

SCK 2.3 Test Plan

Introduction

Four binary files are used for testing and flashing the Smart Citizen Kit:

1. SAMD21 Bootloader
2. ESP12-F firmware
3. SAMD21 testing firmware (customized with the Wi-Fi credentials provided by you)
4. SAMD21 production firmware.

Test firmware




The SAMD21 *test firmware* is provided to you via email. It's customised with the Wi-Fi credentials of your facilities.

Production firmware


The production firmware is provided in the Github Repository:

<https://github.com/fablabbcn/smartcitizen-kit-2x/releases/latest>

Please refer to the binaries named `sck23_air.*` for **SAMD21 Chip**:

 <code>SAM_firmware_sck23_air.bin</code>	196 KB
 <code>SAM_firmware_sck23_air.hex</code>	553 KB
 <code>SAM_firmware_sck23_air.uf2</code>	393 KB

And `ESP_firmware.bin` for the **ESP8266 Chip**:

 <code>ESP_firmware.bin</code>	411 KB
---	--------

Tools needed

There are two main possibilities to do this process:

- by using the **python toolset** provided (based on python)
- by using **atmel-studio** or similar (not provided)

Common needs:

- Computer running Linux or Windows OS (not tested, but should work with minor modifications)
- Micro USB cable
- Atmel-ICE programmer (<https://digkey.es/en/product-highlight/a/atmel/atmel-ice-programmer-debugger>)

Depending on your toolset, choose one of the following:

A) Tools needed for python toolset:

- Python>3.7
- Git
- PlatformIO (<https://platformio.org/platformio-ide>)
- OpenOCD (included with PlatformIO) or Atmel-Studio

B) Tools needed for Atmel-Studio toolset:

- Atmel-studio installed
- Python 3.7 installed

Steps

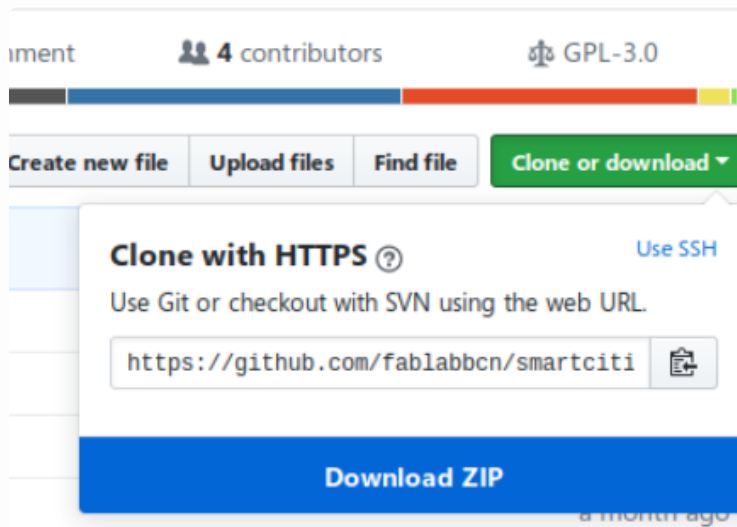
Cloning the firmware repository

This step is only needed for the python toolchain.

All the tools needed to flash the Smart Citizen Kit firmware are in our github repository. You can clone it by:

```
git clone --recursive git@github.com:fablabbcn/smartcitizen-kit-2x.git
```

Or you can download manually going to this link (<https://github.com/fablabbcn/smartcitizen-kit-2x>):



If you follow this method and download the ZIP file, you will also need to:

1. Download the bootloader repository from <https://github.com/fablabbcn/uf2-samdx1>
2. Uncompress the zip file in the firmware repository, inside `smartcitizen-kit-2x/bootloader/` folder
3. Rename the uncompressed zip folder to `uf2-samdx1`

It should look like this: `smartcitizen-kit-2x/bootloader/uf2-samdx1/`

Install requirements

This step is necessary for both toolset options.

In the firmware folder you downloaded, do:

```
cd smartcitizen-kit-2x/tools
pip install -r requirements.txt
```

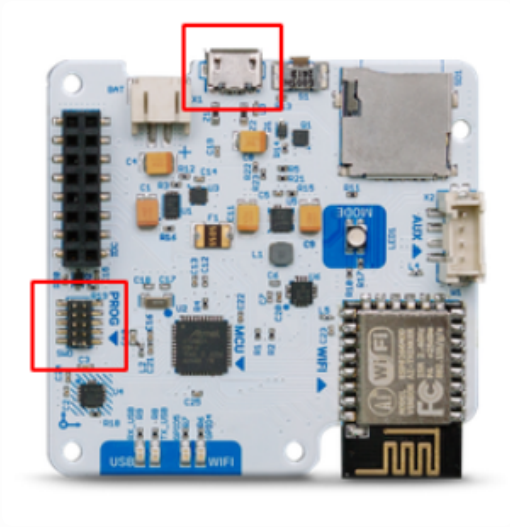
Depending on your platform, it may be that you need to type:

```
pip3 install -r requirements.txt
```

Bootloader

This step is necessary for both toolset options.

Flashing the bootloader can be done with OpenOCD (<https://openocd.org>) or with Atmel-Studio, depending on your preferences. You need an Atmel-ICE programmer connected to the SWD connector of the Smart Citizen Data Board. You will also need to provide power via the USB connector.



Option A: With Python toolset

In the firmware folder, run:

```
./make.py boot -v
```

Or:

```
python make.py boot -v
```

Or:

```
python3 make.py boot -v
```

All the commands above are equivalent. It only changes depending on your OS setup.

If no errors pop up, the LED on the Smart Citizen Kit should turn **green**. You are ready for the next step.

Option B: With Atmel-Studio toolset

For this, you will use the file `bootloader-sck2.3.bin` provided with the test firmware.

We do not provide specific instructions for flashing the bootloader with Atmel Studio. Please follow the application instructions.

If no errors pop up, the LED on the Smart Citizen Kit should turn **green**. You are ready for the next step.

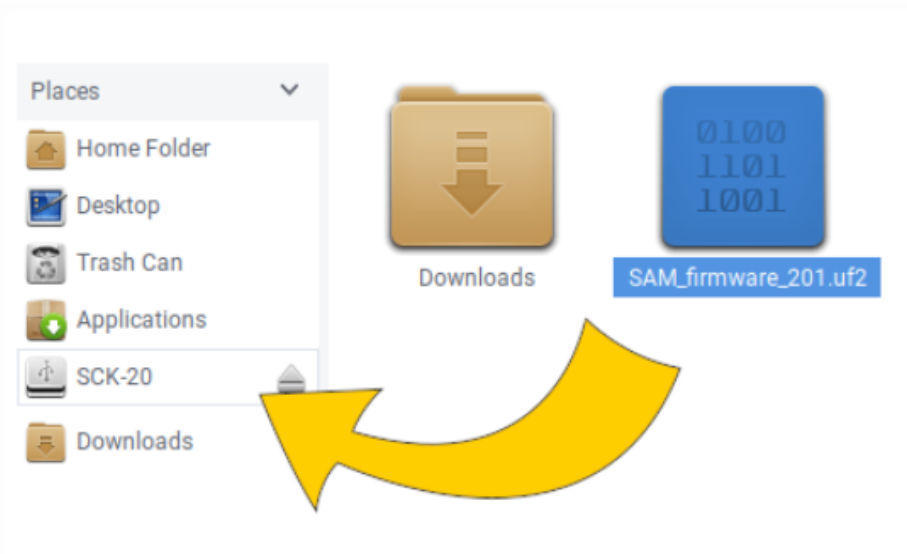
SAMD21 Testing firmware

For this step, you have received a testing firmware with **hardcoded Wi-Fi credentials** called: `SAM_firmware_test`

- Connect the Smart Citizen Kit with a micro USB cable to the computer
- Double click the reset button of the Smart Citizen Kit. The SCK should be green and a new flash-drive named `SCK-23` should appear on your computer



- Drag the firmware file over to the `SCK-23` drive. The LED should blink in **green** and, after some seconds, the device will reset and start the testing firmware



Before proceeding with the Test process, you need to upload the ESP firmware in the next step.

ESP Firmware

For running this script, you need to have *python3* installed in your computer.

- Go to the folder where you downloaded the Smart Citizen Kit firmware:

```
cd smartcitizen-kit-2x
```

- **Build** the firmware:

OPTION A:

If you are compiling the firmware:

- Only the first time, build the ESP firmware (**only once**):

```
python make.py build esp -v
```

OPTION B:

If you are not compiling the ESP firmware, and you are using the one provided via email, or from the firmware repository releases page, proceed as follows:

1. Copy the file to the `smartcitizen-kit-2x/bin/ESP_firmware.bin`
2. Proceed with the upload explained on the next step

- **Flash** the firmware

To upload the firmware to the microcontroller, connect the SCK to the computer via USB and run:

```
./make.py flash esp -v
```

Or:

```
python make.py flash esp -v
```

Or:

```
python3 make.py flash esp -v
```

If everything went OK, you are ready to start the test procedure on the SCK boards.

Test Procedure

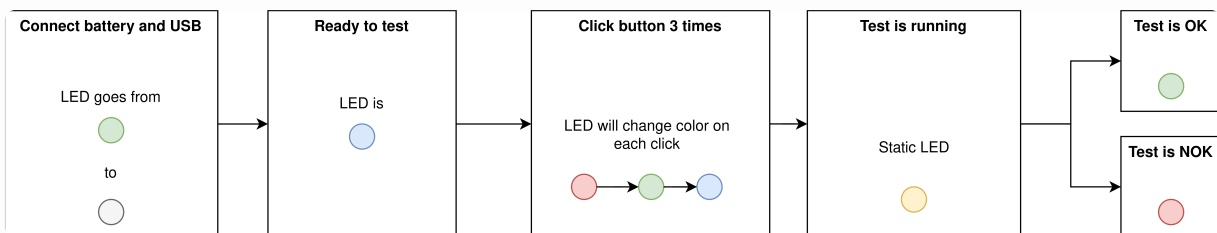
Requirements

For the test you will need:

1. SCK Urban Board 2.3 connected to the SCK Data Board
2. Sensirion SEN5X sensor connected to the SCK Urban Board 2.3
3. SHT35 grove module connected to the SCK Data board via Grove Auxiliary Port
4. Writable micro sd-card inserted in the SCK Data Board slot.
5. LiPo Battery **NOT fully charged, or NOT fully dead** connected to the SCK Data Board
6. USB cable connected to the SCK Data Board
7. A serial port to check debugging information
8. The Wi-Fi network active

Steps

1. Connect the **battery** and the **USB cable** to the SCK Data Board. The USB cable is only needed if you want to see debug logs
2. LED color should change from green to *breathing* white and finally blue when SCK is ready to start the test
3. **Click the button 3 times:** LED should cycle red-green-blue colors
4. Test is running. The LED will be **static YELLOW** during the tests.
5. When the test is finished, **LED will be green OK, red if there is a problem**



In case of problems, you can open a serial terminal while the SCK is running the test to see what's failing. Below you have an output of a successful test:

```
Waiting for ESP first boot...
May take some time due to flash formating
Please don't disconnect the SCK

*****
Starting SmartCitizenKit test...
SAM id: 105816085030524E572E3120FF12123C

Please click the button until the led is blue again...
Changing Led to red...
Changing Led to green..
Changing Led to blue..
Button and led test finished OK

Testing ESP and WIFI connectivity...
Wifi connection OK

Testing battery
Battery voltage: 4.23 V
Charger status: Fast charging
Battery test finished OK

Testing SDcard...
SDcard test finished OK

Testing Flash memory...
Found flash chip with 8388608 bytes of size.
Flash memory test finished OK

Testing SHT31 sensor...
Temperature: 25.38 C
Humidity: 41.82 %
SHT31 sensors test finished OK

Testing Light sensor...
Light: 254.00 lux
Light sensor test finished OK

Testing UVA sensor...
AS7331 UVA: 5.10 uW/cm2
UVA sensor test finished OK

Testing Pressure sensor...
MPL Barometric pressure: 102.17 kPa
Pressure sensor test finished OK
```



```
Testing Noise sensor...
Noise dBA: 41.53 dBA
Noise sensor test finished OK

Testing SEN5X PM sensor...
SEN5X PM 1.0: 0.00 ug/m3
SEN5X PM sensor test finished OK

Testing auxiliary I2C bus...
Ext SHT35 Temperature: 24.78 C
Auxiliary I2C bus test finished OK

Test results sent to platform

*****

Testing finished, all tests OK

*****
```

We have detected that **Flash Memory** test fails sometimes. Repeating the test normally fixes the issue.

Production firmware

If the test succeeded, you need to upload the SAMD21 production firmware. To do so, follow the next steps:

1. Go to the folder where you downloaded the Smart Citizen Kit firmware:

```
cd smartcitizen-kit-2x
```

2. **Build** the firmware:

OPTION A:

If you are compiling the firmware:

- Only the first time, build the SAMD21 firmware (**you only need to do this once, if successful**):

```
python make.py build sam -v --env sck23_air
...
SUCCESS
```

Make sure that you see a `SUCCESS` at the end.

OPTION B:

If you are not compiling the SAM firmware, and you are using the one provided via

email, or from the firmware repository releases page, proceed as follows:

1. Copy the `SAM_firmware_sck23_air.uf2` file to the `smartcitizen-kit-2x/bin/` folder
2. Proceed with the upload explained on the next step

3. Flash the SAM firmware to the board:

OPTION A:

If you want to use the command line:

```
```\npython make.py flash sam -v --env sck23_air\n\\``
```

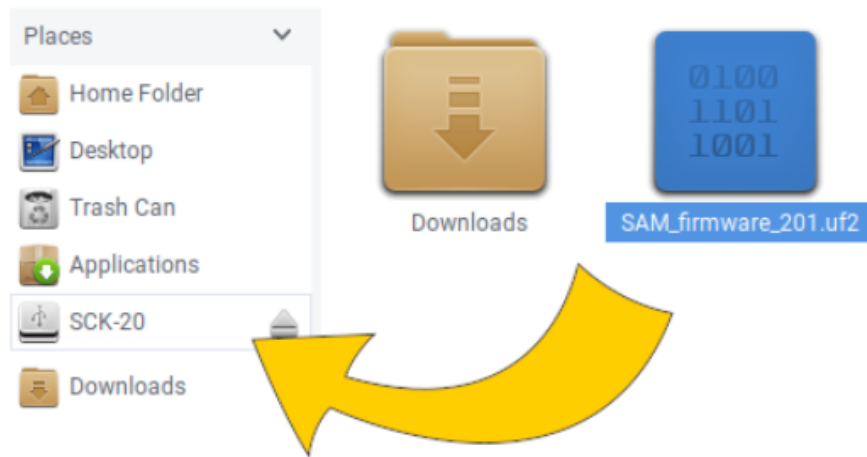
#### OPTION B:

If not:

- Double click the reset button of the Smart Citizen Kit. The SCK should be green and a new flash-drive named `SCK-23` should appear on your computer:



- Drag the production firmware file over to the `SCK-23` drive. The LED should blink in **green** and, after some seconds, the device will reset and start the testing firmware



Done!