NEC

Preliminary User's Manual

IE-78K0-NS-P04

IE-1615-NS-EM4

Emulation Board and Probe Board for IE-78K0-NS-A

Target device
μPD1615A Subseries

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CE

This equipment complies with the EMC protection requirements.

Warning

This is a ´Class A´ (EN 55022: 1994) equipment. This equipment can cause radio frequency noise when used in the residential area. In such cases, the user/operator of the equipment may be required to take appropriate countermeasures under his responsibility.

Caution

This equipment should be handled like a CMOS semiconductor device. The user must take all precautions to avoid build-up of static electricity while working with this equipment. All test and measurement tools including the workbench must be grounded. The user/operator must be grounded using the wrist strap. The In-Circuit Emulator probe target connector plug and/or its adapter pins should not be touched with bare hands.

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Introduction

Product Overview

The IE-78K0-NS-P04 and the IE-1615-NS-EM4, when combined with the IE-78K0-NS-A, is used to debug the following target devices that belong to the 78K/0 Series of 8-bit single-chip microcontrollers.

- μPD1615A Subseries

Target Readers

This manual is intended for engineers who will use the IE-78K0-NS-P04 with the IE-78K0-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-1615-NS-EM1 and the IE-1615-NS-EM4, refer to not only this manual but also the manual that is supplied with the IE-78K0-NS-A.

IE-78K0-NS-A User's Manual	**IE-78K0-NS-P04 IE-1615-NS-EM4 User's Manual**
· Basic specifications · System configuration · Part names · External interface functions	· General · Parts 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-78K0-NS-P04 and the IE-1615-NS-EM4.

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 a device (a μPD1615A Subseries 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-78K0-NS-A, the IE-78K0-NS-P04 and the IE-1615-NS-EM4.

Conventions Data significance weight : 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 indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Document Name	Document Number	
	English	Japanese
IE-78K0-NS-A	To be prepared	To be prepared
IE-78K0-NS-P04 / IE-1615-NS-EM4	This manual	To be prepared
ID78K0-NS Integrated Debugger Reference Windows Based	U12900E	U12900J

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

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[MEMO]

Chapter 1 General

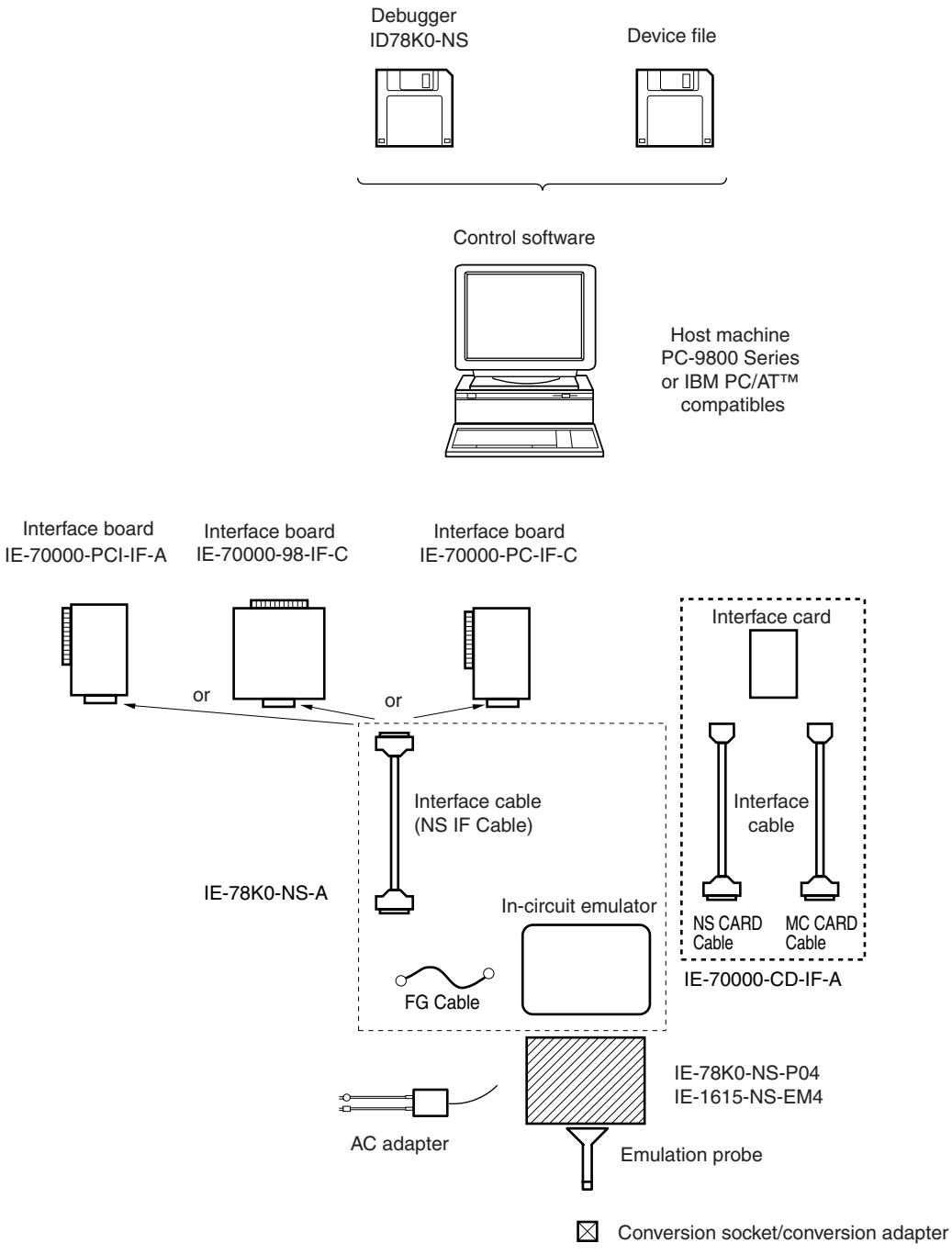
The IE-78K0-NS-P04 and the IE-1615-NS-EM4 are development tools for efficient debugging of hardware or software when using one of the following target devices that belong to the 78K/0 Series of 8-bit single-chip microcontrollers.
This chapter describes the emulation board’s and probe board's system configuration and basic specifications.

- Target device
  - µPD1615A Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-78K0-NS-P04 and the IE-1615-NS-EM4's system configuration.

Figure 1-1: System Configuration



Note: The packages, emulation probes, and conversion sockets/conversion adapters are listed below.

Package	Emulation Probe	Conversion Socket/ Conversion Adapter
80-pin plastic QFP (GC - type)	NP-80GC-TQ	NQPACK080SB YQPACK080SB HQPACK080SB YQSOCKET080SBF

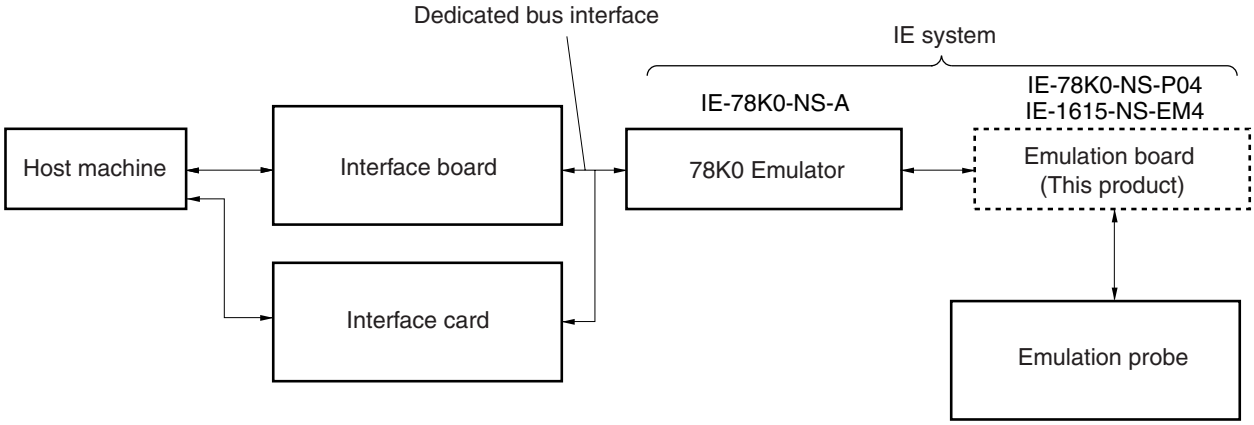
The NP-80GC-TQ is a product of Naito Densei Machidaseisakusho Co., Ltd.

The sockets are products of TOKYO ELETECH CORPORATION.

1.2 Hardware Configuration

Figure 1-2 shows the IE-78K0-NS-P04/IE-1615-NS-EM4's position in the basic hardware configuration.

Figure 1-2: Basic Hardware Configuration



1.3 Basic Specifications

The IE-78K0-NS-P04 and the IE-1615-NS-EM4's basic specifications are listed in Table 1-1.

Table 1-1: Basic Specifications

Parameter	Description
Target device	μPD1615A Subseries
System clock	Main system clock: 8.38 MHz Subsystem clock: typically 32.768 KHz
Clock supply	External: Pulse input Internal: Mounted on emulation board
Voltage support	4.0 to 5.5 V (same as target device)

1.4 Notes on Use of IE-78K0-NS-P04 and IE-1615-NS-EM4

(1) Ensure that the power supply for the IE-78K0-NS-A and the target system is OFF before connecting or disconnecting to/from the IE-78K0-NS-A and the target device, or changing switch settings, etc.

(2) When carrying out target device emulation using the IE-78K0-NS-P04/IE-1615-NS-EM4 in conjunction with the IE-78K0-NS-A, there are certain differences from the operation of the actual device (see **Differences from Target Device**).

(3) The target system V_{DD} must be between 4.0 V and 5.5 V.

(4) **Power on sequence:**
   1. Power on IE-78K0-NS-A
   2. Power on target hardware
   3. Start debugger ID78K0-NS

(5) **Power off sequence:**
   1. Exit from debugger ID78K0-NS
   2. Power off target hardware
   3. Power off IE-78K0-NS-A.

Chapter 2 Part Names

This chapter introduces the parts of the IE-78K0-NS-P04 and the IE-1615-NS-EM4.
The packaging boxes of the IE-78K0-NS-P04 and the IE-1615-NS-EM4 contain the following items:

2.1 Package Components

IE-78K0-NS-P04 Components

The IE-78K0-NS-P04 comprises the following components. Please check that all these items are included in the package.

(1)	IE-78K0-NS-P04	x 1
(2)	Parts holder (with cover)	x 2
(3)	Registration Card	x 1
(4)	Readme First	x 1
(5)	List of Contents	x 1

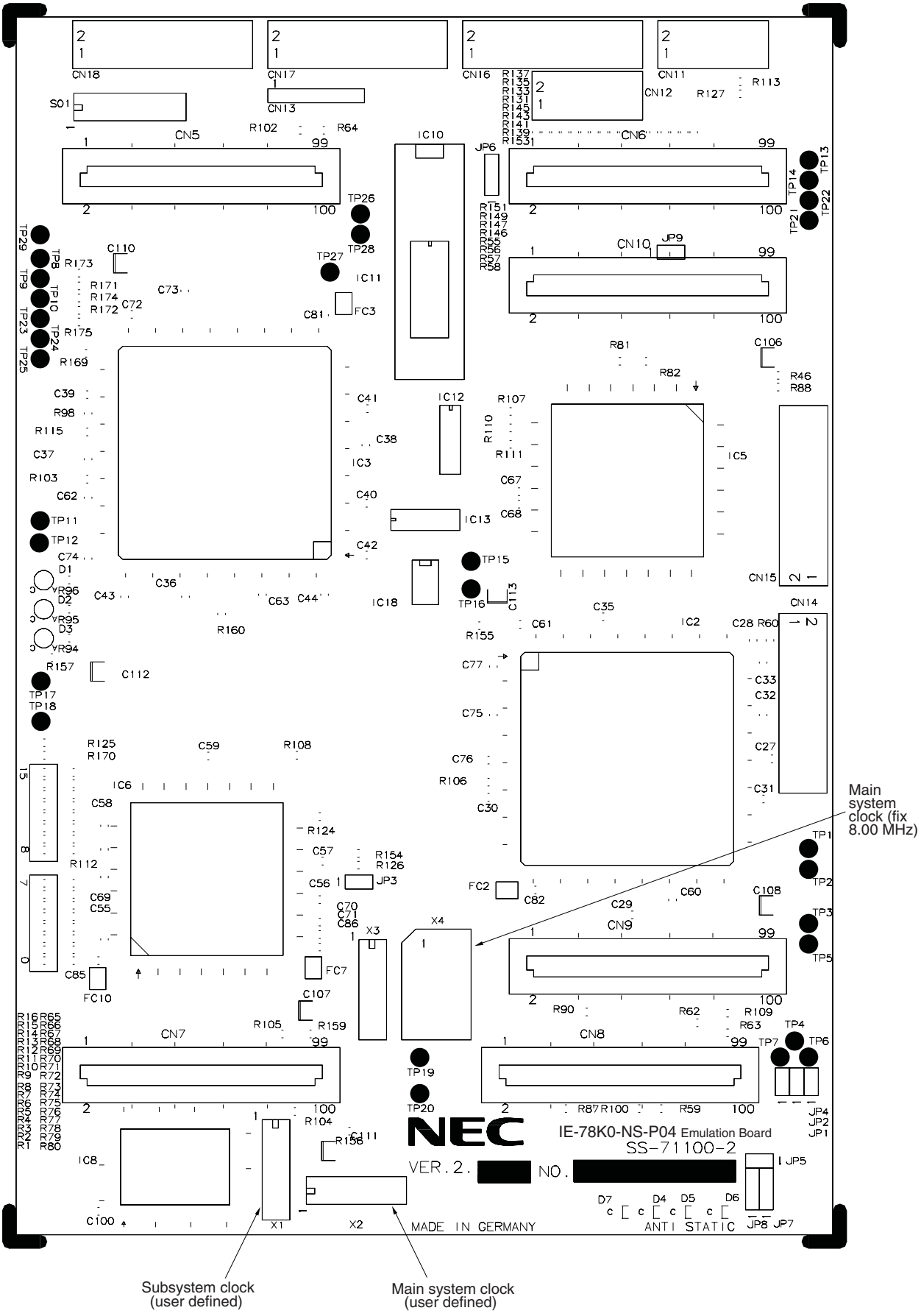
IE-1615-NS-EM4 Components

The IE-1615-NS-EM4 comprises the following components. Please check that all these items are included in the package.

(1)	IE-1615-NS-EM4	x 1
(2)	Screws set	x 1
(3)	Registration Card	x 1
(4)	Readme First	x 1
(5)	List of Attachment	x 1
(6)	Floppy disk with Device File and FPGA Data	x 1
(7)	User's Manual (this manual)	x 1

2.2 Parts of the IE-78K0-NS-P04 Emulation Board

Figure 2-1: IE-78K0-NS-P04 Emulation Board External View and Part Names



2.3 Parts of the IE-1615-NS-EM4 Probe Board

Figure 2-2: IE-1615-NS-EM4 Probe Board External View

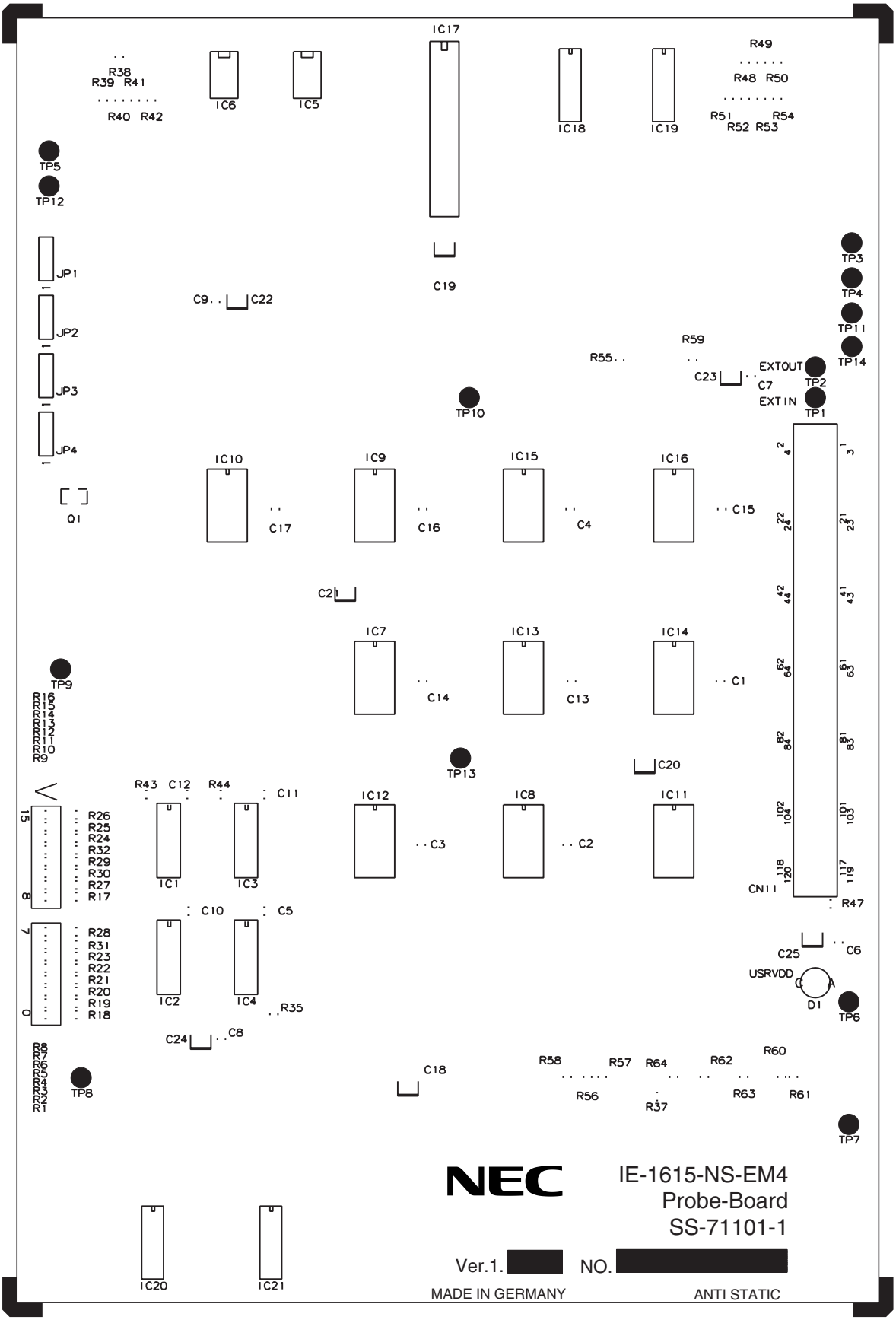


Table 2-1: Names of IE-78K0-NS-P04 Parts

Name	Description (IE-78K0-NS-P04 Emulation Board)	Name	Description (IE-1615-NS-EM4 Probe Board)
CN1	Emulator connections	CN5	Emulation board connectors
CN2		CN6	
CN3		CN7	
CN4		CN8	
CN5	Probe board connectors	CN9	
CN6		CN10	
CN7		CN11	Probe connector
CN8		JP1	VAN in/out buffer select
CN9		JP2	VAN in/out buffer select
CN10		JP3	VAN in/out buffer select
CN11	Test connector (only for internal use by NEC)	JP4	VAN in/out buffer select
CN12			
CN13			
CN14			
CN15			
CN16			
CN17			
CN18			
JP1	Analog reference voltage		
JP2	GND-pin of A/D Converter		
JP3	Reseved (only for internal use by NEC)		
JP4	JTAG mode selection (only for internal use by NEC)		
JP5	FPGA mode selection		
JP6	JTAG mode selection (only for internal use by NEC)		
JP7	LVREF1		
JP8	LVREF0		
JP9	Future Function		

Chapter 3 Installation

This chapter describes the method for the connection of the IE-78K0-NS-P04, the IE-1615-NS-EM4 and the emulation probe.

- Installation of the IE-78K0-NS-P04 Emulation Board
- Installation of the IE-1615-NS-EM4 Probe Board
- Installation of the emulation probe
- Setting of the jumpers for the clock selection

The power supply of the IE-78K0-NS-A and the target system must be switched off when connecting or disconnecting any item.

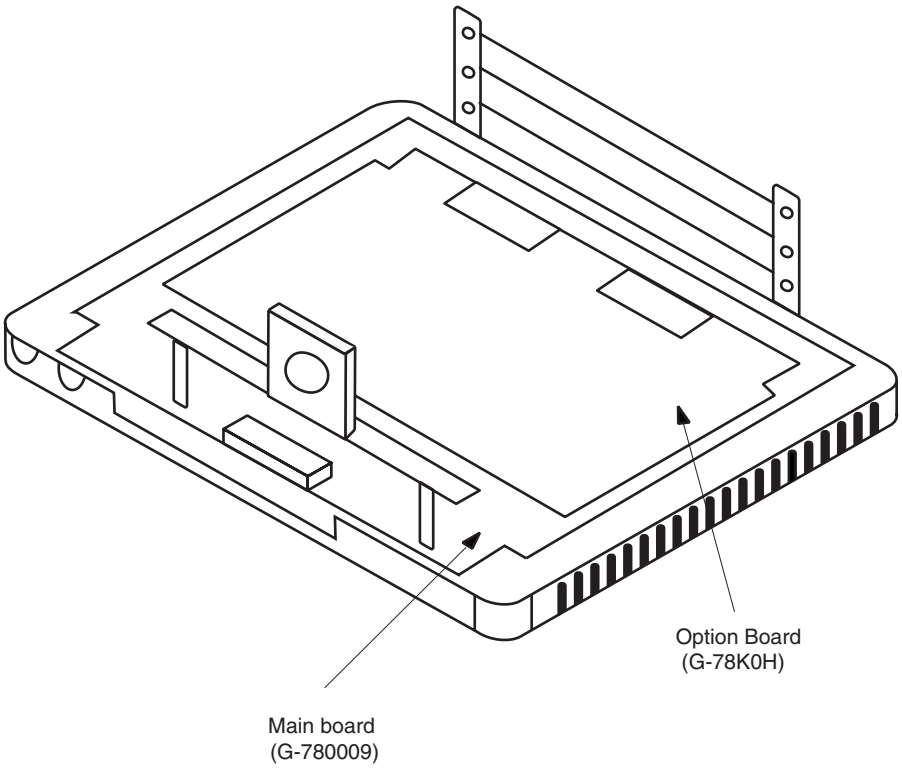
Caution: Usage of incorrect connection methods may damage the IE system.

3.1 Installation Procedure

<1> Remove the 4 screws at the sides of the IE-78K0-NS-A and open the top of the cover.

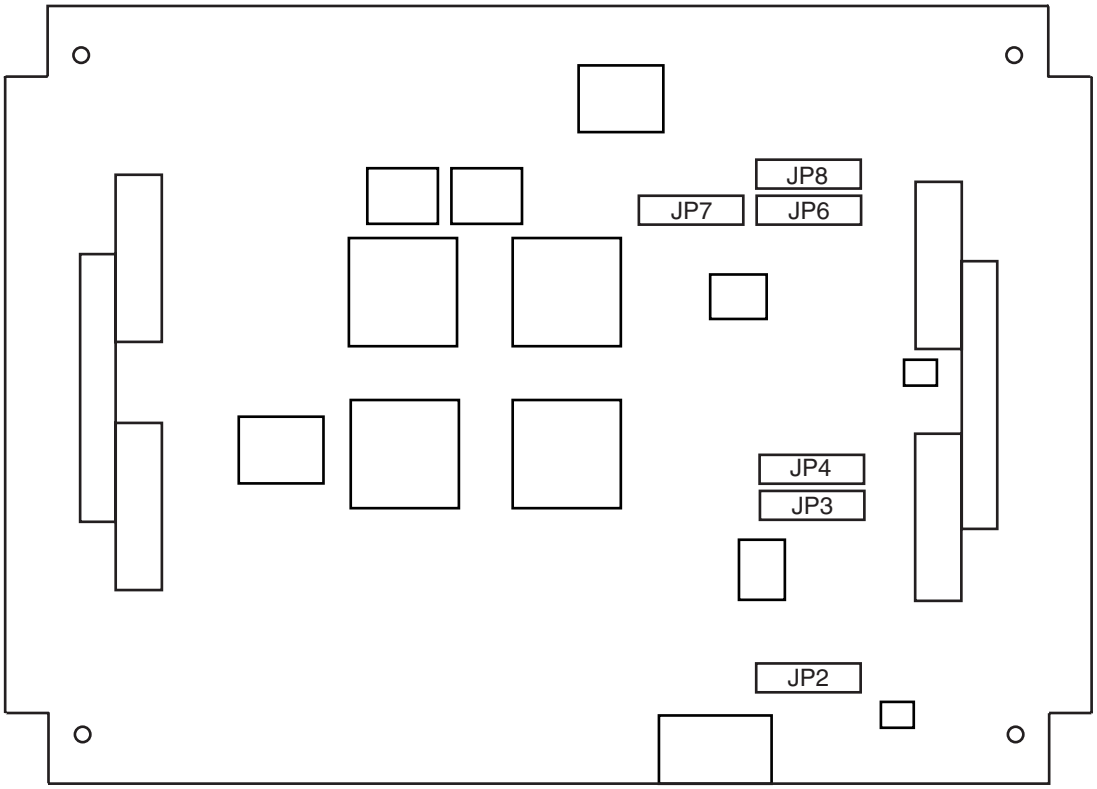
<2> Remove the screws on the option board (G-78K0H) and remove the option board.

Figure 3-1: IE-78K0-NS-A inside



<3> Setup the jumper's on the **main board** (G-780009).
It is necessary to set some jumpers on the main board for the clock selection. An example for the jumper setting will be given in the chapter clock setting.

Figure 3-2: Main Board (G-780009) Jumper Positioning



Jumper JP2

Table 3-1: Flash ROM Mode

Jumper Position	Function
(1-2)	Internal use
(2-3)	Internal use **(default)**

Jumper JP3

Table 3-2: Internal Mode 1

Jumper Position	Function
(1-2)	Internal use **(default)**
(2-3)	Internal use

Jumper JP4

Table 3-3: Internal Mode 2

Jumper Position	Function
(1-2)	Internal use **(default)**
(2-3)	Internal use

Jumper JP6

Table 3-4: Main Clock Selection

Jumper Position	Function
(1-2)	Not selectable
(3-4)	EM1/P04 board selection **(default)**
(5-6)	EM4 board selection

Jumper JP7

Table 3-5: Main Clock Doubler Selection

Jumper Position	Function
(1-2)	Main board selection **(default)**
(3-4)	EM board selection 1
(5-6)	EM board selection 2

Jumper JP8

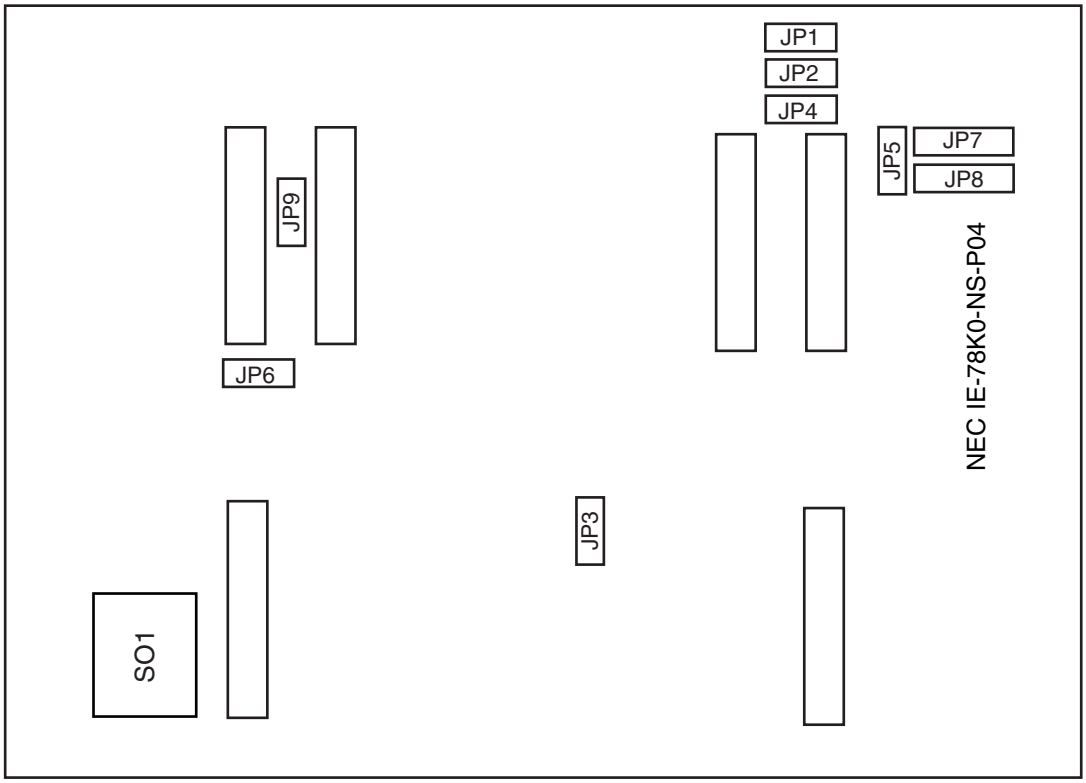
Table 3-6: Sub Clock Selection

Jumper Position	Function
(1-2)	On EM board **(default)**
(3-4)	On target system
(5-6)	On main board

<4> Connect the option board (G-78K0H) to the main board (G-780009).

<5> Setup of the **emulation board (IE-78K0-NS-P04)**

Figure 3-3: Emulation Board (IE-78K0-NS-P04) Jumper Positioning



Jumper JP1

Table 3-7: Reference Voltage Pin of AD-Converter

Jumper Position	AAV_{REF}	Function
Open	Target	Connected to target selected reference voltage **(default)**
Close	GND	Reference voltage

Remark: Close jumper JP1 when the AD-converter is not used.

Jumper JP2

Table 3-8: Ground Voltage Pin of AD-Converter

Jumper Position	AAV_{SS}	Function
Open	Target	Connected to target selected ground base **(default)**
Close	GND	Internal digital ground

Remark: Close jumper JP2 when the AD-converter is not used.

Jumper JP3

Table 3-9: JTAG Mode

Jumper Position	JTAG	Function
Open	Pull-up	Reserved (Internal use) **(default)**
Close	GND	Reserved (Internal use)

Jumper JP4

Table 3-10: JTAG Mode

Jumper Position	JTAG	Function
Open	Pull-up	Reserved (Internal use)
Close	GND	Reserved (Internal use) **(default)**

Jumper JP5

Table 3-11: FPGA Mode Selection

Jumper Position	ESN	Function
Open	Pull-up	Asynchronous peripheral mode (FPGA s are loaded by IE) **(default)**
Close	GND	Reserved (Internal use)

Jumper JP6

Table 3-12: JTAG Mode

Jumper Position	JTAG	Function
(1-2)	Pull-up	Reserved (Internal use)
(2-3)	GND	Reserved (Internal use) **(default)**

Jumper JP7

Table 3-13: Reference Voltage Setting

Jumper Position	LV_{REF1}	Function
(1-2)	V_{CC}	Reserved (Internal use) **(default)**
(2-3)	LV_{DD}	Reserved (Internal use)

Jumper JP8

Table 3-14: Reference Voltage Setting

Jumper Position	LV_{REF0}	Function
(1-2)	V_{CC}	Reserved (Internal use) **(default)**
(2-3)	LV_{DD}	Reserved (Internal use)

Jumper JP9

Table 3-15: Future Function

Jumper Position		Function
Open	Pull-up	Reserved (Internal use) **(default)**
Close	GND	Reserved (Internal use)

LED Indicator

Table 3-16: LED Indicator D1, D2, D3

LED	Condition	Function
LED1 green	Blinking	FPGA download ongoing
LED1 green	On	FPGA download complete
LED1 green	Off	FPGA not programmed
LED2 yellow	Blinking	Not used
LED2 yellow	On	V_{CC} on
LED2 yellow	Off	V_{CC} off
LED3 red	Blinking	Not used
LED3 red	On	Not used
LED3 red	Off	Not used

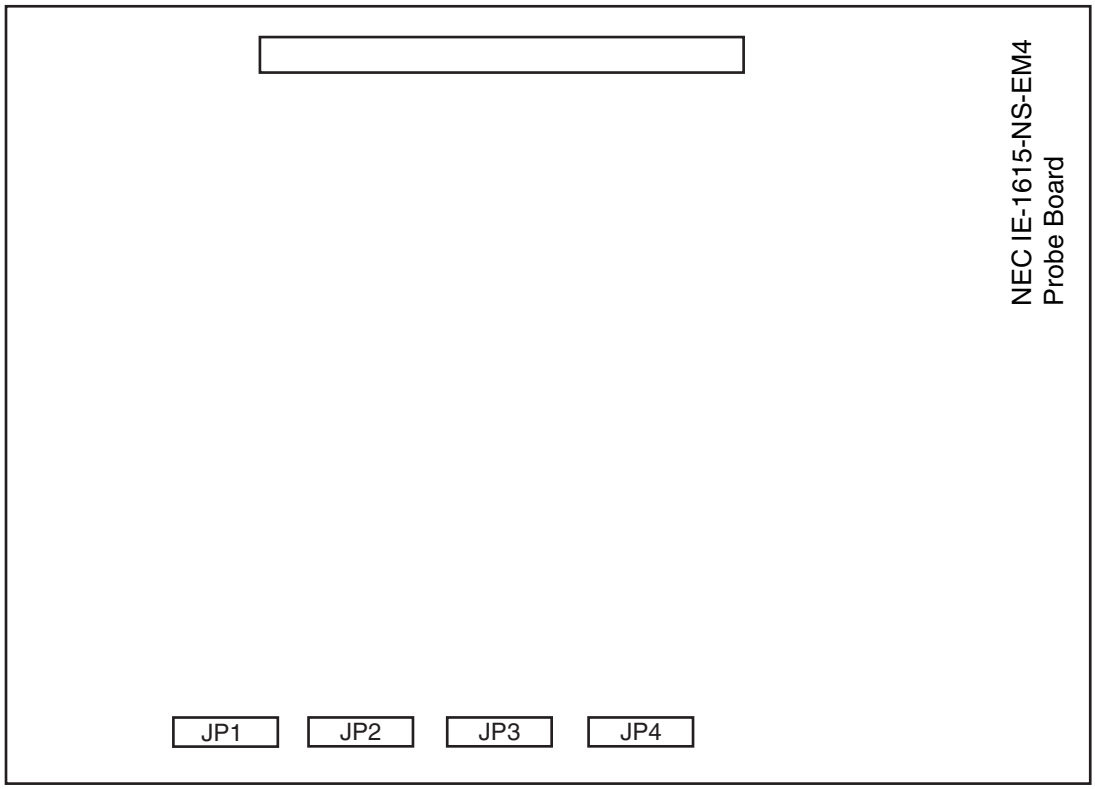
Remark: Not used LED's are reserved for future functions.

<6> Connect the emulation board (IE-78K0-NS-P04) to the option board (G-78K0H).

<7> When user clock as main clock or sub clock is used, the main system clock or subsystem clock can be mounted by using a parts holder or a crystal oscillator (see chapter clock setting).

<8> Setup of the **probe board (IE-1615-NS-EM4)**

Figure 3-4: Probe Board (IE-1615-NS-EM4) Jumper Positioning



Jumper JP1 to JP4

Table 3-17: VAN serial in/out

Jumper Position		Function
(1 - 2)	Pin Emulator	Original Buffer Type (**default**)
(2 - 3)	FPGA	Buffer Type different / timing optimized

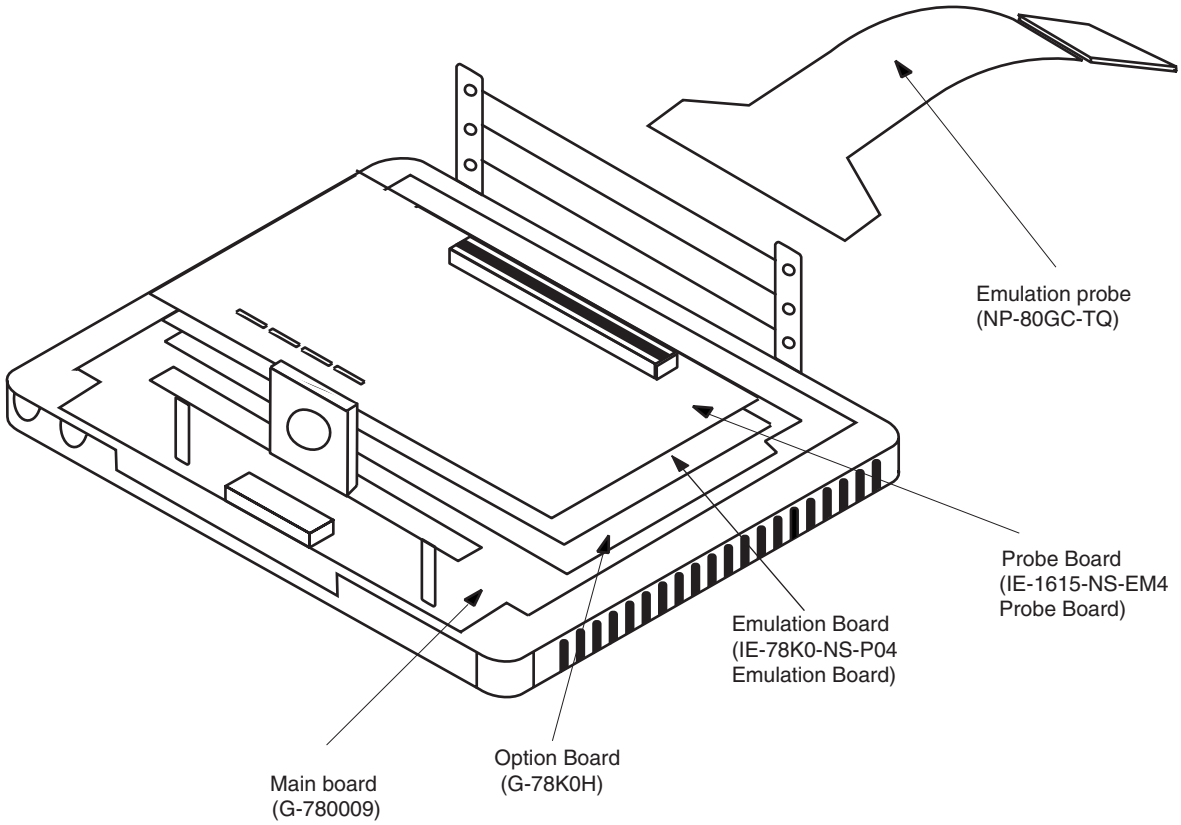
<9> Connect the probe board (IE-1615-NS-EM4) to the emulation board (IE-78K0-NS-P04)

<10> Remove the top and the bottom plate by removing the screws

<11> Connect the probe (NP-80GC-TQ) to CN11 of the probe board (IE-1615-NS-EM4).

<12> Connect the cover and tighten the 4 screws.

Figure 3-5: Connection of Boards



3.2 Clock Settings

3.2.1 Overview of clock settings

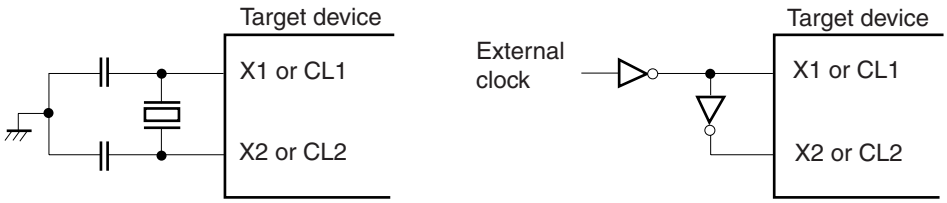
Main system clock / Subsystem clock

Select from (1) to (3) below as the main system clock and subsystem clock to be used during debugging.

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

If the target system includes an internal clock, select either "(1) Clock that is already mounted on emulation board" or "(2) Clock that is mounted by user". An internal clock connects the target device to an oscillator and uses the target device's internal oscillation circuit. An example of an external circuit is shown in part (a) of Figure 3-6. During emulation, the oscillator that is mounted on the target system is not used. Instead, it uses the clock that is mounted on the emulation board which is installed for the IE-78K0-NS-A.
If the target system includes an external clock, select "(3) External clock".
An external clock supplies a clock signal from outside of the target device and does not use the target device's internal oscillation circuit. An example of an external circuit is shown in part (b) of Figure 3-6.

Figure 3-6: External Circuits Used as System Clock Oscillation Circuit

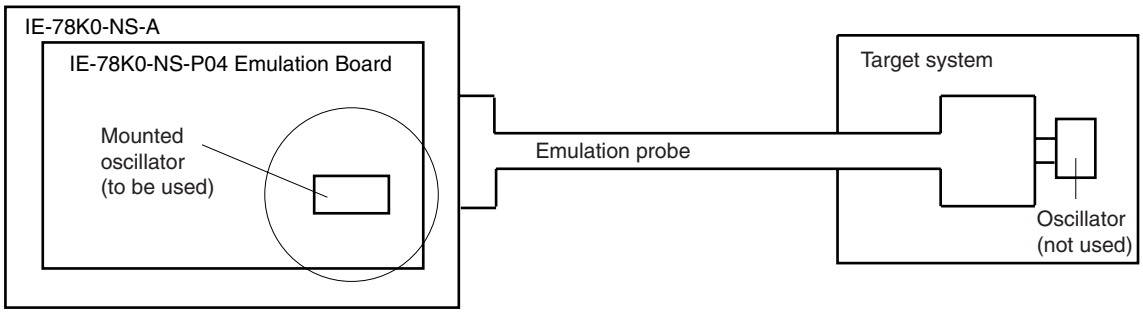


3.2.2 Main System Clock Selections

(1) Clock that is already mounted on emulation board

A crystal resonator is already mounted on the emulation board. Its frequency is 8.0000 MHz.

Figure 3-7: When Using Clock That Is Already Mounted on Emulation Board

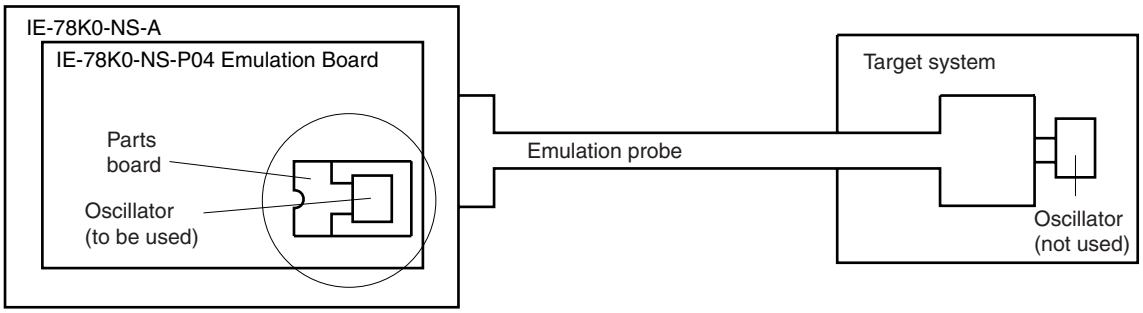


Remark: The clock that is supplied by the IE-78K0-NS-P04 Emulation Board oscillator (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-78K0-NS-P04 Emulation Board. First mount the oscillator on the parts holder, then attach the parts board to the IE-78K0-NS-P04 Emulation Board. This method is useful when using a different frequency from that of the pre-mounted clock.

Figure 3-8: When Using User-mounted Clock

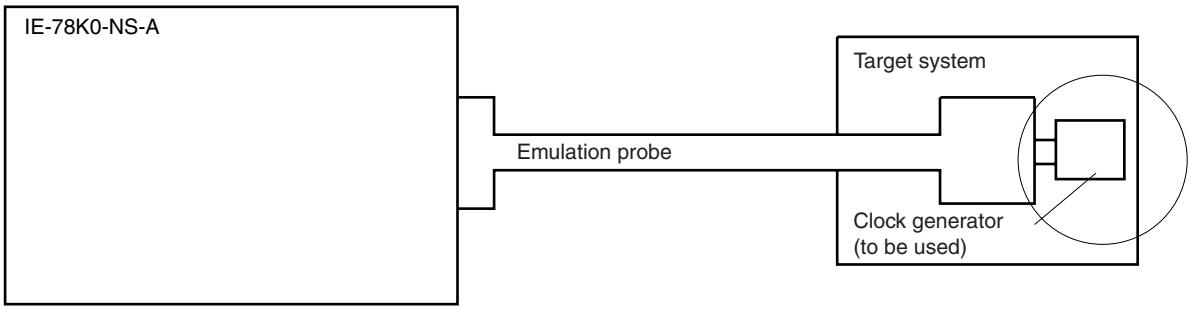


Remark: The clock that is supplied by the IE-78K0-NS-P04 Emulation Board oscillator (encircled in the figure) is used.

(3) External clock

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

Figure 3-9: When Using an External Clock



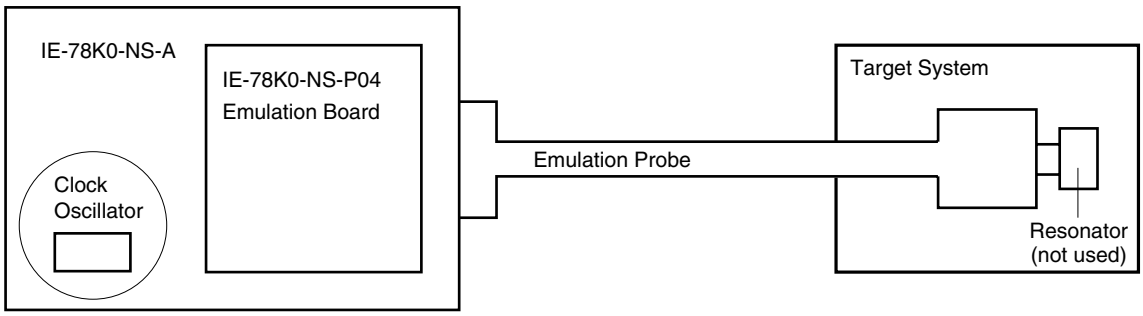
Remark: The clock supplied by the target system's clock generator (encircled in the figure) is used.

3.2.3 Subsystem Clock

(1) Standard clock offered by the main board

A crystal oscillator is already mounted on the main board. The frequency is 32.768 KHz.

Figure 3-10: When Using Standard Clock Mounted on Main Board

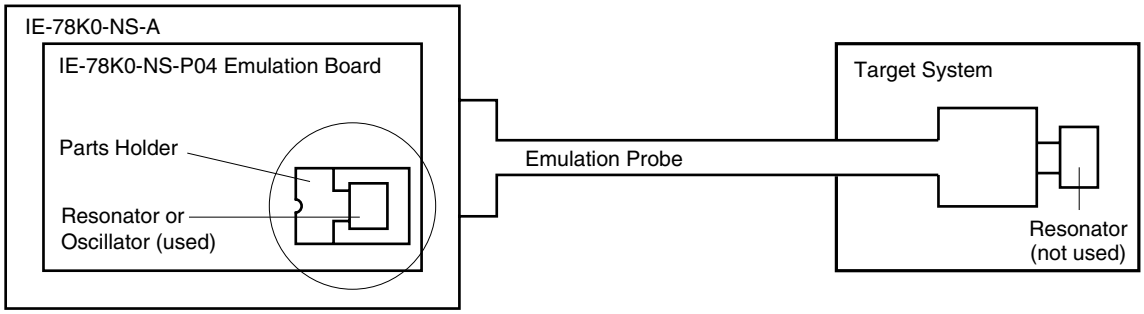


Remark: The clock supplied from the oscillator on the Main Board (G-78009) (circled) is used.

(2) Clock mounted by user on the emulation board

A clock that matches the specifications set by the user can be mounted on the IE-78K0-NS-P04 Emulation Board. The resonator or oscillator to be used is mounted on a parts holder and that parts holder is installed on the IE-78K0-NS-P04 Emulation Board. This is useful if you want to perform debugging at a different frequency from that of the clock mounted beforehand.

Figure 3-11: When Using Clock Mounted on the Emulation Board

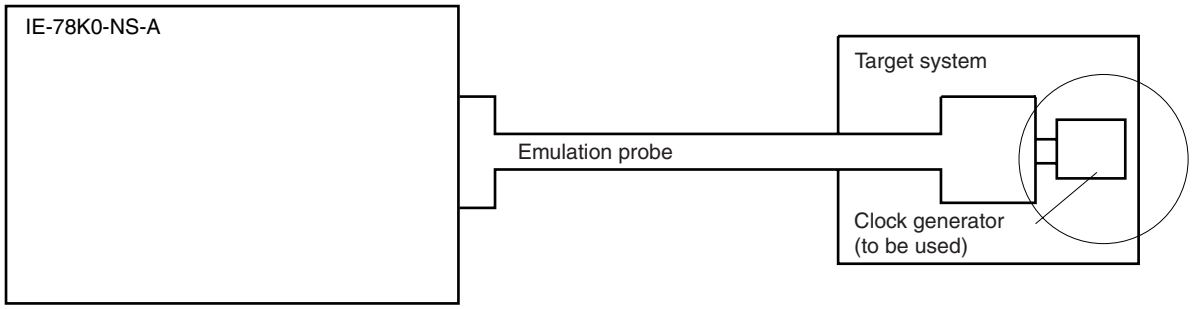


Remark: The clock supplied from the resonator or oscillator on the IE-78K0-NS-P04 Emulation Board (circled) is used.

(3) External clock on the target hardware

The external clock on the target system can be used via an emulation probe.

Figure 3-12: Using an External Clock mounted on the Target Hardware



Remark: The clock supplied by the clock generator circuit (circled in the above figure) is used.

3.2.4 Main system clock settings

Table 3-18: Main System Clock Settings

Frequency of Main System Clock		IE-78K0-NS-P04 Emulation Board	CPU Clock Source Selection (ID)
When using clock that is already mounted on emulation board	8.0000 MHz	Shortcut 6-8	Internal
When using clock mounted by user	Other than 8.0000 MHz	Includes oscillator circuit	External
When using external clock		Shortcut 6-8	

Caution: When using an user defined clock or external clock, open the configuration dialog when starting the integrated debugger (ID78K0-NS) and select "External" in the area (Clock) for selecting the CPU's clock source (this selects the user's clock).

Remark: The IE-78K0-NS-P04 Emulation Board factory settings are those listed above under "when using clock that is already mounted on emulation board".

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

When the IE-78K0-NS-P04 Emulation Board is shipped, an 8.0000-MHz crystal resonator is already mounted in the IE-78K0-NS-P04 Emulation Board X4 socket. When using the factory-set mode settings, there is no need to make any other hardware settings.

When starting the integrated debugger (ID78K0-NS), open the configuration dialog and select "Internal" in the area (Clock) for selecting the CPU's clock source (this selects the emulator's internal clock).

(2) When using clock mounted by user

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

When starting the integrated debugger (ID78K0-NS), open the configuration dialog 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 oscillator or crystal resonator

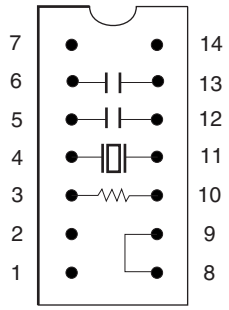
- Items to be prepared
  - Parts holder (supplied with IE-78K0-NS-P04)
  - Ceramic oscillator or crystal resonator
  - Resistor Rx
  - · Capacitor CA
  - · Capacitor CB
  - · Solder kit

<Steps>

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

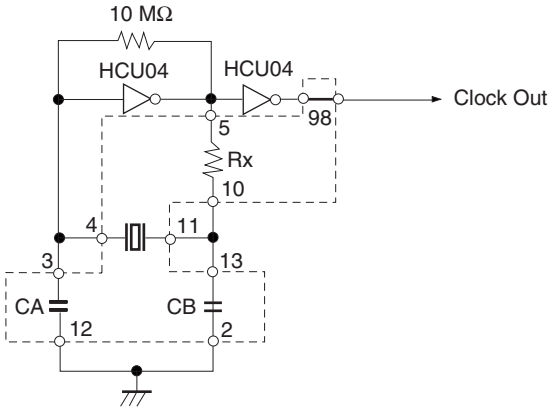
Figure 3-13: Connections on Parts Board (When Using Main System Clock or User-Mounted Clock)

Parts board (MAINCLK)



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

Circuit diagram

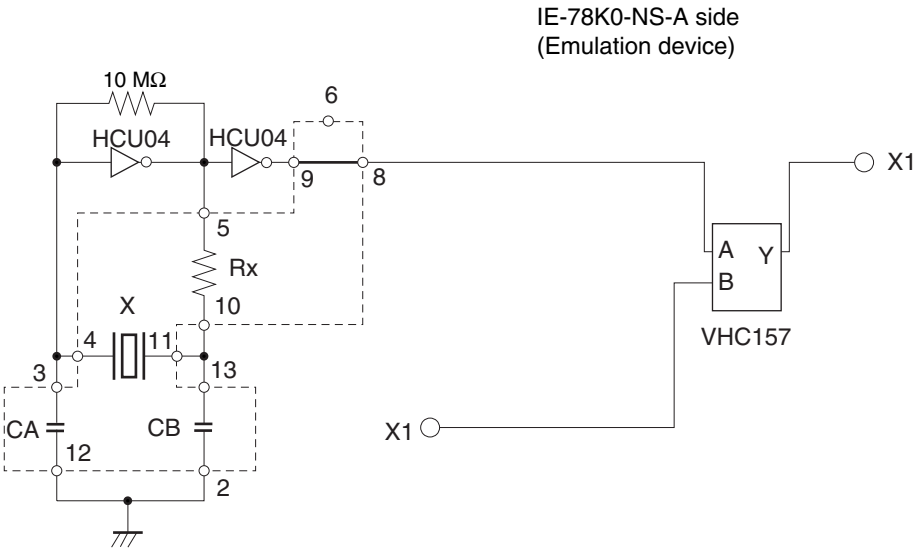


Remark: The sections enclosed in broken lines indicate parts that are attached to the parts board.

<2> Prepare the IE-78K0-NS-P04 Emulation Board.
<3> Remove the parts holder inserted in the socket (marked "X2") on the IE-78K0-NS-P04 Emulation Board.
<4> Connect the parts holder (from <1> above) to the socket (X2) from which the part holder was removed. Check the pin 1 mark to make sure the board is mounted in the correct direction.
<5> Make sure that the parts board mounted in the X2 socket on the emulation board is wired as shown in Figure 3-10 above.
<6> Install the IE-78K0-NS-P04 Emulation Board and the IE-1615-NS-EM4 Probe Board in the IE-78K0-NS-A.

The above steps configure a circuit and enable clock output to be supplied from the mounted oscillator to the emulation device.

Figure 3-14: IE-78K0-NS-A side (Emulation Device)

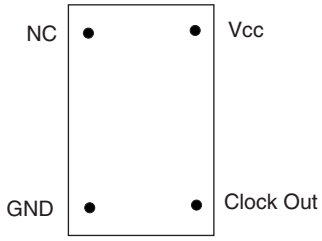


Remark: The sections enclosed in broken lines indicate parts that are attached to the parts holder.

(b) When using a crystal oscillator

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

Figure 3-15: Crystal Oscillator (When Using Main System Clock or User-mounted Clock)



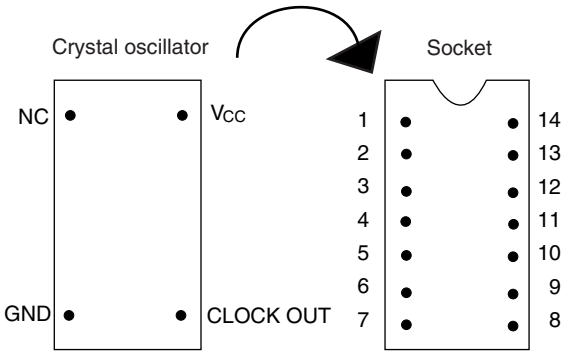
<Steps>

<1> Prepare the IE-78K0-NS-P04 Emulation Board.

<2> Remove the parts holder inserted in the socket (marked “X2”) on the IE-78K0-NS-P04 Emulation Board.

<3> Connect the parts board (from <2> above) to the socket (X2) from which the parts holder was removed. Insert the crystal oscillator into the socket so as to align the pins as shown in the figure below.

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

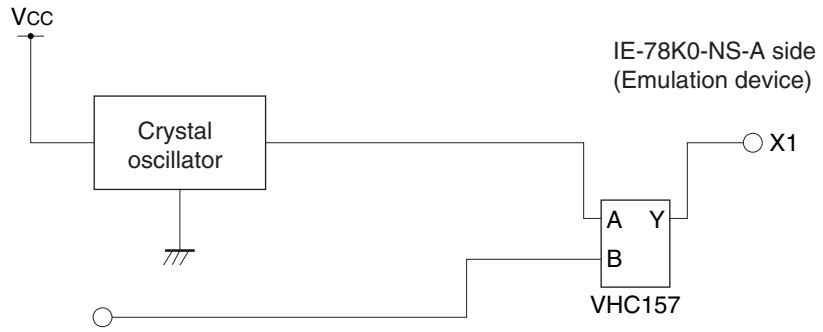


Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
V_{CC}	14

<4> Install the IE-78K0-NS-P04 Emulation Board and the IE-1615-NS-EM4 Probe Board in the IE-78K0-NS-A.

The above steps configure a circuit and enable clock output to be supplied from the mounted oscillator to the emulation device.

Figure 3-17: IE-78K0-NS-A side (Emulation Device)



(3) When using an external clock

No hardware settings are required for this situation.

Make sure that the parts holder with a shortcut between 6 and 8 is in the socket (marked "X2").

When starting the integrated debugger (ID78K0-NS), open the configuration dialog and select “External” in the area (Clock) for selecting the CPU’s clock source (this selects the user’s clock).

3.2.5 Examples of Main System Clock Setting

(1) Standard Clock 8.0000 MHz offered by the IE-78K0-NS-P04 Emulation Board

Main Board:	JP6 - (3-4)
	JP7 - (1-2)
Emulation Board:	X2 with shortcut between 6 - 8
ID78K0-NS:	Internal

(2) Clock mounted by the User on the IE-78K0-NS-P04 Emulation Board

- User related Clock

Main Board:	JP6 - (3-4)
	JP7 - (1-2)
Emulation Board:	X2 with parts holder and crystal resonator, ceramic resonator or crystal oscillator
ID78K0-NS:	External

(3) External Clock on the Target Hardware

Main Board:	JP6 - (3-4)
	JP7 - (1-2)
Emulation Board:	X2 with shortcut between 6 - 8
ID78K0-NS:	External

3.3 Subsystem Clock

3.3.1 Subsystem Clock Setting

Table 3-19: Subsystem Clock Settings

Subsystem Clock Frequency to be Used		IE-78K0-NS-P04 Emulation Board	IE-78K0-NS-A
		Parts holder (X1)	JP8
When using clock that is already mounted on main board	32.768 KHz	Short 6 - 8	Short 5 - 6
When using user-mounted clock	Other than 32.768 KHz	Includes oscillator	Short 1 - 2
When using external clock		Not used	Short 3 - 4

Caution: Jumper JP8, which is used to select the board's clock or an external clock, should be set only after turning off the IE-78K0-NS-A's power.

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

When the IE-78K0-NS-P04 is shipped, there is no 32.768 KHz crystal on the board. The parts holder on X1 is shortened between 6 and 8. Short pins 5 and 6 of JP8 of the IE-78K0-NS-A's main board to use the 32.768 KHz crystal of the emulator. There is no additional setting of the integrated debugger ID78K0-NS necessary.

(2) When using the user-mounted clock on the IE-78K0-NS-P04 Emulation Board

The settings described under either (a) or (b) are required, depending on the type of clock to be used.
Short pins 1 and 2 on the IE-78K0-NS-A's jumper (JP8).
There is no need to make any other settings via the integrated debugger (ID78K0-NS).

(a) When using a ceramic oscillator or crystal resonator

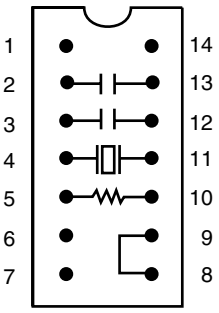
- Items to be prepared
  - Parts board (supplied with IE-78K0-NS-P04)
  - Ceramic oscillator or crystal resonator
  - Resistor Rx
  - Capacitor CA
  - Capacitor CB
  - Solder kit

<Steps>

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

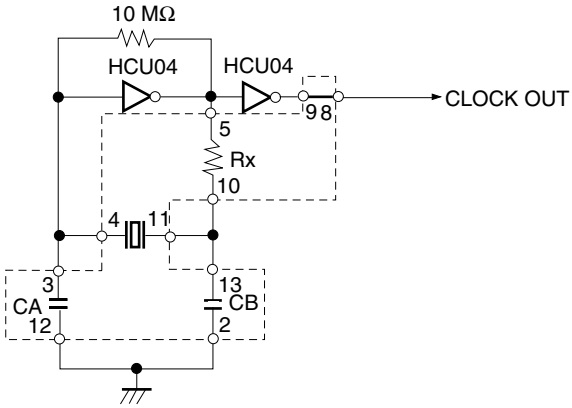
Figure 3-18: Connections on Parts Board (When Using Subsystem Clock or User-Mounted Clock)

Parts holder (X1 of IE-78K0-NS-P04 Emulation Board)



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

Circuit diagram

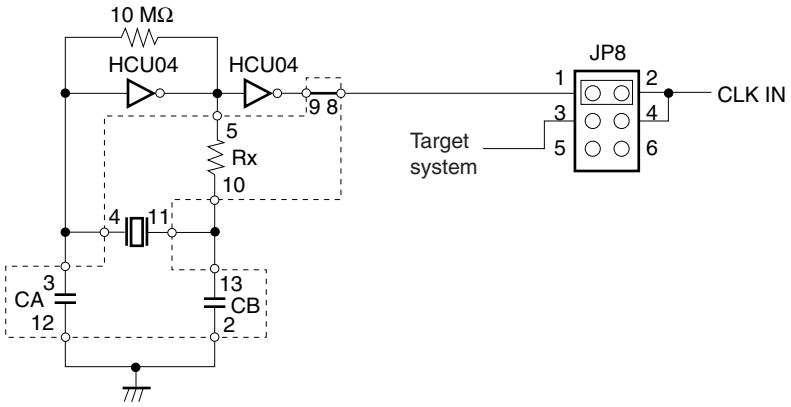


Remark: The sections enclosed in broken lines indicate parts that are attached to the parts board.

<2> Prepare the IE-78K0-NS-P04 Emulation Board.
<3> Remove the crystal oscillator that is mounted in the IE-78K0-NS-P04 Emulation Board'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 (see <3> above). Check the pin 1 mark to make sure the board is mounted in the correct direction.
<5> Install the IE-78K0-NS-P04 Emulation Board and the IE-1615-NS-EM4 Probe Board in the IE-78K0-NS-A.

The above steps configure a circuit and enable clock output to be supplied from the mounted oscillator to the emulation device.

Figure 3-19: IE-78K0-NS-A side

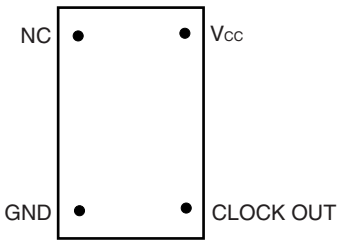


Remark: The section enclosed in broken lines indicates parts that are attached to the parts board.

(b) When using a crystal oscillator

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-20)

Figure 3-20: Crystal Oscillator (When Using Subsystem Clock or User-mounted Clock)

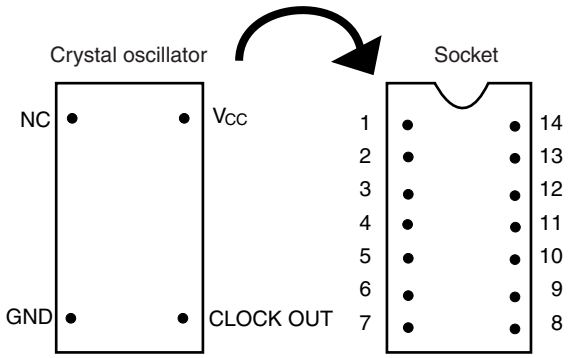


<Steps>

<1> Prepare the IE-78K0-NS-P04 Emulation Board.

<2> Remove the crystal oscillator that is mounted in the IE-78K0-NS-P04 Emulation Board's socket (the socket marked as "X1").

<3> Connect the parts board (from <2> above) to the socket (X1) from which the crystal oscillator was removed. Insert the crystal oscillator into the socket so as to align the pins as shown below.

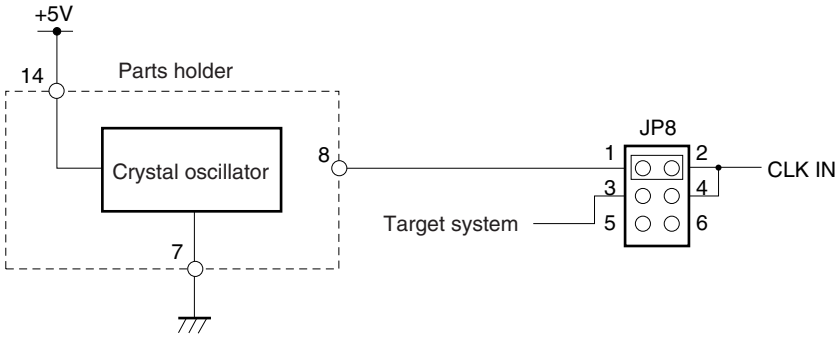


Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
VCC	14

<4> Install the IE-78K0-NS-P04 Emulation Board and the IE-1615-NS-EM4 Probe Board in the IE-78K0-NS-A.

The above steps configure a circuit and enable clock output to be supplied from the mounted oscillator to the emulation device.

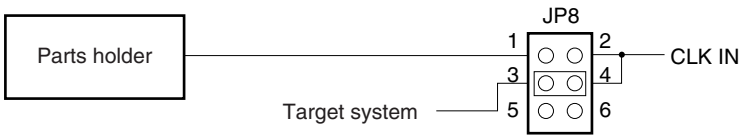
Figure 3-21: IE-78K0-NS-A side



(3) When using an external clock

Short pins 3 and 4 on the IE-78K0-NS-A's jumper (JP8). There is no need to make any settings via the integrated debugger (ID78K0-NS).

Figure 3-22: IE-78K0-NS-A side



3.3.2 Examples of Subsystem Clock Setting

(1) Standard Clock 32.768 KHz offered by the Main Board (G-78009)

Main Board:	JP8 - (5-6)
Emulation Board:	X1 with shortcut between 6 - 8
ID78K0-NS:	don't care

(2) Clock mounted by the User on the IE-78K0-NS-P04 Emulation Board

Main Board:	JP8 - (1-2)
Emulation Board:	X1 with oscillation circuit
ID78K0-NS:	don't care

(3) External Clock on the Target Hardware

Main Board:	JP8 - (3-4)
Emulation Board:	X1 with shortcut between 6 - 8
ID78K0-NS:	don't care

3.4 LCD-C/D Resistor Network

At the device the LCD split resistors have to be connected externally. In this case there is no LCD-C/D resistor network in the emulation necessary.

3.5 Jumper Settings

When using the IE-78K0-NS-P04 and the IE-1615-NS-EM4, set the jumpers as shown below.

Table 3-20: Jumper Settings on IE-78K0-NS-A

	JP2	JP3	JP4	JP6	JP7	JP8
Short	2-3	1-2	1-2	3-4	1-2	5-6

Table 3-21: Jumper Settings on IE-78K0-NS-P04

JP1	JP2	JP3	JP4	JP5	JP6	JP7	JP8	JP9
Open	Open	Open	Closed	Open	2-3	1-2	1-2	Open

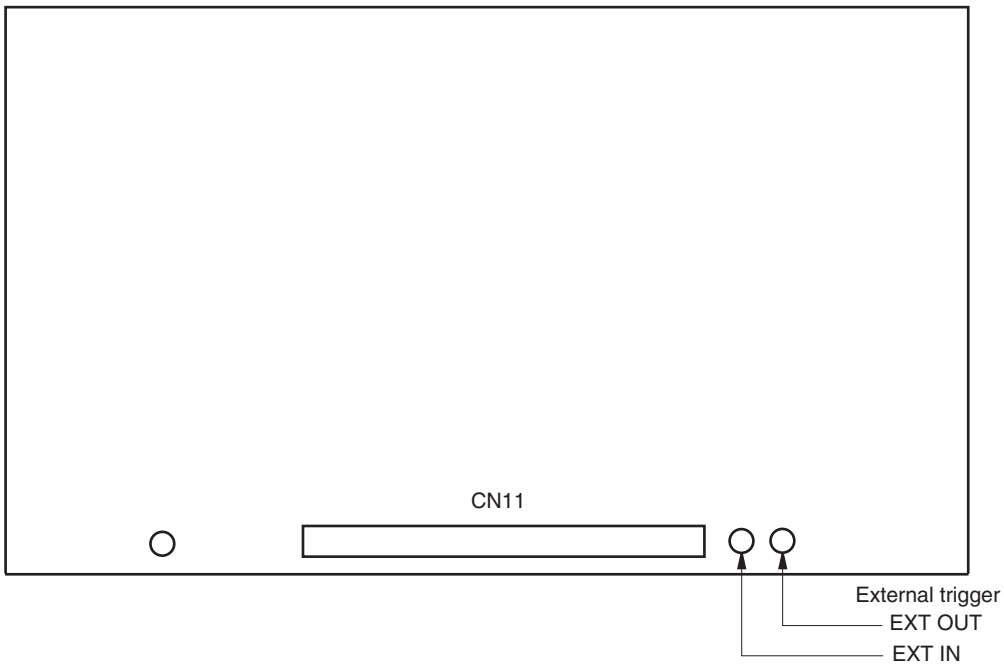
Table 3-22: Jumper Settings on IE-1615-NS-EM4

JP1	JP2	JP3	JP4
1-2	1-2	1-2	1-2

3.6 External Trigger

To set up an external trigger, connect the IE-1615-NS-EM4 Probe Board's check pin, EXTOUT, and EXTIN as shown below.
See the in-circuit emulator (IE-78K0-NS-A) User's Manual for description of related use methods and pin characteristics.

Figure 3-23: External Trigger Input Position



Chapter 4 Differences among Target Devices and Target Interface Circuits

This chapter describes differences between the target device and the IE-78K0-NS-P04 / IE-1615-NS-EM4 target interface circuit.
Although the target device is a CMOS circuit, the IE-78K0-NS-P04 and the IE-1615-NS-EM4's target interface circuit consists of an emulation chip, TTL, CMOS-IC, and other components.
When connected the IE system with the target system for debugging, the IE system performs emulation so as to operate as the actual target device would operate on the target system.
However, some minor differences exist since the operations are performed via the IE system's emulation.

4.1 Input/Output Signals

<1> Signals which are input or output from the gate array (µPD7880, µPD7881).

<2> Signals which are input or output from the gate array (µPD7883).

<3> Signals wich are input or output from the µPD780009 emulation CPU

<4> Other signals

The IE system circuit is used as follows for above mentioned signals.

(1) Signals which are input or output from the gate array (µPD7880, µPD7881)

P00 to P02, P06, P07
P10/ANI0 to P17/ANI7
P40 to P46
P80 to P87
P90 to P97
P100 to P107
P110 to P117
P120 to P127
AV_{DD}/AV_{REF}
AV_{SS}
TxVAN
Rx0VAN
Rx1VAN
Rx2VAN

(2) Signals which are input or output from the µPD78P0308

S0 to S39
COM0 to COM4
V_{LC0} to V_{LC2}

(3) Signals which are input or output from the µPD780009 emulation CPU

X1
CL1
$\overline{\text{RESET}}$

(4) Other signals

P47
$V_{DD}0$, $V_{DD}1$
$V_{SS}0$, $V_{SS}1$
X2
CL2
V_{PP}/Test

Figure 4-1: Equivalent Circuit 1 from Emulation Circuit

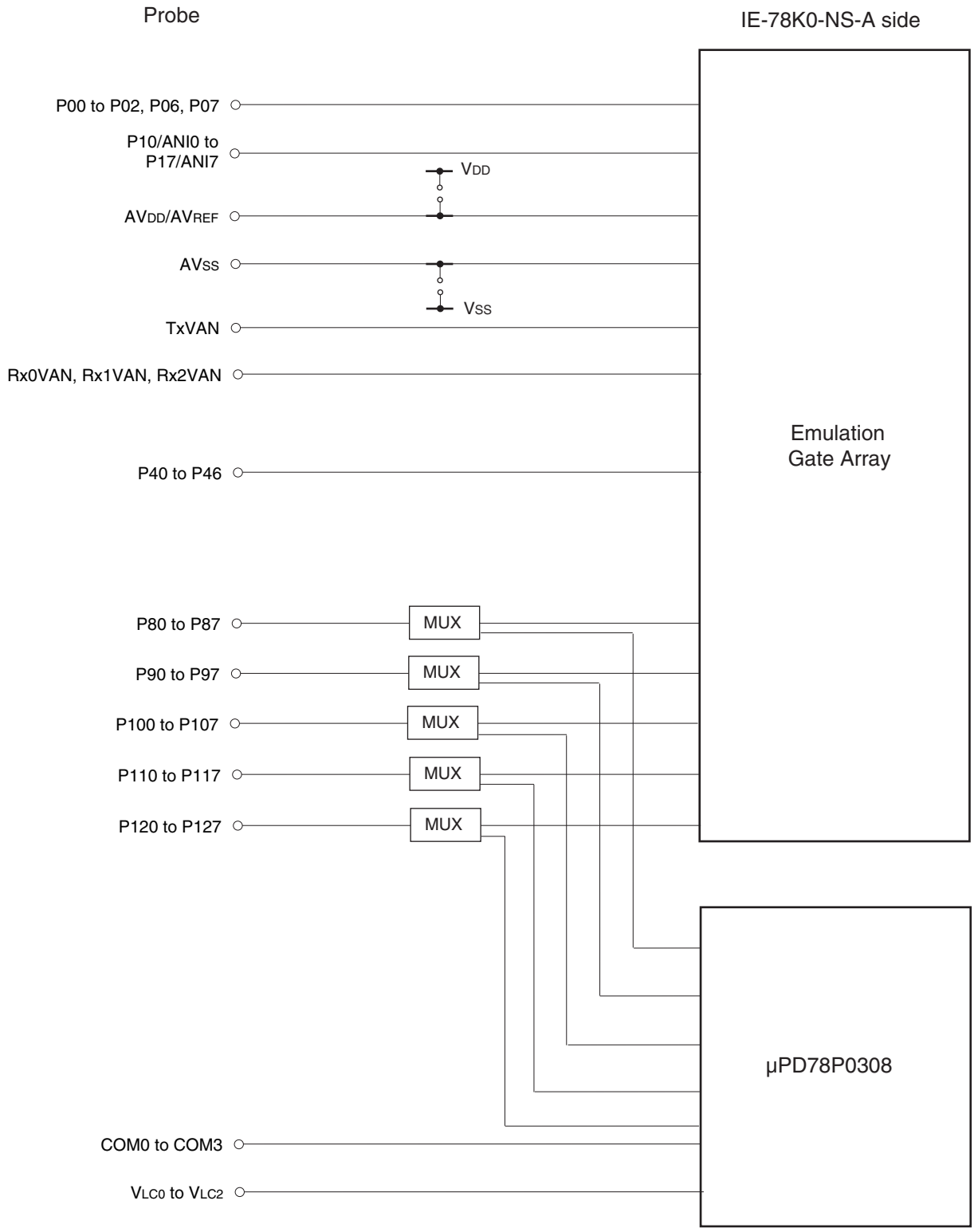


Figure 4-2: Equivalent Circuit 2 from Emulation Circuit

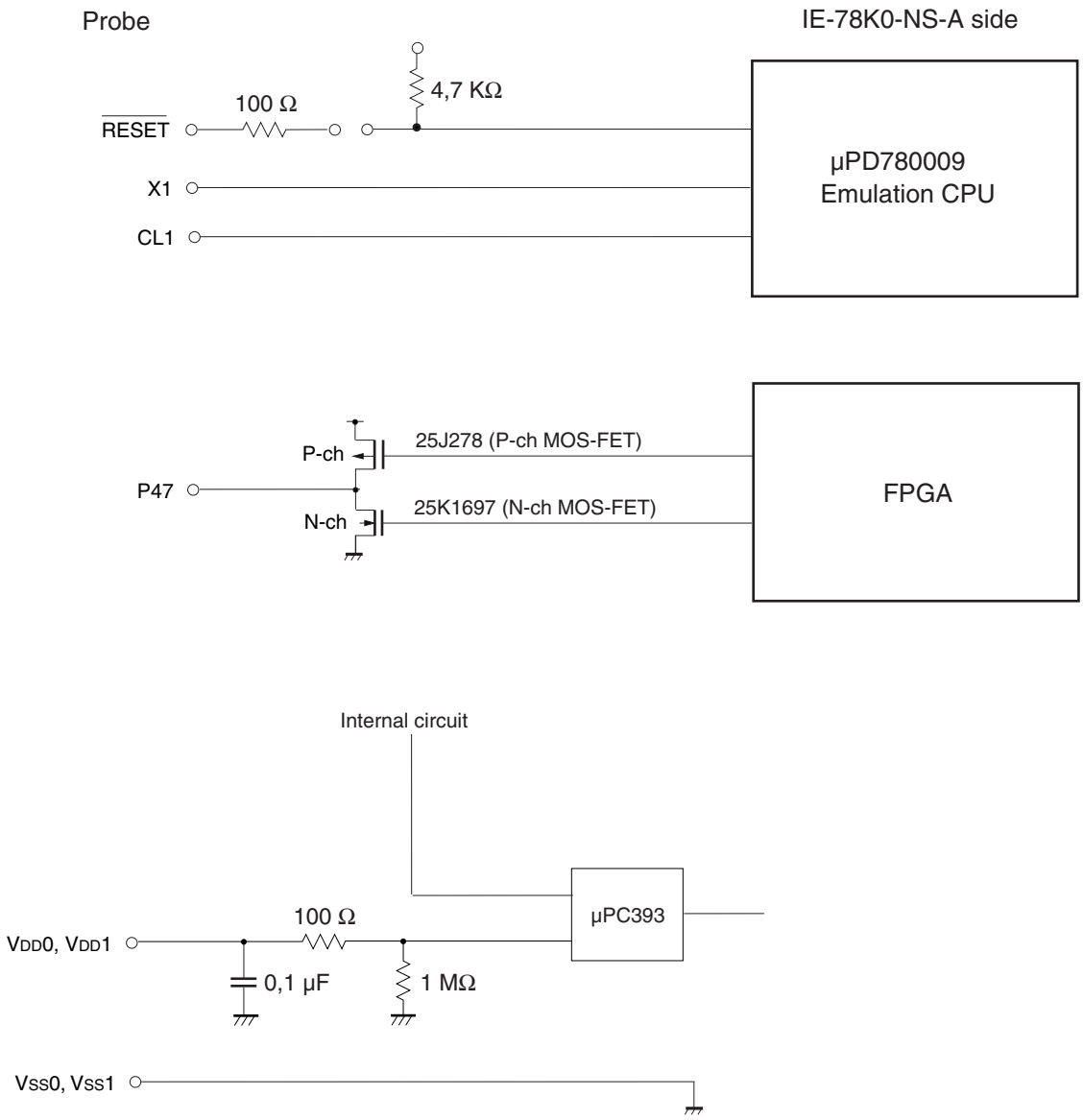
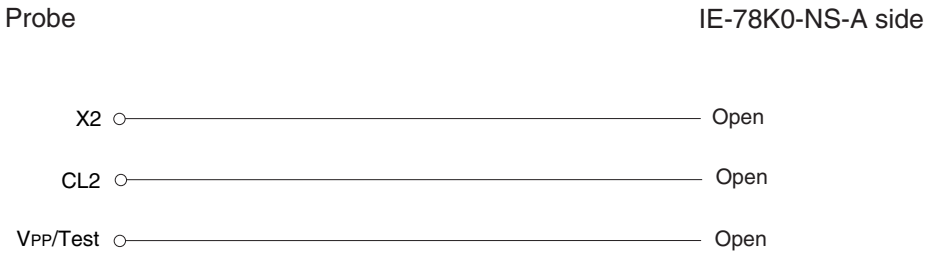


Figure 4-3: Equivalent Circuit 3 from Emulation Circuit



4.2 Differences in Port Functions

(1) Port 4, 8, 9, 10, 11, 12.0, 12.4 and 12.6 of the device are normal CMOS inputs with no hysteresis. The emulator has pins with hysteresis.

(2) The LCD-segment signals S0-S39 are input/output ports of type 17A/17B at the device. The emulator drives these signals by an analog switch.

4.3 Differences in SFR-Registers

Cautions:
1. **The emulator has a register to emulate the powerfail detection which is not existing at the real chip. The name of the register is DAM0 (SFR-Adr: 0xFF9C). This register has to be set to the value 0x01 by the user program.**
2. **The emulator has a register for the emulation of the LCD-function. The name of the register is LCDTM (SFR-Adr: 0xFF4A). This register has to be set to the value 0x02 by the user program.**
3. **The LCD - C/D of the emulator is different than on the device. The details will be given in the chapter Restrictions.**

4.4 Target Interface Circuit

The purpose of the target interface circuit is to have the same operations as the target device performed in the IE-78K0-NS-A. It comprises the emulation device and various dates (CMOS, TTL and othes ICs). When debugging is performed with the target system connected to the IE-78K0-NS-A, the IE-78K0-NS-A target interface circuit performes emulation as though the actual target device were operating in the target system.
The target device has a CMOS LSI configuration. The target interface circuit emulator device also has a CMOS LSI configuration, and is virtually identical to the target device in terms of DC characteristics and AC characteristics (when operating on V_{DD} = 4.0 to 5.5 V).
However, where emulation device signal input/output is performed via gates in the target interface circuit, DC and AC characteristics differ from those of the target device.
In particular, regarding AC characteristics, there is a date delay time (which differs from date to date) each time a gate is passed through.
The above points must be taken into consideration when designing the target system.

Caution: When the IE-78K0-NS-A, the IE-78K0-NS-P04 and the IE-1615-NS-EM4 are connected to the target system, 4.0 to 5.5 V must be supplied as the target system power supply (V_{DD}).

Chapter 5 Restrictions

1. Starting up the IE system without target board connected makes initial values for ports-indefinite.

2. The RESET value of the IF-REG (F801h) register is not correct. The reset value will be correct after the clock of the VANUDL is enabled.

3. LCD-controller/driver differences.

There are different LCD-controller/driver macro's used on the device and the emulation board (IE-78K0-NS-P04). Due to this there are differences in the initialisation of the special function register (SFR) for the LCD-controller driver.

In the following there is the description of the configuration of the LCD-controller/driver control registers as they are implemented on the emulation of the µ1615A Subseries and the devices of the µ1615A Subseries. These registers have to be set based on the configuration of the application.

(1) Emulation Board (IE-78K0-NS-P04) of µ1615A Subseries

(a) LCDM - LCD Display Mode Register

Symbol	7	6	5	4	3	2	1	0
LCDM	LDON	LCDM6	LCDM5	LCDM4	0	LCDM2	LCDM1	LCDM0

LDON	Enables/disables LCD display
0	Display off
1	Display on

LCDM6	LCDM5	LCDM4	Select LCD clock
0	0	0	$fx/2^{17}$
0	0	1	$fx/2^{16}$
0	1	0	$fx/2^{15}$
0	1	1	$fx/2^{14}$
Other than above			Setting prohibited

LCDM2	LCDM1	LCDM0	Select Display Mode of LCD-controller/driver	
			Time division	Bias
0	0	0	4	1/3
0	0	1	3	1/3
0	1	0	2	1/2
0	1	1	3	1/2
1	0	0	Static	
Other than above			Setting prohibited	

The bit 3 has to be set to 0.

(b) LCDC - LCD Control Register

Symbol	7	6	5	4	3	2	1	0
LCDC	1	0	0	0	0	0	0	LIPS

LIPS	LCD Driving Power Supply selection
0	Does not supply power to LCD
1	Supplies power to LCD from V_{DD} pin

The bit 7 has to be set to 1 and the bits 6 to 4 have to be set to 0.

(2) Device of µ1615A Subseries

(a) LCDM - LCD Display Mode Register

Symbol	7	6	5	4	3	2	1	0
LCDM	LCDON	0	0	LIPS	0	LCDM2	LCDM1	LCDM0

LCDON	Enables/disables LCD display
0	Display off
1	Display on

LIPS	LCD Driving Power Supply selection
0	Does not supply power to LCD
1	Supplies power to LCD from V_{DD} pin

LCDM2	LCDM1	LCDM0	Select Display Mode of LCD-controller/driver	
			Time division	Bias
0	0	0	4	1/3
0	0	1	3	1/3
0	1	0	2	1/2
0	1	1	3	1/2
1	0	0	Static	
Other than above			Setting prohibited	

(b) LCDC - LCD Control Register

Symbol	7	6	5	4	3	2	1	0
LCDC	0	0	0	0	LCDC3	LCDC2	0	0

LCDC3	LCDC2	Select LCD clock
0	0	$fx/2^{17}$
0	1	$fx/2^{16}$
1	0	$fx/2^{15}$
1	1	$fx/2^{14}$

[MEMO]

Appendix A IE-78K0-NS-P04 and IE-1615-NS-EM4 Product Specifications

Product name : IE-78K0-NS-P04, IE-1615-NS-EM4
Operating temperature : 0 to 50 °C
Humidity : 10 to 80% RH (no condensation)
Storage temperature : –15 to +60 °C
Power supply : Power supply capacity : DC 200 mA (Max.) 1.0 W +5 V

Table A-1: Connectors on IE-78K0-NS-P04 Board

Name	Description (IE-78K0-NS-P04 Emulation Board)	Name	Description (IE-1615-NS-EM4 Probe Board)
CN1	Emulator connections	CN5	Emulation board connectors
CN2		CN6	
CN3		CN7	
CN4		CN8	
CN5	Probe board connectors	CN9	
CN6		CN10	
CN7		CN11	Probe connector
CN8		JP1	VAN in/out buffer select
CN9		JP2	VAN in/out buffer select
CN10		JP3	VAN in/out buffer select
CN11	Test connector (only for internal use by NEC)	JP4	VAN in/out buffer select
CN12			
CN13			
CN14			
CN15			
CN16			
CN17			
CN18			
JP1	Analog reference voltage		
JP2	GND-pin of A/D Converter		
JP3	Reseved (only for internal use by NEC)		
JP4	JTAG mode selection (only for internal use by NEC)		
JP5	FPGA mode selection		
JP6	JTAG mode selection (only for internal use by NEC)		
JP7	LVREF1		
JP8	LVREF0		
JP9	Future Function		

[Memo]

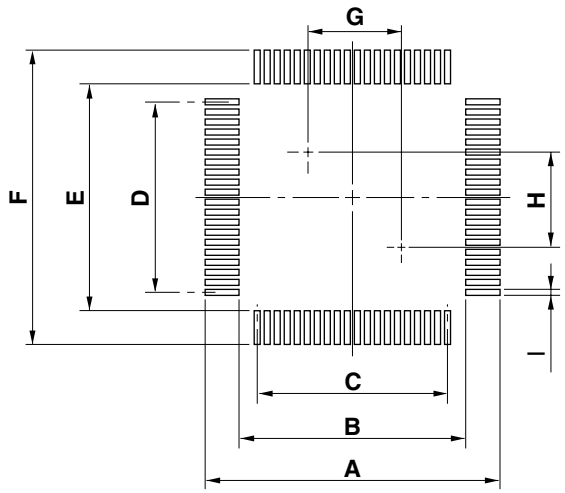
Appendix B Conversion Socket Adapter Package Drawings and recommended Board Mounting Pattern

The following sockets and socket adapters are available for the connection of the probe or device:

- Soldering socket : NQPACK080SB
- Probe adapter : YQPACK080SB
- High adapter : YQSOCKET080SBF
- Device Lid : HQPACK080SB

Figure B-1: 80GC Package Drawings (Reference)

Pad drawing (in mm)



ITEM	MILLIMETERS	INCHES
A	19.7	0.776
B	15.0	0.591
C	0.65±0.02 x 19 = 12.35±0.05	$0.026^{+0.001}_{-0.002}$ x 0.748 = 0.486 $^{+0.003}_{-0.002}$
D	0.65±0.02 x 19 = 12.35±0.05	$0.026^{+0.001}_{-0.002}$ x 0.748 = 0.486 $^{+0.003}_{-0.002}$
E	15.0	0.591
F	19.7	0.776
I	0.35±0.02	$0.014^{+0.001}_{-0.001}$

Remark: Manufactured by Tokyo Eletech.Corp.

Appendix C Pin Correspondence Tables of Emulation Probe

Table C-1: Connector CN11 to Emulation Probe (1/2)

No.	Real-chip	Pin Function
1		GND
3		NC
5		NC
7	Pin 42	P83/S36
9	Pin 20	Rx2VAN
11		GND
13	Pin 44	P85/S34
15	Pin 18	Rx0VAN
17	Pin 46	P87/S32
19	Pin 16	P06/TI50/TO50
21	Pin 48	P91/S30
23	Pin 14	P01/INTP1
25		GND
27	Pin 50	P93/S28
29	Pin 12	VDD0
31		NC
33		NC
35	Pin 40	P81/S38
37	Pin 21	TxVAN
39		GND
41	Pin 38	COM3
43	Pin 22	P47/SGO/SGOF
45	Pin 36	COM1
47	Pin 24	P45
49	Pin 34	VLC2
51	Pin 26	P43
53		GND
55	Pin 32	VLC0
57	Pin 28	P41
59	Pin 30	VSS1
61	Pin 70	P117/S8
63	Pin 68	P115/S10
65	Pin 72	P121/TIO0/TO0/S6
67		GND
69	Pin 66	P113/S12
71	Pin 74	RxD/S4
73	Pin 64	P111/S14
75	Pin 76	P125/SCK3/S3
77	Pin 62	P107/S16
79	Pin 78	SI3/S0
81		GND
83	Pin 61	P106/S17
85	Pin 80	P13/AN13
87		NC
89		NC
91	Pin 52	P95/S26
93	Pin 10	CL2
95		GND
97	Pin 54	P97/S24
99	Pin 08	IC/VPP
101	Pin 56	P101/S22
103	Pin 06	X1

No.	Real-chip	Pin Function
2		GND
4		NC
6		NC
8	Pin 41	P82/S37
10	Pin 19	Rx1VAN
12		GND
14	Pin 43	P84/S35
16	Pin 17	R07/TI51/TO51
18	Pin 45	P86/S33
20	Pin 15	P02/INTP2
22	Pin 47	P90/S31
24	Pin 13	P00/INTP0
26		GND
28	Pin 49	P92/S29
30	Pin 11	VSS0
32		NC
34		NC
36		NC
38		NC
40		GND
42	Pin 39	P80/S39
44	Pin 23	P46/SGOA
46	Pin 37	COM2
48	Pin 25	P44
50	Pin 35	COM0
52	Pin 27	P42
54		GND
56	Pin 33	VLC1
58	Pin 29	P40
60	Pin 31	VDD1
62	Pin 72	PCL/S7
64	Pin 69	P119/S9
66	Pin 73	TIO1/S5
68		GND
70	Pin 67	P114/S11
72	Pin 75	TxD/S3
74	Pin 65	P112/S13
76	Pin 77	SO3/S1
78	Pin 63	P110/S15
80	Pin 79	AVss
82		GND
84		NC
86		NC
88		NC
90		NC
92	Pin 51	P94/S27
94	Pin 09	CL1
96		GND
98	Pin 53	P96/S25
100	Pin 07	X2
102	Pin 55	P100/S23
104	Pin 05	RESET

Table C-1: Connector CN11 to Emulation Probe (2/2)

No.	Real-chip	Pin Function
105	Pin 58	P103/S20
107	Pin 04	AVREF
109		GND
111	Pin 60	P105/S18
113	Pin 02	P11/ANI1
115		NC
117		NC
119		GND

No.	Real-chip	Pin Function
106	Pin 57	P102/S21
108	Pin 03	P10/ANI0
110		GND
112	Pin 59	P104/S19
114	Pin 01	P12/ANI2
116		NC
118		NC
120		GND

Remark: The meaning of the symbols and figures in the Emulation Probe column is as follows:
GND: Ground clip
NC: Not connected
1–120: Emulation probe tip pin numbers

NEC

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