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RENESAS

User's Manual

QB-78K0KX2

In-Circuit Emulator

Target Devices

78K0/KB2
78K0/KC2
78K0/KD2
78K0/KE2
78K0/KF2

Document No. U17341EJ5V0UM00 (5th edition)
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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 connection to the AC adapter, USB interface cable, or 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**.

INTRODUCTION

Readers

This manual is intended for users who wish to perform debugging using the QB-78K0KX2. 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-78K0KX2.

Organization

This manual is divided into the following sections.

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

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-78K0KX2
→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-78K0KX2
→See the user's manual of the debugger (supplied with the QB-78K0KX2) 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/Kx2	Generic name indicating 78K0/KB2, 78K0/KC2, 78K0/KD2, 78K0/KE2, and 78K0/KF2.
IECUBE™	Generic name for NEC Electronics' high-performance/compact in-circuit emulator.

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-78K0KX2 In-Circuit Emulator		This manual
RA78K0 Assembler Package Ver. 3.80	Operation	U17199E
	Language	U17198E
	Structured Assembly Language	U17197E
CC78K0 C Compiler Ver. 3.70	Operation	U17201E
	Language	U17200E
ID78K0-QB Ver. 2.90 Integrated Debugger	Operation	U17437E
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.

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CHAPTER 1 GENERAL

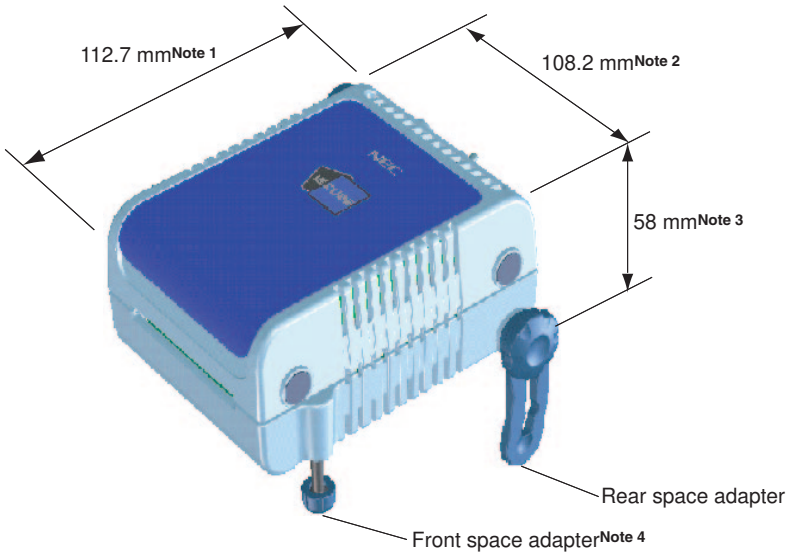
The QB-78K0KX2 is an in-circuit emulator for emulating the 78K0/Kx2.

Hardware and software can be debugged efficiently in the development of systems in which the 78K0/Kx2 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-78K0KX2 Hardware Specifications

Parameter		Specification	
Target device		78K0/KB2, 78K0/KC2, 78K0/KD2, 78K0/KE2, 78K0/KF2	
Operating voltage		1.8 to 5.5 V	
Operating frequency		Main system clock	V_{DD} = 4.0 to 5.5 V: 20 MHz V_{DD} = 2.7 to 5.5 V: 10 MHz V_{DD} = 1.8 to 5.5 V: 5 MHz
		Internal oscillation clock	Internal high-speed oscillation clock V_{DD} = 2.7 to 5.5 V: 8 MHz (TYP.) Internal low-speed oscillation clock V_{DD} = 2.7 to 5.5 V: 240 kHz (TYP.) (120 to 480 kHz)
		Subsystem clock	V_{DD} = 1.8 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-78K0KX2	15 V, 1 A	
	Target system power supply	Voltage: 1.8 to 5.5 V Current: target device's current consumption + 10 mA (approx.)	
Weight		300 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 space adapter

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

4. Front space adapter can vary from 20 mm (longest) to 5 mm (shortest)

1.2 System Specifications

This section shows the QB-78K0KX2 system specifications.

Table 1-2. QB-78K0KX2 System Specifications

Parameter		Specification
Emulation memory capacity	Internal ROM	128 KB (MAX.)
	Internal high-speed ROM	1 KB (MAX.)
	Internal expansion RAM	6 KB (MAX.)
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 48 hours and 50 minutes (Resolution 41 μs)
	Minimum resolution	20 ns (Measuring 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

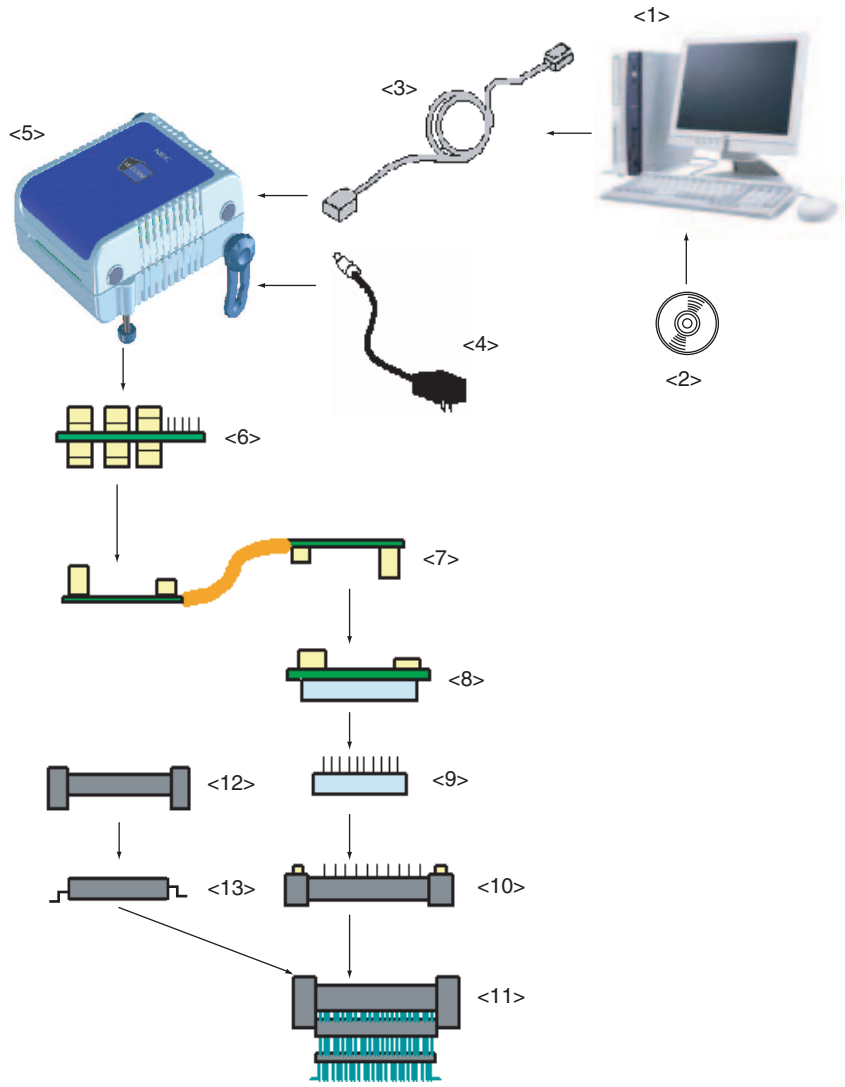
1.3 System Configuration

This section shows the system configuration when using the QB-78K0KX2 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/Kx2

Device Name (Common Name)	Package	Device Name
		Flash Memory Version
78K0/KB2	30-pin SSOP (MC)	μPD78F0500, μPD78F0501, μPD78F0502, μPD78F0503, μPD78F0503D
	36-pin FLGA (FC)	
78K0/KC2	44-pin LQFP (GB)	μPD78F0511, μPD78F0512, μPD78F0513, μPD78F0513D
	48-pin LQFP (GA)	μPD78F0511, μPD78F0512, μPD78F0513, μPD78F0514, μPD78F0515, μPD78F0515D
78K0/KD2	52-pin LQFP (GB)	μPD78F0521, μPD78F0522, μPD78F0523, μPD78F0524, μPD78F0525, μPD78F0526, μPD78F0527, μPD78F0527D
78K0/KE2	64-pin LQFP (GB, GC, GK)	μPD78F0531, μPD78F0532, μPD78F0533, μPD78F0534, μPD78F0535, μPD78F0536, μPD78F0537, μPD78F0537D
	64-pin TQFP (GA)	
	64-pin FLGA (FC)	
78K0/KF2	80-pin LQFP (GC, GK)	μPD78F0544, μPD78F0545, μPD78F0546, μPD78F0547, μPD78F0547D

Figure 1-1. System Configuration



<1> Host machine:	PC-9821 series, PC/AT compatible can be used
<2> ID78K0-QB Disk/Accessory Disk[Note1]:	Debugger, USB drivers, manual, etc.
<3> USB interface cable:	Cable connecting QB-78K0KX2 to host machine
<4> AC adapter:	Can support 100 to 240 V by replacing AC plug
<5> QB-78K0KX2:	This product
<6> Check pin adapter[Note2]:	Adapter used when observing waveforms on oscilloscope
<7> Emulation probe:	Flexible type of emulation probe
<8> Exchange adapter[Note3]:	Adapter that performs pin conversion
<9> Space adapter[Note3]:	Adapter for height regulation
<10> YQ connector[Note3]:	Connector that connects exchange adapter to target connector
<11> Target connector[Note3]:	Connector soldered to target system
<12> Mount adapter[Note3]:	Adapter for socket mounting target device
<13> Device	Target device

Refer to **1.4 Package Contents** for the purchase forms of the above products.

Notes 1. Obtain device files from the NEC Electronics website.
http://www.necel.com/micro/ods/eng/index.html

2. Please refer to **[Related Information]** on the following URL about attachment method for pin header cover.
http://www.necel.com/micro/english/iecube/index.html

3. As for handling of connectors, refer to **2.5 Mounting and Connecting Connectors.**

Table 1-4. Check Pin Adapters

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

Table 1-5. Exchange Adapters

Package	Exchange Adapter
80GC	QB-80GC-EA-01T
80GK	QB-80GK-EA-01T
64FC	QB-64FC-EA-01T
64GA	QB-64GA-EA-01T
64GB	QB-64GB-EA-04T
64GC	QB-64GC-EA-03T
64GK	QB-64GK-EA-04T
52GB	QB-52GB-EA-02T
48GA	QB-48GA-EA-02T
44GB	QB-44GB-EA-03T
36FC	QB-36FC-EA-01T
30MC	QB-30MC-EA-02T

Table 1-6 Emulation Probes

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

Table 1-7. YQ Connectors

Package	YQ Connector
80GC	QB-80GC-YQ-01T
80GK	QB-80GK-YQ-01T
64FC	–[Note]
64GA	QB-64GA-YQ-01T
64GB	QB-64GB-YQ-01T
64GC	QB-64GC-YQ-01T
64GK	QB-64GK-YQ-01T
52GB	QB-52GB-YQ-01T
48GA	QB-48GA-YQ-01T
44GB	QB-44GB-YQ-01T
36FC	–[Note]
30MC	QB-30MC-YQ-01T

Note Both 36FC and 64FC do not have YQ connectors, space adapters, and mount adapters.

Table 1-8 Space Adapters

Package	Space Adapter
80GC	QB-80GC-YS-01T
80GK	QB-80GK-YS-01T
64FC	–[Note]
64GA	QB-64GA-YS-01T
64GB	QB-64GB-YS-01T
64GC	QB-64GC-YS-01T
64GK	QB-64GK-YS-01T
52GB	QB-52GB-YS-01T
48GA	QB-48GA-YS-01T
44GB	QB-44GB-YS-01T
36FC	–[Note]
30MC	QB-30MC-YS-01T

Table 1-9. Target Connectors

Package	Target Connector
80GC	QB-80GC-NQ-01T
80GK	QB-80GK-NQ-01T
64FC	QB-64FC-NQ-01T
64GA	QB-64GA-NQ-01T
64GB	QB-64GB-NQ-01T
64GC	QB-64GC-NQ-01T
64GK	QB-64GK-NQ-01T
52GB	QB-52GB-NQ-01T
48GA	QB-48GA-NQ-01T
44GB	QB-44GB-NQ-01T
36FC	QB-36FC-NQ-01T
30MC	QB-30MC-NQ-01T

<R>

Note Both 36FC and 64FC do not have YQ connectors, space adapters, and mount adapters.

Table 1-10. Mount Adapters

Package	Mount Adapter
80GC	QB-80GC-HQ-01T
80GK	QB-80GK-HQ-01T
64FC	–[Note]
64GA	QB-64GA-HQ-01T
64GB	QB-64GB-HQ-01T
64GC	QB-64GC-HQ-01T
64GK	QB-64GK-HQ-01T
52GB	QB-52GB-HQ-01T
48GA	QB-48GA-HQ-01T
44GB	QB-44GB-HQ-01T
30MC	–[Note]
30MC	QB-30MC-HQ-01T

Note Both 36FC and 64FC do not have YQ connectors, space adapters, and mount adapters.

Remark For notes on target system design and package drawings, refer to [Related Information] on the following URL.
http://www.necel.com/micro/english/iecube/index.html

1.4 Package Contents

The following items have been placed in the QB-78K0KX2 packing box. Please check the contents.

Products supplied with QB-78K0KX2-ZZZ

1: QB-78K0KX2
2: AC adapter
3: USB interface cable (2 meters)
4: User registration
5: Simplified flash programmer (PG-FPL3 or QB-MINI2)
6: ID78K0-QB Disk (CD-ROM)
7: Accessory Disk (CD-ROM)
8: IECUBE Setup Manual

Products supplied with QB-78K0KX2-T80GC

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-80GC-EA-01T
11: YQ connector QB-80GC-YQ-01T
12: Target connector QB-80GC-NQ-01T

Products supplied with QB-78K0KX2-T80GK

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-80GK-EA-01T
11: YQ connector QB-80GK-YQ-01T
12: Target connector QB-80GK-NQ-01T

Products supplied with QB-78K0KX2-T64FC

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-64FC-EA-01T
12: Target connector QB-64FC-NQ-01T

Products supplied with QB-78K0KX2-T64GA

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-64GA-EA-01T
11: YQ connector QB-64GA-YQ-01T
12: Target connector QB-64GA-NQ-01T

Products supplied with QB-78K0KX2-T64GB

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-64GB-EA-04T
11: YQ connector QB-64GB-YQ-01T
12: Target connector QB-64GB-NQ-01T

Products supplied with QB-78K0KX2-T64GC

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-64GC-EA-03T
11: YQ connector QB-64GC-YQ-01T
<R> 12: Target connector QB-64GC-NQ-01T

Products supplied with QB-78K0KX2-T64GK

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-64GK-EA-04T
11: YQ connector QB-64GK-YQ-01T
12: Target connector QB-64GK-NQ-01T

Products supplied with QB-78K0KX2-T52GB

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-52GB-EA-02T
11: YQ connector QB-52GB-YQ-01T
12: Target connector QB-52GB-NQ-01T

Products supplied with QB-78K0KX2-T48GA

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-48GA-EA-02T
11: YQ connector QB-48GA-YQ-01T
12: Target connector QB-48GA-NQ-01T

Products supplied with QB-78K0KX2-T44GB

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-44GB-EA-03T
11: YQ connector QB-44GB-YQ-01T
12: Target connector QB-44GB-NQ-01T

Products supplied with QB-78K0KX2-T36FC

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-36FC-EA-01T
12: Target connector QB-36FC-NQ-01T

Products supplied with QB-78K0KX2-T30MC

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-30MC-EA-02T
11: YQ connector QB-30MC-YQ-01T
12: Target connector QB-30MC-NQ-01T

The following products are sold as single items.

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

Note Both 36FC and 64FC do not have YQ connectors, space adapters, and mount adapters.

CHAPTER 2 SETUP PROCEDURE

This chapter explains the QB-78K0KX2 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

If using the internal clock, hardware settings are not required.

If mounting an oscillator is required, see **2.2 Removal of Acrylic Board** and **2.3 Clock Settings**.

↓

Software settings

See **2.4 Software Settings**.

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Mounting and connecting connectors

See **2.5 Mounting and Connecting Connectors**.

↓

Connecting QB-78K0KX2 to target system

See **2.6 Connecting QB-78K0KX2 to Target System**.

↓

Connecting USB interface cable and AC adapter

See **2.8 Connecting USB Interface Cable and AC Adapter**.

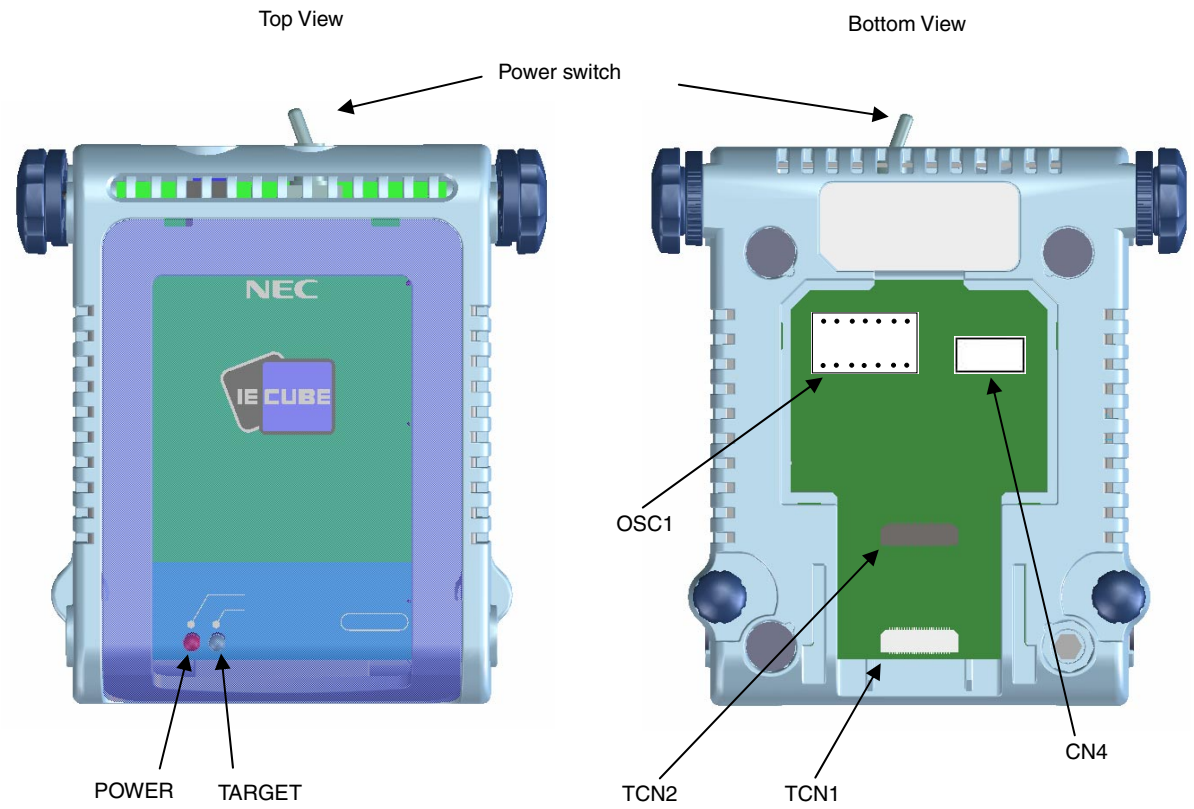
↓

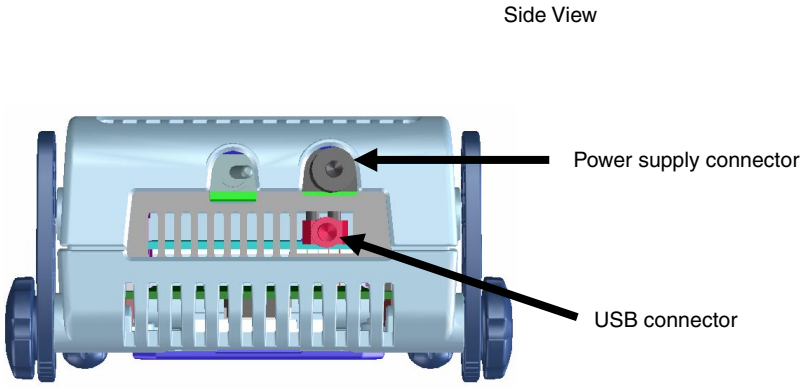
Switching power on and off

See **2.9 Switching Power On and Off**.

2.1 Names and Functions of Hardware

Figure 2-1. Names of Parts of QB-78K0KX2





(1) TCN1, TCN2

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

(2) OSC1

This is a socket for mounting the oscillator.

(3) CN4[Note]

This is a connector for the shipment inspection.

Note It is not necessary for user to use CN4.

(4) POWER (Red LED)

This is an LED that shows whether or not the power supply of the QB-78K0KX2 is switched on.

LED State	QB-78K0KX2 State
Lit	Power switch ON
Not lit	Power switch OFF or AC adapter not connected to QB-78K0KX2
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

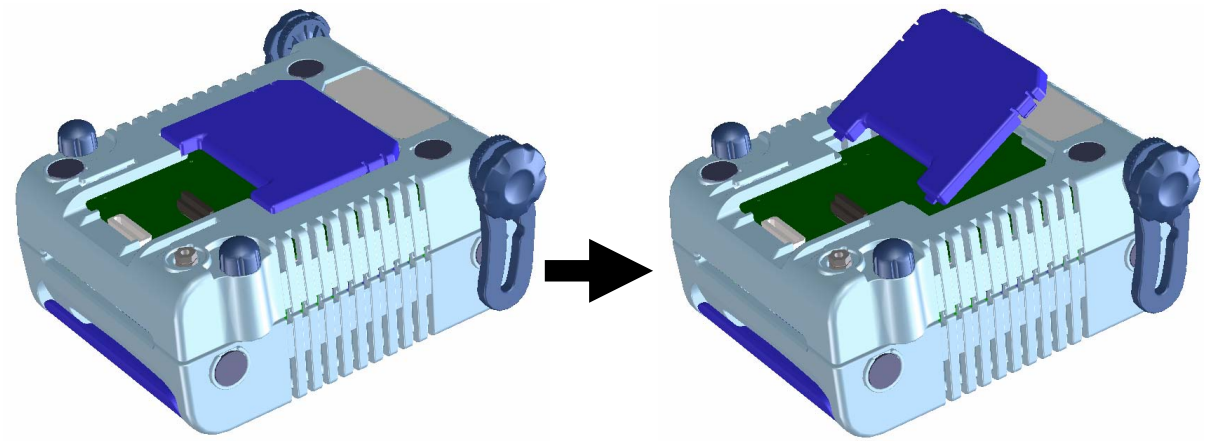
This is the power switch of the QB-78K0KX2.

It is OFF at shipment.

2.2 Removal of Acrylic Board

To modify the clock setting, the acrylic board on the bottom of the QB-78K0KX2 must be removed.
The acrylic board can be removed by lifting it up.

Figure 2-2. Acrylic Board Removal Method



<R> 2.3 Clock Settings

2.3.1 Overview of clock settings

The following 5 types of clock settings are available.
For details, see **2.3.2 Clock setting methods**.

Main system clock:

(1) Using the clock generated in the emulator (with high-speed internal oscillator used)
(2) Suppling a clock (square wave) from the target system
(3) Using the oscillator (OSC1) mounted in the emulator

Subsystem clock:

(1) Using the clock generated in the emulator
(2) Suppling a clock (square wave) from the target system

2.3.2 Clock setting methods

This section shows the clock settings.

Table 2-1. Main System Clock Setting

Type of Clock to Be Used	OSC1	Debugger Setting
(1) Using the clock generated in the emulator (with high-speed internal oscillator used)	–	System
(2) Suppling a clock (square wave) from the target system[Note]	–	External
(3) Using the oscillator (OSC1) mounted in the emulator	Mount oscillator	Clock Board

Note Do not select this setting when the TARGET LED is not lit.

Remarks 1. Settings other than those above are prohibited.

2. Selection of (1) or (2) is possible regardless of whether or not the oscillator is mounted onto OSC1.

Table 2-2. Subsystem Clock Setting

Type of Clock to Be Used	Remarks
(1) Using the clock generated in the emulator	System
(2) Suppling a clock (square wave) from the target system[Note]	External

Note Do not select this setting when the TARGET LED is not lit.

Remark Settings other than those above are prohibited.

2.3.3 Main system clock

(1) Using the clock generated in the emulater (with high-speed internal oscillator used)

Select “System” in the configuration dialog box of the debugger and select the desired frequency from the dialog menu.

(2) Suppling a clock (square wave) from the target system

Select “External” in the configuration dialog box of the debugger to use the clock input from the target system. To input the clock from the target system, input to the clock pin (X2) the square wave[Note] with the same potential as the target device (inputting the inverted waveform to the X1 pin is unnecessary).

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