

RL78 Family

Reality AI Data Acquisition Module (Data Collector / Data Shipper) – Sample Code

Introduction

This application note describes sample software for data acquisition for Reality AI. Acquired data is converted into any files using Reality AI Data Storage Tool on PC.

Target Device

RL78 Family MCUs : G23,G24,G13,G13A,G1D,G1H,G14 (ROM size more than 128KB)

• Operation confirmed MCU: RL78G23

When using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

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 3. 3.1 3.2 3.2.1 3.2.2 3.2.3 	Build project. How to implement data acquisition [RL78/G14] Import sample project for Data Collector and Data Shipper. Information sample project for Data Collector and Data Shipper. Copy source code from RL78/G23 sample project. Modify settings of Code Generator. Modify source code.	27 27 27 28 29 30 34
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1. Data acquisition for Reality AI

Follow the steps below to collect data for Reality AI.

- Signal data such as sensors are stored in memory by Data Collector.
- The stored data is sent to the PC Data Shipper.
- Data Storage Tool running on a PC converts it into a file and uploads it to Reality AI.

Reality AI analyzes uploaded data and generates source code. Please see the e2 studio documentation for information on how Reality AI and e2 studio work together.

The following diagram is the system structure.



1.1 Overview of Data Collector

Data Collector collects data such as sensors in memory. There are two ways to collect it.

Snapshot

Data is collected using a timer provided by the Data Collector.

Data Feed

Data is collected using a timer provided by the user.

After collecting a specified number of data, it calls the Data Shipper's API.

1.2 Overview of Data Shipper

Data Shipper sends data stored in memory by Data Collector to the PC via UART.

UART settings are set in "UART Communication Driver Interface Middleware".

1.3 Overview of Data Storage Tool

Data Storage Tool convert file from sent data by Data Shipper.



RL78 Family Reality AI Data Acquisition Module (Data Collector / Data Shipper) - Sample Code

6									>	×
🔀 Reality Al Data Storage Tool 🗙									- 6	
Project: DC_DS_TST									~	^
Status	Settings									
Data error		Data connection.		Data	file settings		View data s	tructure	<u></u>	
Data capture	Signal view									
Number of frames per file: 20 □ Unlimited Instance ID: 0 Class name: myClass Start new capture	O Live view) File m	eview		A	256 sample	Ch f 2 c 3 c • Auto sc • Fixed sc es	Name dc0_snapshot_ch0 dc0_snapshot_ch1 dc0_snapshot_ch2 cale view cale view	>		
Data file group	Data file	Create date	Size	Class name	Status	Cole ^	Refresh			
metadata.csv	myClass_20230 myClass_20230	Wed Jul 05 09: Wed Jul 05 09:	14.3 KB 14.6 KB	yourClass myClass	GOOD GOOD	Blue Red	Select all dat	a		
	myClass_20230	Wed Jul 05 09:	14.6 KB	myClass	GOOD	Yell	Copy data to gro	oup		
	myClass_20230 myClass_20230	Wed Jul 05 09: Wed Jul 05 09:	14.7 KB 15.3 KB	myClass myClass	GOOD GOOD	Blue	Delete			
	myClass_20230 myClass 20230	Wed Jul 05 10: Wed Jul 05 10:	16.1 KB 16.1 KB	myClass myClass	GOOD GOOD	Blue	Edit metadata			
	myClass_20230	Wed Jul 05 10:	15.8 KB	myClass	GOOD	Blue	Editor path:			
	myciass_20230	Wed Jul 05 10:	15.8 KB	myciass	GOOD NC	Blui	<default></default>			¥

2. How to implement data acquisition [RL78/G23]

Describes how to implement a data acquisition module using Data Collector and Data Shipper into a program.

2.1 Create New project.

1. Select [File]>[New]>[Renesas C/C++ Project]>[Renesas RL78] menu.

6	rl78-sample - e² studio								-		\times
File	e Edit Source Refactor Navigate	Search Projec	t R	enesas Views Run Renesas Al Window Help							
	New	Alt+Shift+N >		Renesas C/C++ Project	>	Renesas Debug	1		Q i 😭	6 G	/C++
	Open File		C*	Makefile Project with Existing Code	_	Renesas RA		-	E Outline ×		
	Open Projects from File System		C	C/C++ Project		Renesas RL78			There is no active editor that	provide	s an
	Recent Files	>		Project		Renesas RX	,		outline.		
	Close Editor	Ctrl+W	C++	Convert to a C/C++ Project (Adds C/C++ Nature)	Γ		_				
	Close All Editors	Ctrl+Shift+W	63	Source Folder							
	Save	Ctrl+S	6	Folder							
	Save As		C	Source File							
	Save All	Ctrl+Shift+S	h	Header File							
	Revert		Ľ	File from Template							
	Move		G	Class							
	Rename	F2	1	Code Generator							
s	Refresh	F5	2	Example							
	Convert Line Delimiters To	>		Other C	Ctrl+N						
Ð	Print	Ctrl+P	Γ								
2	Import										
<u>z</u>	Export										
	Properties	Alt+Enter									
	Switch Workspace	>									
	Restart			Problems X 📃 Console 🔲 Properties 🎰 Smart	Browser D	Smart Manual			<u>7</u>	8 🗖	
	Exit		ite	ms	9	y on architera			U	0	_
			De	scription Re	esource	Path	Location	Туре			
0 it	ems selected										



2. Select [Renesas CC-RL C/C++ Executable Project] item.





3. Specify Project Name.

8				_	
New Renesas CC	- RX Executable Project RX Executable Project				Ď
Project name: Re	ealityAlSample				
🗹 Use default lo	ocation				
Location:	C:¥workspace¥e2studio¥Reality	yAlSample			Browse
	Create Directory for Project				
Choose file syster	n: default 🖂				
Working sets					
Add project	to working sets				New
Working sets:				\sim	Select
\bigcirc		< Back	Next >	Finish	Cancel

Push [Next] button.



4. Select [RL78G23-128p_FastPrototypingBoard] in Target Board.

8		— 🗆 X
New Renesas (You must sele	CC-RL Executable Project ect a device	
Toolchain Setti Language: Toolchain: Toolchain Versi	ings C O C++ Renesas CC-RL \checkmark ion: v1.12.00 \checkmark <u>Manage Toolchains</u>	
Device Setting Target Board: Target Device: Endian: Project Type:	s Custom RL78G15_FastPrototypingBoard RL78G22_FastPrototypingBoard RL78G23-128p_FastPrototypingBoard RL78G23-64p_FastPrototypingBoard RL78G24_FastPrototypingBoard Default	Configurations Create Hardware Debug Configuration Create Debug Configuration Create Debug Configuration Create Release Configuration
?	< Back N	ext > Finish Cancel

Push [Next] and [Finish] button to create a new project.



2.2 Import and setup for SIS Modules for Reality AI

1. Open Smart Configurator.

Double Click ["projectname".scfg] in Project Explorer.

😨 e2studio - e² studio		- 🗆 ×
File Edit Source Refactor Navigate Search		
🔚 🛞 = 🔦 = 🔌 🎋 = 💁 = 🖻 🗉	٩.	🗄 😰 🛛 🔀 C/C++ 📓 Smart Configurator
🍋 Project Explorer 🗙 📄 🚍 🏹 🖇 📟 🗖		🗄 Outline X 🔰 📮 🗖
✓		There is no active editor that provides an
> 👸 Includes		outline.
RealityAlSample.scfg		
X RealityAlSample HardwareDebug.launch		
⑦ Developer Assistance		
	Problems 🗐 Console X 🔤 Properties) 🚇 Smart Browser) 🖽 Smart Manual	
	Smart Configurator Output	
		^
	5	×



2. Add Components.

Select [Components] tab and Click [Add component] icon.

Reality/AlSample/F	Realituál Sample sofo - e ² studio		- D X	_
File Edit Navigate Search	Project Renesas Views Run Renesas Al Window Help			
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Project X	RealityAlSample.scfg ×		MCU/MPU Package × ③ Developer Assist Brow	5
 □ 4 7 8 ✓ BealityAlSample 	Software component configuration	Generate Code Generate Report		>>
> Includes	Com 🚵 🛃 📲 📻 🗭 Configure	(1)		-
Project X □ Project X □ SealityAlSample SealityAlSamples.cfg RealityAlSamples.cfg RealityAlSamples.cfg RealityAlSamples.cfg Developer Assistance	Image: Startup ✓ Startup ✓ Startup ✓ Startup ✓ Startup ✓ Startup ✓ Startup		RENESAS RU3623 R710005N#8	
< >	Overview Board Clocks System Components Pins Interrupt		▶ Legend	
Console X	🔍 🔝 🖻 🚽 🗂 🖛 🗖	Configuration Problems X	₹ § = E	3
Smart Configurator Output		0 items	Tran	
		Description	iype	
<	>			



3. Download FIT modules.

- Select [Download RL78 Software Integration System modules] link.

📴 New Co	omponent						×
Software (Select con	Component Selection nponent from those available in list						
Category	All						\sim
Function	All						\sim
Filter							
Compon	nents ^	Short Name	Туре	Version			^
H A/D C	Converter		Code Generator	1.4.0			
Board	d Support Packages v1.60	r_bsp	RL78 Software I	1.60			
Capac	citive Sensing Unit driver.	r_ctsu	RL78 Software I	1.40			
H Clock	Output /Buzzer Output Controller		Code Generator	1.4.0			¥
Show o	only latest version						
Descriptio	n						
The analo	og to digital (A/D) converter is function	on for converting analo	og inputs to digital signa	ls.			~
Download Download	I RL78 Software Integration System m I ELCL modules	odules U					
Configure	general settings						
?			< Back	Next >	Finish	Ca	ncel



- Select Region on dialog.
- Check the following SIS modules in list.
 - RAI Data Collector Middleware
 - RAI Data Shipper Middleware
 - UART Communication Driver Interface Middleware

8				—	
RL78 Sele	Software Integration System Modules I ct the RL78 Software Integration System modul		Ľ		
	Title	Document No.	Rev.	Issue date 🔺	Select All
	RL78 Family Renesas Flash Driver RL78 Typ	R20AN0653EJ0	Rev. 1. 10	2023-08-07	Decelect All
	RL78 Family Renesas Flash Driver RL78 Typ	R20AN0654EJ0	Rev.1.10	2023-08-07	Deselect All
	RL78 Family Renesas Flash Driver RL78 Typ	R20AN0655EJ0	Rev.1.10	2023-08-07	
	RL78 Family ZMOD4410, ZMOD4450 and Z	R01AN6197EJ0	Rev.1.22	2023-07-04	
	RL78 Family CTSU Module Software Integr	R11AN0484EJ0	Rev.1.40	2023-06-13	
	RL78 Family TOUCH Module Software Inte	R11AN0485EJ0	Rev.1.40	2023-06-13	
	RL78 Family FS2012 Sensor Control Modul	R01AN6196EJ0	Rev.1.12	2023-04-26	
	RL78 Family HS400X Sensor Control Modu	R01AN6446EJ0	Rev.1.02	2023-04-26	
	RL78 Family HS300x Sensor Control Modul	R01AN6194EJ0	Rev.1.22	2023-03-03 ¥	
<				>	
Mo	dule Folder Path:				
	C:¥Users! ¥.eclipse¥com.renesas.platf	orm_download¥RL7	78_Modules¥	GenericModules	Browse
			D	ownload	Cancel

Push [Download] button

Confirm "End User License Agreement (Sample Code)". If you can agree this license, push [Accept] button.



– Input [rai] in Filter and select [RAI Data Shipper Middleware] item.

When select [RAI Data Shipper Middleware], Smart Configurator will automatically import the required components.

New Co	omponent				\times			
Software Component Selection Select component from those available in list								
Category Function Filter	All All rai				~			
Compon	ents	Short Name	Туре	Version				
🕀 RALD	ata Collector Middleware	rm rai data collector	Firmware Integr	1.00				
✓ Show of ✓ Hide its Descriptio	only latest version ems that have duplicated functional m	ity						
Depende Depende Depende This mod <u>Download</u> <u>Configure</u>	Dependency : r_bsp version(s) 7.21 Dependency : rm_comms_uart_rx version(s) 1.00 Dependency : rm_rai_data_collector_rx version(s) 1.00 This module collects and shipping data for RAI.							
?	< 8	ack Next >	Finish	Cancel				

Push [Finish] button in New Component Dialog.



4. Import Data Transfer Controller (DTC) and setup.

Data Collector use DTC feature. So, import Code Generator module.

- Select [Components] tab and Click [Add component] icon in Smart Configurator.
- Select [Data Transfer Controller] item and push [Finish] button.

🙆 New Co	omponent					_		×
Software Component Selection							r	ala i
Select com	ponent from those available in list						τ	
Category	All							\sim
Function	All							\sim
Filter	data							
Comment	~ ^	Chart Name	T	Martin				
Compon	ents Fransfer Controller	Short Name	lype Code Generator	131				
H RAI D	ata Collector Middleware	rm rai data collector rl	RL78 Software I	1.00				
H RAI D	ata Shipper Middleware	rm_rai_data_shipper_rl	RL78 Software I	1.00				
Show o	only latest version							
Descriptio	n	tions for DTC to perform de						
This sort	ware component provides configura	ations for DTC to perform da	ta transfers.					
Download	RL78 Software Integration System (modules						
Download	ELCL modules							
<u>Configure</u>	general settings							
~					_			
?			< Back	Next >	Finish		Cance	d -



- Change the settings of [Config_DTC] as follows:

Items	Value
Chain transfer (DTCD0)	Check
Activation source (DTCD0)	End of channel 1 of timer array unit 0 count or capture

0			— 🗆 X			
🌼 *RealityAlSample.scfg 🗙						
Software component configuration	Software component configuration					
Components 🚵 🛃 🎘 🕞 🕀 Configure			^			
State State Base setting type filter text DTC base addres	s 0xFFD00					
✓	e setting ata transfers can be continuously performe	d by one activation source wher	using Chain transfer.			
✓ ➢ Drivers	(DTCD0) Chain transfer (DTCD0)	Activation source (DTCD0)	End of channel 1 of timer array unit 0 count o			
Data transfer controller Control data1 Config. DTC	(DTCD1) Chain transfer (DTCD1)	Activation source (DTCD1)	INTP1			
✓ ➢ Middleware	(DTCD2) Chain transfer (DTCD2)	Activation source (DTCD2)	INTP2			
✓ 🧁 Generic 🗌 Control data3	(DTCD3) Chain transfer (DTCD3)	Activation source (DTCD3)	INTP3			
rm_conins_uarc_n	(DTCD4) Chain transfer (DTCD4)	Activation source (DTCD4)	INTP4			
💱 rm_rai_data_shipper_rl 🗌 Control data5	(DTCD5) Chain transfer (DTCD5)	Activation source (DTCD5)	INTP5			
Control data6	(DTCD6) Chain transfer (DTCD6)	Activation source (DTCD6)	A/D conversion end			
Control data7	(DTCD7) Chain transfer (DTCD7)	Activation source (DTCD7)	UART0 reception transfer end/CSI01 transfer e			
Control data	(DTCD8) Chain transfer (DTCD8)	Activation source (DTCD8)	UART0 transmission transfer end/CSI00 transfe			
Control data	(DTCD9) Chain transfer (DTCD9)	Activation source (DTCD9)	UART1 reception transfer end/CSI11 transfer e			
Control data1	0 (DTCD10) Chain transfer (DTCD10)	Activation source (DTCD10)	UART1 transmission transfer end/CSI10 transfe			
Control data1	1 (DTCD11) Chain transfer (DTCD11)	Activation source (DTCD11)	UART2 reception transfer end/CSI21 transfer e			
Control data1	2 (DTCD12) Chain transfer (DTCD12)	Activation source (DTCD12)	UART2 transmission transfer end/CSI20 transfe			
Control data1	3 (DTCD13) Chain transfer (DTCD13)	Activation source (DTCD13)	End of channel 0 of timer array unit 0 count of			
Control data1	4 (DTCD14) Chain transfer (DTCD14)	Activation source (DTCD14)	End of channel 1 of timer array unit 0 count of			
Control data1	5 (DTCD15) Chain transfer (DTCD15)	Activation source (DTCD15)	End of channel 2 of timer array unit 0 count of			
Control data1	6 (DTCD16) Chain transfer (DTCD16)	Activation source (DTCD16)	End of channel 3 of timer array unit 0 count of			
			~			
Overview Board Clocks System Components Pins Interrupt			N			



5. Import Interval Timer and setup.

Data Collector use timer. So, import SIS module and change the settings.

- Select [Components] tab and Click [Add component] icon in Smart Configurator.
- Select [Interval Timer] item and push [Next] button.

🙆 New Co	mponent					_		×
Software Component Selection						ala -		
Select com	ponent from those	e available in list						
Category	All							\sim
Function	All							\sim
Filter	timer							
Compon	entr ^	Short Name	Тире	Version				
H Interv	al Timer	Short Name	Code Generator	1.4.0				
H Watch	ndog Timer		Code Generator	1.4.0				
Show o	nly latest version							
Description	n							
The interv	val timer function is	s timer that generating timer interrupt at r	regular intervals. It also	can measure th	ne interval of th	ne input si	gnals.	~
								\sim
<u>Download</u>	RL78 Software Inte	egration System modules						
Download Configure	ELCL modules							
configure	general settings							
?			< Back	Next >	Finish		Canc	el



- Change [16bit count mode] of "Operation" and push [Finish] button.

New Component		_		×
Add new configuratio	n for selected component		1	
Interval Timer				
Configuration name:	Config_TAU0_1			
Operation:	16 bit count mode			\sim
Resource:	TAU0_1			\sim
Caution:				
16 bit capture mode I When 8 bit mode IT	TL000_ITL001 can not be used together with 16 bit count mode ITL012_ITL013. is used, 16 bit ITL and 32 bit ITL can not be used.			^
When 16 bit mode ITI	is used, 8 bit ITL and 32 bit ITL can not be used.			~
0	d Dark Names Finish		Corre	1
•	< back Next > Finish	63	Cance	21



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- Change the settings of [Config_TAU0_1] as follows:

Items	Value
Interval value (16 bits)	1 ms
Priority	Level 0 (high)

			— 🗆
RealityAlSample.scfg ×			8
ftware component configurat	ion		词 📄 Generate Code 🛛 Generate Rep
mponents 🚵 🛃 🖓 🕀 🕀	Configure		(
Si 🔯 🥫	Clock setting		
rpe filter text	Operation clock	СК00 ~	
Startup	Clock source	fCLK ~	(Clock frequency: 32000 kHz)
r bsp	Interval timer setting		-
🗁 Drivers	Interval value (16 bits)	1 ms ~	Actual value: 1)
Config DTC	Generates INTTM01 when	counting is started	
✓ imers	Interrupt setting		
Config TAU0 1	End of timer channel 1 co	nt, generate an interrupt (INTTM01)	
Middleware	Priority	Level 0 (high)	
rm_comms_uart_rl			
rm_rai_data_collector_rl			
rm_rai_data_shipper_ri			
I			

6. Import UART communication and setup.

Data Shipper use UART communication. So, import code generator module and change the settings.

- Select [Components] tab and Click [Add component] icon in Smart Configurator.



- Select [UART communication] item and push [Next] button.

🙆 New Co	omponent					_		×
Software (Component Selection						ſ	
Select com	nponent from those available in list						1	
Category	All							\sim
Function	All							\sim
Filter	uart							
Compon	entr.	Short Name	Туре	Version				
UART	Communication	Short Name	Code Generator	1.5.0				
UART	Communication Driver Interface M	rm_comms_uart_rl	RL78 Software I	1.00				
Show o	nly latest version							
Descriptio	n							
The unive	ersal asynchronous receiver/transmitt	er(UART) interface suppo	rts serial communicat	ion.	 			~
								\vee
Download	I RL78 Software Integration System me	odules						
<u>Download</u> Configure	general settings							
?			< Back	Next >	Finish		Cance	el

 Select [Transmission/reception] in "Operation" and select [UART3] in "Resource" and push [Finish] button.

New Component	New Component			_		×	
Add new configuration	n for selected component					4	
							-
- UART Communication							
Configuration name:	Config_UART3						
Operation:	Transmission/reception						\sim
Resource:	UART3						\sim
?		< Back	Next >	Finish		Cance	el



- Change the settings of [Config_UART3] and [Transmission] tab as follows:

Items	Value
Clock source	fCLK/2
Transfer rate setting	115200 (bps)

0		— 🗆 X
*RealityAlSample.scfg ×		- D
Software component configuration		Generate Code Generate Report
Components 🚵 🛃 🖓 🕞 🕀	Configure	^
54 🐹 👘 😜	Transmission Reception	
type filter text	UART3 clock setting	
V 🗁 Startup	Operation clock	CK10 ~
✓	Clock source	fCLK/2
✓ ➡ Drivers ✓ ➡ Data transfer controller	Transfer mode setting	
Config_DTC	Single transfer mode	○ Continuous transfer mode
✓ 🧁 Timers	Data length setting	
✓ (b) I/O port	○ 7 bits	8 bits
Config_PORT	Transfer direction setting	
Config UART3	LSB	⊖ MSB
✓ ➢ Middleware	Parity setting	
V 🗁 Generic	None O parity	Odd parity O Even parity
rm_comms_uart_rl	Stop bit length setting	
rm_rai_data_shipper_rl	I bit	○ 2 bits
	Transfer data level setting	
	Non-reverse	○ Reverse
	Transfer rate setting	
	Transfer rate setting	115200 v (bps) (Current error: 0.64%)
	Interrupt setting	
	Transmit end interrupt priority (INTST3)	Level 3 (low) V
	Callback function setting	
	Transmission end	×
Quantizer Based Clasks System Company to D		>
Overview Board Clocks System Components Pins	nterrupt	



- Change the settings of [Config_UART3] and [Reception] tab as follows:

Items	Value
Clock source	fCLK/2
Transfer rate setting	115200 (bps)

0		— 🗆 X
*RealityAlSample.scfg ×		- D
Software component configuration		🐻 👜 Generate Code Generate Report
Components 🚵 🛃 📲 🗭	Configure	^
Components Image: Components type filter text v @ Startup • @ Config_DTC • @ Config_DART • @ Config_ORT • @ Config_ORT • @ Config_UART3 • @ Config_UART3 • @ Middleware • @ Generic • m.rai_data_collector_rl • m.rai_data_shipper_rl	Configure Transmission Reception UART3 clock setting Operation clock Clock source Data length setting 7 to bits Transfer direction setting © LS8 Parity setting © None 0 o parity Stop bit length setting 1 bit fixed Receive data level setting © Non-reverse Transfer rate setting Transfer rate setting Transfer rate setting Construct setting Reception end interrupt priority (INTSR3) Callback function setting Reception end Receive on a	CK10
Quanticut Roard Clarke Sustem Components Dire	<	× *
overview board clocks system components Plins	inchupt	



2.3 Import sample project for Data Collector and Data Shipper

A sample project created using the steps described in this application note is attached with this application note. Please import by the following steps. Please refer to the imported project as necessary.

- Right-button click [rm_rai_data_shipper_rl] in tree of Smart Configurator and select [Download and import sample projects] menu.
- Launch [Smart Browser] view and right button click [RL78 Family Reality AI Data Acquisition Module (Data Collector / Data Shipper) - Sample Code] list and select [Sample Code(import projects)] menu.

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Smart Browser X			Ŷ	s 🖇	🕆 🖧 🐇	ž 🔆 🗸	000	- 0
Device: R7F100GSN(RL78G23)	Last up	odated: 2023/08	/23 at 23:42:39	JST				
Context Help User's Manual Technical Update Application Notes Tool Ne	vs Notifications							
1 matches								
Title	Document	Rev.	Issue Date		Sample Code	Remarks		^
RL78 Family Reality AI Data Acquisition Module (Data Co	Open			1	available			
	Sample Co	de (download)			available			
	Sample Code (import projects)			available			× .	
	Property							-

- Select [RealityAI_DataAcquisition_RL78G23_NonOS] item



2.4 Setup Data Collector

• Change the settings of [rm_rai_data_collector_rl] as follows:

Property	Value
Snapshot Mode Channel 0 Name	Data1
Snapshot Mode Channel 0 Data Type	8-bit Signed
Snapshot Mode Channel 1 Name	Data2
Snapshot Mode Channel 1 Data Type	8-bit Unsigned
Snapshot Mode Channels	2
Timer Driver Type	16-bits counter
Timer Component name	Config_TAU0_1
DTC Component name	Config_DTC







2.5 Setup Data Shipper

• Change the property of [rm_rai_data_shipper_rl] as follows:

Property Value

Frame Rate Divider 50

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🔅 *RealityAlSample.scfg 🗙		- 8	
Software component configuration Generate Code Generate Ro			
Components $\bowtie \ \square \ \square \ \square \ \square \ \square \ \square$	Configure	1	
type filter text Startup Generic T_bsp Data transfer controller Config_DTC Timers Config_TAU0_1 Dot Config_PORT Config_UART3 Generic Config_UART3 Generic Timers Config_UART3 Generic Time_comms_uart_rl Timerai_data_collector_rl	Property	Value Use system default 50 rai_data_shipper0_callback UART Communication Device0 Enabled	
< >>		~	



2.5.1 Setup UART for Data Shipper

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Change the property of [rm_comms_uart_rl] as follows:

Property	Value
Component name of UART	Config_UART3
Channel No. of SAU UART	3
[UART Communication Device0] Callback Function	rm_rai_data_shipper_callback0

8		— 🗆 X			
🔅 *RealityAlSample.scfg 🗙		- 8			
Software component configuration 🔋 📄 Generate Rep					
Components 🚵 🛃 📮 🕀	Configure	(1)			
type filter text Startup Generic r_bsp Drivers Data transfer controller Config_DTC Timers Config_TAU0_1 Config_PORT Config_UART3 Config_UART3 Middleware Config_data_collector_rt m_rai_data_collector_rt m_rai_data_shipper_rt	Property Seconfigurations # Parameter Checking # Number of UART Shared Buses # Number of UART Communication Devices # Number of UART Communication Devices # [TX] Blocking Operation Supporting with RTOS # [TX] Bus Lock Operation Supporting with RTOS # [TX] Bus Lock Operation Supporting with RTOS # [RX] Blocking Operation Supporting with RTOS # [RX] Bus Lock Operation Supporting with RTOS # [RX] Bus Lock Operation Supporting with RTOS # Component Name of UART # Channel No. of SAU UART # [UART Shared Bus0] Timeout for Bus Lock of RTOS # [UART Communication Device0] UART Shared Bus # [UART Communication Device0] Timeout for Block	Value System Default 1 1 1 Enabled Enabled Enabled Enabled Config_UART3 3 0xFFFFFFF UART Shared Bus0 rm_rai_data_shipper_callback0 0xFFFFFFF tion Device0.			
Overview Board Clocks System Compo	onents Pins Interrupt				



2.6 Generate source code by smart configurator.

• push [Generate Code] button.

8		— 🗆 X			
🔅 RealityAlSample.scfg 🗙					
Software component configuration					
Components 🖻 🛃 📮 🕀	Configure	<u>(</u>)			
type filter text Startup Generic Fbsp Data transfer controller Config_DTC Finers Orbig_TAU0_1 HO port Config_PORT Config_UART3 Middleware Seneric	Property	Value System Default 1 1 Enabled Enabled Enabled Enabled Config_UART3 3 0xFFFFFFFF UART Shared Bus0 rm_rai_data_shipper_callback0 0xFFFFFFFF			
Image: comms_uart_rl Image: comms_ua	Addition: COMMS_UART_CFG_DEVICE0_CALLBACK Specify the callback function name of the UART Communication	tion Device0.			
< >> Overview Board Clocks System Compo	nents Pins Interrupt	~			

2.7 Modify source code.

Add process of main function and add callback function to SCI.

• Replace and rename sample source file to src folder.

Replace	File
From	RealityAI_DataAcquisition_RL78G23_NonOS/sample/RealityAISample.c.sample
То	"Project Folder"/src/RealityAlSample.c
From	RealityAI_DataAcquisition_RL78G23_NonOS/sample/Config_TAU0_1_user.c.sample
То	"Project Folder"/src/smc_gen/Config_TAU0_1/Config_TAU0_1_user.c
From	RealityAI_DataAcquisition_RL78G23_NonOS/sample/Config_UART3_user.c.sample
То	"Project Folder"/src/smc_gen/Config_UART3/Config_UART3_user.c



2.8 Build project.

• Right-button click "Project Name" in Project Explorer and select [Build Project] menu.



3. How to implement data acquisition [RL78/G14]

For RL78 devices that do no support SIS modules (like as RL78/G14). Please refer the sample project as a guide to implement data acquisition module for Reality AI.

3.1 Import sample project for Data Collector and Data Shipper

A sample project attached this application note. Please import by the following steps.

- 1. Select [Renesas Views] [Solution Toolkit] [Smart Browser] menu.
- 2. Select [Select device] icon.

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🌸 Smar	t Browser X				<mark>به</mark> کې	🌋 🗗 ൟ 🖨	‰ √	000	- 0
Device:	R5F104ML(RL78/G14)			Last u	pdated: 2023/10/18	elect device			
Contex	t Help User's Manua	I Technical Update	Application Notes	Tool News	Notifications				
Total:	43								
	Received Date	Category	Contents						^
NE	V! 2023/10/18	Community N	RE: ADC- Analog volt	age reading					
NE	VI 2023/10/18	Community N	RE: R5F104BCGFP MC	U					
NE	VI 2023/10/18	Community N	RE: RTC seconds and	minutes cou	nts exceeding range.				
NE	V! 2023/10/18	Community N	RE: RL78 L13 Bootload	der/Jump To	App problem				
NE	V! 2023/10/18	Community N	RE: Function address	mismatch in	array declaration				
NE	VI 2023/10/18	Community N	RE: how to try RL78/G	i1F disable/e	nable TIMER RD com	plementary PWM			
NE	V! 2023/10/18	Community N	RE: R7F102GGE2DFB F	RL78/G22 fas	t prototyping board -	current consum			\sim

- 3. Select [RL78] [G14] [R5F104ML] tree and [OK] button.
- 4. Select [Application Notes] tab.



5. Select [RL78 Family Reality AI Data Acquisition Module (Data Collector / Data Shipper) Sample Code] and Click right-button [Sample Code (import projects)] item.

Conte	xt Help	User's Manual	Technical Update	Application Notes	Tool News	Notifications			
143 m	atches								
	Title					Document	Rev.	Issue Date	Sample (^
	RL78 Fa	amily Reality AI D	Data Acquisition Mo	dule (Data Collector	·/ Data S	R01AN699	Rev.1.00	2023/08/25	available
	RL78/G	€14 Capacitive To	ouch Evaluation Syst	em Sample Op	ben			2023/08/21	available
	RL78 Fa	amily Renesas Fla	ash Driver RL78 Type	01 SC vers Sa	mple Code (o	lownload)		2023/08/07	available
	RL78 Fa	amily Renesas Fla	ash Driver RL78 Type	01 SC vers Sa	mple Code (i	mport projects)		2023/08/07	available
	RL78 Family Renesas Flash Driver RL78 Type 01 SC vers		operty		-0	2023/08/07	available		
	RL78 Fa	amily SHA Hash	Function Library: Int	troduction				2023/08/01	available 🛩
<									>

After importing the sample project, display it in Project Explorer.



3.2 Information sample project for Data Collector and Data Shipper

RL78/G14 sample project copies and modifies the necessary source code from RL78/G23 sample project. Therefore, we recommend importing RL78/G23 sample project and compare source code.

How to import sample project for RL78/G23, please refer <u>Import sample project for Data Collector and Data</u> <u>Shipper</u>.



3.2.1 Copy source code from RL78/G23 sample project.

Copy and modify the following source code for RL78/G23 sample project.



Folder	Description
general	copy only r_smc_entry.h and modify it.
r_bsp\mcu\all	don't copy cstart.asm.
	don't copy r_rtos.h.
r_bsp	copy platform.h and modify it.
r_config	don't copy r_bsp_config.inc
rm_comms_uart_rl	copy all files
rm_rai_data_collector_rl	copy all files
rm_rai_data_shipper_rl	copy all files



3.2.2 Modify settings of Code Generator

1. Select [Clock Generator] tree and [On-chip debug setting] tab. Change the settings as shown in the following figure.

RealityAlSample2 - e ² studio			- (\times
File Edit Navigate Search Project Renesas Views					
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🎦 Project Explorer 🗙 🛛 🖻 😫 🍸 🖇 🗖 🖬	😹 Code Preview 💯 FIT Configurator 🧱 Peripheral Functions 🗙	🐻 Generate Code	3	- 0	
✓ CalifyAl_DataAcquisition_RL78614_NonOS	This assignment Tocks etting Tocks Tock Tocks Tock Tocks Tocks Tock Tocks Tocks Tocks Tock Tocks Tock Tock				
0 items selected	RealityAI DataAcquisition RL78G14 NonOS/Code Generator/Peripheral Functions/Clock Generator				

2. Select [Port] tree and [Port4] tab. Change the settings as shown in the following figure.

RealityAlSample2 - e ² studio									-		\times
File Edit Navigate Search Project Renesas Views	Run Renesas A	Window	Help								
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✓	Port0 Port1	Port2 Port	3 Port4	Port5 Port6	Port7 Port10 Por	t11 Port12	Port13 Port14 Port15				8
> 💒 Binaries	- P40										1 12
> Includes	Unused	🔾 ln 🔒	Out	🕽 🔽 Pull-up			1				
> 😝 generate	- P41										
> 🗁 HardwareDebug	Unused		Out	Pull-up			1				
> 🗁 doc	- P42										
RealityAl_DataAcquisition_RL78G14_NonOS.laur	Unused		Out	Pull-up			1				
RealityAl_DataAcquisition_RL78G14_NonOS.rcp	- P43		0								
✓ [™] Code Generator			Out	Pull-up	TTI buffer	N-ch					
V Peripheral Functions	PAA	0	000								
Clock Generator	Ollowed	01-		D Pull up	TTL buffer	□ N ch					
Poit	DAE	0	Out	run-up							
Serial	-F#3	0.	001								
A/D Converter	Onused		Out			- IN-CU					
📦 D/A Converter											
💣 Timer											
📦 Watchdog Timer											
Real-time Clock											
Comparison											
Clock Output/Buzzer Output											
Data Transfer Controller											
Event Link Controller											
Voltage Detector											
> 🛒 Code Preview											
> 🚰 RealityAl_DataAcquisition_RL78G23_NonOS											
< >>	<									2	1
				RealityAl_Data	Acquisition_RL78G1	4_NonOS/Cod	de Generator/Peripheral Functions	/Port :			



3. Select [Interrupt] tree and [External Interrupt] tab. Change the settings as shown in the following figure.

RealityAlSample2 - e ² studio									-		×
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✓	External Interrupt	ley input intern	upt								^ 🍣
> 🐇 Binaries	- INTP0 setting										
> D Includes	INTP0	Valid edge	Falling	~	Priority	Low	~				
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> 🗁 doc		valid edge	Falling	\sim	Priority	Low	\sim				
RealityAl DataAcquisition RL78G14 NonOS.laur	- INTP2 setting										
RealityAl_DataAcquisition_RL78G14_NonOS.rcp	🗌 INTP2 🔒	Valid edge	Falling		Priority	Low					
✓ [™] Code Generator	- INTP3 setting										
✓ peripheral Functions	INTP3	Valid edge	Falling	\sim	Priority	Low	\sim				
Clock Generator	INTR4 setting		-								
Port	T INTER	Valid adaa	Colline		Priority	Law					
1 Interrupt		valiu euge	railing	~	Filolity	LOW	~				
Senal	- INTP5 setting										
D/A Converter	INTP5	Valid edge	Falling	\sim	Priority	Low	\sim				
Timer	- INTP6 setting										
Watchdog Timer	INTP6	Valid edge	Falling	\sim	Priority	Low	\sim				
📦 Real-time Clock	INTP7 setting										
📦 12-Bit Interval Timer		Valid adaa	Falling		Priority	Law					
Comparator		vanu euge	Failing	~	ritority	LOW	v				
Clock Output/Buzzer Output	- INTP8 setting										
💣 Data Transfer Controller	INTP8	Valid edge	Falling	\sim	Priority	Low	\sim				
View Discontroller	- INTP9 setting										
Voltage Detector	INTP9	Valid edge	Falling		Priority	Low					
S RealityAL DataAcquisition RI 78G23 NonOS	- INTP10 setting										
/ / nearly / _ batancequisition_nerodes_nonos	INTP10	Valid edge	Falling	~	Priority	Low	~				
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			RealityAl Da	taAcquisiti	on RL78G14	1 NonOS/Co	de Generator,	/Peripheral Functions/Interrupt :			

4. Select [Serial] tree and [SAU0] [Channel] tab. Change the settings as shown in the following figure.

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>) includes	-Function		
> 🖂 src	Channel 0 UART0 V Transmit/receive function V		
> > HardwareDebug	Channel 1 Unused V		<u> </u>
> 🗁 doc			
RealityAl_DataAcquisition_RL78G14_NonOS.laur	Channel 2 Unused V		
RealityAl_DataAcquisition_RL78G14_NonOS.rcp	Channel 3 Unused V		
Code Generator			
Clock Generator			
Port			
2 Interrupt			
💣 Serial			
A/D Converter			
D/A Converter			
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Real-time Clock			
 12-Bit Interval Timer 			
Comparator			
Clock Output/Buzzer Output			
💣 Data Transfer Controller			
Event Link Controller			
Voltage Detector			
SealtyAL DataAcquisition RI 78623 NonOS			
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	RealityAI_DataAcquisition_RL78G14_NonOS/Code Generator/Peripheral Functions/Seria	al	



5. Select [Serial] tree and [SAU0] [UART0] [Receive] tab. Change the settings as shown in the following figure.

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> El includes	Receive Transmit						6
> 🖉 src	- Data length setting						
> 👝 HardwareDebug	○ 7 bits	O 9 bits					
> 🗁 doc	Transfer direction setting						
RealityAl_DataAcquisition_RL78G14_NonOS.laur RealityAl_DataAcquisition_RL78G14_NonOS.laur	LSB	○ MSB					
Code Generator	- Parity setting					_	
Peripheral Functions	None O Zero	Odd	O Even				
Clock Generator	- Stop bit length setting						
e Port	1 bit fixed						
Serial	- Receive data level setting						
A/D Converter	Normal	○ Reverse					
D/A Converter	Transfer rate setting						
2 Timer	Baudrate	2000000 ~	(bps) (Current error: +0.00% the minimum is -4.00%	% the maximum is +3.90%)			
Watchdog limer Real time Cleck	Interrupt setting		,				
12-Bit Interval Timer	Recention and interrunt priority (INTSR)						
Comparator	Reception and manapip promy (introduced	TSPE0)					
Clock Output/Buzzer Output	 Neception error interrupt priority (interrupt) 	Level 2 V					
Data Transfer Controller	- Callback function setting						
Voltage Detector	Reception end	Reception error					
> J Code Preview							
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6. Select [Serial] tree and [SAU0] [UART0] [Transmit] tab. Change the settings as shown in the following figure.

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RealityAlSample2 - e ² studio							-		×
File Edit Navigate Search Project Renesas Views	Run Renesas Al Window	Help							
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🔁 Project Explorer 🗙 📄 🖨 🗖	🛃 Code Preview 💯 FIT Co	onfigurator 🔛 Peri	pheral Functions X			🐻 Generate Code	. 🙆	8 🗖	
✓	SAUO SAU1 IICAO IICA	1							<u>^ 8</u>
> 🕌 Binaries	Channel UARTO UART1	CSI00 CSI01 0	SI10 CSI11 IIC00 IIC01	IIC10 IIC	011				
> Includes	Receive Transmit								
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> 👝 HardwareDebug	Single transfer mode		Continuous tran	nsfer mode					· · · ·
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RealityAl_DataAcquisition_RL78G14_NonOS.laur	O 7 bits	8 bits 8	9 bits						
Code Generator	- Transfer direction setting								
✓ Peripheral Functions	LSB		○ MSB						
Clock Generator	Parity setting								
e Port	None	○ Zero	Odd	O Ever	n				
Conist	- Stop bit length setting								
A/D Converter	I bit		2 bits						
D/A Converter	- Transmit data level setting								
🔗 Timer	Normal		Reverse						
Vatchdog Timer	- Transfer rate setting								
12-Bit Interval Timer	Baudrate		2000000	(bps)	(Current error: +0.00%)				
Comparator	- Interrupt setting								
Clock Output/Buzzer Output	Transmit end interrupt p	riority (INTST0)	Level 2	\sim					
Data Transfer Controller Super Link Controller	-Callback function setting								
Voltage Detector	Transmission end								
> 🛒 Code Preview									1
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		RealityAl	DataAcquisition_RL/8G14_N	ionUS/Code	Generator/Peripheral Functions/Serial	1			



7. Select [Data Transfer Controller] tree and [DTC setting] tab. Change the settings as shown in the following figure.

RealityAlSample2 - e [*] studio File Edit Navigate Search Project Renerar View	Rup Reperar Al Window Help					– U	×
	Null Nelless Al Wildow Help				् । 😭 🖥 c/c+	+ 🔛 Code Ger	nerato
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✓ ﷺ RealityAl_DataAcquisition_RL78G14_NonOS	DTC setting DTCD0 DTCD1						^ 2
> 💒 Binaries	DTC base address	0xffd00					
> includes							
> 😝 generate	Control data0 (DTCD0)	Chain transfer	Activation sources	TAU01	~		I III
> 🕞 HardwareDebug	Control data1 (DTCD1)	Chain transfer	Activation sources	TAU01	~		•
> 🗁 doc				INTO			
RealityAl_DataAcquisition_RL78G14_NonOS.laur	Control data2 (DTCD2)	Chain transfer	Activation sources	INTO			
RealityAl_DataAcquisition_RL78G14_NonOS.rcp	Control data3 (DTCD3)	Chain transfer	Activation sources	INTO	~		
Code Generator				INTO			
Clock Generator	Control data4 (D1CD4)	Chain transfer	Activation sources	INTO	<u> </u>		
Port	Control data5 (DTCD5)	Chain transfer	Activation sources	INTO	~		
🖉 Interrupt	Control data6 (DTCD6)	Chain transfer	Activation sources	INT0	~		
💣 Serial			Activation sources				
A/D Converter	Control data7 (DTCD7)	Chain transfer	Activation sources	INTO	×		
D/A Converter	Control data8 (DTCD8)	Chain transfer	Activation sources	INT0	~		
💓 limer							
Real-time Clock	Control data9 (DTCD9)	Chain transfer	Activation sources	INTO			
📦 12-Bit Interval Timer	Control data10 (DTCD10)	Chain transfer	Activation sources	INT0	~		
Comparator				INTO			
Clock Output/Buzzer Output	Control data11 (D1CD11)	Chain transfer	Activation sources	INTO	~		
💓 Data Transfer Controller	Control data12 (DTCD12)	Chain transfer	Activation sources	INTO	~		
Voltage Detector	Control data 12 (DTCD12)	Chain transfer	Activation courses	INT0	~		
S S Code Preview		Chain transier	Activation sources				
> 🚰 RealityAl_DataAcquisition_RL78G23_NonOS	Control data14 (DTCD14)	Chain transfer	Activation sources	INTO	~		
	Control data15 (DTCD15)	Chain transfer	Activation sources	INTO	×		
	Control data16 (DTCD16)	Chain transfer	Activation sources	INTO	~		

8. Select [Data Transfer Controller] tree and [DTC0] tab. Change the settings as shown in the following figure.

RealityAlSample2 - e ² studio			-		- 0	×
File Edit Navigate Search Project Renesas Views	Run Renesas Al Windo	ow Help				
i		·		Q 😰 🔤 C/C++	Code Ger	nerator
陷 Project Explorer 🗙 📄 🖨 🏹 🖇 🗖 🗖	🛃 Code Preview 💯 FIT	Configurator 🔛 Peripheral I	Functions ×	🐻 Generate Code	💽 8 🗖 1	
✓	DTC setting DTCD0 D	TCD1				<u>^</u> &
> 🖗 Binaries	Transfer mode setting					1 ÷
> 🗊 Includes	Namel and a					e
> 😂 generate	Informal mode					
> 🚰 src	 Transfer data size setting 					2
> 🗁 HardwareDebug	8 bits 8		○ 16 bits			
> 🗁 doc	Repeat mode interrupt cel	ting				
X RealityAl_DataAcquisition_RL/8G14_NonOS.laur	Disable	ang				
RealityALDataAcquisition_RL/8614_NonOS.rcp	Uisable					
Code Generator	 Repeat area setting —— 					
Clock Generator	Transfer destination	n	 Transfer source 			
Port	Transfer address and cou	nt setting				
2 Interrupt		la scor				
Serial	Source address	UXFEDE	Address fixed			
A/D Converter	Destination address	0xFEDE	Address fixed \sim			
D/A Converter	Count	1				
💣 Timer						
📦 Watchdog Timer	Block size	1				
📦 Real-time Clock				1		
12-Bit Interval Timer						
Comparator						
Clock Output/Buzzer Output						
Tata Iransfer Controller						
Veltare Detector						
Code Provinue						
See Code Free Weight Strate Courses Strate Stra						
						5
	Realit	yAI_DataAcquisition_RL78G14	_NonOS/Code Generator/Peripheral Functio	ns/Data Transfer Controller		



9. Select [Data Transfer Controller] tree and [DTC setting] tab. Change the settings as shown in the following figure.

RealityAlSample2 - e ² studio						-		×
File Edit Navigate Search Project Renesas Views	Run Renesas Al Wind	ow Help						
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✓	DTC setting DTCD0	TCD1						^ 🎤
> 🖑 Binaries	Transfer mode setting							- ÷
> 🔊 Includes	Normal mode		O Report mode					~
> 😕 generate	Informal mode		O Repeat mode					
> 😝 src	-Transfer data size setting							
> 🗁 HardwareDebug	8 bits		16 bits					
> 🦢 doc	Repeat mode interrunt se	ting						
KealityAl_DataAcquisition_RL/8G14_NonOS.laur	Disable	ang	O Earth					
RealityAl_DataAcquisition_KL/8614_NonOS.rcpi	Unsable .							
Parinharal Function	- Repeat area setting							
Clock Generator	 Transfer destination 	n	 Transfer source 					
Port	Transfer address and co	nt setting						
anterrupt	Course address	0.CEDE	Adding frond					
Serial	Source address	UKFEDE	Address fixed					
A/D Converter	Destination address	0xFEDE	Address fixed \checkmark					
D/A Converter	Count	1						
💣 Timer	DI 1 -	1						
Watchdog Timer	BIOCK SIZE							
Real-time Clock	L							
12-Bit Interval Timer								
Comparator								
Clock Output/Buzzer Output								
Event Link Controller								
Voltage Detector								
Code Preview								
> 🞏 RealityAl DataAcquisition RL78G23 NonOS								
< >								v
						_		_
	Reali	yAl_DataAcquisition_RL78G14_	NonOS/Code Generator/Peri	ipheral Functions/Data Transf	er Controller			

3.2.3 Modify source code.

1. Select [r_cg_dtc.h] tree.

Modify source code as shown in the following figure.

RealityAlSample2 - RealityAl_DataAcquisition_RL78G14	4_NonOS/src/r_cg_dtc	.h - e² studio			-		×
File Edit Source Refactor Navigate Search Proj	ect Renesas Views	Run Renesas Al Window Help					
📓 💠 🕶 💁 🕶 🌛			Q	😰 📴 C/C++	ି <u>ଅ</u> C	ode Gen	erator
🍋 Project Explorer 🗙 📄 🖶 🖓 🖇 📟 🗖	▶ r_cg_dtc.h ×					- 6	в) ""
✓ RealityAl_DataAcquisition_RL78G14_NonOS [▲	174	#define 01 DTCD0 TRANSFER BYTE (0y01U)				^	چ
> 💒 Binaries	175	#define 01 DTCD0 TRANSFER BLOCKSIZE (0x01U)					- 1×
> 🔊 Includes	176	#define FEDE DTCD1 SRC ADDRESS (0xFEDEU)					8
> 📇 generate	177	#define FEDE_DTCD1_DEST_ADDRESS (0xFEDEU)					•
× 🛱 srr	178	#define _01_DTCD1_TRANSFER_BYTE (0x01U)					
> Can general	179	#define _01_DTCD1_TRANSFER_BLOCKSIZE (0x01U)					<u>101</u>
> Chicken	180	a Transfer de Chattantes II					8
) 👝 a serific	182	• typedet detinitions.					
> 🗁 r_contig	185	s typeder struct					335
> 🗁 rm_comms_uart_rl	186	wint8 t_dtccr:					2.2
> 🗁 rm_rai_data_collector_rl	187	uint8 t dtbls;					0 111
> 🗁 rm_rai_data_shipper_rl	188	uint8 t dtcct;					
> c r_cg_cgc_user.c	189	uint8_t dtrld;					
> 💽 r_cg_cgc.c	190	<pre>uint16_t dtsar;</pre>					
> h r_cg_cgc.h	191	uint16_t dtdar;					
> c r_cq_dtc_user.c	192	<pre>}st_dtc_data;</pre>					
> c r ca dtc.c	193	@ Clabel function					
> b) r cg dtc.h	195	woid P DTC (reate(woid):					
> in r co inte user e	198	void & DTC_O Start(void):					
> Regime_dation	199	void R DTCD0 Stop(void);					
> in r_cg_intele	200						
> in r_cg_intc.n	201	/* Start user code for function. Do not edit comment generated here */					
> h r_cg_macrodriver.h	202	⊖ typedef struct					
> c r_cg_port_user.c	203	{					
> cg_port.c	204	uint8_t dtccr;					
> h r_cg_port.h	205	uint8_t dtbls;					
> lc r_cg_serial_user.c	206	uint8_t atcct;					
> 🖻 r_cg_serial.c	208	uint16 t dtsar:					
> h r cg serial.h	200	uint16 t dtdar:					
> 🗟 r ca timer user.c	210	<pre>}st dtc data t;</pre>					
> 🗟 r ca timer.c	211	/* End user code. Do not edit comment generated here */					
) in ca timer.h	212	#endif					
× ····································	213					~	
< >>		<				>	
RealityAl DataAcquisition RI 78G14 NonOS/src/r cg s	ttc h	RealityAI Data&couisition RI 78G14 NonOS/Code Generator/Perinheral Functions/Data Transfer Controller :					



2. Select [r_cg_serial_user.c] tree.

Modify source code as shown in the following figure.

RealityAlSample2 - RealityAl_DataAcquisition_RL78G14	1_NonOS/src/r_cg_s	erial_user.c - e² studio	-			×
File Edit Source Refactor Navigate Search Proj-	ect Renesas Views	Run Renesas Al Window Help				
📓 🗄 🕶 💁 🕶 🗾		Q 🗄 🖻 🖬 c/c++	-	Code G	enera	ator
🔁 Project Explorer 🗙 📃 🖻 😫 🦳 🗖	h r_cg_dtc.h	C r_cg_serial_user.c ×		-		8
> 💽 r_cg_cgc.c 🔥	2	ISCLAIMER.			^	8
> h r_cg_cgc.h	19					1 m
> c r_cq_dtc_user.c	21	⊕* File Name : r_cg_serial_user.cl				8
> c r c dtc.c	28	R Tesludos				
) lin r ca dtc.h	32	#include "r cg macrodriver h"				
r co into user.c	33	#include in cg serial.h"				
> r co inte c	34	/* Start user code for include. Do not edit comment generated here */				8
> a register	35	<pre>#include "rm_comms_uart_if.h"</pre>				
> m r_cg_mean	36	<pre>/* End user code. Do not edit comment generated here */</pre>				FIT
s in r_cg_macrounver.n	37	<pre>#include "r_cg_userdefine.h"</pre>				沁麗
> ic r_cg_port_user.c	38	and the state of				22
> [e] r_cg_port.c	40	· rages directive.				
> h r cq port.h	42	#pragma interrupt i uarto interrupt secolycectatisto)				
> c r_cg_serial_user.c	44	#pragma interrupt r uarto interrupt econ(vect=INISKO)				
> _c r_cg_serial.c	45					
> h r_cg_serial.h	46	/* End user code. Do not edit comment generated here */				
> c r_cg_timer_user.c	47	-				
> c r_cg_timer.c	49					
> h r cq timer.h	51	extern volatile uint8_t * gp_uart0_tx_address; /* uart0 send buffer address */				
h r ca userdefine.h	52	extern volatile uintlo t guart0 tx_count; /* uart0 send data number */				
r co wdt user c	55	extern volatile unita t "gp_uarte rx address; /* uarte receive butter address */				
> r cq wdt c	55	extern volatile unition guardo rx length: // unito receive data length */				
> C co with	56	/* Start user code for global. Do not edit comment generated here */				
s in legwach	57	extern void rm comms uart bus0 callback(rm comms uart event t event);				
> ic r_main.c	58	/* End user code. Do not edit comment generated here */				
> c r_systeminit.c	59					
> AC RealityAl_DataAcquisition_RL78G14_Non(61					
r_cg_serial_user.c.bak	🏘 66	estatic voidnear r_uart0_interrupt_receive(void)				
r_cg_timer_user.c.bak	67					
📄 r_main.c.bak	60	Volatile units_t FX_data;				
> 🗁 HardwareDebug	70	rx data = RXD0:				
> 🧁 doc	71					
<	70			>	*	
	RealityAl_Data	Acquisition_RL78G14_NonOS/Code Generator/Peripheral Functions/Data Transfer Controller Writable				

 Select [r_cg_serial_user.c] tree. Modify source code as shown in the following figure.





4. Select [r_cg_timer_user.c] tree.

Modify source code as shown in the following figure.

RealityAlSample2 - RealityAl_DataAcquisition_RL78G14_No	nOS/src/r_cg_timer_user.c - e² studio	- 0		×
File Edit Source Refactor Navigate Search Project	Renesas Views Run Renesas Al Window Help			
📓 💠 • 💁 • 🌛	Q 🗄 😰 🔤 C/C++	Code (Senera	ator
陷 Project Explorer 🗙 📄 🔄 🕞 🕼	r_cg_dtc.h 🕜 r_cg_serial_user.c 🕧 r_cg_timer.h 🕼 r_cg_timer.c 🔬 r_cg_timer_user.c 🗙	-		8
> 🗁 r_bsp 🔨 🔺	2 ⊕ [*] DISCLAIMER.		^	8
> 🗁 r_config				0
> 🗁 rm_comms_uart_rl	21 09 File Name : r_cg_timer_user.cL			
> 🗁 rm_rai_data_collector_rl	30 • Includes			8
> 🗁 rm_rai_data_shipper_rl	32 #include "r cg macrodriver.h"			
> 🖻 r_cg_cgc_user.c	33 #include "r_cg_timer.h "			
> 🖻 r_cg_cgc.c	34 /* Start user code for include. Do not edit comment generated here */			<u>ara</u>
> 🖻 r_cg_cgc.h	35 #include <stddet.< b="">h></stddet.<>			8
> c r_cg_dtc_user.c	7 - End user code, bo not effic comment generated here '7			1
> c r_cq_dtc.c	38			m
> h r cq dtc.h	40			た田
> c r cq intc user.c	42 #pragma interrupt r_tau0_channel1_interrupt(vect=INTTM01)			2.
> le r cq intc.c	43 ⊕/* Start user code for pragma. Do not edit comment generated here */			
> in r cg intc.h	<pre>44 /* End user code. Do not edit comment generated here */ 47</pre>			
b r cg macrodriver.h	42 A7 @Global variables and functions			
> in r cg port user.c	49 /* Start user code for global. Do not edit comment generated here */			
> C ca port c	50 void rm rai data collector dc0 timer callback(void * pdata);			
h r ca porth	51 /* End user code. Do not edit comment generated here */			
s in conservation user of	52			
> R co serial c	54 • Function Name: r_tau0_channel1_interrupt(
s so social b	Static void near rtabe_thanneliinterrup((void))			
> in r cq senain	61 /* Start user code. Do not edit comment generated here */			
> Ag r_cg_umer_user.c	62 rm_rai_data_collector_dc0_timer_callback((void *)NULL);			
> ici r_cg_umer.c	63 /* End user code. Do not edit comment generated here */			
> m r_cg_umer.n	64 }			
> In r_cg_userderine.n	65			
> [c] r_cg_wat_user.c	67 Start user code for adulty, bo not edit comment generated here "/			
> in r_cg_wat.c	68			
> [h] r_cg_wdt.h				
> c r_main.c				
> ic r_systeminit.c			~	
< >	<	>		
	RealityAI DataAcquisition RL78G14 NonOS/Code Generator/Peripheral Functions/Data Transfer Controller Writable			

5. Select [r_bsp_config.h] tree. Modify source code as shown in the following figure.

RealityAlSample2 - RealityAl_DataAcquisition_RL78G14_N	NonOS/src/r_cor	nfig/r_bsp_config.h - e² stud	lio				-		×
File Edit Source Refactor Navigate Search Project	t Renesas View	s Run Renesas Al Wir	ndow Help						
📓 : 🏘 🕶 💁 🕶 🇾						Q 🕴 📑 🖬 C/C+	+ 🗐 (Code Ge	nerato
눱 Project Explorer 🗙 📄 🖨 🖗 🗖 👔	h r_cg_dtc.h	r_cg_serial_user.c	h r_cg_timer.h	r_cg_timer.c	🔎 r_cg_timer_user.c	▶ r_bsp_config.h ×		-	
RealityAl DataAcquisition_RL78G14_MonOS (907 908 919 910 911 912 911 912 914 915 916 917 917 917 917 918 918 917 917 918 917 918 917 918 919 912 920 922 923 924 925 924 925 927 929 929 930 931 932 933 934 935 936 937	2023-04 : 1 If you are set the fol v1.0.1 : 1 v1.1.0 : 1 v1.1.0 : 1 v1.2.0 : 1 *define BSP_CF 0 /* API function 0 : Enable AP 1 : Disable A */ #define BSP_CF 0 /* API function 0 : Enable AP 1 : Disable A #define BSP_CF 0 /* API function 0 : Enable AP 1 : Disable A */ #define BSP_CF 0 /* API function 0 : Enable AP 1 : Disable A */ #define BSP_CF 0 /* API function 0 : Enable AP 1 : Disable A */ #define BSP_CF 0 /* API function 0 : Enable AP 1 : Disable A */	<pre>000 000 000 000 000 000 000 000 000 00</pre>	LIDIE VERSION (1070) StartClock, R_BS N_API_FUNCTIONS_ GetFclkFreqHz) UNCTIONS_DISABLE SetClockSource) CE_API_FUNCTIONS ChangeClockSetti ETTING_API_FUNCT	/* Generated value. /* Generated value. P_StopClock) DISABLE (1) (1) /* 	Do not edit this manually */]		



3.2.4 Change build settings.

Right-button click "Project Name" in Project Explorer and select [Properties] menu.

1. Select [C/C++ Build] [Settings] tree and [Tool Settings] tab and [Source] tree. Change build setting as shown in the following figure.





2. Select [C/C++ Build] [Settings] tree and [Tool Settings] tab and [Language] tree. Change build setting as shown in the following figure.





 Select [C/C++ Build] [Settings] tree and [Tool Settings] tab and [Object] tree. Change build setting as shown in the following figure. In this sample project, turned [-far_rom] option on, but change it to suit your system.



3.2.5 Delete source file.

Delete source file (generate\hdwinit.asm).



4. How to get sensor data from evaluation board

4.1 Setup Reality AI Data Storage Tool

- 1. Install Reality AI Data Storage Tool.
 - Select [Help]>[Install Renesas IDE Features] in e2 studio.

Help	5		
3	Welcome		
? ??	Help Contents Search Show Context Help		
1	Show Active Keybindings Cheat Sheets	Ctrl+Shift+L	
	Renesas Help		>
:	CMSIS Packs Management		>
B	Add Renesas Toolchains		
۹	Eclipse User Storage		>
2	Perform Setup Tasks		
<i>e</i> .,	Check for Updates		
۹ ۵ -	Install New Software		
٩	Eclipse Marketplace		
	Install Renesas IDE Features	Ν	
a	IAR Embedded Workbench plugin manager	-0	
6	About e ² studio		



Check [Renesas Reality AI – Data Storage Tool] and push [Finish] button.

G Install			×
Install e ² studio features			
Select e ² studio features to install then click Finish to start download & installation			
 Renesas RZ Device Support Renesas RZ Smart Configurator Renesas AI Renesas Reality AI - Data Storage Tool 			
Finis	sh 💦	Cance	;

2. Launch Reality AI Data Storage Tool

•

• Select [Renesas AI]>[Show View]>[Reality AI Data Storage Tool] menu.





3. Select Project

• Select ["Project Name"] combo box.

oject: RealityAlSample						Ŋ
itatus î No data Data error	Settings Data	connection	Data file	e settings	View data	structure
Data capture	Signal view					
rame size: Jumber of rames per file: Unlimited Instance ID: Class name: MyClass Start new capture				Ch Na Na O Fixed sca	le view le view	
	● Live view ○ F	ile review	0 sa	imples		
Manage capture data files						
Data file group	Data file	Create date	Size	Class name	Refresh	
					Select all da	ata
					Copy data to g	roup

- 4. Get data structure information from Smart Configurator
 - Push [View data structure] button in Reality AI Data Storage Tool.
 - Push [Import settings from Smart Configurator] button and push [Close] button.

D	Data structure X					
	Data struc	ture: Retrieved from Smart Con	figurator	Import settings from Smart Configurator		
	ch	Name	Format			
	1	Data1	int8			
	2	Data2	uint8			
				Close		



- 4. Get connection settings from Smart Configurator
- Push [Data connection] button in Reality AI Data Storage Tool.
- Push [Import settings from Smart Configurator] button and Select [COM port] and push [Close] button.

Connection settings X					
Import set	ttings from Smart Configurator				
UART					
COM port:		\sim			
Baudrate:	9600	~			
Data length:	7bit	\sim			
Parity:	None	\sim			
Stop bit:	1bit	\sim			
O TCP/IP					
	Connect Close				

Limitation: "Renesas Reality AI Data Storage Tool" V1.0.0 can not get information from Smart Configurator. So please change the settings manually.



4.2 Connect Evaluation Board and PC

- Short 2-3 in J20
- Connect PMOD (USB-UART) module to evaluation board and connect PMOD module and PC via USB.
- Connect evaluation board and PC via USB.
- For Connection details, please refer "RL78/G23-128p Fast Prototyping Board" manual. The Manual is available on Renesas Web.



4.3 Modify debugger settings.

- Right-button click "Project Name" in Project Explorer and select [Properties] menu.
- Select [Run/Debug Settings] tree and select [RealityAISample HardwareDebug] item and push [Edit] button.



Properties for RealityAlSam	ple -	
type filter text	Run/Debug Settings	<> ▼ <> ▼ 8
 Resource Builders C/C++ Build C/C++ General 	This page allows you to manage launch configurations associated selected resource.	d with the currently
Project Natures Project References	RealityAlSample HardwareDebug	New
Refactoring History		Duplicate
Renesas QE Run/Debug Settings		Edit
Task Tags		Delete
		Arely
	Restore Default	ts Apply
?	Apply and Close	Cancel



Select [Debugger] tab and Select [Connection Settings] tab and Change "COM Port" to [COMX]. (X is the COM port number connecting your PC and the evaluation board.)

Bdit Configuration	_		×			
dit launch configuration properties Erase Flash on Start is Enabled. Please Disable this option after sucessful connection.						
Name: RealityAlSample HardwareDebug	n					
Debug hardware: COM Port (RL78) V Target Device: R	7F100GSN					
GDB Settings Connection Settings Debug Tool Settings						
✓ Clock						
Main Clock Frequency[MHz]	Using Internal Clock	•	×			
Sub Clock Frequency[kHz]	Using Internal Clock	•	4			
Monitor Clock	System	•	×			
 Connection with Target Board 			-			
COM Port	COM7					
Reset control pin	DTR		4			
Baud Rate [bps]	Auto		v			
✓ Flash						
Current Security ID (HEX)	000000000000000000000000000000000000000					
Current Serial Programming Security ID (HEX)	FFFFFFFFFFFFFFFFFFFFFFFFFF					
Permit rewrite the serial programming security ID	No		1			
Permit Flash Programming	Yes		4			
Use Wide Voltage Mode	Yes		1			
Erase Flash ROM When Starting	Yes		4			
Program uses flash self programming	No		4			
Fill unused area with 0xFF when writing flash memory	No	1	4			
	Revert	Apply				
?	ОК	Cancel	I			

•



4.4 Execute program.

- Right-button click "Project Name" in Project Explorer.
- Select [Debug As]>[Debug Configuration] menu.
- Select ["Project Name" HardwareDebug] tree and push [Debug] button.

Debug Configurations			- U
Treate, manage, and run configurations			Ŕ
Image: Solution of the second seco	Name: RealityAlSample HardwareDebug Imain ☆ Debugger Source Project: RealityAlSample (C/C++ Application: HardwareDebug/RealityAlSample.x Build (if required) before launching Build Configuration: Build Configuration: Select Automatically O Enable auto build Is workspace settings	Common Variables Search Proje	Browse sct Browse
> ilter matched 11 of 13 items		Revert	Apply
?		Debu	ig N Close

- •
- Push [Resume] icon on toolbar.

File	Edit	Source	Refactor	Navigate	Search	Project	Renesas Views	Run	Renesa:
			`≈ 🕩		🔁 _ r	i ⇒ i 🍇	🛓 🎄 🕶 💁 •	-	- 🍇 🛛



4.5 Get sensor data.

- Push [Data connection] button in Reality AI Data Storage Tool.
- Select [COM port] connecting "PMOD (USB-UART) module " and PC and push [Connect] button.

Co	Connection settings ×					
[Import set	ttings from Smart Configurator				
	COM port:	COM4	\sim			
	Baudrate:	115200	~			
	Data length:	8bit	\sim			
	Parity:	None	\sim			
	Stop bit:	1bit	\sim			
(TCP/IP					
		Connect Close				



When sensor data is acquired, a signal appears on the Reality AI Data Storage Tool view. For the operation of Reality AI Data Storage Tool, refer to the help.





Revision History

		Description	
Rev.	Date	Page	Summary
1.0.0	20 Oct, 2023	-	First Release



General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.)

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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