Quick Start Guide

RL78/G23 Group

Y-DK-IAQ-SENSE-RL78G23
RL78/G23
Quick Start Guide

Renesas RL78 Family
G23 Series

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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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Precautions

This Evaluation Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area, or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

• Ensure attached cables do not lie across the equipment.

• Reorient the receiving antenna.

• Increase the distance between the equipment and the receiver.

• Connect the equipment into an outlet on a circuit different from that which the receiver is connected.

• Power down the equipment when not in use.

• Consult the dealer or an experienced radio/TV technician for help.

Note: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

• The user is advised that mobile phones should not be used within 10 m of the product when in use.

• The user is advised to take ESD precautions when handling the equipment.

The Evaluation Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

Renesas RL78 Family

Y-DK-IAQ-SENSE-RL78G23

Contents

Figures

1. Introduction

This Quick Start Guide (QSG) provides the following for the Y-DK-IAQ-SENSE-RL78G23:

- A brief overview of the systems hardware.
- First time setup instructions.
- Usage instructions.
- Informative notes on further reading and development material for the PCB & out of the box firmware.

1.1 Assumptions and Advisory Notes

1. 1x Y-DK-IAQ-SENSE-RL78G23 PCB
2. 2x AAA Batteries

2. Hardware Overview

The following hardware is present on the Y-DK-IAQ-SENSE-RL78G23:

1. RL78/G23 48pin (768k/48k)
2. HS4001
3. ZMOD4410
4. Rotary Encoder
5. Buzzer (reverse side)
6. RB LED

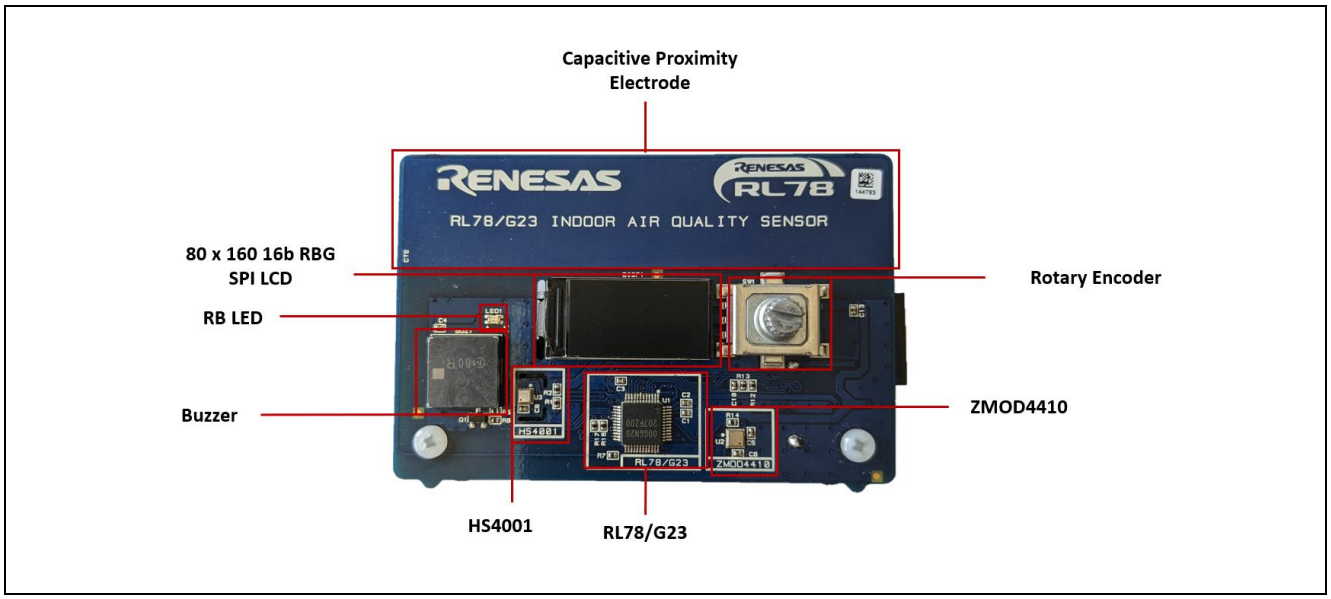

Figure 1. Y-DK-IAQ-SENSE-RL78G23 PCB – Front

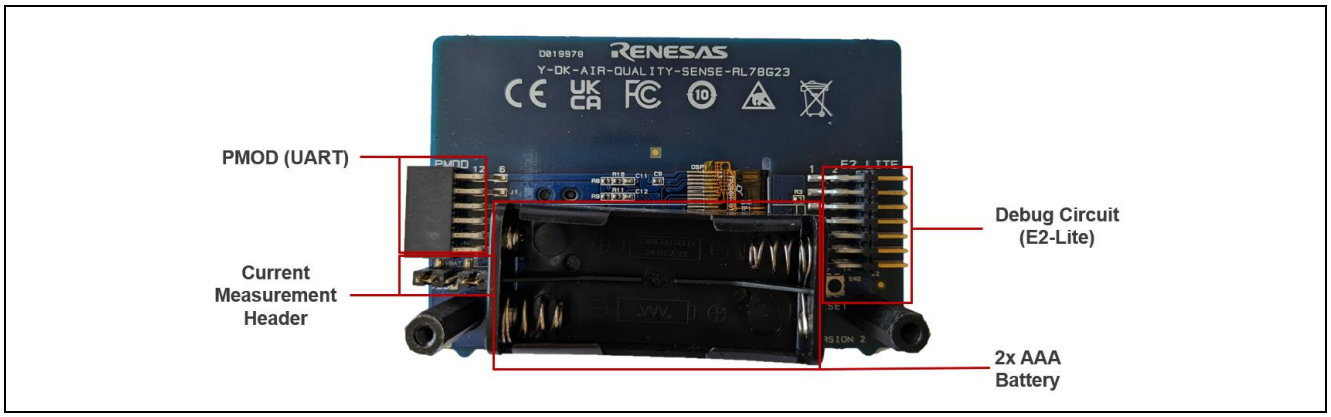

Figure 2. Y-DK-IAQ-SENSE-RL78G23 PCB - Back

3. Instructions for First Power On

This section provides an instructional overview of the steps to be taken when first powering on the demonstrator.

3.1 Power

Ensure the jumpers on **H1** are placed in the correct configuration and that is:

- Short positions 1-2.
- Short positions 4-5.

This is shown in Figure 3.

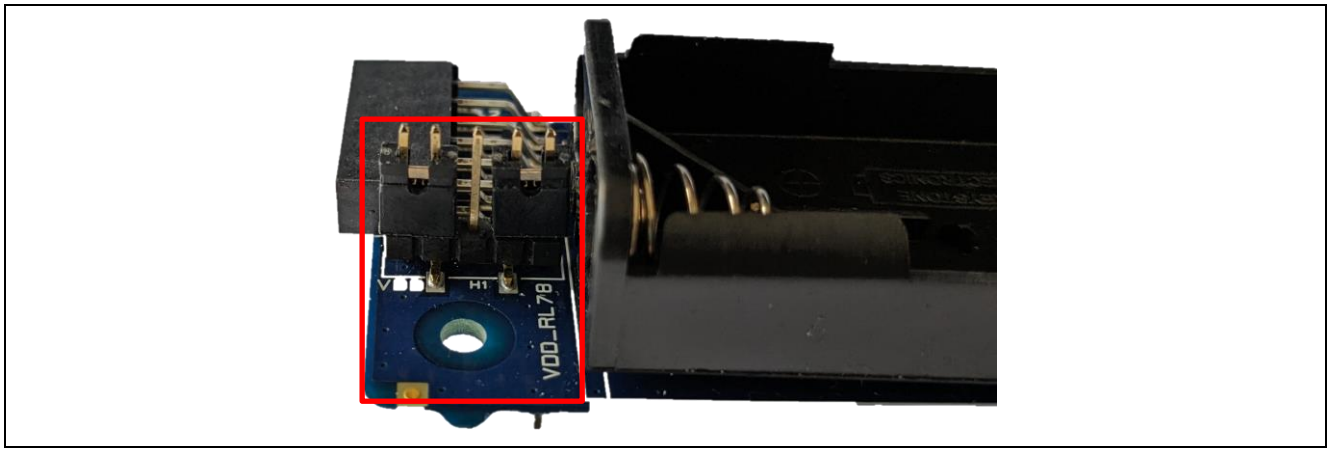

Figure 3. H1 Settings

Take 2x AAA Batteries and place them in the battery holder according to the correct polarity as shown in Figure 4.

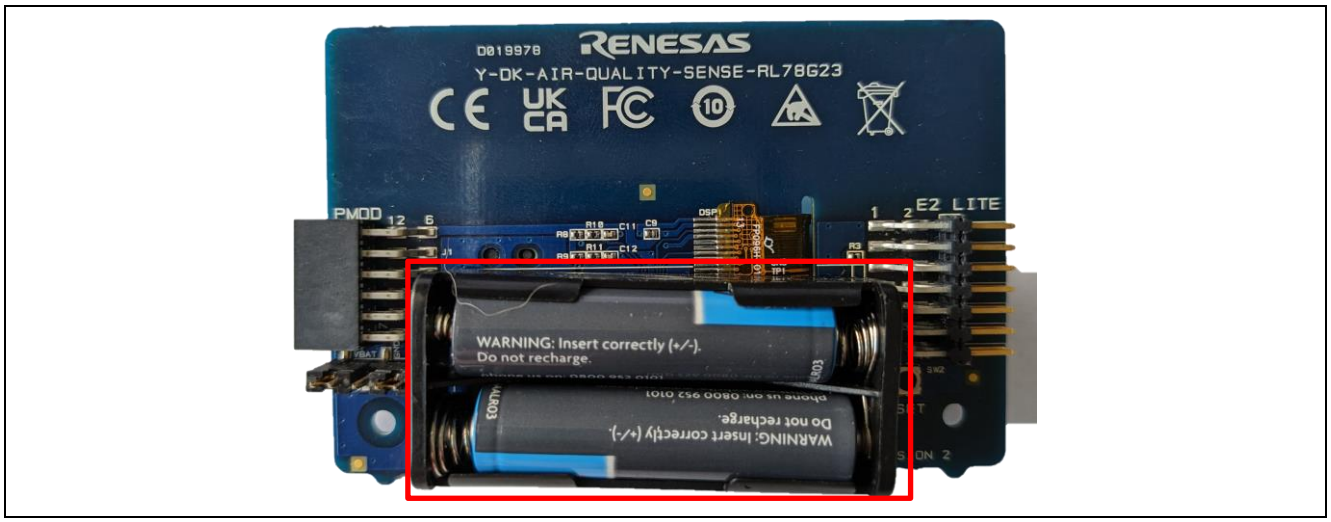

Figure 4. Batteries

3.2 Initial Offset Tuning

Each time power is applied to the system after a period of having no power the system will perform initial offset tuning on the capacitive proximity sensing electrode – this offset tuning process in necessary to compensate for environmental and system factors in the capacitive touch sensing peripheral. After plugging in the batteries, you will be confronted with the screen shown in Figure 5.

Figure 5. Initial Offset Tuning Screen

The instructions are to ensure correct operation of component hardware and that when the initial offset tuning is performed there is no human interference as this ensures greatest sensitivity of proximity detection. The instructions are to twist the rotary encoder, clockwise and counterclockwise and to click the button and place the PCB on a surface free from human interaction before the timer counts down to 0. After clicking the button there is approximately a 5 second delay of which a countdown is displayed – this gives you time to place the PCB on a surface away from interaction. The countdown screen is shown in Figure 6.

Figure 6. Countdown Screen

Once the countdown has elapsed the device will enter the tuning state for approximately 1 second – after which tuning is complete and system operation is resumed i.e., the device will display a success message and the LED should come on while the buzzer sounds (Figure 7**)** and then enter a low power state.

Figure 7. Success Message Screen

The system is now ready for use.

4. Instructions on Usage

This section provides an instructional overview of the interactive options and features of the demonstrator, it can be thought of as the “user guide” or “instruction manual”.

4.1 Wave Awake

While the demonstrator is idle on a surface a user can wake the system by waving their hand within a few centimeters of the face of the PCB – on doing so the system will wake and display the temperature and humidity readings – this can be seen in Figure 8.

Figure 8. Temperature & Humidity Screen

The screen components are labelled as follows:

1. Temperature
2. Humidity

4.1.1 Display Cycle

After approximately 3 seconds has elapsed – the display will then switch and display the air quality readings – this can be seen in Figure 9.

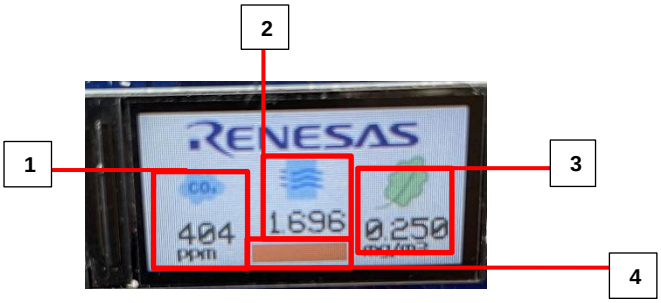

Figure 9. Air Quality Screen

The screen components are labelled as follows:

1. eCO2 (estimated CO2)
2. IAQ Index (Indoor Air Quality Index – please consult the ZMOD4410 datasheet for more information on this metric)
3. TVOC (Total Volatile Organic Compounds – please consult the ZMOD4410 datasheet for more information on this metric)
4. Colour Status Indicator – Green – Red (Good – Bad)

After approximately a further 3 seconds the screen will revert back to displaying temperature and humidity readings, shown in Figure 8. This will continue to occur for 20 seconds before the system will revert back to the low power state and the display will shut down.

4.2 Hold Awake

While the demonstrator is idle on a surface a user can wake the system by picking it up and holding the PCB – on doing so the system will wake and display the temperature and humidity readings – this can be seen in Figure 8.

4.2.1 Display Cycle

While holding the PCB no automatic display cycling will occur – therefore to cycle the display between temperature & humidity data and the air quality data the user must **rotate the rotary encoder shaft**.

4.3 Alarm

The demonstrator also has an alarm feature which allows the user to set **air quality thresholds** which the system will compare each sensor reading against. On breaching any of the conditions (i.e. larger air quality index, larger eCO2 or larger TVOC) the system enters an alarm state.

The alarm state takes the form of transitioning the display to an alarm screen, shown in Figure 10.

Figure 10. Alarm Screen

On top of showing this screen, the buzzer will periodically sound a tone & the RB LED will flash red.

This state will exist for a maximum of 15 seconds – without user interaction (or the user holding the PCB) the system ill then revert back to low power mode.

If entering this mode from low power state, this will occur only once – after which the system will return to sleep after 15 seconds. If the user has missed the alarm and the system has returned to sleep, the alarm will sound again only once the user wakes the system, methods of which outlined in sections 4.1 & 4.2.

The only way to acknowledge and remove this alarm is, to **click the rotary encoder shaft button** while on the alarm screen – this exits the alarm state and disables the alarm.

4.3.1 Alarm Setting

To access the alarm thresholds for the air quality sensor the user must first navigate to the screen displaying the air quality data, from here the user must **hold down the rotary encoder shaft button** this will transition the display to allowing the setting of alarm thresholds for each metric, shown in Figure 11.

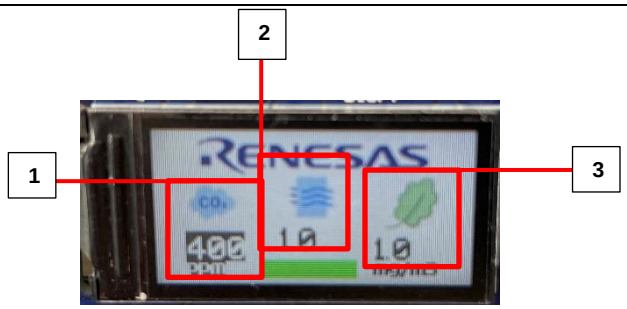

Figure 11. Alarm Setting Screen

1. eCO2 – larger value means worse air quality i.e., more estimated CO2.
2. IAQ Index – larger values means worse air quality.
3. TVOC – larger value means worse air quality i.e., more TVOC's present.

To increment or decrement each value the user should rotate clockwise and anti-clockwise the rotary encoder respectively.

To cycle between the values i.e., change which value is being manipulated by the encoder, the user must **click the rotary encoder shaft button**.

Once satisfied with the alarm thresholds, the user must **hold down the rotary encoder shaft button**, the system will then transition to the alarm on/off screen, shown in Figure 12 – here use the rotary encoder to select alarm on or off and finally when satisfied with the selection **click the rotary encoder shaft button** and the system will return to the air quality data screen.

Figure 12. Alarm On/Off Screen

4.4 Important Notes

The following list outlines certain operations of the system which may require explanation to the user:

- For the first 2-5 minutes after **power on** there will be zero readings on the temperature and humidity screen while the HS3001 sensor stabilizes.
- For the first 15 minutes after **power on** there will be a calibration message on the air quality screen while the ZMOD4410 sensor stabilizes.
- The sensor stabilization times are due to sensor sampling rates being fixed at 90second intervals.
- After 20 seconds of no activity and the user not holding on to the PCB, regardless of the current state, the system will return to sleep mode.

5. Flashing Firmware

Upon using the board for trainings or evaluation a user may wish to revert firmware back to the original application. his section provides an overview on flashing the factory firmware to the RL78/G23 Indoor Air Quality Demonstrator Board.

This section assumes the read has followed the instructions outlined in.

5.1 Requirements

- E2-Lite
- Renesas Flash Programmer (> V3.09)
- Completed section 3 Instructions for First Power On

5.2 Connection

Connect the E2-Lite to the users PC & connect the E2-Lite 14pin cable to J2 on the back of the board – the polarised 14 pin connector should allow for connection only one way – but the polarizing notch should be facing away from the PCB – shown in Figure 13.

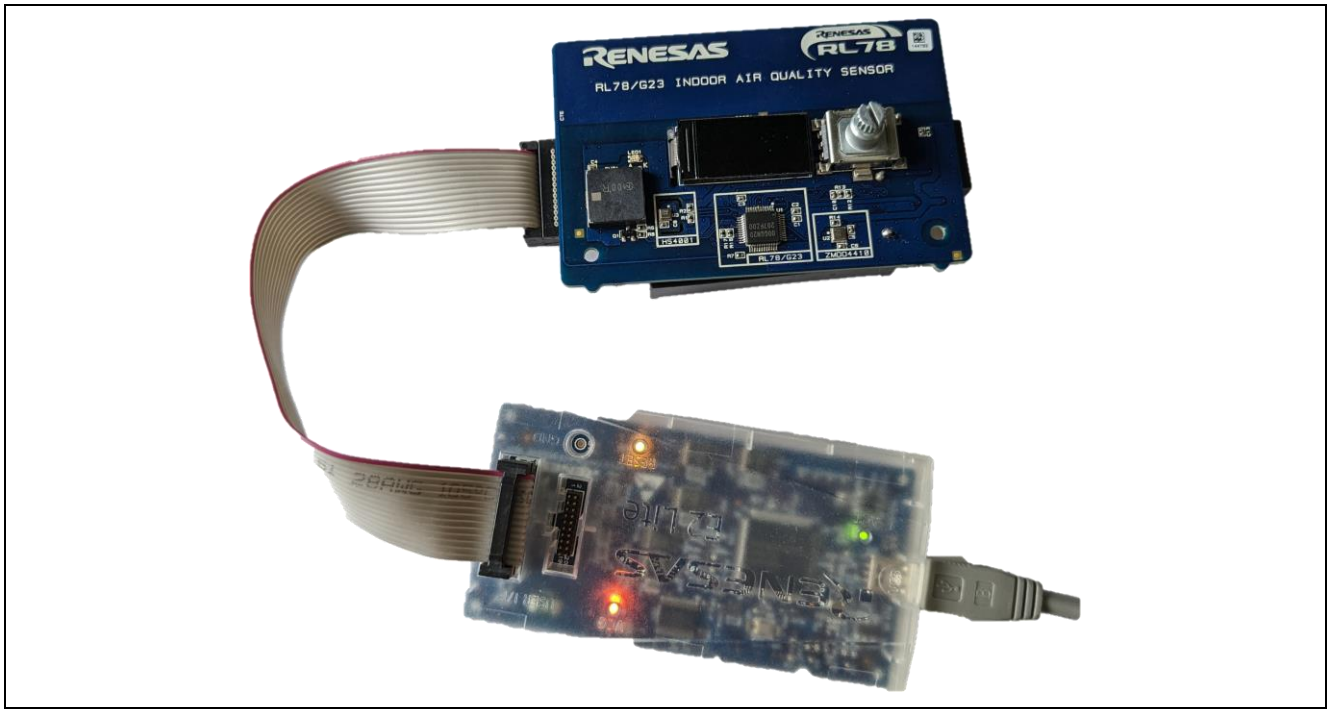

Figure 13. E2-Lite Connection

5.3 RFP

Launch RFP (Renesas Flash Programmer) and create a new project – if the new project dialog doesn't automatically open click **File → New Project…** as shown in Figure 14.

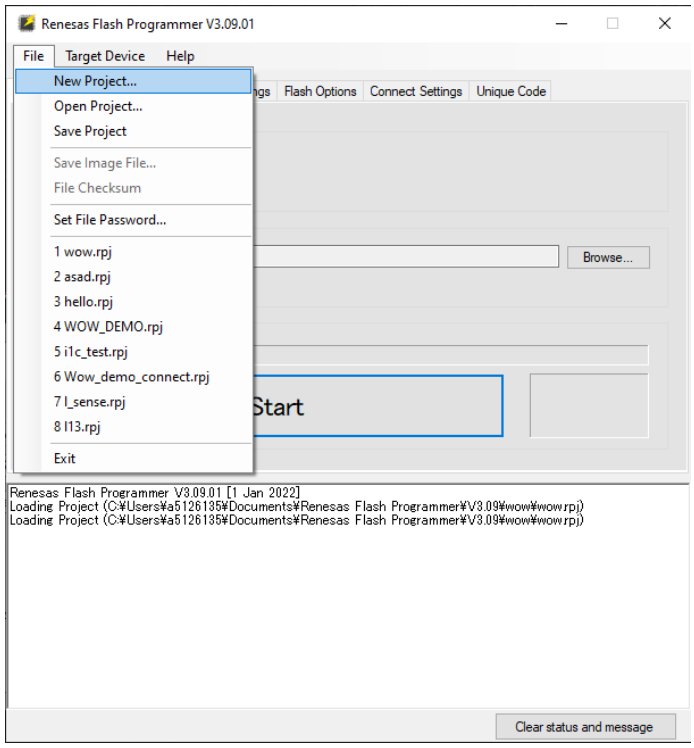

Figure 14. RFP New Project

In the new project dialog make the following selections, shown in Figure 15:

Microcontroller: *RL78/G2x*

Project Name: *Anything Suitable*

Project Folder: *Anywhere Suitable*

Tool: E2 emulator Lite

Num (Tool Details…): *Auto Select*

Power (Tool Details…): *None*

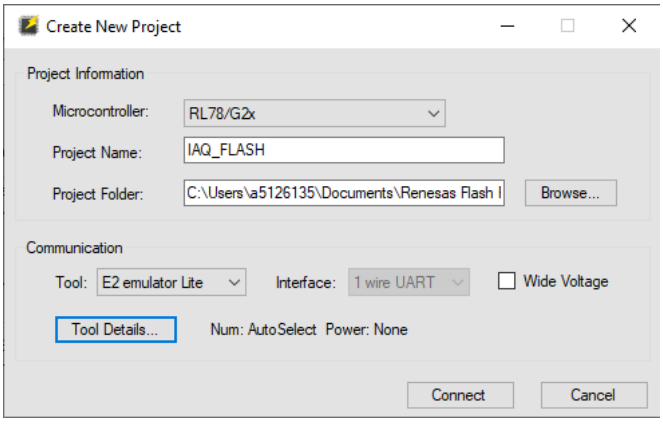

Figure 15. RFP New Project Dialog

Then click **Connect**.

RFP should proceed to successfully connect to the device and acquire basic information, as shown in Figure 16, if this screen is not shown please check batteries, header settings & cable connections.

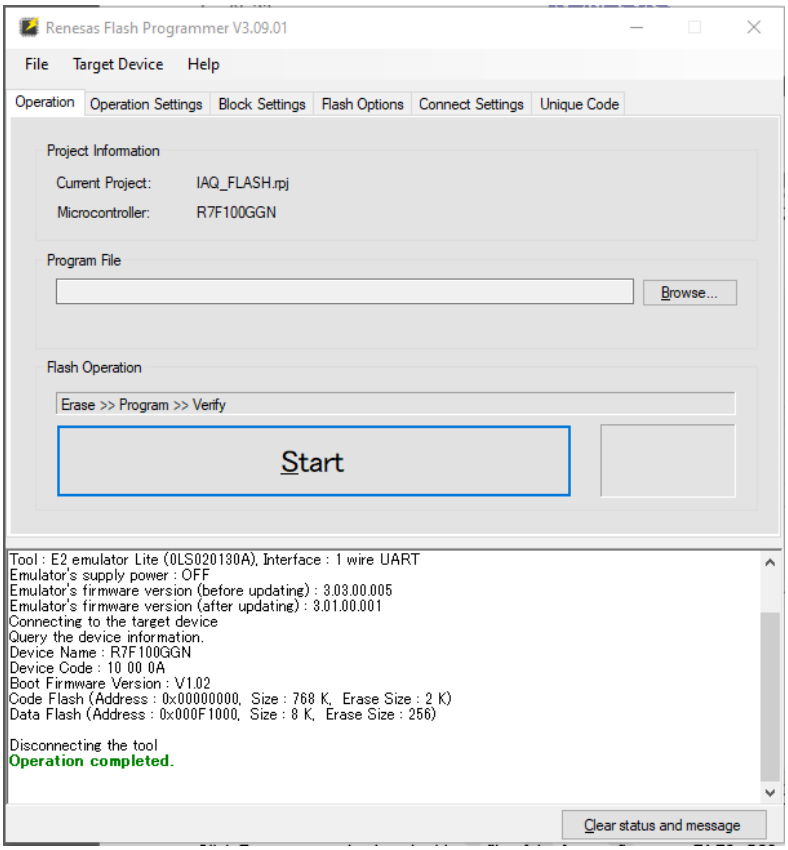

Figure 16. RFP Successful Connection

Click **Browse…** and select the binary file of the factory firmware: **RL78_G23_IAQ_DEMO.mot** shown in Figure 17.

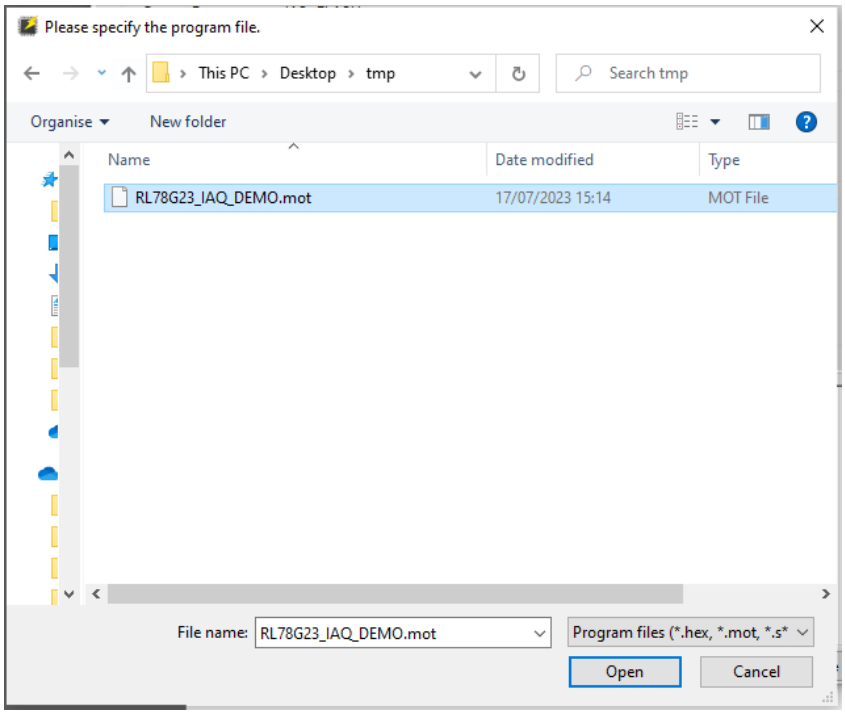

Figure 17. File Select

Click the **Start** button on RFP and flash the device – RFP will proceed to flash the device firmware and present a completion screen on success as shown in Figure 18.

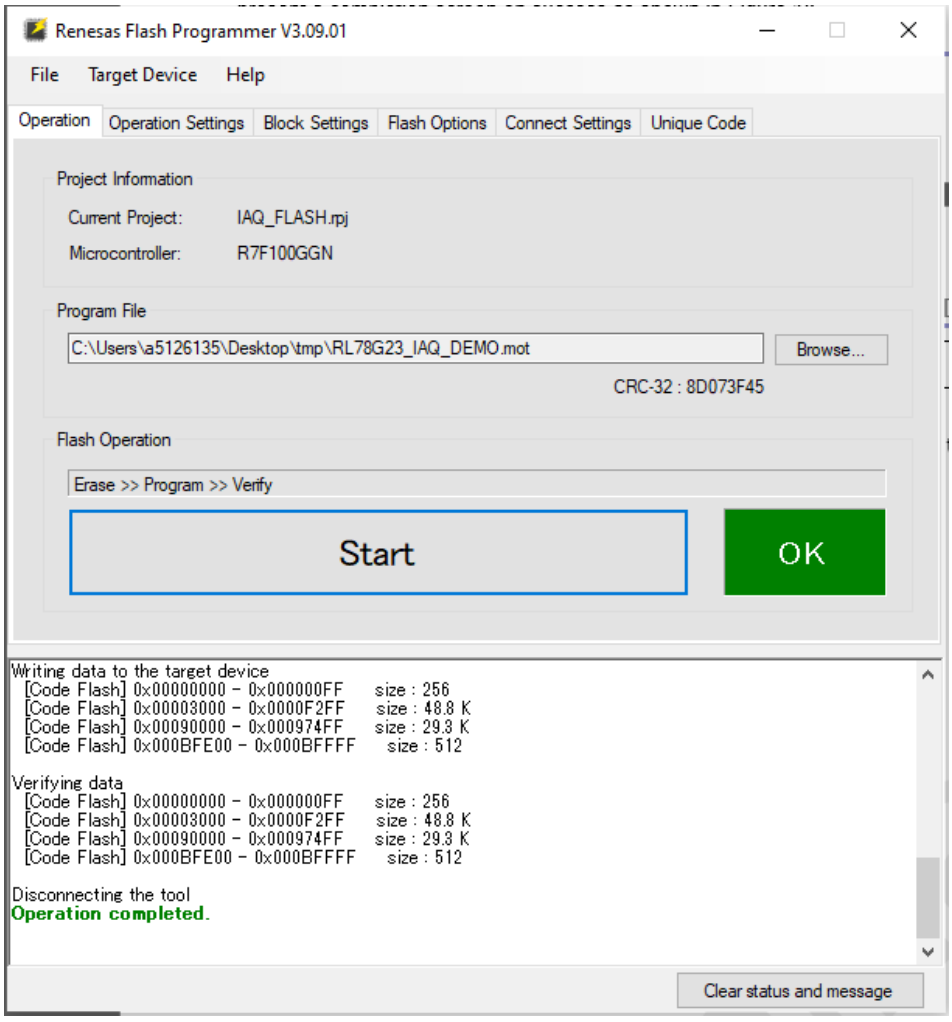

Figure 18. Operation Completed

Finally disconnect the E2-Lite and click **SW2** the **Reset** button on the back of the board and proceed to operate the device.

6. Next Steps

For anyone who would like to access the demo application and develop their understanding and the application further – please access R12AN0131EG0100 – the application note for this board and its factory programmed software.

7. Website and Support

For support please visit:

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Revision History

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