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# RL78/G14

R01AN1304EG0100

Rev1.00

Oct 12, 2012

## Utilising the Serial Array Unit (SAU) in LIN Communications Sample Code for Cubesuite+

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### Introduction

The purpose of this Application Note is to show the user how to add the associated RL78/G14 sample code to a new or existing CubeSuite+ workspace; as well as give an explanation of what the sample code does.

The sample code demonstrates usage of the Serial Array Unit (SAU) implementing LIN communication. The program runs on the RL78/G14 Renesas Starter Kit (RSK) and can configure the RSKRL78G14 as a LIN master or slave. This is through the inclusion or exclusion of the macro '#define MASTER\_LIN' found in r\_cg\_userdefine.h header file. In master mode, the RL78/G14 transmits a LIN header frame which includes a wake-up signal and waits for the slave to respond with 3 data bytes which includes a checksum. In slave mode, the RL78/G14 waits for reception of a header frame from the master. Upon detection of the header frame, the slave checks if the address, 0x10, contained in the header frame matches its address before proceeding with transmitting the data bytes. By default, the sample code is configured to build and execute in the master mode.

### Target Device

RL78/G14

### Contents

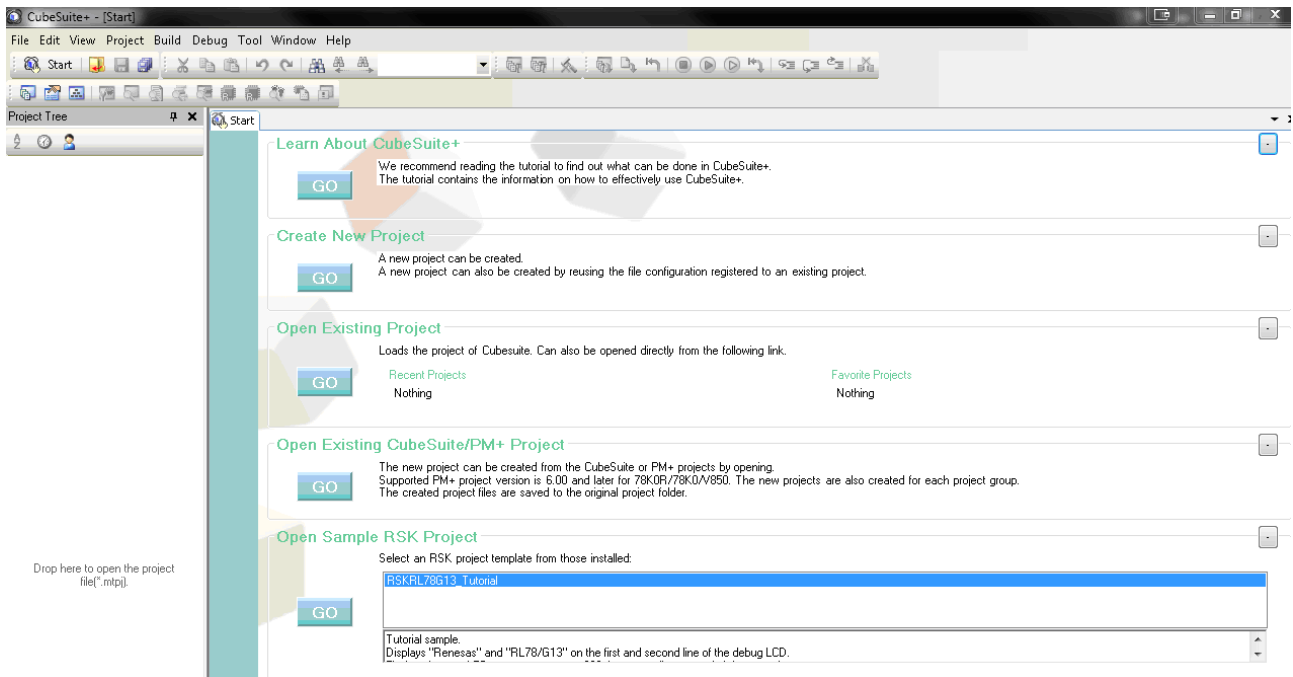
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## 1. Installation

This section assumes CubeSuite+ IDE is already installed on the user's personal computer (PC). Create a new folder and name it as 'RSKRL78G14\_Workspace'. Copy the zipped file LIN.zip, available in the Application Note package downloaded from the website, to this folder. Extract the LIN.zip file to the RSKRL78G14\_Workspace folder.

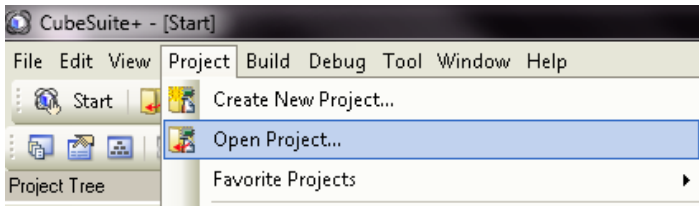
## 2. Creating the Project Workspace

Open CubeSuite+ IDE by clicking the Windows Start button, select All Programs > Renesas Electronics CubeSuite+ > CubeSuite+.



## RL78/G14 Utilising the (SAU) in LIN Communications Sample Code for Cubesuite+

From the menu bar select File > Project > Open Project...

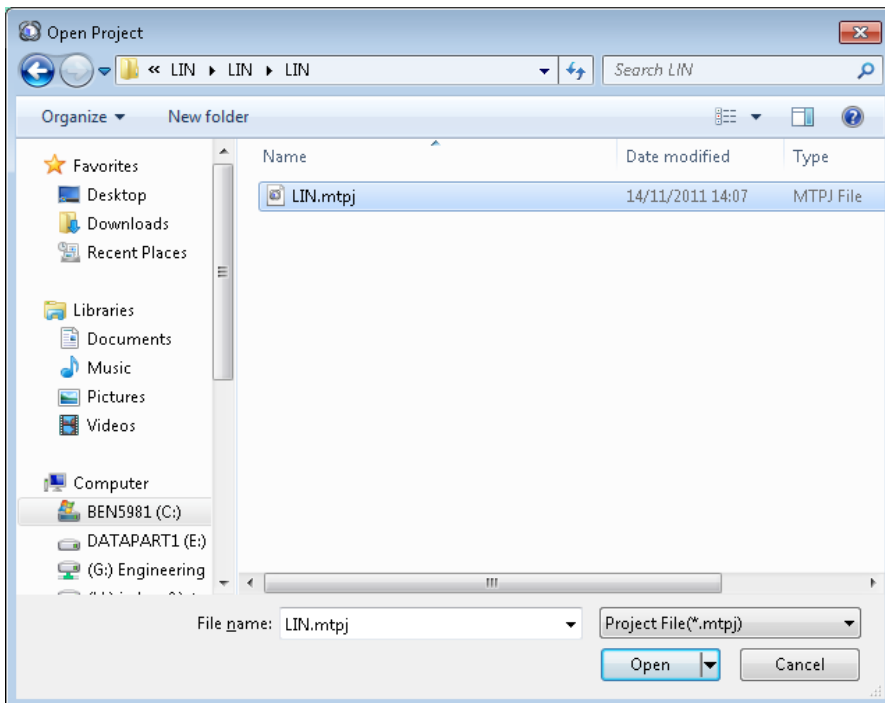


CubeSuite+ will open a dialog.

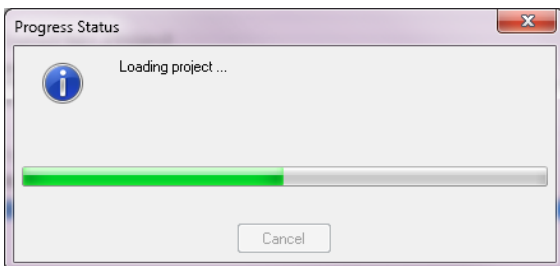
Navigate to the unzipped LIN folder located in RSKRL78G14\_Workspace.

Select the LIN.mtpj file.

Click <Open>.

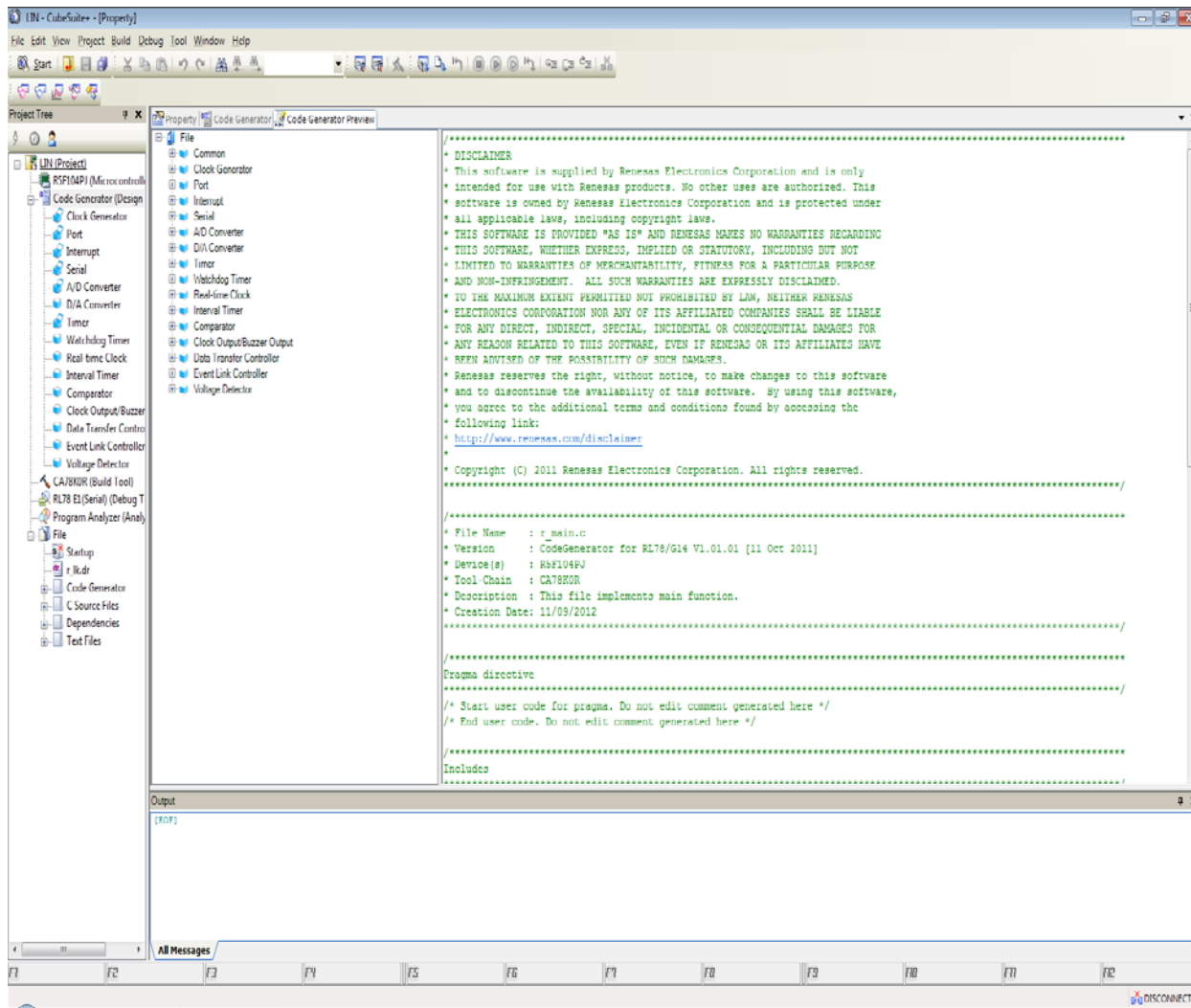


A Progress Status dialog will appear briefly whilst CubeSuite+ loads the project.



### 3. Opening Sample Code and Source Files

Once the project has been opened, the source code and all dependant files can be opened in the editor by expanding the folders in the Project Tree window and double clicking the files listed. All files have been grouped according to their file type.



### 4. Source Code Functionality

The source code project is specifically written to run on the appropriate RSK. However this source code can be useful as an example even without the RSK.

The project was written using source files containing API functions generated using Code Generator. The project will contain a C source file 'r\_main.c'. This source file includes the C function main(). All source files and dependant files whose filenames are prefixed with 'r\_' were generated using Code Generator.

### **5. Code Execution**

This sample code requires an external 5V regulated power supply.

1. When in master mode, configure the non-RSKRL78G14 slave device to transmit 3 data bytes upon reception of a LIN header from the master.
2. Make the following connections between RSKRL78G14 board and slave device.

RSKRL78G14		SLAVE device
a. LIN pin no.1 (VBAT)	-->	LIN pin no.1 (VBAT)
b. LIN pin no.2 (LIN)	-->	LIN pin no.2 (LIN)
c. LIN pin no.3 (GROUND)	-->	LIN pin no.3 (GROUND)

For master mode, ensure R93 and R94 are fitted.

For slave mode, ensure R93 and R94 are removed.

3. Connect a 5.0V regulated power supply to the RSKRL78G14 board.
4. Build this application and download it to the RSKRL78G14 board.
5. Press the 'Restart' button on debug tool bar.
6. Reset the slave device if applicable.
7. In master operations, data received from the slave is displayed on the debug LCD. In slave mode, a 10-bit A/D conversion value is stored in two bytes and a checksum of the two is calculated and stored in another byte. The three bytes are then transmitted

to the master. Different A/D values and checksum can be obtained by adjusting the potentiometer.

The displayed value will be as follows:

=H'xxxx

where xxxx denotes the 10-bit A/D conversion value.

NOTE: Usually there is no need to connect power supply to the LIN slave device as it will draw power from RSKRL78G14 master board via the LIN connector.

### **6. Website, Inquiries and Support**

Renesas Electronics Website

<http://www.renesas.com/>

Inquiries

<http://www.renesas.com/inquiry>

Support

<http://www.renesas.com/rskrl78g14>

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## Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Oct 12, 2012	—	First edition issued

## General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

### 1. Handling of Unused Pins

Handle unused pins in accord 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.

### 2. Processing at Power-on

The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.

### 3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

- The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

### 4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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. Moreover, 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.

### 5. Differences between Products

Before changing from one product to another, i.e. to one with a different type number, confirm that the change will not lead to problems.

- The characteristics of MPU/MCU in the same group but having different type numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different type numbers, implement a system-evaluation test for each of the products.

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