Quick Start Guide

RL78/G23 Group

RL78/G23 Microcontroller Group
Inductive Proximity Sensor Shield
Quick Start Guide

Renesas RL78 Family
G23 Series
Inductive Proximity Sensing Solution

Renesas Electronics
www.renesas.com

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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

Inductive Proximity Sensor Shield

Contents

Figures

1. Introduction

This Quick Start Guide (QSG) provides:

- An introduction to the Inductive Proximity Sensor Shield and the components shipped with it.
- An outline of the steps to be taken for setting up the Inductive Sensor Shield hardware and the RL78/G23 64pin FPB.
- An outline of the steps to be taken to start evaluating the sample project for the RL78/G23 64pin FPB and the Inductive Sensor Shield.

1.1 Assumptions and Advisory Notes

This document assumes the following:

1. The reader has access to an RL78/G23 64 pin Fast Prototyping Board (FPB).
2. The reader has installed the serial terminal application RealTerm.
3. The reader has access to a USB micro-B cable.

2. Kit Contents

The following components are included in the RL78/G23 Inductive Sensor shield kit:

1. Inductive Sensor Shield
2. Row MCU Pin Headers (16 positions)
3. Row MCU Pin Headers (19 positions)

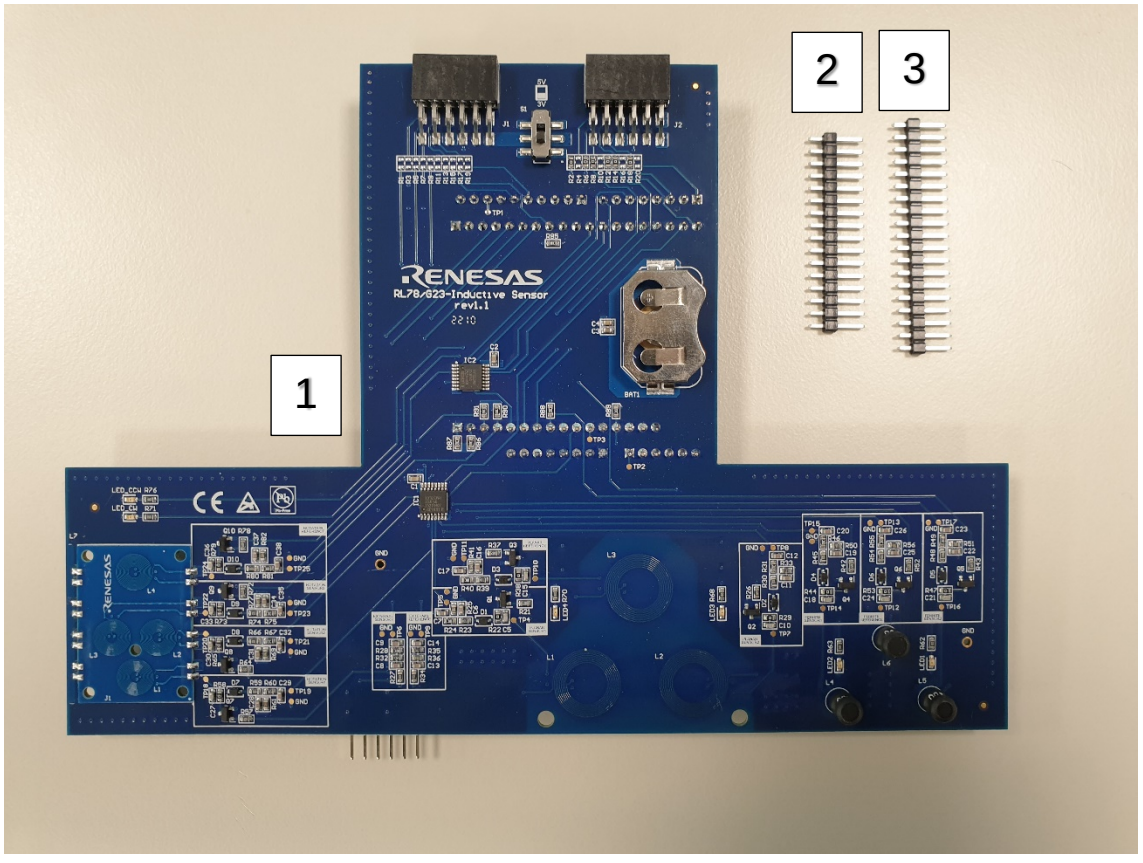

Figure 1. Inductive Proximity Sensor Shield Kit Contents

2.1 Modifications Required

The following four board modifications are required on the RL78/G23 FPB for the application to run:

1. Cut the **AVREFP** track. (Figure 2)
2. Cut the **AVREFM** track. (Figure 2)
3. Fit jumper **J17** to **pos 2-3** (+3V3).
4. Populate **J6** and **J7** with the **pin headers provided**.

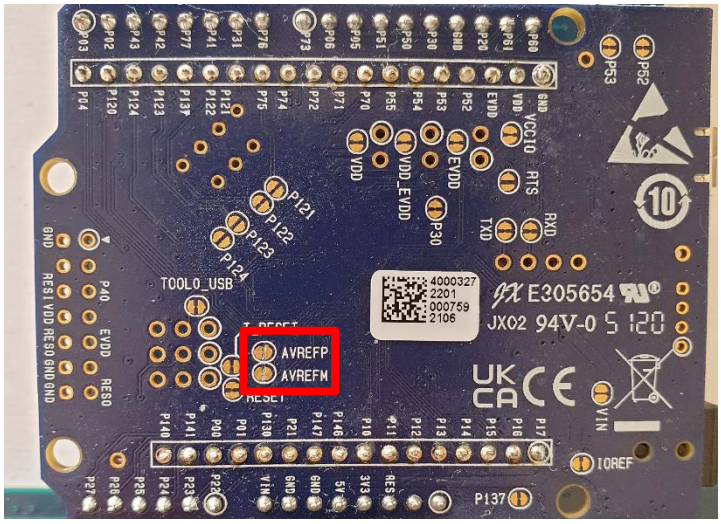

Figure 2. AVREFP AVREFM tracks

3. Running the Example Project

The example project for the RL78/G23 Inductive Sensor Shield periodically and sequentially scans each available coil group:

- Planar
- Ferrite Core
- Rotation

Action is then taken depending on the scan results to turn an LED on or off as well as incrementing internal counters for the serial terminal application.

3.1 Requirements

Hardware Requirements

- RL78/G23-64p Fast Prototyping Board
- Inductive Sense Shield Kit

Software Requirements

- RL78G23_Inductive_Sensor_v1_0_CodeFlash.srec
- RL78G23_Inductive_Sensor_v1_0_DataFlash.hex
- RealTerm
- Renesas Flash Programmer (Programming GUI) | Renesas (Minimum V3.09)

Important Notes:

1. Ensure all modifications from section 2.1 are made – this is very important; the application will not work correctly without these modifications and prolonged running without these modifications may cause damage.
2. Do not connect the RL78/G23 FPB and the sensor shield until the firmware is programmed.

3.2 Running the Quick Start Example Project

The following section outlines how to run the Inductive Proximity Sensing example project.

3.2.1 Download the example firmware using RFP

Connect to the RL78/G23 FPB using the USB micro-B cable.

Launch the Renesas flash programmer tool and follow the steps below.

Create a new project: File → New Project…

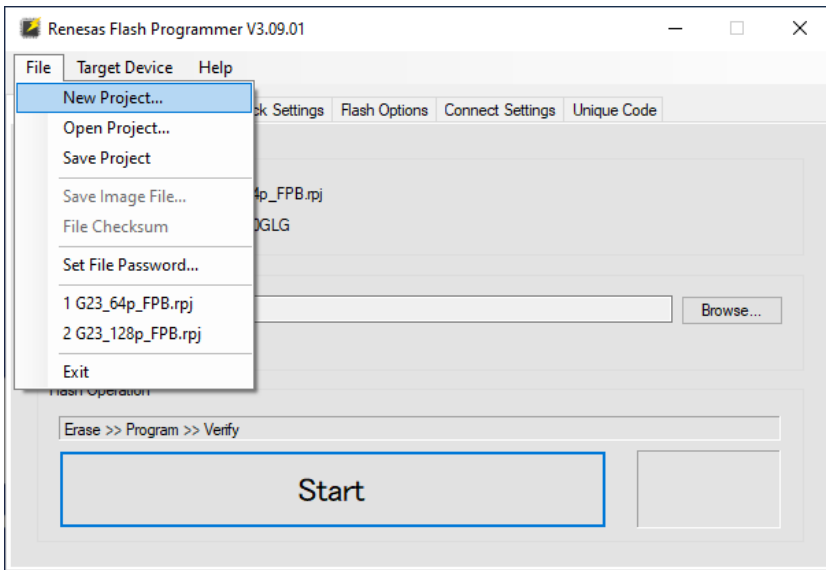

Figure 3. Create Project RFP

Make the following Selections (Figure 4):
Microcontroller: RL78/G2x
Project Name: [ANY_NAME]
Project Folder: [ANY_FOLDER] (Leave as default)
Tool: COM port
Interface: 2 wire UART
Tool Details… → Select appropriate COM Port

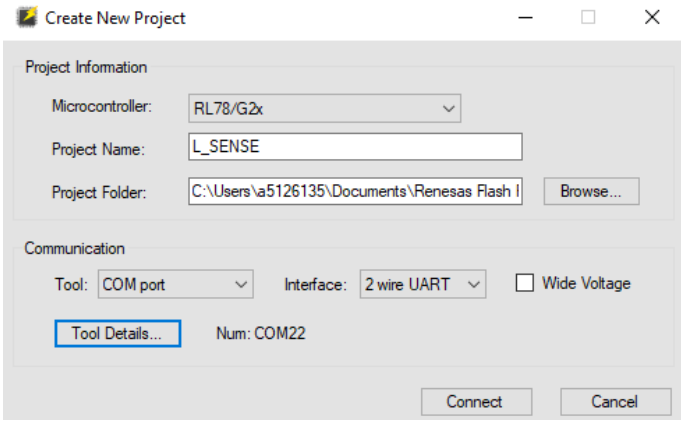

Figure 4. New Project Dialog

Click **Connect** and **Operation completed** should be displayed in the console dialog (Figure 5).

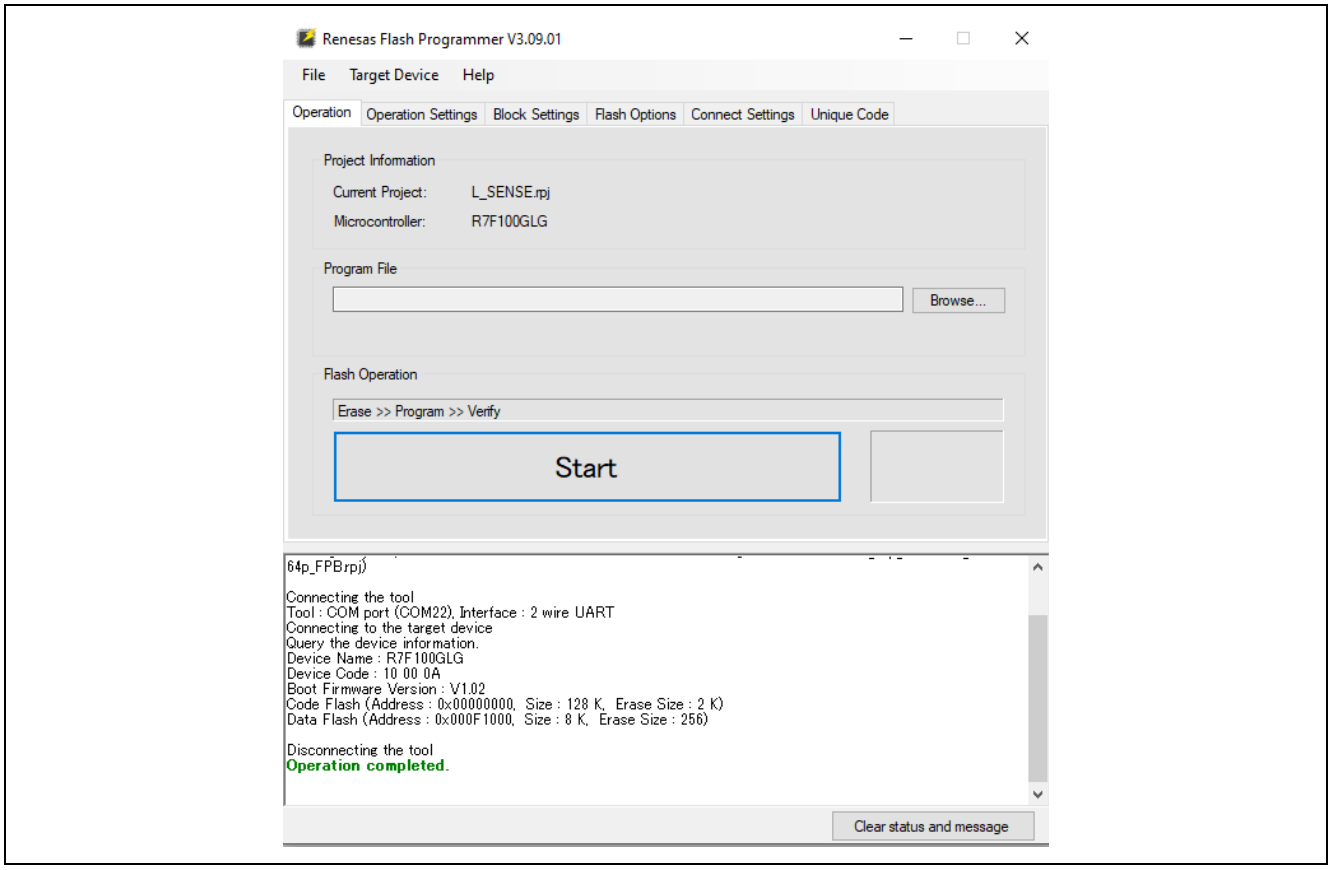

Figure 5. Post connect RFP main window

Select **Browse**.

As shown in Figure 6 Navigate to the location containing both:

- **RL78G23_Inductive_Sensor_v1_0_CodeFlash.srec**
- **RL78G23_Inductive_Sensor_v1_0_DataFlash.hex**

Using **Ctrl + click** select both images and click **Open**.

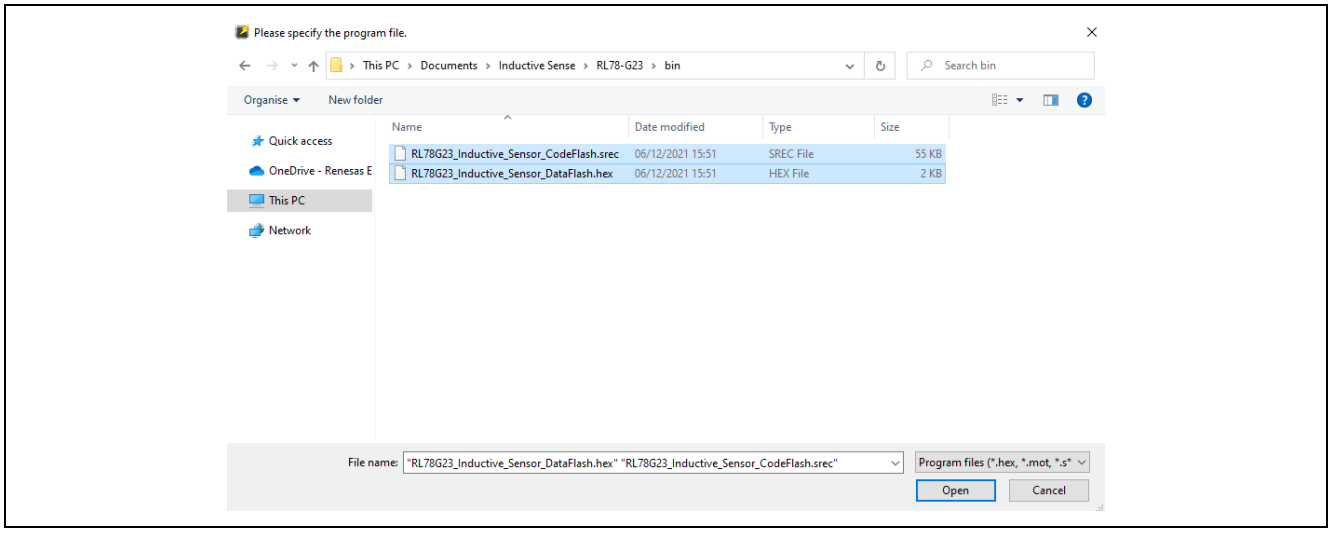

Figure 6. File browser for programming binaries

Click **Start** to program the board.

The console dialog will present the **Operation completed** message indicating the firmware has been written to the device (Figure 7).

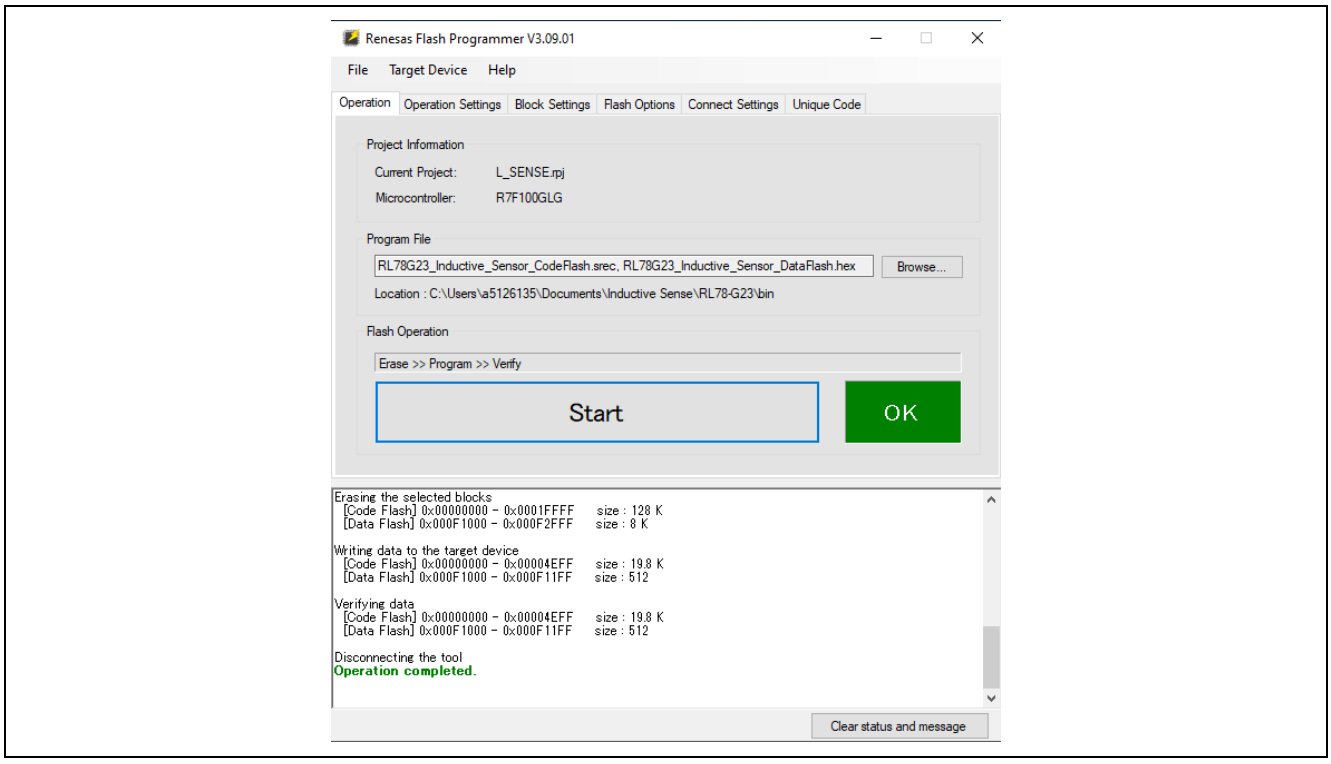

Figure 7. Firmware programming completed RFP main window

3.2.2 Connect the boards

Disconnect the USB cable to ensure the board is not live when connecting to the shield.

Connect the RL78/G23 FPB and the Inductive Sense Shield together, the headers are polarized using the Arduino interface specification so this can only be performed in one orientation. This is shown in Figure 8.

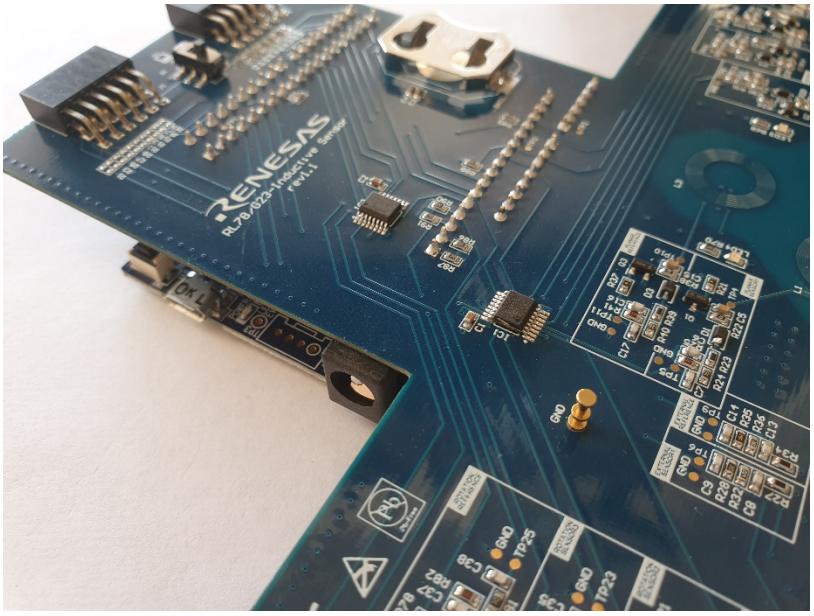

Figure 8. Sensor shield connected to RL78/G23 FPB

3.2.3 Power up and evaluate sense

Connect the USB cable to the RL78/G23 FPB.

You can now wave conductive targets near the coils and the coils corresponding LED's will illuminate (Figure 9).

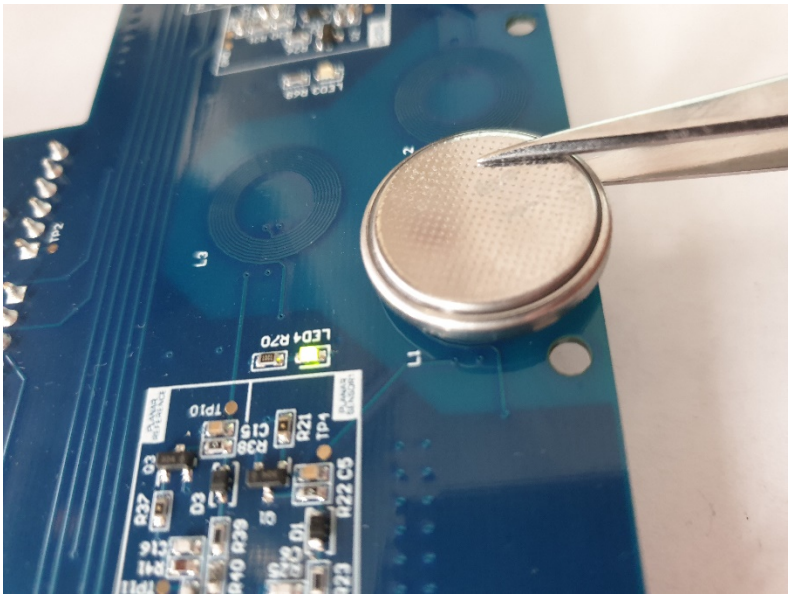

Figure 9. Conductive target detection illuminating LED

3.2.4 Open the serial terminal application

Launch the RealTerm application.

Select the **Port tab** and make the following settings (Figure 10):
Baud: 15625 (non-conventional proven to work)
Parity: None
Data Bits: 8
Stop Bits: 1
Hardware Flow Control: None

Select the correct COM port on your machine, using the drop-down, and click the **Change** button.

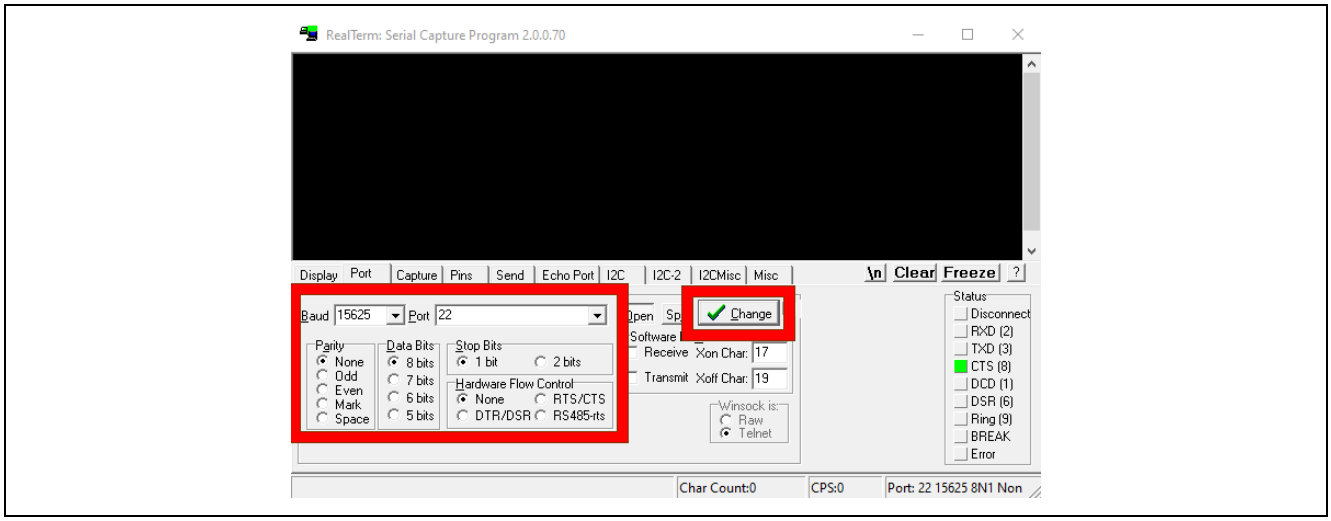

Figure 10. RealTerm port settings

Then Select the **Send tab**.

In the top text field enter: **0x22 0xFF 0x1B**

And press **Send Numbers**.

The console should display the sense counters for each coil on the shield as can be seen in Figure 11.

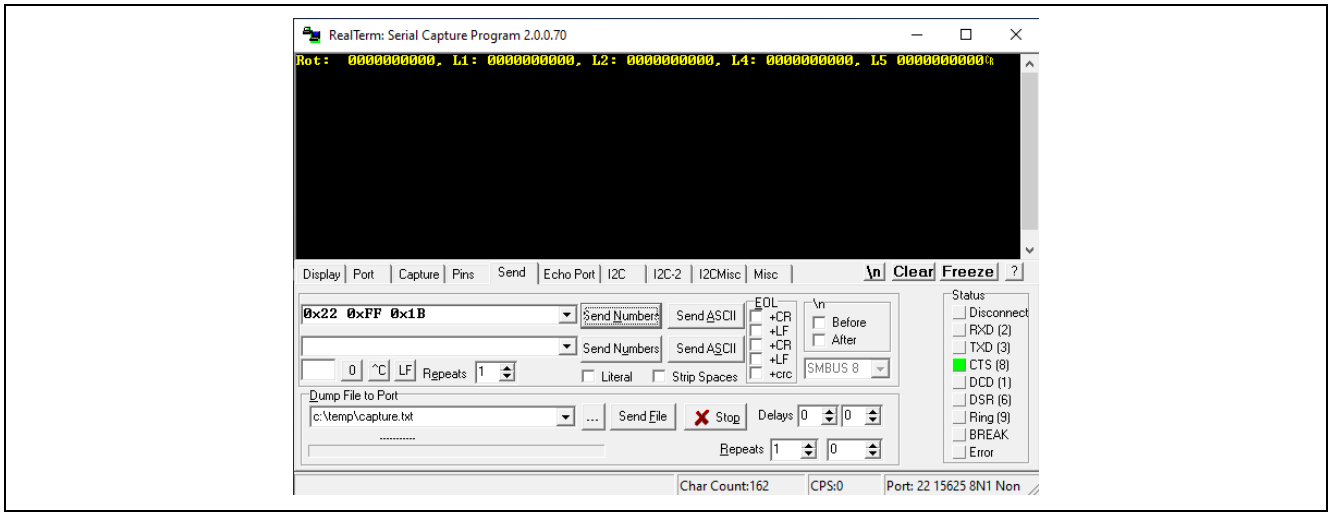

Figure 11. Sense counter reading

For further evaluation please refer to the Inductive Sense Shield user manual and the relevant application note.

4. Next Steps

Acquire the inductive proximity sensor shield user manual (R12UZ0106EG0100) and e^{2}studio software project to evaluate further – both of which can be found on the website: www.renesas.com/rl78g23-sensor-shield

5. Website and Support

Visit the following URLs to learn about the kit and the RL78 family of microcontrollers, download tools and documentation, and get support.

RL78/G23 64p FPB Resources	RL78/G23-64p Fast Prototyping Board | Renesas
RL78 Product Information	RL78 Low Power 8 & 16-bit MCUs | Renesas
RL78 Product Support Forum	RenesasRulz
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Renesas Support	renesas.com/support
Inductive Proximity sensor User Guide	R12UZ0106EG0100
Renesas Inductive Proximity Senor	www.renesas.com/rl78g23-sensor-shield

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