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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+

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Date Published October 2007 NS

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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.

- General
- Setup procedure
- Settings at product shipment
- Differences between target device and target interface circuit
- Cautions
- Restrictions

How to Read This Manual

It is assumed that the readers of this manual have general knowledge in the fields of electrical engineering, logic circuits, and microcontrollers.
This manual describes the basic setup procedures and how to set switches.

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.

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.

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**.

CONTENTS

CHAPTER 1 GENERAL

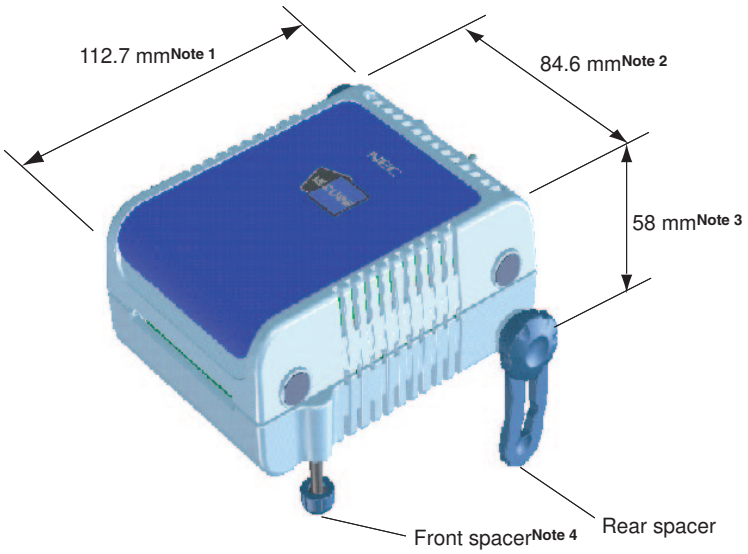
The QB-78K0KX1H is an in-circuit emulator for emulating the 78K0/Kx1 or 78K0/Kx1+.

Hardware and software can be debugged efficiently in the development of systems in which the 78K0/Kx1 or 78K0/Kx1+ is used. This manual descries 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 1. Does not include projection of power switch

2. Includes projection of screw that fixes rear spacer

3. Dimension when rear spacer is made shortest (88 mm when longest)

4. 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 μs)
	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

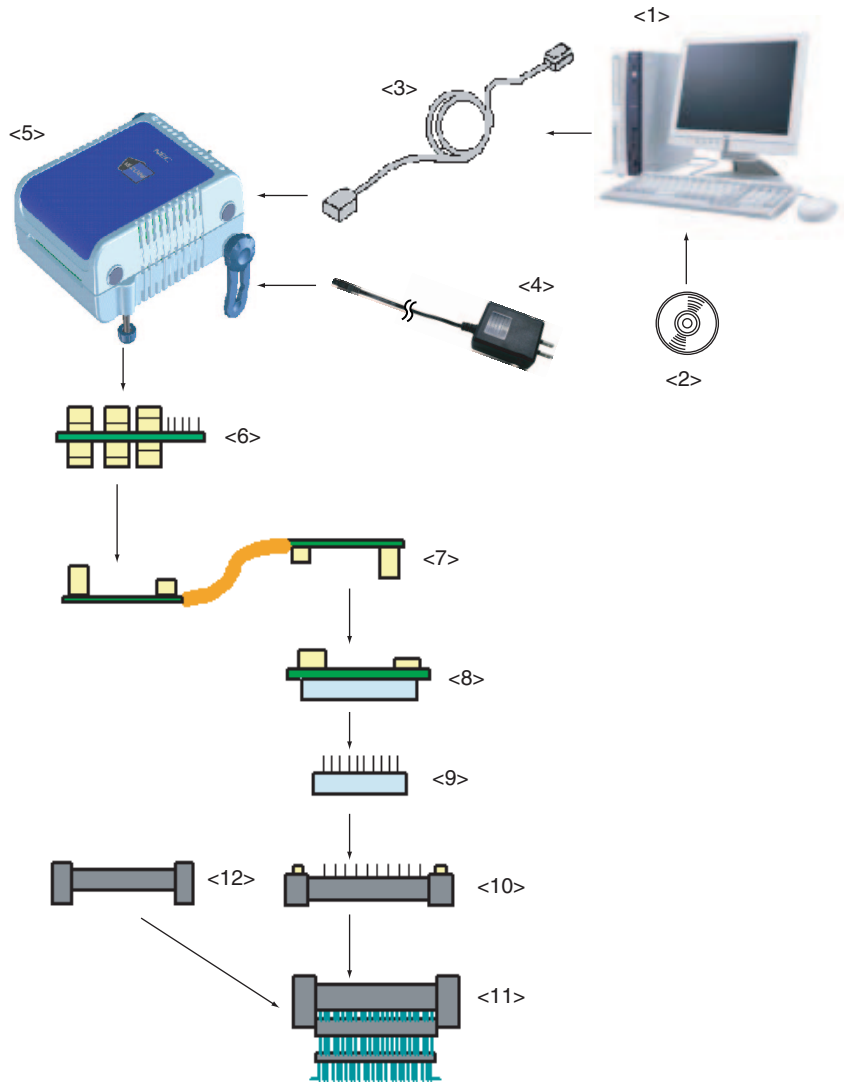
Device Name (Common Name)	Package	Device Name	
		Flash Memory Version	Mask ROM Version
78K0/KB1	30-pin SSOP (MC)	μPD78F0103	μPD780101, μPD780102, μPD780103
78K0/KC1	44-pin LQFP (GB)	μPD78F0114	μPD780111, μPD780112, μPD780113, μPD780114
78K0/KD1	52-pin QFP (GB)	μPD78F0124	μPD780121, μPD780122, μPD780123, 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, μ PD78F0134H, 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

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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.

Clock settings

The internal clock board is mounted at shipment.
If using the internal clock, modification of the settings are unnecessary.
If modification is necessary, see **2.2 Removal of Acrylic Board** and **2.3 Clock Settings**.

↓

Software settings

See **2.4 Software Settings**.

↓

Mounting and connecting connectors

See **2.5 Mounting and Connecting Connectors**.

↓

Connection of QB-78K0KX1H to target system

See **2.6 Connection of QB-78K0KX1H to Target System**.

↓

Connection of USB interface cable and AC adapter

See **2.8 Connection of USB Interface Cable and AC adapter**.

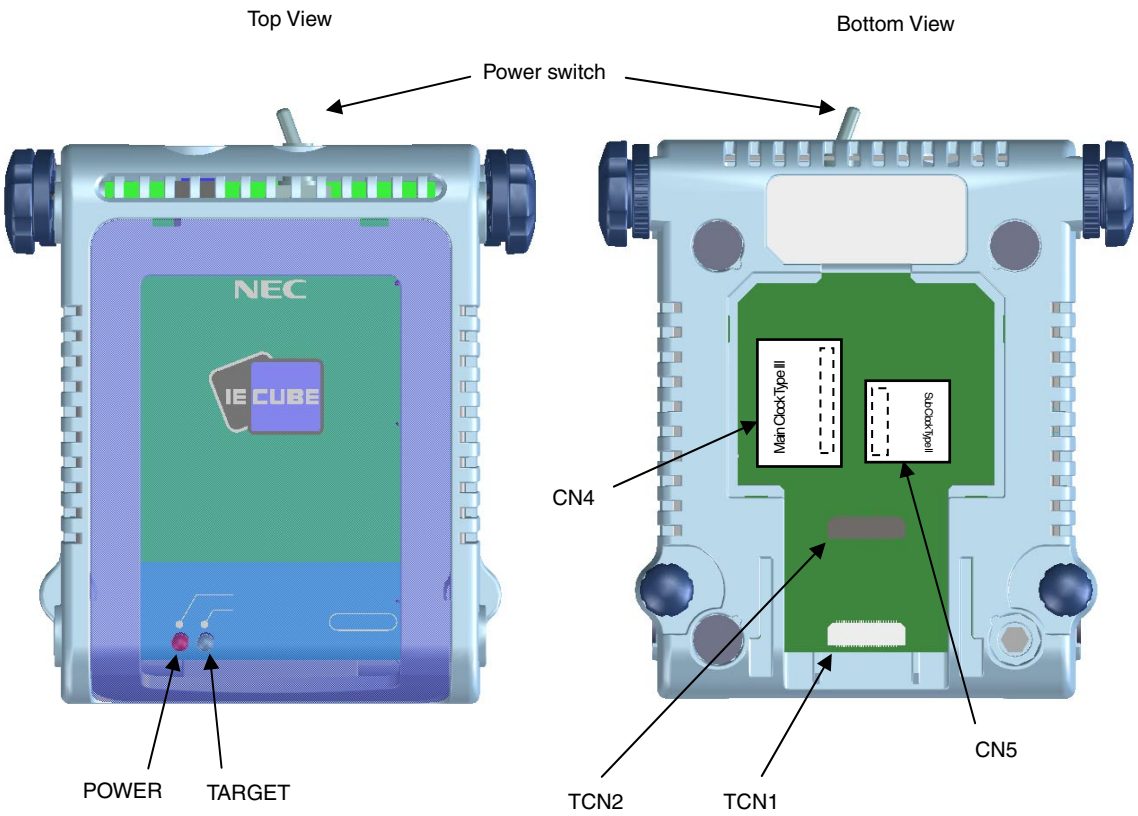
↓

Switching power on and off

See **2.9 Switching Power On and Off**

2.1 Names and Functions of Hardware

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



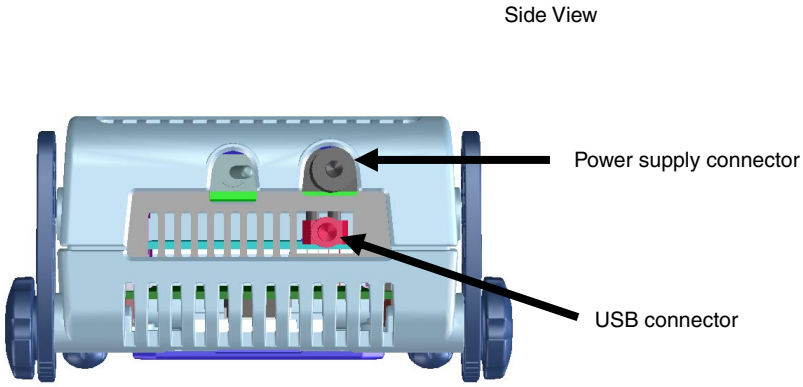
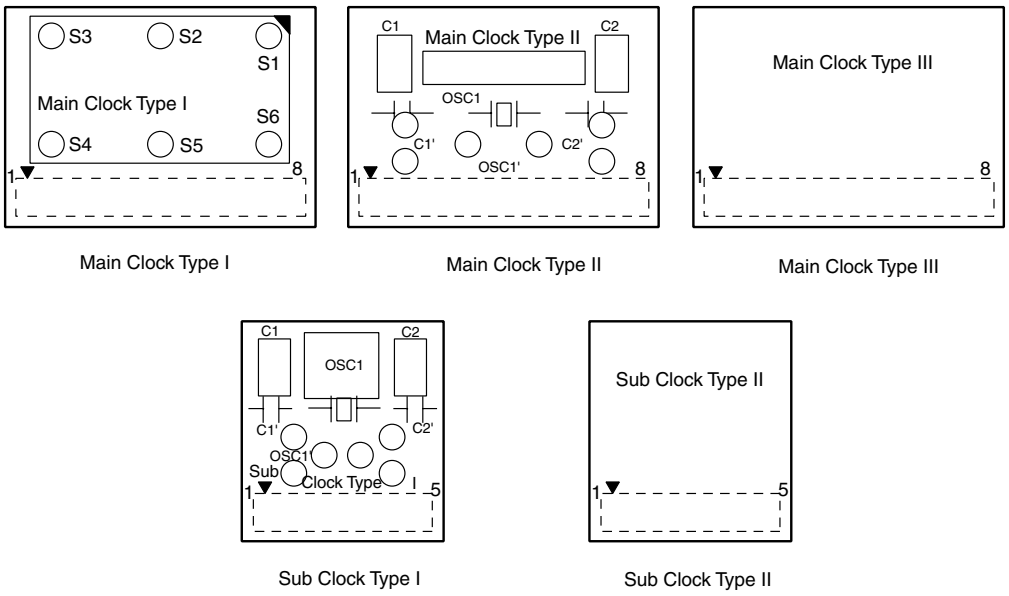


Figure 2-2. Clock Board



(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

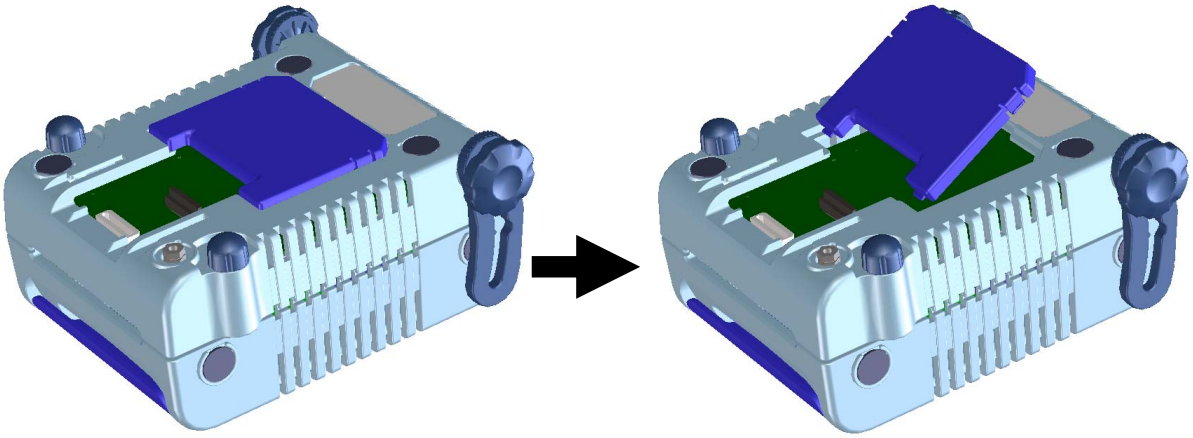
(6) Power switch

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.

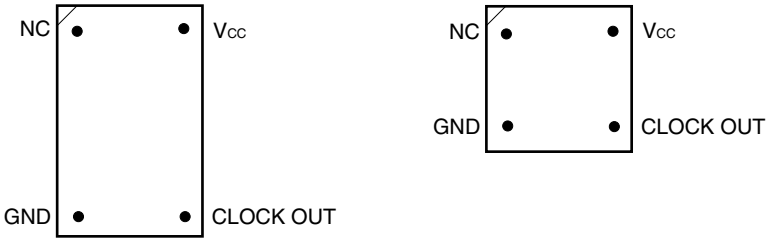
2.3.3 Main system clock

(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

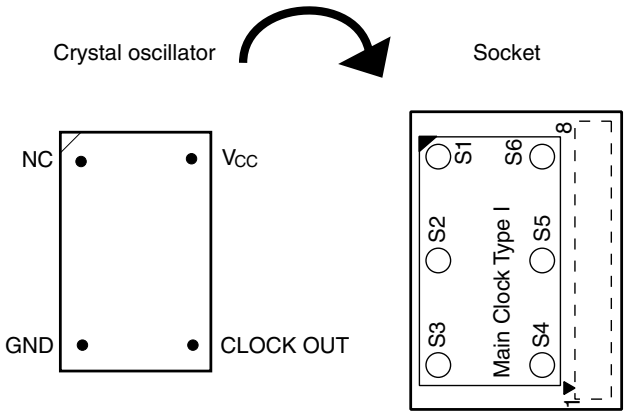
<Procedure>

<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)



Oscillator Pin	Board Pin Number
NC	S1
GND	S2
	S3
CLOCK OUT	S4
	S5
VCC	S6

<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)