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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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User's Manual

QB-78K0KX1H

In-Circuit Emulator

Target Devices

78K0/KB1	78K0/KB1+
78K0/KC1	78K0/KC1+
78K0/KD1	78K0/KD1+
78K0/KE1	78K0/KE1+
78K0/KF1	78K0/KF1+

[MEMO]

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INTRODUCTION

Readers	This manual is intended for users who wish to perform debugging using the QB-78K0KX1H. The readers of this manual are assumed to be familiar with the device functions and usage, and to have knowledge of debuggers.	
Purpose	This manual is intended to give users an understanding of the basic specifications and correct usage of the QB-78K0KX1H.	
Organization	This manual is divided into following parts. <ul style="list-style-type: none">• General• Setup procedure• Settings at product shipment• Differences between target device and target interface circuit• Cautions• Restrictions	
How to Read This Manual	<p>It is assumed that the readers of this manual have general knowledge in the fields of electrical engineering, logic circuits, and microcontrollers.</p> <p>This manual describes the basic setup procedures and how to set switches.</p> <p>To understand the overall functions and usages of the QB-78K0KX1H →Read this manual according to the CONTENTS. The mark <R> shows major revised points. The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.</p> <p>To know the manipulations, command functions, and other software-related settings of the QB-78K0KX1H →See the user's manual of the debugger (supplied with the QB-78K0KX1H) to be used.</p>	
Conventions	Note:	Footnote for item marked with Note in the text
	Caution:	Information requiring particular attention
	Remark:	Supplementary information
	Numeric representation:	Binary ... xxxx or xxxxB Decimal ... xxxx Hexadecimal ... xxxxH
	Prefix indicating power of 2 (address space, memory capacity):	K (kilo): $2^{10} = 1,024$ M (mega): $2^{20} = 1,024^2$

Terminology

The meanings of the terms used in this manual are described in the table below.

Term	Meaning
Target device	This is the device to be emulated.
Target system	This is the system to be debugged. This includes the target program and the hardware provided by the user.
78K0/Kx1	Generic name indicating 78K0/KB1, 78K0/KC1, 78K0/KD1, 78K0/KE1, and 78K0/KF1.
78K0/Kx1+	Generic name indicating 78K0/KB1+, 78K0/KC1+, 78K0/KD1+, 78K0/KE1+, and 78K0/KF1+.

Related Documents

Please use the following documents in conjunction with this manual.

The related documents listed below may include preliminary versions. However, preliminary versions are not marked as such.

Documents Related to Development Tools (User's Manuals)

Document Name		Document Number
QB-78K0KX1H In-Circuit Emulator		This manual
RA78K0 Assembler Package Ver. 3.70	Operation	U17015E
	Language	U17014E
	Structured Assembly Language	U11789E
CC78K0 C Compiler Ver. 3.60	Operation	U17017E
	Language	U17016E
ID78K0-QB Ver. 2.81 Integrated Debugger	Operation	U16996E
PM plus Ver. 5.20		U16934E

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

General Precautions for Handling This Product

1. Circumstances not covered by product guarantee

- If the product was disassembled, altered, or repaired by the customer
- If it was dropped, broken, or given another strong shock
- Use at overvoltage, use outside guaranteed temperature range, storing outside guaranteed temperature range
- If power was turned on while the AC adapter, USB interface cable, or connection to the target system was in an unsatisfactory state
- If the cable of the AC adapter, the USB interface cable, the emulation probe, or the like was bent or pulled excessively
- If an AC adapter other than the supplied product was used
- If the product got wet
- If this product is connected to the target system when there is a potential difference between the GND of this product and GND of the target system.
- If the connectors or cables are plugged/unplugged while this product is in the power-on state.
- If excessive load is applied to the connectors or sockets (As for handling, please see **2.5 Mounting and Connecting Connectors**).
- If the product is used or stored in an environment where an electrostatic or electrical noise is likely to occur

2. Safety precautions

- If used for a long time, the product may become hot (50°C to 60°C). Be careful of low temperature burns and other dangers due to the product becoming hot.
- Be careful of electrical shock. There is a danger of electrical shock if the product is used as described above in **1 Circumstances not covered by product guarantee**.

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CHAPTER 1 GENERAL

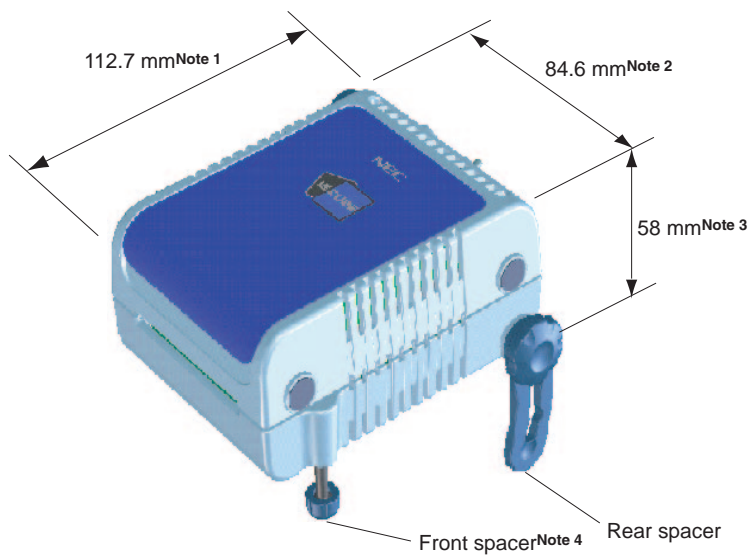
The QB-78K0KX1H is an in-circuit emulator for emulating the 78K0/Kx1 or 78K0/Kx1+.

Hardware and software can be debugged efficiently in the development of systems in which the 78K0/Kx1 or 78K0/Kx1+ is used. This manual describes basic setup procedures, hardware specifications, system specifications, and how to set switches.

1.1 Hardware Specifications

Table 1-1. QB-78K0KX1H Hardware Specifications

Parameter		Specification	
Target device		78K0/KB1, 78K0/KC1, 78K0/KD1, 78K0/KE1, 78K0/KF1 78K0/KB1+, 78K0/KC1+, 78K0/KD1+, 78K0/KE1+, 78K0/KF1+	
Operating voltage	78K0/Kx1	2.5 to 5.5 V	
	78K0/Kx1+	2.2 to 5.5 V	
Operating frequency	78K0/Kx1	Main system clock	V _{DD} = 4.0 to 5.5 V: 12 MHz V _{DD} = 3.5 to 4.0 V: 10 MHz V _{DD} = 3.0 to 3.5 V: 8.38 MHz V _{DD} = 2.5 to 3.0 V: 5 MHz
		Subsystem clock	V _{DD} = 2.5 to 5.5 V: 32.768 kHz
	78K0/Kx1+	Main system clock	V _{DD} = 4.0 to 5.5 V: 16 MHz V _{DD} = 4.0 to 4.5 V: 16 MHz V _{DD} = 3.3 to 4.0 V: 8.38 MHz V _{DD} = 2.7 to 3.3 V: 5 MHz V _{DD} = 2.2 to 2.7 V: 500 kHz (Internal oscillation clock only)
		Subsystem clock	V _{DD} = 2.5 to 5.5 V: 32.768 kHz
Operating temperature range		0 to 40°C (No condensation)	
Storage temperature range		-15 to 60°C (No condensation)	
External dimensions		See figure below	
Power consumption	AC adapter for QB-78K0KX1H	15 V, 1 A	
	Target system power supply	Same level as target device	
Weight		382 g	
Host interface		USB interface (1.1, 2.0)	



- Notes**
- Does not include projection of power switch
 - Includes projection of screw that fixes rear spacer
 - Dimension when rear spacer is made shortest (88 mm when longest)
 - Front spacer can vary from 20 mm (longest) to 5 mm (shortest)

1.2 System Specifications

This section shows the QB-78K0KX1H system specifications.

Table 1-2. QB-78K0KX1H System Specifications

Parameter		Specification
Emulation memory capacity		64 KB
Program execution functions	Real-time execution function	Go, Start from Here, Go & Go, Come Here, Restart, Return Out, Ignore break points and Go
	Non-real-time execution function	Step execution
Break functions	Event break	Execution: 8 points Access: Byte 8 points, word 2 points
	Software break	2000 points
	Pre-execution break	16 points
	Fail-safe break	Exists
	Other	Forcible break, trace full break, trace delay break, timeout break, timer overflow break
Trace functions	Trace data types	Program address, program data, access address, access data, status
	Trace modes	Full trace, section trace, qualify trace
	Trace functions	Delay function, full stop function
	Memory capacity	128K frames
Real-time RAM monitoring function		All spaces
Time measurement functions	Measurement clock	50 MHz or CPU clock
	Measurement objects	Beginning through end of program execution Start event through end event
	Maximum measurement time	Approximately 24 hours (Resolution 41 μ s)
	Minimum resolution	20 ns (Measurement time: 85 seconds)
	Number of timers for measurement	Start through end of program execution: 1 Start event through end event: 2
	Measurement results	Maximum, minimum, average, cumulative, number of passes (between events)
	Other	Timer overflow break function, timeout break function
Other functions		Mapping function, event function, coverage function, snapshot function, DMM function, stub function, power-off emulation function, pin mask function

1.3 System Configuration

This section shows the system configuration when using the QB-78K0KX1H connected to a PC (PC-9821 series, PC/AT™ compatible). Connection is possible even without optional products.

Table 1-3. Devices Subject to Emulation by 78K0/Kx1

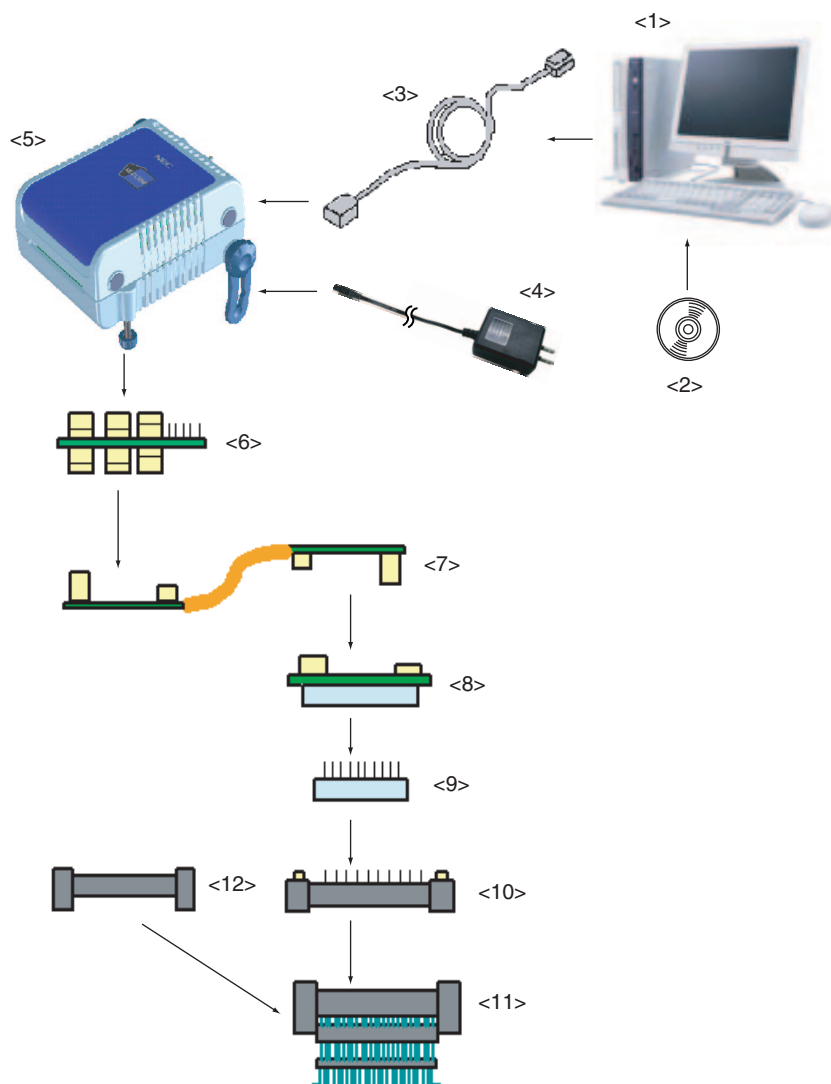
Device Name (Common Name)	Package	Device Name	
		Flash Memory Version	Mask ROM Version
78K0/KB1	30-pin SSOP (MC)	μPD78F0103	μPD780101, μPD780102, μPD780103
78K0/KC1	44-pin LQFP (GB)	μPD78F0114	μPD780111, μPD780112, μPD780113, μPD780114
78K0/KD1	52-pin QFP (GB)	μPD78F0124	μPD780121, μPD780122, μPD780123, μPD780124
78K0/KE1	64-pin QFP (GB, GK, GC)	μPD78F0134, μPD78F0138	μPD780131, μPD780132, μPD780133, μPD780134, μPD780136, μPD780138
78K0/KF1	80-pin QFP (GK, GC)	μPD78F0148	μPD780143, μPD780144, μPD780146, μPD780148

Table 1-4. Devices Subject to Emulation by 78K0/Kx1+

Device Name (Common Name)	Package	Device Name	
		Flash Memory Version	Mask ROM Version
78K0/KB1+	30-pin SSOP (MC)	μPD78F0101H, μPD78F0102H, μPD78F0103H	–
78K0/KC1+	44-pin LQFP (GB)	μPD78F0112H, μPD78F0113H, μPD78F0114H	–
78K0/KD1+	52-pin QFP (GB)	μPD78F0122H, μPD78F0123H, μPD78F0124H	–
78K0/KE1+	64-pin QFP (GB, GK, GC)	μPD78F0132H, μPD78F0133H, μPD78F0134H, μPD78F0136H, μPD78F0138H	–
78K0/KF1+	80-pin QFP (GK, GC)	μPD78F0148H	–

<R>

Figure 1-1. System Configuration



- | | |
|------------------------------------|--|
| <1> Host machine: | PC-9821 series, PC/AT compatible can be used |
| <2> ID78K0-QB Disk/Accessory Disk: | Debugger, USB drivers, manual, etc. |
| <3> USB interface cable: | Cable connecting QB-78K0KX1H to host machine |
| <4> AC adapter: | Can support 100 to 240 V |
| <5> QB-78K0KX1H: | This product |
| <6> Check pin adapter: | Adapter used when observing waveforms on oscilloscope |
| <7> Emulation probe: | Flexible type of emulation probe |
| <8> Exchange adapter: | Adapter that performs pin conversion |
| <9> Space adapter: | Adapter for height regulation |
| <10> YQ connector: | Connector that connects exchange adapter to target connector |
| <11> Target connector: | Connector soldered to target system |
| <12> Mount adapter: | Adapter for socket mounting target device |

Remarks 1. Obtain device files from the NEC Electronics website.

http://www.necel.com/micro/index_e.html

2. See 1.4 **Package Contents** for the purchase forms of the above products.

Table 1-5. Check Pin Adapters

Package	Check Pin Adapter
Common	QB-144-CA-01

Table 1-6. Exchange Adapters

Package	Exchange Adapter
80GC	QB-80GC-EA-01T
80GK	QB-80GK-EA-01T
64GB	QB-64GB-EA-01T
64GC	QB-64GC-EA-01T
64GK	QB-64GK-EA-01T
52GB	QB-52GB-EA-01T
44GB	QB-44GB-EA-01T
30MC	QB-30MC-EA-01T

Table 1-7. Emulation Probes

Package	Emulation Probe
Common	QB-80-EP-01T

Table 1-8. YQ Connectors

Package	YQ Connector
80GC	QB-80GC-YQ-01T
80GK	QB-80GK-YQ-01T
64GB	QB-64GB-YQ-01T
64GC	QB-64GC-YQ-01T
64GK	QB-64GK-YQ-01T
52GB	QB-52GB-YQ-01T
44GB	QB-44GB-YQ-01T
30MC	QB-30MC-YQ-01T

Table 1-9. Space Adapters

Package	Space Adapter
80GC	QB-80GC-YS-01T
80GK	QB-80GK-YS-01T
64GB	QB-64GB-YS-01T
64GC	QB-64GC-YS-01T
64GK	QB-64GK-YS-01T
52GB	QB-52GB-YS-01T
44GB	QB-44GB-YS-01T
30MC	QB-30MC-YS-01T

<R>

Table 1-10. Target Connectors

Package	Target Connector
80GC	QB-80GC-TC-01T
80GK	QB-80GK-TC-01T
64GB	QB-64GB-TC-01T
64GC	QB-64GC-TC-01T
64GK	QB-64GK-TC-01T
52GB	QB-52GB-TC-01T
44GB	QB-44GB-TC-01T
30MC	QB-30MC-TC-01T

Table 1-11. Mount Adapters

Package	Target Connector
80GC	QB-80GC-HQ-01T
80GK	QB-80GK-HQ-01T
64GB	QB-64GB-HQ-01T
64GC	QB-64GC-HQ-01T
64GK	QB-64GK-HQ-01T ^{Note} , QB-64GK-HQ-02T ^{Note}
52GB	QB-52GB-HQ-01T
44GB	QB-44GB-HQ-01T
30MC	QB-30MC-HQ-01T

Note QB-64GK-HQ-01T is the adapter for a device without on-chip debug functions.
QB-64GK-HQ-02T is the adapter for a device that has on-chip debug functions.

Remark For notes on target system design and package drawings, refer to [Related Information] on the following URL.

<http://www.necel.com/micro/en/development/asia/Emulator/IE/iecube.html>

<R> 1.4 Package Contents

The following items have been placed in the QB-78K0KX1H packing box. Please check the contents.

Products supplied with QB-78K0KX1H-ZZZ

- 1: QB-78K0KX1H
- 2: AC adapter
- 3: USB interface cable
- 4: Clock board set
 - Main Clock Type I
 - Main Clock Type II
 - Main Clock Type III (Mounted at shipment)
 - Sub Clock Type I
 - Sub Clock Type II (Mounted at shipment)
- 5: User registration
- 6: Simplified flash programmer (PG-FPL or QB-MINI2)
- 7: ID78K0-QB Disk (CD-ROM)
- 8: Accessory Disk (CD-ROM)
- 9: Setup Manual

Products supplied with QB-78K0KX1H-T80GC

- 1 to 9
- 10: Emulation probe QB-80-EP-01T
 - 11: Exchange adapter QB-80GC-EA-01T
 - 12: YQ connector QB-80GC-YQ-01T
 - 13: Target connector QB-80GC-TC-01T

Products supplied with QB-78K0KX1H-T80GK

- 1 to 9
- 10: Emulation probe QB-80-EP-01T
 - 11: Exchange adapter QB-80GK-EA-01T
 - 12: YQ connector QB-80GK-YQ-01T
 - 13: Target connector QB-80GK-TC-01T

Products supplied with QB-78K0KX1H-T64GB

- 1 to 9
- 10: Emulation probe QB-80-EP-01T
 - 11: Exchange adapter QB-64GB-EA-01T
 - 12: YQ connector QB-64GB-YQ-01T
 - 13: Target connector QB-64GB-TC-01T

Products supplied with QB-78K0KX1H-T64GC

- 1 to 9
- 10: Emulation probe QB-80-EP-01T
 - 11: Exchange adapter QB-64GC-EA-01T
 - 12: YQ connector QB-64GC-YQ-01T
 - 13: Target connector QB-64GC-TC-01T

Products supplied with QB-78K0KX1H-T64GK

1 to 9

- 10: Emulation probe QB-80-EP-01T
- 11: Exchange adapter QB-64GK-EA-01T
- 12: YQ connector QB-64GK-YQ-01T
- 13: Target connector QB-64GK-TC-01T

Products supplied with QB-78K0KX1H-T52GB

1 to 9

- 10: Emulation probe QB-80-EP-01T
- 11: Exchange adapter QB-52GB-EA-01T
- 12: YQ connector QB-52GB-YQ-01T
- 13: Target connector QB-52GB-TC-01T

Products supplied with QB-78K0KX1H-T44GB

1 to 9

- 10: Emulation probe QB-80-EP-01T
- 11: Exchange adapter QB-44GB-EA-01T
- 12: YQ connector QB-44GB-YQ-01T
- 13: Target connector QB-44GB-TC-01T

Products supplied with QB-78K0KX1H-T30MC

1 to 9

- 10: Emulation probe QB-80-EP-01T
- 11: Exchange adapter QB-30MC-EA-01T
- 12: YQ connector QB-30MC-YQ-01T
- 13: Target connector QB-30MC-TC-01T

The following products are sold as single items.

- Emulation probe
- Exchange adapter
- YQ connector
- Target connector
- Check pin adapter
- Space adapter
- Mount adapter

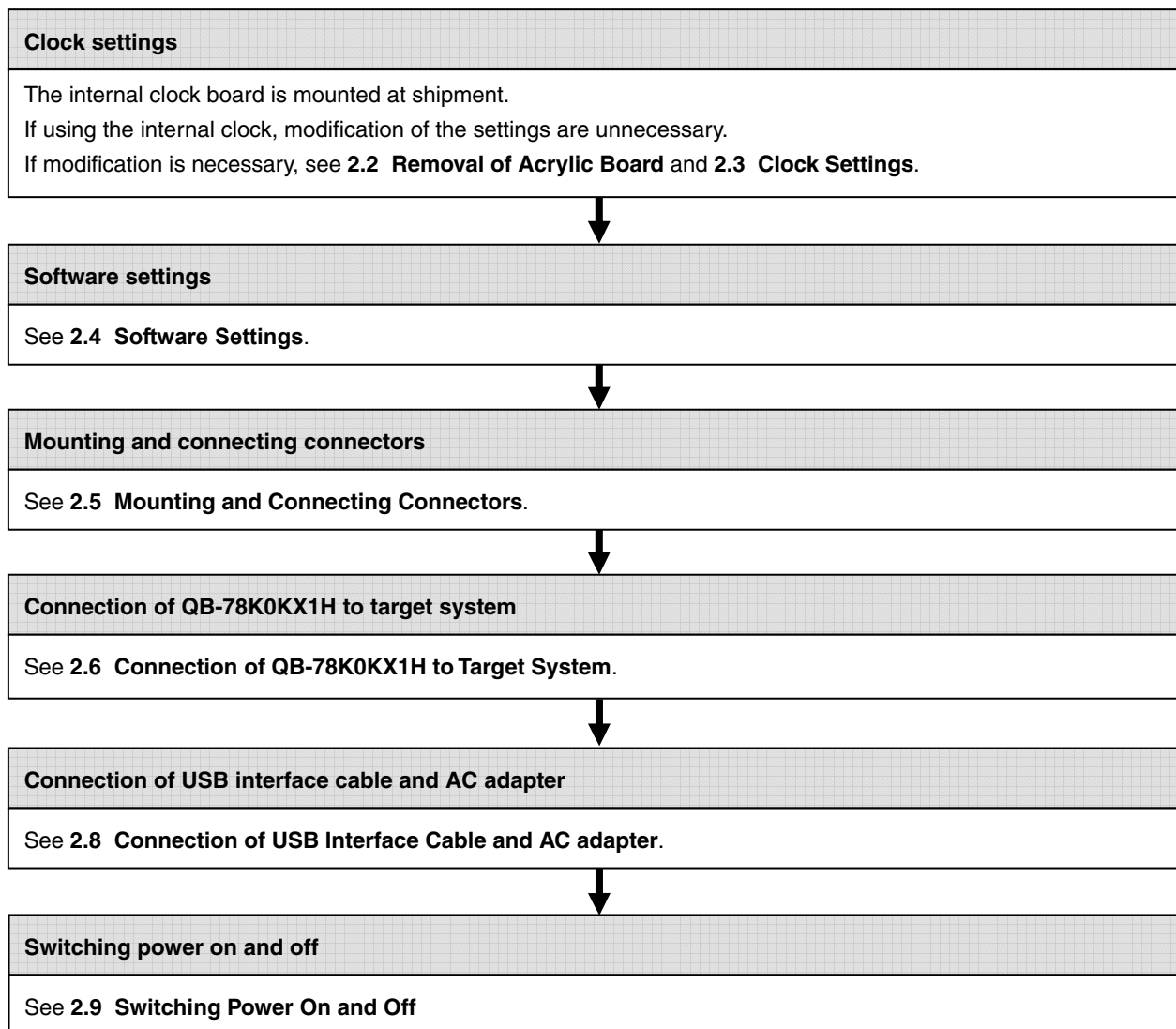
CHAPTER 2 SETUP PROCEDURE

This chapter explains the QB-78K0KX1H setup procedure.

Setup can be completed by performing installation setup in the order in which it appears in this chapter.

Perform setup along the lines of the following procedure.

See **2.1 Names and Functions of Hardware** for clock board positions.



2.1 Names and Functions of Hardware

Figure 2-1. Names of Parts of QB-78K0KX1H

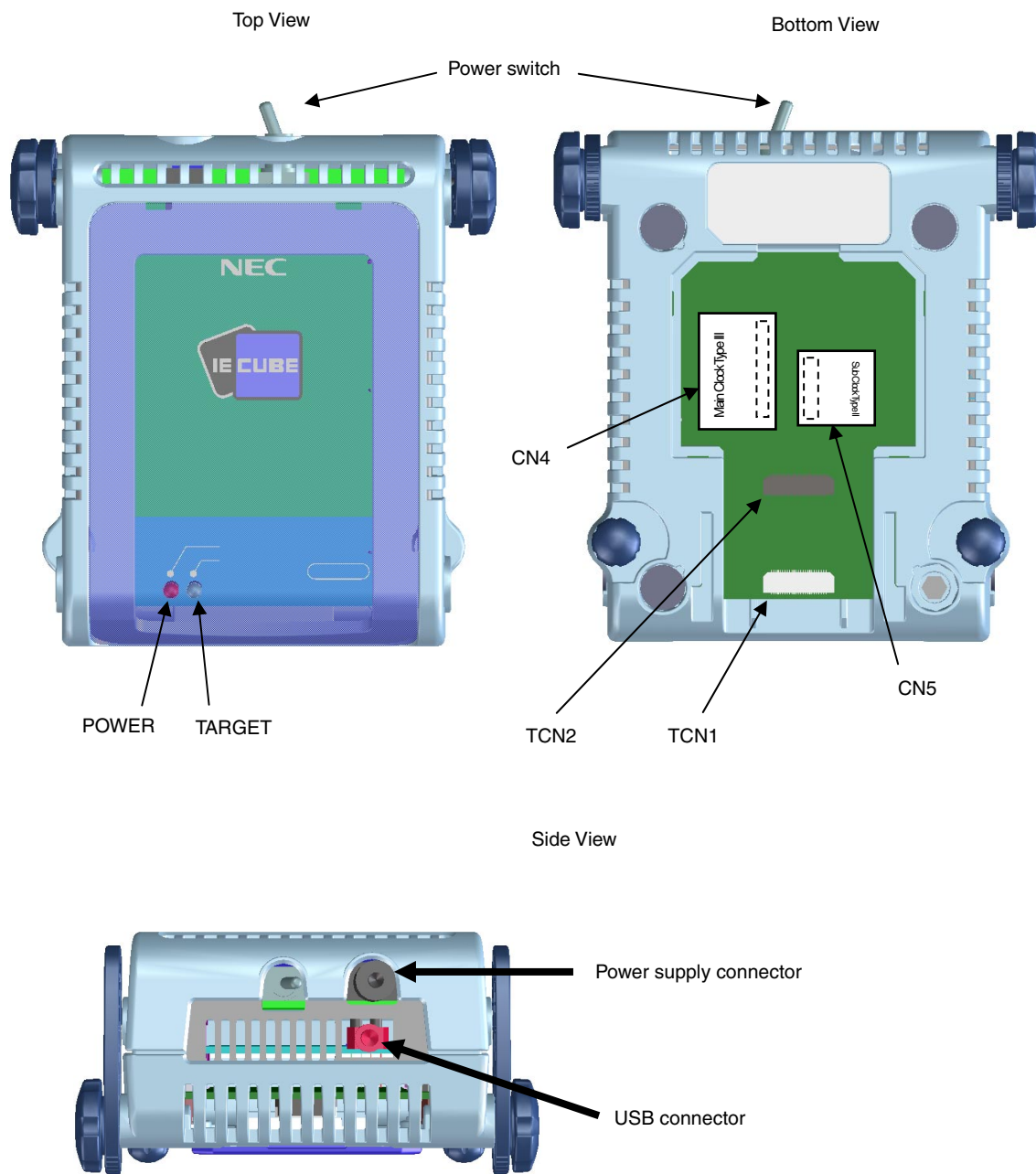
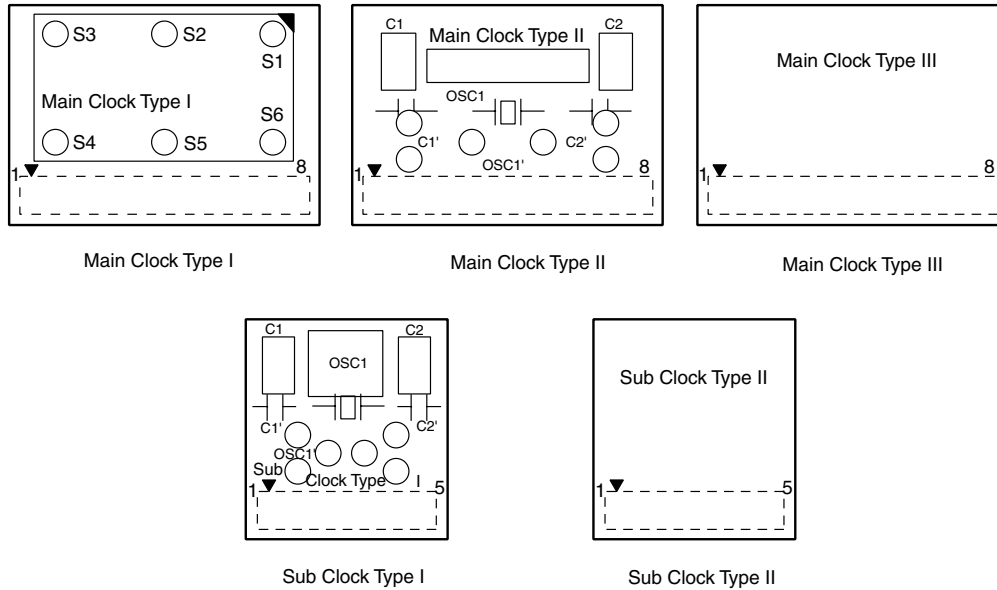


Figure 2-2. Clock Board



(1) **TCN1, TCN2**

These are connectors for connecting a check pin adapter or emulation probe.

(2) **CN4**

CN4 (Main clock board connector) is the connector for mounting the main clock board. Main Clock Type III is mounted at shipment.

(3) **CN5**

CN5 (Subclock board connector) is the connector for mounting the subclock board. Sub Clock Type II is mounted at shipment.

(4) **POWER (Red LED)**

This is an LED that shows whether or not the power supply of the QB-78K0KX1H is switched on.

LED State	QB-78K0KX1H State
Lit	Power switch ON
Not lit	Power switch OFF or AC adapter not connected to QB-78K0KX1H
Blinking	Internal error occurred (Contact an NEC Electronics sales representative or distributor)

(5) **TARGET (Green LED)**

This is an LED that shows whether or not the power supply of the target system is switched on.

LED State	Target System State
Lit	Target system power supply ON
Not lit	Target system power supply OFF or target system not connected

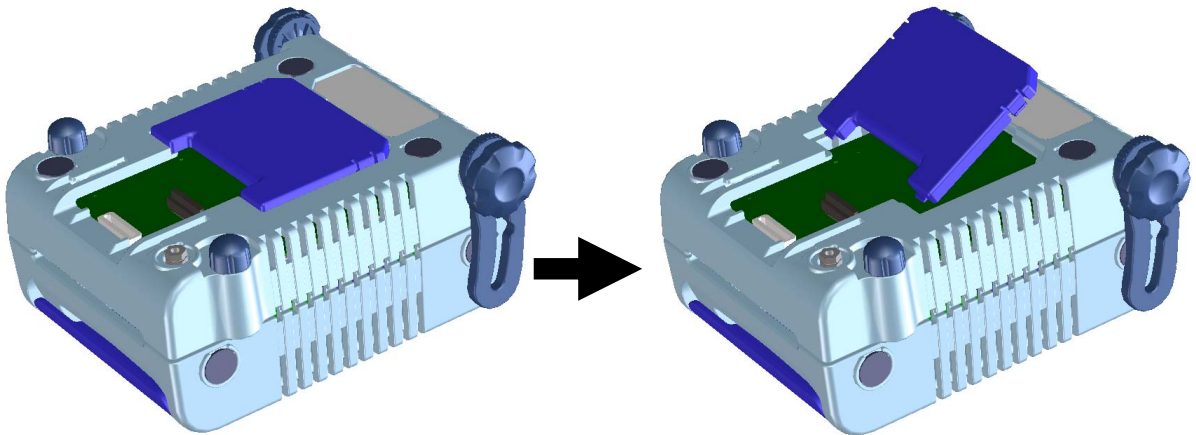
(6) **Power switch**

This is the power switch of the QB-78K0KX1H. It is OFF at shipment.

2.2 Removal of Acrylic Board

To modify the clock setup, the acrylic board on the bottom of the QB-78K0KX1H must be removed. The acrylic board can be removed by lifting it up.

Figure 2-3. Acrylic Board Removal Method



2.3 Clock Settings

2.3.1 Overview of clock settings

The following 7 types of clock settings are available.

For details, see **2.3.2 Clock setting methods**.

Main system clock

- (1) Mount the clock board in CN4 and use the internally generated clock
- (2) Mount the clock board in CN4 and use an externally input clock
- (3) Mount the oscillator clock board in CN4 and generate the clock from the clock board
- (4) Mount the oscillation circuit clock board in CN4 and generate the clock from the clock board

Subsystem clock

- (1) Mount the clock board in CN5 and use the internally generated clock
- (2) Mount the clock board in CN5 and use an externally input clock
- (3) Mount the oscillation circuit clock board in CN5 and generate the clock from the clock board

2.3.2 Clock setting methods

This section shows the hardware settings when setting the clock.

Table 2-1. Hardware Settings When Setting Main System Clock

Type of Clock to Use	CN4	Remarks
(1) Mount clock board in CN4 and use internally generated clock	Mount Main Clock Type III in CN4.	Mounted in CN4 at shipment
(2) Mount clock board in CN4 and use externally input clock	Mount Main Clock Type III in CN4.	Mounted in CN4 at shipment
(3) Mount oscillator clock board in CN4 and generate clock from clock board	Mount Main Clock Type I on which oscillator is mounted in CN4.	
(4) Mount oscillation circuit clock board in CN4 and generate clock from clock board	Mount Main Clock Type II on which oscillation circuit is assembled in CN4.	

Remark Settings other than the above are prohibited.

Table 2-2. Hardware Settings When Setting Subsystem Clock

Type of Clock to Use	CN5	Remarks
(1) Mount clock board in CN5 and use internally generated clock	Mount Sub Clock Type II in CN5	Mounted in CN5 at shipment
(2) Mount clock board in CN5 and use externally input clock	Mount Sub Clock Type II in CN5	Mounted in CN5 at shipment
(3) Mount oscillation circuit clock board in CN5 and generate clock from clock board	Mount Sub Clock Type I on which oscillation circuit is assembled in CN5	

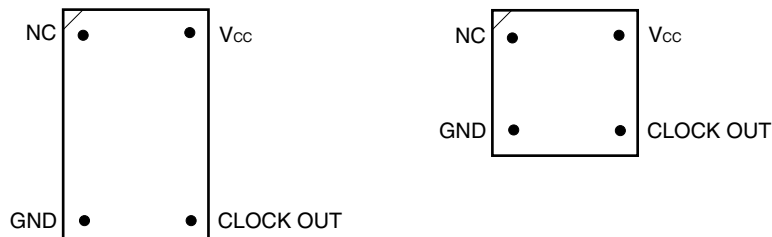
Remark Settings other than the above are prohibited.

2.3.3 Main system clock

(1) For mounting Main Clock Type I (for oscillator use)

- ◆ Things to prepare
 - Oscillator (with pins as shown in Figure 2-4 and 5 V power supply)

Figure 2-4. Oscillator (Main System Clock)



Top View

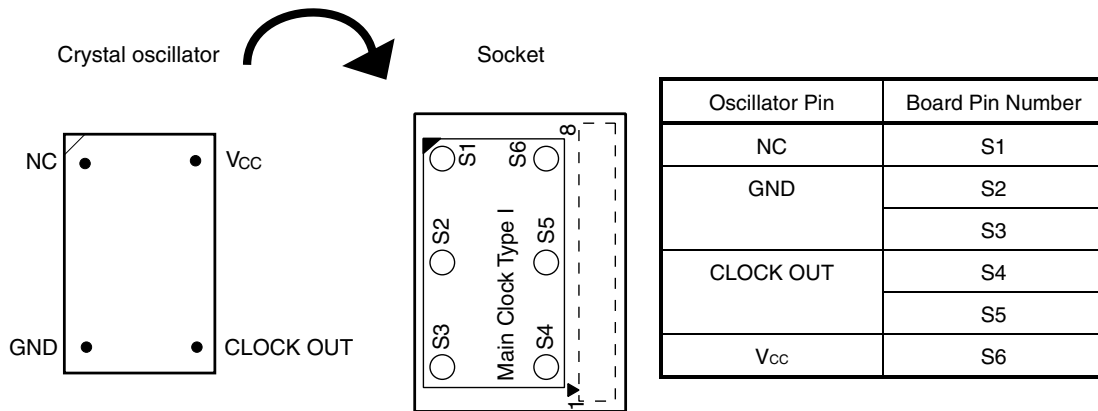
<Procedure>

<1> Prepare the QB-78K0KX1H and Main Clock Type I. Remove the clock board that is mounted in the CN4 socket on the QB-78K0KX1H.

When removing the clock board, do so carefully, since the pins of the CN4 socket bend easily.

<2> Implement the prepared oscillator in Main Clock Type I. Carefully insert it in the direction of the number 1 pin mark.

Figure 2-5. Mapping of Oscillator to Main Clock Type I (Main System Clock)



<3> Fit Main Clock Type I prepared in <2> in the CN4 socket from which the clock board was removed in <1>.

In the configuration dialog box of the debugger, only the "Clock Board" button can be selected (others displayed in gray) at this time. For the frequency at this time, the clock of the oscillator that is mounted on the clock board is used.

(2) For mounting Main Clock Type II (for oscillation circuit use)

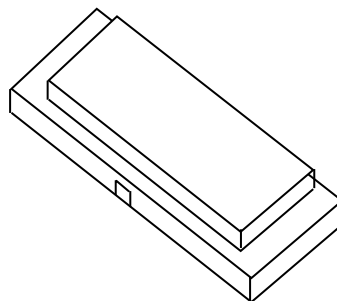
(a) When using 3-pin type resonator

◆ Things to prepare

- Ceramic resonator or crystal resonator^{Note}
- Soldering tool set

Note CSTCE10M0G (by Murata Mfg. Co., Ltd.) is assumed.

Figure 2-6. Resonator (Main System Clock: 3-Pin)



<Procedure>

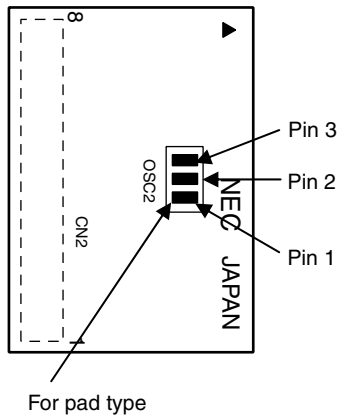
<1> Prepare the QB-78K0KX1H and Main Clock Type II. Remove the clock board that is mounted in the CN4 socket on the QB-78K0KX1H.

When removing the clock board, do so carefully, since the pins of the CN4 socket bend easily.

<2> Solder the ceramic resonator or crystal resonator used in OSC1 of Main Clock Type II.

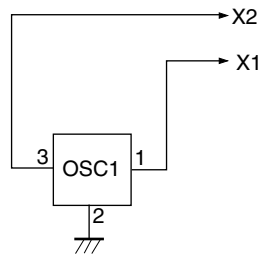
Figure 2-7. Connection to Main Clock Type II (Main System Clock: 3-Pin)

Main Clock Type II (Back)



Pin Number	Connection
OSC2	Ceramic resonator or crystal resonator

Circuit Diagram



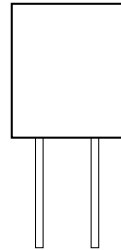
<3> Fit Main Clock Type II of <2> in the CN4 socket from which the clock board was removed in <1>.

(b) When using 2-pin type resonator

◆ Things to prepare

- Ceramic resonator or crystal resonator
- Capacitor C1
- Capacitor C2
- Soldering tool set

Figure 2-8. Resonator (Main System Clock: 2-Pin)



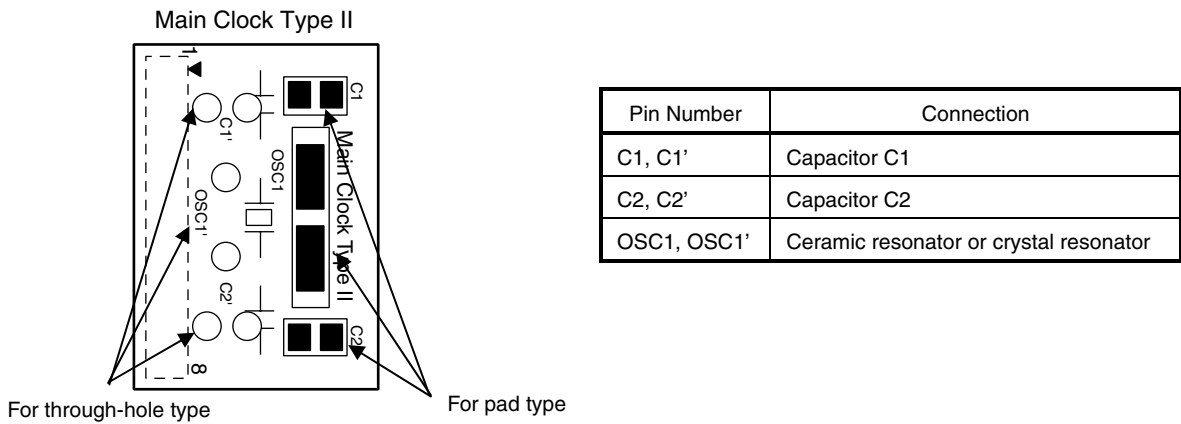
<Procedure>

<1> Prepare the QB-78K0KX1H and Main Clock Type II. Remove the clock board that is mounted in the CN4 socket on the QB-78K0KX1H.

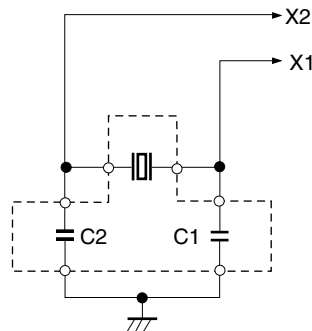
When removing the clock board, do so carefully, since the pins of the CN4 socket bend easily.

<2> Solder the ceramic resonator or crystal resonator used in OSC1 of Main Clock Type II and capacitor C1 and capacitor C2 conforming with its oscillation frequency as follows. When soldering, use either through-hole types or pad types.

Figure 2-9. Connection to Main Clock Type II (Main System Clock: 2-Pin)



Circuit Diagram



<3> Fit Main Clock Type II of <2> in the CN4 socket from which the clock board was removed in <1>.

In the configuration dialog box of the debugger, only the "Clock Board" button can be selected at this time (others are displayed in gray). For the frequency at this time, the clock of the oscillation circuit that is mounted on the clock board is used.

(3) For mounting Main Clock Type III (for internally generated clock or externally input clock use)

Main Clock Type III is fitted in the CN4 socket at shipment. If in the same state as at shipment, hardware settings are unnecessary.

In the configuration dialog box of the debugger, only "External" or "System" can be selected at this time ("Clock Board" is displayed in gray). If "External" is selected, a clock that is input from the target system is used. If "System" is selected, select the desired frequency from the dialog menu.

If inputting an external clock, input a square wave^{Note} of the same potential as the target device in the clock pin (X1, XT1) (input of inverse waveform to X2, XT2 is unnecessary).

Note Square waves from oscillators using a resonator are not supported.

2.3.4 Subsystem clock

(1) For mounting Sub Clock Type I (For oscillation circuit use)

◆ Things to prepare

- Ceramic resonator or crystal resonator^{Note}
- Capacitor C1
- Capacitor C2
- Soldering tool set

Note The resonator used is assumed to be NC-206 (by Kyushu Dentsu Co., Ltd.).

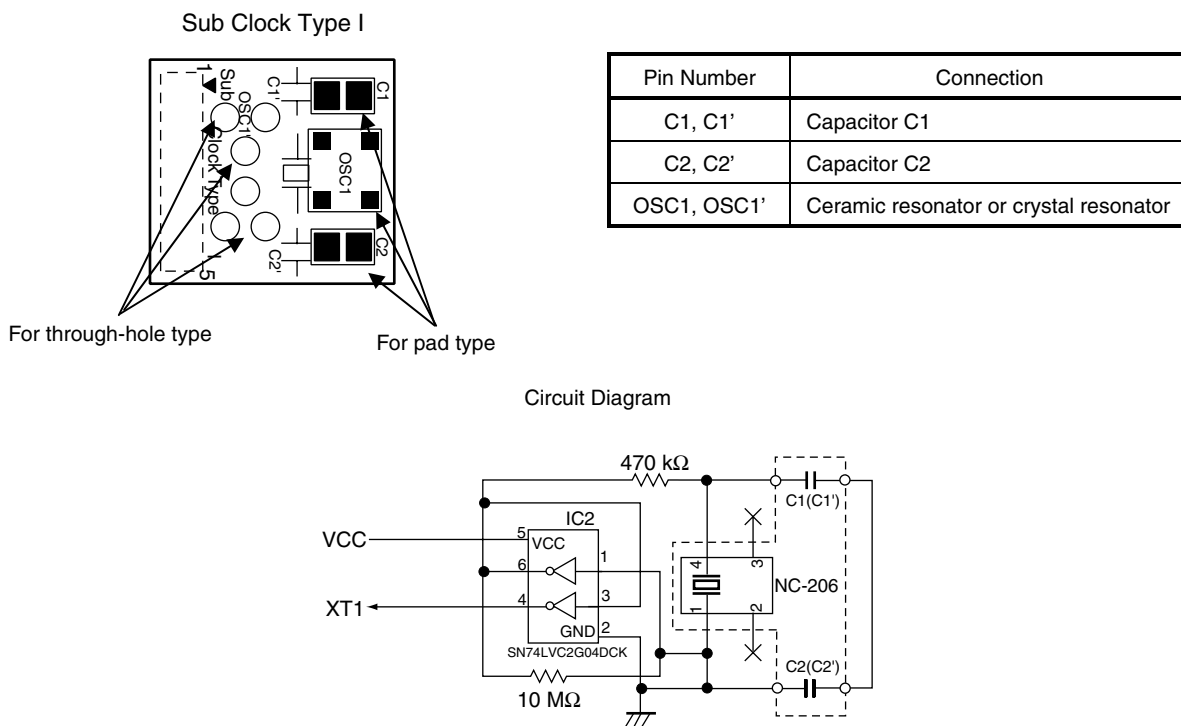
<Procedure>

<1> Prepare the QB-78K0KX1H and Sub Clock Type I. Remove the clock board that is mounted in the CN5 socket on the QB-78K0KX1H.

When removing the clock board, do so carefully, since the pins of the CN5 socket bend easily.

<2> Solder the ceramic resonator or crystal resonator that is used in Sub Clock Type• and capacitor C1 and capacitor C2 that conform to its oscillation frequency as follows.

Figure 2-10. Connection to Subclock Type I (Subsystem Clock)



Remark Places surrounded by broken lines indicate portions installed on the parts board.

<3> Fit Sub Clock Type I of <2> in the CN5 socket from which the clock board was removed in <1>.

In the configuration dialog box of the debugger, only the "Clock Board" button can be selected at this time (others are displayed in gray). For the frequency at this time, the clock of the oscillation circuit that is mounted on the clock board is used.

(2) For mounting Sub Clock Type II (for internally generated clock or externally input clock use)

Sub Clock Type II is fitted in the CN5 socket at shipment. If in the same state as at shipment, hardware settings are unnecessary.

In the configuration dialog box of the debugger, only "External" or "System" can be selected at this time ("Clock Board" is displayed in gray). If "External" is selected, a clock that is input from the target system is used. If "System" is selected, select the desired frequency from the dialog menu.

If inputting an external clock, input a square wave^{Note} of the same potential as the target device to the clock pin (X1, XT1) (input of inverse waveform to X2, XT2 is unnecessary).

Note Square waves from oscillators using a resonator are not supported.

2.4 Software Settings

For details, see the ID78K0-QB Ver. 2.81 Integrated Debugger Operation User's Manual (U16996E).

<R> 2.5 Mounting and Connecting Connectors

This section describes the methods of connecting the QB-78K0KX1H and target system.

Make connections with both the QB-78K0KX1H and target system powered OFF.

The following abbreviations are used in this section.

- TC: Target connector
- YQ: YQ connector
- EA: Exchange adapter
- HQ: Mount adapter
- CA: Check pin adapter
- YS: Space adapter

<R> 2.5.1 Mounting TC in target system

- (1) Thinly apply a two-component epoxy adhesive (hardening time at least 30 minutes) to the ends of the four projections on the base of the TC and adhere the TC to the user board (clean the surface of the user board using alcohol or the like). If alignment of user board pads to TC leads is difficult, align them as in (2).
- (2) Align by inserting the guide pins for alignment for the TC (TC -Guide) through the pin holes on the top of the TC. Accessory holes are $\phi 1.0$ mm non-through holes in 2 or 3 places.
(For hole positions, see the particular TC drawing.)
- (3) Solder after fitting the HQ to the TC. This is to prevent troubles such as flux or solder splashing and adhering to the TC contact pins when soldering.
 - Soldering conditions Solder reflow $240^{\circ}\text{C} \times 20$ seconds or less
 Manual soldering $240^{\circ}\text{C} \times 10$ seconds or less (1 pin)

Caution Do not perform washing by flux immersion or vapor.

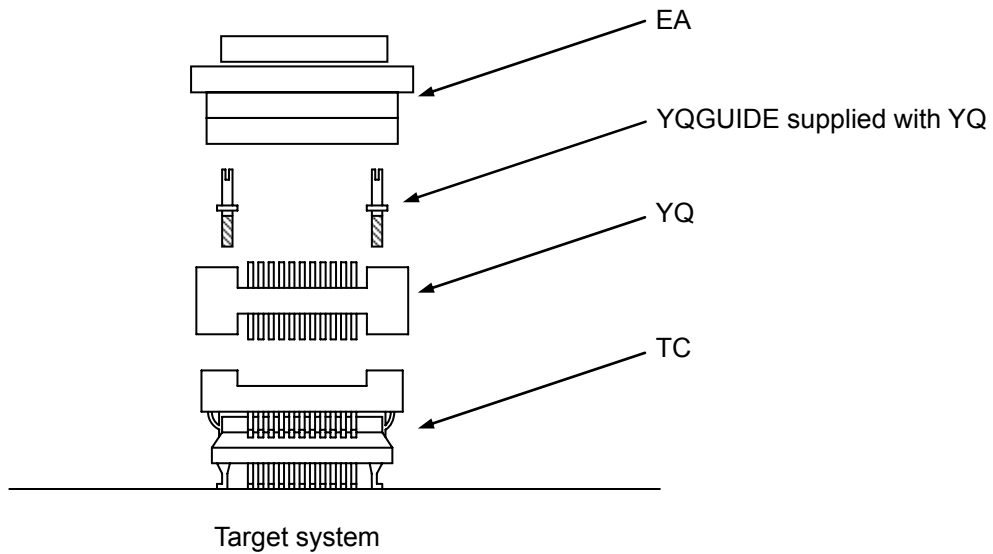
- (4) Take away the guide pins.

<R>

2.5.2 Mounting YQ on TC

- (1) After confirming that there are no broken or bent YQ contact pins, fit the YQ onto the TC and use the provided YQGUIDE screws to fix it into place. (See (2) for how to fix.) If repeatedly inserting and removing, be sure to inspect the YQ pins before fitting. If pins are bent, correct them using something thin and flat such as the edge of a knife.
- (2) Use the provided YQGUIDE screws to fix the YQ onto the TC on the target system. Use the provided slotted screwdriver or a torque driver to fasten the screws equally in the four corners. The tightening torque of the YQGUIDE screws should be no more than 0.55 kgf • cm (0.054 Nm). Too great tightening causes bad connections.

Screws for fitting to the MA (M2 × 10 mm/4) are included with the YQ.



<R> 2.5.3 Plugging EA into YQ

Match the No. 1 pin position of the YQ or YS (C cuts match in both) to the No. 1 pin position of the EA and plug in.

- When plugging or unplugging, press on the TC, YQ, and YS with a finger so that there is no force on the TC.
- When plugging or unplugging, be careful of the direction of rocking.

As a tool when unplugging, insert a bamboo skewer or the like between the YQ (YS) and EA and rock while slowly unplugging. Be careful since the connector will be damaged if this is done in the wrong direction.

<R> 2.5.4 Precautions for handling TC, YQ, YS

- (1) When taking the TC from the box, press down on the body and take out the sponge first.
- (2) Since the pins of the YQ are thin and easily bent, be careful. When inserting it in the TC, confirm that there are no bent pins.
- (3) When screwing a YQ soldered to a board to the TC, fasten the screws in four places in turn using a No. 0 or No. 1 (+) precision driver or torque driver after tentatively tightening them. Fix the torque at 0.054 Nm (Max.). If just one place is overtightened, it may cause poor contact. Moreover, a board being connected to the YQ must have accessory holes in prescribed positions (4 places: $\phi 2.3$ mm or $\phi 3.3$ mm). The $\phi 3.8$ mm or $\phi 4.3$ mm that is the screw head size is an area where wiring is prohibited.
- (4) In YQ and YS removal, since there is a danger of YQ pins being bent or broken when prying and rocking, remove them gradually using a (-) driver from four directions. Moreover, to connect and use the YQ and YS, screw the YQ to the TC according to the YQGUIDE (sold separately) using a 2.3 mm (-) driver and then connect it to the YS. Fix the torque at 0.054 Nm (Max.). If even one place is overtightened, it may cause poor contact.
- (5) For the TC, YQ, and YS, since there is a danger that washing fluid on the structure will remain in the connector, do not perform washing.
- (6) TC, IC, and YQ cannot be used in combination.
- (7) An TC /YQ system cannot be used in an environment of vibrations or shocks.
- (8) It is assumed that this product will be used in system development and evaluation. Moreover, when used in Japan, Electrical Appliance and Material Control Law and electromagnetic disturbance countermeasures have not been applied.
- (9) Since there are rare cases of shape change if the box is left for a long time in a place where it is 50°C or higher, for safekeeping, store it in a place where it is no higher than 40°C and direct sunlight does not hit it.
- (10) For details about handling the TC, YQ, and YS, see the TCPACK series technical materials at the website of Tokyo Eletech Corporation.

Tokyo Eletech Corporation website: <http://www.tetc.co.jp/>

<R>

2.5.5 Precautions on mounting TC and IC

- (1) Confirm that there is no weld flash in the resin (sealant part) of the IC. If there is weld flash, remove it using a knife or the like.
- (2) Confirm that there is no weld flash breaking or bending of IC leads. In particular, confirm the planarity of IC leads. If there is abnormality in the planarity, correct that portion.
- (3) Viewing the TC contact pins from the top, if there are foreign bodies on them, remove them using a brush or the like.

After confirming (1) to (3), fit the IC to the TC. Also fit the HQ.

- (4) Put the supplied M2 × 6 mm screws in the 4 accessory holes of the HQ and fasten the screws in opposite corners. At that time, use either the dedicated screw driver that is supplied or a torque driver to fasten them equally in turn with a tightening torque of MAX. 0.55 kg • f (0.054 Nm). Since the contact is poor if tightening is too great, once you have lightly fastened the HQ screws, tighten them again.
- (5) Depending on the use environment, when starting up a device that has been left for a long time, starting it may be difficult. In this case, loosen the screws slightly and then retighten them.
- (6) If startup still is difficult after (5) above, check (1) to (3) again.
- (7) Tightening the screws of the HQ too much may give rise to cracks in the molded part of the HQ (plastic part) and bend the mold into a bowed shape, making contact poor.
- (8) After soldering the TC, do not perform washing by flux immersion or vapor.

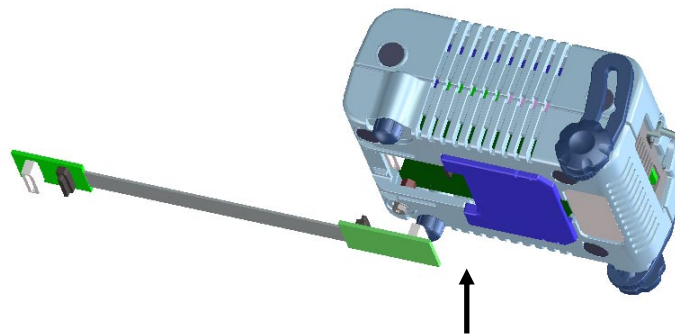
2.6 Connection of QB-78K0KX1H to Target System

If connecting the emulation probe (QB-80-EP-01T), connect it to the QB-78K0KX1H and the target system by the following procedure.

(a) Connection of emulation probe

Connect the emulation probe to the QB-78K0KX1H.

Figure 2-11. Emulation Probe Connection Method



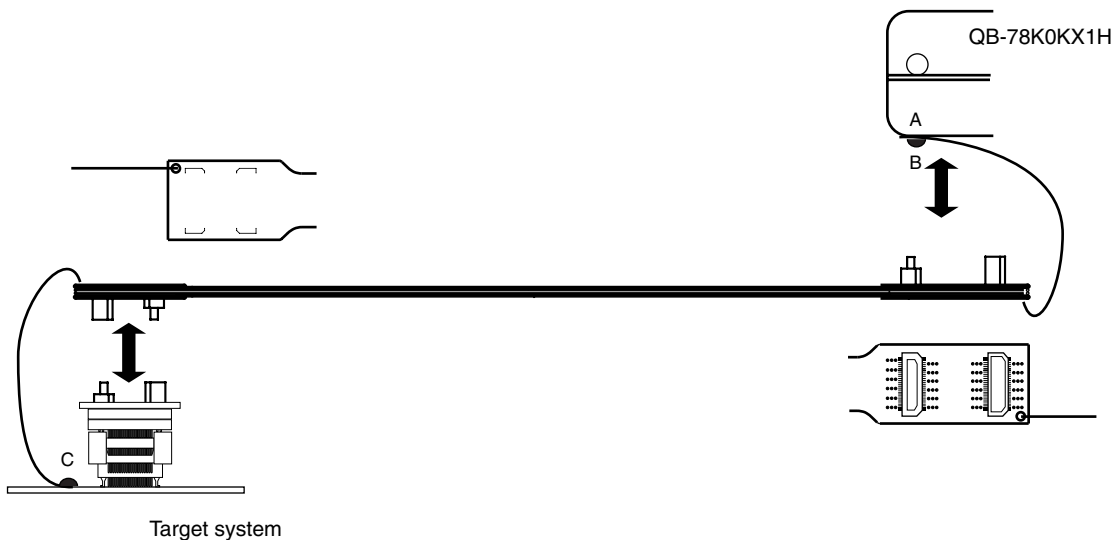
Insert CN1 and CN2 of the probe into TCN1 and TCN2 of the QB-78K0KX1H.

(b) Connection of emulation probe GND wire

There are 2 GND wires in the emulation probe. Connect them to the QB-78K0KX1H and target system.

- <1> Fasten the GND wire on the QB-78K0KX1H side of the emulation probe to the nut on the bottom of the QB-78K0KX1H using a #0 or #1 (+) precision driver (connection of B to A in Figure 2-12).
- <2> Next plug the connector on top of the emulation probe into the connector in the opening in the bottom of the QB-78K0KX1H from below being careful of the insertion direction.

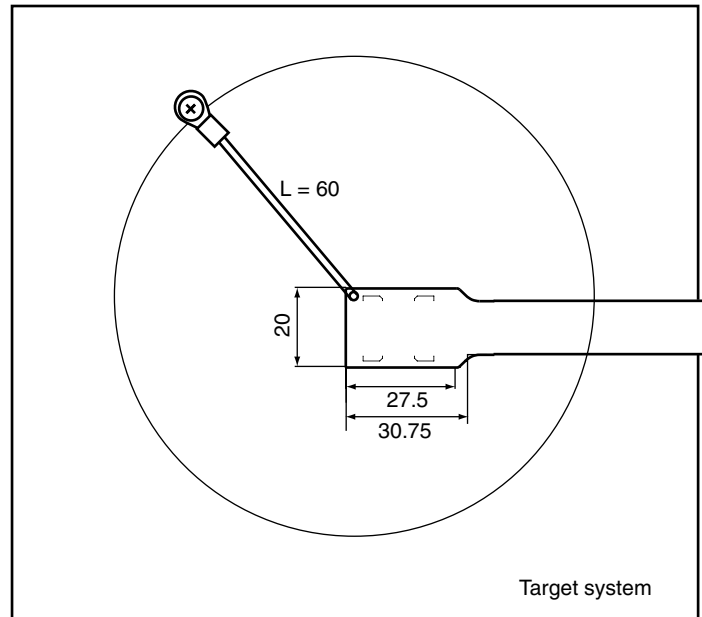
Figure 2-12. GND Wire



- <3> Connect the exchange adapter and emulation probe to the target connector.
- <4> Connect the GND wire on the target system side of the emulation probe to the target system GND. If a pin or screw is fastened to the target system GND, remove the transparent terminal cover on the end of the GND wire and fasten the Y terminal of the GND wire to the target system (C in Figure 2-12). If the GND on the target system is an exposed pad, likewise fasten the Y terminal to the pad on the target system by soldering (recommended soldering iron temperature setting: 300°C).

<5> Since the length of the GND wire below the head (insulated part) is approximately 60 mm, there must be a GND to which it can be connected in the range of an approximately 60 mm radius of the section of the target system for connecting the emulation probe, as shown in Figure 2-13.

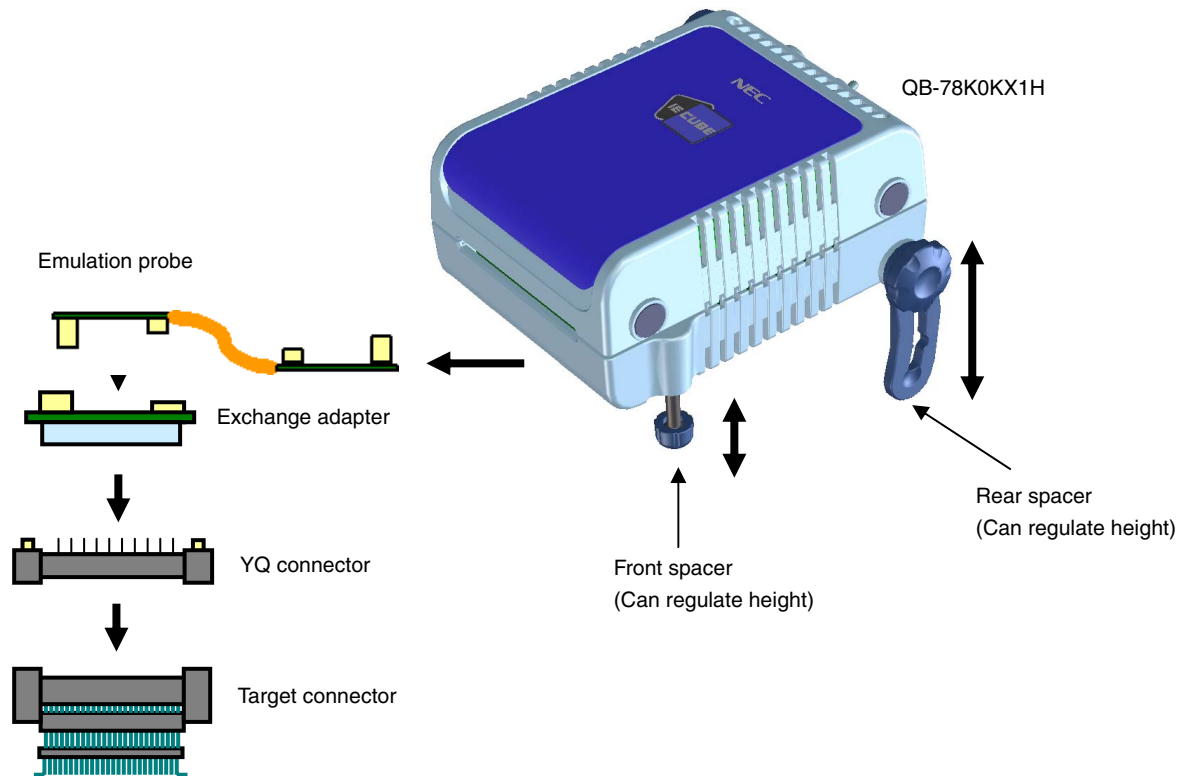
Figure 2-13. Where GND Wire Can Be Connected



(c) Ensuring isolation

When connecting the target system to the QB-78K0KX1H using an emulation probe, perform height regulation using the front spacer or rear spacer of the QB-78K0KX1H and ensure isolation from the target system.

Figure 2-14. Connection Using Emulation Probe

**(d) Precautions related to emulation probe**

The following precautions pertain to using the emulation probe.

- <1> Be careful that stress of the emulation probe is not placed on the target connector. Moreover, when removing the emulation probe, remove it slowly while pressing down on the exchange adapter with a finger so that there is no stress on the target connector.
- <2> Be sure to connect the GND wire of the emulation probe to the QB-78K0KX1H and the target system. If it cannot be connected, the impedance of the cable is unstable and could bring about lowering of signal transmission characteristics or distortion of the output waveform for an input waveform.

2.7 Power Supply and GND Pin Connection Precautions

For power supplies and GND pins of the target device, be sure to connect all pins to each power supply or GND.

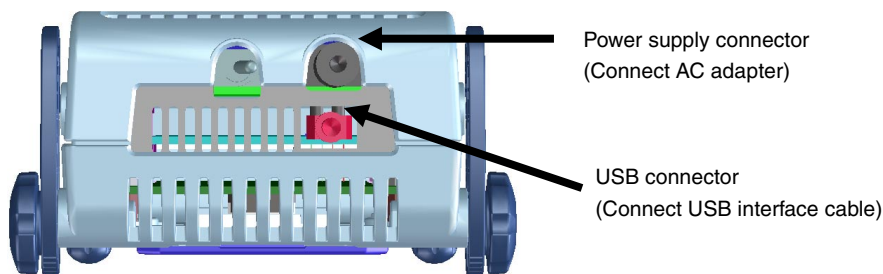
2.8 Connection of USB Interface Cable and AC Adapter

Plug the USB interface cable supplied with the QB-78K0KX1H into the USB connector of the host machine and also plug it into the USB connector on the rear of the QB-78K0KX1H.

Plug the AC adapter supplied with the QB-78K0KX1H into a receptacle and plug it into the power supply connector on the rear of the QB-78K0KX1H.

<R> For QB-78K0KX1H connector positions, see **Figure 2-15**.

Figure 2-15. Connector Positions



2.9 Switching Power On and Off

Be sure to switch the power on and off according to the following procedures.

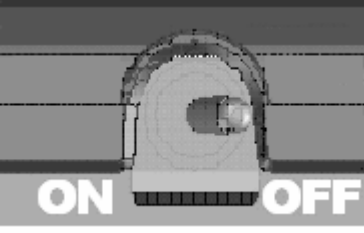
- | | |
|--|---|
| • Switching power on | • Switching power off |
| <1> QB-78K0KX1H power on | <1> Debugger termination |
| <2> Target system power on ^{Note} | <2> Target system power off ^{Note} |
| <3> Debugger startup | <3> QB-78K0KX1H power off |

Note In the procedures, <2> is unnecessary if the target system is not connected.

Caution If there is a mistake in the order, the target system or QB-78K0KX1H may fail.

CHAPTER 3 SETTINGS AT PRODUCT SHIPMENT

Table 3-1. Settings at Shipment

Item	Setting	Remarks
CN4	Main Clock Type III is mounted	
CN5	Sub Clock Type II is mounted	
Power switch		Set to OFF at shipment.

CHAPTER 4 DIFFERENCES BETWEEN TARGET INTERFACE CIRCUIT AND TARGET DEVICE

This chapter explains the differences between the signal lines of a target interface circuit of the QB-78K0KX1H and the signal lines of a target device

Although the target device is a CMOS circuit, the target interface circuit of the QB-78K0KX1H consists of an emulation circuit that depends on the emulation CPU, TTL, CMOS-IC, or other.

When the target system is debugged by connecting it to the QB-78K0KX1H, the QB-78K0KX1H emulates just as if the actual target device were operating on the target system.

However, small differences arise because the QB-78K0KX1H actually is emulating.

- (1) Signals input and output by emulation CPU (μ PD78F0148H)
- (2) Signals input and output by emulation CPU (FPGA)
- (3) Other signals

The circuits of the QB-78K0KX1H for the signals in (1) to (3) above are shown below by target device.

4.1 For 78K0/KB1 or 78K0/KB1+ Emulation

For the signals in (1) to (3) below, see **Figure 4-1 Emulation Circuit Equivalent Circuit 1.**

(1) Signals input and output by emulation CPU (μ PD78F0148H)

- P03 to P00
- P17 to P10
- P23 to P20
- P33 to P30
- P120
- P130
- AVREF, VDD

(2) Signals input and output by emulation CPU (FPGA)

- X1, $\overline{\text{RESET}}$, IC/VPP^{Note}

Note For the 78K0/KB1+, the pin name is FLMD0.

(3) Other signals

- X2, VSS, AVSS,

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

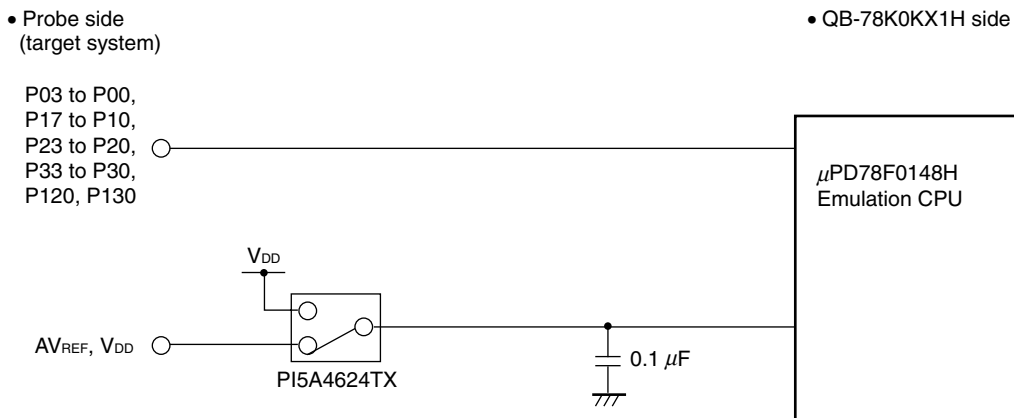
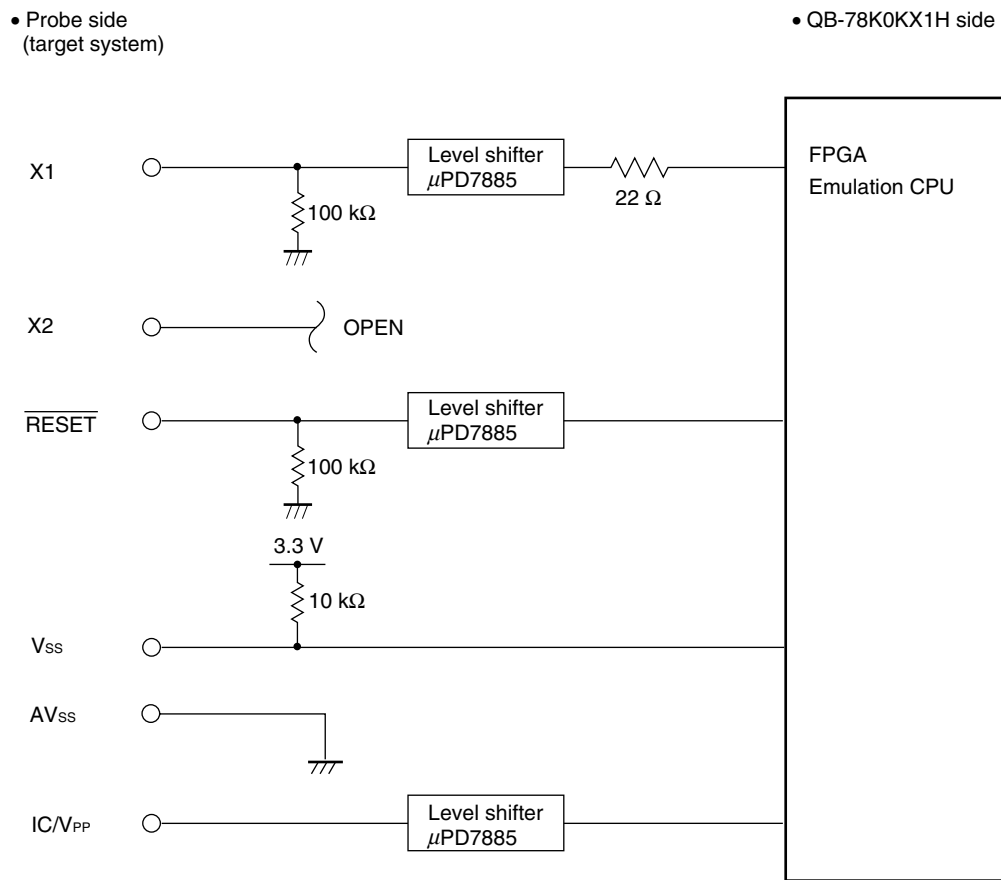


Figure 4-1. Emulation Circuit Equivalent Circuit 1 (2/2)



4.2 For 78K0/KC1 or 78K0/KC1+ Emulation

For the signals in (1) to (3) below, see **Figure 4-2 Emulation Circuit Equivalent Circuit 2**.

(1) Signals input and output by emulation CPU (μ PD78F0148H)

- P01, P00
- P17 to P10
- P27 to P20
- P33 to P30
- P73 to P70
- P120
- P130
- AVREF, VDD, EVDD

(2) Signals input and output by emulation CPU (FPGA)

- P63 to P60
- X1, XT1, RESET, VSS, IC/VPP^{Note}

Note For the 78K0/KC1+, the pin name is FLMD0.

(3) Other signals

- X2, XT2, EVSS, AVSS

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

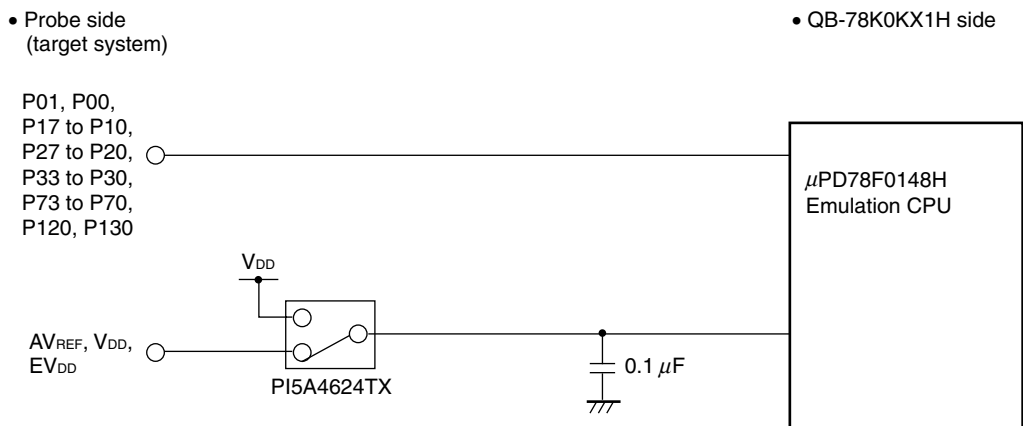
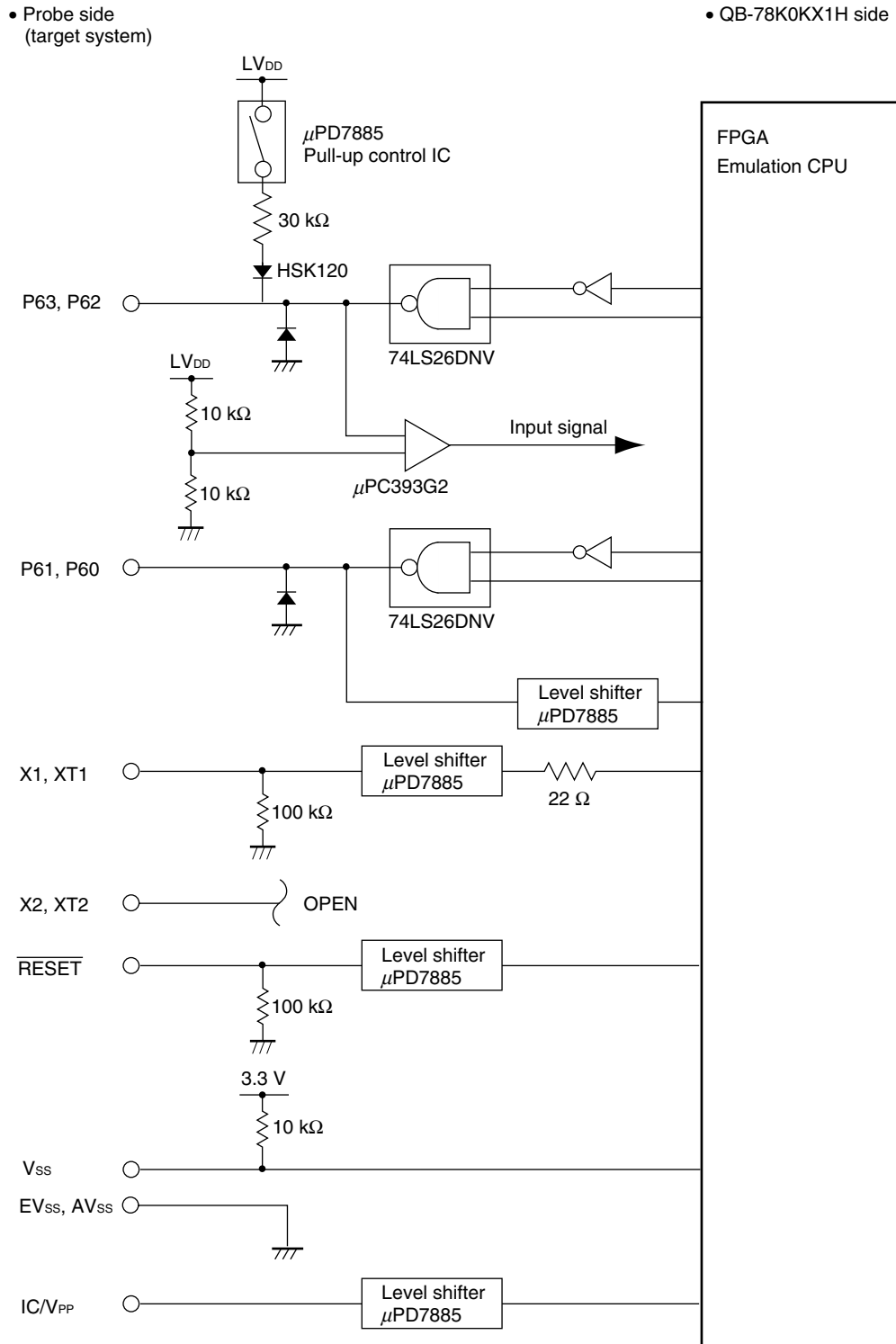


Figure 4-2. Emulation Circuit Equivalent Circuit 2 (2/2)



4.3 For 78K0/KD1 or 78K0/KD1+ Emulation

For the signals in (1) to (3) below, see **Figure 4-3 Emulation Circuit Equivalent Circuit 3**.

(1) Signals input and output by emulation CPU (μ PD78F0148H)

- P03 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P77 to P70
- P120
- P130
- P140
- AVREF, VDD, EVDD

(2) Signals input and output by emulation CPU (FPGA)

- P63 to P60
- X1, XT1, $\overline{\text{RESET}}$, VSS, IC/VPP^{Note}

Note For the 78K0/KD1+, the pin name is FLMD0.

(3) Other signals

- X2, XT2, EVSS, REGC, AVSS,

Figure 4-3. Emulation Circuit Equivalent Circuit 3 (1/2)

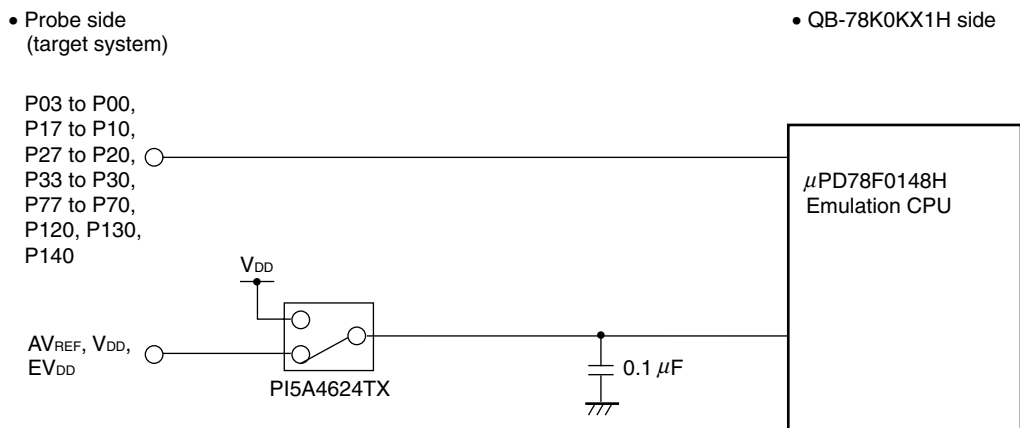
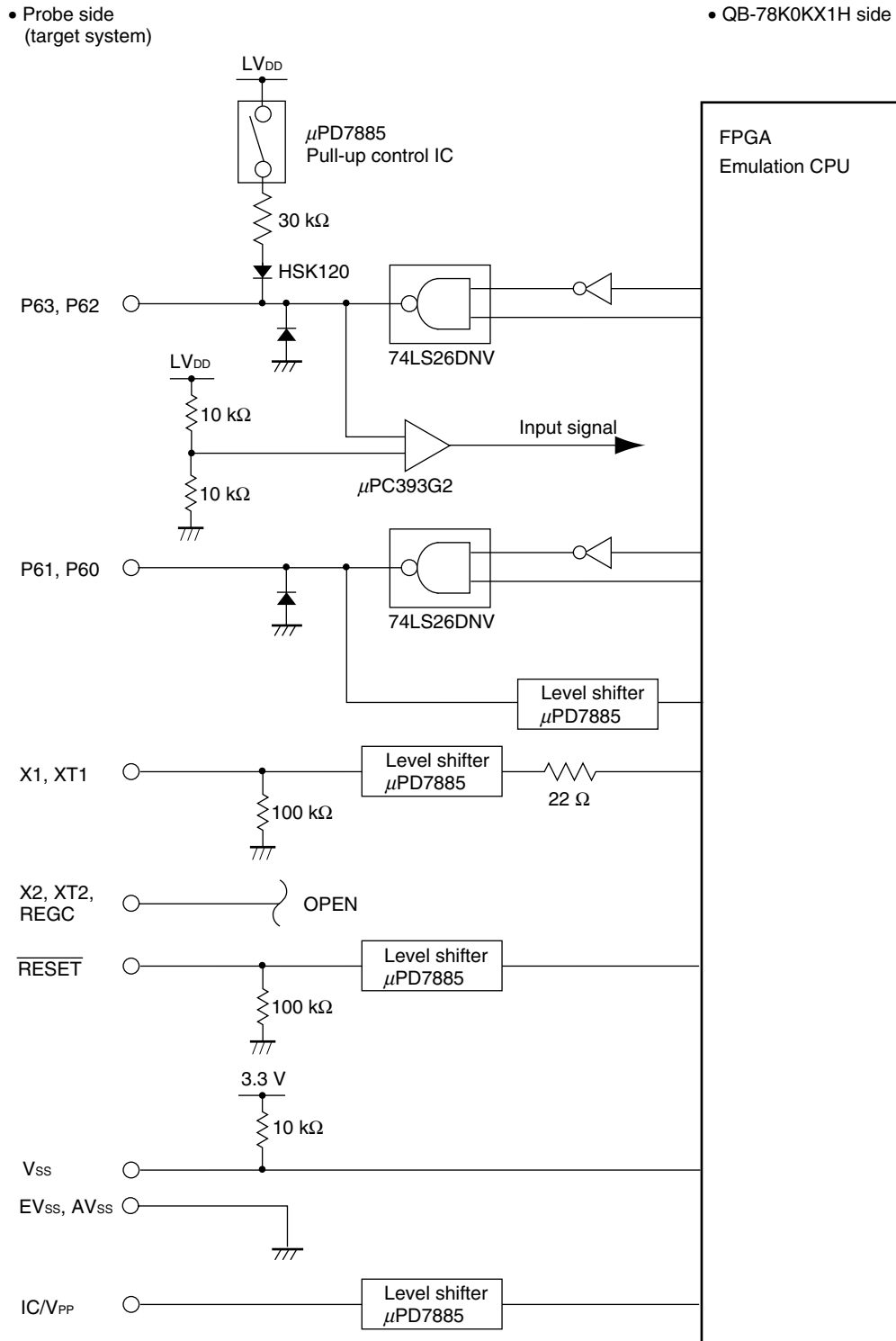


Figure 4-3. Emulation Circuit Equivalent Circuit 3 (2/2)



4.4 For 78K0/KE1 or 78K0/KE1+ Emulation

For the signals in (1) to (3) below, see **Figure 4-4 Emulation Circuit Equivalent Circuit 4**.

(1) Signals input and output by emulation CPU (μ PD78F0148H)

- P06 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P77 to P70
- P120
- P130
- P141, P140
- AVREF, VDD, EVDD

(2) Signals input and output by emulation CPU (FPGA)

- P43 to P40
- P53 to P50
- P63 to P60
- X1, XT1, $\overline{\text{RESET}}$, VSS, IC/VPP^{Note}

Note For the 78K0/KE1+, the pin name is FLMD0.

(3) Other signals

- X2, XT2, EVSS, REGC, AVSS

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

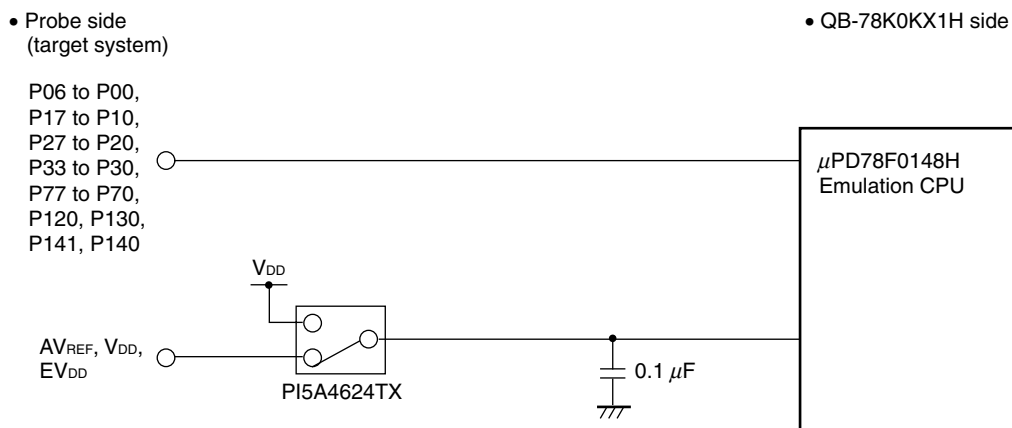
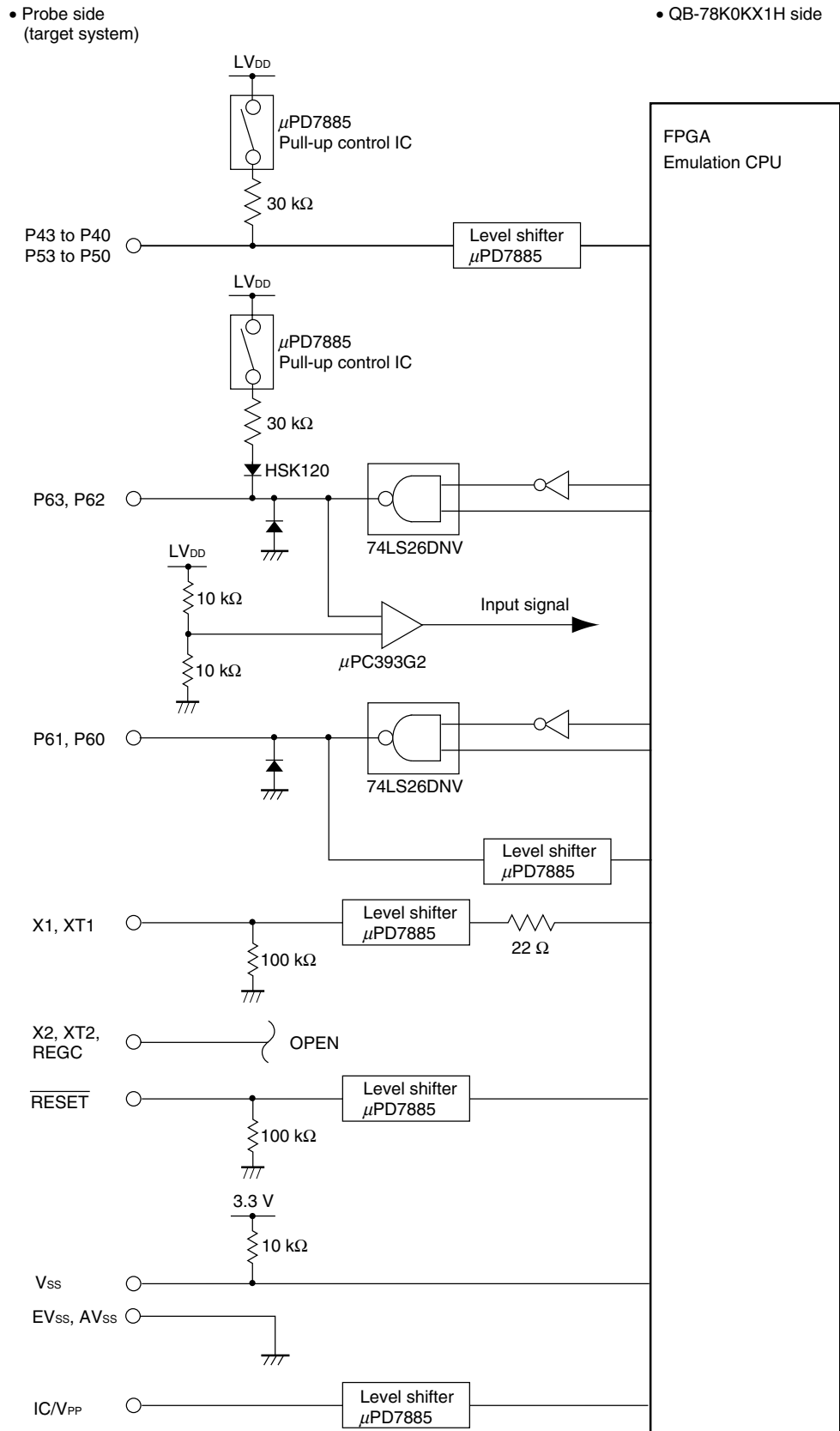


Figure 4-4. Emulation Circuit Equivalent Circuit 4 (2/2)



4.5 For 78K0/KF1 or 78K0/KF1+ Emulation

For the signals in (1) to (3) below, see **Figure 4-5 Emulation Circuit Equivalent Circuit 5**.

(1) Signals input and output by emulation CPU (μ PD78F0148H)

- P06 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P77 to P70
- P120
- P130
- P145 to P140
- AV_{REF}, V_{DD}, EV_{DD}

(2) Signals input and output by emulation CPU (FPGA)

- P47 to P40
- P57 to P50
- P67 to P60
- X1, XT1, RESET, V_{SS}, IC/V_{PP}^{Note}

Note For the 78K0/KF1+, the pin name is FLMD0.

(3) Other signals

- X2, XT2, EV_{SS}, REGC, AV_{SS}

Figure 4-5. Emulation Circuit Equivalent Circuit 5 (1/2)

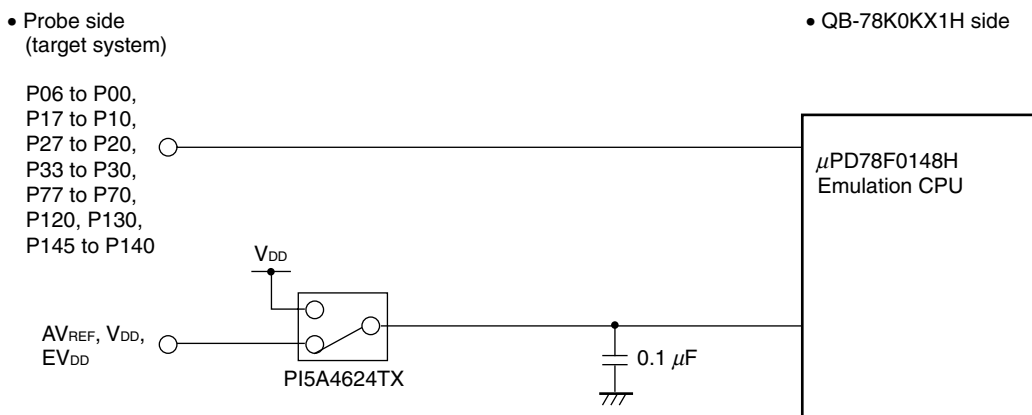
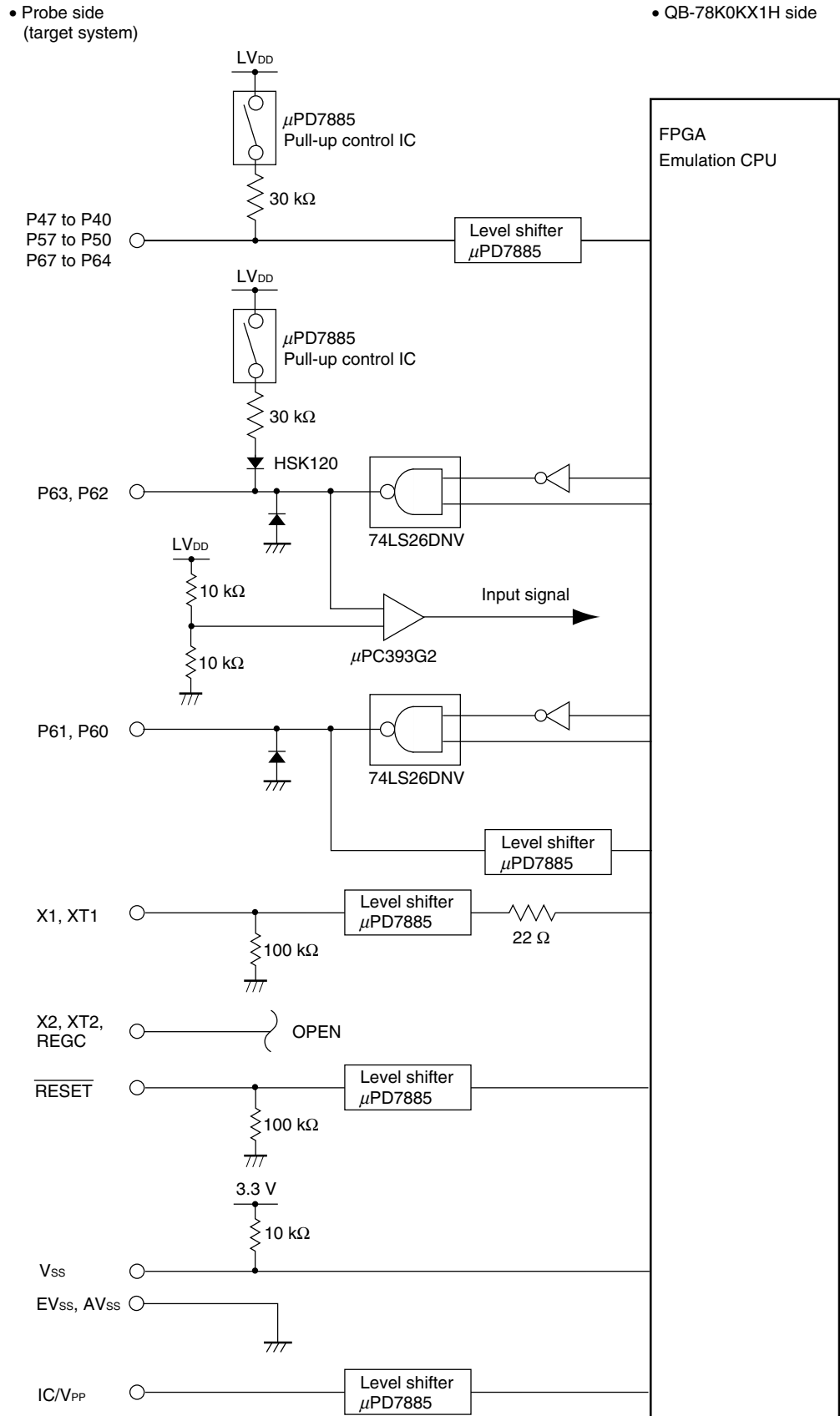


Figure 4-5. Emulation Circuit Equivalent Circuit 5 (2/2)



Observe the following cautions.

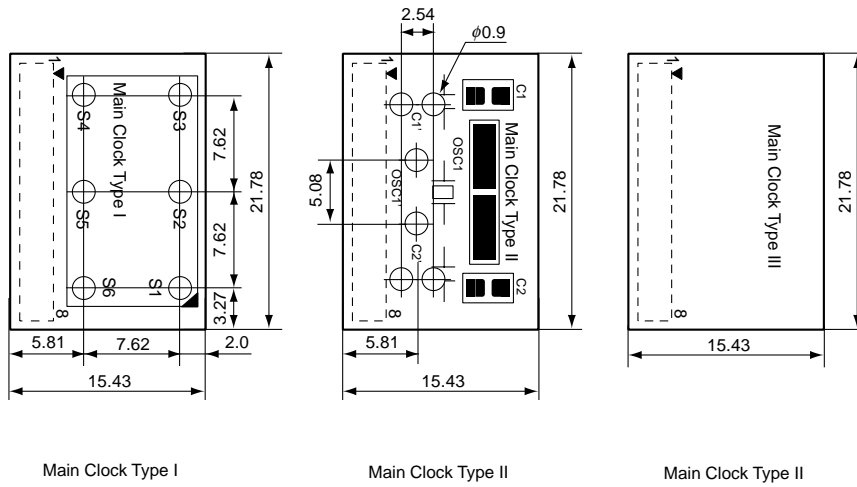
- Do not decrease the voltage of the target system during a break.
A reset generated by LVI or POC during a break may cause an incorrect operation of the debugger or communication errors.
- Even when using the product without connecting a target system, connect and use the emulation probe and exchange adapter.
If the product is used without connecting the emulation probe and exchange adapter, a warning window is displayed but use is possible.
- The function that sets the option byte to address 0080H cannot be emulated when a microcontroller that has an internal flash memory and an option byte function is used.
Set the option byte function in the mask option setting dialog of the debugger.

APPENDIX A PACKAGE DRAWINGS

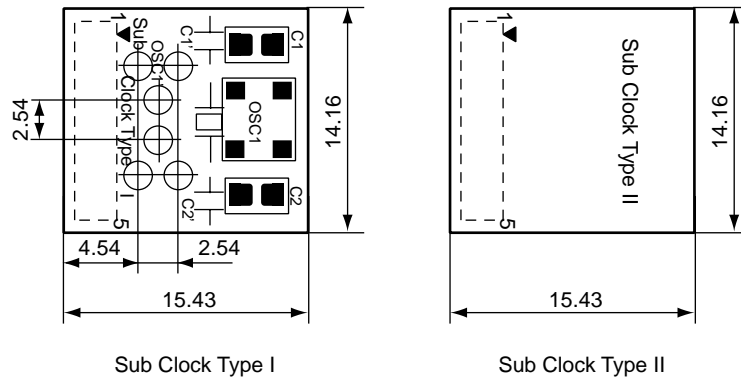
A.1 Clock Board

Figure A-1. Clock Board

(a) Main clock board



(b) Subclock board



APPENDIX B REVISION HISTORY

Revisions up to the previous edition are shown below. The “Applied to” column indicates the chapter in each edition to which the revision was applied.

Edition	Description	Applied to
2nd edition	Deletion of 1.3.1 AC adapter	CHAPTER 1 GENERAL
	Addition of APPENDIX C REVISION HISTORY	APPENDIX C REVISION HISTORY
3rd edition	1.3 System Configuration • Addition of Remark	CHAPTER 1 GENERAL
	1.4 Package Contents • Change of Products supplied with QB-78K0KX1H-ZZZ	
	Change of 2.3 Clock Settings	CHAPTER 2 SETUP PROCEDURE
	Deletion of APPENDIX A NOTES ON TARGET SYSTEM DESIGN from a previous edition	–
	Deletion of B.1 Target Connectors to B.7 Emulation Probe from a previous edition	APPENDIX A PACKAGE DRAWINGS
4th edition	1.3 System Configuration • Change AC plug of Figure 1-1 System Configuration • Change NQ of Table 1-10 Target Connection to TC • Change URL	CHAPTER 1 GENERAL
	1.4 Package Contents • Change NQ to TC	
	2.5 Mounting and Connecting Connectors • Change NQ to TC	CHAPTER 2 SETUP PROCEDURE
	Change of 2.5.2 Mounting YQ on TC	
	2.8 Connection of USB Interface Cable and AC Adapter • Deletion of types of AC adapter plug	
	Change of CHAPTER 5 CAUTIONS	CHAPTER 5 CAUTIONS
	Deletion of CHAPTER 6 RESTRICTIONS from a previous edition	–

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