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RENESAS

User's Manual

QB-780731

In-Circuit Emulator

Target Devices
μPD78F0731

Document No. U17804EJ2V0UM00 (2nd edition)
Date Published September 2006 N CP(K)

[MEMO]

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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**.

[MEMO]

INTRODUCTION

Readers

This manual is intended for users who wish to perform debugging using the QB-780731. 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-780731.

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-780731
→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-780731
→See the user's manual of the debugger (supplied with the QB-780731) 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.
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-780731 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

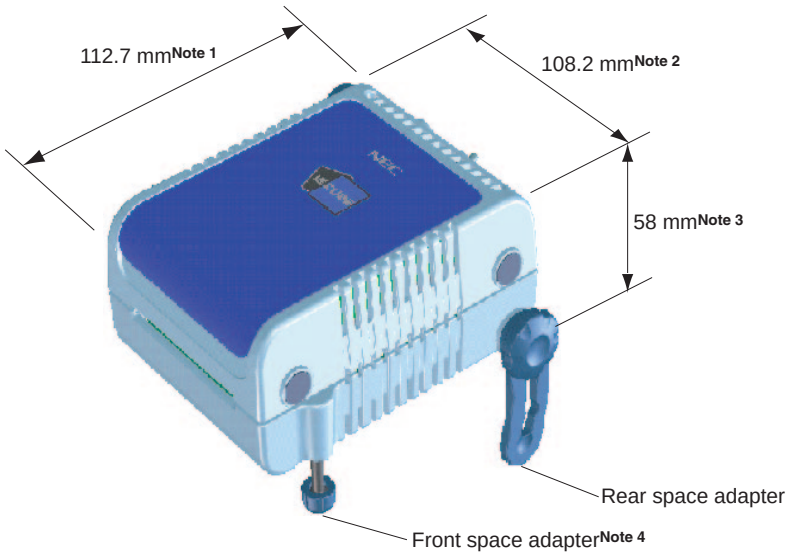
The QB-780731 is an in-circuit emulator for emulating the μPD78F0731.

Hardware and software can be debugged efficiently in the development of systems in which the μPD78F0731 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-780731 Hardware Specifications

Parameter		Specification	
Target device		μPD78F0731	
Operating voltage		4.0 to 5.5 V	
Operating frequency		Main system clock	V_{DD} = 4.0 to 5.5 V: 12 MHz or 16 MHz
		Internal oscillation clock	Internal high-speed oscillation clock V_{DD} = 2.7 to 5.5 V: 16 MHz or 6 MHz (TYP.) Internal low-speed oscillation clock V_{DD} = 2.7 to 5.5 V: 240 kHz (TYP.)
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-780731	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-780731 system specifications.

Table 1-2. QB-780731 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

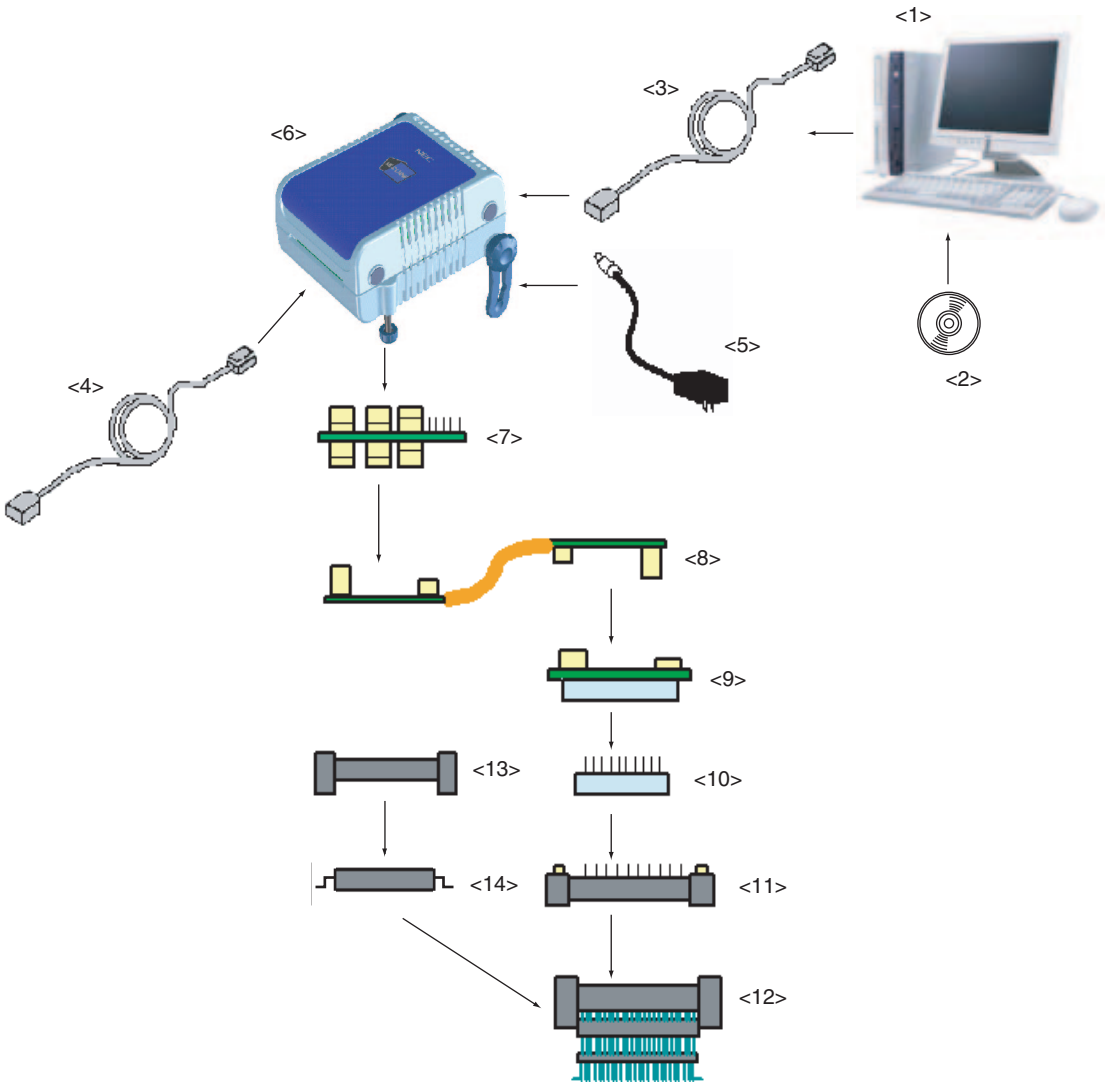
1.3 System Configuration

This section shows the system configuration when using the QB-780731 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 μPD78F0731

Package	Device Name
	Flash Memory Version
30-pin SSOP (MC)	μPD78F0731

Figure 1-1. System Configuration



<1>	Host machine:	PC-9821 series, PC/AT compatible can be used
<2>	ID78K0-QB Disk/Accessory Disk[Note 1]:	Debugger, USB drivers, manual, etc.
<3>	USB interface cable:	Cable connecting QB-780731 to host machine
<4>	USB interface cable:	Cable to emulate USB interface function
<5>	AC adapter:	Can support 100 to 240 V by replacing AC plug
<6>	QB-780731:	This product
<7>	Check pin adapter[Note 2]:	Adapter used when observing waveforms on oscilloscope
<8>	Emulation probe:	Flexible type of emulation probe
<9>	Exchange adapter[Note 3]:	Adapter that performs pin conversion
<10>	Space adapter[Note 3]:	Adapter for height regulation
<11>	YQ connector[Note 3]:	Connector that connects exchange adapter to target connector
<12>	Target connector[Note 3]:	Connector soldered to target system
<13>	Mount adapter[Note 3]:	Adapter for socket mounting target device
<14>	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
30MC	QB-30MC-EA-01T

Table 1-6. Emulation Probes

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

Table 1-7. YQ Connectors

Package	YQ Connector
30MC	QB-30MC-YQ-01T

Table 1-8. Space Adapters

Package	Space Adapter
30MC	QB-30MC-YS-01T

Table 1-9. Target Connectors

Package	Target Connector
30MC	QB-30MC-NQ-01T

Table 1-10. Mount Adapters

Package	Mount Adapter
30MC	QB-30MC-HQ-01T

<R> **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-780731 packing box. Please check the contents.

Products supplied with QB-780731-ZZZ

1: QB-780731
2: AC adapter
3: USB interface cable (2 meters) × 2
4: User registration
<R> 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-780731-T30MC

1 to 8
9: Emulation probe QB-80-EP-01T
10: Exchange adapter QB-30MC-EA-01T
11: YQ connector QB-30MC-YQ-01T
12: Target connector QB-30MC-NQ-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-780731 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**.

↓

Mounting and connecting connectors

See **2.5 Mounting and Connecting Connectors**.

↓

Connecting QB-780731 to target system

See **2.6 Connecting QB-780731 to Target System**.

↓

Connecting USB interface cable and AC adapter

See **2.9 Connecting USB Interface Cable and AC Adapter**.

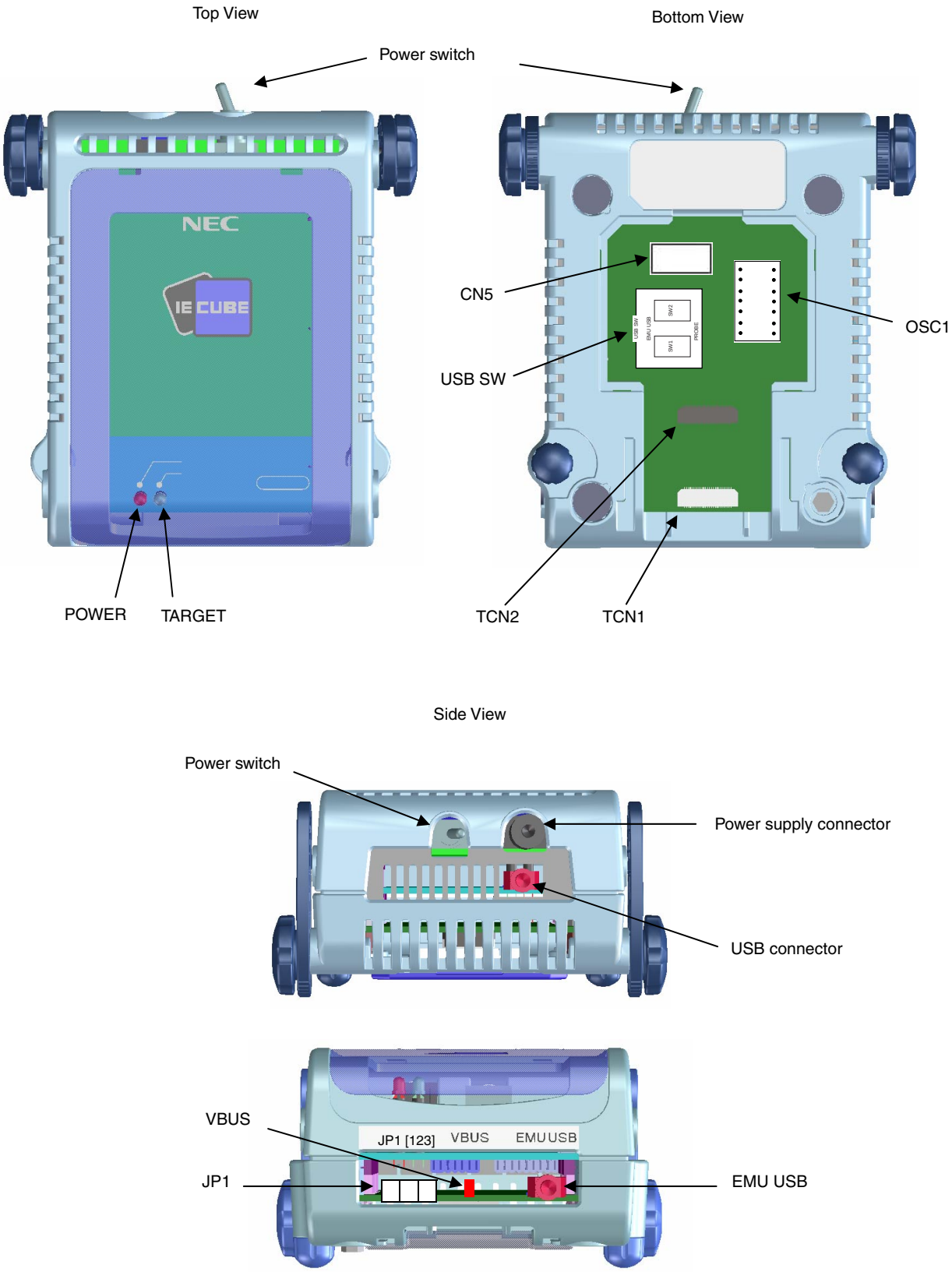
↓

Switching power on and off

See **2.10 Switching Power On and Off**.

2.1 Names and Functions of Hardware

Figure 2-1. Names of Parts of QB-780731



<R>

(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.

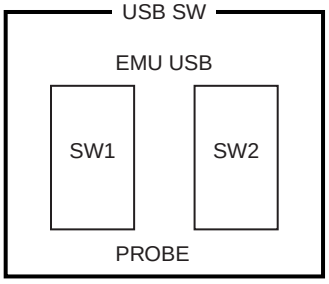
(3) CN5

This is a connector for the shipment inspection.

(4) USB SW

This is a switch for selecting a USB connector to be emulated.

It is used to select the USB connector on the target system or USB on the QB-780731 when the USB interface function is emulated.



USB SW		
SW1	SW2	
PROBE side	PROBE side	Executes emulation using the USB connector on the target system.
EMU USB side	EMU USB side	Executes emulation using the USB connector on the QB-780731.

(5) POWER (Red LED)

This is an LED that shows whether or not the power supply of the QB-780731 is switched on.

LED State	QB-780731 State
Lit	Power switch ON
Not lit	Power switch OFF or AC adapter not connected to QB-780731
Blinking	Internal error occurred (Contact an NEC Electronics sales representative or distributor)

(6) 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

(7) Power switch

This is the power switch of the QB-780731.

It is OFF at shipment.

(8) VBUS

This check pin supplies VBUS that is power to USB.

(9) EMU USB

This is a connector for emulating the USB interface function by using the USB connector on the QB-780731.

<R> **(10) JP1**

This is a jumper that is used to set on/off of the pull-up resistor connected to USBP (D+), for performing emulation of the USB interface function using the EMU USB connector.

Switch the settings according to the target system configuration.

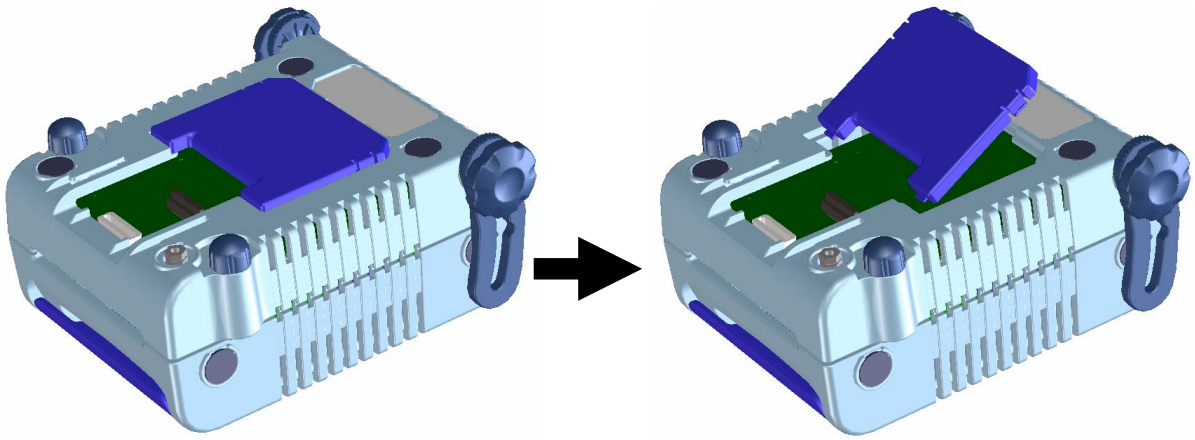
JP1	Bit 1 (CONNECT) of UF0GPR Register	Pull-up Resistor Connected to USBP (D+)
1-2 shorted	0	ON
	1	OFF
2-3 shorted	0	OFF
	1	ON

2.2 Removal of Acrylic Board

To modify the clock setting, the acrylic board on the bottom of the QB-780731 must be removed.

The acrylic board can be removed by lifting it up.

Figure 2-2. Acrylic Board Removal Method



2.3 Clock Settings

2.3.1 Overview of clock settings

The following 3 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

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.

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).

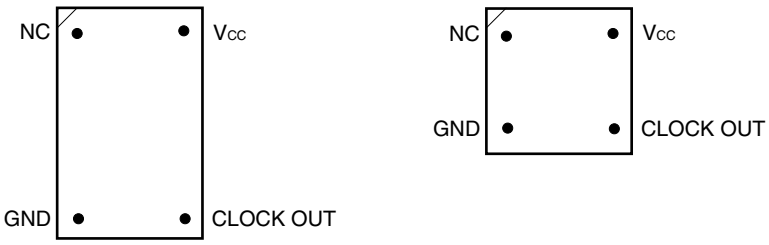
Note Square waves from oscillators using a resonator are not supported.

(3) Using the oscillator (OSC1) mounted in the emulator

♦Things to prepare

- Oscillator[Note] (with pins as shown in Figure 2-3 and 5 V power supply)

Figure 2-3. Oscillator (Main System Clock)



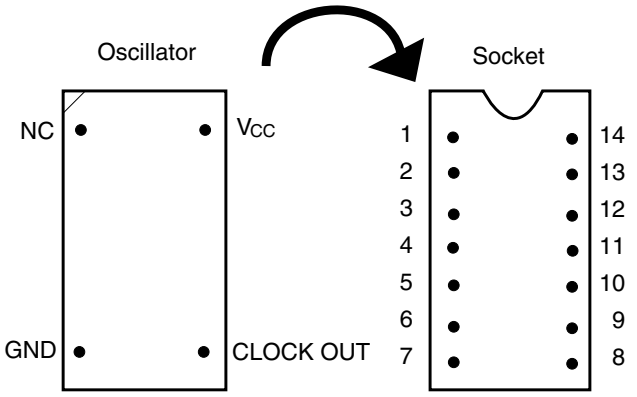
Top View

Note The oscillation circuit using an oscillation is not supported.

<Procedure>

<1> Mount the prepared oscillator in OSC1. When mounting the oscillator in OSC1 be careful to insert it in the direction of the number 1 pin mark.

Figure 2-4. Mapping of Oscillator to Socket (Main System Clock)



Oscillator Pin	OSC1 Pin Number
NC	1
GND	4
	7
CLOCK OUT	8
	11
VCC	14

<2> Set the "Clock Board" in the configuration dialog box of the debugger.

For the frequency at this time, the clock of the oscillator that is mounted on OSC1 is used.

2.4 Software Settings

For details, see the **ID78K0-QB Ver. 2.90 Integrated Debugger Operation User's Manual (U17437E)**.

2.5 Mounting and Connecting Connectors

This section describes the methods of connecting the QB-780731 and target system.
Make connections with both the QB-780731 and target system powered OFF.
The following abbreviations are used in this section.

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

2.5.1 Mounting NQ 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 NQ and adhere the NQ to the user board (clean the surface of the user board using alcohol or the like). If alignment of user board pads to NQ leads is difficult, align them as in (2).

(2) Align by inserting the guide pins for alignment for the NQ (NQ-Guide) through the pin holes on the top of the NQ. Accessory holes are ϕ1.0 mm non-through holes in 2 or 3 places.
(For hole positions, see the particular NQ drawing.)

(3) Solder after fitting the HQ to the NQ. This is to prevent troubles such as flux or solder splatter and adhering to the NQ contact pins when soldering.

- Soldering conditions
  - Solder reflow: At 240°C for a maximum of 20 seconds
  - Manual soldering: At 240°C for a maximum of 10 seconds (1 pin)

Caution Do not perform washing by flux immersion or vapor.

(4) Take away the guide pins.

2.5.2 Mounting YQ on NQ

(1) After confirming that there are no broken or bent YQ contact pins, fit the YQ in the NQ and fasten the screw. 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) Accessory holes are needed in prescribed positions in 4 places in the board for connecting the YQ. Fasten the YQ to the NQ on the user board using the supplied M2 × 10 mm screws. The thickness of a board corresponding to these screws is 1.0 to 2.0 mm. Fasten the screws equally in the four corners using a No. 1 or No. 0 precision (+) driver or torque driver. The tightening torque of the screws is 0.054 Nm (MAX.). Too great tightening causes bad connections.
Screws for fitting to the NQ (M2 × 10 mm/4) are included with the YQ.

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

As a tool when unplugging, insert some kind of thin non-conductive material such as a wooden stick 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.

2.5.4 Notes on handling NQ, YQ, and YS

(1) When taking the NQ 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 NQ, confirm that there are no bent pins.

(3) When screwing a YQ soldered to a board to the NQ, fasten the screws in four places in turn using a No. 0 or No. 1 Phillips 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: ϕ2.3 mm or ϕ3.3 mm). The ϕ3.8 mm or ϕ4.3 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 screwdriver from four directions. Moreover, to connect and use the YQ and YS, screw the YQ to the NQ according to the YQGUIDE (sold separately) using a 2.3 mm screwdriver 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 NQ, YQ, and YS, since there is a danger that washing fluid on the structure will remain in the connector, do not perform washing.

(6) NQ, IC, and YQ cannot be used in combination.

(7) An NQ/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 NQ, YQ, and YS, see the NQPACK series technical materials at the website of Tokyo Eletech Corporation.
Tokyo Eletech Corporation website: http://www.tetc.co.jp/

2.5.5 Notes on mounting NQ 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 NQ 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 NQ. 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 0.054 Nm (MAX.). 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 NQ, do not perform washing by flux immersion or vapor.

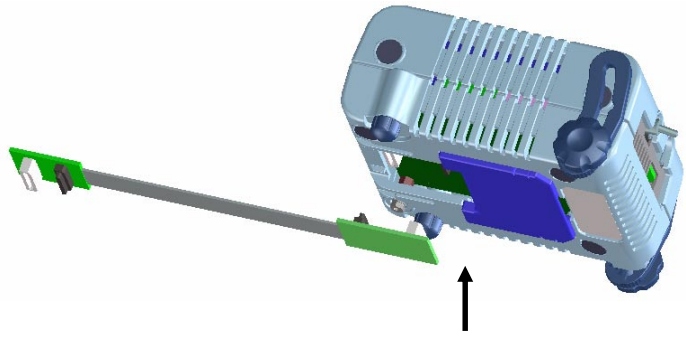
2.6 Connecting QB-780731 to Target System

If connecting the emulation probe (QB-80-EP-01T), connect it to the QB-780731 and the target system by the following procedure.

(a) Connection of emulation probe

Connect the emulation probe to the QB-780731.

Figure 2-5. Emulation Probe Connection Method



Insert CN1 and CN2 of the probe into TCN1 and TCN2 of the QB-780731.

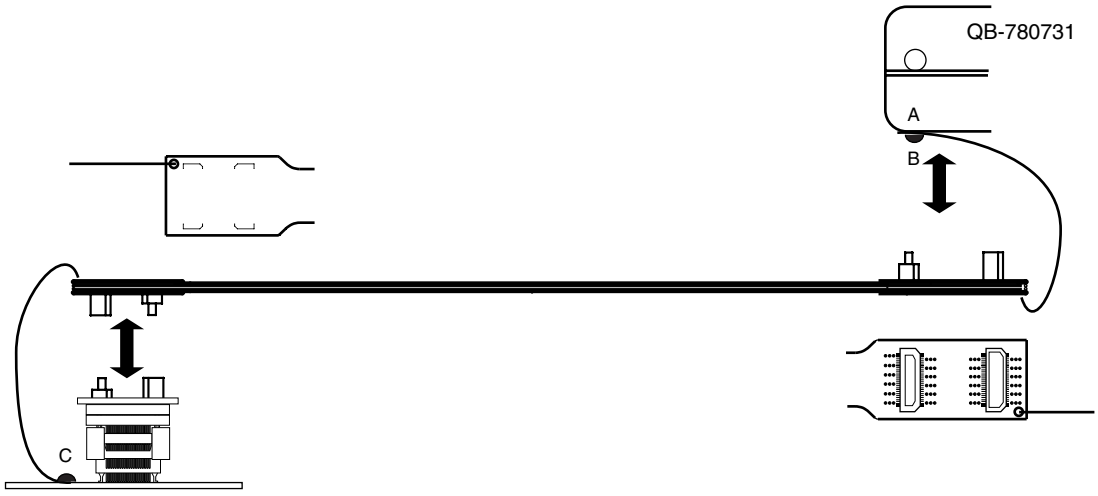
(b) Connection of emulation probe GND wire

There are 2 GND wires in the emulation probe. Connect them to the QB-780731 and target system.

<1> Fasten the GND wire on the QB-780731 side of the emulation probe to the nut on the bottom of the QB-780731 using a #0 or #1 Phillips precision driver (connection of B to A in Figure 2-6).

<2> Next plug the connector on top of the emulation probe into the connector at the opening on the bottom of the QB-780731 from below being careful of the insertion direction.

Figure 2-6. GND Wire

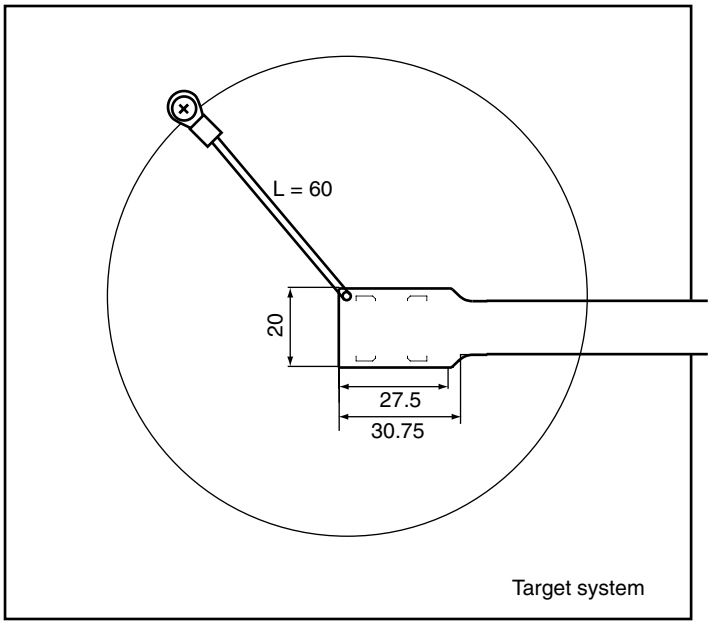


<3> Connect the exchange adapter and emulation probe to the target connector.

<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 2-6). 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 to within the range of an approximately 60 mm radius section of the target system for connecting the emulation probe, as shown in Figure 2-7.

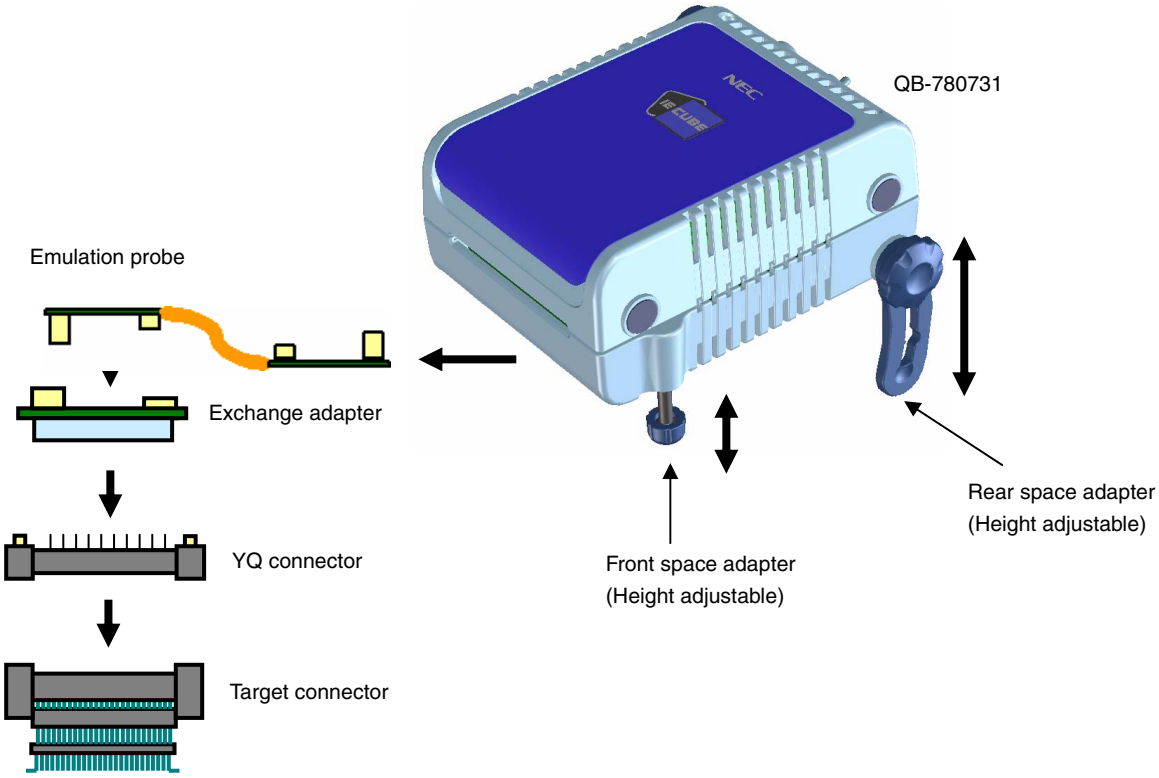
Figure 2-7. Where GND Wire Can Be Connected



(c) Ensuring isolation

When connecting the target system to the QB-780731 using an emulation probe, adjust the height using the front space adapter or rear space adapter of the QB-780731 and ensure isolation from the target system.

Figure 2-8. 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-780731 and the target system. If not, the impedance of the cable becomes unstable, resulting in the lowering of signal transmission characteristics or distortion of the output waveform for an input waveform.

2.7 Connection to Emulate USB Interface Function

Connection to emulate the USB interface function is performed in the following two ways.

<1> Using USB connector on target system

<2> Using USB connector (EMU USB) on QB-780731

Table 2-2 shows the setting to use the USB connector on the target system or QB-780731.

Table 2-2. Setting to Emulate USB Interface Function

	OSC1		VBUS Check Pin
	SW1	SW2	
To use USB connector on target system	PROBE side	PROBE side	–
To use USB connector (EMU USB) on QB-780731[Note1]	EMU USB side	EMU USB side	Connected to VBUS on target system[Note2]

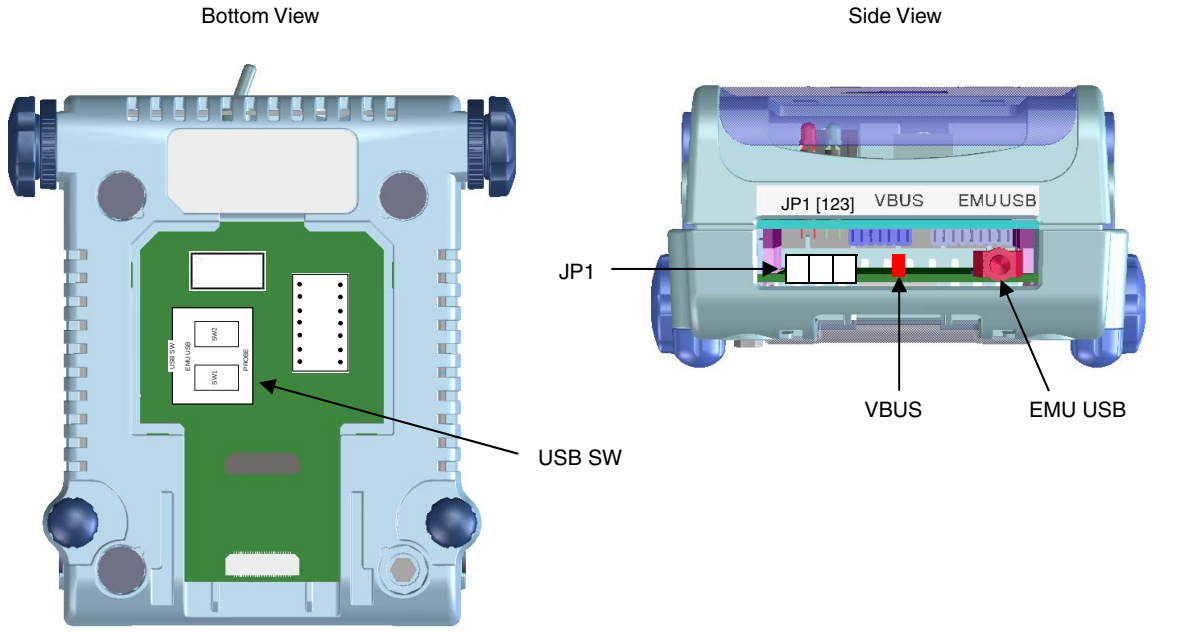
<R>

Notes 1. Set on/off of the pull-up resistor connected to USBP (D+) using JP1 on the side of the QB-780731. Switch the settings according to the target system configuration.

JP1	Bit 1 (CONNECT) of UF0GPR Register	Pull-up Resistor Connected to USBP (D+)
1-2 shorted	0	ON
	1	OFF
2-3 shorted	0	OFF
	1	ON

2. Connect the VBUS check pin on the QB-780731 and VBUS on the target system by using an IC clip. Use an IC clip that can withstand the rated current to be supplied. Exercise care that the IC clip does not contact any other components.

Figure 2-9. Positions of Switches and Connectors for Emulating USB Interface Function



Caution When the USB connector on the target system is used, the difference in electrical characteristics from those of the actual device increase from when the USB connector (EMU USB) on the QB-780731 is used.

2.8 Notes on Power Supply and GND Pin Connection

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

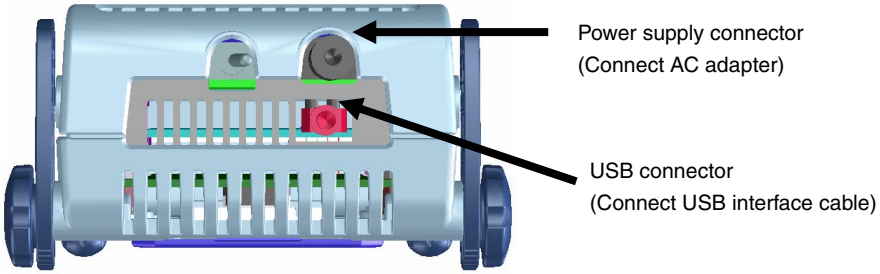
2.9 Connecting USB Interface Cable and AC Adapter

Plug the USB interface cable supplied with the QB-780731 into the USB connector of the host machine, and plug the other side into the USB connector on the rear of the QB-780731.

Plug the AC adapter supplied with the QB-780731 into a receptacle and plug the other side into the power supply connector on the rear of the QB-780731.

For QB-780731 connector positions, see **Figure 2-10**. There are three types of AC adapter plug. Use the one that has a suitable shape.

Figure 2-10. Connector Positions



2.10 Switching Power On and Off

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

- Switching power on

<1> QB-780731 power on

<2> Target system power on[Note]

<3> Debugger startup

- Switching power off

<1> Debugger termination

<2> Target system power off[Note]

<3> QB-780731 power off

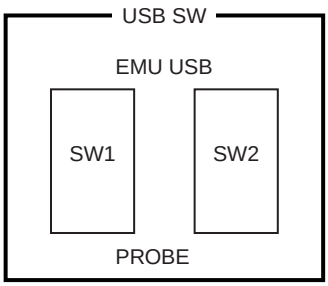
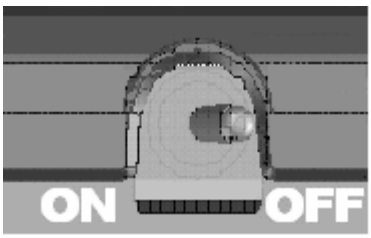
Note In the procedures, <2> is unnecessary if the target system is not connected.

Cautions 1. If the wrong sequence was used for the operation, the target system or QB-780731 may fail.

<R> **2. When a debugger is started with the QB-780731 alone (without target system connected), set USB SW (SW1, SW2) to the PROBE side.**
When switching to the EMU USB side, make sure that the debugger has been started.

CHAPTER 3 SETTINGS AT PRODUCT SHIPMENT

Table 3-1. Settings at Shipment

Item	Setting	Remarks
OSC1	Not mounted	Oscillator can be mounted.
USB SW		SW1 and SW2 are set to the PROBE side at shipment.
Power switch		Set to OFF at shipment.
<R> JP1		1-2 shorted 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-780731 and the signal lines of a target device

Although the target device is a CMOS circuit, the target interface circuit of the QB-780731 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-780731, the QB-780731 emulates just as if the actual target device were operating on the target system.

However, small differences arise because the QB-780731 actually is emulating.

(1) Signals input and output by emulation CPU (FPGA, μPD78F0731)

(2) Other signals

The circuits of the QB-780731 for the signals in (1) and (2) above are shown below by target device.

4.1 For μPD78F0731 Emulation

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

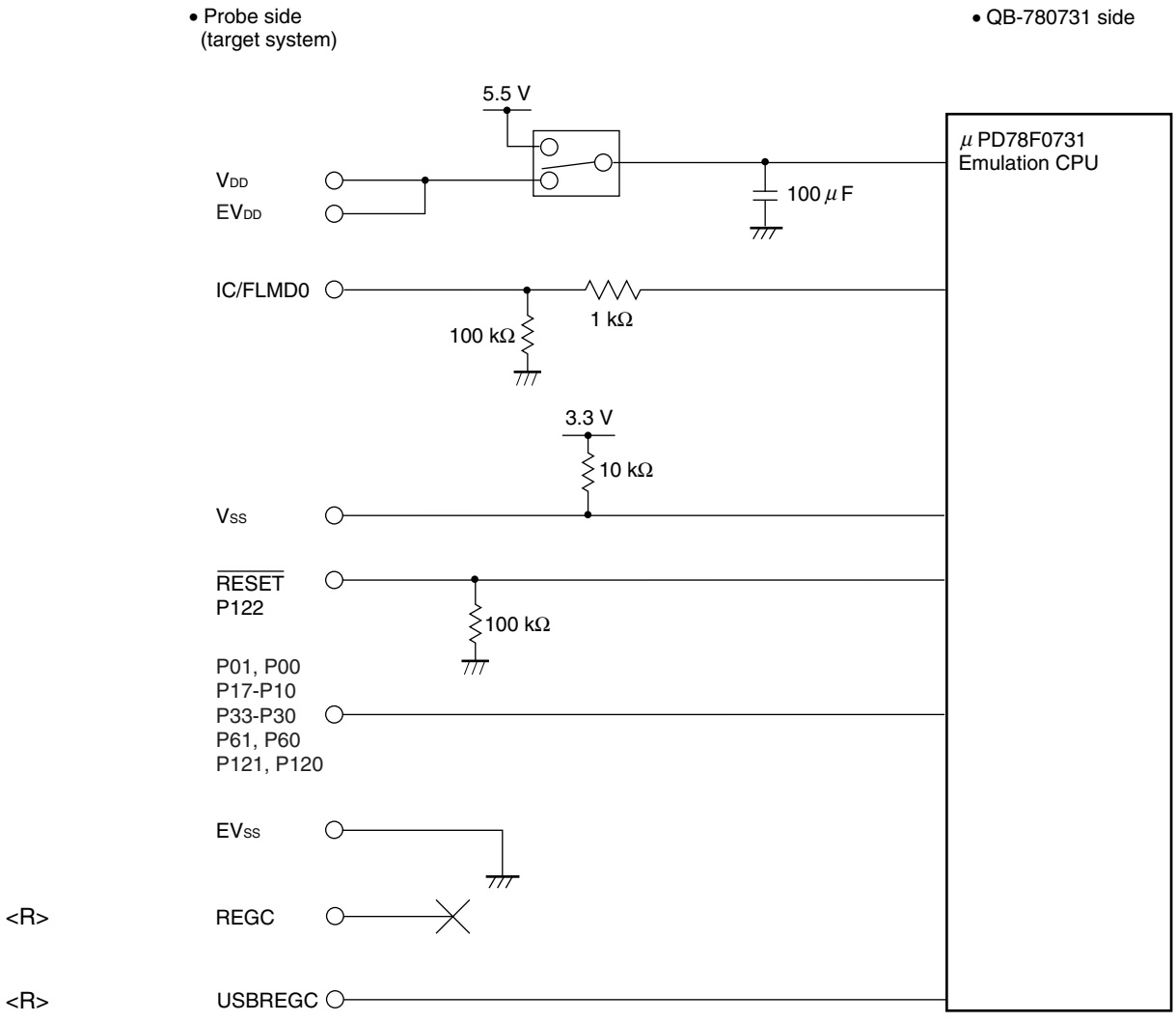
(1) Signals input and output by emulation CPU (μPD78F0731)

- P01, P00
- P17 to P10
- P33 to P30
- P61, P60
- P122 to P120
- $\overline{\text{RESET}}$, V_{SS}, IC/FLMD0
- V_{DD}, EV_{DD}

(2) Other signals

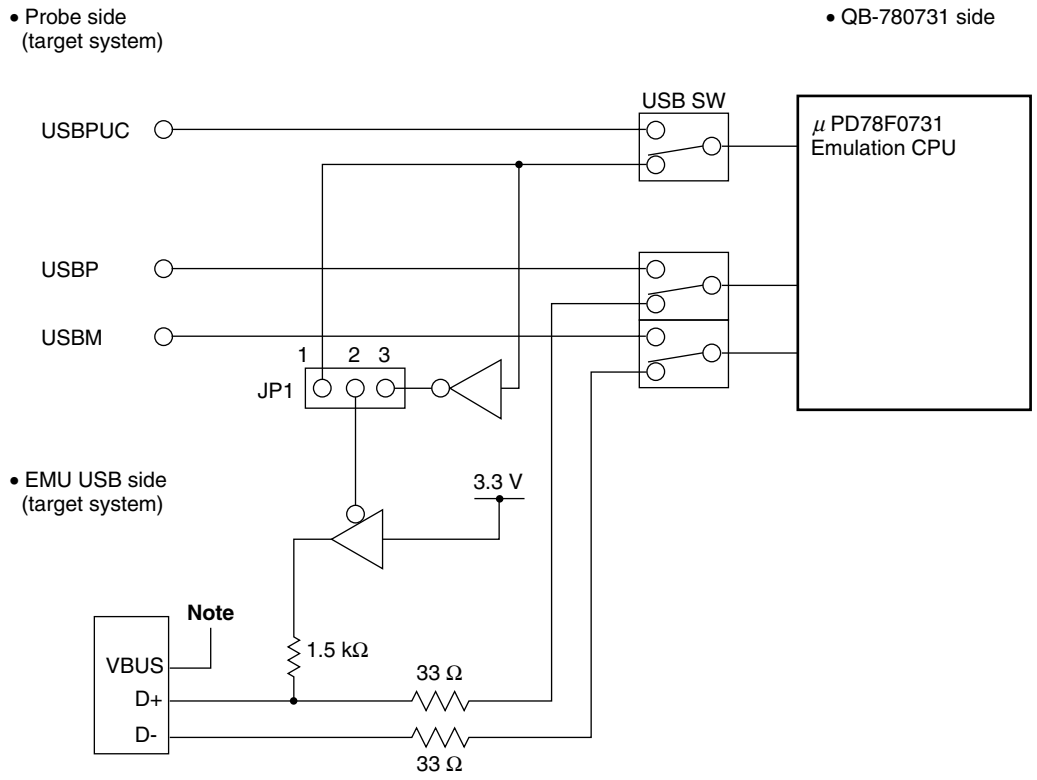
- EV_{SS}, REGC, USBREGC, USBPUC, USBP, USBM

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



<R>

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



Note Connect to the VBUS check pin on the QB-780731.

CHAPTER 5 NOTES

Observe the following notes.

- Do not turn off the target power supply (do not allow it to become lower than the POC voltage) during a break (power supply can be turned off only during RUN).
- 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 adapter and exchange adapter, a warning window is displayed but use is possible.
- A WDT reset is not generated when an area for which the capacities of the internal ROM, internal high-speed ROM, and internal expansion RAM are not set with the IMS and IXS registers is illegally accessed. Emulation is performed with a fail-safe break.
- Since a voltage around 1.7 V is set as a threshold value for POC detection by the QB-780731, it is different from the POC detection voltage of the device.
- The QB-780731 may be damaged if AV_{REF} is applied before the target powers V_{DD} and EV_{DD} are applied.
- LVI does not respond unless V_{DD} is lowered to the POC detection voltage value of the device when option byte POC is cleared.
- The self write time cannot be emulated with the QB-780731.
- To use USB connector (EMU USB) on QB-780731, connect the VBUS check pin on the QB-780731 and VBUS on the target system by using an IC clip. Use an IC clip that can withstand the rated current to be supplied. Exercise care that the IC clip does not contact any other components.
- When the USB connector on the target system is used, the difference in electrical characteristics from those of the actual device increase from when the USB connector (EMU USB) on the QB-780731 is used.

<R>
- When a debugger is started with the QB-780731 alone (without target system connected), set USB SW (SW1, SW2) to the PROBE side.
  When switching to the EMU USB side, make sure that the debugger has been started.

<R>

APPENDIX A 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	**1.3 System Configuration** • Addition of **Remark** • Deletion of **1.3.1 AC adapter** from a previous edition	CHAPTER 1 GENERAL
	1.4 Package Contents • Change of **Products supplied with QB-780731-ZZZ**	
	Change of **2.3 Clock Settings**	CHAPTER 2 SETUP PROCEDURE
	2.7 Connection to Emulate USB Interface Function • Addition of Note 1	
	2.10 Switching Power On and Off • Addition of Note 2	
	Addition of **APPENDIX A REVISION HISTORY**	APPENDIX A REVISION HISTORY

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