EU154-1 Quick Start Guide

Quick Start Guide

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1. Overview

This is Renesas EU154-1 Smart Water Valve Control device.

It demonstrates automatic shutdown valve control after EU153-1 device has detected inappropriately high moisture level or water spilling.

In another use case, it can automatically control watering of plants etc. by switching water valve ON when water level is too low, and switching water valve OFF when water level becomes (sufficiently) high enough,

Also EU154-1 can be manually controlled by MQTT commands via Smartphone or Table GUI, or from a PC via web browser, using an appropriate web-based MQTT server.

This solution kit allows quick evaluation of Renesas HVPAK H-bridge device as well as WiFi/BLE using third-party data acquisition and visualization tools.

The solution kits contain the following Renesas Parts

- ISL9301 - Li-Ion Battery Charger
- ISL9122A - Ultra-Low IQ Buck/Boost Regulator
- ISL9111A – High Efficiency Synchronous Boost Converter
- ISL97519A - 600kHz/1.2MHz PWM Step-Up Regulator
- SLG47105 - GreenPAK Programmable Mixed-Signal Matrix with High Voltage Features
- SLG59H1401C – GreenFET Load Switch for OR'ing Power MUX
- SLG59M1557V – GreenFET Single P-Channel Load Switch
- DA16600MOD - Ultra-Low Power Wi-Fi + Bluetooth® Low Energy Combo Module

2. Purpose of this document

This Quick Start Guide walks you through the best out-of-the-box experience and provides a step-by-step guide on how to use this solution kit.

3. Running the Out-of-Box demo

1. Download the Smartphone App “**Dialog WiFi Provisioning**” from either Google Play (in case of Android phone or tablet) or Apple App Store (for iPhone / iPad) and install it.

Figure 1. WiFi Provisioning app in Google Play and App Store

2. Unbox the solution kit and take out the board (Figure 2)

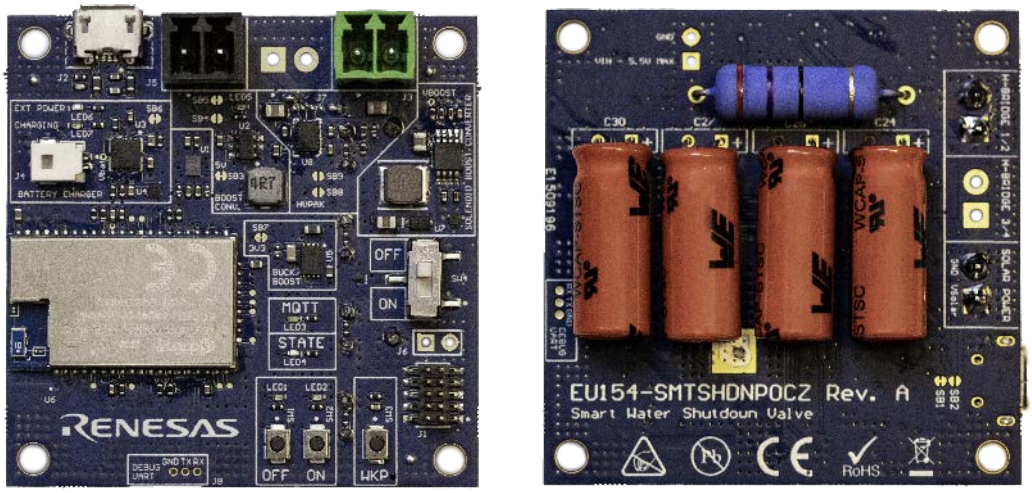

Figure 2: Top and back view of EU154-1 board

3. Please note the main connectors that are shown in Figure 3:

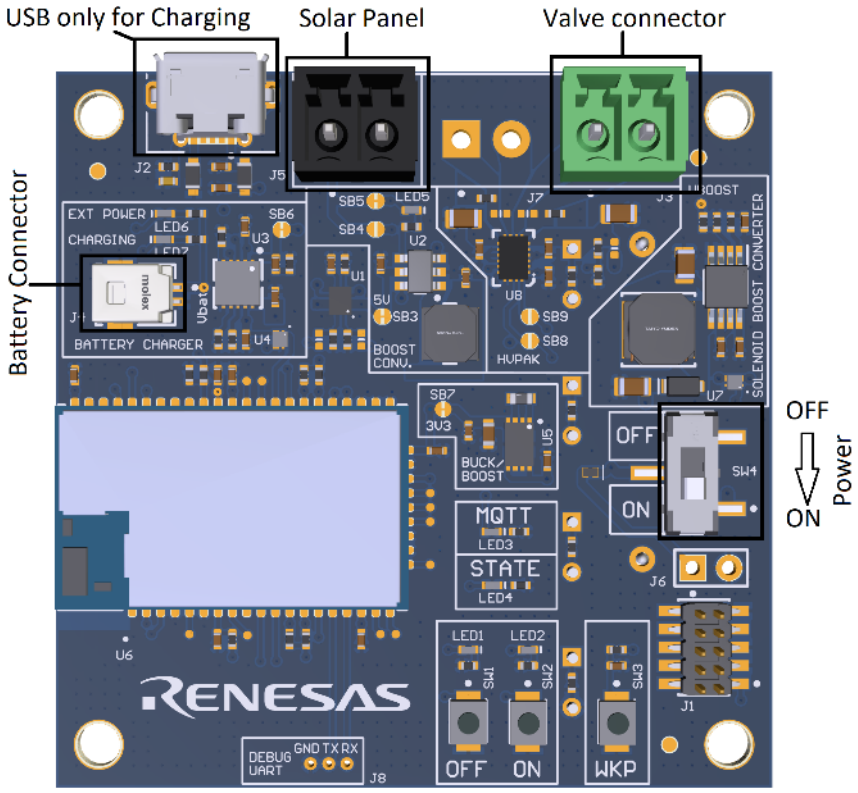

Figure 3: PCB Top View with the default jumper configuration.

4. Connect battery and valve wires as it is shown in Figure 4

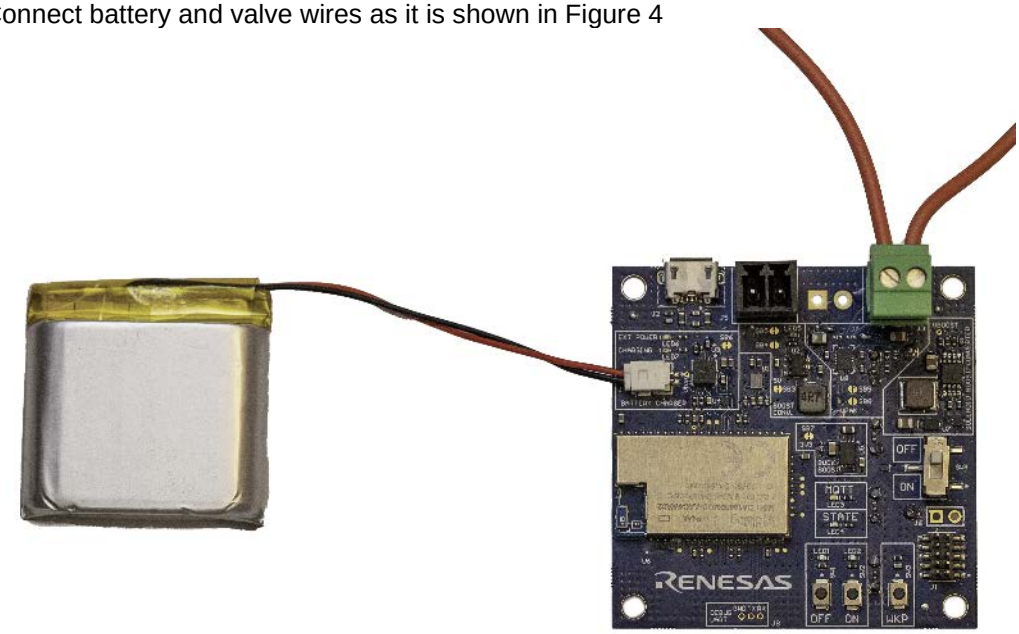

Figure 4. Battery and Valve wires connection

5. Move the Power Supply Switch to ON Position (Figure 3)

6. Verify the board status through the LEDs indication, see Table 1. Please note when the device is in Low Power Mode (DPM) and functioning normally, only LED3 can be on or blinking

Led Coding		
LED	**LED Status**	**Information**
LED1	ON	Indicates that valve is closed
	Blinking	Indicates that valve is closed in DPM mode
LED2	ON	Indicates that valve is opened
	Blinking	Indicates that valve is opened in DPM mode
LED1 and LED2	Blinking	Error occurred during valve switching
LED4	ON	Not connected to WiFi Access point
	Blinking	Connected to AP but no communication with MQTT broker
	Blinking	When DPM is off after short SW3 button press starts blinking
LED3	Blinking	Indicates MQTT communication
LED5	On/OFF	DC/DC Boost error indication when ON.
LED6	ON/OFF	It is on when external power supply is connected (i.e. USB)
LED7	ON/OFF	Charging status indication. On - charging

Table 1: LEDs Coding Table

7. If the battery is not sufficiently charged or the charge is low, connect the solution kit to a USB cable or solar cell. The green LED (LED6) will come up to indicate external power supply and battery charge status will be shown on yellow LED7. When charging is complete LED7 is off.
8. As soon as the DA16600MOD Bluetooth® communication starts, open Dialog WiFi Provisioning App to setup the device.
9. When the app starts, follow the procedure shown in Figure 5:
    - Click on **Start DA16600 based** button
    - Click **Start**
    - Select EU154-1 device
    - Scan WiFi Network

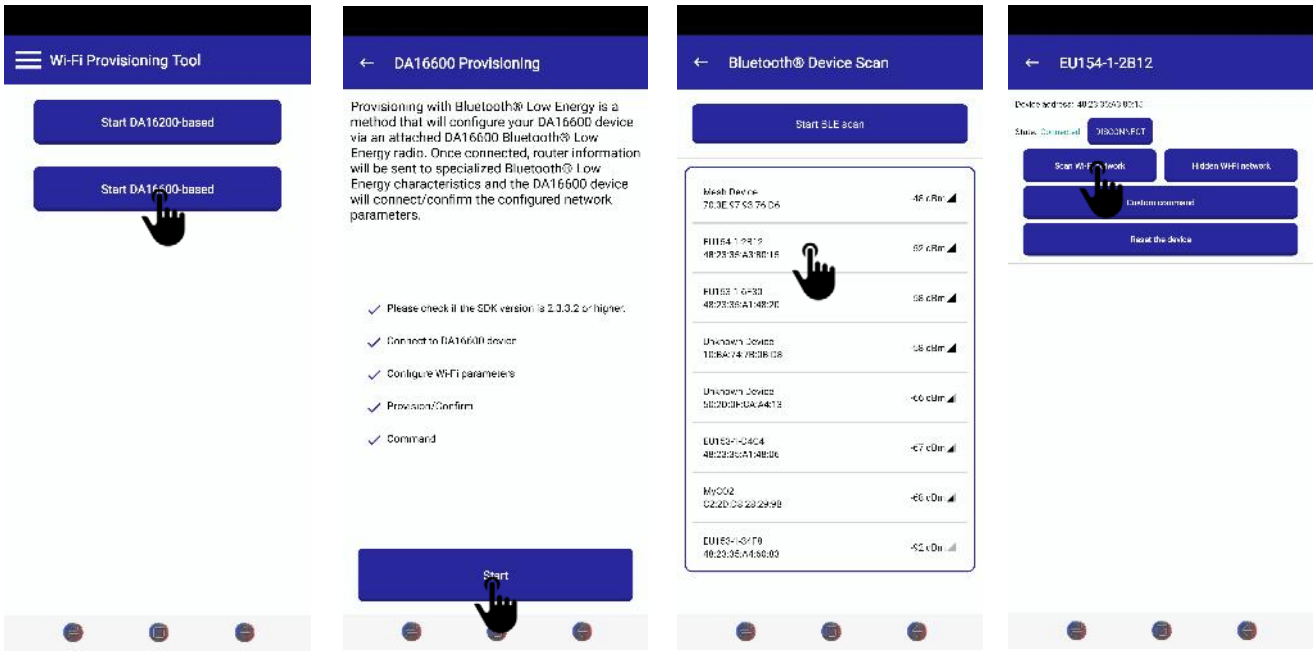

Figure 5: Search for the device using BLE.

10. Next steps are shown in Figure 6:
    - Select the WiFi access point you want to connect to
    - Enter your WiFi credentials
    - Click Connect to selected access point button
    - If the procedure was successful, you will be informed about it in the next pop up screen:

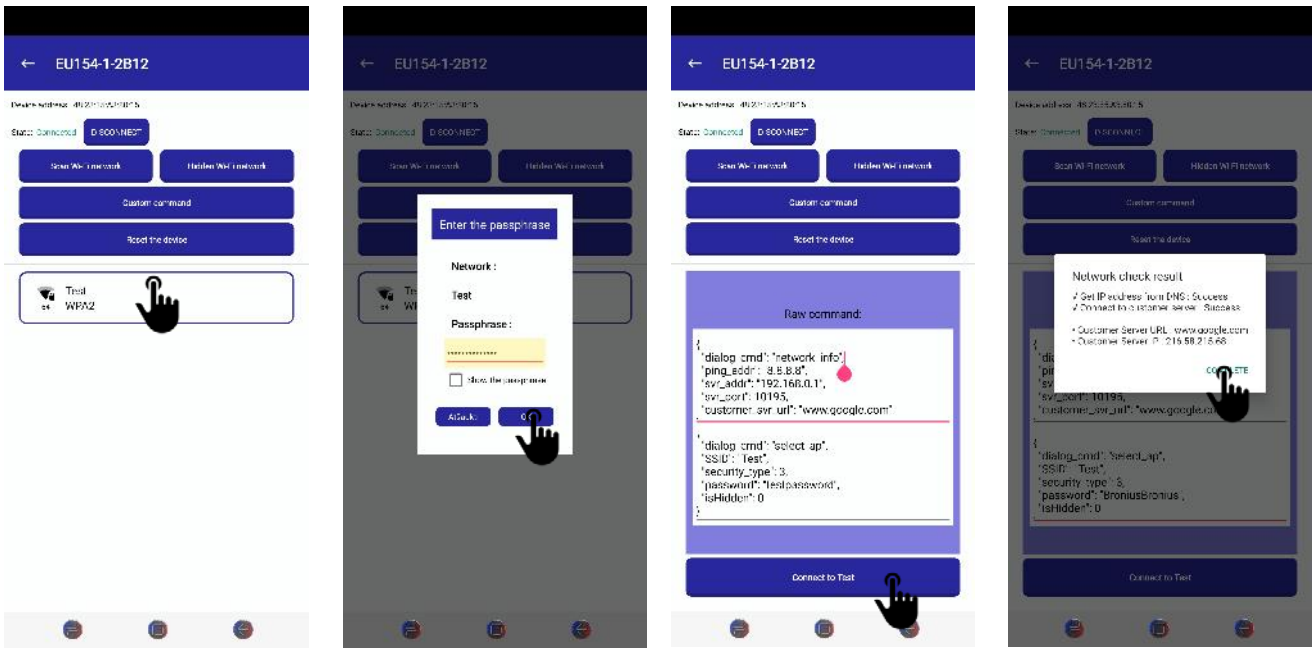

Figure 6. WiFi Provisioning

11. When the device is connected to the WiFi you need to setup an MQTT broker address and client parameters. This is done by copying and pasting custom command in json format. Detailed print screens are in Figure 7.

    MQTT broker and client parameters in json format"

```
{
        "dialog_cmd":"mqtt_cfg",
        "broker_ip":"52.54.110.50",
        "port":1883,
        "user":"mqtt_user",
        "password":"mqtt_password",
        "ping_period":30
}
```

Note. The custom command should be copied as <u>one row</u>:
{"dialog_cmd":"mqtt_cfg","broker_ip":"52.54.110.50","port":1883,"user":"mqtt_user","password":"mqtt_password","ping_period":30}

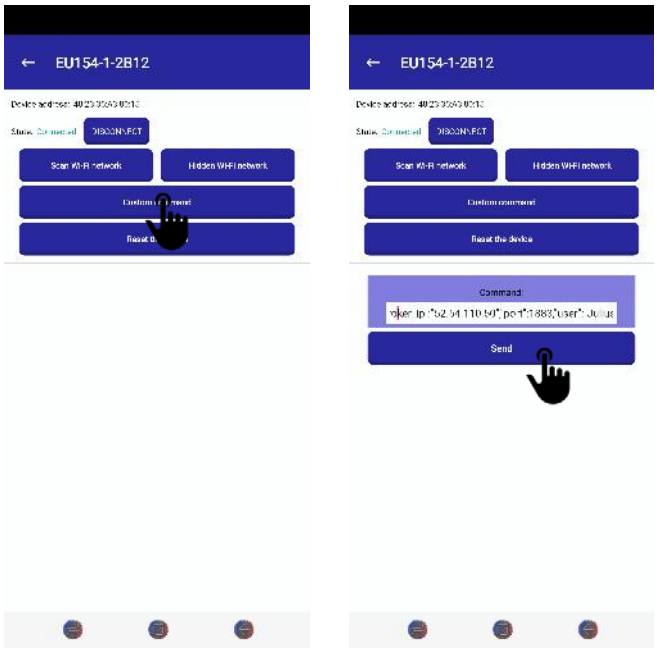

Figure 7. MQTT broker and client parameters

MQTT broker is accepted only as IP address.

Any MQTT broker/ can be used. As an example, EU154-1 was tested with Adafruit IO service. Detailed info how to set it up can be found in section Setting up Adafruit IO

4. Setting up Adafruit IO

Adafruit is offering free full featured MQTT broker and dashboard with limited number of devices and limited data feeds (per time). As it is one of the easiest tools to start with, we have chosen it as tool to visualize data that EU153-1 and EU154-1 are providing, and/or controlling those solution kits.

1. If you already have an Adafruit account you can use it; if not you have to set up.
2. MQTT broker/server credentials can be found by clicking on the key symbol in yellow background as it is shown in Figure 8. Active Key is your password.

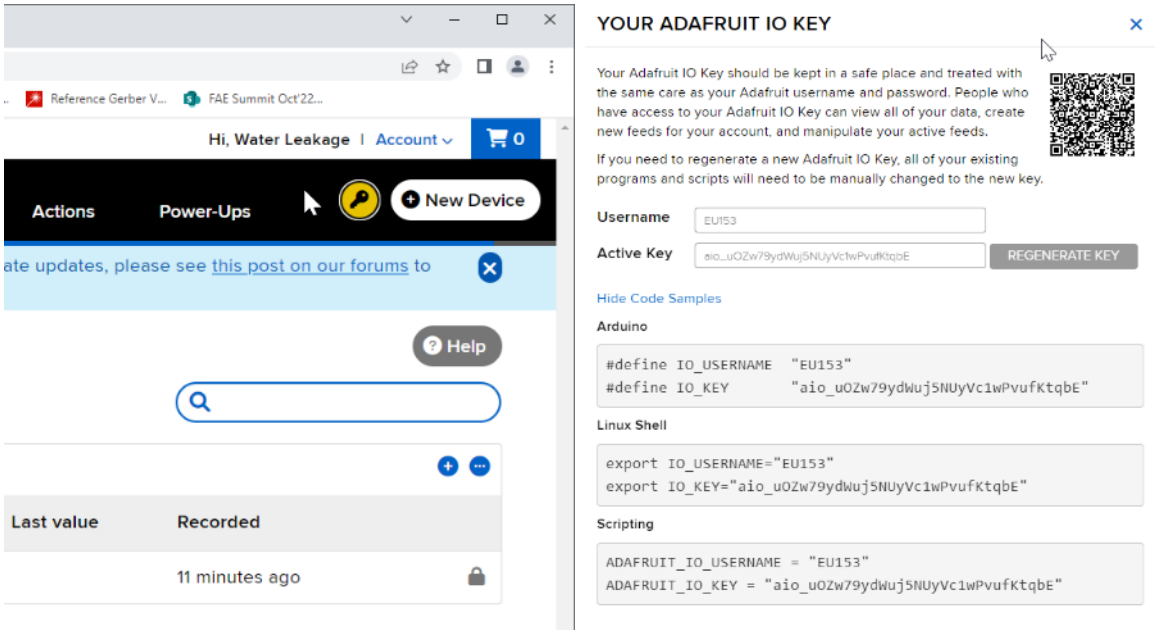

Figure 8. Adafruit IO MQTT broker username and password

3. EU154-1 is intended to be used together with EU153-1. If you have set it up before or want to use Smart Valve Control solution kit as standalone device skip next section and go directly to paragraph Create Adafruit IO dashboard for EU154-1 calve controlling device.

Note that both devices – EU153 and EU154 should be connected to the same Adafruit io account, but may be using different WiFi networks.

4.1 Create Adafruit IO dashboard for EU153-1 Smart Water Sensor

1. If you have successfully logged in to io.adafruit.com you will have only one Welcome feed. You can delete it.
   When device updates the topics your Feeds should look like Figure 9. If you don't want to wait until it is automatically updates, you can press button SW2 on EU153-1 board (assuming it is NOT in Low Power Mode, where SW2 is deactivated; in this case you have to wait or temporarily set the EU153-1 board into normal run mode).

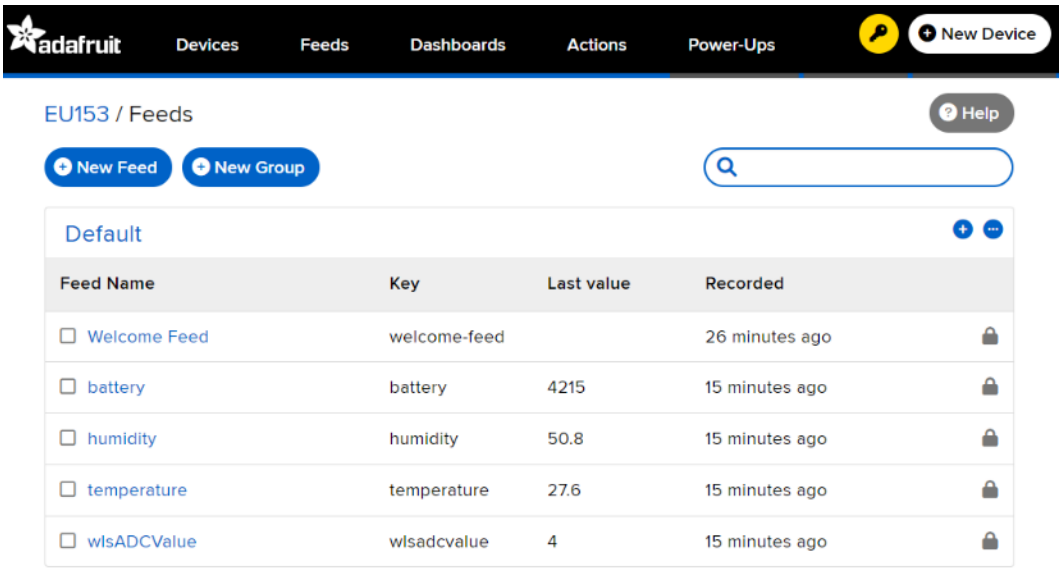

Figure 9. Newly updated topics/ Feeds

2. To control LED3 on the board you have to create new *"username/Feeds/LED3"* feed manually (Figure 10):
   a. Press New Feed
   b. Enter the Name for the new feed
   c. Press Create

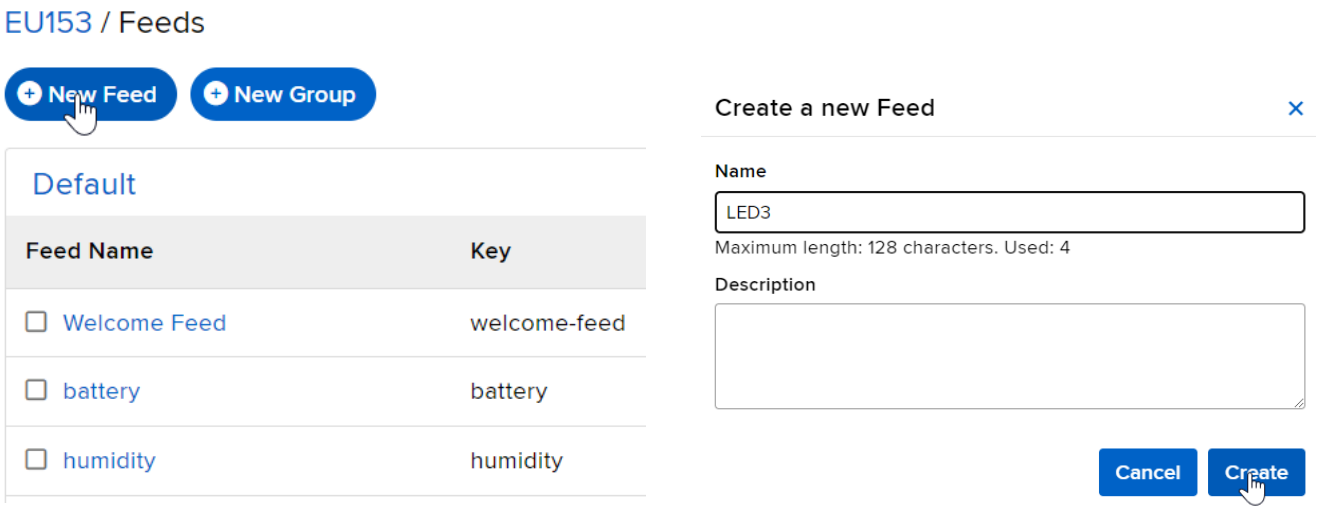

Figure 10. Create LED3 Feed

3. Create new Dashboard that would look like

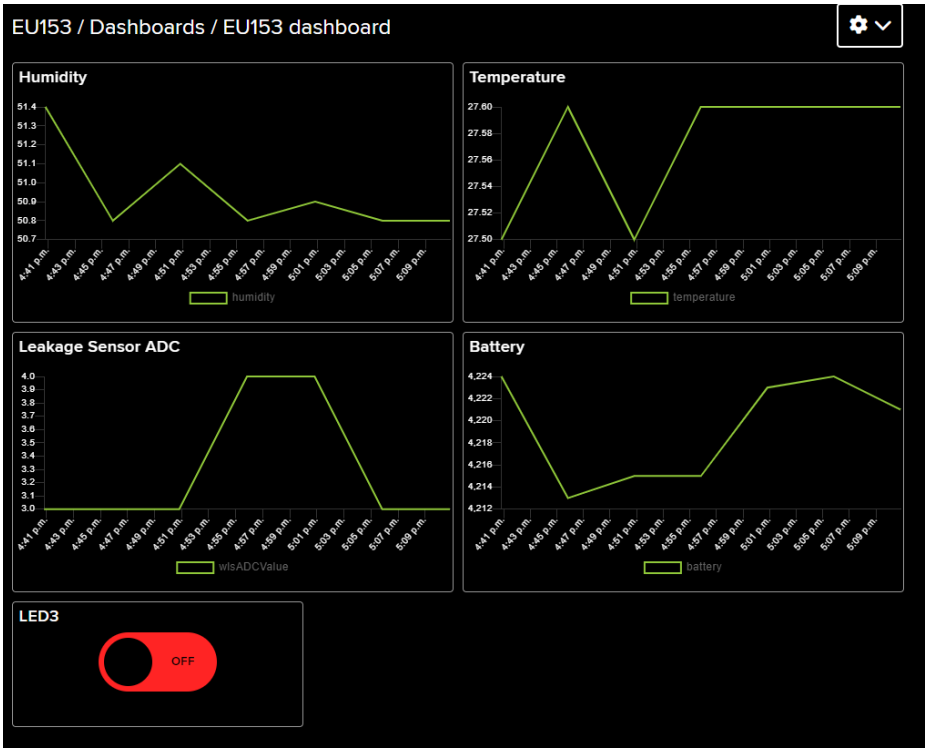

Figure 11. EU153 Dashboard

4. LED3 Value will be controlled using LED3 radio switch on the dashboard. LED3 will be switched on and off only when ‘1’ or ‘0’ character will be received. Please check configuration in Figure 12 (note that Button On and Button Off value must be set to “1” and “0” respectively; do not try to change these)

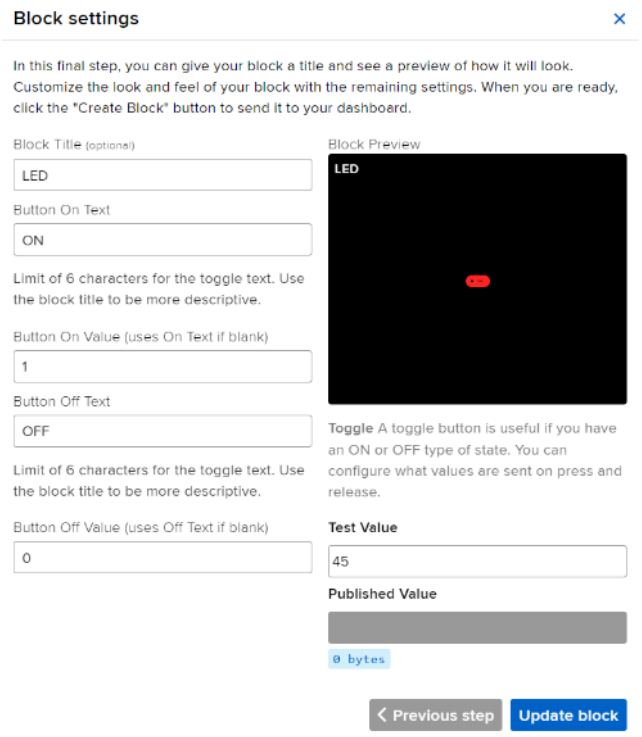

Figure 12. LED3 feed configuration and possible values

5. The data in the dashboard will be updated automatically every 5 minutes. Manually it can by updated only when Low Power Mode is off by pressing SW2 button in normal run mode In Low Power Mode, SW2 is deactivated; in this case you have to wait or temporarily set the EU153-1 board into normal run mode.

4.2 Create Adafruit IO dashboard for EU154-1 Smart Water Actuator Valve controlling device

All the feeds will be inserted automatically. You should create a new dashboard to control abnd visualize the EU154-1 device. It could look similar to the one displayed in Figure 16. EU154-1 Control dashboard.

Next steps will show how to create control widgets and what values should be entered.

1. Create widget to control valve state. Select eu154valve feed and create block with values 1 for ON and 0 for off as it is shown in Figure 13 (do not alter Buttons´ On / Off values; must be “1” and “0”; the FW on the board otherwise will not recognize it)

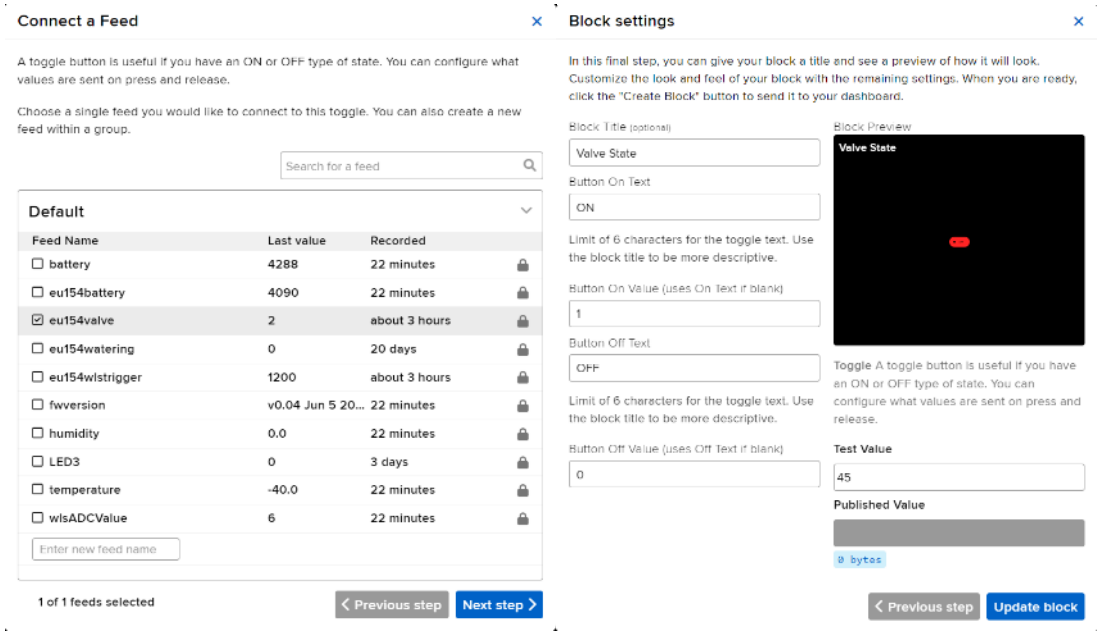

Figure 13. Create and configure a widget to control the valve

2. Create a widget to set auto or manual valve control. It uses the same eu154valve feed, just value “2” must be set for “auto control” and value “3” for “manual” as it is shown in Figure 14; otherwise the solution kits’ FW will not recognize those commands appropriately.

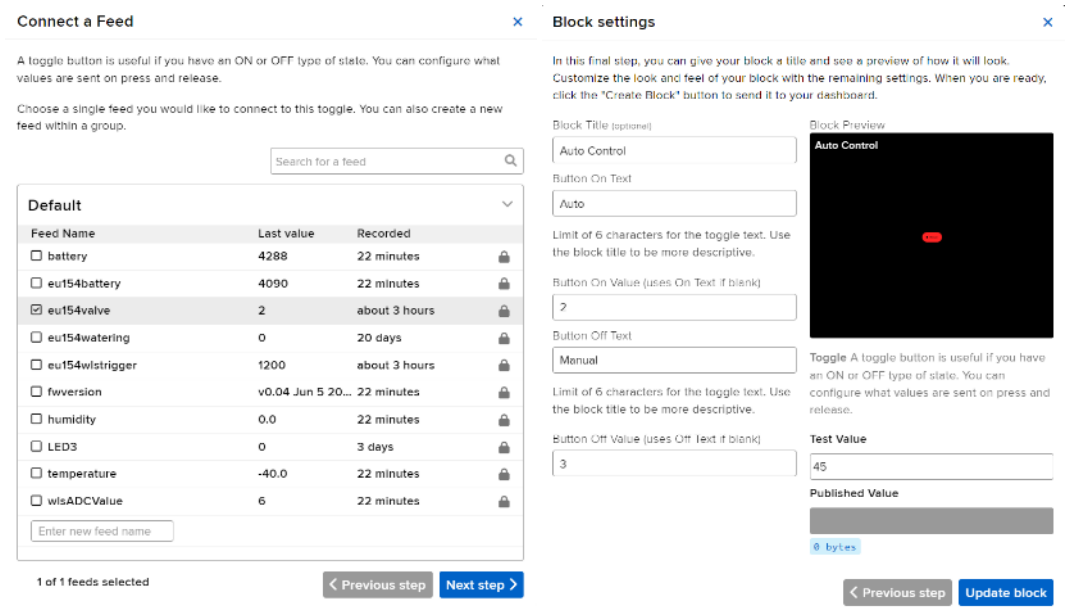

Figure 14. Create and configure widget to set manual or auto valve control

3. Trigger value for automatic valve control could be set using the slider widget associated with “eu154wlstrigger” feed as it is shown in Figure 15. Please note that maximum value for WLS sensor is 2500.

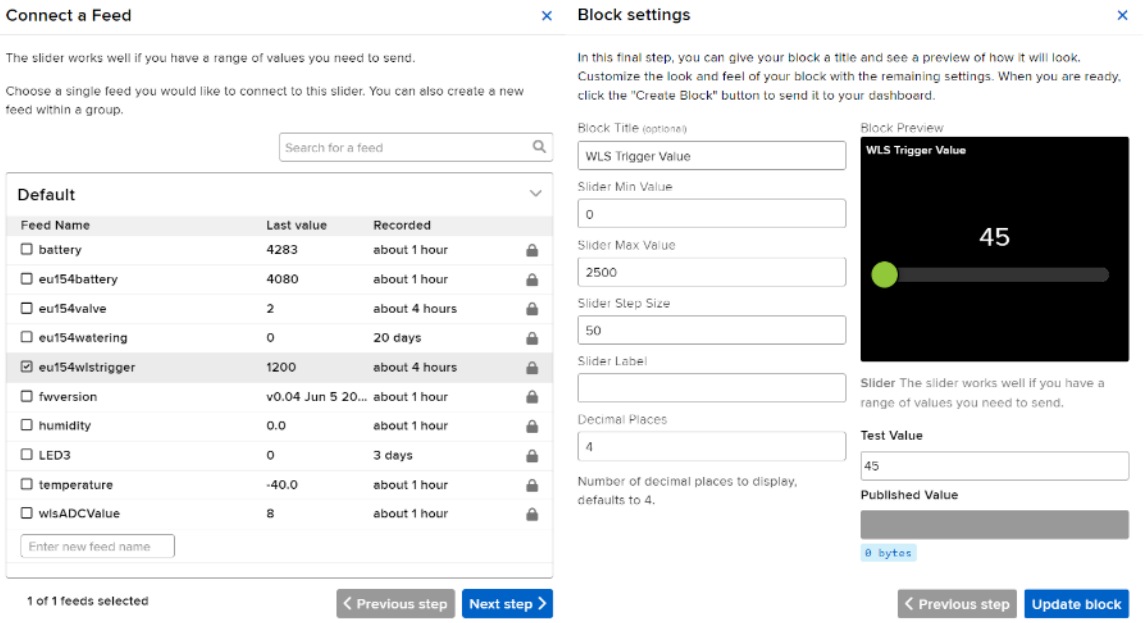

Figure 15. Trigger value setup for automatic valve control

4. EU154-1 solution can be used for watering control *or* flooding protection. Which feature is used controls eu154watering feed. Simple toggle button assosiated with eu154watering feed is needed in order to choose this basic function. The feed mentioned before can have two values: “0” for flooding control and “1” for watering as it is shown in Figure 16

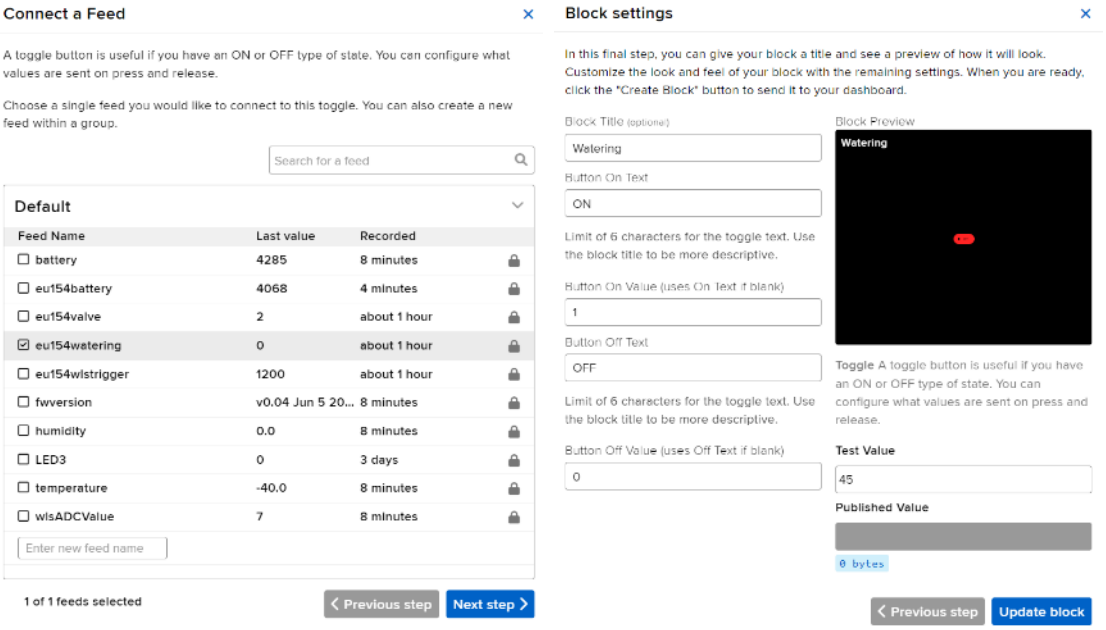

Figure 16. Valve control function selection. Watering or Flooding protection.

5. You can also add graphs to display eu154battery and wlsADCValue feed (from EU153-1 Smart Water Sensor solution kit)as it shown in Figure 17:

Figure 17. EU154-1 Control dashboard

5. Low Power and normal run Mode

The device has two operating modes – Low Power Mode and normal run Mode. By default, low power mode is enabled. Please note that in this mode all buttons except wake-up button (SW3) are disabled (!); e.g. SW2 does not trigger an MQTT update / WiFi Transmission in Low Power Mode.

Determining the operation mode

If the device is in normal run mode LED1 and LED2 will be lit displaying the valve state (Closed or opened) and it is possible to change the mode by pressing SW2.

If the device is in sleep mode it can wake up by pressing SW3 (wake up button). This initiates data update to the cloud and blinks the valve status on the LED1 or LED2.

When SW1 is set to On position and the battery is sufficiently charged, pressing SW3 does not do anything and/or LED1 or LED2 are not constantly lit, then the device is in Low Power Mode.

Disabling low power mode

1. Switch off the device
2. Press SW2 button and keep it pressed (!).
3. Switch on the device.
4. After 5-6 seconds LED1 will light on indicating that the mode has been changed.
5. Release SW2 button.

Enabling Low Power Mode

When the device is in normal run mode, **press SW2** and keep it pressed for **5 seconds** until **three LEDs are lit on**. After that, the device will reboot and will enter low power mode.

Persistency
Please note the operation mode, i.e. low power mode / normal run mode, is persistently stored in flash memory. Hence, it does *not* change when powering the device off or on again (!).

6. Valve control

Connect an appropriate bistatic ~9V_{dc} latching magnetic valve to J3, and check polarity for open / close mode. Please note that non-latching valves are not supported and will not work with this solution kit.

Simple wires can be to connect the valve. However, to avoid unwanted magnetic fields, we recommend to use twisted wires. Also the AWG should be sufficient to achieve low ohmic losses, keeping in mind that peak currents of several Ampere will happen.

Before usage, make sure in which position the valve is open / closed:

1. Connect the valve
2. Put the device in normal run mode
3. Press SW1 to close the valve. The process might take up to 30-40 seconds for the first time, as the capacitors need to be charged first, before sending the current pulse to the valve).
4. Check if the valve is closed (some valves may require water pressure to do so)
5. If the valve is opened, swap the polarity of the wiring on the J3 terminal block connecting the valve to the device.

Note that after boot valve will be set to the state that it had before switching the device off.

7. Software License and Disclaimers

Please note that the Renesas Software License agreement and disclaimers apply.

For more details please see here:
https://www.renesas.com/eu/en/document/oth/disclaimer002?language=en
and check out Section “General precautions…” at the end of this document.

8. Certifications

The EU154-1 Smart Water Actuator Solution Kit complies with the laws and regulations described below.

8.1 Europe CE

Hereby, Renesas Electronics Europe GmbH, declares that the EU154-1 Smart Water Actuator Solution Kit (EU154-SMTSHDNPOCZ) is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU (Radio Equipment Directive).

9. References

[1] Renesas Electronics, "EU154-1 - Hardware User's Guide" – r30an0429ed0101-eu154-1-smart-water-actuator-hw-um.pdf

[2] Renesas Electronics, "EU154-1 - Software User's Guide" - r30an0430ed0101-eu154-1-smart-water-actuator-sw-um.pdf

[3] Renesas Electronics, “EU154-1 Quick Start Guide” - r30qs0012ed0101-eu154-1-smart-water-actuator-qsg.pdf

Revision History

Rev.	Date	Description	
		Page	Summary
0.01	01 August 2023		Initial version.
0.02	09 August 2023		Updated component list in Overview
01.01	10.08.2023		Editorial changes, adding document numbers

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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