

QB-RL78D1A

In-Circuit Emulator

Preliminary User's Manual

Target Devices

RL78/D1A

All information contained in these materials, including products and product specifications, represents information on the product at the time of publication and is subject to change by Renesas Electronics Corp. without notice. Please review the latest information published by Renesas Electronics Corp. through various means, including the Renesas Electronics Corp. website (<http://www.renesas.com>).

Rev.1.01 2011.6

ZUD-BG-11-0085

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
 - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.
 - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.
 - "Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

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 a metal part of the power switch, cooling fan, or another such part comes in contact with an electrostatic charge.
- 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**.
- The AC adapter supplied with the product is exclusively for this product, so do not use it with other products.

How to Use This Manual

Readers	This manual is intended for users who wish to perform debugging using the QB-RL78D1A. 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-RL78D1A.	
Organization	This manual is divided into the following sections. <ul style="list-style-type: none"> • General • Setup procedure • Settings at product shipment • Cautions 	
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-RL78D1A</p> <p>→ Read this manual in the order of 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-RL78D1A</p> <p>→ See the user's manual of the debugger (supplied with the QB-RL78D1A) to be used.</p>	
Conventions	<p>Note: Footnote for item marked with Note in the text</p> <p>Caution: Information requiring particular attention</p> <p>Remark: Supplementary information</p> <p>Numeric representation: Binary ... xxxx or xxxxB Decimal ... xxxx Hexadecimal ... xxxxH</p> <p>Prefix indicating power of 2 (address space, memory capacity): K (kilo): $2_{10} = 1,024$ M (mega): $2_{20} = 1,024_2$</p>	

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 Renesas 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 Device (User's Manuals)

Document Name	Document Number
RL78/D1A User's Manual	Under development
RL78 Microcontrollers for Instructions User's Manual	Under development

Documents Related to Development Tools (User's Manuals)

Document Name		Document Number
QB-RL78D1A In-Circuit Emulator User's Manual		This manual
CubeSuite Integrated Development Environment User's Manual	Start	R20UT0256E
	Design	R20UT0007E
	RL78,78K0R Cording	Under development
	RL78,78K0R Build	Under development
	RL78,78K0R Debug	Under development
	Analysis	R20UT0265E
	Programming	R20UT0266E
	Message	R20UT0267E

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.

IECUBE is a registered trademark of Renesas Electronics Corporation in Japan and Germany.

Windows is either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

PC/AT is a trademark of International Business Machines Corporation.

CONTENTS

CHAPTER 1	GENERAL	7
1.1	Hardware Specifications	8
1.2	Names and Functions of Hardware	9
1.3	System Specifications	11
1.4	System Configuration	12
1.5	System Configuration for Each Target Device	14
1.6	Package Contents	15
1.7	AC Adapter for IECUBE	16
CHAPTER 2	SETUP PROCEDURE	17
2.1	Software Settings	18
2.1.1	Obtain IECUBE Configuration data	18
2.1.2		18
2.2	Clock Settings	19
2.3	Mounting and Connecting Connectors	24
2.3.1	Mounting NQ to target system	24
2.3.2	Mounting YQ to NQ	25
2.3.3	Plugging EA into YQ	26
2.3.4	Precautions for handling NQ, YQ, SA, and CA	26
2.3.5	Precautions for mounting IC using NQ and MA	27
2.4	Connecting QB-RL78D1A to Target System	28
2.5	Notes on Power Supply and GND Pin Connection	30
2.6	Connecting USB Interface Cable and AC Adapter	31
2.7	Switching Power On and Off	31
CHAPTER 3	SETTINGS AT PRODUCT SHIPMENT	32
CHAPTER 4	CAUTIONS	33
4.1	Cautions Regarding Differences Between Target Device and Emulator	33
APPENDIX A	CHARACTERISTICS OF TARGET INTERFACE	35
APPENDIX B	REVISION HISTORY	38
B.1	Major Revisions in This Edition	38

CHAPTER 1 GENERAL

The QB-RL78D1A is an in-circuit emulator for emulating the RL78/D1A.

Hardware and software can be debugged efficiently in the development of systems in which the RL78/D1A is used.

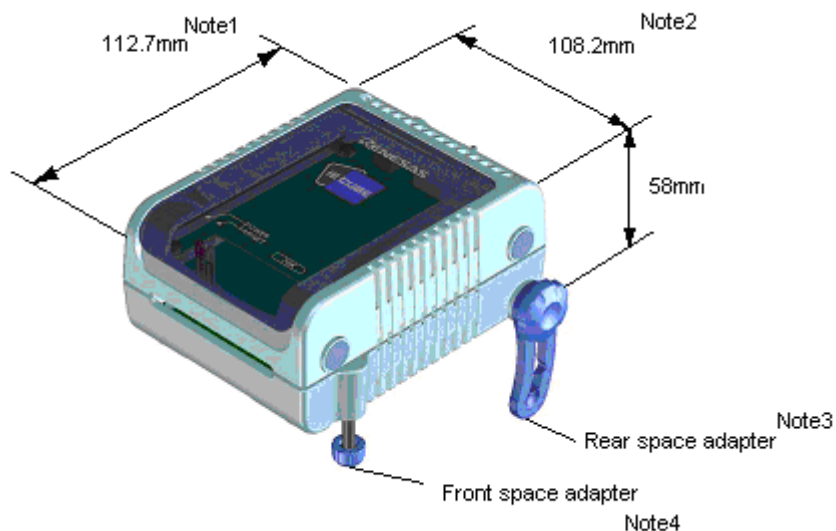
This manual describes basic setup procedures, hardware specifications, system specifications, and how to set switches.

1.1 Hardware Specifications

Table 1-1. QB-RL78D1A Hardware Specifications

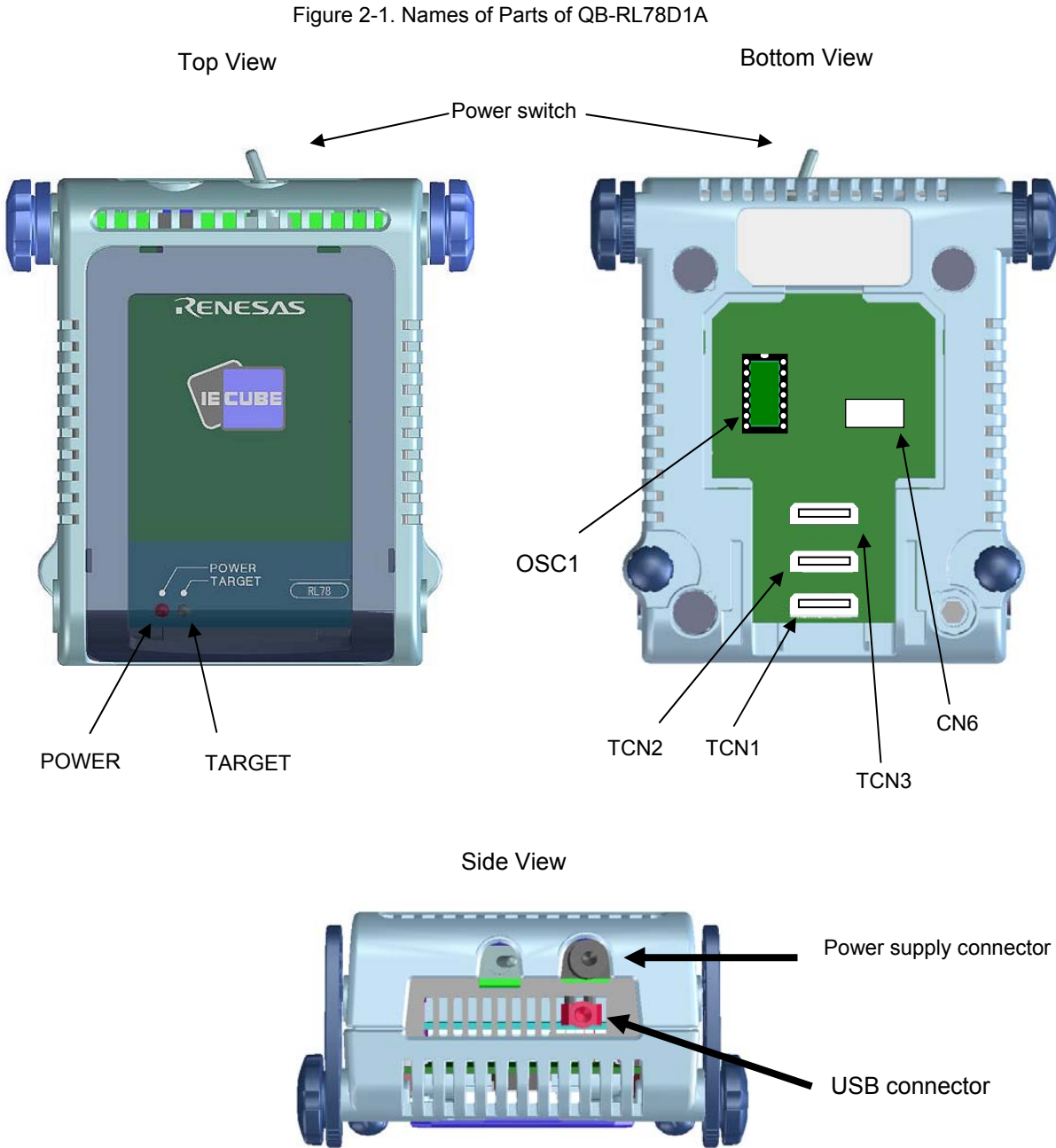
Parameter		Specification
Target device		RL78/D1A
Operating voltage		2.4~5.5V
Operating frequency ^{Note}	High-speed system clock	2.4 V V _{DD} 5.5 V : 1~20 MHz
	Internal high-speed oscillation clock	2.4 V V _{DD} 5.5V : 1~32 MHz
	Low-speed system clock	2.4 V V _{DD} 5.5 V : 15 kHz
	Subsystem clock	2.4 V V _{DD} 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	Target system power supply	Voltage: 2.4 to 5.5 V Maximum current consumption : Approx. 0.2mA
Weight		Approx. 400 g
Host interface		USB interface (1.1, 2.0)

Note Errors are within $\pm 0.5\%$. However, this does not apply to errors of the oscillator or clock system on the target board.



- Notes**
- Does not include projection of power switch
 - Includes projection of screw that fixes rear space adapter
 - Rear space adapter can adjust the height from 30 mm (longest) to 0 mm (shortest)
 - Front space adapter can adjust the height from 20 mm (longest) to 5 mm (shortest)

1.2 Names and Functions of Hardware



(1) TCN1, TCN2, TCN3

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

(2) OSC1

This is a socket for mounting the oscillator.

(3) CN4

This is a connector for the shipment inspection. It is not something that the user will need.

(4) POWER (Red LED)

This is an LED that shows whether the power supply of the QB-RL78D1A is switched on.

LED State	QB-RL78D1A State
Lit	Power switch ON
Not lit	Power switch OFF or AC adapter not connected to QB-RL78D1A
Blinking	Internal error occurred (Contact an Renesas Electronics sales representative or distributor)

(5) TARGET (Green LED)

This is an LED that shows whether 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-RL78D1A.

It is OFF at shipment.

1.3 System Specifications

This section shows the QB-RL78D1A system specifications.

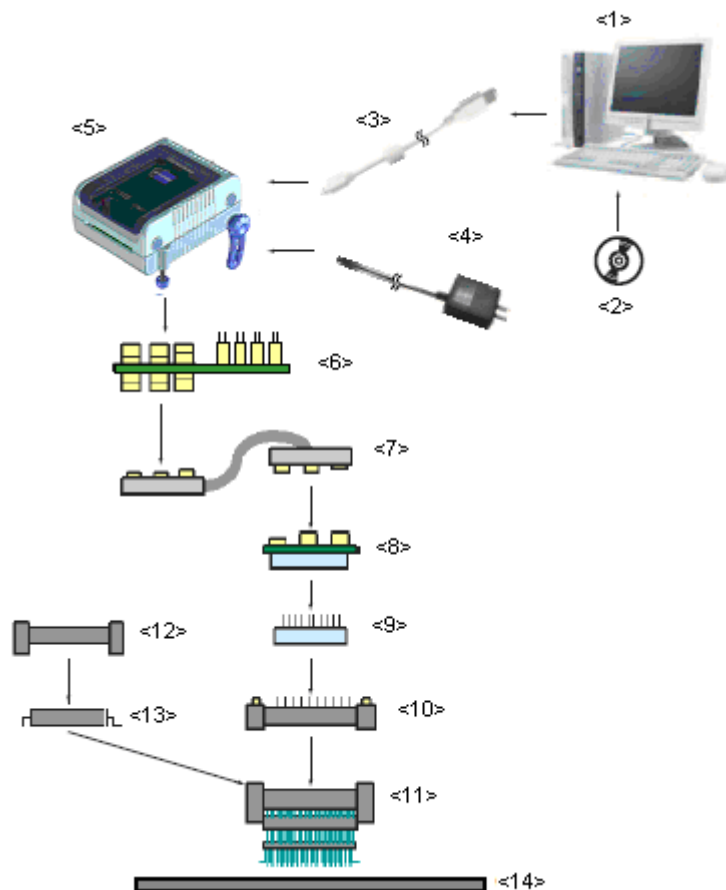
Table 1-2. QB-RL78D1A System Specifications

Parameter		Specification
Emulation memory capacity	Internal ROM	512 KB (MAX.)
	Internal RAM	61.75 KB (MAX.)
Program execution functions	Real-time execution function	Go, Start from Here, Come Here, Restart, Return Out, Ignore break points and Go
	Non-real-time execution function	Step In, Next Over, Slowmotion, Go & Go
Memory manipulation		Available (initialize, copy, compare)
Register manipulation		Available (general-purpose registers, control registers, SFRs)
Disassemble function		Available
Local variable view		Local variables
Watch data view		Local variables, global variables, or else
Stack trace view		Available
Break functions	Event break	Execution: 8 points Access: 8 points
	Software break	2000 points
	Pre-execution break	4 points
	Fail-safe break	Non-map, write protect, SFR illegal access, stack overflow, or else
	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, time tag
	Trace modes	Unconditional trace, section trace, qualify trace, delay trigger trace
	Trace functions	Non-stop, full stop, full break, delay trigger stop, delay trigger break
	Memory capacity	128K frames
Real-time RAM monitoring function		All internal RAM spaces
Time measurement functions	Measurement clock	60 MHz
	Measurement objects	Start through end of program execution Start event through end event
	Maximum measurement time	Approx. 40 hours and 43 minutes (Resolution: 17 ns)
	Number of timers for measurement	Start through end of program execution: 1 Start event through end event: 2
	Measurement results	Execution time (start through end of execution) Maximum, minimum, average, total, pass count (between events)
	Other	Timer overflow break function, timeout break function
Other functions		Command functions set in the console, mapping function, event function, coverage function, snapshot function, DMM function, power-off emulation function, pin mask function, flash self programming emulation function

1.4 System Configuration

This section shows the system configuration when using the QB-RL78D1A connected to a PC (Windows™ PC, PC/AT™ compatible). Connection is possible even without optional products.

Figure 1-1. System Configuration



- | | |
|------------------------------------|--|
| <1> Host machine | : Windows PC, IBM PC/AT compatible can be used |
| <2> ID78K0R-QB Disk/Accessory Disk | : Manual, etc. |
| <3> USB interface cable | : Cable connecting QB-RL78D1A to host machine |
| <4> AC adapter | : AC adapters classified by region |
| <5> QB-RL78D1A | : This product |
| <6> Check pin adapter (optional) | : Adapter used for monitoring waveforms with oscilloscope |
| <7> Emulation probe | : High-characteristic FPC type emulation probe |
| <8> Exchange adapter | : Adapter that performs pin conversion |
| <9> Space adapter (optional) | : Adapter used for height adjustment |
| <10> YQ connector | : Connector that connects exchange adapter to target connector |
| <11> Target connector | : Connector soldered to target system |
| <12> Mount adapter (optional) | : Adapter used for mounting target device into socket |
| <13> Device | : Target device |
| <14> Target system | |

- Remarks 1.** Obtain device information files from the Renesas Electronics website.
<http://www2.renesas.com/micro/en/ods/>
- 2.** Obtain IECUBE configuration data from the Renesas Electronics website.
<http://www2.renesas.com/micro/en/ods/>
- 3.** Refer to **1.5 Package Contents** for the purchase forms of the above products.
- 4.** As for handling of connectors, refer to **2.5 Mounting and Connecting Connectors**.
- 5.** The part number of <4> differs depending on the region of use. See **Table 1-5 Part Numbers of AC Adapter for IECUBE Classified by Region** for the part numbers. The IECUBE requires an ACadapter that must be purchased separately.
- 6.** See **Table 1-4 Common Probe and Adapter** for the part numbers of <6> and <7>.
- 7.** The combination of <8>, <9>, <10>, <11>, and <12> varies depending on the emulation device. See **Table 1-3 Adapters and Connectors for Each Target Device** for the combinations.

1.5 System Configuration for Each Target Device

The following table lists the system configuration for each target device of the QB-RL78D1A.

The adapter and connector for each device, and common probe and adapter are sold separately. An exchange adapter, a YQ connector, a target connector, and an emulation probe are included, depending on the order product name. For details, refer to **1.6 Package Contents**.

Remark For the package drawings of the connector, adapter, and probe, refer to the following URL.
<http://www2.renesas.com/micro/en/development/asia/Emulator/IE/iecube.html>

Table 1-3. Adapters and Connectors for Each Target Device

Target Device	Package	Exchange Adaptor	Space Adaptor	YQ Connector	Target Connector	Mount Adaptor
RL78/D1A	64FB	QB-64FB-EA-02T	QB-64FB -YS-01T	QB-64FB -YQ-01T	QB-64FB -NQ-01T	QB-64FB -HQ-01T
	80FB	QB-80FB-EA-02T	QB-80FB-YS-01T	QB-80FB-YQ-01T	QB-80FB-NQ-01T	QB-80FB-HQ-01T
	100FB	QB-100FB-EA-02T	QB-100FB-YS-01T	QB-100FB-YQ-01T	QB-100FB-NQ-01T	QB-100FB-HQ-01T

Table 1-4. Common Probe and Adapter

Name	Part Number	Target Device
Check pin adapter	QB-144-CA-01	RL78/D1A
Emulation probe	QB-144-EP-02S	RL78/D1A

1.6 Package Contents

The included products are described for each order product name.

Products supplied with QB-RL78D1A-ZZZ

- 1: QB-78K0RD1A
- 2: USB interface cable (2 meters)
- 3: Probe holder
- 4: Online user registration card (warranty card and software contract in one)
- 5: Packing list

Products supplied with QB-RL78D1A-T64FB

1~5

6: Emulation probe QB-144-EP-02S

<R> 7: Exchange adapter QB-64FB-EA-02T

8: YQ connector QB-64FB-YQ-01T

9: Target connector QB-64FB-NQ-01T

Products supplied with QB-RL78D1A-T80FB

1~5

6: Emulation probe QB-144-EP-02S

<R> 7: Exchange adapter QB-80FB-EA-02T

8: YQ connector QB-80FB-YQ-01T

9: Target connector QB-80FB-NQ-01T

Products supplied with QB-RL78D1A-T100FB

1~5

6: Emulation probe QB-144-EP-02S

7: Exchange adapter QB-100FB-EA-02T

8: YQ connector QB-100FB-YQ-01T

9: Target connector QB-100FB-NQ-01T

1.7 AC Adapter for IECUBE

The specifications of the AC adapter for IECUBE differ depending on the region of use. Be sure to use an AC adapter corresponding to the region of use.

Table 1-5. Part Numbers of AC Adapter for IECUBE Classified by Region

Product	Destination (Region) ^{Notes 1, 2}	Part Number ^{Note 3}
AC adapter (sold separately)	Japan	QB-COMMON-PW-JP
	USA	QB-COMMON-PW-EA
	China	QB-COMMON-PW-CN
	Hong Kong	QB-COMMON-PW-HK
	South Korea	QB-COMMON-PW-KR
	Singapore	QB-COMMON-PW-SG
	Taiwan	QB-COMMON-PW-TW

Notes 1. Products are shipped only on order from each region.

2. Contact a distributor or an Renesas Electronics sales representative for information on regions other than the above.

3. Only the AC adapter usable in each region can be ordered

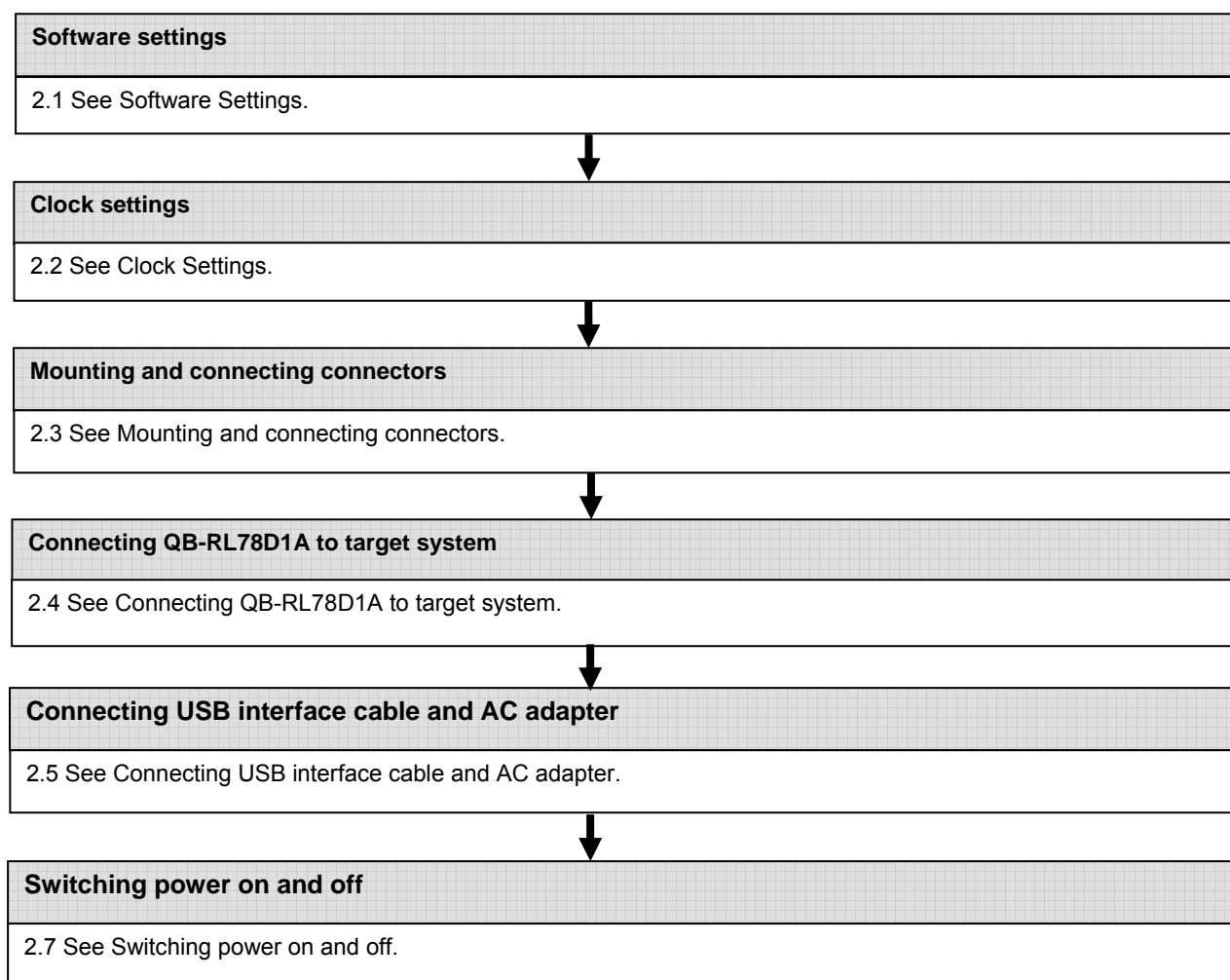
CHAPTER 2 SETUP PROCEDURE

This chapter explains the QB-RL78D1A 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 1.2 Names and Functions of Hardware for clock positions.



2.1 Software Settings.

When connecting QB-RL78D1A with CubeSuite, a IECUBE configuration data is downloaded by IECUBE from CubeSuite.

It's necessary to install a IECUBE configuration data in CubeSuite as a setup.

2.1.1 Obtain IECUBE Configuration data

- (1) Download the installation file RL78_F_Vx.zip from the Development Tools Download page on the Renesas Electronics website.

URL: <http://www2.renesas.com/micro/en/ods/> → Click "Version-up Service".

Category: Each Development Tool → IECUBE_Software

Product Name/version : IECUBE for RL78

File name : RL78_F_Vx.zip ("x" is the number which indicates the version.)

- (2) Decompress the downloaded file.

2.1.2 Execution of installation

Copy .bin file of all into the following folder.

C:\Program Files\NEC Electronics CubeSuite\ICubesuite\DebugTools78K0REmulator\DII

Caution C:\Program Files\NEC Electronics CubeSuite is the default installation folder of the CubeSuite. If the CubeSuite was installed in a different path, specify that path.

2.2 Clock Settings

The following four types of clock settings are available.

Each clock setting is listed below.

Oscillation with the resonator on the target system is not supported. Therefore, the in-circuit emulator cannot emulate the oscillation operation of the clock on the target system.

Clock Used	Clock Supply	CubeSuite Setting (in connect Settings of property)
(1) High-speed system clock ^{Note 1} (X1 oscillator or External input)	(a) When the clock generated within the emulator is used	Generate by emulator
	(b) When the clock is supplied from the target system	External
	(c) When the oscillator (OSC1) mounted onto the emulator is used	Clock Socket
(2) Internal high-speed oscillation clock	Uses the clock internally generated from the emulator	—
(3) Subsystem clock ^{Note 2} (XT1 oscillator)	(a) When the clock generated within the emulator is used	Generate by emulator
	(b) When the clock is supplied from the target system	External

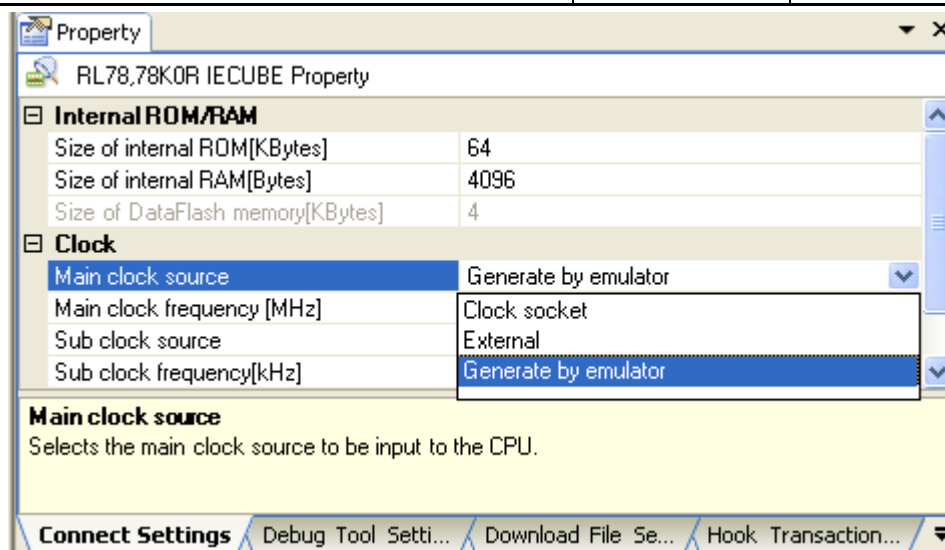
- Notes**
- First, select "Generate by emulator" in the debugger settings (refer to (a) When the clock generated within the emulator is used, in (1) High-speed system clock).
If there is no clock that can be selected, follow the descriptions below.
 - If the target system clock can supply a square wave for the emulator:
Select "External" in the debugger settings (refer to (b) When the clock is supplied from the target system, in (1) High-speed system clock).
 - If the target system clock cannot supply a square wave for the emulator:
Mount onto the emulator the oscillator of the clock to be used and select "Clock Socket" in the debugger settings (refer to (c) When the oscillator (OSC1) mounted onto the emulator is used, in (1) High-speed system clock).
 - First, select "Generate by emulator" in the debugger settings (refer to (a) When the clock generated within the emulator is used, in (3) Subsystem clock).
If there is no clock that can be selected, it can be supplied from the target system clock. A square wave, however, must be supplied (refer to (b) When the clock is supplied from the target system, in (3) Subsystem clock).

(1) High-speed system clock

The clock settings are listed below.

Table 2-1. Settings for High-Speed System Clock

Type of Clock to Be Used	OSC1	CubeSuite Setting
(a) When the clock generated within the emulator is used	–	Generate by emulator
(b) When the clock is supplied from the target system ^{Note}	–	External
(c) When the oscillator (OSC1) mounted onto the emulator is used	Oscillator mounted	Clock Socket



Note This setting is not possible when TARGET LED is not lit.

Remarks 1. Settings other than the above are prohibited.

2. Selection of (a) or (b) is possible regardless of whether the oscillator is not mounted in the OSC1socket.

(a) When the clock generated within the emulator is used

Select the "Generate by emulator" in the debugger and select the desired frequency from the drop-down list. The following frequencies are selectable.

2.00, 3.00, 3.57, 4.00, 4.19, 4.91, 5.00, 6.00, 8.00, 8.38, 10.00, 12.00, 16.00, 20.00 [MHz]

(b) When the clock is supplied from the target system

Select the "External" in the debugger. The clock input from the target system is then used.

Oscillation with the resonator on the target system is not supported. To input a clock from the target system, input to the clock pin (X2) the square-wave signal with the same voltage potential as that of the target device supply voltage (VDD). Inputting the inverted signal to X1 is not necessary.

The selectable frequencies are same as those of the target device.

(c) When the oscillator (OSC1) mounted onto the emulator is used

Mount an oscillator in the OSC1 socket in the emulator and then select the "Clock socket" in the debugger.

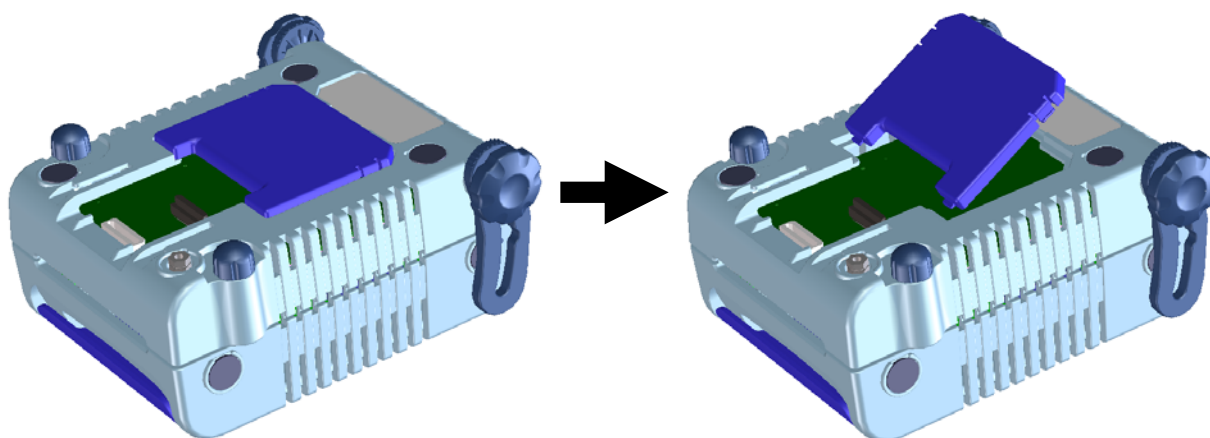
The clock generated from the oscillator mounted on the emulator is used.

The selectable frequencies are same as those of the target device.

To modify the clock setting, the acrylic board on the bottom of the QB-RL78D1A must be removed.

The acrylic board can be removed by lifting it up.

Figure 2-1. Acrylic Board Removal Method



As an oscillator^{Note} to be mounted in the OSC1 socket in the emulator, use the one that satisfies the following specifications.

- Supply voltage: 5 V
- Output level: CMOS

Note An oscillator that uses a resonator cannot be used.



Figure 2-2. Oscillator Shape

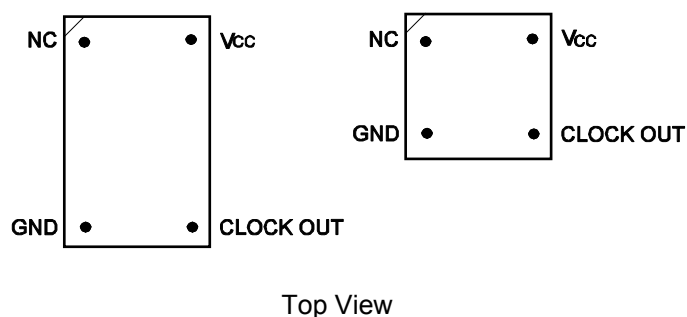
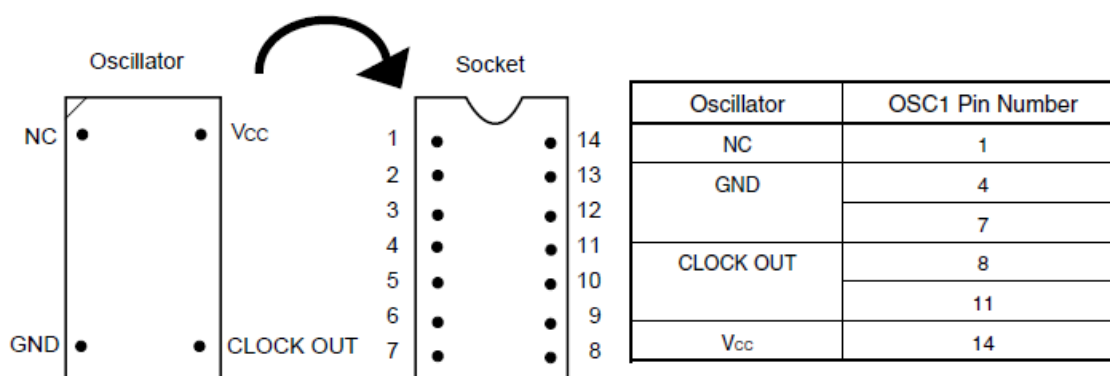


Figure 2-4. Mapping of Oscillator to Socket



Remark Insert the oscillator into the socket, take care for the pin 1 position.

(2) Internal high-speed oscillation clock

The debugger setting is not necessary.

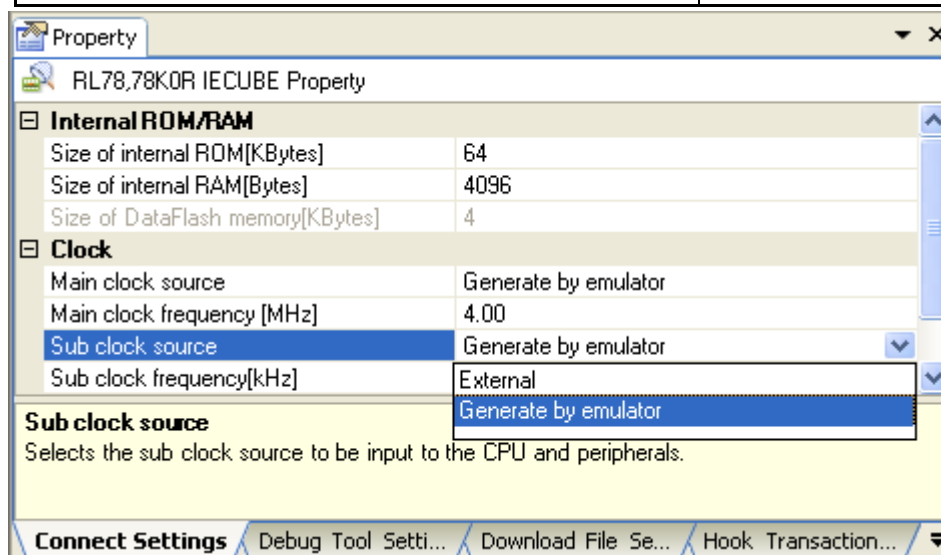
The use of the internal high-speed oscillation clock can be specified in the user program.

(3) Subsystem clock

The clock settings are listed below.

Table 2-3. Settings for Subsystem Clock

Type of Clock to Be Used	CubeSuite Setting
(a) When the clock generated within the emulator is used	Generate by emulator
(b) When the clock is supplied from the target system ^{Note}	External



Note This setting is not possible when TARGET LED is not lit.

Remark Settings other than above are prohibited.

(a) When the clock generated within the emulator is used

Select the "Generate by emulator" in the debugger and select "32.768" [kHz] as the frequency from the drop-down list.

32.768 [kHz]

Remark "38.400" [kHz] can also be selected from the list, but do not select this frequency; it is not supported by the device.

(b) When the clock is supplied from the target system

Select the "External" in the debugger. The clock input from the target system is then used.

Oscillation with the resonator on the target system is not supported. To input a clock from the target system, input to the clock pin (XT2) the square-wave signal with the same voltage potential as that of the target device supply voltage (V_{DD}). Inputting the inverted signal to XT1 is not necessary.

The selectable frequencies are same as those of the target device.

2.3 Mounting and Connecting Connectors

This section describes the methods of connecting the QB-RL78D1A and target system.

Make connections with both the QB-RL78D1A and target system powered OFF.

The following abbreviations are used in this section:

- NQ: Target connector
- YQ: YQ connector
- EA: Exchange adapter
- MA: Mount adapter
- CA: Check pin adapter
- SA: Space adapter

2.3.1 Mounting NQ to target system

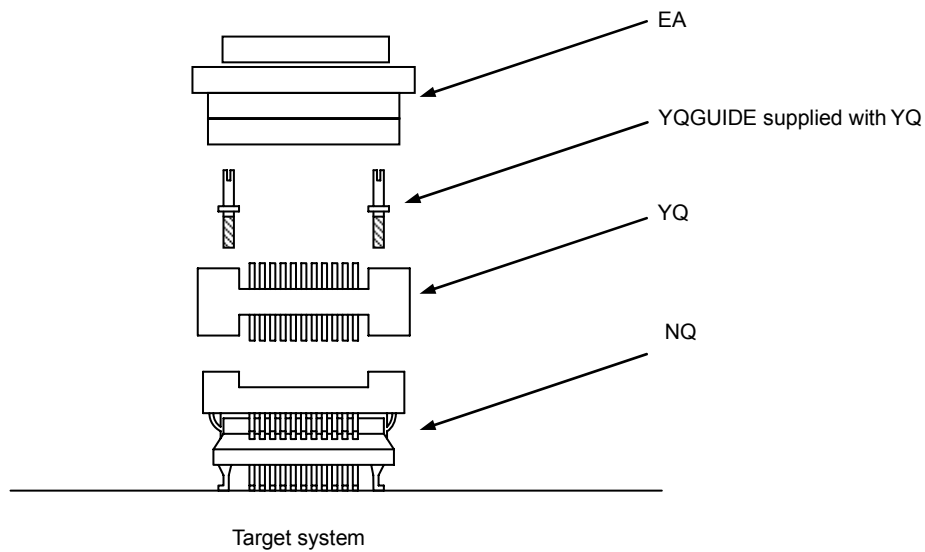
- (1) Thinly apply a two-component epoxy adhesive (hardening time at least 30 minutes) to the ends of the four projections on the base of the NQ and adhere the NQ to the user board (clean the surface of the target system board using alcohol or the like). If alignment of target system pads to NQ leads is difficult, align them as in (2).
- (2) Align by inserting the guide pins for alignment for the NQ (NQGUIDE) through the pin holes on the top of the NQ. Accessory holes are ± 1.0 mm non-through holes in two or three places.
(For hole positions, see the particular NQ drawing.)
- (3) Solder after fitting the MA to the NQ. This is to prevent troubles such as flux or solder splashing and adhering to the NQ contact pins when soldering.
 - Soldering conditions Solder reflow 260°C · 10 seconds or less
 Manual soldering 350°C · 5 seconds or less (1 pin)

Caution Do not perform washing by flux immersion or vapor.

- (4) Take away the guide pins.

2.3.2 Mounting YQ to NQ

- (1) After confirming that there are no broken or bent YQ contact pins, fit the YQ in the NQ and fasten it using the supplied YQGUIDE (for the fastening method, see the next step, (2)). 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) Fasten YQ to the NQ on the target system using the supplied YQGUIDE. Fasten the screws equally in the four corners using the supplied flat-blade screwdriver or a torque driver. The tightening torque of the YQGUIDE is 0.054 Nm (MAX.). Too great tightening causes bad connections. However, four screws for fitting to the NQ (M2 x 10 mm / 4 units) are included with the YQ.



2.3.3 Plugging EA into YQ

Match the pin 1 position of the YQ or SA (corner cuts match in both) to the pin 1 position of the EA and plug in.

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

As a tool when unplugging, insert some kind of thin non-conductive material such as a wooden stick between the YQ (SA) and EA and wiggle while slowly unplugging. Be careful since the connector will be damaged if this is done in the wrong direction.

2.3.4 Precautions for handling NQ, YQ, SA, and CA

- (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 #0 or #1 Phillips precision screwdriver 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 (four 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 SA removal, since there is a danger of YQ pins being bent or broken when prying and wiggling, remove them gradually using a flatbladed screwdriver from four directions. Moreover, to connect and use the YQ and SA, screw the YQ to the NQ according to the YQGUIDE (included with the YQ) using a 2.3 mm flatbladed screwdriver and then connect it to the SA. 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 SA, 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) A 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 SA, see the NQPACK series technical materials at the website of Tokyo Eletech Corporation.

URL: <http://www.tetc.co.jp/>

(11) CA

The CA is an optional product for IECUBE, and can be used to measure the waveform between IECUBE and the target system.

Since the pins on the CA do not correspond to the pin layout in each device, the pin header cover must be mounted according to the device to be used. For mounting methods of the pin header cover, refer to **[Related Content]** on the following URL.

<http://www2.renesas.com/micro/en/development/asia/Emulator/IE/qb-144-ca-01.html>

2.3.5 Precautions for mounting IC using NQ and MA

- (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 MA.

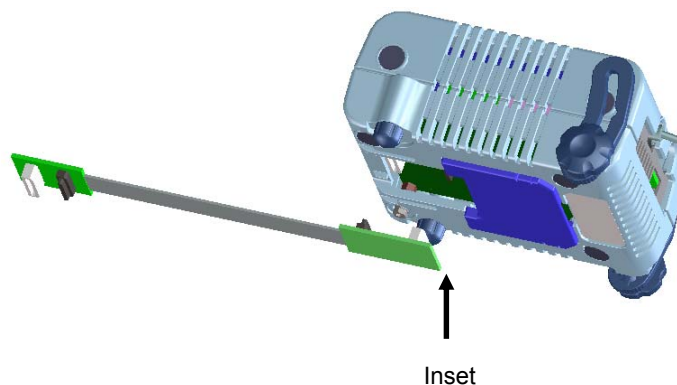
- (4) Put the supplied M2 x 6 mm screws in the four accessory holes of the MA and fasten the screws in opposite corners. At that time, use either the dedicated screwdriver that is supplied or a torque driver to fasten them equally in turn with a tightening torque of 0.054 Nm (MAX.). Since the contact is poor if tightening is too great, once you have lightly fastened the MA 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 MA too much may give rise to cracks in the molded part of the MA (plastic part) and bend the mold into a bowed shape, making contact poor.
- (8) After soldering the NQ, do not perform cleaning by flux immersion or vapor.

2.4 Connecting QB-RL78D1A to Target System

If connecting the emulation probe (QB-144-EP-02S), connect it to the QB-RL78D1A and the target system by the following procedure.

- (a) Connect the QB-RL78D1A to the probe.

Figure 2-5. Connect the QB-RL78D1A to the probe



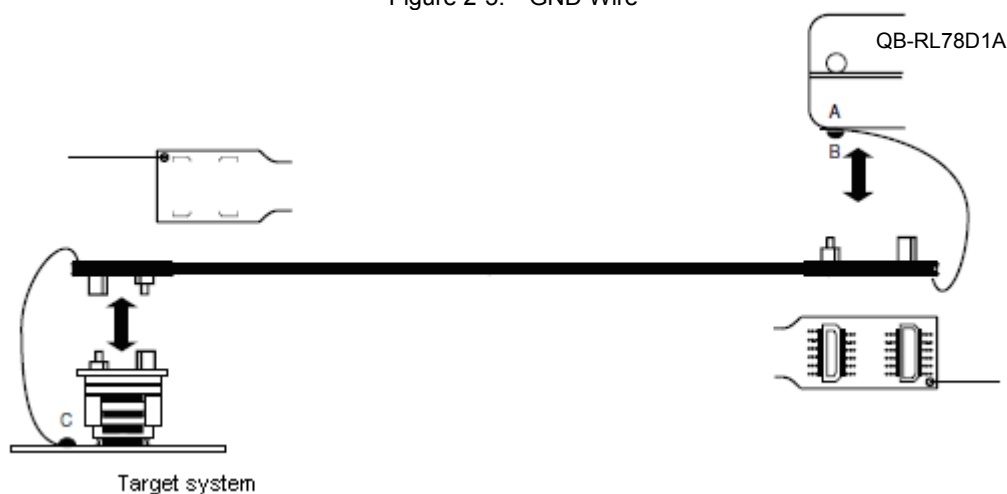
- (b) Connection of emulation probe GND wire

There are three GND wires in the emulation probe. Connect them to the QB-RL78D1A and target system.

<1> Fasten the GND wire on the QB-RL78D1A side of the emulation probe to the nut on the bottom of the QB-RL78D1A using a #0 or #1 Phillips precision screwdriver (connection of B to A in Figure 2-5).

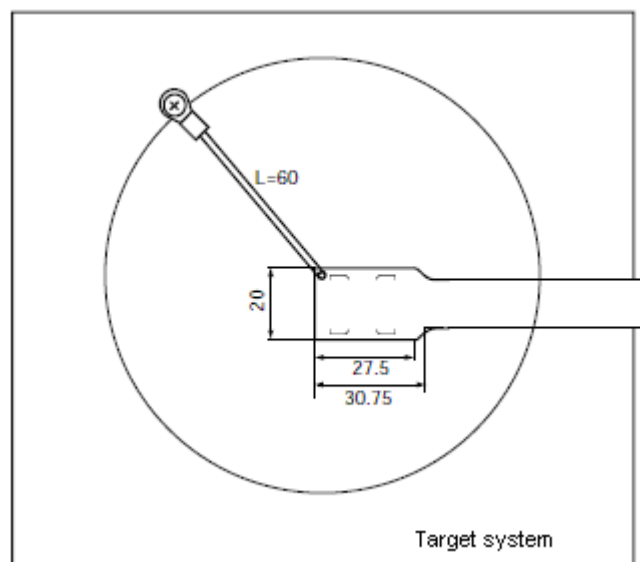
<2> Next insert the connector on the top of the emulation probe into the connector at the opening on the bottom of the QB-RL78D1A from below being careful of the insertion direction (connection of C in Figure 2-5 to QB-RL78D1A).

Figure 2-5. GND Wire



- <3> Connect the exchange adapter and emulation probe to the target connector.
- <4> Connect the two GND wires 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 (G in Figure 2-5). 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 (H in Figure 2-5) (recommended soldering iron temperature setting: 300°C).
- <5> If the target system has only one GND, connect only one of the GND wires of the emulation probe. Cut off the other GND wires with a nipper or leave it as is without removing the pin cover.
- <6> Since the length of the GND wire below the head (insulated part) is approximately 60 mm, there must be at least a GND to which it can be connected to within the range of the two approximately 60 mm radius sections of the target system for connecting the emulation probe, as shown in Figure 2-6. The GND wire of the emulation probe is soldered to positions J and K in Figure 2-6.

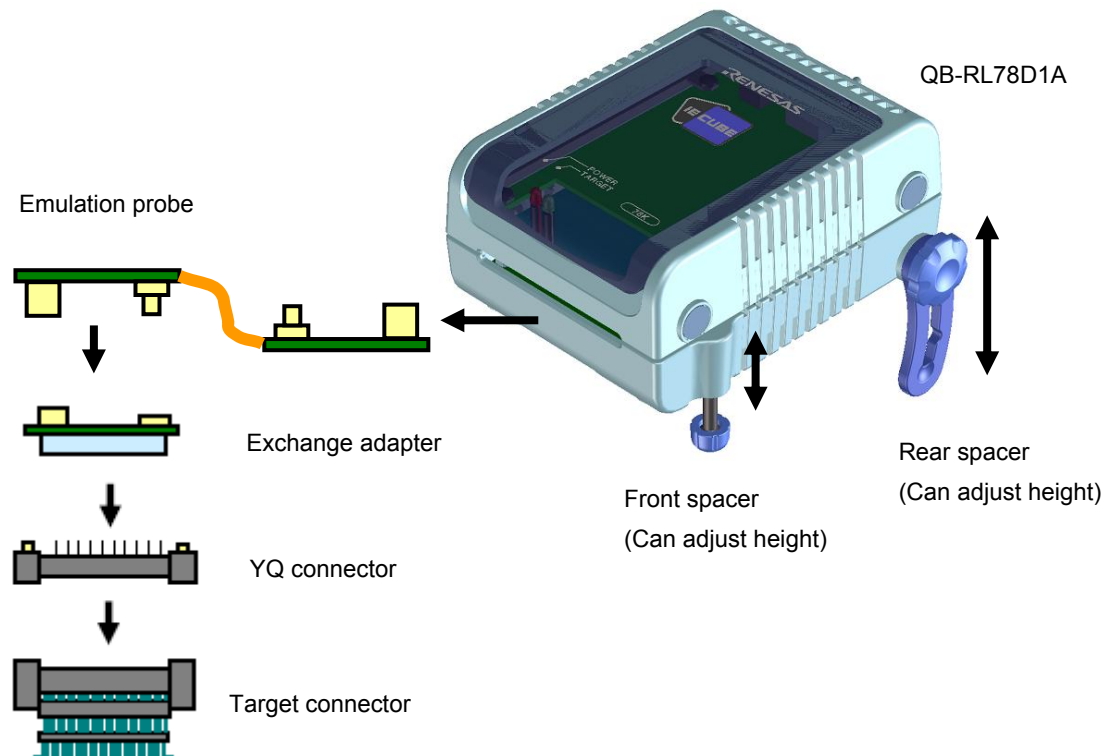
Figure 2-6 Where GND Wire Can Be Connected



(c) Ensuring isolation

When connecting the target system to the QB-RL78D1A using an emulation probe, perform height regulation using the front spacer or rear spacer of the QB-RL78D1A and ensure isolation from the target system.

Figure 2-8. Connection Using Emulation Probe



(d) Precautions related to 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-RL78D1A 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.

2.5 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.

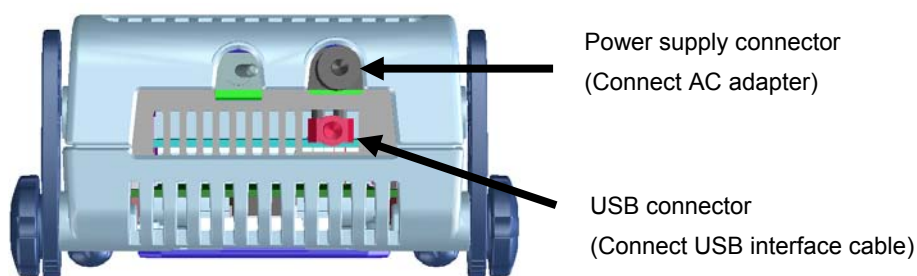
2.6 Connecting USB Interface Cable and AC Adapter

Plug the USB interface cable supplied with the QB-RL78D1A into the USB connector of the host machine, and plug the other side into the USB connector on the rear of the QB-RL78D1A.

Plug the AC adapter supplied with the QB-RL78D1A into a receptacle and plug the other side into the power supply connector on the rear of the QB-RL78D1A.

For QB-RL78D1A connector positions, see Figure 2-8.

Figure 2-9. Connector Positions



2.7 Switching Power On and Off

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

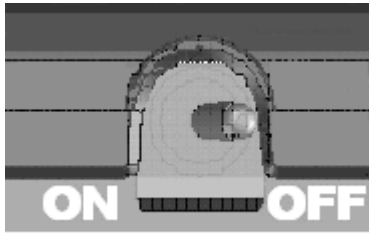
- | | |
|--|---|
| - Switching power on | - Switching power off |
| <1> QB-RL78D1A power on | <1> Debugger termination |
| <2> Target system power on ^{Note} | <2> Target system power off ^{Note} |
| <3> Debugger startup | <3> QB-RL78D1A power off |

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

Caution If the wrong sequence was used for the operation, the target system or QB-RL78D1A may fail

CHAPTER 3 SETTINGS AT PRODUCT SHIPMENT

Table 3-1. Settings at Shipment

Item	Setting	Remarks
OSC1	Not mounted	Oscillator can be mounted ^{Note} .
Power switch		Set to OFF at shipment.

Note The oscillation circuit using an oscillation cannot be used.

CHAPTER 4 CAUTIONS

4.1 Cautions Regarding Differences Between Target Device and Emulator

When debugging is performed by connecting the QB-RL78D1A to the target system, the QB-RL78D1A emulates the target device as if it operates in the target system. However, the target device and the QB-RL78D1A operate differently in the following ways. Consequently, the target device should be used for final evaluation before launching mass production, and the customer is to be responsible for judging the appropriateness of applying the QB-RL78D1A.

- Operation after target system power application

After power application, a program will be executed for the target device mounted in the target system when reset is released. However, with the QB-RL78D1A, the program does not start until an operation to start execution is performed after the program is downloaded using the debugger.

- Oscillator

The QB-RL78D1A does not support clock input by an oscillator in the target system. Consequently, the operation clock frequency when the target device is mounted in the target system may differ from the operation clock frequency when the QB-RL78D1A is connected.

- Pin characteristics

The pin characteristics of the QB-RL78D1A slightly differ when the target device is mounted to the target system, because a connector, adapter, emulation probe, and circuit board exist between the QB-RL78D1A and the target system. In particular, note that the A/D converter conversion results are commonly-affected.

- On-chip debug function

The on-chip debug function cannot be emulated.

- Current consumption

The current consumption of the QB-RL78D1A differs from that of the target device.

The same amount of current is consumed in standby mode.

- Power-on-reset (POR) voltage value

The power-on-reset (POR) voltage value differs from that of the target device.

Table 4-2. Power-on-reset (POR) voltage value

Item		MIN.	TYP.	MAX.
Target device	VPOR	1.48 V	1.51 V	1.54 V
	VPDR	1.47 V	1.50 V	1.53 V
IECUBE	VPOR	—	1.54 V	—
	VPDR	—	1.47 V	—

- Characteristic of Target interface

Please refer to APPENDIX A.

- Pull-up

There is a time lag (max 150ns) to work pull up register after setting PUX register.

- LCD

There is a time lag (max 3ms) to output LCD waveform outputs after setting LCD's SFR.

- Clock monitor

External clock can't be suspended at the time of external clock choice as operation clock of CPU.

Please emulate a clock monitor by pseudo-emulation.

- IAW

When Illegal Access (IAW) occurs, Reset does not occur but also Break occurs.

Please emulate IAW reset by pseudo-emulation.

- PLL

PLL is emulated by choosing fixed clock. The PLL input clock frequency (fPLLI) is only 0MHz, 4MHz, and 8MHz. The PLL output clock frequency (fPLLO) is established according to the PLL input clock frequency (fPLLI).

- CRC

When a software break is set at time using a CRC operational function, the CRC operation result goes different.

<R> - A/D converter

The A/D conversion result is not stable until 200us after changing VREF(+) selection by ADM2:bit6,bit7. Please wait 200us after changing VREF(+) selection.

<R> - Standby mode

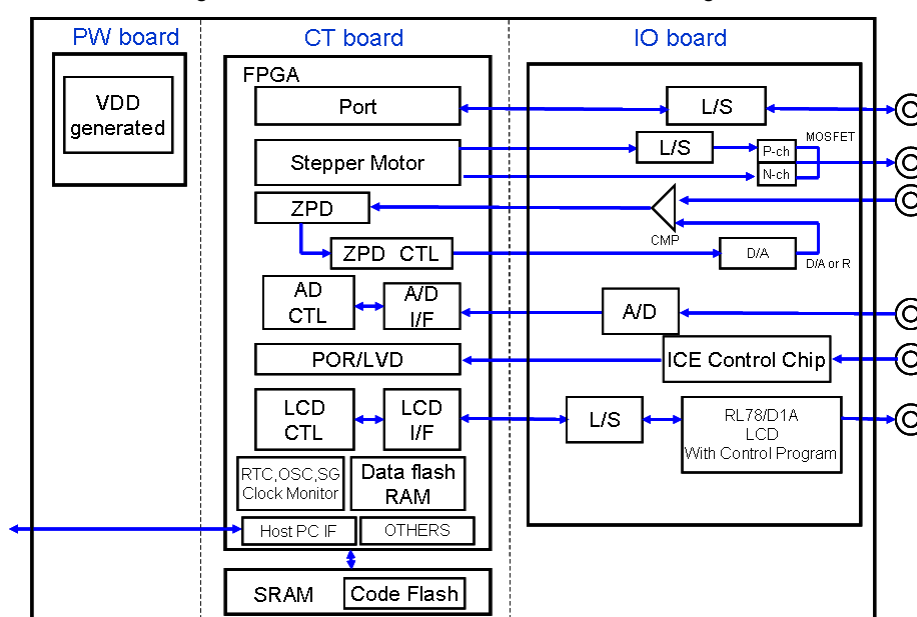
The emulator does not enter standby mode when HALT/STOP instruction is executed by the step execution. The emulator exits from standby mode when the break occurs.

APPENDIX A CHARACTERISTICS OF TARGET INTERFACE

The target interface (signals connecting the in-circuit emulator and target system) operate, in terms of function, as if an actual device were connected. The characteristics, however, may be different from those of the actual device.

QB-RL78D1A emulates the target interface by FPGA and some additional devices. The characteristics of target interface depend on their device characteristics. For the devices using in each target interface, please refer to the following.

Figure A-1. Overview of QB-RL78D1A Block diagram



- Port

Port function is emulated by FPGA and additional Level Shifter.

Following devices are used.

Level Shifter: UPD7886, NLX3G17, SN74LVC1T45

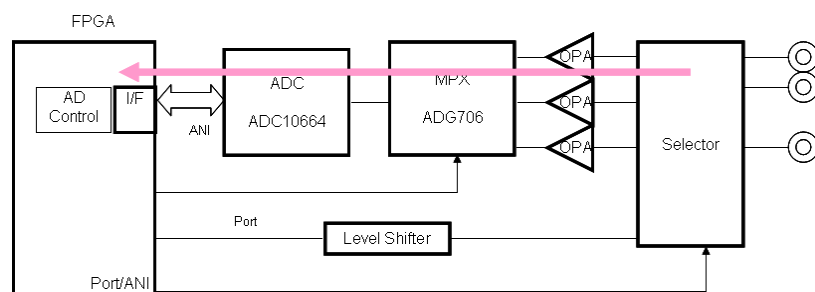
PIN	INPUT	OUTPUT	Etc.
P122	SN74LVC1T45	-	P122: Pull-down (1M ohm)
P121, P123, P124, RESET	NLX3G17	-	P124, RESET: Pull-down (1M ohm)
P40,P01,P11,P17,P31, P50,P51,P52,P55,P56,P57, P61,P63,P70,P135	NLX3G17	UPD7886	
Others	UPD7886	UPD7886	P137: input only

- A/D Converter

A/D Converter function is emulated by FPGA and additional ADC device.

Following devices are used:

ADC: ADC10664
 Selector: PI5A4684
 MPX: ADG706
 OPAMP: OPA4354

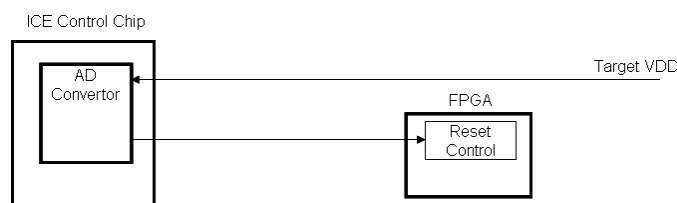


- POR/LVD

POR/LVD function is emulated by FPGA and additional ICE Control chip. The ICE Control chip sense the target VDD with its AD converter.

Following device is used:

ICE Control chip: V850ES/SG3



- LCD Controller/Driver

LCD function is emulated by FPGA and additional LCD driver.

Following device is used:

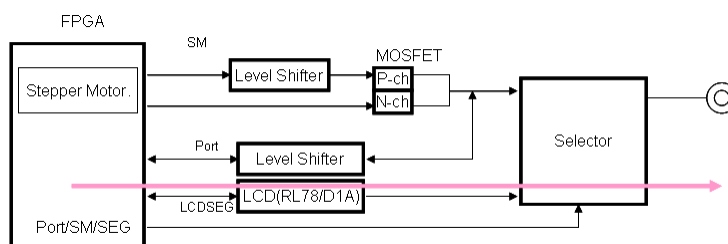
LCD driver: RL78/D1A (same as the target device)

LCD function is emulated by following operation.

Register setting of LCD are accepted by LCD Controller in the FPGA. LCD CTL write to the LCD register of RL78/D1A on IO board using serial command interface between FPGA and RL78/D1A on IO board. RL78/D1A on IO board contains original program that receive the command from FPGA then write data to own register.

There is a time lag to output LCD waveform outputs after setting LCD's SFR.

Clock can not be stopped.



- ZPD

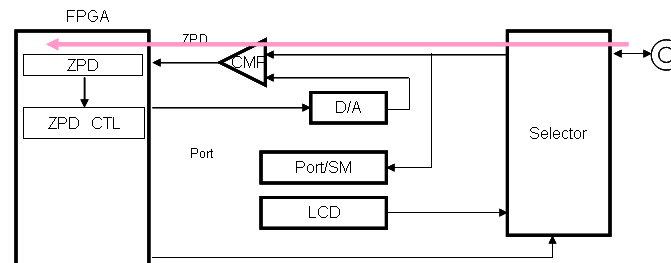
ZPD function is emulated by FPGA and additional CMP and DAC device.

Following devices are used:

Selector: PI5A4624

CMP: TC75W57FK

DAC: AD7305BRUZ (or separated registers)



- Stepper Motor Controller/Driver

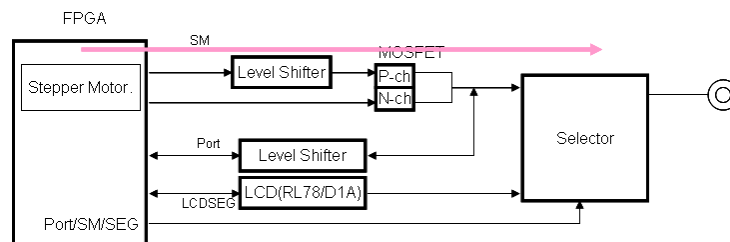
Stepper-Motor function is emulated by FPGA and additional Level Shifter and MOSFET.

Following devices are used:

Selector: PI5A4624

MOSFET: UPA679TB

Level Shifter: UPD7885, UPD7886



APPENDIX B REVISION HISTORY

B.1 Major Revisions in This Edition

Page	Description
8	Addition of power consumption to Table 1-1. QB-RL78D1A Hardware Specifications.
14	Addition of parts number to Table 1-3. Adapters and Connectors for Each Target Device.
15	Addition of parts number to 1.6 Package Contents
34	Addition of cautions to 4.1 Cautions Regarding Differences Between Target Device and Emulator.

QB-RL78D1A

In-circuit Emulator

Preliminary User's Manual



SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "http://www.renesas.com" for the latest and detailed information.

Renesas Electronics America Inc.

2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited

1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH

Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.

7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.

Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited

Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.

7F, No. 363 Fu Shing North Road Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.

1 HarbourFront Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001

Renesas Electronics Malaysia Sdn.Bhd.

Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.

11F., Samik Laviel' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Renesas Electronics:](#)

[QB-64FB-EA-02T](#) [QB-80FB-EA-02T](#)