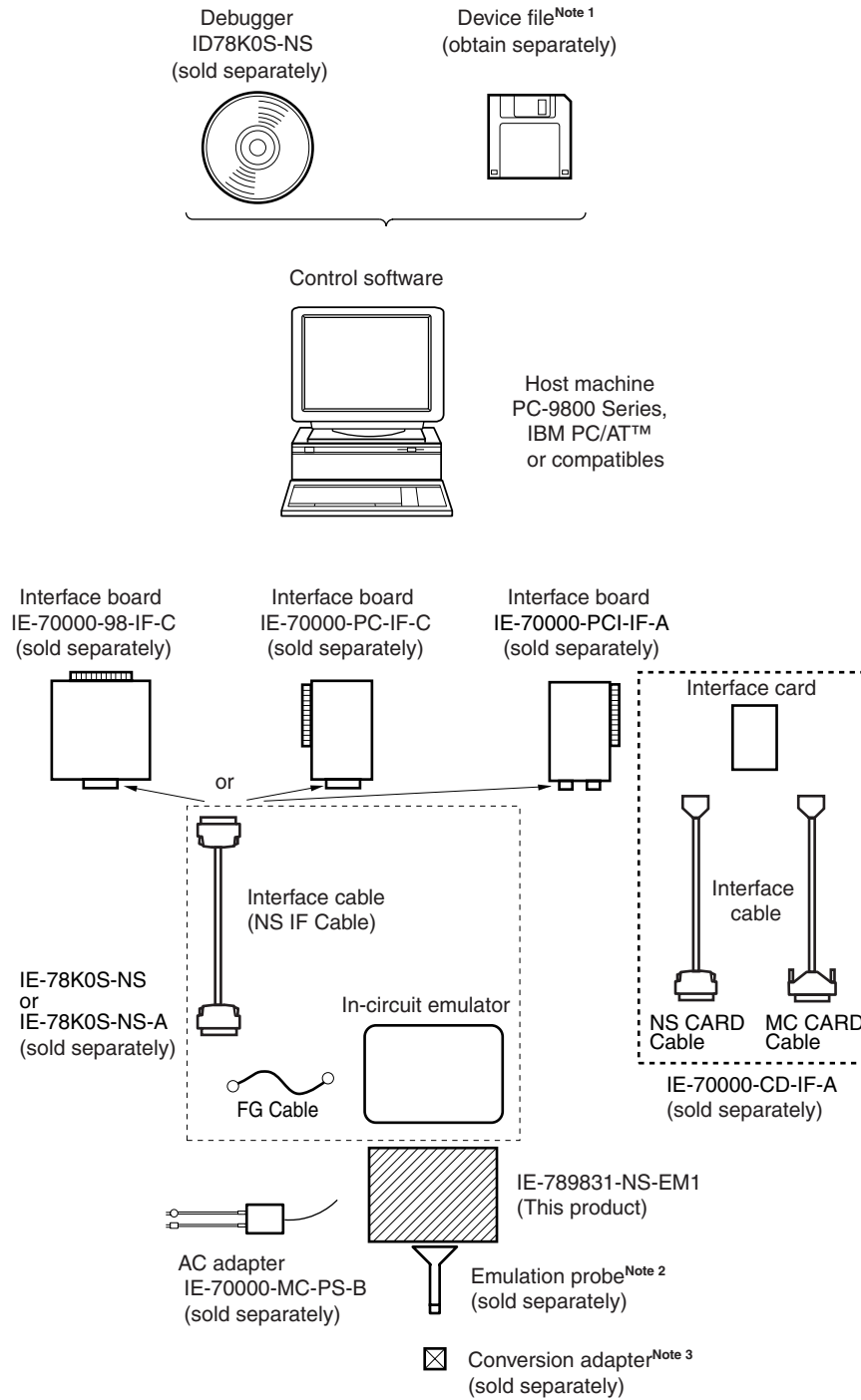
- Target devices
  - $\mu$ PD789830 Subseries

## 1.1 System Configuration

Figure 1-1 illustrates the IE-789831-NS-EM1's system configuration.

★

**Figure 1-1. System Configuration**



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

$\mu$ SxxxxDF789831:  $\mu$ PD789830, 78F9831 Subseries

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

2. The emulation probes NP-100GC and NP-H100GC-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 TGC-100SDW 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)

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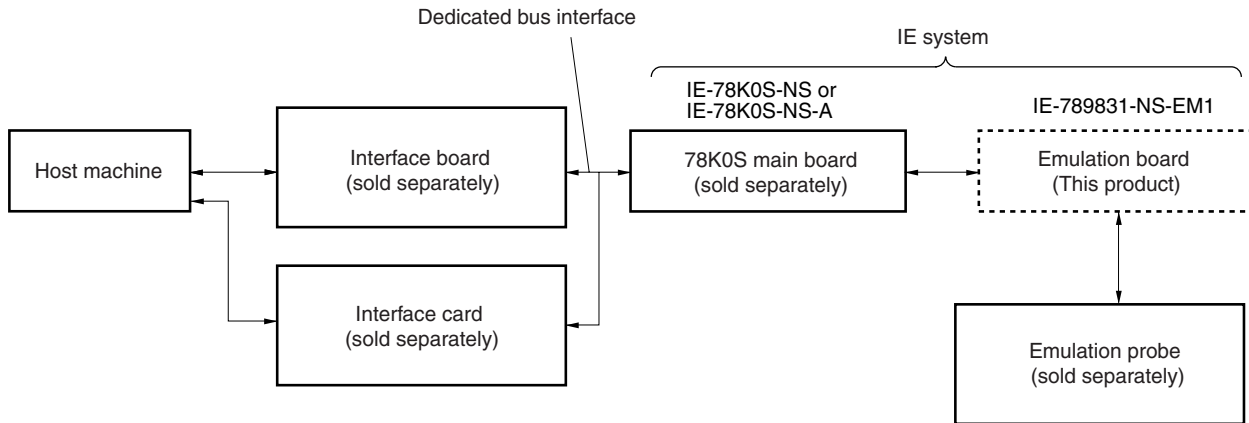
**Table 1-1. Correspondence Between Emulation Probe and Conversion Adapter**

| Package                           | Emulation Probe                     | Conversion Socket/Conversion Adapter |
|-----------------------------------|-------------------------------------|--------------------------------------|
| 100-pin plastic LQFP<br>(GC type) | NP-100GC (probe length: 200 mm)     | TGC-100SDW                           |
|                                   | NP-H100GC-TQ (probe length: 400 mm) |                                      |

## 1.2 Hardware Configuration

Figure 1-2 shows the IE-789831-NS-EM1's position in the basic hardware configuration.

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





### 1.3 Basic Specifications

The basic specifications of the IE-789831-NS-EM1 are listed in Table 1-2.

**Table 1-2. Basic Specifications**

| Parameter                  | Description   |
|----------------------------|---|
| Target device              | $\mu$ PD789830 Subseries  |
| System clock               | 3.58 MHz  |
| Main system clock supply   | External: Input via an emulation probe from the target system<br>Internal: Mounted on emulation board (3.58 MHz), or mounted on the parts board by the user       |
| Subsystem clock supply     | External: Input via an emulation probe from the target system<br>Internal: Mounted on the emulation board (32.768 kHz), or mounted on the parts board by the user |
| ★ Target interface voltage | $V_{DD} = 2.7$ to $5.0$ V (same as that of target device)<br>Operates on internal power supply (5 V) when target system is not connected                          |

## CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-789831-NS-EM1 main unit.

The packing box contains the emulation board (IE-789831-NS-EM1), packing list, user's manual, and guarantee card.

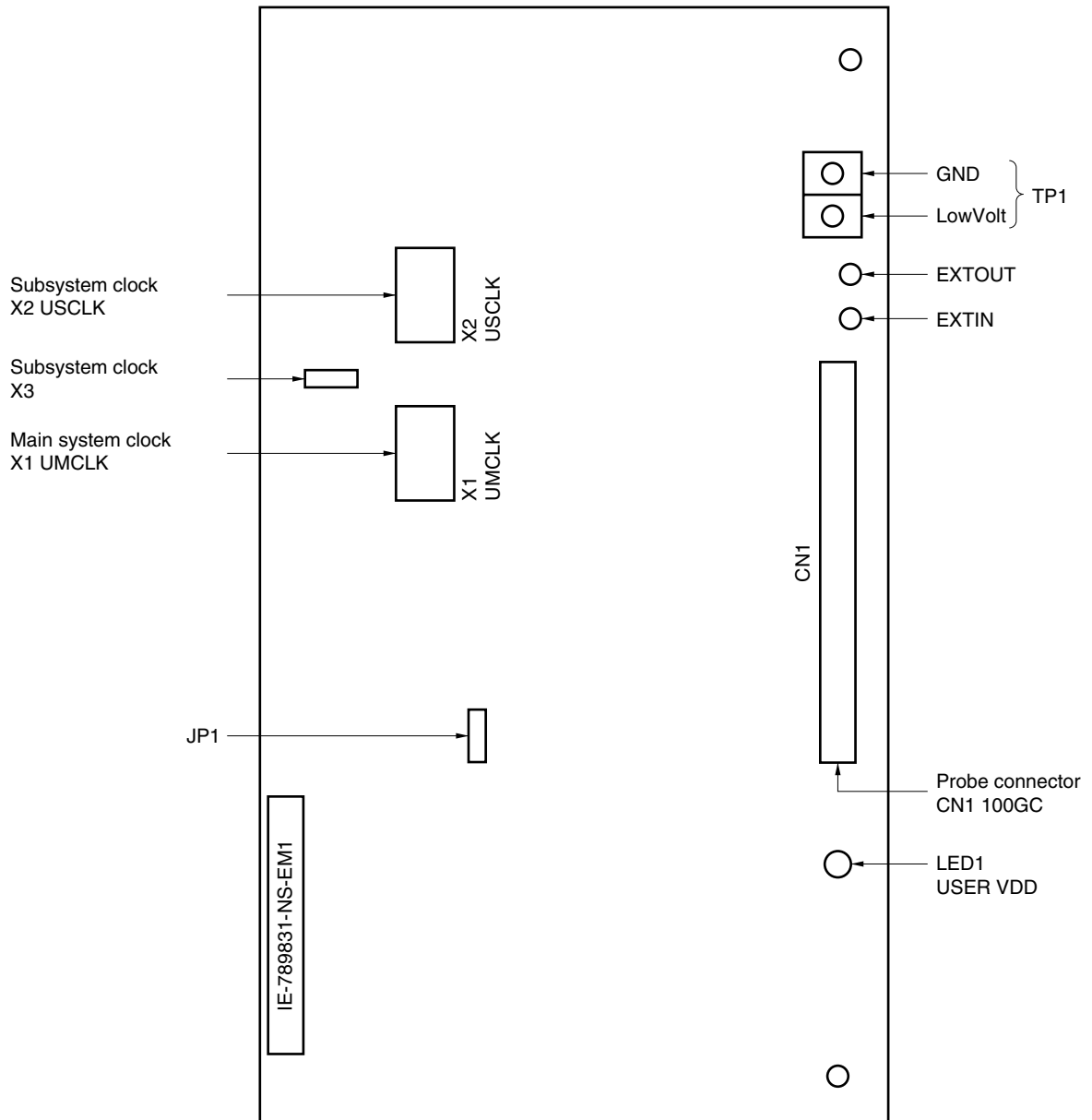
If there are any missing or damaged items, please contact an NEC Electronics sales representative.

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

2.1 Parts of Main Unit

Figure 2-1 shows the part names of the IE-789831-NS-EM1.

Figure 2-1. IE-789831-NS-EM1 Part Names



## CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-789831-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)** for a description of how to connect the IE-789831-NS-EM1 to the IE-78K0S-NS<sup>Note</sup>.

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

#### (2) Connection with emulation probe

See the **IE-78K0S-NS User's Manual (U13549E)** for a description of how to connect an emulation probe to the IE-789831-NS-EM1<sup>Note</sup>.

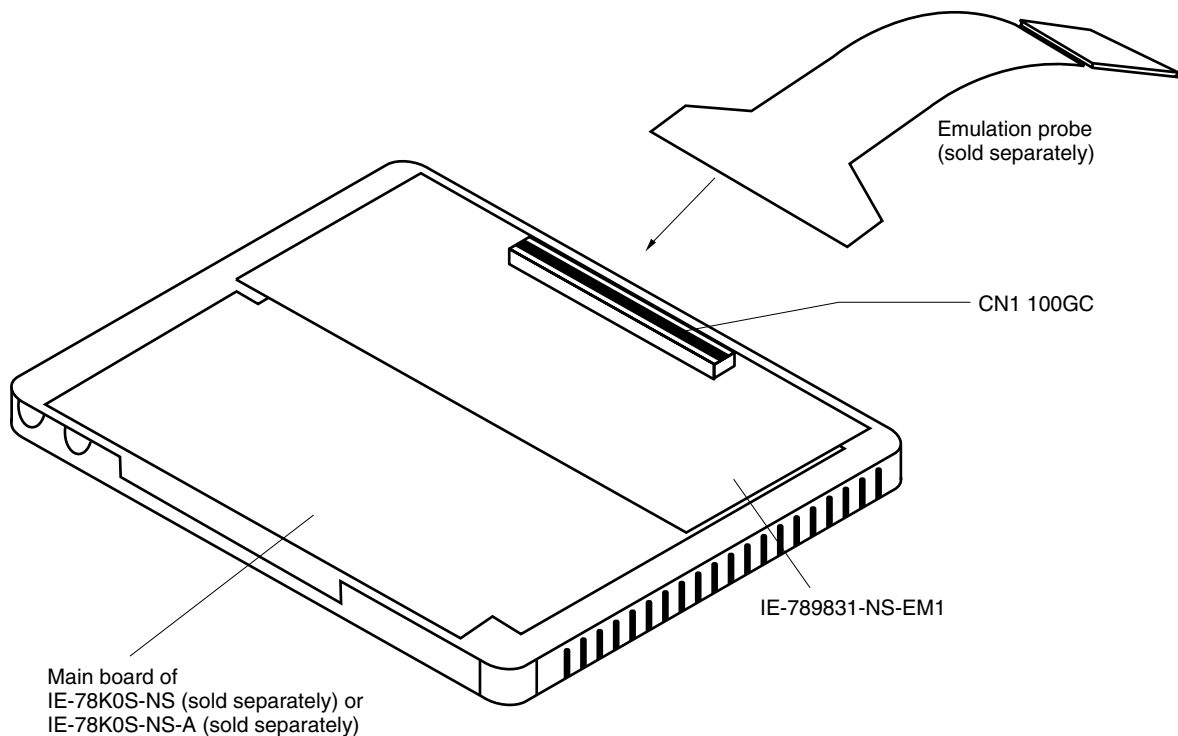
On this board, connect the emulation probe to CN1.

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

**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.

Figure 3-1. Connection of Emulation Probe



## 3.2 Switch and Jumper Settings on Main Unit

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

When using the IE-789831-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<br>(Fixed) | All switches ON<br>(Fixed) | 2 and 3 shorted | 1 and 2 shorted |

**Caution** Incorrect connection may damage the IE-789831-NS-EM1.

### ★ (2) Settings on the IE-78K0S-NS-A

When using the IE-789831-NS-EM1, set the switches and jumpers on the IE-78K0S-NS-A as shown in Table 3-2. For details of these switch and jumper settings, 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 and 2 shorted (fixed) | Shorted (fixed) |

**Caution** Incorrect connection may damage the IE-789831-NS-EM1.

★ 3.3 Setting Power Supply Voltage of Target Interface

In the IE system, emulation is possible with a voltage of the same level as the power supply voltage of the target system.

When the target system is not connected, the IE system automatically operates with the emulator's internal power supply (5 V).

When debugging with a voltage that is the same level as that of the target system, supply the same voltage as that of the target system to the TP1 terminal pin of the IE-789831-NS-EM1 (the same applies when the voltage is 5 V).

Set the target voltage to between 2.7 and 5.0 V.

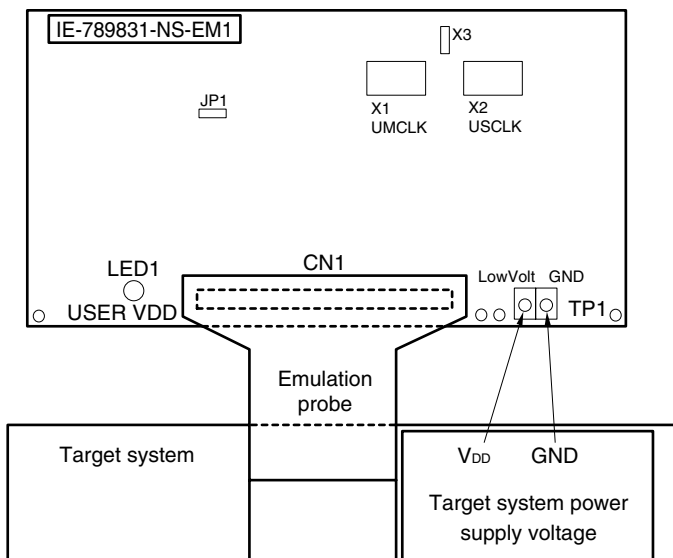
For how to select the operating power supply, refer to the **ID78K Series Ver.2.30 or Later Operation Windows-Based User's Manual (U15185E)**.

- Maximum current consumption of TP1  
2.7 to 5.0 V: Approximately 100 mA

Table 3-3. Setting Power Supply of Target Interface

| Power Supply of Target Interface (LVcc) |              | Integrated Debugger (ID78K0S-NS) |
|---|--------------|----------------------------------|
|   |              | Operating Power Supply Selection |
| When connecting target system           | 2.7 to 5.0 V | Target                           |
| When not connecting target system       | 5 V          | Internal                         |

Figure 3-2. Connecting TP1 and Target System Power Supply Voltage



**Caution** Before connecting TP1 on the board and the target system power supply voltage, turn off the power to the IE-78K0S-NS or IE-78K0S-NS-A.

**Remark** The V<sub>DD</sub> pin on the target system is exclusively used to control LED1 (USER VDD) that monitors whether the power supply of the target system is connected in the IE-789831-NS-EM1.

## 3.4 Clock Settings

### 3.4.1 Overview of clock settings

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

- (1) Clock that is already mounted on emulation board
- (2) Clock that is mounted by user
- (3) 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 the 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 3-3. 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 in the IE-78K0S-NS or IE-78K0S-NS-A is used.

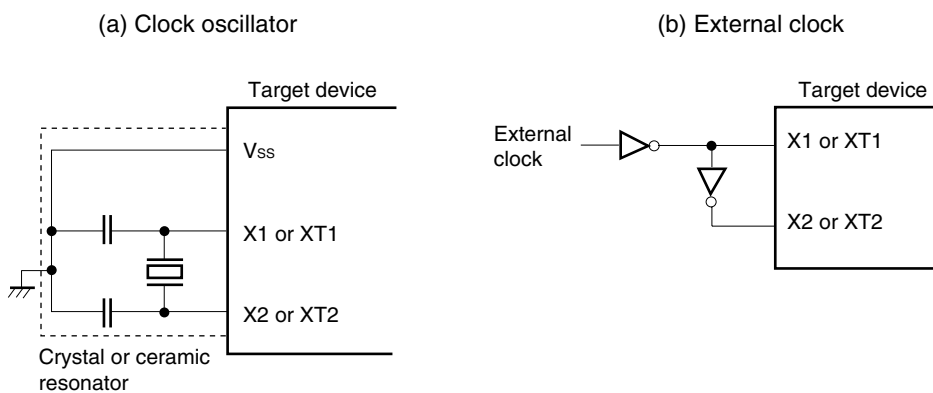
If the target system includes an external clock, select either **(1) Clock that is already mounted on emulation board**, **(2) Clock that is mounted by user**, or **(3) Pulse input from target system**.

For the 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 3-3.

**Caution** The IE system will be hung-up if the main system clock is not supplied normally. Moreover, be sure to input a rectangular wave as the pulse from the target system. There is no need to supply a clock to the X2 and XT2 pins. Also, even if a crystal resonator is connected directly to X1 (for the main system clock) or XT1 (for the subsystem clock), the target device will not operate.

★

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





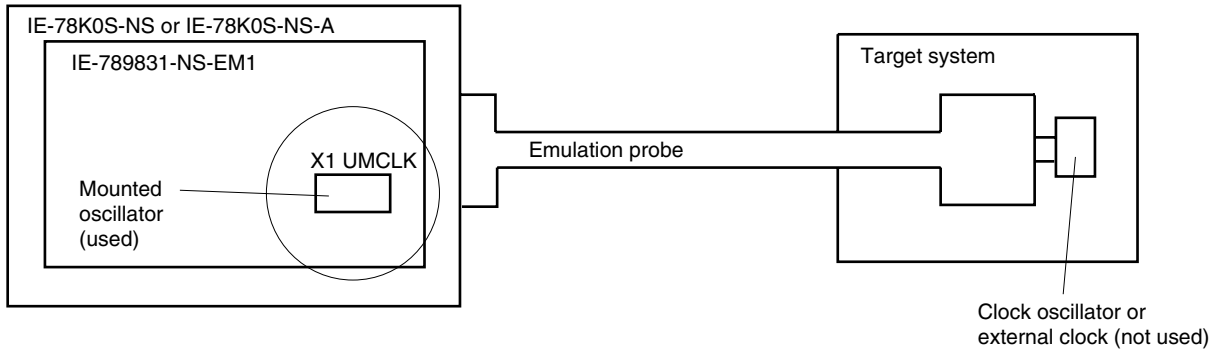
(1) **Clock that is already mounted on emulation board**

The crystal oscillator mounted on the IE-789831-NS-EM1 can be used.

(a) **Main system clock**

A crystal oscillator (X1 UMCLK) is already mounted on the emulation board. Its frequency is 3.58 MHz.

★ **Figure 3-4. When Using Clock That Is Already Mounted on Emulation Board (Main System Clock)**

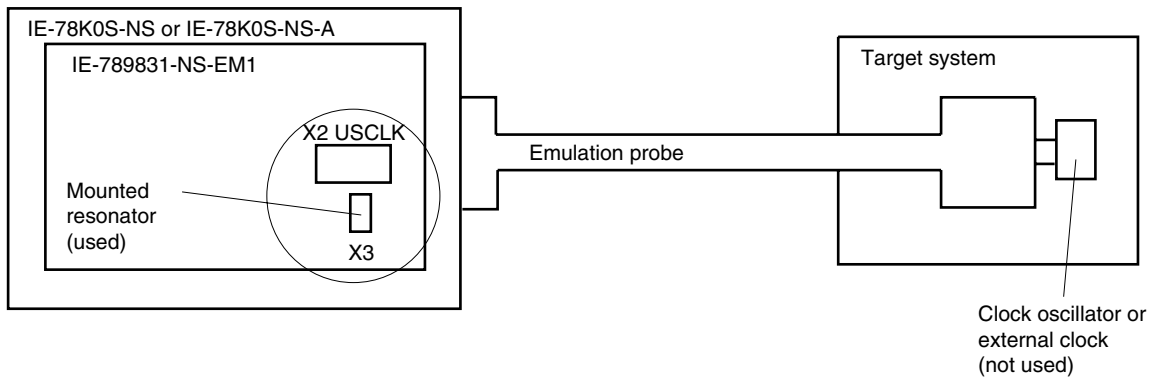


**Remark** The clock that is supplied by the oscillator of the IE-789831-NS-EM1 (encircled in the figure) is used.

(b) **Subsystem clock**

A crystal resonator (X3) is already mounted on the emulation board. Its frequency is 32.768 kHz

★ **Figure 3-5. When Using Clock That Is Already Mounted on Emulation Board (Subsystem Clock)**



**Remark** The clock that is supplied by the resonator of the IE-789831-NS-EM1 (encircled in the figure) is used.

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

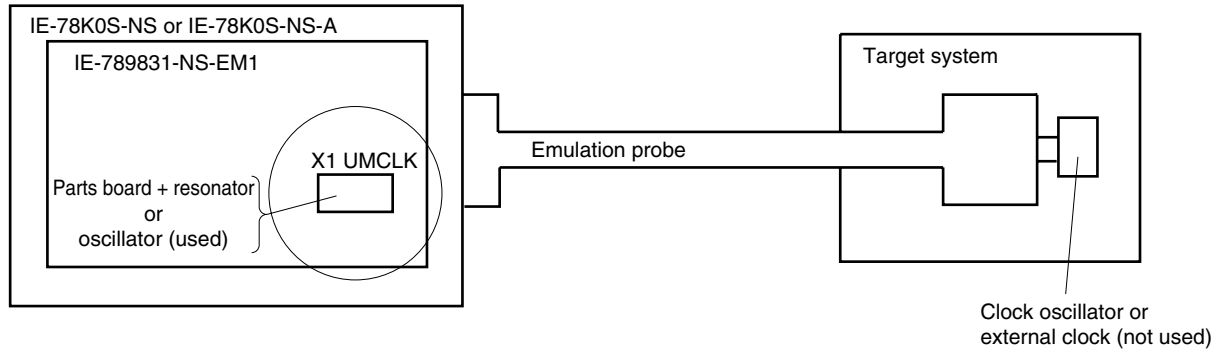
The user can mount any clock supported by the set specifications on the IE-789831-NS-EM1. This feature is effective when debugging at a different frequency than the clock already mounted.

**(a) Main system clock**

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

★

**Figure 3-6. When Using User-Mounted Clock (Main System Clock)**



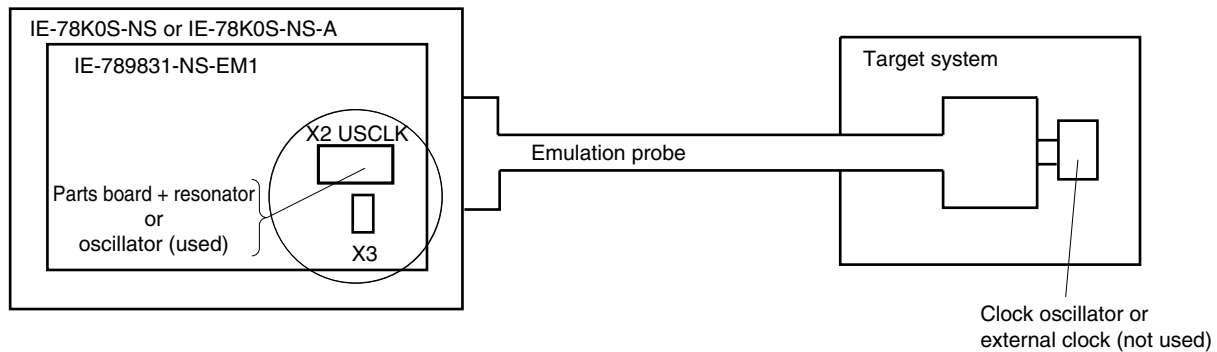
**Remark** The clock that is supplied by the resonator of the IE-789831-NS-EM1 (encircled in the figure) or the oscillator is used.

**(b) Subsystem clock**

Remove the parts board (X2 USCLK) that is already mounted on the emulation board, and mount the parts board on which the resonator to be used is mounted or mount the oscillator to be used.

★

**Figure 3-7. When Using User-Mounted Clock (Subsystem Clock)**



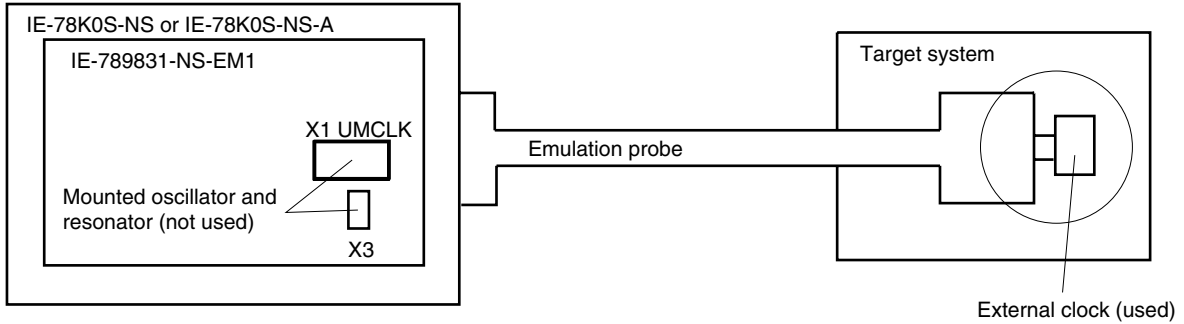
**Remark** The clock that is supplied by the resonator of the IE-789831-NS-EM1 (encircled in the figure) or the oscillator is used.

**(3) Pulse input from target system**

An external clock on the target system can be used as both the main system clock and subsystem clock via an emulation probe.

★

**Figure 3-8. When Supplying Pulse from Target System**



**Remark** The pulse that is supplied by the external clock on the target system (encircled in the figure) or the oscillator is used.

**3.4.2 Main system clock settings**

Table 3-4 shows the settings of the IE-789831-NS-EM1 when the main system clocks in (1) to (3) are used.

**Table 3-4. Main System Clock Settings**

| Frequency of Main System Clock                                  |                     | IE-789831-NS-EM1              | CPU Clock Source Selection (ID78K0S-NS) |
|---|---------------------|-------------------------------|---|
|   |                     | X1 UMCLK                      |   |
| (1) When using clock that is already mounted on emulation board | 3.58 MHz            | Oscillator                    | Internal                                |
| (2) When using clock mounted by user                            | Other than 3.58 MHz | Oscillator configured by user |   |
| (3) When inputting pulse from target system                     |                     | Oscillator (not used)         | External                                |

**Caution** When inputting a pulse 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’s clock).

**Remark** The factory settings of the IE-789831-NS-EM1 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-789831-NS-EM1 is shipped, a 3.58 MHz crystal oscillator is already mounted in the IE-789831-NS-EM1’s socket (X1 UMCLK). 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**

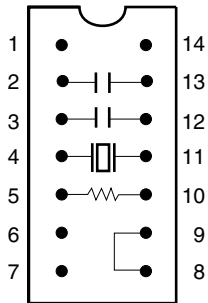
- Items to be prepared
  - Parts board
  - Ceramic resonator or crystal resonator
  - Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

<Steps>

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

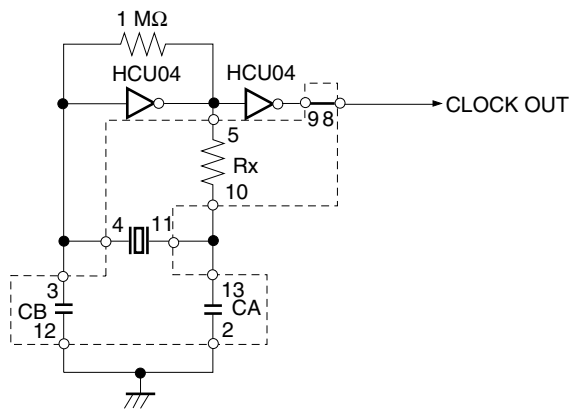
**Figure 3-9. Connections on Parts Board (Main System Clock)**

Parts board (X1 UMCLK)



| 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.

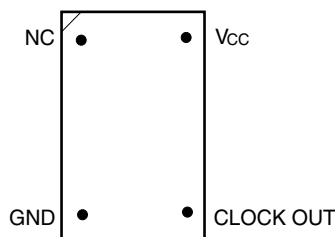
- <2> Prepare the IE-789831-NS-EM1.
- <3> Remove the crystal oscillator that is mounted in the IE-789831-NS-EM1's socket (X1 UMCLK).
- <4> Connect the parts board (from <1> above) to the socket (X1 UMCLK) from which the crystal oscillator was removed. Check the pin 1 mark to make sure the board is mounted in the correct direction.
- <5> Make sure that the parts board is wired as shown in Figure 3-9 above.
- <6> Install the IE-789831-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 3-10)

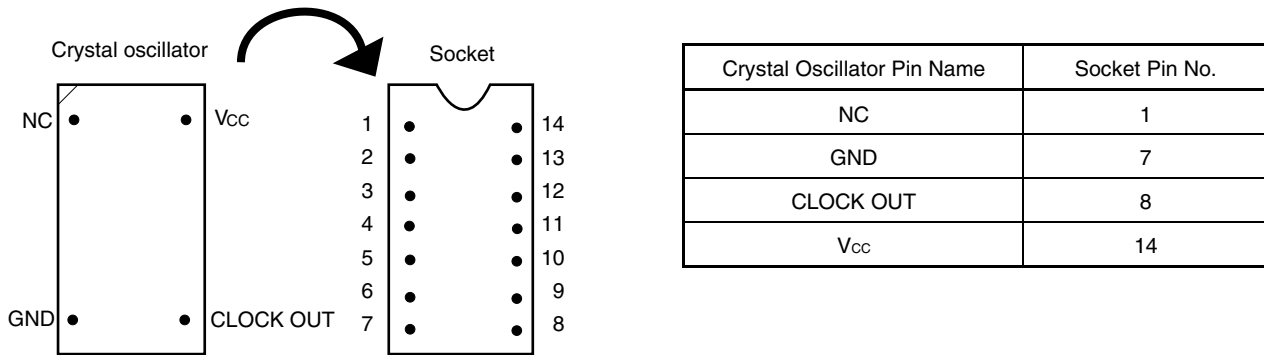
**Figure 3-10. Crystal Oscillator (Main System Clock)**



**<Steps>**

- <1> Prepare the IE-789831-NS-EM1.
- <2> Remove the crystal oscillator that is mounted in the IE-789831-NS-EM1's socket (X1 UMCLK).
- <3> Connect a crystal oscillator to the socket (X1 UMCLK) from which the crystal oscillator was removed (in <2> above). Insert the pins of the crystal oscillator into the socket aligning the pins as shown in the figure below.

**Figure 3-11. Pin Alignment of Crystal Oscillator and Socket (Main System Clock)**



<4> Install the IE-789831-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

**(3) When inputting pulse 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 setting

Table 3-5 shows the settings of the IE-789831-NS-EM1 when the subsystem clocks in (1) to (3) are used.

**Table 3-5. Subsystem Clock Settings**

| Frequency of Subsystem Clock   |                       | IE-789831-NS-EM1              |                 |
|--|-----------------------|-------------------------------|-----------------|
|  |                       | X2 USCLK                      | JP1             |
| (1) When using clock (X3) that is already mounted on emulation board | 32.768 kHz            | 6 and 8 shorted               | 2 and 3 shorted |
| (2) When using clock mounted by user                                 | Other than 32.768 kHz | Oscillator configured by user |                 |
| (3) When inputting pulse from target system                          |                       |                               | Not used        |

**Caution** Before setting JP1 to switch between the clock on the board and external clock, turn off the power of the IE-78K0S-NS or IE-78K0S-NS-A.

**Remark** The factory settings of the IE-789831-NS-EM1 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-789831-NS-EM1 is shipped, a 32.768 kHz crystal resonator (X3) and a parts board (X2 USCLK) on which pins 6 and 8 are shorted are already mounted on the IE-789831-NS-EM1. Short 2 and 3 of the jumper (JP1) on the IE-789831-NS-EM1. No settings are required on the integrated debugger (ID78K0S-NS).

#### (2) When using clock mounted by user

Perform the settings in (a) or (b) below, depending on the type of clock to be used. Short 2 and 3 of the jumper (JP1) on the IE-789831-NS-EM1.

No settings are required on 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

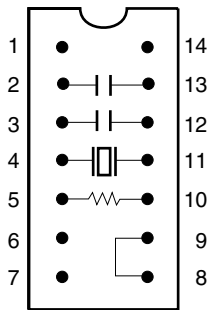
<Steps>

<1> Prepare the IE-789831-NS-EM1.

<2> Solder the target ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequencies) onto the parts board (X2 USCLK).

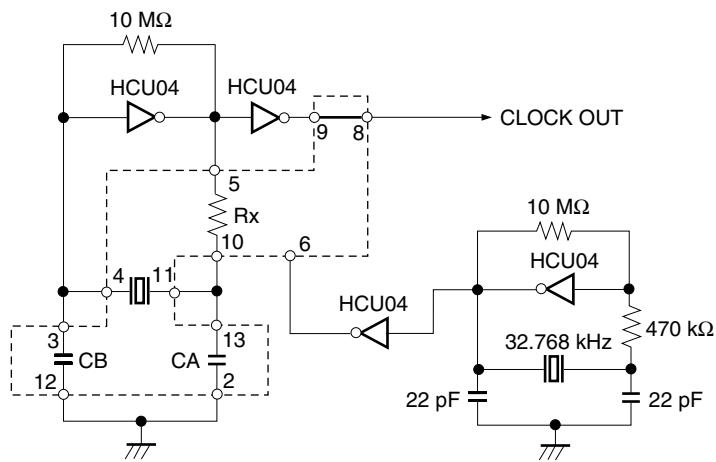
Figure 3-12. Connections on Parts Board (Subsystem Clock)

Parts board (X2 USCLK)



| 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.

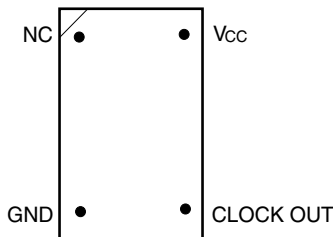
- <3> Make sure that the parts board (X2 USCLK) is wired as shown in Figure 3-12 above.
- <4> Install the IE-789831-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.



**(b) When using a crystal oscillator**

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-13)

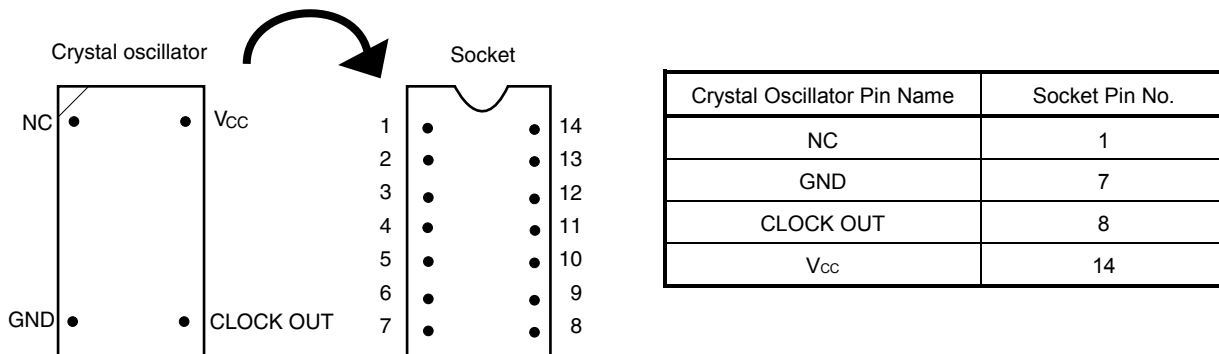
**Figure 3-13. Crystal Oscillator (Subsystem Clock)**



<Steps>

- <1> Prepare the IE-789831-NS-EM1.
- <2> Remove the parts board that is mounted in the socket (X2 USCLK) of the IE-789831-NS-EM1.
- <3> Connect a crystal oscillator to the socket (X2 USCLK) from which the parts board was removed (in <2> above). Insert the crystal oscillator into the socket aligning the pins as shown in the figure below.

**Figure 3-14. Pin Alignment of Crystal Oscillator and Socket (Subsystem Clock)**



- <4> Install the IE-789831-NS-EM1 in the IE-78K0S-NS or IE-78K0S-NS-A.

**(3) When inputting pulse from target system**

Short 1 and 2 of the jumper (JP1) on the IE-789831-NS-EM1.  
 No settings are required on the integrated debugger (ID78K0S-NS).

### 3.5 External Trigger

To set an external trigger, connect the IE-789831-NS-EM1's check pins EXTOUT and EXTIN as shown below.

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

For the use methods, see the **ID78K Series Ver.2.30 or Later Operation Windows Based User's Manual (U15185E)**.

#### (1) EXTOUT

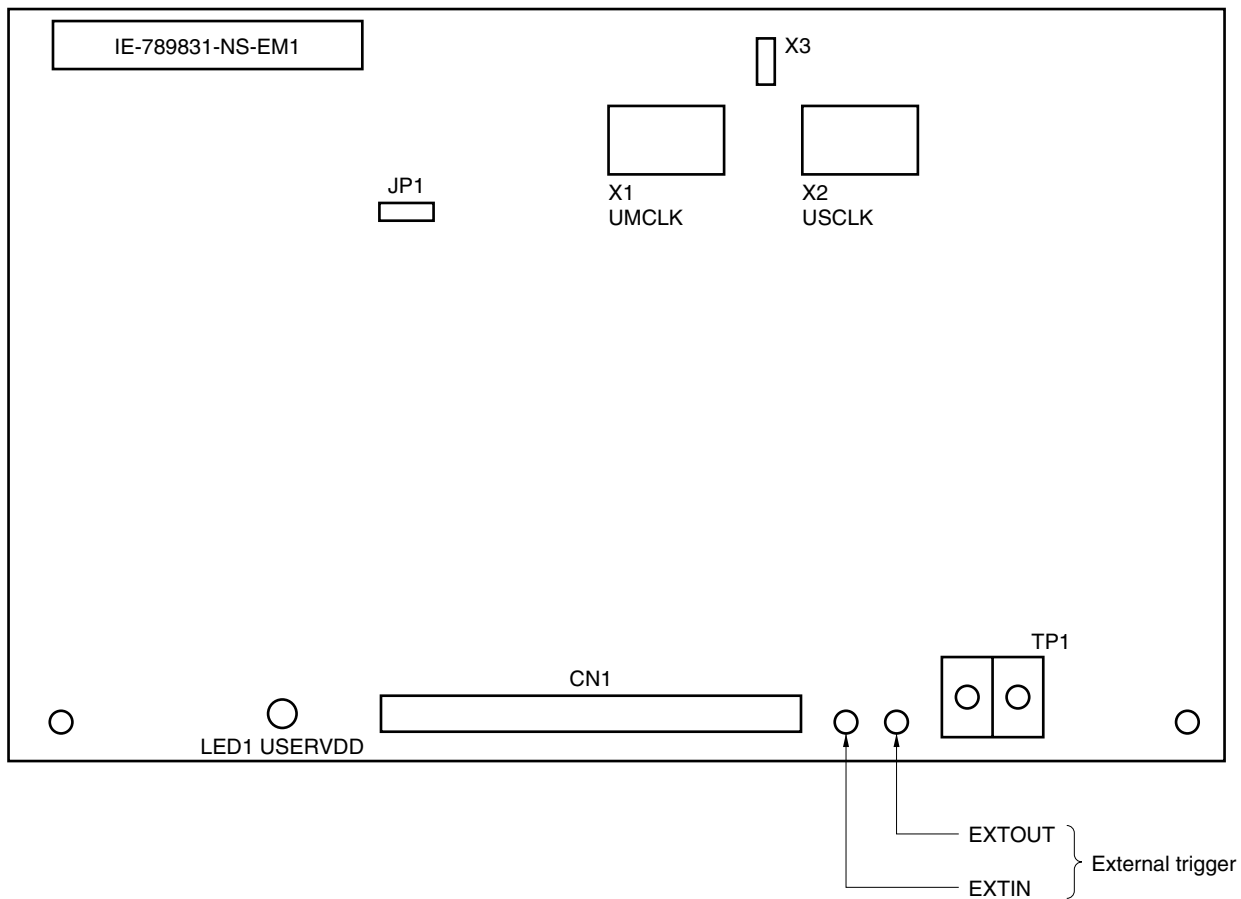
The EXTOUT pin on the IE-789831-NS-EM1 outputs a low level for 1.3  $\mu$ s when a break event occurs.

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

#### (2) EXTIN

An event signal can be input from the EXTIN pin on the IE-789831-NS-EM1. Input a high-level pulse signal for 2 CPU operation clocks or more.

**Figure 3-15. External Trigger Input Position**



## CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICE AND TARGET INTERFACE CIRCUIT

This chapter describes differences between the target device's signal lines and the signal lines of the target interface circuit of the IE system.

The target interface circuit of the IE system realizes emulation via an emulation circuit configured by an emulation CPU, TTL, CMOS-IC, and other components. The electrical characteristics are different from those of the target device because a protector and other circuits are provided.

- (1) Signals input to or output from the emulation CPU
- (2) Signals input from the target system via a gate
- (3) LCD-related signals
- (4) Other signals

The IE-789831-NS-EM1's circuit is used as follows for signals listed in (1) to (4) above.

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

The following signals perform the same operations as in the  $\mu$ PD789830 and the  $\mu$ PD78F9831. However, a 1  $\Omega$  pull-down resistor and 100  $\Omega$  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 4

### (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 the  $\mu$ PD789830 and the  $\mu$ PD78F9831. Their AC characteristics and DC characteristics are therefore different from the  $\mu$ PD789830 and the  $\mu$ PD78F9831 making it necessary to observe a stricter timing design than in the  $\mu$ PD789830 and the  $\mu$ PD78F9831.

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

In all the signals input from the target system, the  $\overline{\text{RESET}}$  signal and signals related to clock input are input to the emulation CPU via a logic IC. The DC characteristics are therefore different from the  $\mu$ PD789830 and the  $\mu$ PD78F9831.

**(3) LCD-related signals**

Because the following signals input/output LCD-related signals, special processing is not performed in the IE-789831-NS-EM1.

- Common pins (COM0 to COM15)
- Segment pins (S0 to S31)
- Port 5 (alternately functions as P50 to P57/S32 to S39)

**(4) Other signals**

- $V_{DD}$  pin  
When the emulation CPU is operating at 5 V, its power is supplied from the IE-789831-NS-EM1, 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 ( $TV_{CC}$ ) in the IE-789831-NS-EM1 that monitors the input of the target system's power supply.
- $V_{SS}$  pin  
The  $V_{SS}$  pin is connected to GND in the IE-789831-NS-EM1
- TEST/ $V_{PP}$  pin  
The TEST/ $V_{PP}$  pin is not used in the IE-789831-NS-EM1.
- X2, XT2 pins  
The X2 and XT2 pins are not used in the IE-789831-NS-EM1.

Figure 4-1. Equivalent Circuit of Emulation Circuit (1/2)

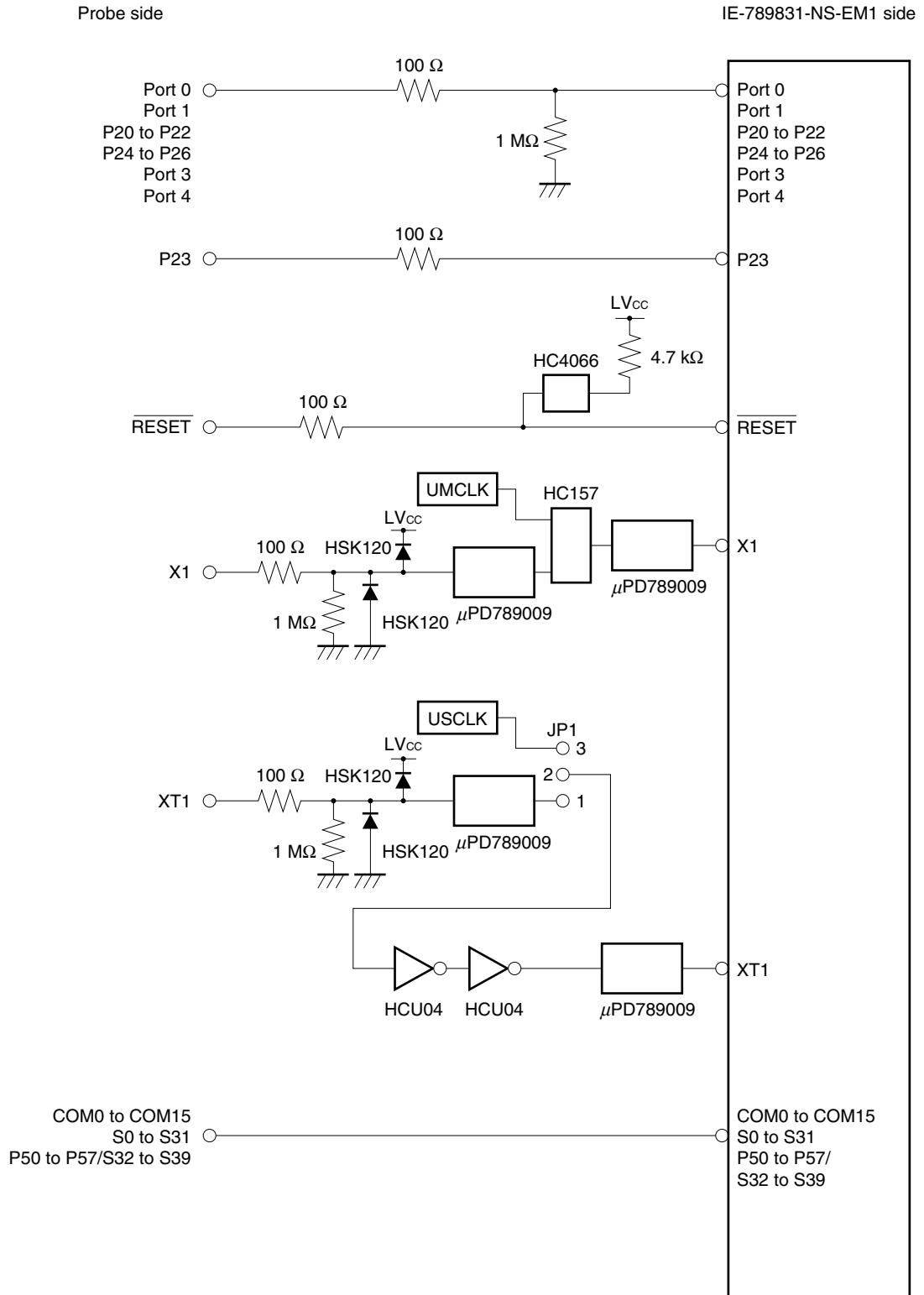
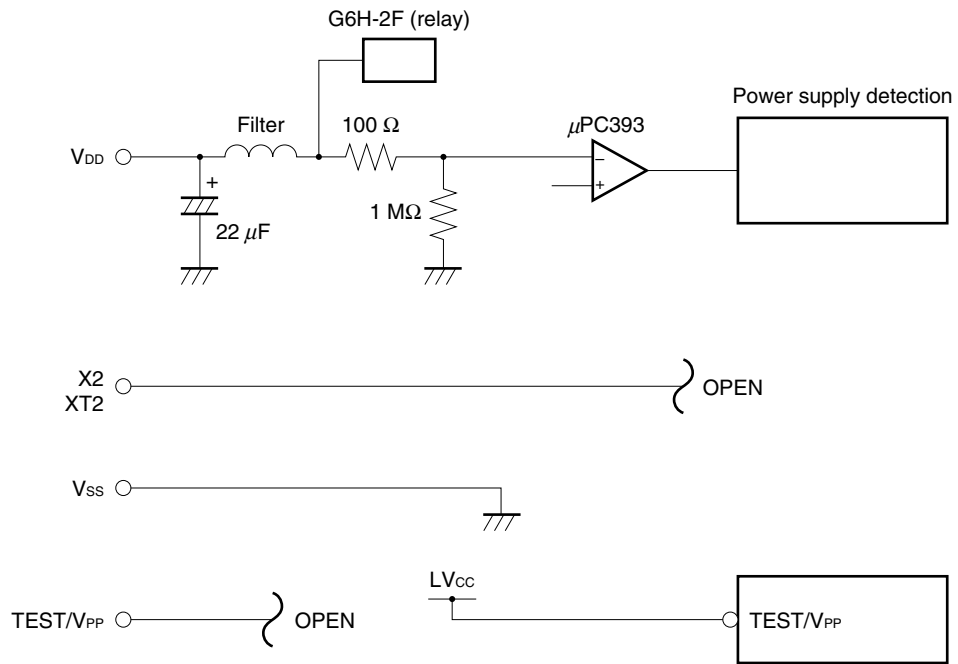


Figure 4-1. Equivalent Circuit of Emulation Circuit (2/2)

Probe side

IE-789831-NS-EM1 side



## APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

**Table A-1. NP-100GC, NP-H100GC-TQ Pin Assignments (1/2)**

| Emulation Probe | CN1 Pin No. | Emulation Probe | CN1 Pin No. |
|-----------------|-------------|-----------------|-------------|
| 1               | 118         | 35              | 57          |
| 2               | 117         | 36              | 58          |
| 3               | 114         | 37              | 59          |
| 4               | 113         | 38              | 60          |
| 5               | 108         | 39              | 55          |
| 6               | 107         | 40              | 56          |
| 7               | 104         | 41              | 49          |
| 8               | 103         | 42              | 50          |
| 9               | 100         | 43              | 45          |
| 10              | 99          | 44              | 46          |
| 11              | 94          | 45              | 41          |
| 12              | 93          | 46              | 42          |
| 13              | 30          | 47              | 35          |
| 14              | 29          | 48              | 36          |
| 15              | 24          | 49              | 31          |
| 16              | 23          | 50              | 32          |
| 17              | 20          | 51              | 4           |
| 18              | 19          | 52              | 3           |
| 19              | 16          | 53              | 8           |
| 20              | 15          | 54              | 7           |
| 21              | 10          | 55              | 14          |
| 22              | 9           | 56              | 13          |
| 23              | 6           | 57              | 18          |
| 24              | 5           | 58              | 17          |
| 25              | 33          | 59              | 22          |
| 26              | 34          | 60              | 21          |
| 27              | 37          | 61              | 28          |
| 28              | 38          | 62              | 27          |
| 29              | 43          | 63              | 92          |
| 30              | 44          | 64              | 91          |
| 31              | 47          | 65              | 98          |
| 32              | 48          | 66              | 97          |
| 33              | 51          | 67              | 102         |
| 34              | 52          | 68              | 101         |

- Remarks**
1. NP-100GC and NP-H100GC-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-100GC, NP-H100GC-TQ Pin Assignments (2/2)**

| Emulation Probe | CN1 Pin No. | Emulation Probe | CN1 Pin No. |
|-----------------|-------------|-----------------|-------------|
| 69              | 106         | 85              | 63          |
| 70              | 105         | 86              | 64          |
| 71              | 112         | 87              | 61          |
| 72              | 111         | 88              | 62          |
| 73              | 116         | 89              | 65          |
| 74              | 115         | 90              | 66          |
| 75              | 87          | 91              | 71          |
| 76              | 88          | 92              | 72          |
| 77              | 83          | 93              | 75          |
| 78              | 84          | 94              | 76          |
| 79              | 77          | 95              | 79          |
| 80              | 78          | 96              | 80          |
| 81              | 73          | 97              | 85          |
| 82              | 74          | 98              | 86          |
| 83              | 69          | 99              | 89          |
| 84              | 70          | 100             | 90          |

- Remarks**
1. NP-100GC and NP-H100GC-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.



**APPENDIX B NOTES ON DESIGNING TARGET SYSTEM**

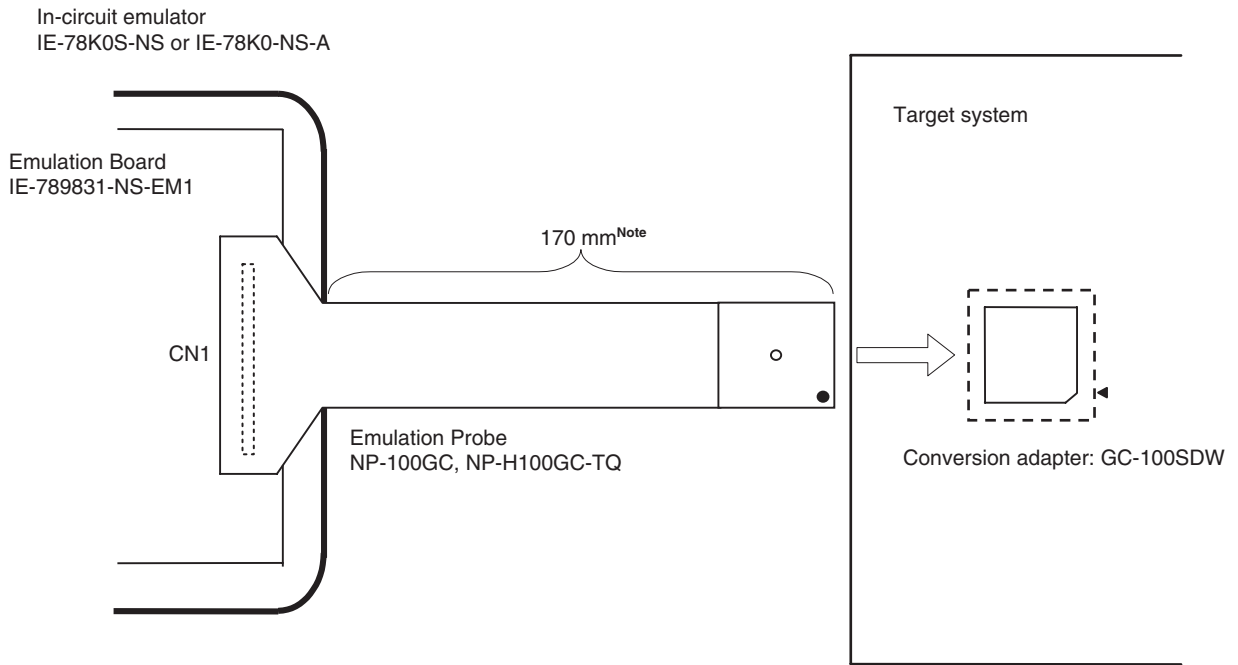
The following shows the conditions when connecting the emulation probe to the conversion adapter. Follow the configuration below and consider the shape of parts to be mounted on the target system when designing a system.

Among the products described in this appendix, NP-100GC and NP-H100GC-TQ are products of Naito Densei Machida Mfg. Co., Ltd., and TGC-100SDW is a product of TOKYO ELETECH CORPORATION.

**Table B-1. Distance Between IE System and Conversion Adapter**

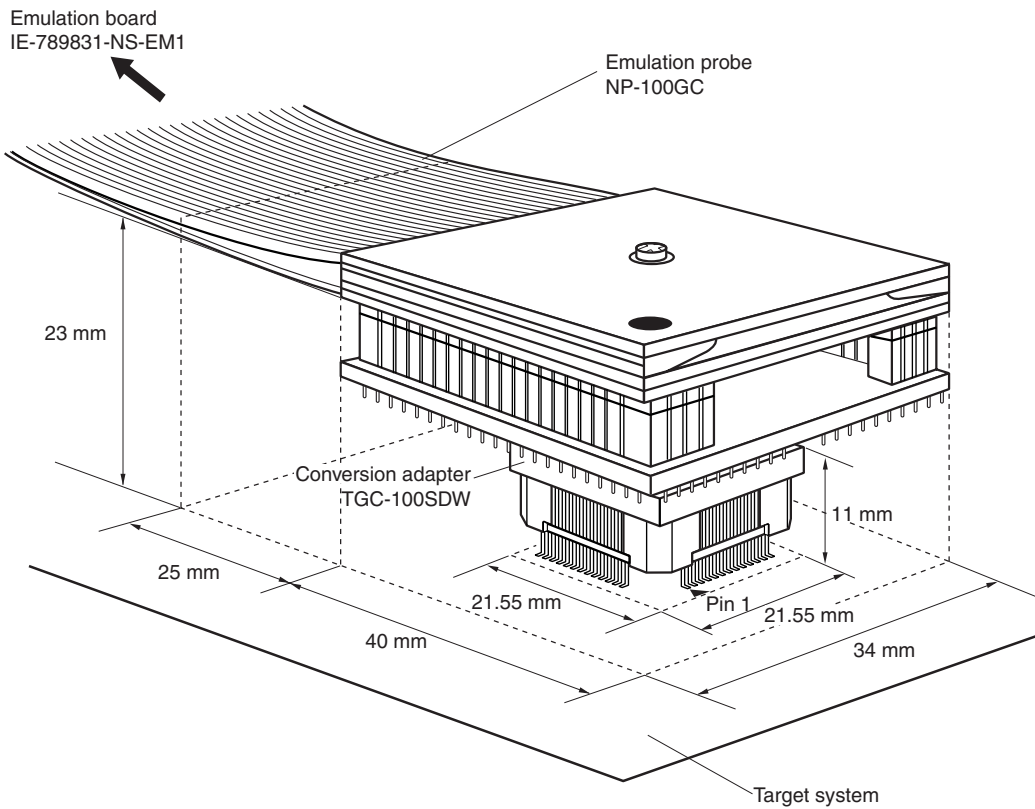
| Emulation Probe | Conversion Adapter | Distance Between IE System and Conversion Adapter |
|-----------------|--------------------|---|
| NP-100GC        | TGC-100SDW         | 170 mm  |
| NP-H100GC-TQ    |                    | 370 mm  |

**Figure B-1. Distance Between IE System and Conversion Adapter**



**Note** Distance when the NP-100GC is used. When the NP-H100GC-TQ is used, the distance is 370 mm.

**Figure B-2. Connection Conditions of Target System (When NP-100GC Is Used)**



**Figure B-3. Connection Conditions of Target System (When NP-H100GC-TQ Is Used)**

