# Quick-start Guide **RL78/F14 RDK**





SimuQuest





Thank you for your interest in the Renesas Demonstration Kit for the RL78/F14 MCU, Version 1.0.

- Before you get started, please first familiarize yourself with this document. You can also view and print an electronic copy from the following link: http://am.renesas.com/products/mpumcu/rl78/rl78f1x/index.jsp
- This document will guide you through all the necessary steps to unlock the full potential of the RDK.



# Introduction

The Renesas RL78/F14 RDK offers a quick and easy way to demonstrate, evaluate, and develop embedded applications based on the RL78/F14 MCU. This full-featured kit has an on-board USB debugging interface, LIN & CAN interface, 512kbit EEPROM with I2C interface, LCD display, and full I/O. Extensive software support is available from Renesas in-house and third-parties.

This Quick-start Guide demonstrates how to use the IAR Embedded Workbench for Renesas RL78 from IAR Systems and QuantiPhi Renesas Edition, developed by SimuQuest, to create a simple application in minutes.

This RDK also supports a motor control extension board, allowing users to quickly develop advanced motor control applications configured in QuantiPhi Renesas Edition and a powerful new configuration and driver generation tool developed by SimuQuest.

# **Toolchain Installation**

\*NOTE: You need an internet connection in order to download and register the software tools needed to run the RDK.

We recommend you select the default installation options, unless you already have the same versions of the software installed or you are an advanced user. Please be aware that the full installation may take up to one hour, depending on the performance of your PC.

- 1. Please visit http://am.renesas.com/products/mpumcu/rl78/rl78f1x/index.jsp
- 2. On the right side of the webpage, find the icon of RL78/F14 RDK and click on it. A registration page will open. Please fill it to register your RDK.
- 3. Once you have completed the RDK registration, the software toolchain download page will open. The following step will require two software tools to use the RDK. They are IAR Embedded Workbench for Renesas RL78 and QuantiPhi Renesas Edition.
- 4. Click on the icon of IAR Systems; the download page for IAR Embedded Workbench for Renesas RL78 will open.
- 5. Follow the instructions to download and install IAR Embedded Workbench for Renesas RL78. Registration may be required to get the license to unlock the software. During the installation of IAR, you will be prompted to choose between a size-limited or time-limited license. The size-limited license will never expire, but the size of your projects cannot exceed 16KB. The time-limited license has no size or other restrictions, but it will expire after 30 days.
- 6. Click on the QuantiPhi Renesas Edition icon and the download page will open. User registration is required before activating the download.
- 7. Follow the instructions to download and install QuantiPhi Renesas Edition.



# **Build Your First Application**

Once the software toolchain installation has finished, you are ready to build your first application for the RL78/F14 RDK.

# I. Using QuantiPhi

## 1. Start menu – Open QuantiPhiRE RL78

Open QuantiPhi from the Start menu.



#### 2. QuantiPhi – New Project (1)

Create a new project.



## 3. QuantiPhi – New Project (2)

Choose the RDK option.





#### 4. QuantiPhi – New Project (3)

Name the project; then click finish. Use the default project directory, which will not match the one pictured.

Project Name: Project Location: Project Folder:	QphiCANdemo C: (Projuctal QuantPhi C: (Projuctal QuantPhi)OphiCANdemo	Browse
Your project for the Please provide the where the folder show you the reso You can use the B into the Project L After clicking Finis open the project double-click the RC project for the RC project	he RDK board will be stored in a folder that you name. e name for the project (Project Name) and the location can be created (Project Location). This interface will Juling name of the projects folder (Project Folder). romse button to select the location or just paste text cation. th, you are ready to configure the RDK board. You will the by double-clicking the project name. And then enesas Demonstration Kit (RDK) item to configure your X.	
	Project Name: Project Location: Project Folder: Your project for t Please provide th where the folder show you the res You can use the f You can use the finite You can use the finite	Project Name: QphiCANdemo] Project Location: C: (Projects/QuantPhi Project Folder: C: (Projects/QuantPhi QphiCANdemo Your project for the RDK board will be stored in a folder that you name. Please provide the name for the project (Project Name) and the location where the folder can be created (Project Location). This interface wil show you the resulting name of the projects folder (Project Folder). You can use the Browse button to select the location or just paste text into the Project Location. After clicking Finish, you are ready to configure the RDK board. You will poen the project three by double-clicking the project name. And then double-click the Reness Demonstration Kit (RDK) tem to configure your project for the RDK.

#### 5. QuantiPhi - RDK

Double-click on Renesas Demonstration Kit (RDK).



## 6. QuantiPhi - RDK Apply

Apply the schematic.

Renesas Demonstration Kit (RDK)	Vari
Apply Settings	_
This Apply button can be used to update your be used to modify the nin settions in your Out	r Quar antiPhi



### 7. QuantiPhi - Compiler

Under Code Generation, choose "IAR RL78" as the compiler.

Standby     Code Generation	Include the date and time in the comment at the
I/O     Serial Communication Interface (SCI)     Controller Area Network (CAN)     Local Interconnect Network (LIN)     Inter-Integrated Circuit (I2C)	Generate a project path in the comment at the Generate a project.xml file with the generated of Include the date and time in project.xml
Erial Peripheral Interface (SPI)     Advanced	Select Compler: IAR RL78  Compiler Location: IAR RL78 for RL78 (6.0) @ C: Q, Search for Compiler Insta
	Preprocessor Defines

### 8. QuantiPhi - Generate Code

Generate the code.



#### 9. QuantiPhi - Note Directory

Note the generated code directory (at the top of the code generation log). Yours will differ from the one pictured.

[05/12/2014 03:	0:021 Cod	e Generation	Initiated	d 5/12/14	3:20 PM		
[05/12/2014 03:	0:02] Gen	eration dire	ctory: C	(Testere)	QuantiPhi\0	phiCANdemo	quantiphi outpu
[05/12/2014 03:	20:03] Gen	erating qp_p	re.h [	ok]			
[05/12/2014 03:	20:03] Gen	erating qp_c	ompiler.h	[ok]			
[05/12/2014 03:	20:03] Gen	erating qp_d	evice.h	. [ok]			
[05/12/2014 03:	20:03] Gen	erating qp_q	lobal_con	fig.h [	ok]		
[05/12/2014 03:	20:03] Gen	erating qp_s	tandard_in	nclude.h	[ok]		
[05/12/2014 03:	20:03] Gen	erating qp.o	[ok]				
[05/12/2014 03:	20:03] Gen	erating qp.h	[ok]				
[05/12/2014 03:	20:03] Gen	erating qp_s	cu_stdlib	.c [ok]			
[05/12/2014 03:	20:03] Gen	erating qp_n	cu_stdlib	.h [ok]			
[05/12/2014 03:	20:04] Gen	erating qp_c	an_api.c.	[ok]			

# II. Using the RDK board

#### 1. Connect the USB cable to the RDK.

CN9 is a female mini-USB connector on the RDK. It can be used as a debug interface and/or power supply to the board, if the board will be powered by USB close jumper J14. In either case, connect a mini-USB cable to CN9.



#### 2. Connect power to the RL78 RDK (if power will not be supplied by USB).

If the board will not be powered via USB, remove jumper J14. Connect a banana cable between CN8, the black banana jack on the RDK, and the power supply ground. Connect a banana cable between a 12V power supply and CN6, the red 12V (outermost) banana jack on the RDK board.

#### 3. Plug in power

If the RDK is not powered from the USB connection, the red 'BAT' LED will illuminate next to the red banana jack on the RDK board when the power supply is turned on.

# **III. Using IAR**

#### 1. Start menu - Open IAR

Open IAR for RL78 from Start menu.

IAR Embedded Workbench	

#### 2. IAR - New Project

Create a new project.

IAR Embedded	Workbench IDE	
File Edit View (	Project Tools Window Help	
0 🖻 🖬 🕼	Add Files	
Workspace	Add Group	
	Import File List	
Files	Add Project Connection	
· · · · · · · · · · · · · · · · · · ·	Edit Configurations	
	Remove	
	Create New Project	
	Add Existing Project	

#### 3. Create New Project

Choose an RL78 C project.

reate New Proj	ect		
Tool chain:	RL78	•	
Project templates	ε		
- Empty proje	ect		
Asm			
C++			
Eutomollub	uit avacutable		
E Kleinally D	uiit executable		
Description:			
Creates a C proj	ect.		
		ок Са	ncel



## 4. Save As

Save it in the directory one level up from the quantiphi\_output directory you noted previously.

Quantipr	ni • QphiCANdemo •	• + <del>7</del>	search QphiCANdemo	م
Organize   New fold	er		8==	- 0
MC-78F0712- *	Projects library QphiCANdemo		Arrange by: Fo	lder 🔻
MICON test	Name		Date modified	Туре
PG-FP5 setup     pinkos     PJ4_AB-050_p     PVM_even_c     Qt     QuantiPhi     GM905	📕 quantiphi_output		5/12/2014 3:20 PM	File folder
MICON *	•	m		
File name: Qphi	CANdemo			-
Save as type: Project	ct Files (*.ewp)			•

# 5. Add Files

Right-click on the project to add files.

Vorkspace Debug	×	IAR Inf	ormation Center for Renesas RL78
Files	2: B2		* * This is a template for
OphiCANC     Main.c     Output	Options		Copyright 2011 IAR S
	Make Compile Rebuild All	\$Revision: 205 \$	
	Stop Build		nt main( void ) return 0;
	Add		Add Files
	Remove Rename		Add "main.c" 45 Add Group



## 6. Add Files – OphiCANdemo

Add all the .c files in the quantiphi\_output directory. (The .h files can be added as well, but are not necessary.)

Organize • New folde	r -			100	
LVI test * MC-78F0712-	Projects library			Arrange by	Folder •
MICON	Name	Date modified	Туре	Size	
MICON test	Joitmap_font.c	5/12/2014 3:20 PM	Notepad++ Docu	6 KB	
PG-FP5 setup	font_8x8.c	5/12/2014 3:20 PM	Notepad++ Docu	66 KB	
pinkos	font_8x16.c	5/12/2014 3:20 PM	Notepad++ Docu	101 KB	
PJ4_AB-050_F	font_helvr10.c	5/12/2014 3:20 PM	Notepad++ Docu	41 KB	
PWM_even_c	font_logos.c	5/12/2014 3:20 PM	Notepad++ Docu	6 KB	
a Qt	font_winfreesystem14x16.c	5/12/2014 3:20 PM	Notepad++ Docu	44 KB	
🎍 QuantiPhi 🗉	font_x5x7.c	5/12/2014 3:20 PM	Notepad++ Docu	35 KB	
🍌 GM905 🔤	font_x6x13.c	5/12/2014 3:20 PM	Notepad++ Docu	50 KB	
MICON	glyph.c	5/12/2014 3:20 PM	Notepad++ Docu	22 KB	
A QphiCANd	glyph_register.c	5/12/2014 3:20 PM	Notepad++ Docu	5 KB	
i Debug	led.e	5/12/2014 3:20 PM	Notepad++ Docu	3 KB	
🍌 quantiph	abrc 🖉	5/12/2014 3:20 PM	Notepad++ Docu	5 KB	
is settings	gp_can_api.c	5/12/2014 3:20 PM	Notepad++ Docu	72 KB	
RDK test co *	an can chie	5/12/2014 3:20 PM	Notenad++ Docu	7 KB	
File na	ame: "st7579 lcd.c" "bitman font.c" "font	8x8.c" "font 8x16.c" "font hel	v10.c" "font logos. *	Source Files (".c.".c	pp:/.cci.ht

## 7. Project Options

Right-click on the project and choose Options.



#### 8. Select Device

Select the R5F10PMF Options for node "QphiCANdemo" × device from the Target Category: tab under General General Options RL78 core S1 - Unspecified Options. C/C++ Compile Assembler RL78 core S2 - Unspecified Target Output Library Configuration Custom Build RL78 core S3 - Unspecified **Build Actions** RL78 - R5F10PAD RL78 - D1A Linker Debugger . Device RL78 - R5F10PAE RL78 - Dxx . D. E1 E20 RL78 core 1 - Unspecified RL78 - R5F10PBD RL78 - F12 . RL78 - R5F10PBE IECUBE Code model RL78 - F13 . Simulator TK RL78 - R5F10PGD RL78 - F14 . Near . RL78 - R5F10PGE Use far runtime library calls RL78 - Fxx . RL78 - G10 RL78 - R5F10PGF . Data model RL78 - R5F10PGG RL78 - G12 . Near RL78 - R5F10PGH RL78 - G13 . Near constant location Start addre RL78 - R5F10PGJ RI 78 - G14 . Mirror ROM 0 + 0xF1000 RL78 - R5F10PLE RL78 - G1A . RL78 - R5F10PLF RL78 - G1C . RL78 - R5F10PLG RL78 - G1D . RL78 - R5F10PLH RL78 - G1E ٠ RL78 - R5F10PLJ RL78 - Gxx . RL78 - R5F10PME RL78 - 11A . RL78 - R5F10PMF RI 78 - RSEINDANG RL78 - 11B .



## 9. Add "Include Directory"

Add **\$PROJ\_DIR\$\quantiphi\_output** to the include directories on the Preprocessor tab of the C/C++ Compiler category (type it manually in the text box).

Category: General Options C/C++ Compiler Assembler	Multi-file Compilation     Discard Unused Publics
Custom Build	Language 2 Optimizations Output List Preprocessor Diagnost
Debugger E1 E20 IECUBE Simulator TK	Additional include directories: (one per line) SPROJ_DIRstquantiphi_output
	Defined symbols: (one per line)  Preprocessor output to file  Preserve comments  Generate #line directives

#### 10. Choose Debugger

Choose the TK debugger from the Setup tab in the Debugger category. Click OK.

ategory:						Factory Settin
General Options						
C/C++ Compiler Assembler						
Custom Build	Setup	Images	Extra Options	Plugins		
Build Actions	Driver:			V	Run to:	
Debugger	TK		•		main	
E1 E20 IECUBE Simulator TK	Setu;	ce descri veride d	ption file lefault:	debuqqe	er'ior5f10pmf.ddf	



#### 11. Add Include

Add the following include in main.c:

#### #include "qp.h"

```
IAR Information Center for Renesas RL78 main.c *

IAR Information Center for Renesas RL78 main.c *

This is a template file.
Copyright 2011 IAR Systems AB.
SRevision: 205 $

int main( void )

f
return 0;
}
```

### 12. Add Code

Add the following code inside main():

QP\_Init();

\_\_enable\_interrupt();

/\* Turn on blue stage of (R)GB LED \*/

PM5\_bit.no5 = 0;

P5\_bit.no5 = 1;

while(1) {

/\* Main program loop \*/

}

## 13. Download to Board

Click the "Download and Debug" button on the toolbar. The file should save automatically, and a build will be performed.

🔀 QphiCANdemo - IAR Embedded Workbench	IDE
<u>File Edit View Project Emulator Tools</u>	Window Help
🗅 📽 🖬 🕼 🖓 🖓 🛍 🛍 🗠 🗠	
Workspace	X IAR Information Center for Renesas RL78 main.c*
Debug	• 早/*****



#### 14. Save Workspace As

Name the workspace.

Organize      New folde	r	82	• 0
Kostal test *	Projects library QphiCANdemo	Arrange by: Fo	lder 🔻
LVI test	Name	Date modified	Туре
MC-78F0712-	Debug	5/12/2014 3:29 PM	File fold
Micom	Juantiphi_output	5/12/2014 3:20 PM	File fold
😹 MICON 🗌	settings	5/12/2014 3:41 PM	File fold
MICON test			
PG-FP5 setup			
pinkos			
PJ4_AB-UJU_t	•		
File name: Ophio	ANdemo.eww		0
Courses Internet	mana Eller (* mun)	6	

#### 15. TK Hardware Setup (R5F10PMF)

Configure the debugger as shown.

ID Code			Time u	mit		OK
FFFFFFFFFFFFFFF	FFFFF		[mmo	-		
Erase flash be	fore next ID ch	eck	noce			Cancel
Main clock		Sub	clock			
Clock board			Clock board			Defect
External		0	External			Derault
<ul> <li>System</li> </ul>			System		Fa	il-safe break
8.00	MHz		32.768	👻 kHz		] View setup
Flash programming	gramming Target pow		er off Low-voltage		Power sup	ply
Permit	Permit		On		Tarnet	
Not Permit	Not Per	mit	<ul> <li>Off</li> </ul>		[ i alder	
Pin mask		Per	pheral break	Target		Target connect
WAIT TARG	ET RESET		A (timer)	C Con	nect	10010
NMI INTER	NAL RESET		B (serial etc.)	O Not	Connect	10020
Memory map						
Start address:	Length:		Type:			
0x0	960	٠	Intern	al ROM	•	Add
0x00000 - 0x17FFF I	nternal ROM 9	6 Kby	es			
0xFDF00 - 0xFFEFF	Internal RAM 8	192 b	ites			
						Remove
						Remove All

Note: Make sure SW1 is set properly to enable the TK debugger.

(SW1-1)TK-SEL must be ON.

(SW1-2)TK-MUXENn must be OFF.

Also, if you get an error when you try to connect the first time, check "Erase flash before next ID check" and try again.



#### 16. TK Flash Write

The program will load to the board.

Starting debugger session: Loading debug file
TK: Writing flash

#### 17. Run

Run the program.



Note: Once the board is re-flashed, you can switch TK-SEL (SW1-1) back to OFF to run the code (without the TK debugger in place).

#### 18. Add Additional Code

Add code as needed to main(). Basic setup is complete.

# IV. Notes for using CS+

1. CS+ is also supported by this RDK. When connecting with CS+ the first time, an incorrect ID error message may be displayed. This can be solved by opening the debugger settings and setting "Erase flash ROM when starting" to "Yes".

2. If the TK debugger USB driver cannot be found in CS+, select the E1 driver.









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