EU036 Multisensorboard

Quick Start Guide

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1. Overview

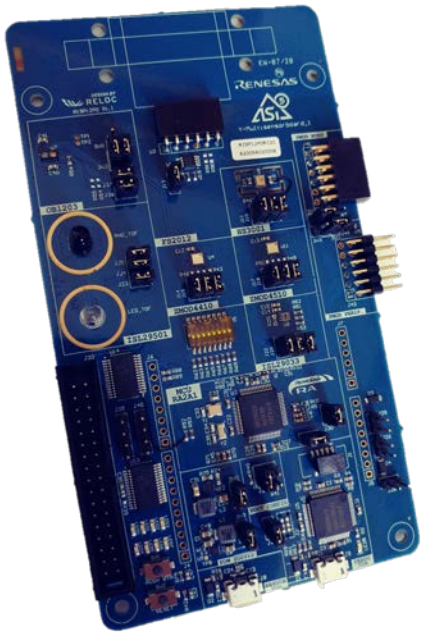

Figure 1: The Renesas Multisensorboard.

The Y-Multisensorboard_1 is a kit for the Renesas RA2A1 Microcontroller that also enables a quick evaluation of several Renesas sensors:

- **FS2012** - Flow Sensor (not part of the standard delivery)
- **HS3001** - Temperature and Humidity Sensor
- **ISL29033** - Ambient Light Sensor
- **ISL29501** - Time of Flight Sensor
- **OB1203** - Digital RGB / Ambient Light, Proximity and Photoplethysmography Sensor
- **ZMOD4410** - Gas Sensor Module for TVOC and Indoor Air Quality Sensor
- **ZMOD4510** - Gas Sensor Module for Outdoor Air Quality sensor

This Quick Start Guide walks you through the Out-of-the-Box Demo and then provides step-by-step directions to load, configure, generate, build, download, and execute the Test Sensors Project on the Renesas Flexible Software Package (FSP).

2. Required Software and tools

- Minimum workstation requirements: Microsoft® Windows® 7 with Intel® Core™ family processor running at 2.0 GHz or higher (or equivalent processor), 8 GB memory, 250 GB hard disk or SSD, USB 2.0, Internet connection
- Renesas e2 studio Integrated Solution Development Environment (ISDE)
- Renesas Flexible Software Package (FSP) [3]
- (optional – needs NDA) ZMOD4410 Indoor Air Quality eCO2 Firmware ver. 20200205
- (optional – needs NDA) ZMOD4510 Outdoor Air Quality Firmware ver. 20191014

3. Default Jumper Settings

Jumper	Board section	Default state	Function
J9	Power supply	CLOSED	Use the internal DC/DC buck as +3.3 V main power supply source.
J10	HS3001	CLOSED	Connect the I2C SCL bus.
J11	HS3001	CLOSED	Connect the I2C SDA bus.
J12	HS3001	CLOSED	Provides power supply to the HS3001.
J13	FS2010	CLOSED	Provides power supply to the FS2012 connector.
J14	ZMOD4410	CLOSED	Provides power supply to the ZMOD4410.
J15	ZMOD4410	CLOSED	Connect the I2C SCL bus.
J16	ZMOD4410	CLOSED	Connect the I2C SDA bus.
J17	ZMOD4510	CLOSED	Provides power supply to the ZMOD4510.
J18	ZMOD4510	CLOSED	Connect the I2C SCL bus.
J19	ZMOD4510	CLOSED	Connect the I2C SDA bus.
J20	ISL29033	CLOSED	Connect the I2C SDA bus.
J21	ISL29033	CLOSED	Connect the I2C SCL bus.
J22	ISL29033	CLOSED	Provides power supply to the ISL29033.
J23	ISL29501	CLOSED	Connect the I2C SCL bus.
J24	ISL29501	CLOSED	Connect the I2C SDA bus.
J25	ISL29501	CLOSED	Provides power supply to the ISL29501.
J26	Power supply	OPEN	Use the +3.3 V of the Arduino connector as +3.3 V main power supply source.
J27	Power supply	CLOSED	Use the internal DC/DC boost as +5 V main power supply source.
J28	Power supply	OPEN	Use the +5 V of the Arduino connector as DC/DC buck power supply source.
J29	Power supply	OPEN	Use the +5 V of the Arduino connector as +5 V main power supply source.
J30	RA2A1 MCU	CLOSED	Provides power supply to the RA2A1 MCU.
J31	J-Link OnBoard	CLOSED	Provides power supply to the S124 MCU.
J32	RA2A1 MCU	CLOSED 1-2	Select the Boot mode of the RA2A1 (default Single-chip)
J34	OB1203	CLOSED	Provides power supply to logic part of the OB1203.
J35	OB1203	CLOSED 1-2	Provides power supply to internal LEDs of the OB1203.
J36	OB1203	CLOSED	Connect the I2C SCL bus.
J37	OB1203	CLOSED	Connect the I2C SDA bus.
J38	RA2A1 MCU	CLOSED	Connect J-Link programmer to the RA2A1 reset pin.
J42	PMOD host	CLOSED 2-3	Select the PMOD host power supply output (default +3.3 V).
J44	PMOD perip.	CLOSED 1-2	Select the PMOD peripheral power supply input (default +5 V).

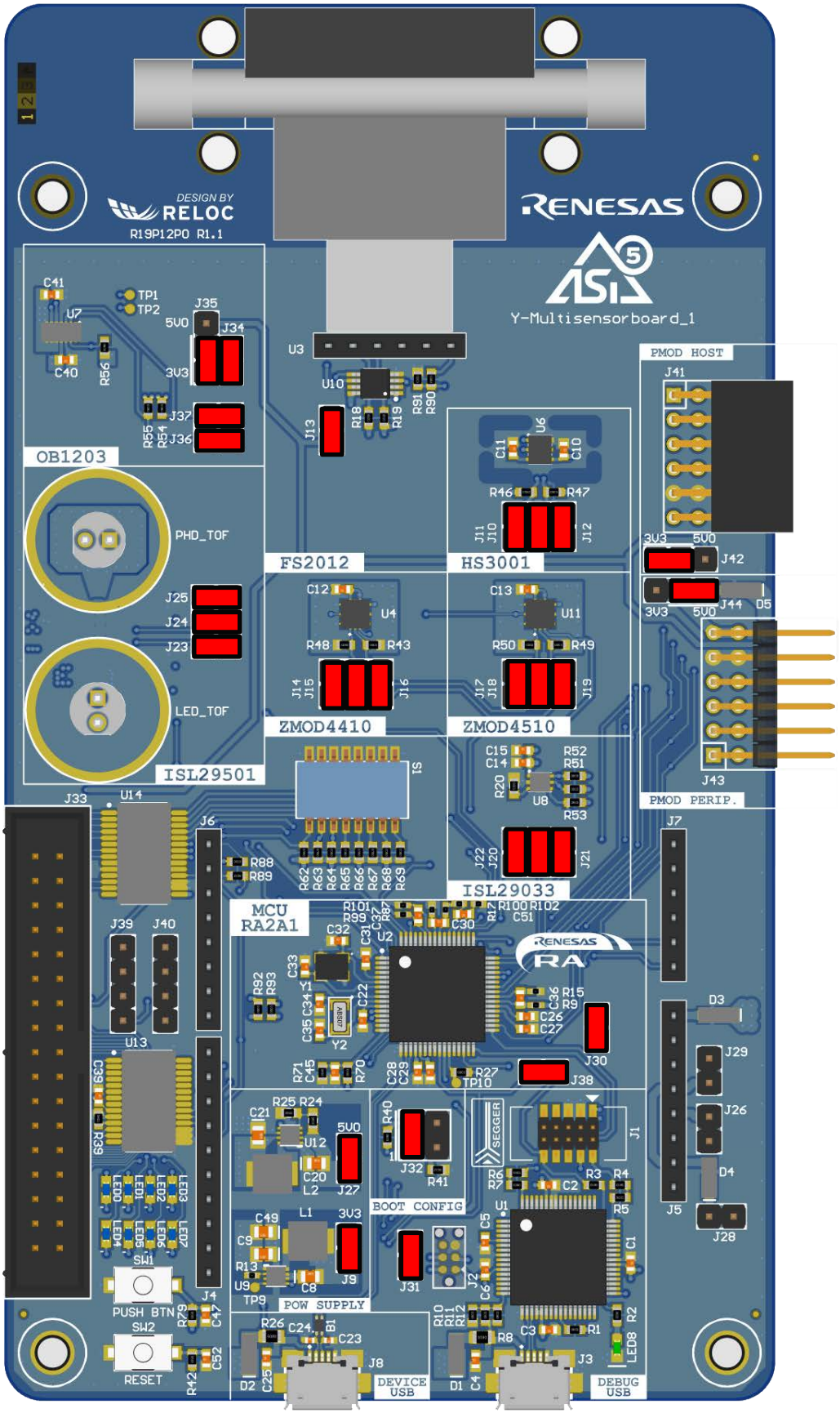

Figure 2: Default Jumpers position.

4. Running the Out-of-Box demo

Once connected a USB cable to one of the two ports, the board will power up, initializing all the sensors (except for the ZMOD sensors that requires external libraries [1]).

The ISL29501, TOF(Time Of Flight) distance sensor, requires an initial calibration performed ad boot: place an object at exactly 30 cm over the diodes of the ISL29501 before powering the board and wait until the boot is completed.

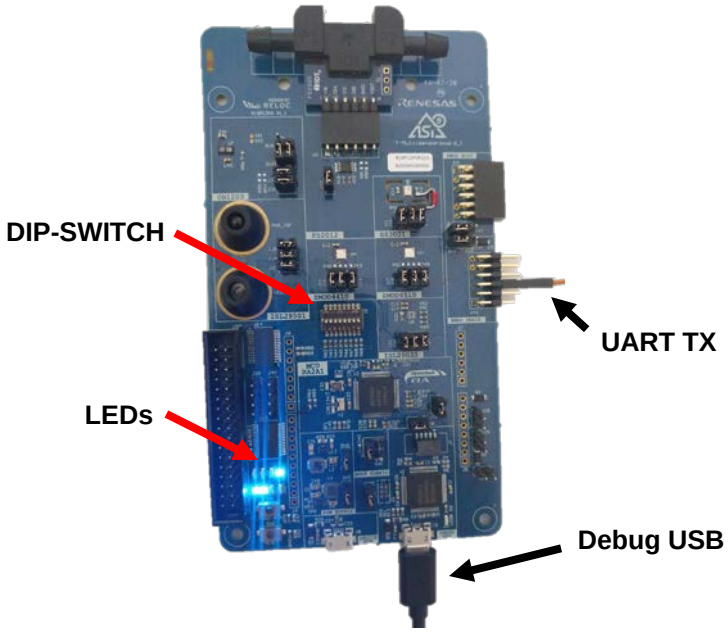

Figure 3: Out of the box demo running (FS2012 may not be included).

The measured sensors data are shown in two ways:

1. On the TX pin of the SCI0 UART @115200 8n1 – 3,3 V, available on:
    a. Pin7 of J6
    b. Pin 3 of the PMOD Perip. J43 (as shown in Figure 3)
    c. Pin 2 of the PMOD Host J41

    A USB/UART converter (FTDI or equivalent) can be used to read the values as shown in Figure 4.

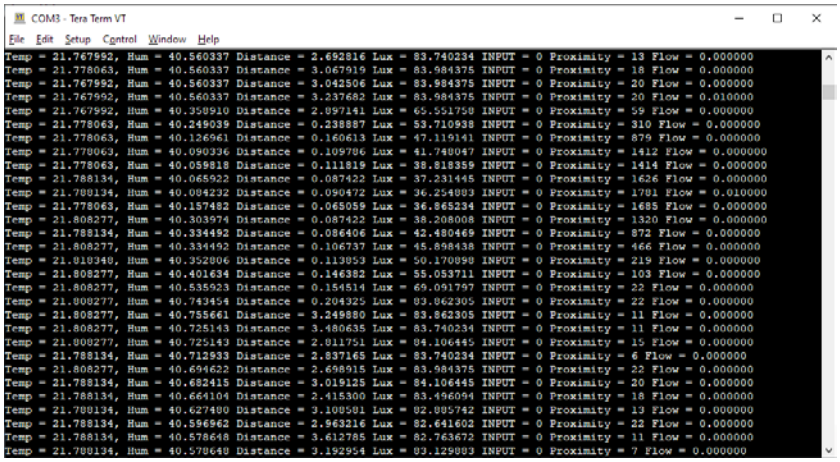

Figure 4: Measures printed on the UART port.

2. On the LEDs in binary 8-bit representation (0-255), depending on the dip-switch states:
    a. All OFF: test counter
    b. 1-ON: Temperature (HS3001)
    c. 2-ON: Humidity (HS3001)
    d. 3-ON: TVOC (ZMOD4410 – Always 0 without external libraries)
    e. 4-ON: IAQ (ZMOD4410 – Always 0 without external libraries)
    f. 5-ON: Distance (ISL29501)
    g. 6-ON: Ambient Light (ISL29033)
    h. 7-ON: Proximity (OB1203)
    i. 8-ON: Flow Rate (FS2012)
    j. More than 1 dip-switch enabled: Toggle all LEDs

This software is also used for the Demo1 (ASi5 simple slave); but for other demos a different software is used, refer to the Software User's Guide [1] for more information.

4.1 Reloading the Out-of-Box Demo

Open e^2 studio and create a new workspace, then:

1) Import the "RSB_R1D1_Test_sensors" project:
    a. "File/Import…"
    b. "General/Existing Projects into Workspace"
    c. "Select Archive file:" and select the project zip file
    d. Select the project and click on "Finish".
2) (optional) Import the ZMOD libraries following the Software User's Guide [1]
3) Build the project: click on the "Build" button 
4) Launch the debugger: click on the "Debug" button  and resume the execution 2 times with the "Resume" button  .

5. Other Demos

In the Software User's Guide [1] other demos are showed, here is a brief list:

1. Display the values on the SK-S7G2 display and transmit them on the BLE.

Figure 5: Demo2B.

2. Transmit the ZMOD4410 values on the BLE and showing them on a smartphone using the IDTSense app:
    a. iOS: https://apps.apple.com/us/app/idtsense/id1388222456
    b. Android: https://play.google.com/store/apps/details?id=com.idt.europe.idtsense

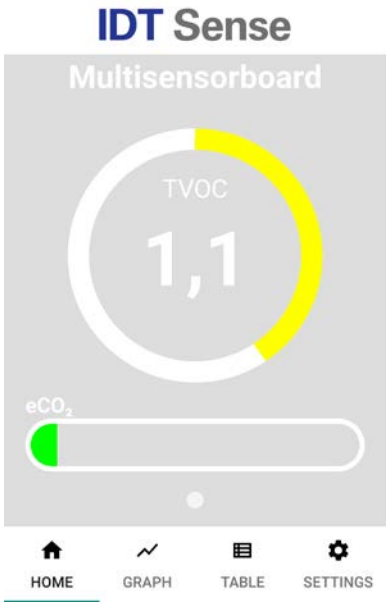

Figure 6: Demo3.

3. Send the measures on the Cloud using the EK-RA6M3 and an Ethernet or a WiFi connection.

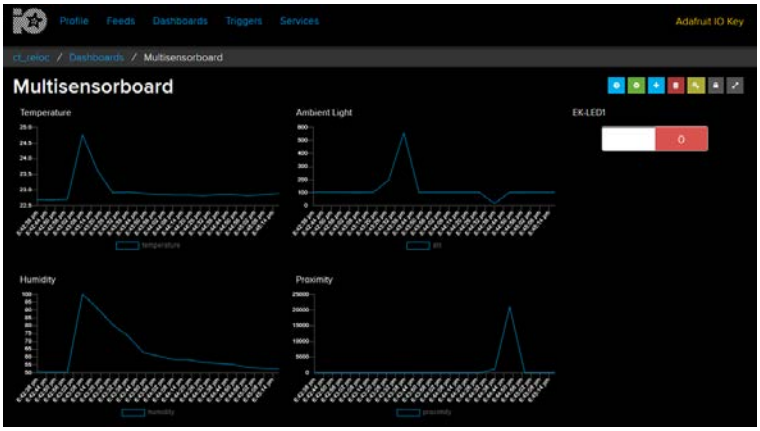

Figure 7: Demo2A and Demo4.

References

[1] Renesas Electronics, “Multisensorboard – Software User’s Guide”.

[2] Renesas Electronics, “Multisensorboard – Hardware User’s Guide”.

[3] Renesas Flexible Software Package (FSP): Link.

[4] Renesas Electronics, “Renesas RA2A1 Group - User’s Manual: Hardware” Oct. 2019 - R01UH0888EJ0100: Link.

[5] Renesas Electronics, “FS2012 Series Datasheet - High Performance Flow Sensor Module”, Aug. 24, 2018: Link.

[6] Renesas Electronics (IDT), “HS300x Datasheet - High Performance Relative Humidity and Temperature Sensor”, Aug. 6, 2018: Link.

[7] Renesas Electronics, “ISL29033 Datasheet - Ultra-Low Lux, Low Power, Integrated Digital Ambient Light Sensor with Interrupt Function”, Rev 5.00 Sep. 28, 2016: Link.

[8] Renesas Electronics, “ISL29501 Datasheet - Time of Flight (ToF) Signal Processing IC”, May. 5, 2017: Link.

[9] Renesas Electronics, “ISL29501 AN1724 – Firmware Routines”, Rev 1.00 Mar. 31, 2017: Link.

[10] Renesas Electronics (IDT), “OB1203 Preliminary Datasheet - Digital RGB / Ambient Light, Proximity and Photoplethysmography Sensor”, Mar. 6, 2019: Link.

[11] Renesas Electronics (IDT), “ZMOD4410 Datasheet - Gas Sensor Module for TVOC and Indoor Air Quality”, Jul. 30, 2019: Link.

[12] Renesas Electronics (IDT), “ZMOD4510 Datasheet - Gas Sensor Module for Outdoor Air Quality”, Sep. 9, 2019: Link.

Revision History

Rev.	Date	Description	
		Page	Summary
0.01	23 Mar 2020		Initial version.
0.02	26 Mar 2020		Renesas feedback corrections.
0.03	09 Apr 2020		Added ISL29501 calibration note.
01.00	03 Sep 2020		Added document#R30QS0002ED0100

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.).
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   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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