RL78/G23

Wireless Communication Sample Sketch Using XBee AT Solution ZB S2C and SHT4x (Arduino™ sketch)

Introduction

This application note explains how to implement wireless communication using XBee ZB S2C with the Arduino library for RL78/G23-128p Fast Prototyping Board (FPB). This application note focuses only on the transmitting side. The data handled in wireless communication consists of temperature and humidity values obtained from the SHT40 sensor.

Target Device

Board	: RL78/G23-128p Fast Prototyping Board
Wireless module	: XBee ZB S2C
Sensor board	: SHT40

Reference Document

Receiving side : RL78/G15 Wireless Communication with the XBee ZB 2SC and SHT4x (R01AN8031)

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Grove is a trademark of Seeed Studio.

Contents

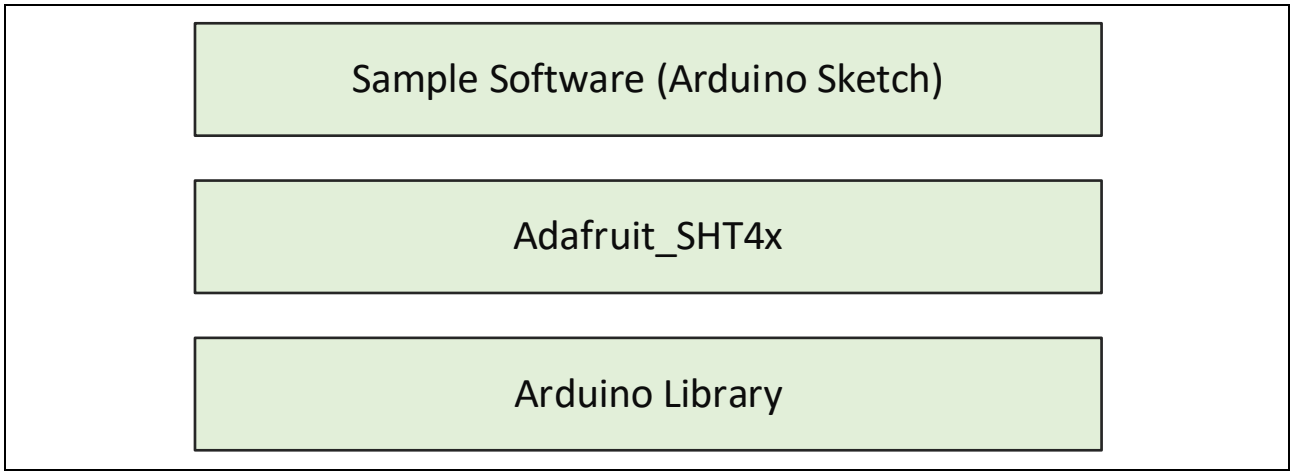
1. System Overview

This system consists of a RL78/G23-128p Fast Prototyping Board (FPB), an XBee ZB S2C module, and an SHT40 temperature and humidity sensor. The Arduino™ IDE is used for program development and writing. In addition to the Arduino Library, the Adafruit_SHT4x library is used to control the SHT40 sensor.

In this system, temperature and humidity measurement starts after the FPB is powered on, and the data is transmitted to the receiving wireless module at 3-second intervals. During communication, LED1 remains on. Pressing the user switch disconnects communication and turns off LED1. Pressing the user switch again reconnects communication and resumes data transmission.

The block structure of the sample sketch used in this system is shown below.

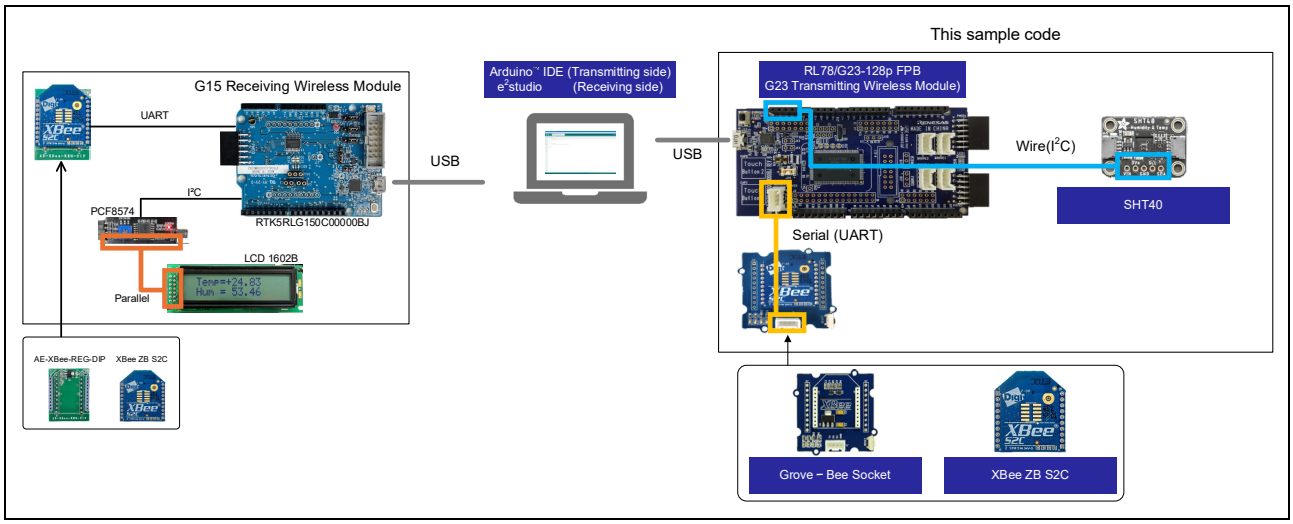
Figure 1-1 Software Block Diagram



1.1 Module Used

The system configuration diagram is shown below.

Figure 1-2 System Configuration



1.1.1 XBee ZB S2C

XBee ZB S2C is a module that performs wireless communication using the ZigBee protocol. In this system, it receives temperature and humidity data from the RL78/G23-128p Fast Prototyping Board via serial communication and transmits it to the receiving wireless module. Control is performed using AT commands. For details on AT commands, refer to '4.1.1 Initial Setup Method Using AT Commands.'

Figure 1-3 shows the XBee ZB S2C used in this system, and Table 1-1 provides an overview of its specifications.

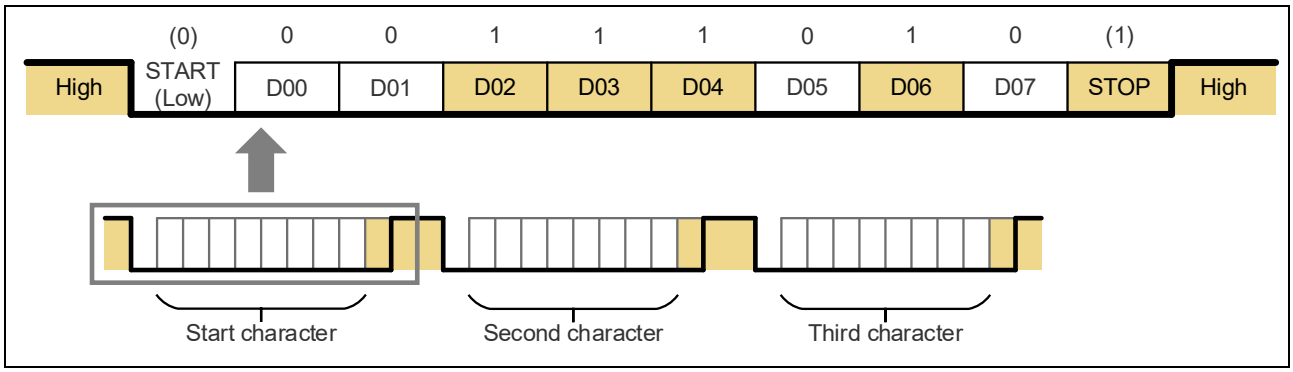
Figure 1-4 illustrates the serial communication format.

Figure 1-3 XBee ZB S2C

Table 1-1 Specifications of XBee ZB S2C

Item	Description
Data rate	RF 250 Kbps, serial (up to 1 Mbps)
Indoors/urban range	Up to 60 m
Outdoors/expected range	Up to 1,200 m
Transmission power	3.1 mW (+5 dBm) / 6.3 mW (+8 dBm) in boost mode
Receiver sensitivity (1% PER)	-100 dBm / -102 dBm in boost mode
Serial data interface	UART, SPI
Configuration method	API or AT command, local or wireless
Frequency band	ISM 2.4 GHz
Operating voltage	2.7 to 3.6 V
Auxiliary board for connecting MCU	Grove – Bee Socket

Figure 1-4 Serial Communication Format



1.1.2 SHT40 Sensor

The SHT40 sensor is used for measuring temperature and humidity. In this system, the SHT40 temperature and humidity sensor is employed, capable of measuring temperatures from -40°C to +125°C and humidity from 0% to 100%. The communication interface uses Wire, and sensor data is obtained using the Arduino Adafruit_SHT4x library.

Figure 1-5 shows the SHT40 used in this system.

Figure 1-5 SHT40

Table 1-2 Specifications of SHT40 Sensor

Item	Description
Humidity measurement range	0 to 100%RH
Humidity accuracy	TYP. ±1.8 %RH (10 to 90%RH, 23 °C)
Temperature measurement range	-40 to 12 °C
Temperature accuracy	TYP. ±0.2 °C (0 to 65 °C)
Average current	High accuracy: 2.3 µA Medium accuracy: 1.2 µA Low accuracy: 0.4 µA Current consumption at 1 measurement per second (temperature and humidity)
Sleep current	0.08 µA
Operating voltage	1.08 V to 3.6 V (TYP. 3.3 V)
Operating temperature	-40 to 125°C

1.2 Operation Overview

Figure 1-6 shows an overview of the operation.

(1) After power is turned on, XBee communication is connected, and after LED1 turns on, SHT40 is initialized.

(2) Temperature and humidity are acquired from SHT40, and transmission data is created.

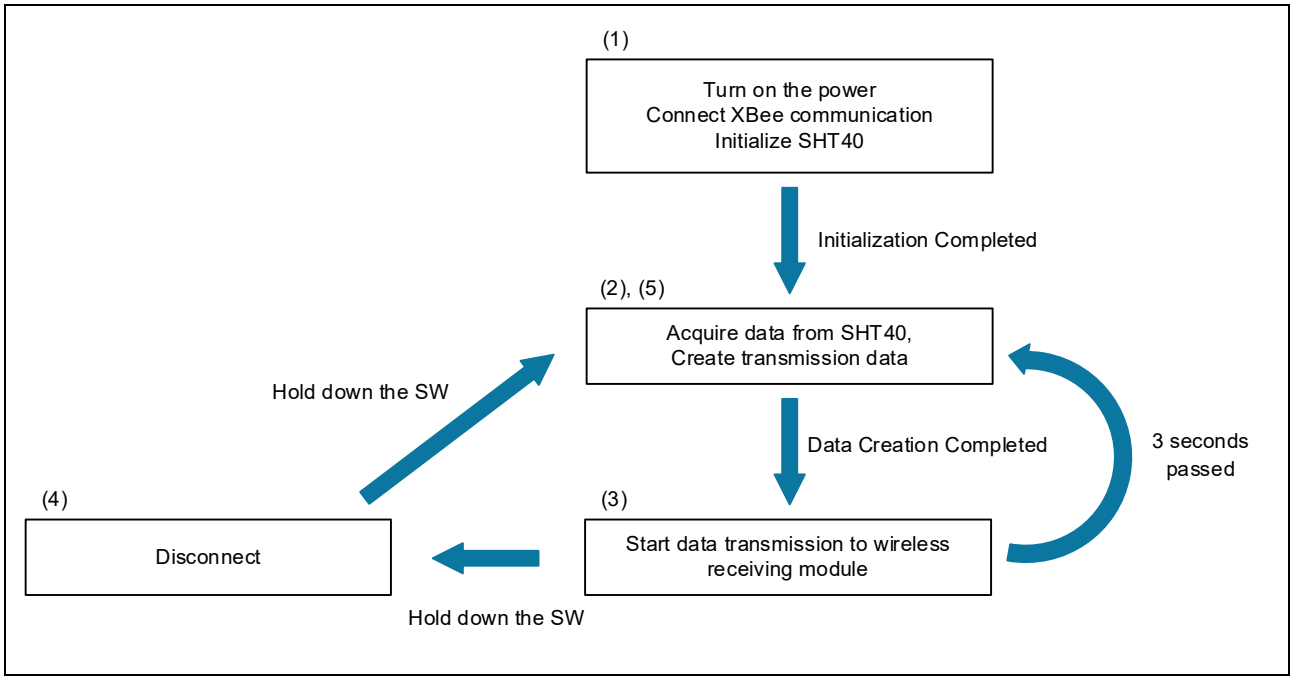
(3) After starting data transmission to the receiving wireless module, the process returns to (2) after 3 seconds have passed.

(4) When the user switch is held down, XBee communication is disconnected and LED1 turns off.

(5) When the user switch is held down again, XBee communication is connected, and after LED1 turns on, the process returns to (2).

note. If an error occurs in (1), (2), (4), or (5), an error message is displayed on the serial monitor. When an error related to XBee communication occurs, only the message is displayed. When an error related to SHT40 occurs, LED1 blinks after the message is displayed. Reboot or press the reset switch to return to (1).

Figure 1-6 Operation overview



2. Operation Confirmation Conditions

The operation of the sample program provided with this application note has been tested under the following conditions.

Table 2-1 Operation Confirmation Conditions (Transmitting hardware)

Item	Description
Board	RL78/G23-128p Fast Prototyping Board - RTK7RLG230CSN000BJ
Wireless module	XBee ZB S2C
Temperature and Humidity sensor	SHT40
Operating voltage	3.3V

Table 2-2 Operation Confirmation Conditions (Transmitting software)

Item	Description	Version
OS	Windows 11 Pro	-
Integrated development environment (IDE)	Arduino™ IDE	2.3.6
Library	RL78/G23-128p FPB Library	1.2.0

Table 2-3 Operation Confirmation Conditions (Receiving hardware)

Item	Description
Board	RL78/G15 Fast Prototyping Board - RTK5RLG150C00000BJ
Wireless module	XBee ZB S2C
Serial-to-Parallel converter module	PCF8574
LCD module	LCD1602B
Operating voltage	3.3V

Table 2-4 Operation Confirmation Conditions (Receiving software)

Item	Description	Version
OS	Windows 11 Pro	-
Integrated development environment (e^2 studio)	Renesas Electronics e^2 studio	2025-10
C compiler (e^2 studio)	C Compiler Package for RL78 Family [CC-RL]	1.15.01
Integrated development environment (CS+)	Renesas Electronics CS+ for CC	V8.14.00
C compiler (CS+)	C Compiler Package for RL78 Family [CC-RL]	1.15.01
Integrated development environment (IAR)	IAR Systems IAR Embedded Workbench for Renesas RL78	V5.20.2
C compiler (IAR)	IAR Systems IAR C/C++ Compiler for Renesas RL78	V 9.4.3.1558

Note. Please see ” RL78/G15 Wireless Communication with the XBee ZB 2SC and SHT4x (R01AN8031)” for details on the receiving side.

3. Build Development Environment

How to connect boards and how to set up the Arduino™ IDE are explained.

This system uses Arduino™ IDE 2.3.6. If you have not installed Arduino™ IDE 2.3.6 or later, please install it.

https://www.arduino.cc/en/software

Board Connection

Figure 3-1 shows the connection between the evaluation board, XBee ZB S2C, and the temperature and humidity sensor board. The temperature and humidity sensor board uses jumper cable connection, and the XBee ZB S2C uses Grove connection. See "3.2.1 Grove Connection" for details on Grove connection.

In this system, power is supplied to the evaluation board via USB. Please check the circuitry of the evaluation board and configure the jumpers as necessary.

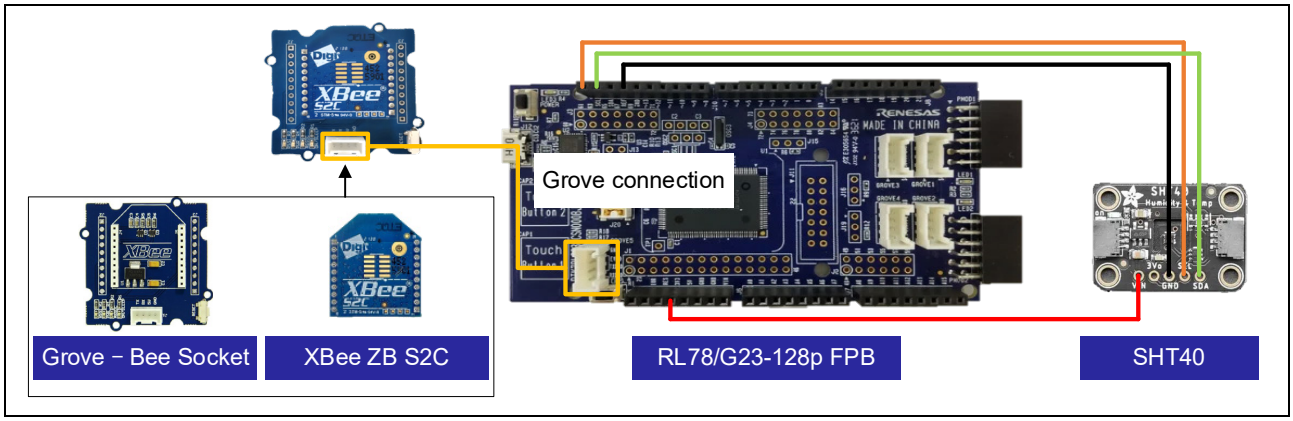
In this system, the jumpers on the evaluation board are configured as follows.

Table 3-1 Jumper Settings of Evaluation Board

Jumper	Settings	Function
J15	1-2 short	COM port debug
J16		
J19		
J20	2-3 short	3.3V power supply to MCU[Note]

Note. The operating voltage of the XBee ZB S2C and SHT40 is a maximum of 3.6V, so please set the power supply to the microcontroller to 3.3V.

Figure 3-1 Connection of Evaluation Board, XBee ZB S2C, and the temperature and humidity sensor board



3.1 List of Pins Used

The following shows the pins used in this system.

Table 3-2 List of Pins Used in This System

Pin name	Function name	Usage
P61	SDAA0	Serial data bus for communication with SHT40
P60	SCLA0	Serial clock for communication with SHT40
P83	TXDA0	UART transmission to XBee ZB S2C
P84	RXDA0	UART reception from XBee ZB S2C
P137	SW1	UART communication connection/disconnection switching
P50	LED1	UART communication status display (Connected: ON / Disconnected: OFF)

Please see the following manual for details of the board.

- RL78/G23-128p Fast Prototyping Board User's Manual (R20UT4870)

3.2 Connection of Boards

This section explains the details of how to connect the board.

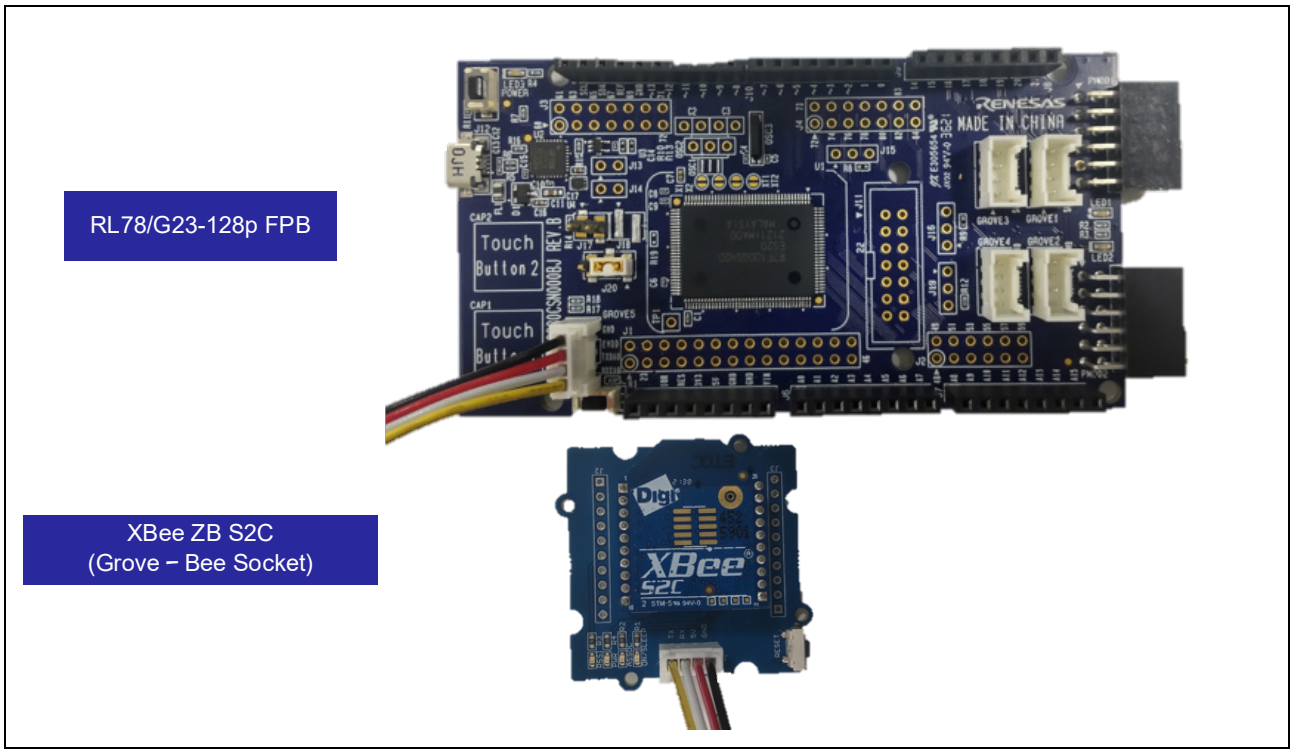
3.2.1 Grove Connection

Grove is a connector standard for IoT devices. The evaluation board and XBee ZB S2C (Grove-Bee Socket) are connected via the Grove5 connector. Connection requires a Grove cable. For details, refer to "5.9 Grove Connector" in the "RL78/G23-128p Fast Prototyping Board User's Manual".

Also, for details on the Grove connector of the Grove-Bee Socket, refer to the following manuals.

- Grove - Bee Socket | Seeed Studio Wiki

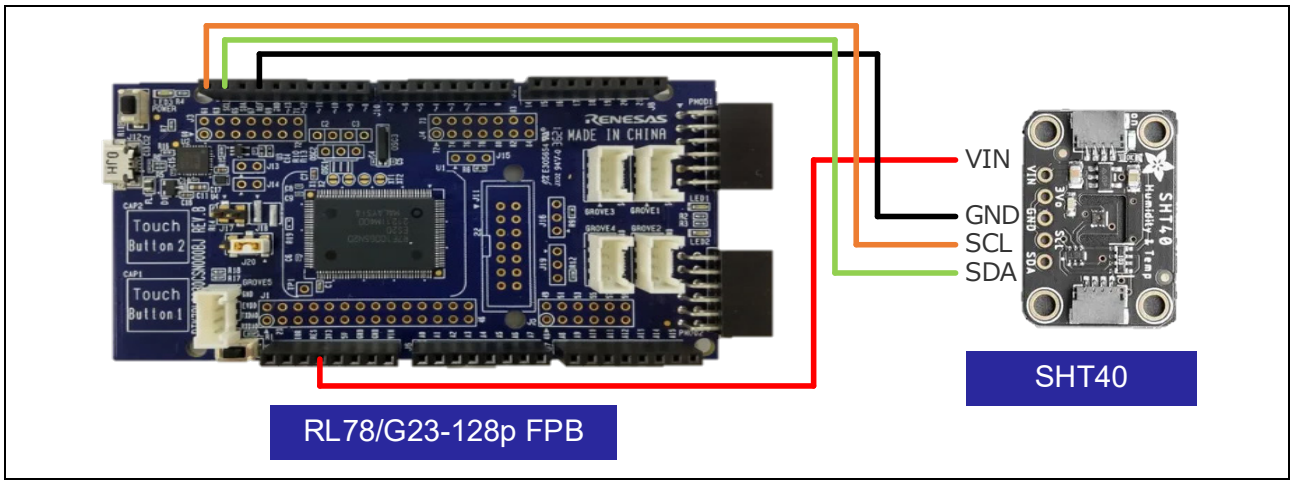
Figure 3-2 Grove connection



3.2.2 Jumper Cable Connection

The evaluation board and SHT40 are connected by a jumper cable. Since the SHT40 has internal pull-up resistors, there is no necessity to connect through external resistors.

Figure 3-3 Jumper cable connection

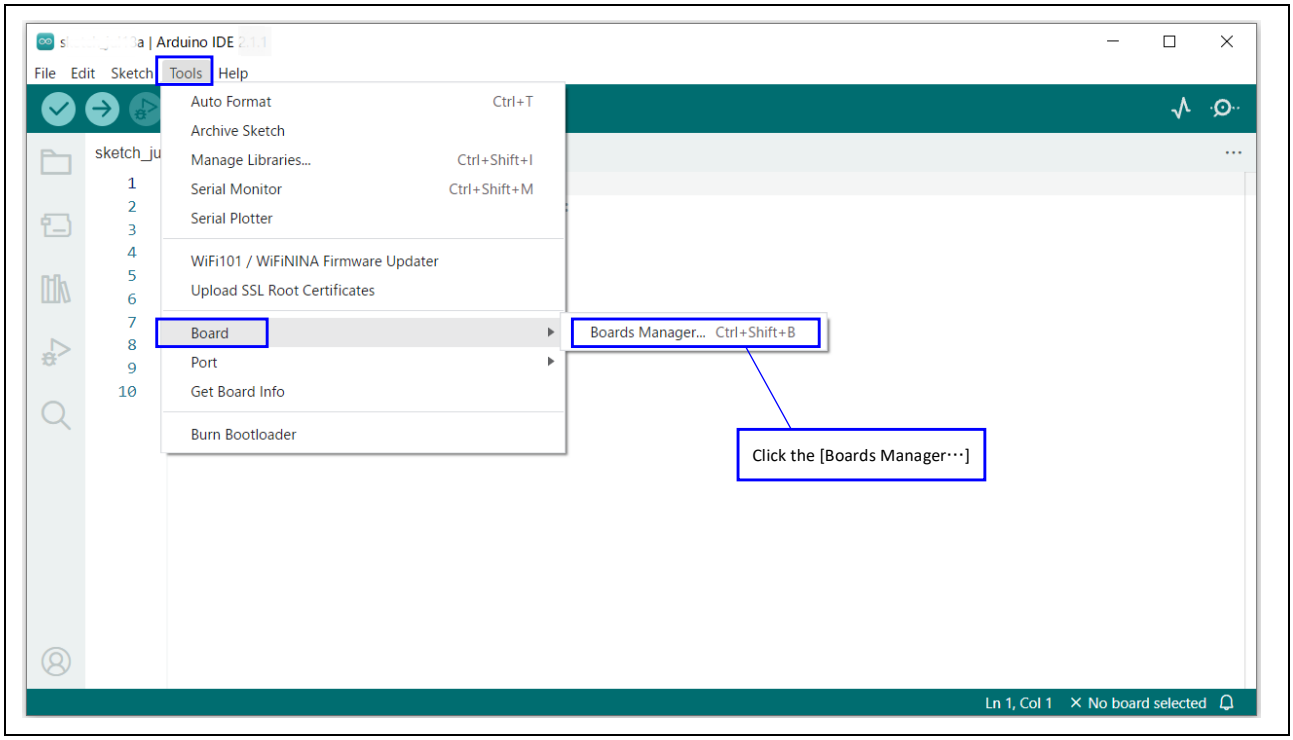


3.3 Setup of Arduino™ IDE

The setup procedure of Arduino™ IDE is explained.

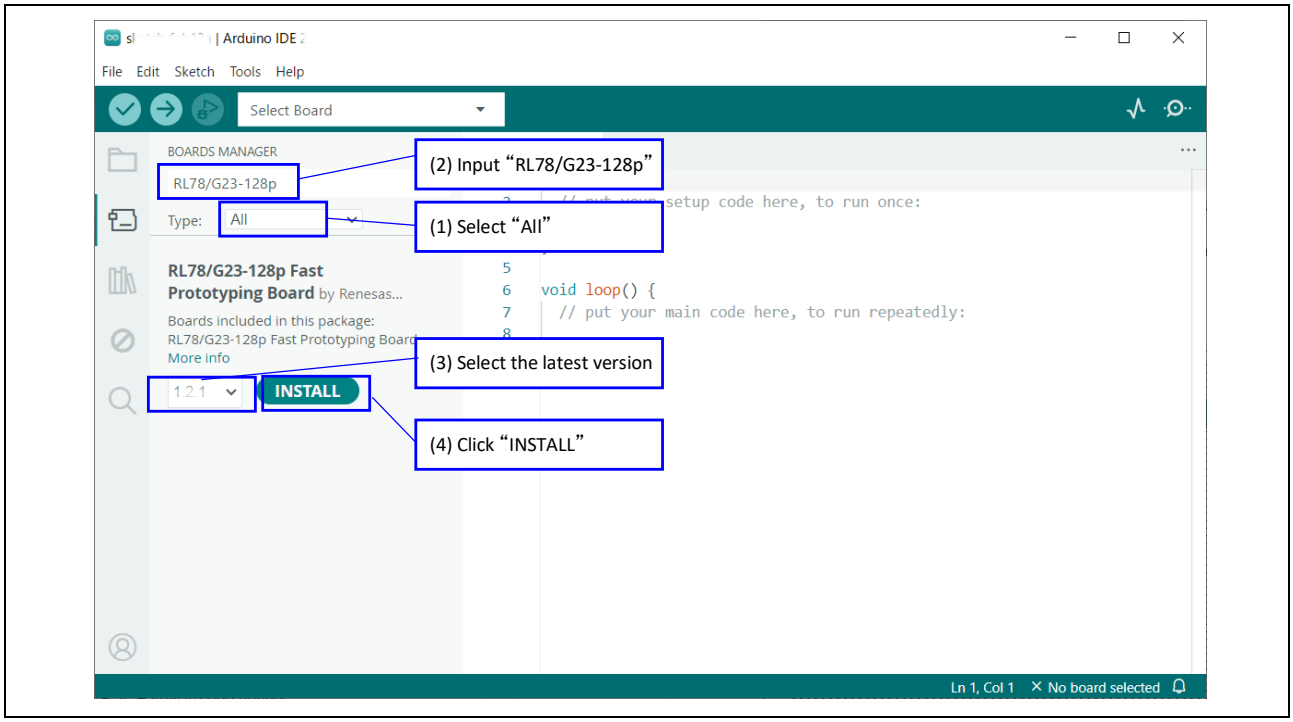
1. Start the Arduino™ IDE.
2. Select the [Tools] – [Board] – [Board Manager…] menu.

Figure 3-4 Selection of [Board Manager…]



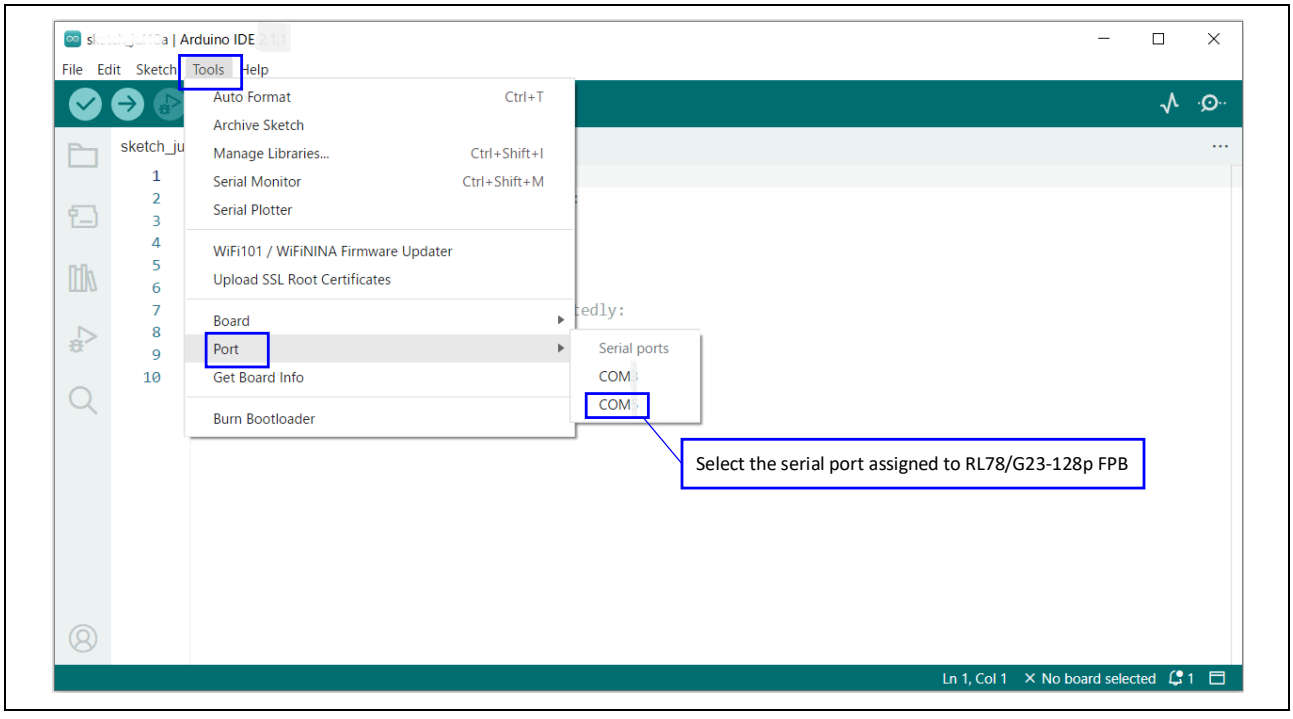
3. Select “All” at the [Type] and input “RL78/G23-128p” in the textbox. Then, “RL78/G23-128p Fast Prototyping Board” is displayed. Next, click the [INSTALL].

Figure 3-5 Installation of Board Manager



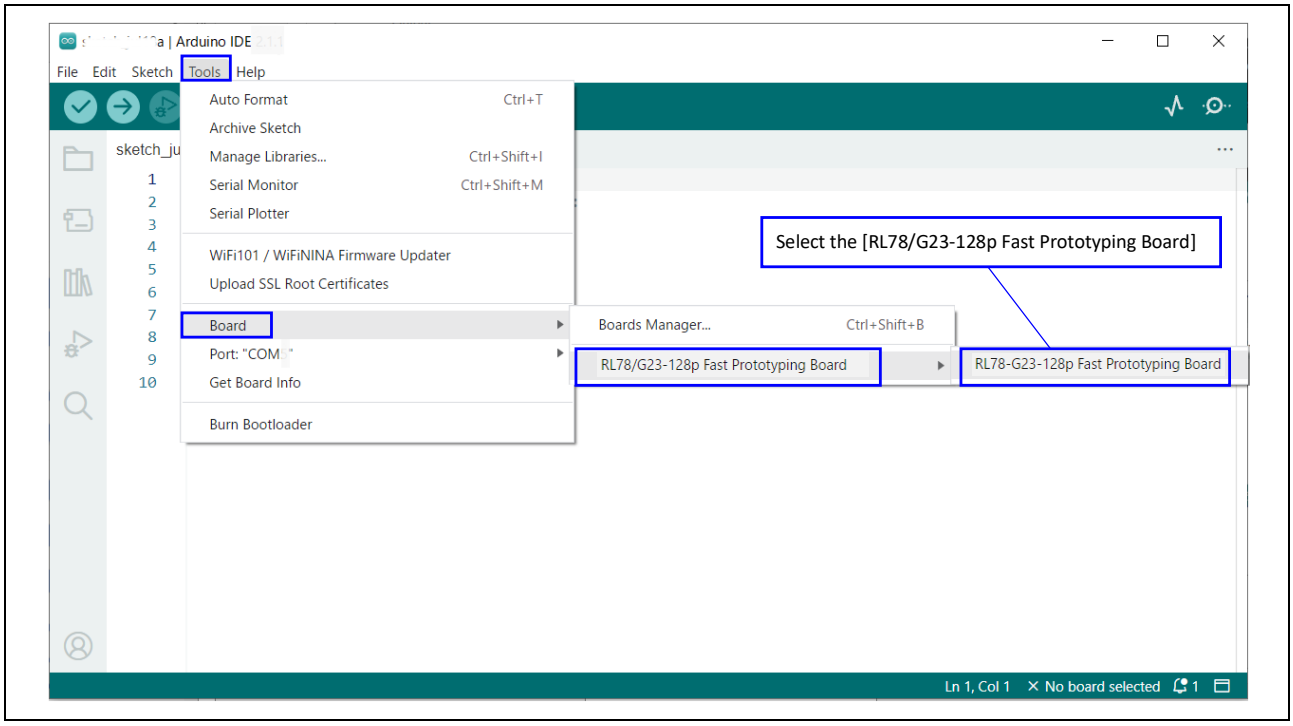
4. Select the serial port assigned to the RL78/G23-128p FPB from the [Tools] - [Port] menu. COM port number can be checked at the Device Manager of Windows.

Figure 3-6 Selection of serial port



5. Select the [Tools] - [Board] - [RL78/G23-128p Fast Prototyping Board] - [RL78/G23-128p Fast Prototyping Board] menu.

Figure 3-7 Selection of board



4. Software Descriptions

4.1 Sample Sketch Overview

This sample code is a sample sketch that executes on the Arduino™ IDE and consists of the libraries shown in Table 4-1.

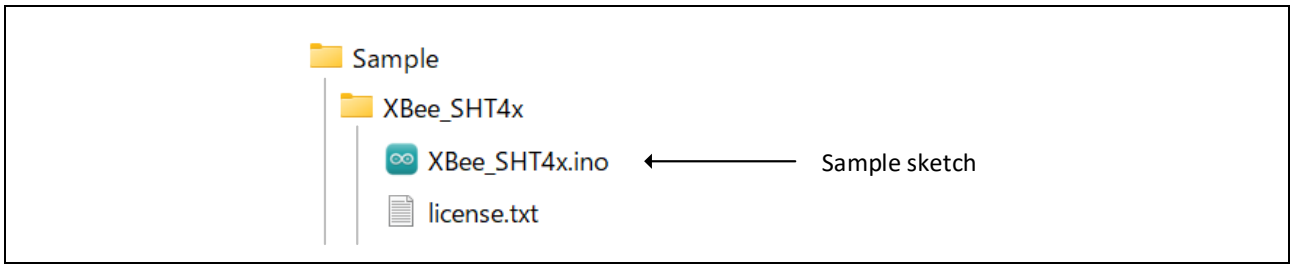
Table 4-1 Sample code overview of the library used

Library used	Description
Adafruit SHT4x Library	Communicates with the temperature and humidity sensor via the Wire interface and acquires temperature and humidity data.

The file structure is shown below.

Please refer to "4.3 API Functions" for the API functions used, and "4.5Operation Check Procedure of Sample Sketch" for details on the sample sketch.

Figure 4-1 File structure of sample code



4.1.1 Initialization Using the AT Commands

To enable communication between two XBee ZB S2C devices, it is necessary to configure them, as they do not communicate with each other in their default settings. Here, I will explain the method for initializing the XBee ZB S2C devices to enable communication using AT commands.

For the initial configuration of the XBee ZB S2C, you can use the UART interface to send AT commands from a microcontroller and set the parameters related to communication. The settings involve writing parameter values to the XBee ZB S2C using AT commands.

Table 4-2 List of AT Commands Used for Configuring XBee ZB S2C

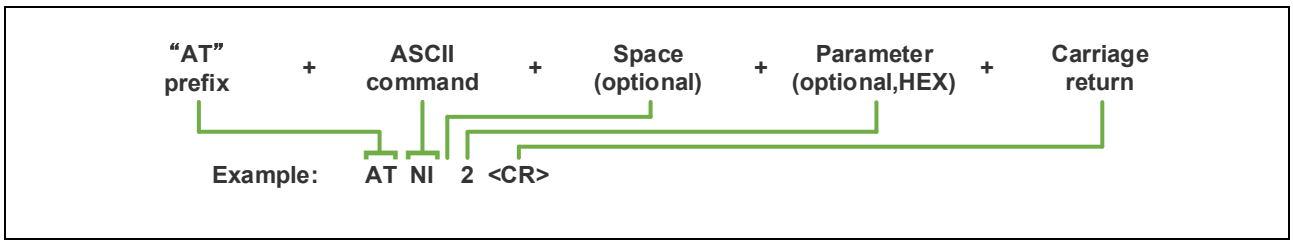
Configuration Items	Configuration Values (Commands)	Description
ID PAN ID	Any value (in the sample program, '5555' is used). *Ensure it is the same for both transmission and reception.	XBee ZB S2C can communicate only with devices that have the same ID parameter.
DH Destination Address High	13A200	Specify the upper address of the communication destination. XBee ZB S2C is fixed at '13A200'.
DL Destination Address Low	The values of DL for each other. Please refer to the XBee ZB S2C device itself for this information.	Specify the lower address of the destination. For XBee ZB S2C, you can check the value by connecting to XCTU and confirming the DL value, or by inspecting the device (MAC).
Entering command mode	+++	Switching XBee ZB S2C to command mode.
Exiting command mode	ATCN	Exiting the command mode of XBee ZB S2C.
RESTORE defaults	ATRE<CR>	Restoring XBee ZB S2C to factory default settings.

To enable communication between two XBee ZB S2C modules, you need to configure three settings: ID, DH, and DL. Please configure these values in the following order: ID → DH → DL. Make sure to set each of these values on both XBee ZB S2C modules.

If you enter command mode, make sure to reconfigure ID, DH, and DL.

The format for sending AT commands is as follows:

Figure 4-2 Transmission Format of AT Commands



To control the XBee ZB S2C using the AT commands, it is necessary to enter command mode before sending the AT commands. Refer to the following online manual for details about how to enter command mode and about parameters to be sent for each AT command.

https://www.digi.com/resources/documentation/Digidocs/90001500/Default.htm

4.2 Sketch Example used in Sample Code

This sample code uses sketch examples provided by Arduino™ IDE. The method for referencing the sketch examples is shown below.

4.2.1 Adafruit SHT4x Library / SHT4test

This is a sketch example that uses XBee_SHT4x to perform Wire communication with a temperature and humidity sensor.

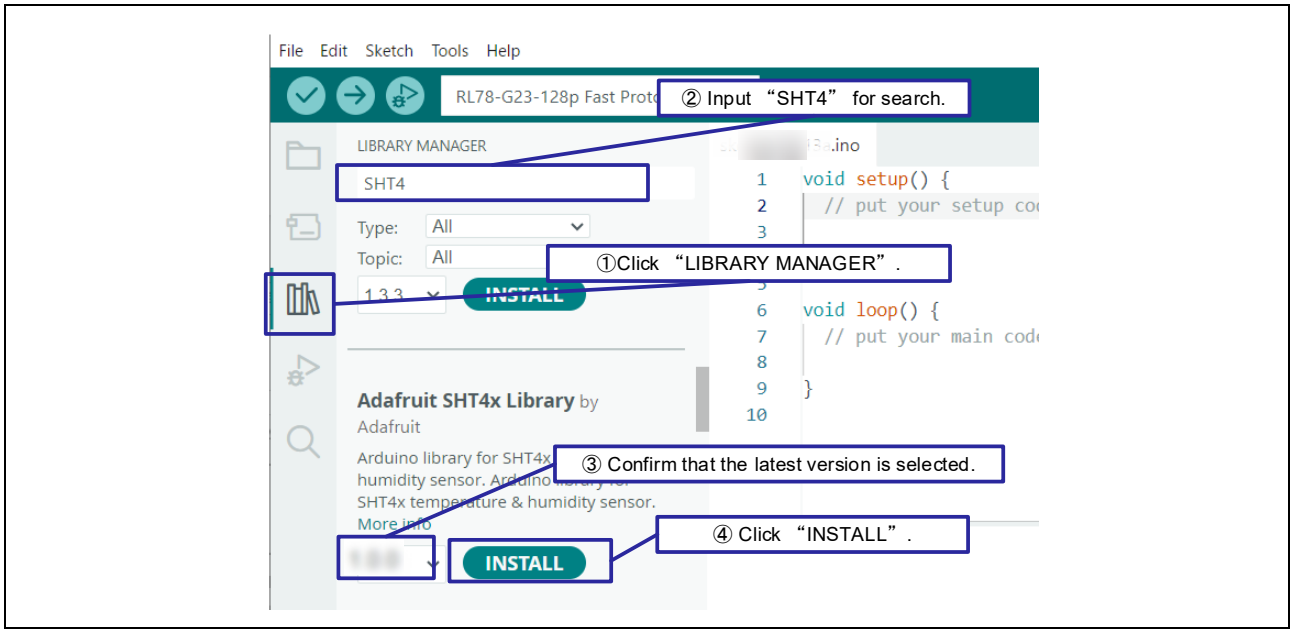
This library is distributed under the BSD license.

Copyright (c) 2012, Adafruit Industries

To reference this, use the following procedure:

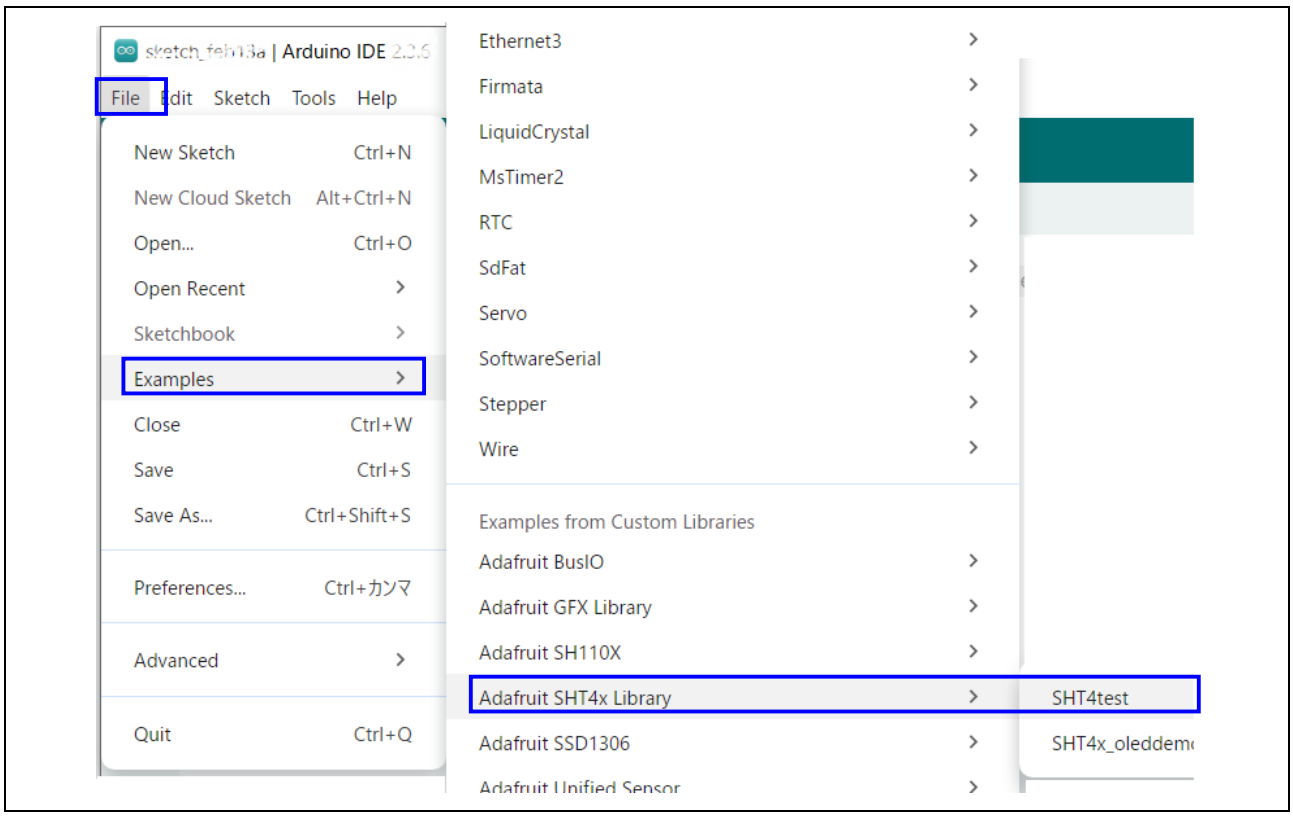
1. Start the Arduino™ IDE.
2. Open the library manager on the left side of the screen, search for [SHT4] in the search field, and install [Adafruit SHT4x Library].

Figure 4-3 Installation of Adafruit SHT4x library



3. Click the [Files] - [Examples] - [Adafruit SHT4x Library] – [SHT4test] .

Figure 4-4 Selection of Adafruit SHT4x Library / SHT4test



4.3 API Functions

The API functions of each library used in this sample sketch are shown below.

Table 4-3 List of APIs

API name	Function
pinMode(pin, mode)	Set input/output of pins
digitalWrite(pin,value)	Output HIGH/LOW from digital pins
millis(ms)	Return the time (ms) that has elapsed since the Arduino board started running the current program. The unit is milliseconds (ms).
delay(ms)	Stop the program for a specified time (ms). The unit is milliseconds (ms).
Serial.begin()	Specify the data transfer rate (bps) for serial communication.
Serial.available()	Get the number of bytes (characters) that can be read from the serial port
Serial.flush()	Wait for data to finish sending
Serial.print(val)	Output data to serial port
Serial.println(val)	Output to serial port with line breaks for each data
Serial.readString()	Read data (strings) from a serial buffer
sht4.begin()	Measurement Preparation (Specify Default Wire1 Channel)
sht4.setPrecision(precision)	Specifying the measurement accuracy (precision) of the temperature and humidity sensor
sht4.setHeater(heater)注	Specifying the heater setting (heater) of the temperature and humidity sensor
sht4.getEvent(&humidity, &temp)	Return humidity(humidity) and temperature(temp) readings

【Note】In this sample sketch, the heater function is set to unused, and the heater function is not used.

For API function specifications of each library, refer to the website of Arduino™ and the other.

API List · renesas/Arduino Wiki · GitHub

pinMode() | Arduino Documentation

digitalWrite() - Arduino Reference

millis() | Arduino Documentation

delay() - Arduino Reference

Serial | Arduino Documentation

GitHub - adafruit/Adafruit_SHT4X: Arduino driver for Adafruit SHT4X temperature / humidity breakout

4.4 Preparing for the Receiving Side

The preparation steps for the receiving side are described below.

Please refer to the application note below for a detailed description of the receiver side and download the sample code in advance.

- RL78/G15 Wireless Communication with the XBee ZB 2SC and SHT4x (R01AN8031)

1. Connect the RL78/G15 receiving wireless module with the XBee ZB S2C, PCF8574, and LCD1602B as follows.

Figure 4-5 Connection diagram (Receiving side)

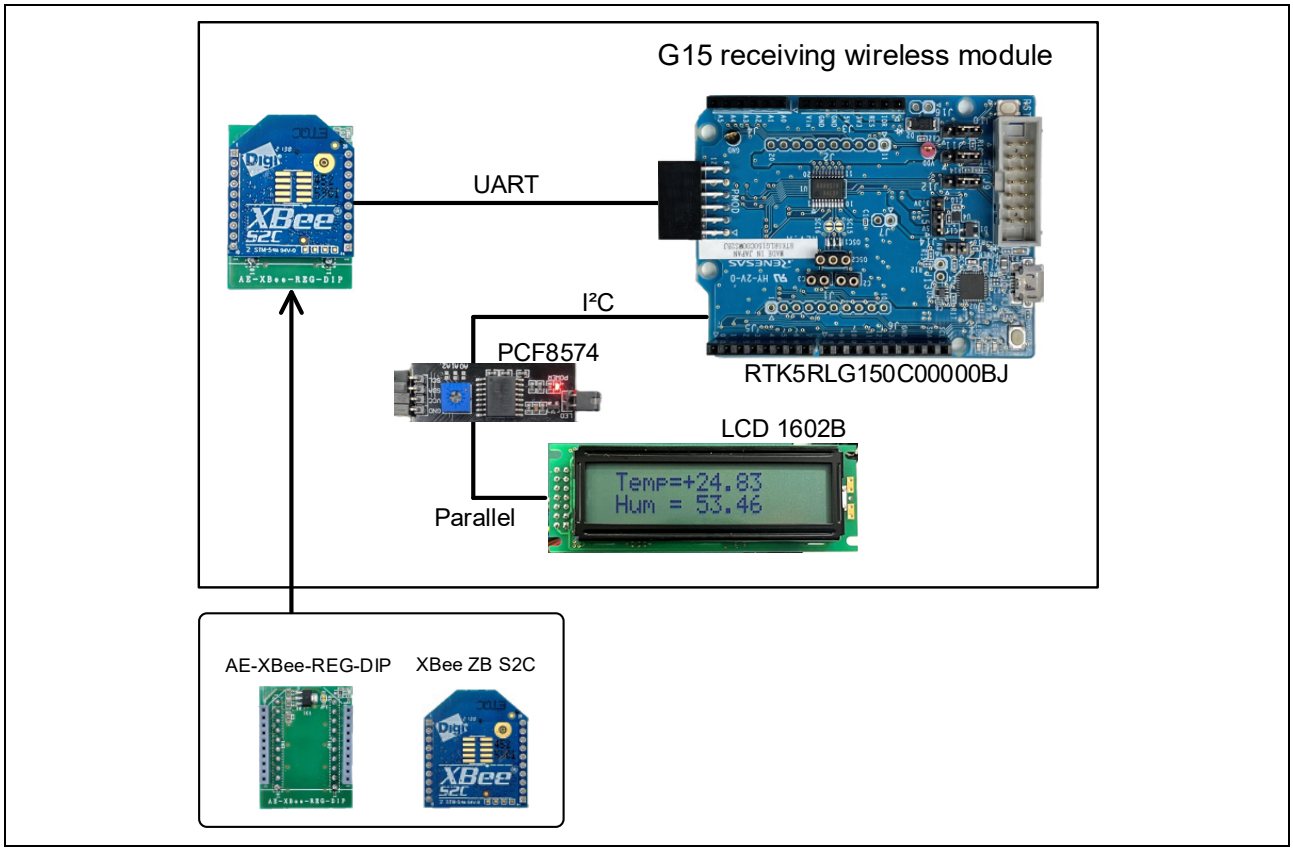


Table 4-4 Pins to connect RL78/G15 and XBee ZB S2C

RL78/G15		XBee ZB S2C		Description
Pin number	Name	Pin number	Name	
-	VDD	Pin1	VCC	3.3V Power supply from RL78/G15 to XBee ZB S2C
-	GND	Pin10	GND	GND of RL78/G15 and XBee ZB S2C
P03	TXD0	Pin3	DIN	UART transmission from RL78/G15 to XBee ZB S2C
P04	RXD0	Pin2	DOUT	UART Reception from XBee ZB S2C to RL78/G15

Table 4-5 Pins to connect RL78/G15 and PFC8574

RL78/G15		PCF8574		Description
Pin number	Name	Pin number	Name	
-	VDD	16	VDD	3.3V Power supply from RL78/G15 to PCF8574
-	GND	8	VSS	GND of RL78/G15 and PCF8574
P06	SCLA0	14	SCL	I^2C clock transmission from RL78/G15 to PCF8574
P07	SDDA0	15	SDA	I^2C data transmission from RL78/G15 to PCF8574
-	-	1	A0	I2C address input pin0
-	-	2	A1	I2C address input pin1
-	-	3	A2	I2C address input pin2

【Note】 1. The address of PCF8574 used in this application is 0x27 (A0, A1, A2 = High).

2. If there is no internal pull-up resistance, please prepare it separately.

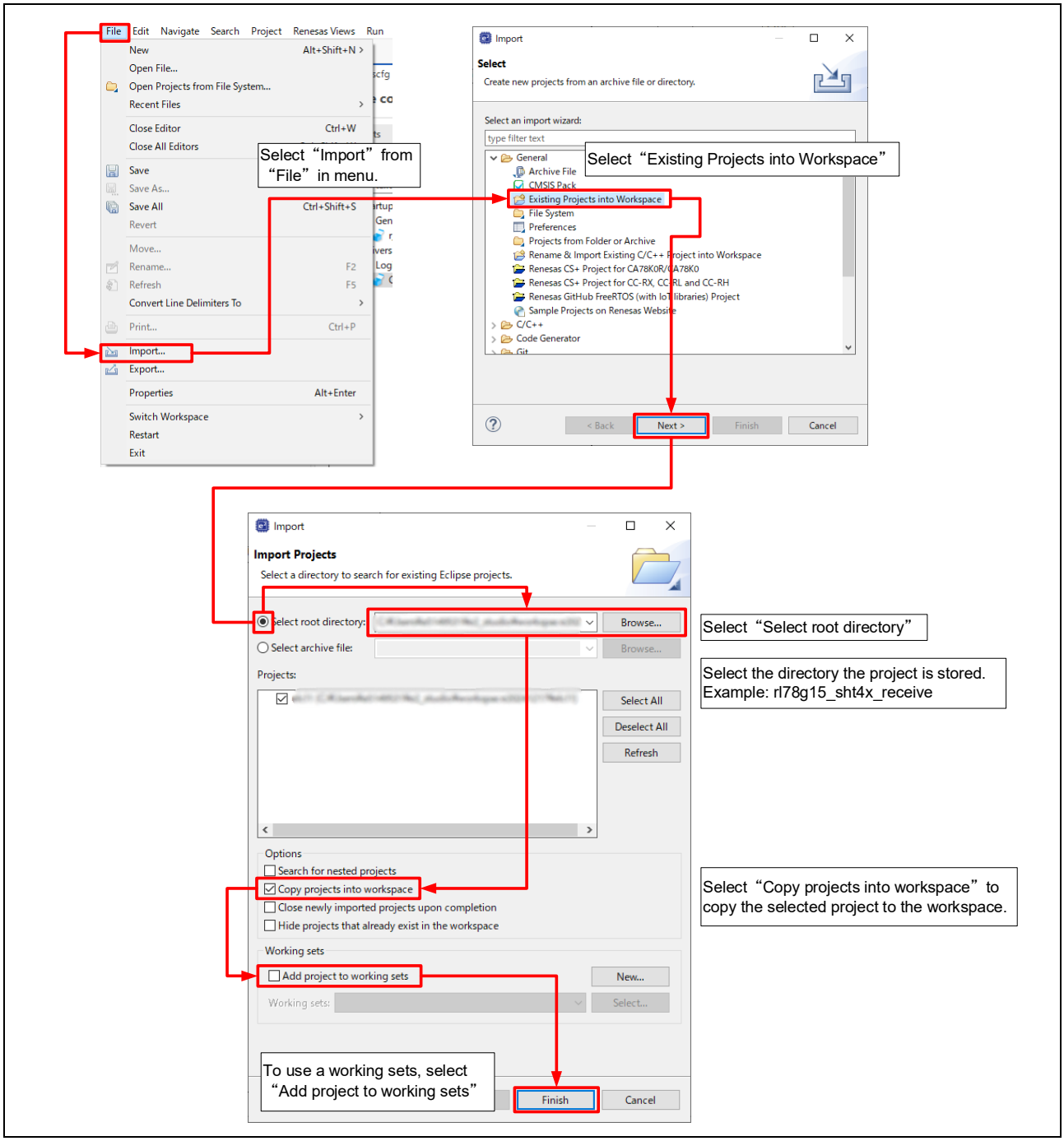
Table 4-6 Pins to connect PFC8574 and LCD1602B

PCF8574		LCD1602B		Description
Pin number	Name	Pin number	Name	
1	VDD	1	VDD	Power supply from PCF8574 to LCD1602B
2	VSS	2	VSS	GND of PCF8574 and LCD1602B
3	VO	3	VO	Contrast control from PCF8574 to LCD1602B
4	P0	4	RS	Register Select from PCF8574 to LCD1602B: Specify whether it's a command or data.
5	P1	5	R/W	Specifying Read/Write from PCF8574 to LCD1602B.
6	P2	6	E	Enable signal from PCF8574 to LCD1602B.
-	-	7	DB0	Data0 from PCF8574 to LCD1602B
-	-	8	DB1	Data1 from PCF8574 to LCD1602B
-	-	9	DB2	Data2 from PCF8574 to LCD1602B
-	-	10	DB3	Data3 from PCF8574 to LCD1602B
11	P4	11	DB4	Data4 from PCF8574 to LCD1602B
12	P5	12	DB5	Data5 from PCF8574 to LCD1602B
13	P6	13	DB6	Data6 from PCF8574 to LCD1602B
14	P7	14	DB7	Data7 from PCF8574 to LCD1602B

【Note】This application does not use LCD1602B DB0~DB3 pins because the LCD1602B is controlled in 4-bit mode.

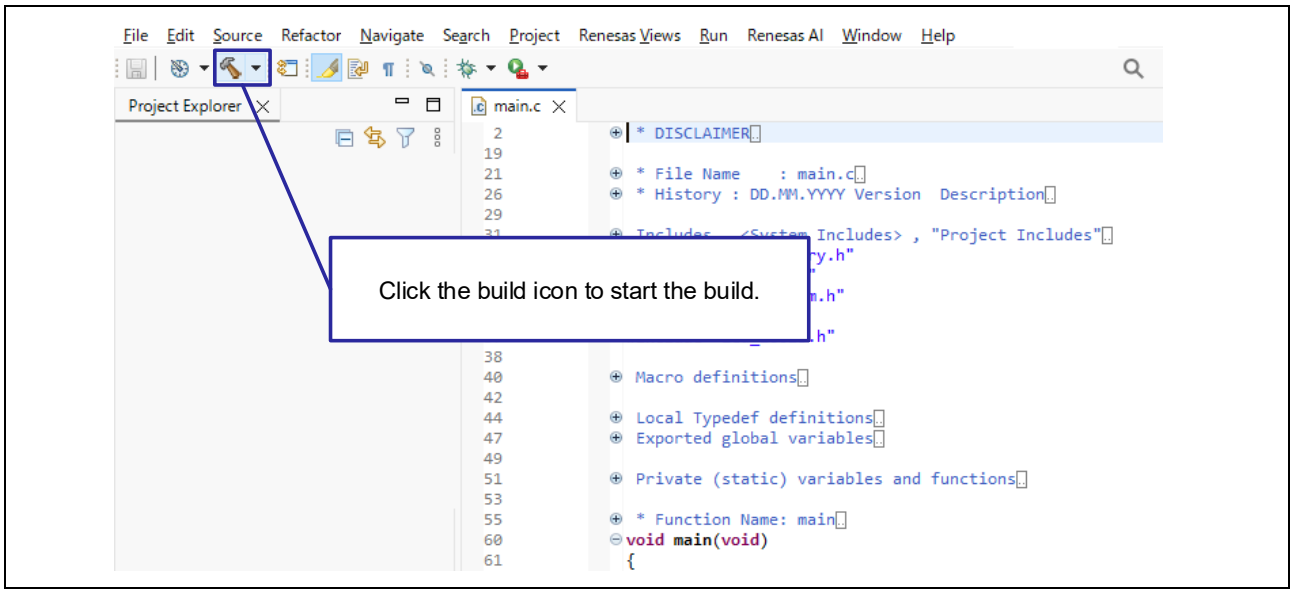
2. Import the sample code to e² studio.
   Please note that the folder name and the file path of the project managed by e² studio should not contain any space, half-width Kana, full-with characters and half-width symbols (especially '$','#','%').
   (Depending on the version of e² studio, the screen may be different from below.)

Figure 4-6 How to import the project to e² studio



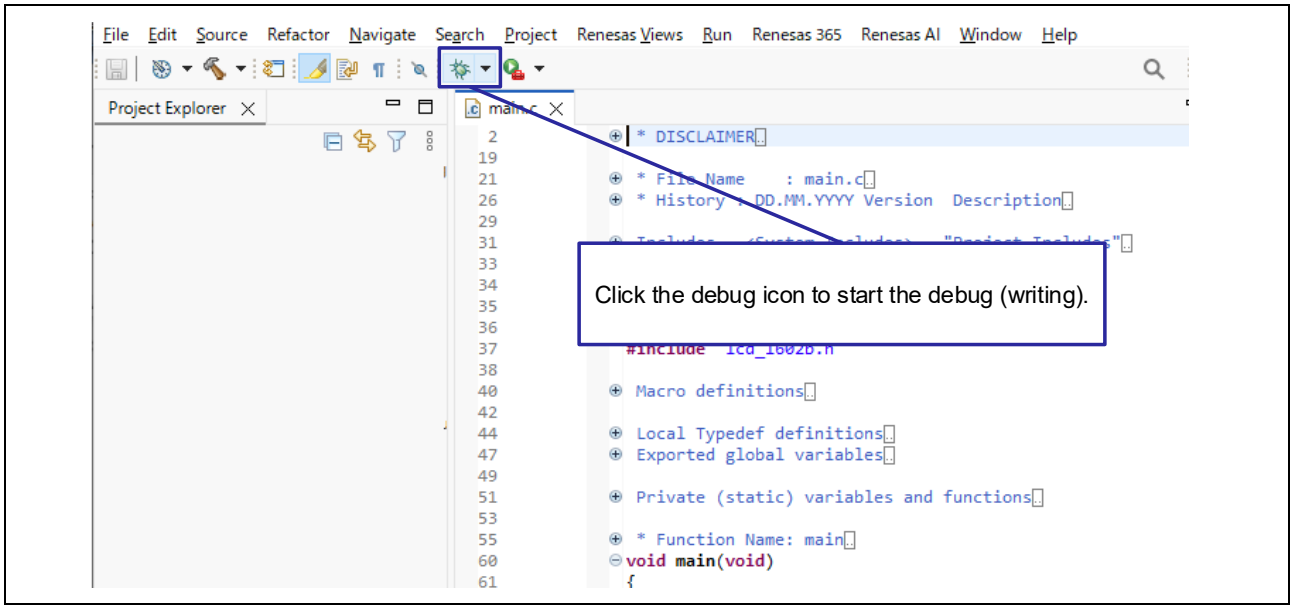
3. Click the build icon to build the sample code.

Figure 4-7 Build the sample code



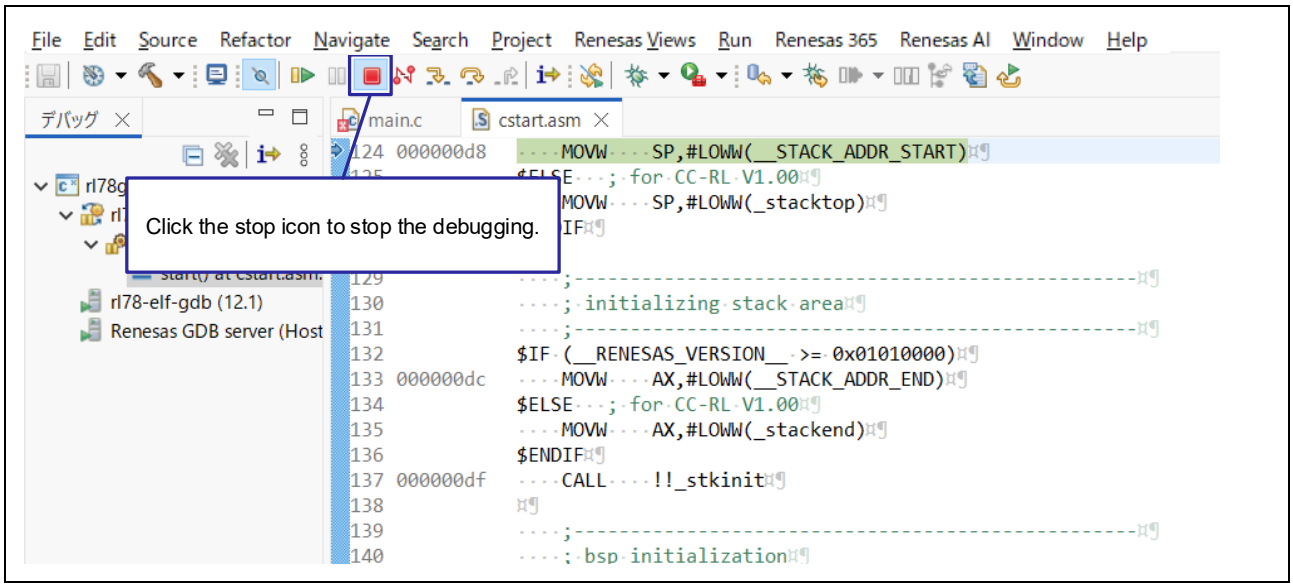
4. After the build is complete, click the debug icon and write to the device.

Figure 4-8 Debugging (writing) sample code



5. After the build is complete, click the stop icon and write to the device.

Figure 4-9 Stop the Debugging



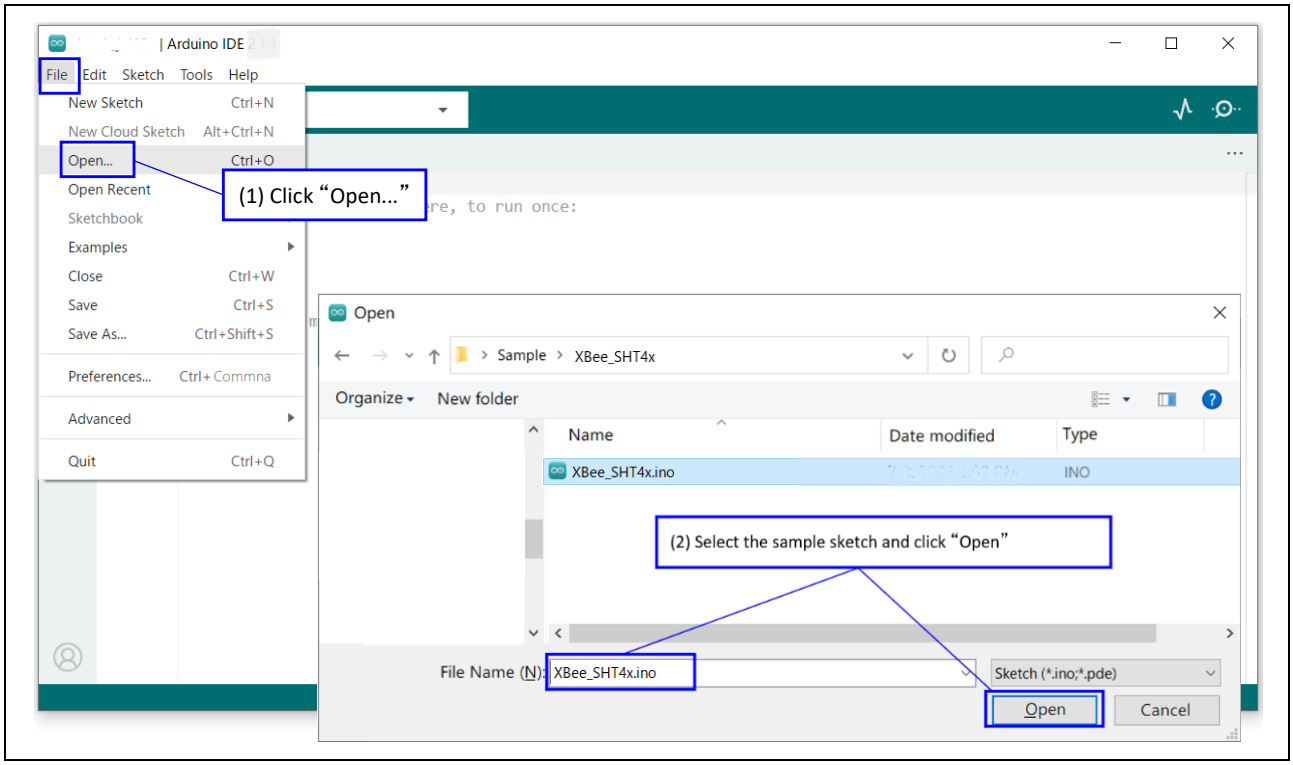
4.5 Operation Check Procedure of Sample Sketch

The procedure for checking the operation of this sample sketch is shown below.

Perform ”3.3 Setup of Arduino™ IDE” in advance.

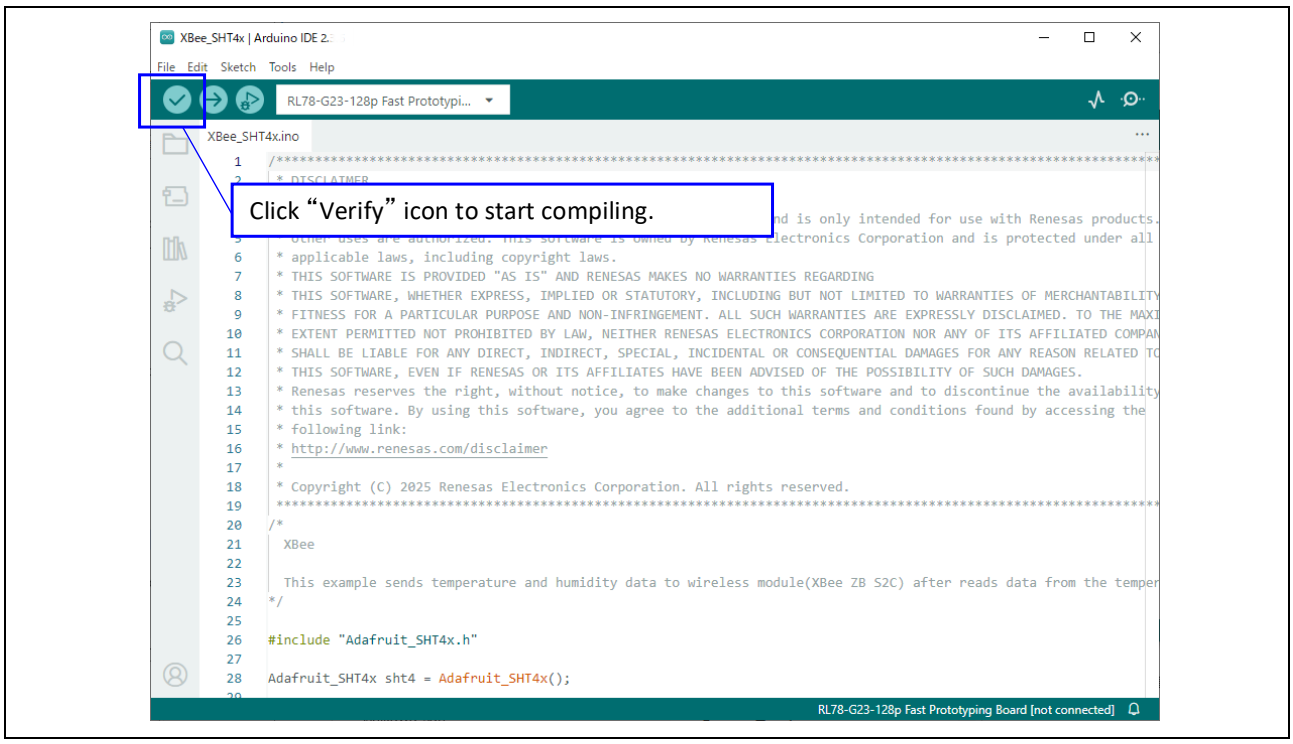
1. Click the [File] - [Open…] menu and open the sample sketch “XBee_SHT4x.ino”.

Figure 4-10 Open Sample Sketch



2. Click the [Verify] icon and compile sketch.

Figure 4-11 Compile Sample Sketch

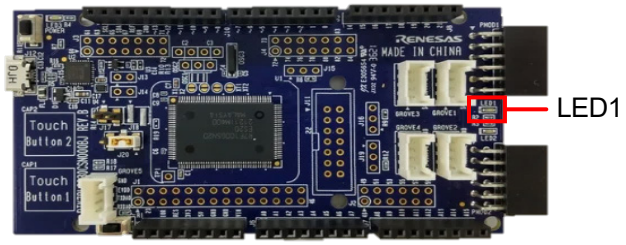


3. After compiling is finished, click the [Upload] icon and write sketch to the device.

Figure 4-12 Write Sample Sketch to Device

4. After the writing is completed, the microcontroller will start working, and the SHT40 will be initialized after the XBee communication connection and LED1 turn on.

Figure 4-13 Position of LED1



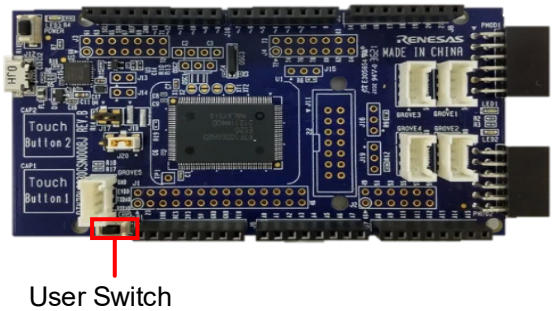
5. After the XBee communication connection and SHT40 initialization are completed, the temperature and humidity data are acquired from the SHT40, and the transmitted data is created and sent to the receiving wireless module. The data is displayed on the LCD.

Figure 4-14 LCD module data display

6. Check the communication mode, and in the case of communication connect mode, acquire temperature and humidity data from SHT40 and transmit it to the receiving wireless module. After sending, the LCD display will be updated. During the communication connect mode, temperature and humidity data are acquired and transmitted repeatedly every 3 seconds.

7. Press and hold the user switch to switch the communication mode. LED1 turns on when in communication connect mode, and LED1 turns off when in communication disconnect mode.

Figure 4-15 Position of User Switch



4.6 Error Occurrence

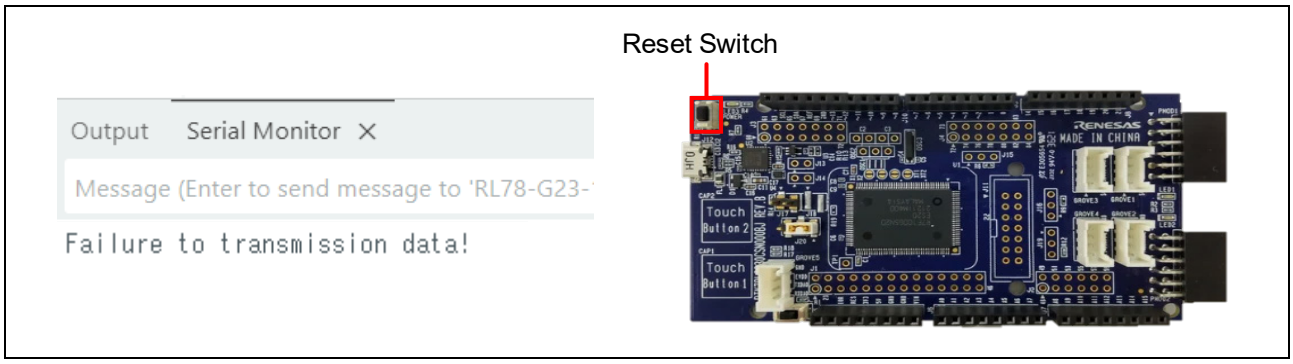
When an error occurs, the system will behave as described below.

After the error, restart the power or press the reset switch, and then return to Step 4 of the Operation Check Procedure.

Table 4-7 Operation when error occurs

Error content	Operation when an error occurs	Factors of occurrence
Failed to send AT command to XBee ZB S2C	“Failure to transmission data!” is displayed on the serial monitor.	No connection to XBee ZB S2C
Failure to receive a response after sending an AT command	“Failure to receive data!” is displayed on the serial monitor.	
SHT40 initialization failure	“Failed to initialize SHT40!” is displayed on the serial monitor and LED1 is blinking.	No connection to Temperature and Humidity sensor board.
SHT40 communication failure	“Abnormally data have detected in SHT40!” is displayed on the serial monitor and LED1 is blinking.	Temperature and Humidity sensor communication failure

Figure 4-16 Error Message on Serial Monitor and Position of Reset Switch



4.7 Flowchart

4.7.1 Main Process

The flowchart for the main processing is shown below.

Figure 4-17 Main Processing Flowchart(1/2)

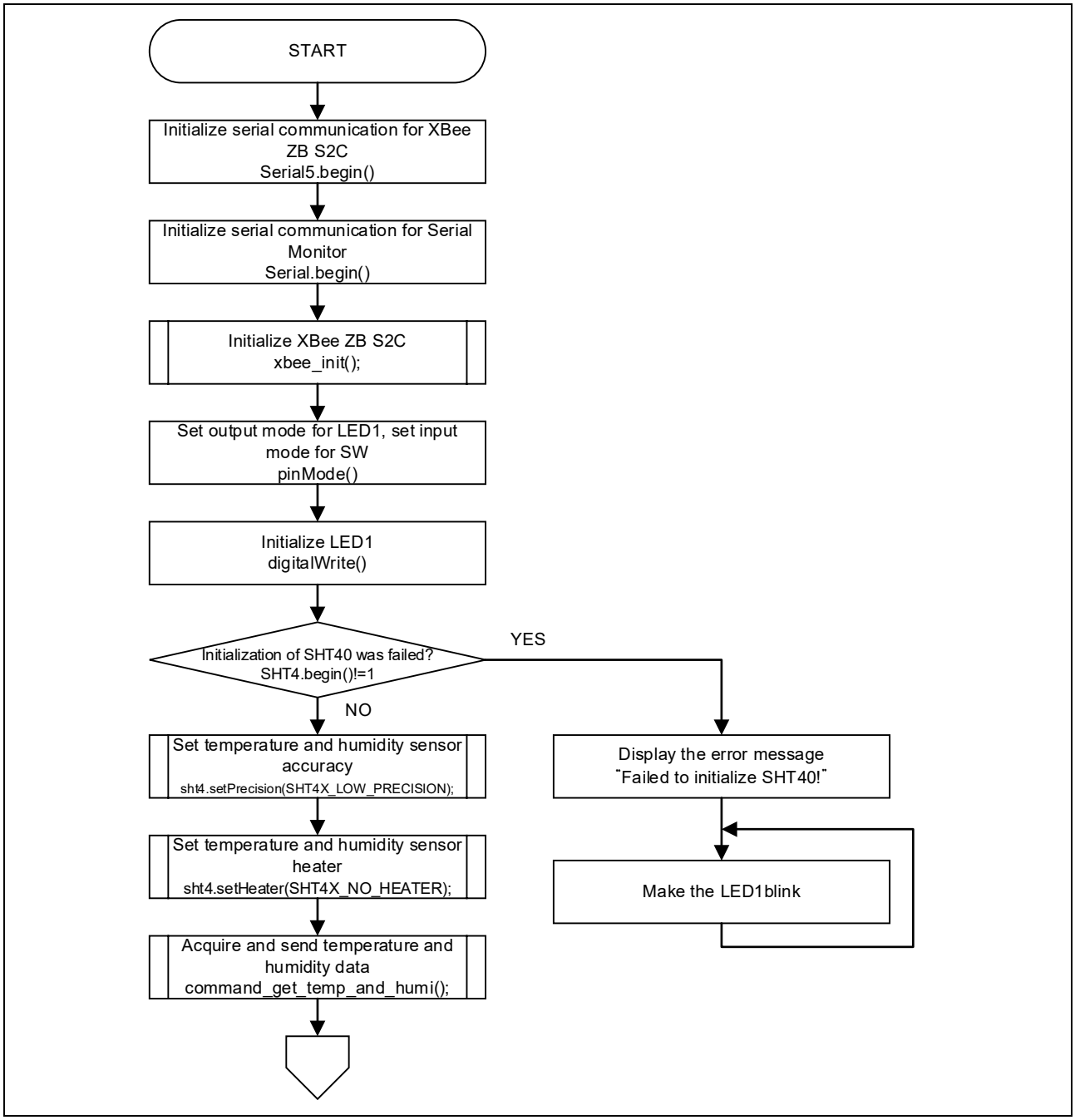
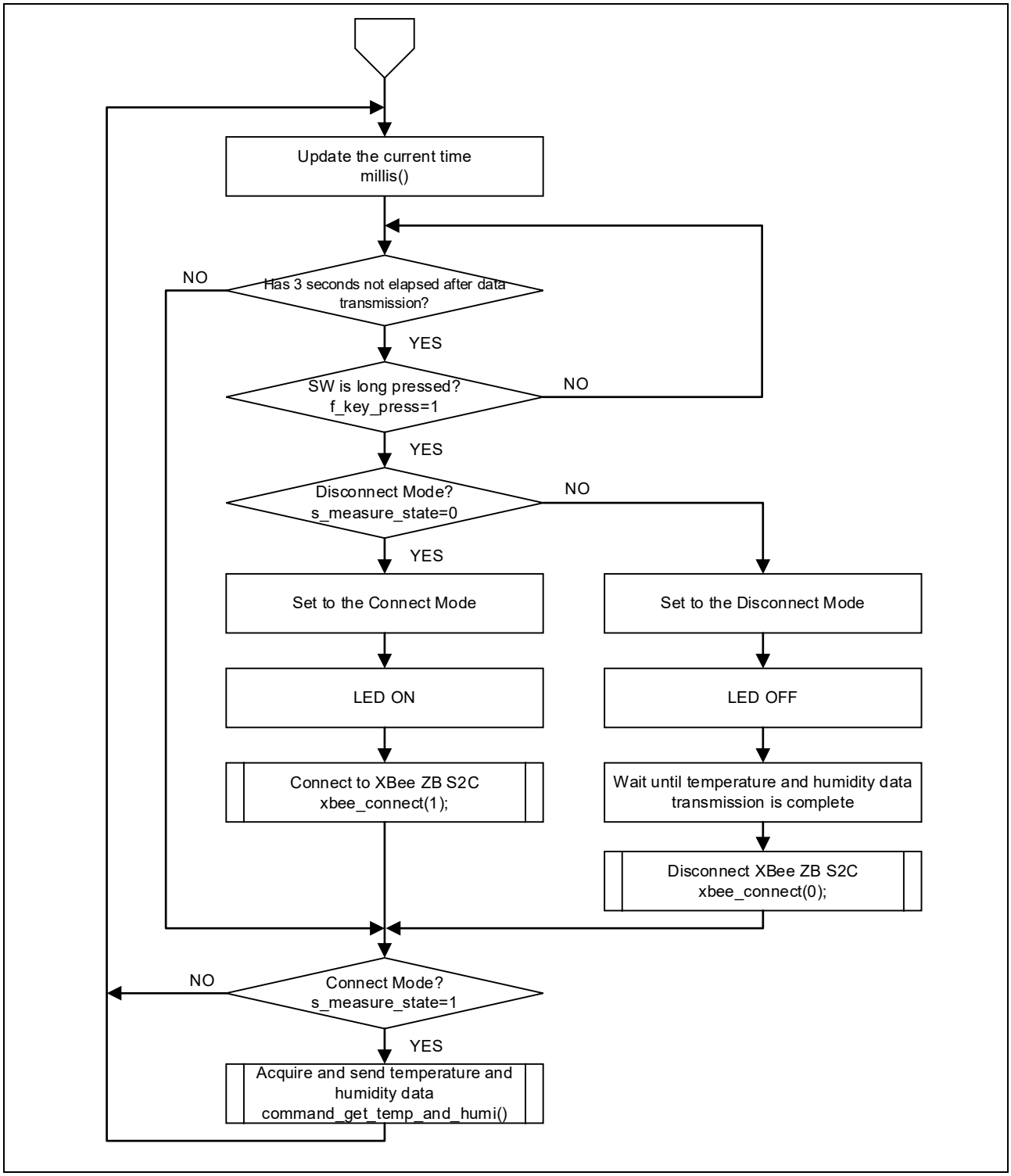


Figure 4-18 Main Processing Flowchart (2/2)

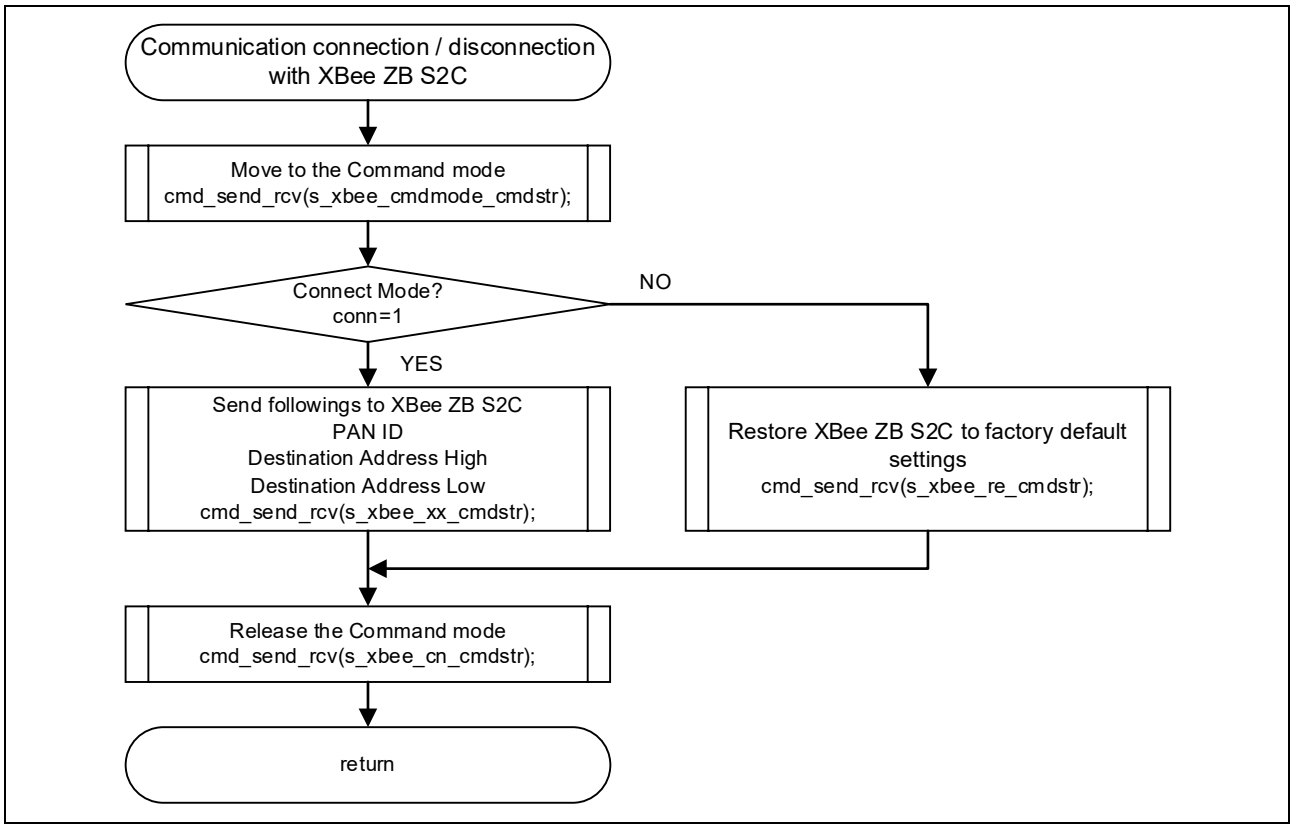


4.7.2 Other Functions

The flows of functions called from the loop function are shown below.

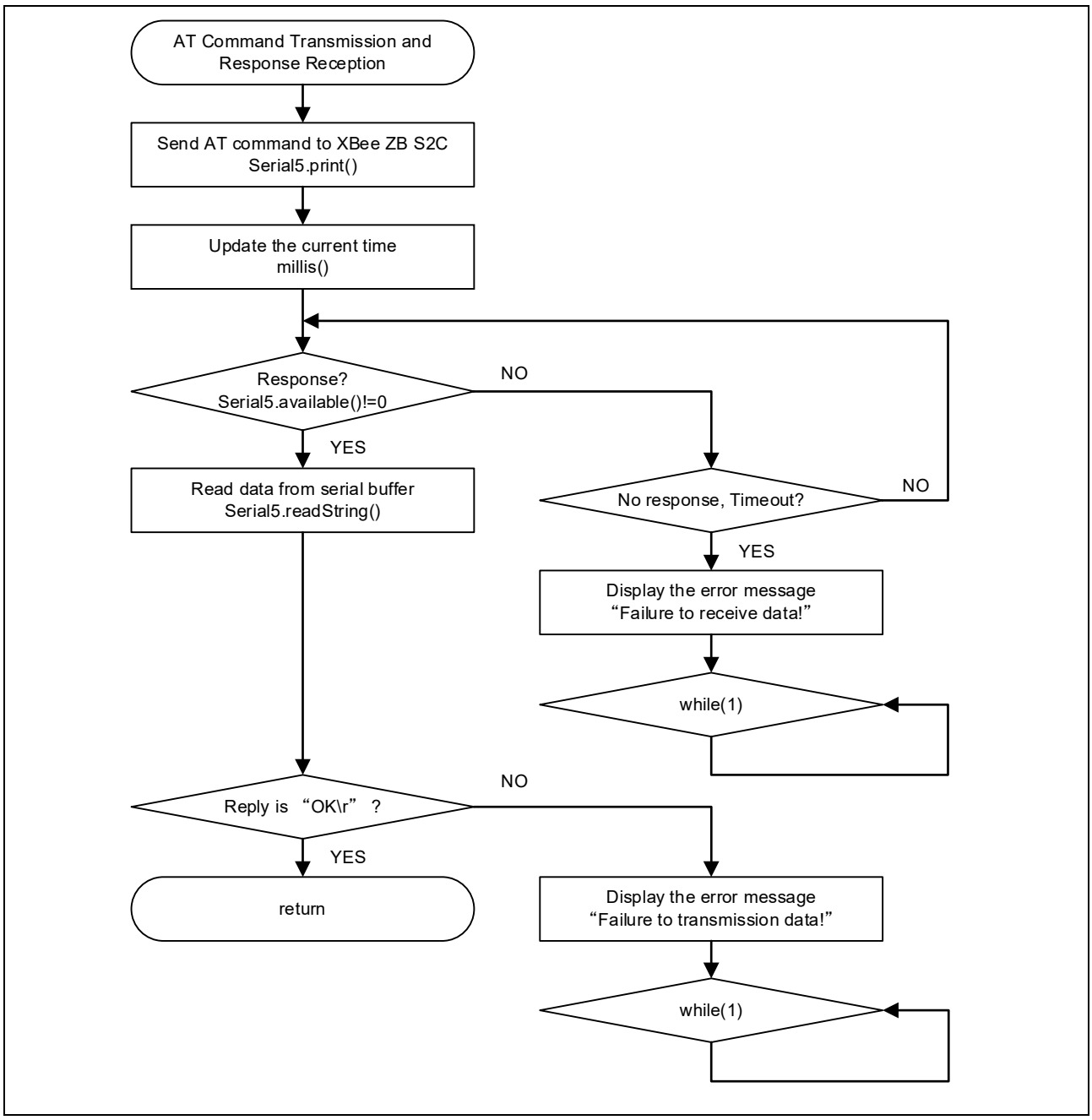
(1) Communication Connection and Disconnection Processing with XBee ZB S2C: xbee_connect:

Figure 4-19 xbee_connect Flowchart



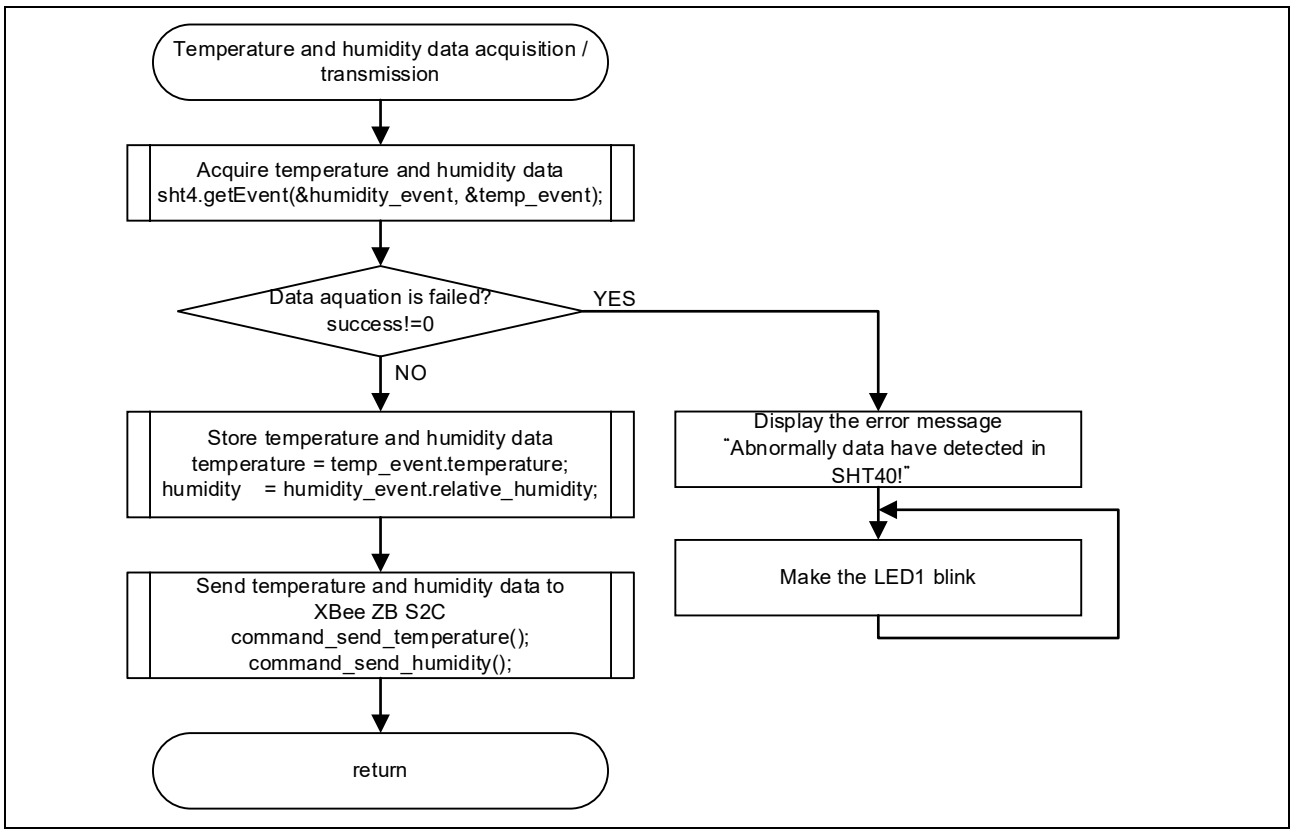
(2) AT Command Transmission and Response Reception Processing : cmd_send_rcv

Figure 4-20 cmd_send_rcv Flowchart



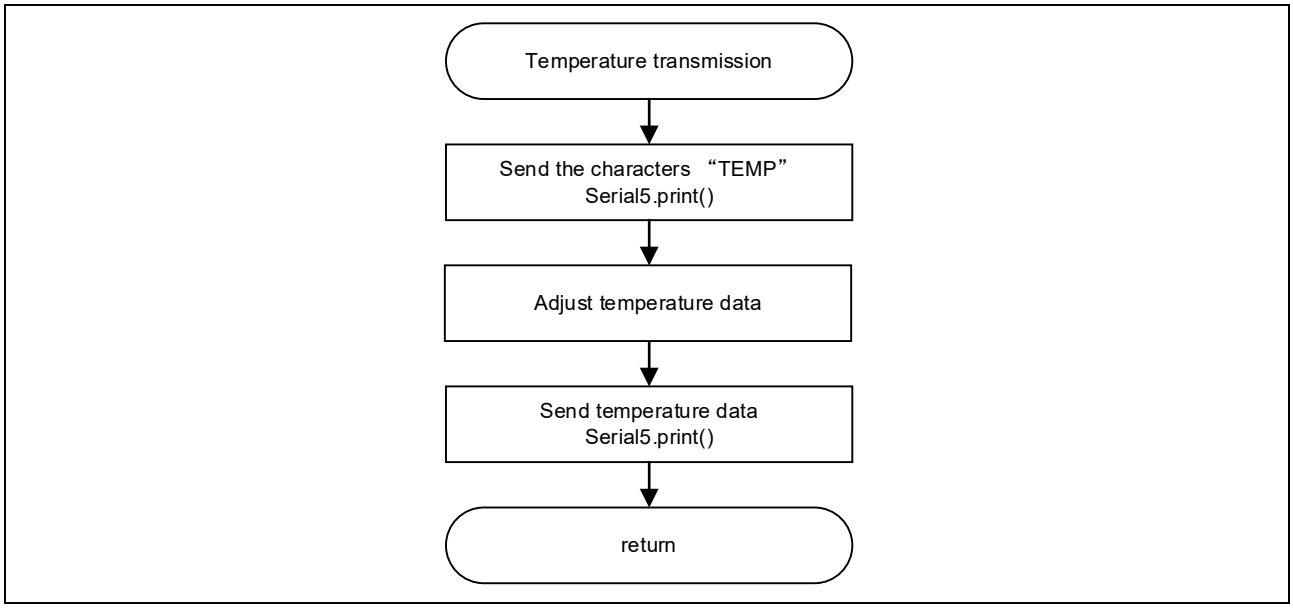
(3) Temperature and humidity data acquisition / transmission : command_get_temp_and_humi

Figure 4-21 command_get_temp_and_humi Flowchart



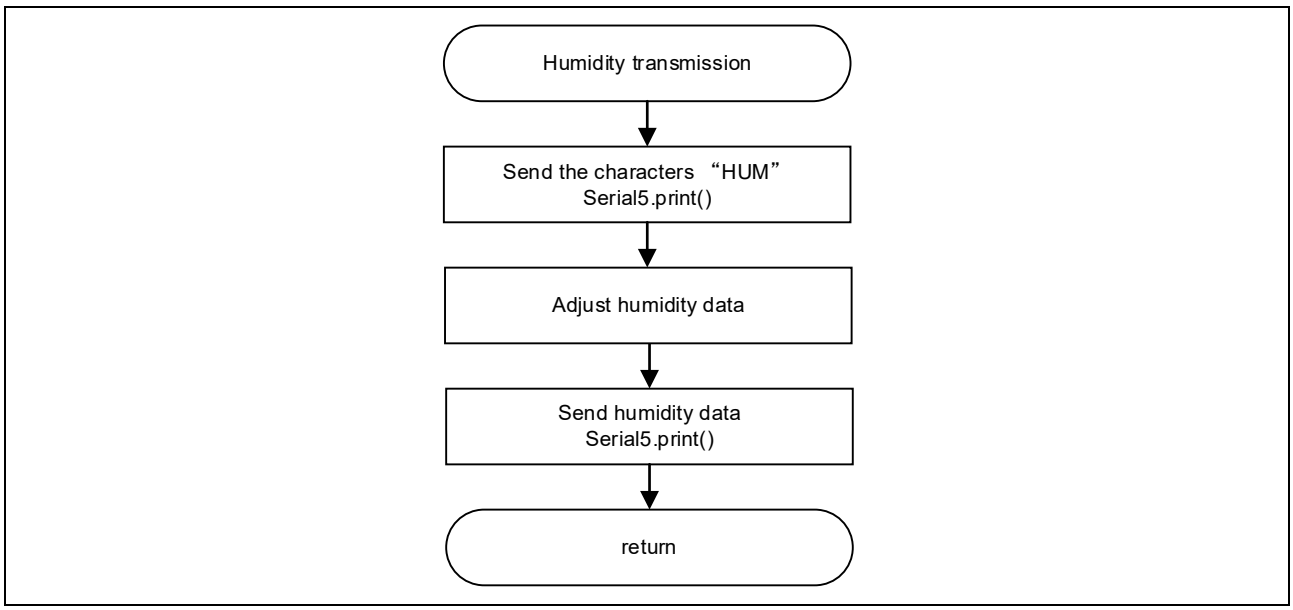
(4) Temperature transmission: command_send_temperature

Figure 4-22 command_send_temperature Flowchart



(5) Humidity transmission: command_send_humidity

Figure 4-23 command_send_humidity Flowchart



4.8 Function Specification

The function specifications of the sample code are shown below.

void xbee_connect (uint8_t)		
Description	Communication Connection and Disconnection Processing with XBee ZB S2C If the argument is 1, send ID, DH and DL to XBee and connect to the XBee. If the argument is 0, XBee reverts to the factory state and disconnects the XBee communication.	
Argument	uint8_t	Connect : 1, Disconnect: 0
Return value	None	

void cmd_send_rcv (String)		
Description	AT Command Transmission and Response Reception Processing Send an AT command of the argument to the XBee ZB S2C and receive a response from the XBee ZB S2C.	
Argument	String	AT command
Return value	None	

void command_get_temp_and_humi (void)	
Description	Temperature and humidity data aquation / transmission Acquire temperature and humidity data from the SHT40, then call the temperature transmission function and humidity transmission function to send the data to the receiving wireless module. If a communication error occurs, LED1 will blink.
Argument	None
Return value	None

void command_send_temperature (void)	
Description	Temperature transmission Adjust the temperature data from the SHT40 for LCD display and transmit it to the receiving wireless module.
Argument	None
Return value	None

void command_send_humidity (void)	
Description	Humidity transmission Adjust the humidity data from the SHT40 for LCD display and transmit it to the receiving wireless module.
Argument	None
Return value	None

5. Troubleshooting

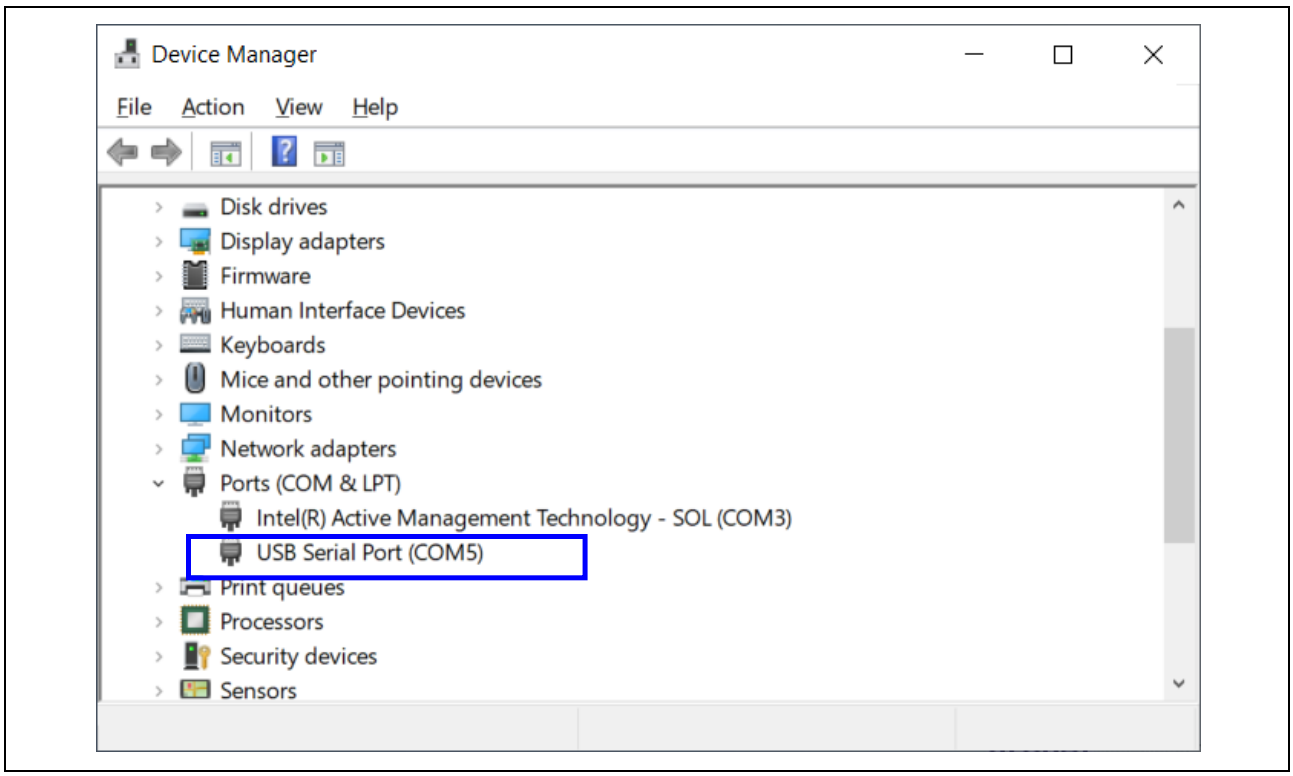
5.1 COM port is not displayed on the Windows Device Manager

When connecting the PC and the evaluation board for the first time, the PC may not recognize the board, and the COM port may not be displayed in Windows Device Manager.

If the COM port is not displayed, install the driver of the USB-to-serial converter (FT232RQ) implemented on the evaluation boat by following the steps below.

1. Download the latest driver installer for the target OS from FTDI's website and install it. https://ftdichip.com/drivers/vcp-drivers/
2. After installation, “USB Serial Port (COMx)” is displayed under the “Ports (COM & LPT)” on the Device Manager. In the following figure, COM5 is the target COM port

Figure 5-1 Windows Device Manager after installation of device driver



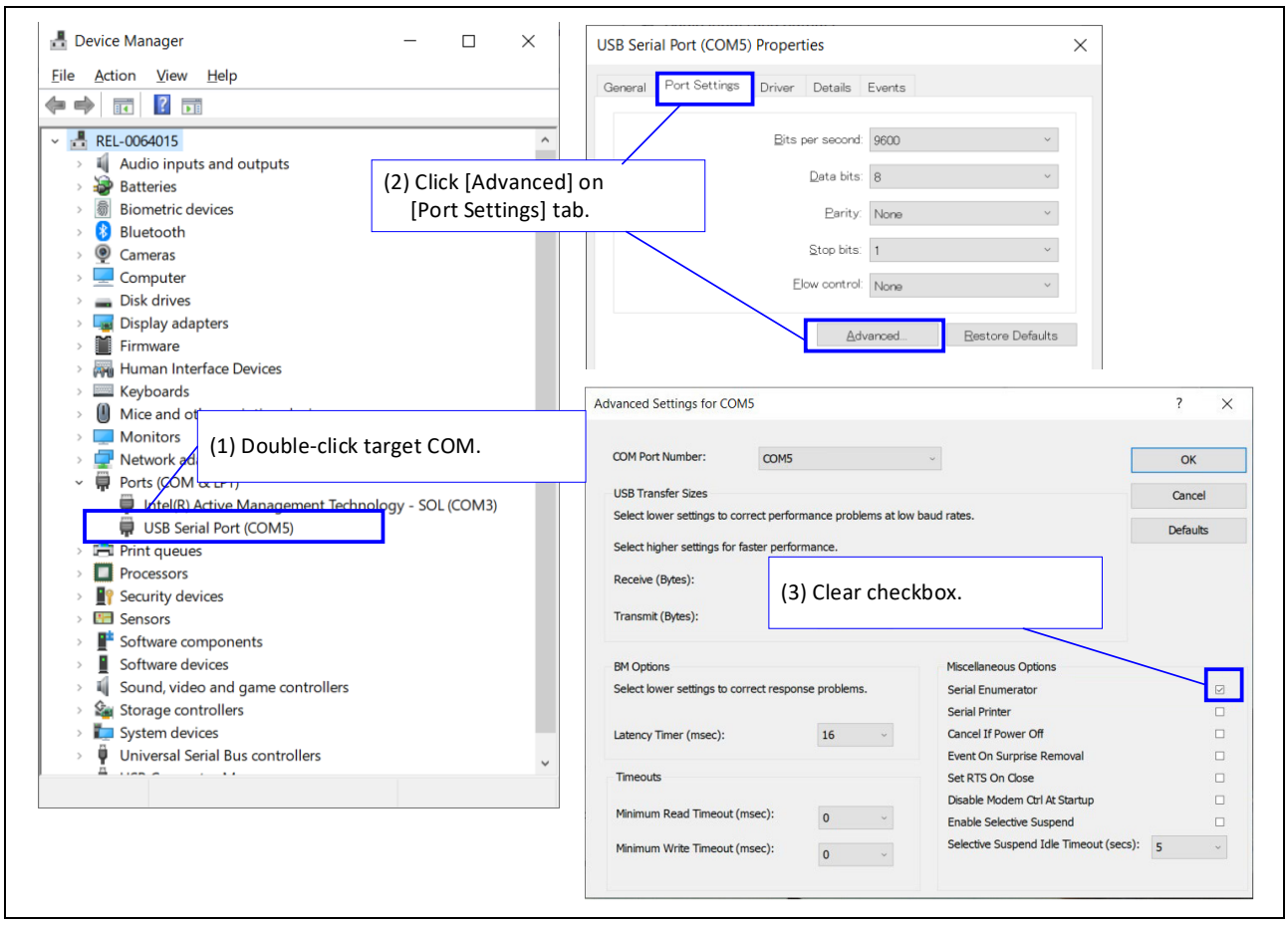
For details of USB-to-serial convector and COM port, refer to “5.13 USB-to-Serial Converter” and “5.14 USB-to-Serial Converter Reset Header” in RL78/G23-128p Fast Prototyping Board User’s manual.

5.2 Program is not written correctly to RL78/G23-128p Fast Prototyping Board

It may not be connected correctly the PC and the evaluation board even if “USB Serial Port (COMx)” is displayed.

If the program is not written correctly, double-click the target COM port on Windows Device Manager and clear the checkbox of [Serial Enumerator].

Figure 5-2 Setting Example of Target COM



6. Sample Sketch

This application note provides the sample sketch.

Sample sketches are available on the Renesas Electronics website.

7. Reference Documents

- RL78/G23 User's Manual: Hardware (R01UH0896)
- RL78/G23-128p Fast Prototyping Board User's Manual (R20UT4870)
- RL78/G15 Wireless Communication with the XBee ZB 2SC and SHT4x (R01AN8031)

(The latest versions can be downloaded from the Renesas Electronics website).

Technical update

(The latest versions can be downloaded from the Renesas Electronics website.)

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Feb 18, 2026	-	First edition

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 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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