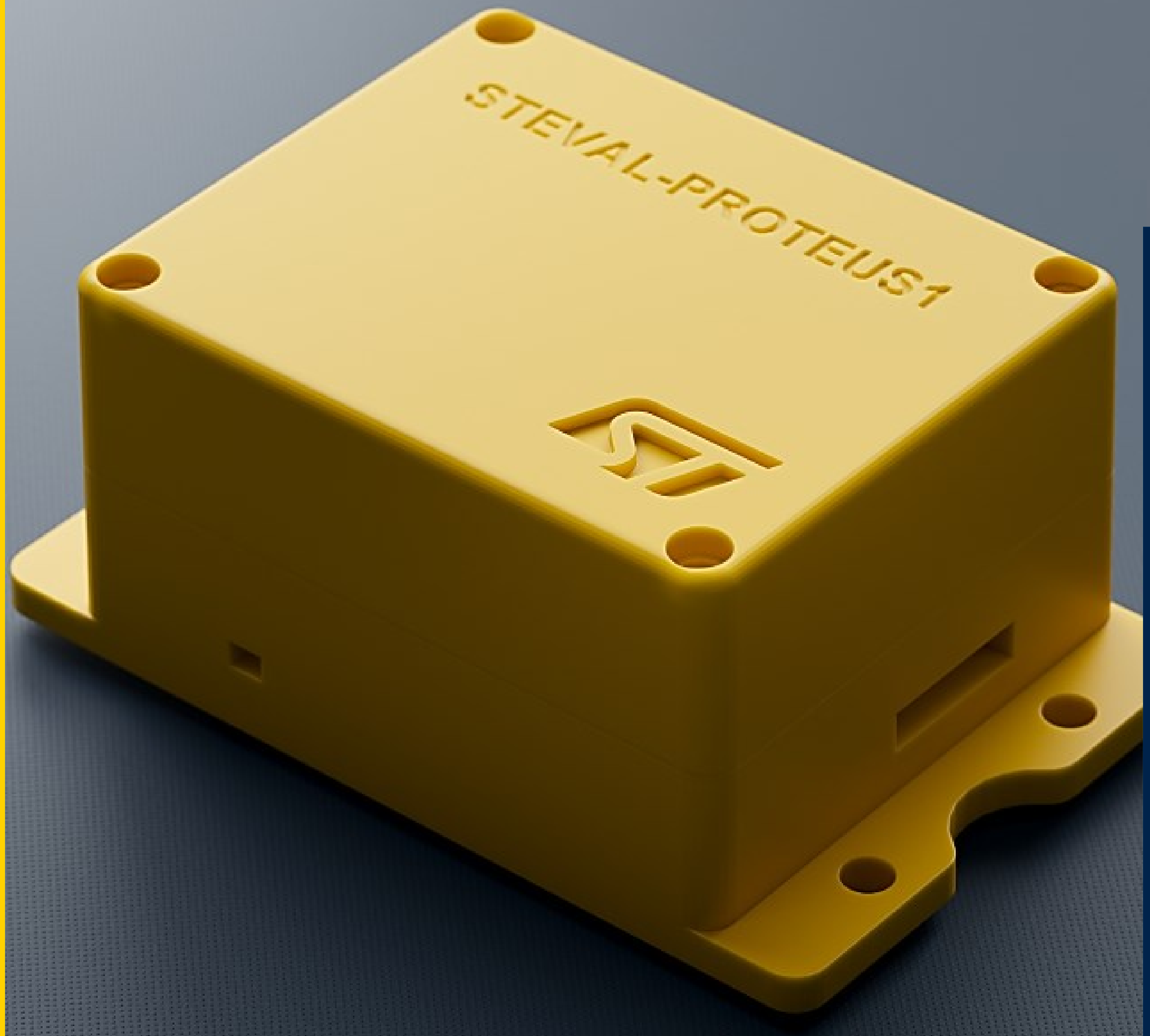

Quick Start Guide

STM32Cube Function Pack for Sensor Data Log and File Transfer over BLE and USB (FP-SNS-DATAPRO1 v1.1.0)

March 24

Agenda

1 Hardware and Software Overview

2 Setup & Demo Examples

3 Documents & Related Resources

4 STM32 Open Development Environment: Overview

1 - Hardware and Software Overview

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STEVAL-PROTEUS1

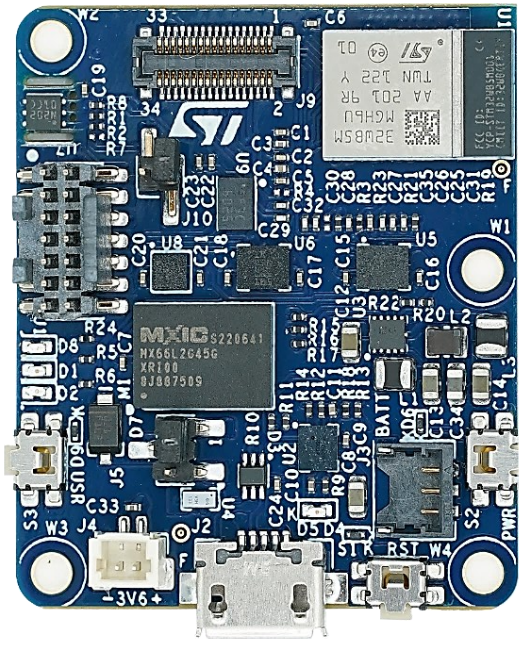
Hardware Overview

Industrial sensor evaluation kit for condition monitoring based on 2.4 GHz STM32WB5MMG module

The STEVAL-PROTEUS1 is an evaluation tool designed for temperature and vibration monitoring, based on a 2.4 GHz multiprotocol wireless SoC to address machinery for industrial applications. All components are exclusively mounted on the top side of the PCB to ensure an easy mounting on other equipment.

Key Features

- Kit content: the **STEVAL-PROTEUS** main board, Li-Po 3.7V 480mAh battery, plastic case and screws
- **STEVAL-PROTEUS**: STM32WB5MMG - ultra-low-power module, dual core 32-bit Arm Cortex-M4 MCU 64 MHz, Cortex-M0+ 32 MHz for real-time radio layer, with 1 Mbyte of flash memory, 256kbyte SRAM, and 2.4GHz RF supporting Bluetooth® Low Energy 5, 802.15.4, Zigbee 3.0, and Thread
- **IIS3DWB** - ultra-wide bandwidth up to 6 kHz, low noise, 3-axis digital accelerometer
- **ISM330DHCX** - iNEMO inertial module with machine learning core and finite state machine with digital output
- **IIS2DLPC** - high-performance ultra-low-power 3-axis digital accelerometer
- **STTS22H** - low-voltage, ultra-low-power, 0.5°C accuracy I²C/SMBus 3.0 temperature sensor
- Memory & Secure: 2Gb QSPI NOR flash memory for data storage, **STSAFE-A110** - secure element
- Power: **STBC02** - Li-Ion linear battery charger with LDO, **ST1PS02** - step-down converter with digital voltage selection
- HMI: 3 push-buttons (Reset, User, Power-on with battery), 4 LEDs (three user LEDs, one STBC02 LED status)
- Flexible power supply options – Li-Po battery, USB power, and primary battery
- Connectors: SWD connector for debugging and programming capability, 34-pin expansion connector compatible with STMOD+



Contains:

FCC ID: YCP-STM32WB5M001

IC: 8976A-STM32WB5M01

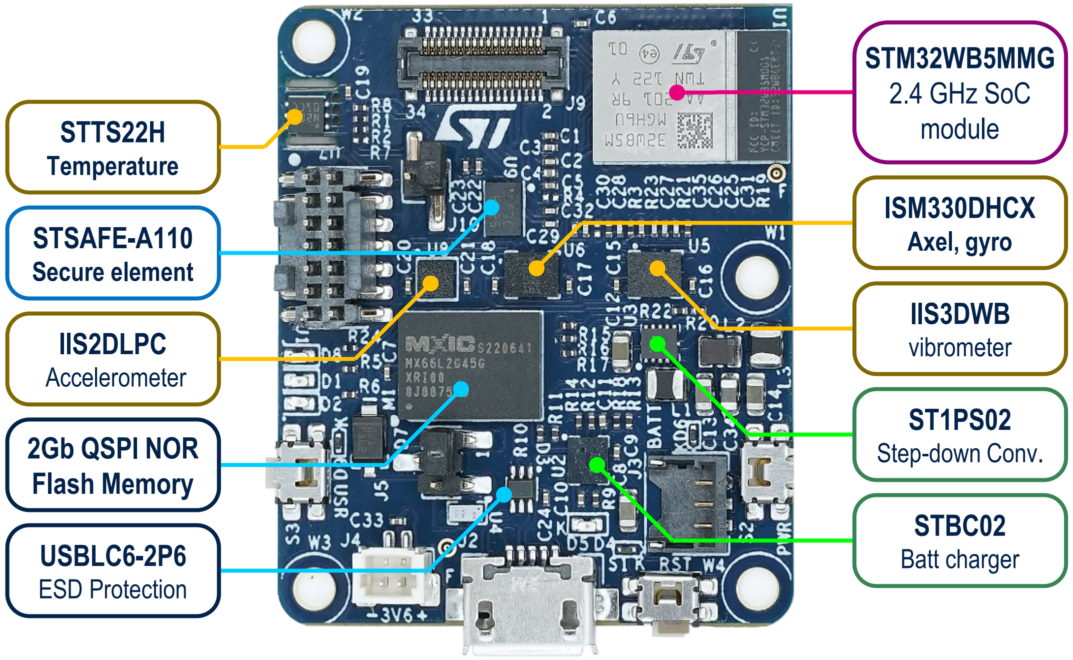
Latest info available at:

https://www.st.com/en/evaluation-tools/steval-proteus1.html

STEVAL-PROTEUS1

Hardware Devices Topology

Top View



STTS22H Temperature

STSAFE-A110 Secure element

IIS2DLPC Accelerometer

2Gb QSPI NOR Flash Memory

USBLC6-2P6 ESD Protection

STM32WB5MMG 2.4 GHz SoC module

ISM330DHCX Axel, gyro

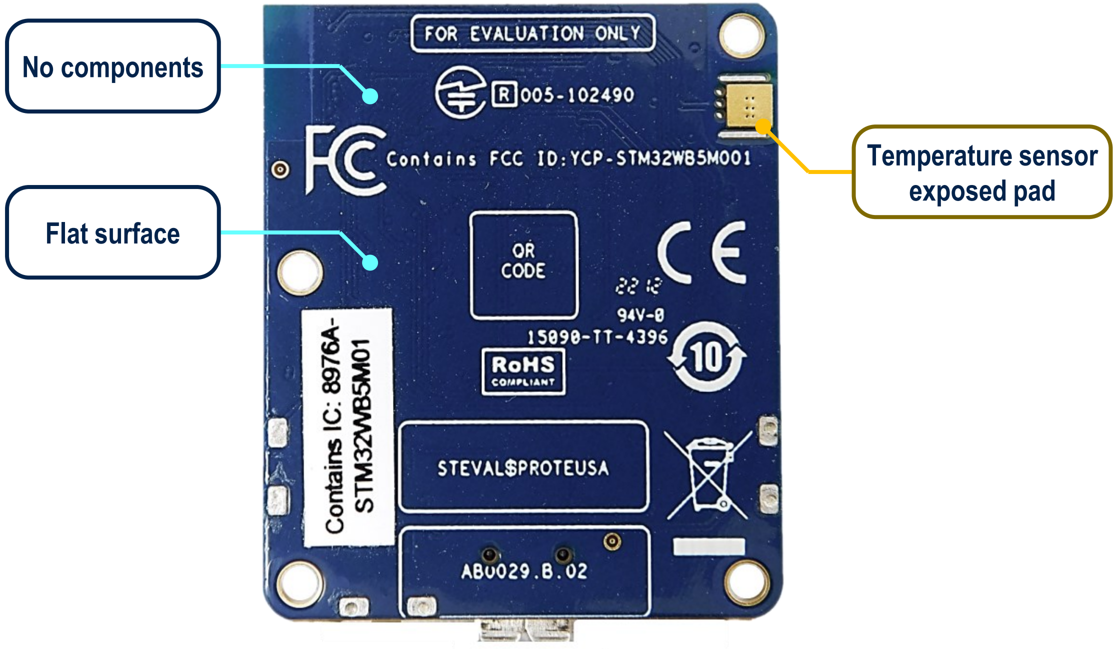
IIS3DWB vibrometer

ST1PS02 Step-down Conv.

STBC02 Batt charger

FR4 - 4 Layer – 29.25 x 34.97 x 1.1 mm

Bottom View



No components

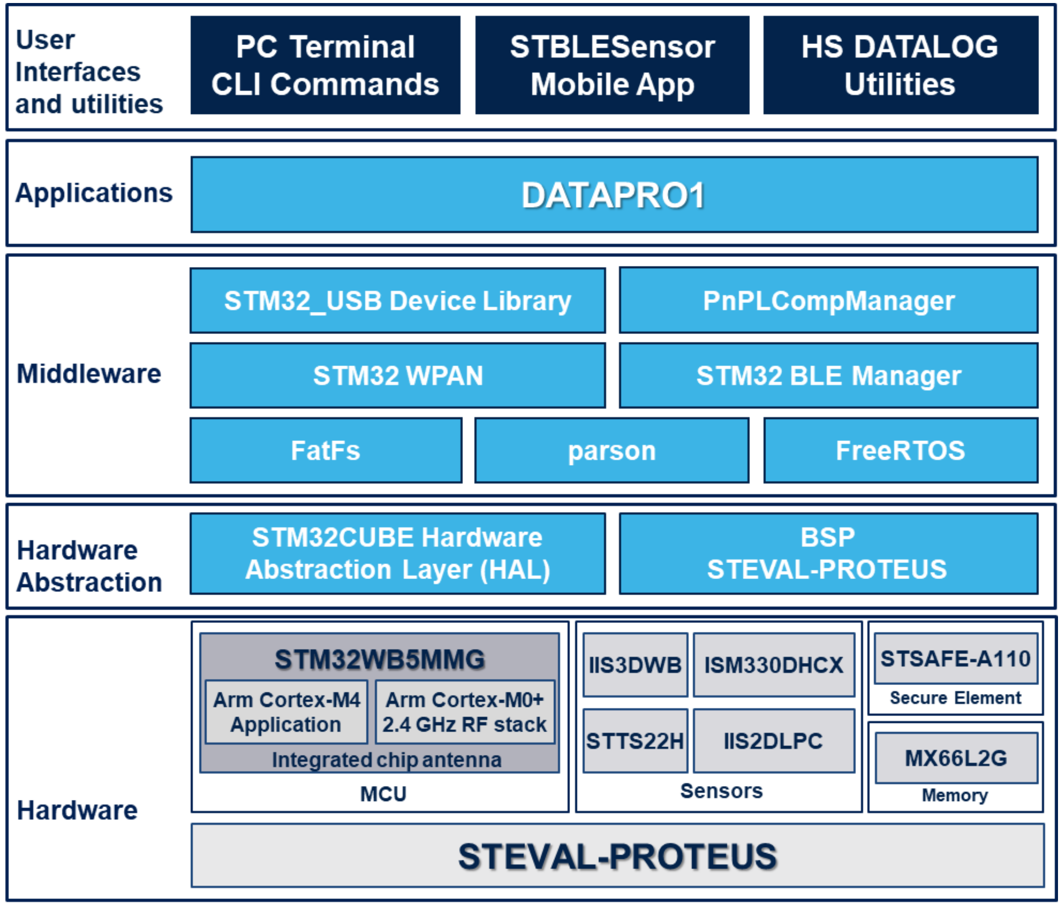
Flat surface

Temperature sensor exposed pad

FP-SNS-DATAPRO1
Software Overview

Key Features

- ❑ Function Pack designed for **STEVAL-PROTEUS1**
- ❑ Data logging of the embedded sensors, supporting wired (USB) or wireless (BLE) connectivity file transfer.
- ❑ **Wired data log** on PC folders through USB and CLI commands on terminal console. The STEVAL-PROTEUS1 is configured as USB-WCID Device, and it is supported by data capture software suite.
- ❑ **Wireless data log** on FatFs volume created into the embedded NOR flash memory through the STBLESensor app that also support transfer of acquisition data log files to the smart mobile device.
- ❑ **USB Mass Storage Device** to expose FatFs volume created into the embedded NOR flash memory.
- ❑ Compatible with STBLESensor (Android 5.2 and above) for:
  - Sensor and System settings, data logging, file transfer from embedded NOR flash memory to smart mobile device
  - Battery monitoring
  - FUOTA
- ❑ Embedded software, middleware, and drivers, including:
  - FreeRTOS™ third-party RTOS kernel for embedded devices
  - FatFS: third-party for FAT file system module for small embedded systems
  - PnPLCompManager to handle PnP-like commands and properties generated through a digital twin definition language (DTDL)
  - STEVAL-PROTEUS BSP drivers



User Interfaces and utilities: PC Terminal CLI Commands | STBLESensor Mobile App | HS DATALOG Utilities

Applications: DATAPRO1

Middleware: STM32_USB Device Library | PnPLCompManager | STM32 WPAN | STM32 BLE Manager | FatFs | parson | FreeRTOS

Hardware Abstraction: STM32CUBE Hardware Abstraction Layer (HAL) | BSP STEVAL-PROTEUS

Hardware:

MCU: STM32WB5MMG – Arm Cortex-M4 Application | Arm Cortex-M0+ 2.4 GHz RF stack | Integrated chip antenna

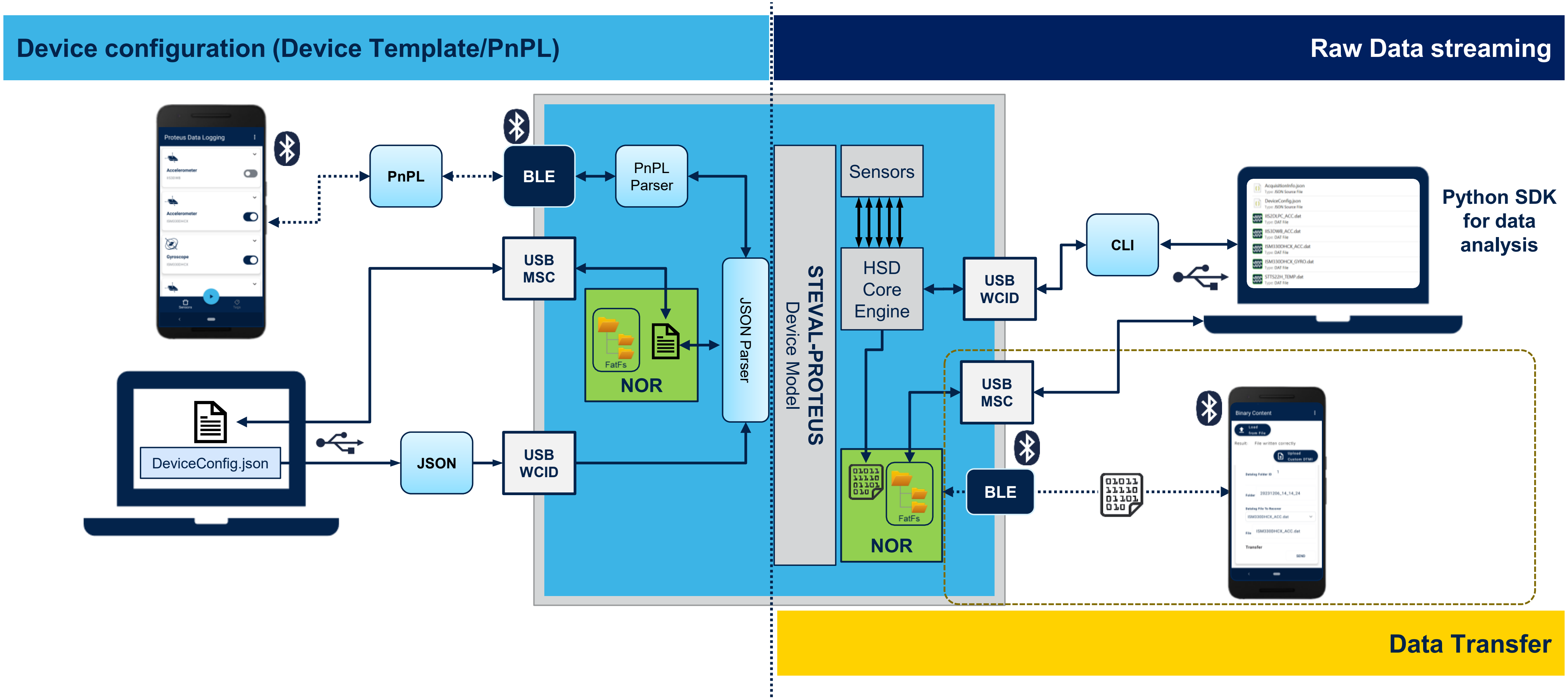
Sensors: IIS3DWB | ISM330DHCX | STTS22H | IIS2DLPC

STSAFE-A110 Secure Element

Memory: MX66L2G

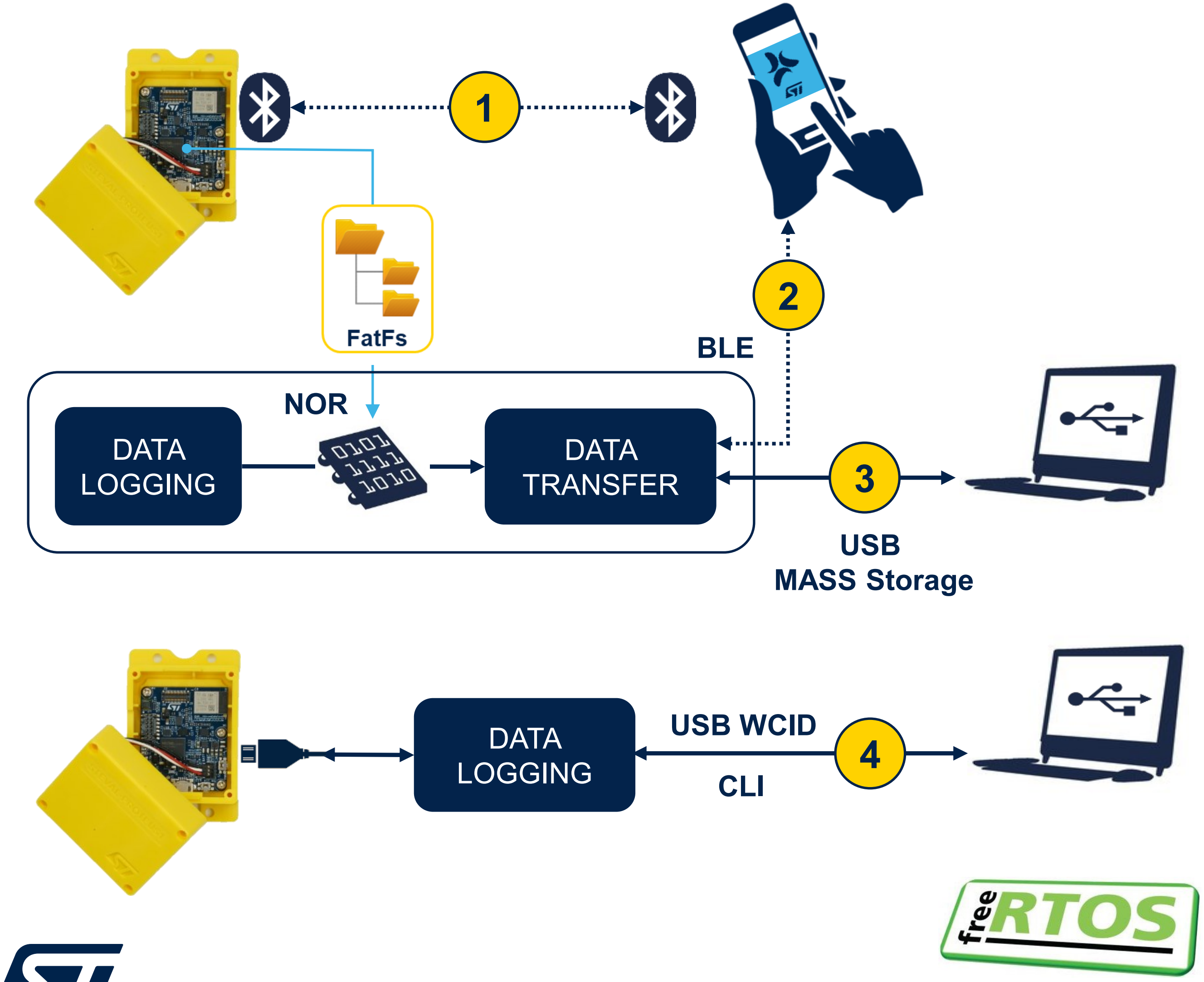
STEVAL-PROTEUS

HS-DATALOG demonstration



FP-SNS-DATAPRO1

FW package for Sensor data logging and transfer over BLE or USB



1 On-Board Data Logging

- Controlled by STBLESensor app.
- Data storage into built-in NOR Flash Memory.

2 BLE File Transfer

- Controlled by STBLESensor app.
- Transfer file stored in NOR Flash Memory to mobile device folder.

3 USB Mass Storage Device

- Proteus recognized as USB Mass Storage device, FatFs formatted.

4 USB Data Logging

- Proteus recognized as USB WCID Device CLI used to start/stop, send parameters (configuration json file, acquisition time).
- Data stored into PC folder.

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2 - Setup & Demo Examples

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Hardware Prerequisites

a) 1 STEVAL-PROTEUS1 evaluation kit
   with 1 USB-A to USB-microB cable

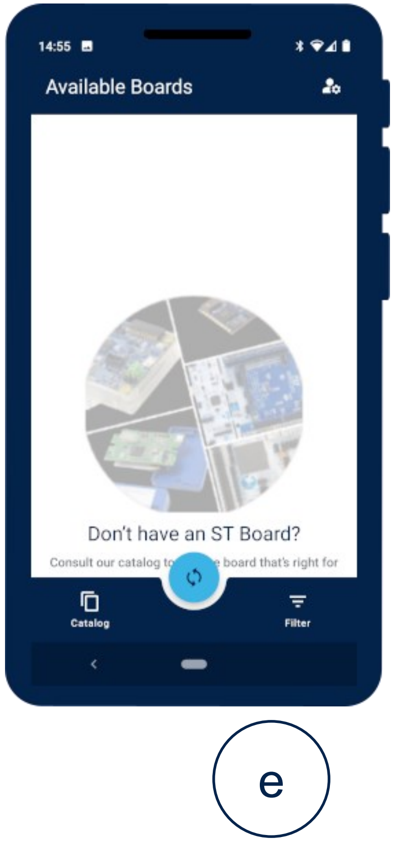
b) 1 STLINK-V3 with 1 USB-A to USB-microB cable
   or 1 STLINK-V3MINIE with USB-A to USB-C cable

c) 1 STDC14 to STDC14 cable (provided with STLINK)

d) Laptop/PC with Windows 7, 8 or 10

e) 1 smartphone with STBLESensor App (v5.2.1 or higher)

STEVAL-PROTEUS1


14:55

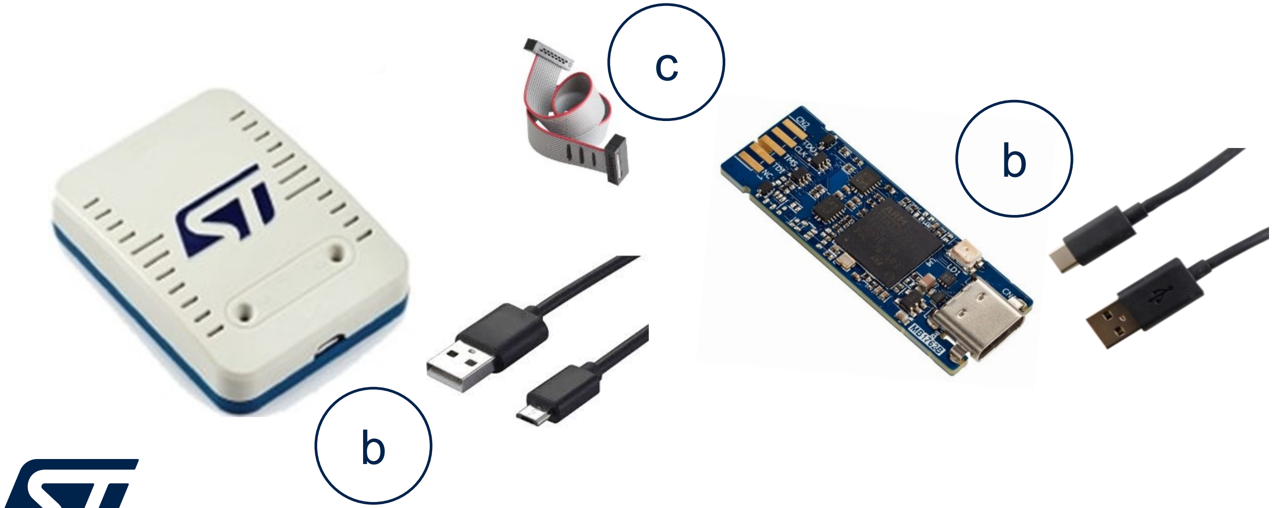
Available Boards

Don't have an ST Board?

Consult our catalog to ... board that's right for

Catalog

Filter



Software and Other Prerequisites

a) STM32CubeProgrammer Software

- Download and install STM32CubeProgrammer.

b) FP-SNS-DATAPRO1

- Download the FP-SNS-DATAPRO1 package from www.st.com, copy the .zip file contents into a folder on your PC. The package contains binaries and source code with project files (STM32CubeIDE , IAR EWARM and Keil MDK) based on STEVAL-PROTEUS1.

c) STBLESensor App

- Download and install STBLESensor App (for Android, use v5.2.1 or above).

d) Python

- To save, plot and elaborate data, Python utility scripts are available.
  (use Python v3.10 or above)

STEVAL-PROTEUS comes with another firmware as default.
Please, follow the instructions in the next slides to update the firmware.

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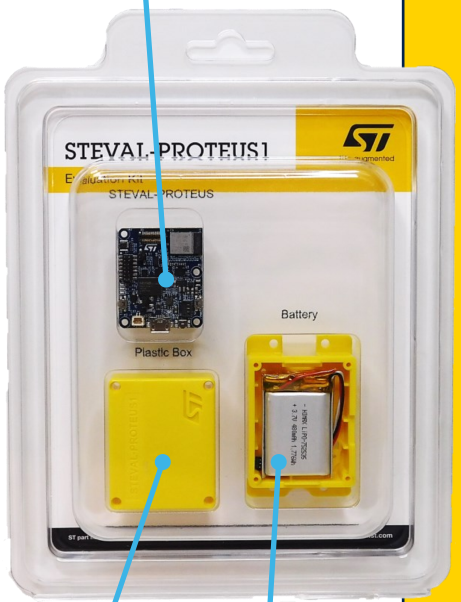
STEVAL-PROTEUS1
Unboxing



STEVAL-PROTEUS

Plastic Case and screws

HiMAX Li Polymer 3.7V 480mAh 752535 Battery

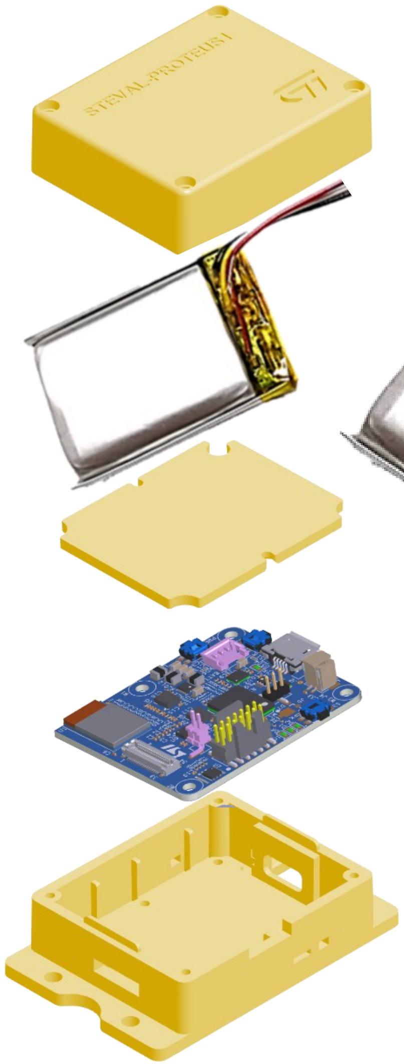
5
Lock the top case to the bottom one with the last four screws included in the kit.

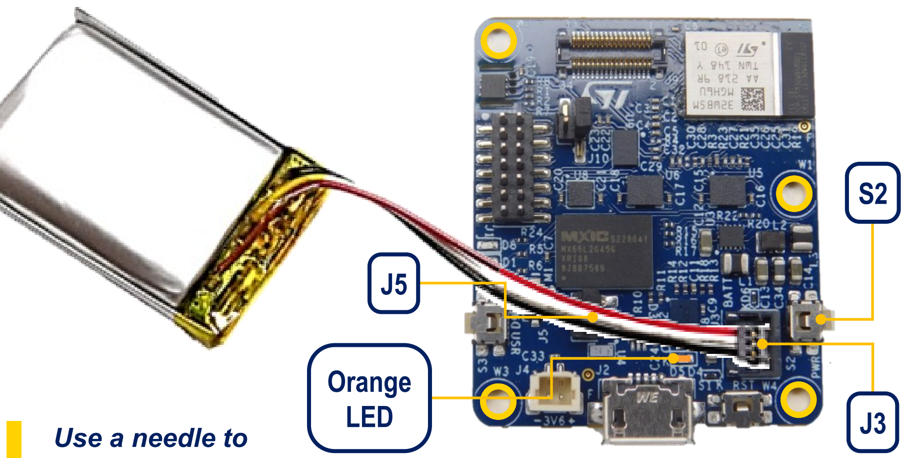
4
Plug the battery connector on J3. Connect 1-2 of J5 with a cap.

3
Put the cover on the battery and close it using two screws.

2
Put the Li-Po battery in the top case, insert the battery cable into the dedicated hole.

1
Fix the main board to the case bottom with the four screws included in the kit.





Use a needle to access the buttons behind the holes on the sides of the case.

POWER ON
Push and hold the power button (S2) for at least 3 sec. (HW Feature)

POWER OFF
Push and hold the power button (S2) for at least 3 sec. (SW Feature)

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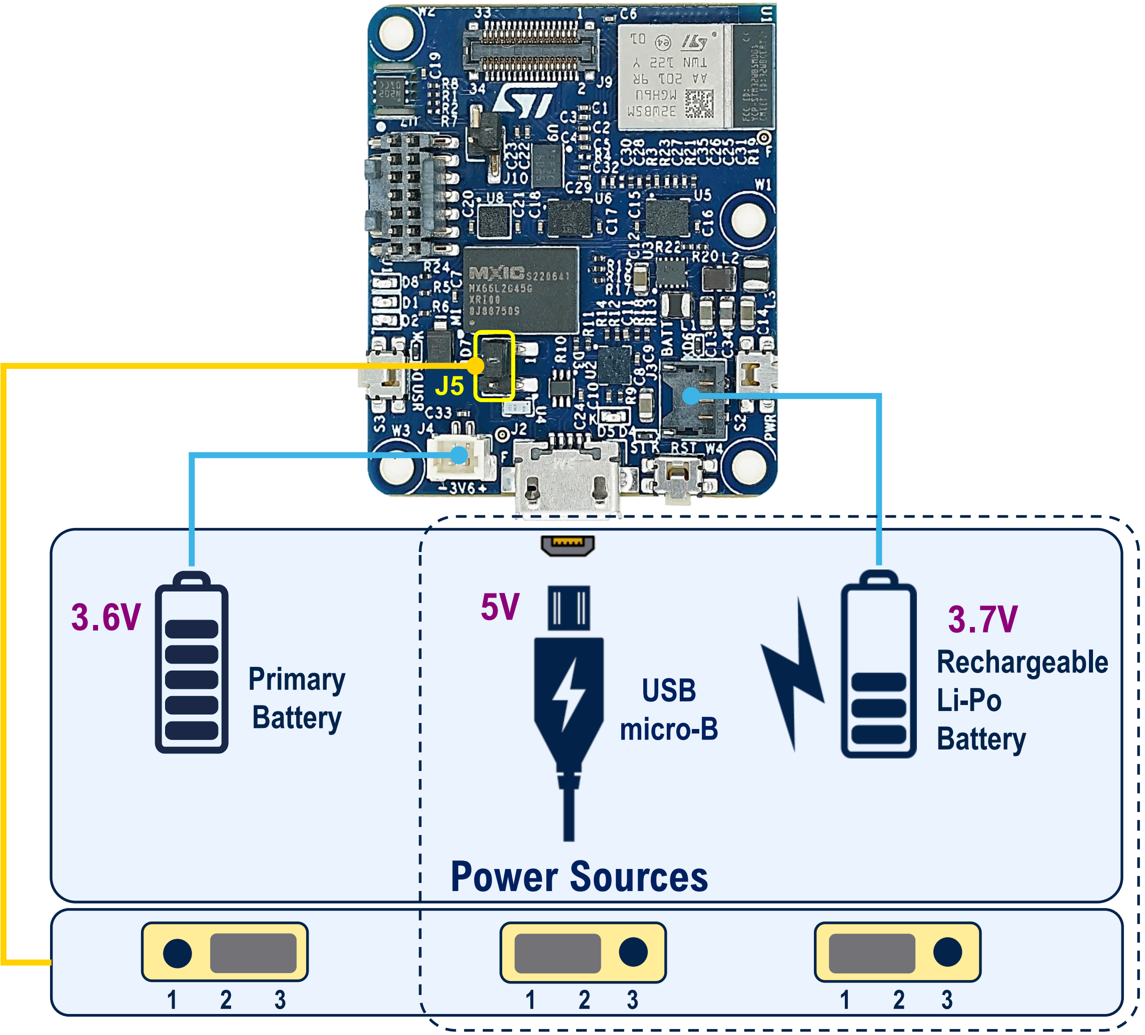
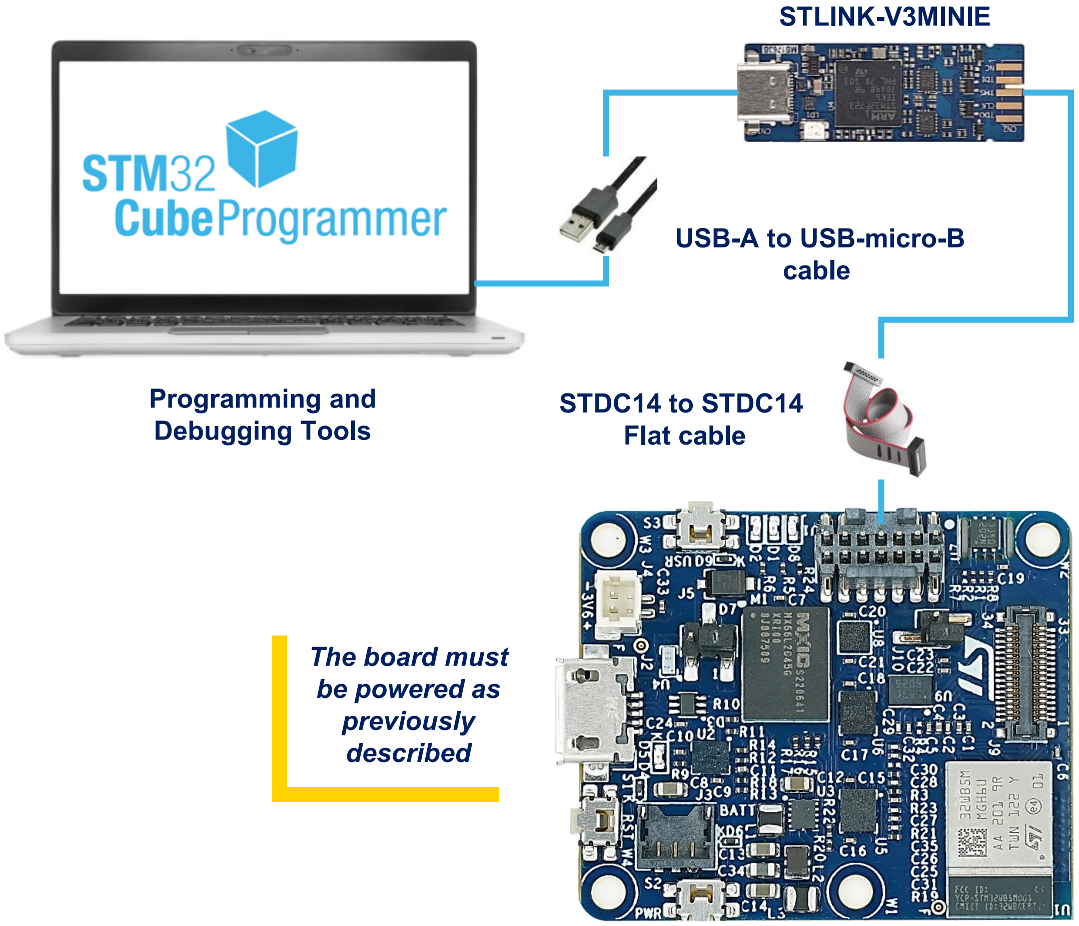
STEVAL-PROTEUS
Power Settings

- Acting on J5 electrical jumper, two power path are possible to route the source to the DC/DC:
  - Through the battery charger (the following sources can coexist)
    - Rechargeable Li-Po battery (3.7 VDC) (included in the kit)
    - USB (5 VDC) (also used to recharge the Li-Po battery)
  - Directly
    - Primary battery (3.6 VDC) (not included in the kit)



STEVAL-PROTEUS
Wired Programming



STLINK-V3MINIE

USB-A to USB-micro-B cable

Programming and Debugging Tools

STDC14 to STDC14 Flat cable

The board must be powered as previously described

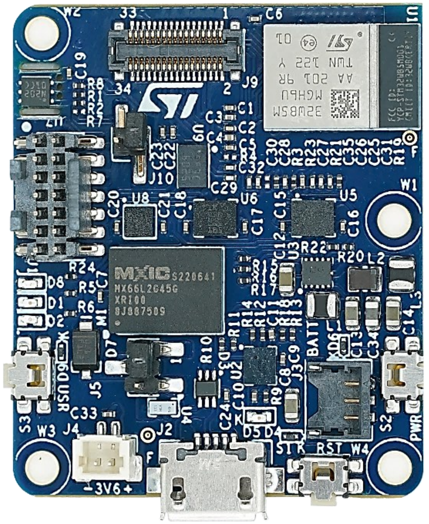
As soon as you get the STEVAL-PROTEUS out of the box, it could be already programmed with a BLE stack to be updated to run the FP-SNS-DATAPRO1.

Please, act as following:

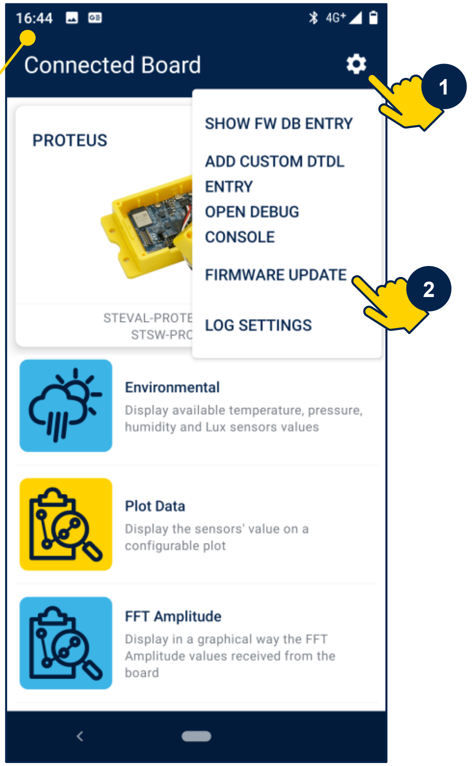
- Supply the STEVAL-PROTEUS
- Connect the STEVAL-PROTEUS to the PC through the STLINK-V3 compact in-circuit debugger and programmer for STM32
- Launch the STM32CubeProgrammer software on the PC
- Proceed to download (respect the order) the BLE wireless stack and the application firmware
  (both binaries are provided with the FP-SNS-DATAPRO1 software package)
  - stm32wb5x_BLE_Stack_full_fw.bin (V1.17.0)
    (@ 0x080CE000)
  - FP-SNS-DATAPRO1_1_1_0.bin
    (@ 0x08007000)
  - PROTEUS_BLE_FUOTA_RFWKPCLK_HSE_DIV1024.bin (optionally)
    (@ 0x08000000)

STEVAL-PROTEUS

Wireless Programming (FUOTA)



The board must be powered as previously described



Environmental

Display available temperature, pressure, humidity and Lux sensors values

Plot Data

Display the sensors' value on a configurable plot

FFT Amplitude

Display in a graphical way the FFT Amplitude values received from the board

As soon as you get the STEVAL-PROTEUS out of the box, it is already programmed with STSW-PROTEUS software package.

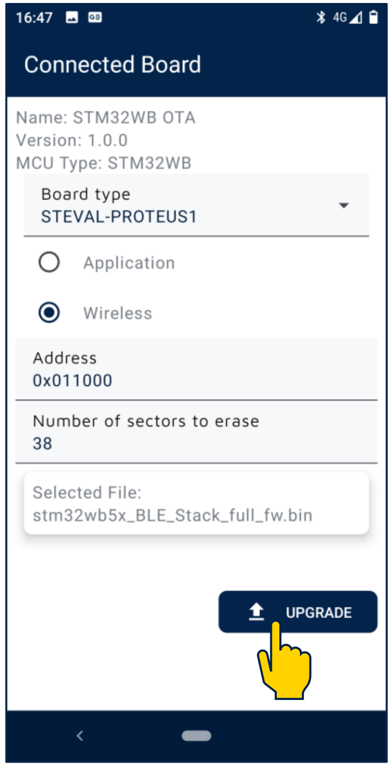
In this case you can perform a firmware update over-the-air to update stack and application firmware.

Please, act as following:

- Supply the STEVAL-PROTEUS
- Connect the smart mobile device running the STBLESensor app to the STEVAL-PROTEUS via BLE
- Tap on the gear menu to launch the firmware update
- Proceed to update (respect the order) the BLE wireless stack and the application firmware
  (both binaries are provided with the FP-SNS-DATAPRO1 software package and must be already copied into the smart mobile device)
  - stm32wb5x_BLE_Stack_full_fw.bin (V1.17.0)
  - FP-SNS-DATAPRO1_1_1_0.bin

STEVAL-PROTEUS

BLE Wireless Stack FUOTA



Connected Board

Name: STM32WB OTA
Version: 1.0.0
MCU Type: STM32WB

Board type
STEVAL-PROTEUS1

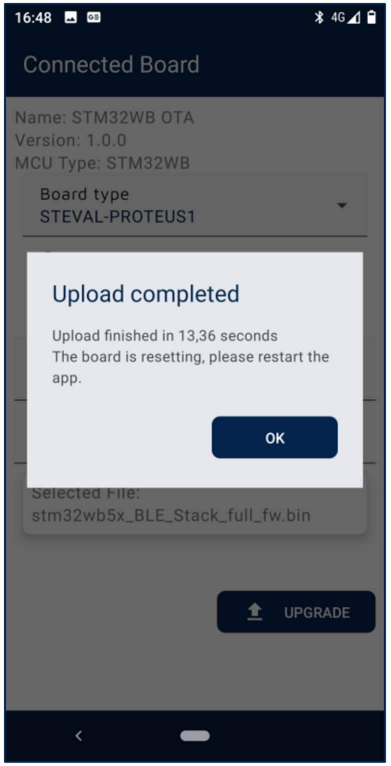
○ Application

● Wireless

Address
0x011000

Number of sectors to erase
38

Selected File:
stm32wb5x_BLE_Stack_full_fw.bin



Connected Board

Name: STM32WB OTA
Version: 1.0.0
MCU Type: STM32WB

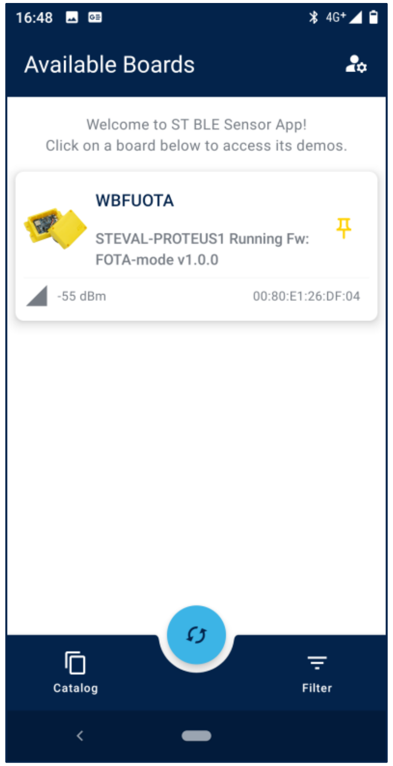
Board type
STEVAL-PROTEUS1

Upload completed

Upload finished in 13,36 seconds
The board is resetting, please restart the app.

Selected File:
stm32wb5x_BLE_Stack_full_fw.bin

Updating the BLE stack deletes the application firmware.
Only the OTA application will remain untouched.



Available Boards

Welcome to ST BLE Sensor App!
Click on a board below to access its demos.

WBFUOTA

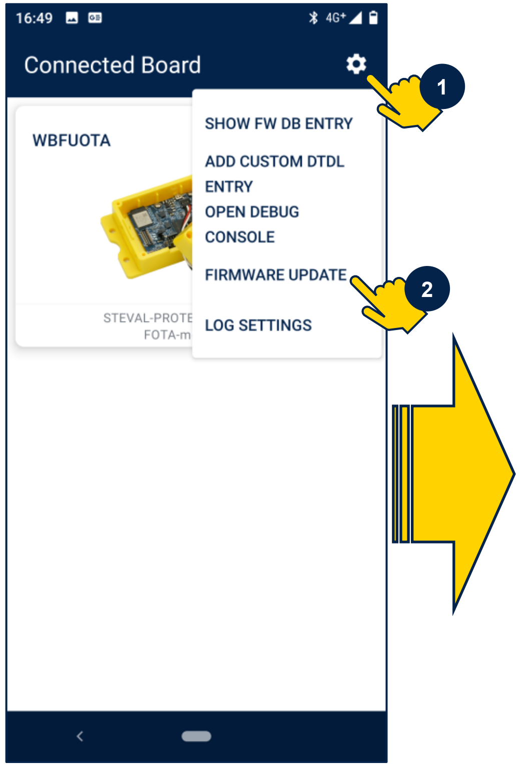
STEVAL-PROTEUS1 Running Fw:
FOTA-mode v1.0.0

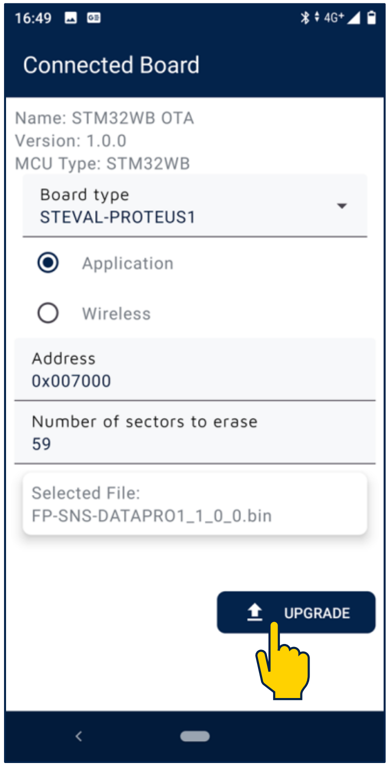
-55 dBm

00:80:E1:26:DF:04

STEVAL-PROTEUS

Application binary FUOTA





Name: STM32WB OTA
Version: 1.0.0
MCU Type: STM32WB

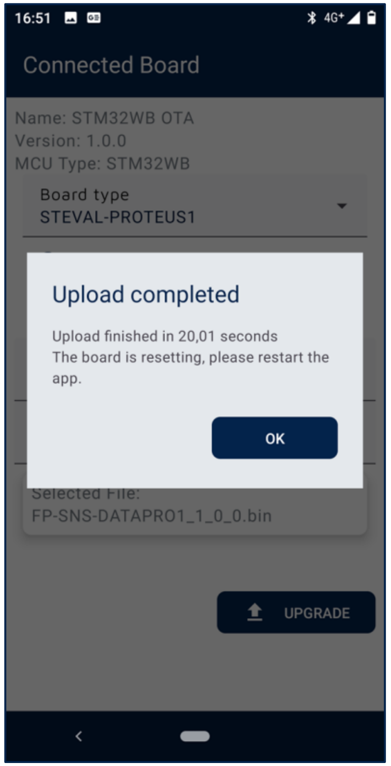
Board type
STEVAL-PROTEUS1

● Application
○ Wireless

Address
0x007000

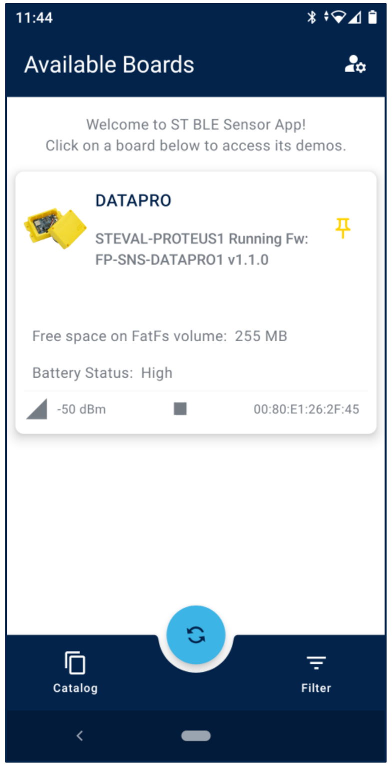
Number of sectors to erase
59

Selected File:
FP-SNS-DATAPRO1_1_0_0.bin



Upload completed

Upload finished in 20,01 seconds
The board is resetting, please restart the app.



Welcome to ST BLE Sensor App!
Click on a board below to access its demos.

DATAPRO
STEVAL-PROTEUS1 Running Fw:
FP-SNS-DATAPRO1 v1.1.0

Free space on FatFs volume: 255 MB

Battery Status: High

-50 dBm 00:80:E1:26:2F:45

Now the STEVAL-PROTEUS can be discovered that runs the FP-SNS-DATAPRO1

Your mobile device may already be reconnected to STEVAL-PROTEUS so it is not shown as an available board. In this case you need to disable and enable the bluetooth on your mobile device to detect the board.

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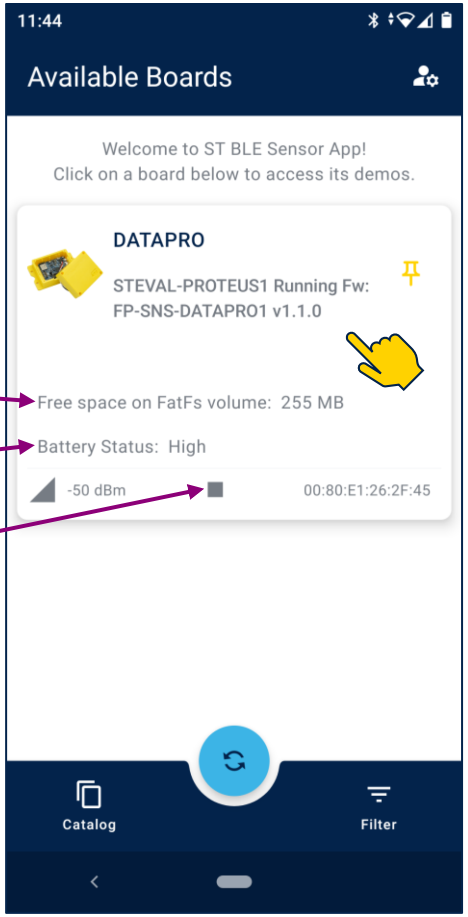
FP-SNS-DATAPRO1

Discover the board and connect via STBLESensor app

While in BLE advertising, the STEVAL-PROTEUS can be discovered by the STBLESensor app.
Into the related tab, you can see a few information:

Custom Option Bytes

- Available Memory
- Battery Status
- Data Logging Status



Available Boards

Welcome to ST BLE Sensor App!
Click on a board below to access its demos.

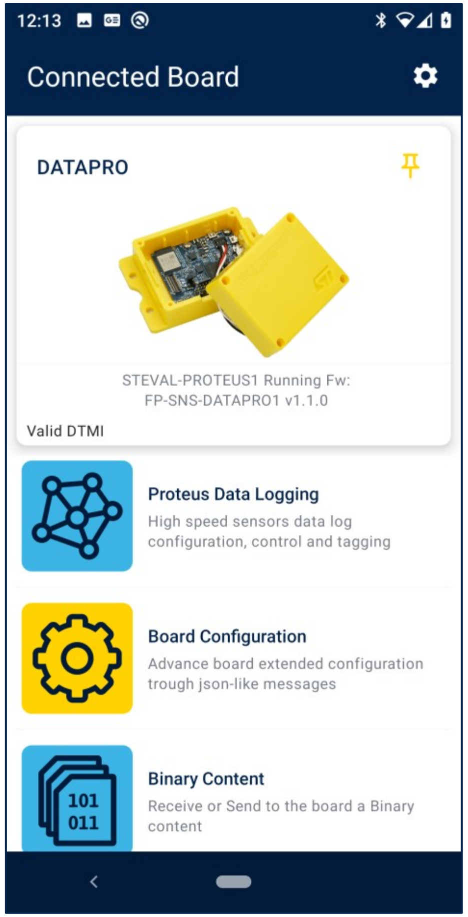
DATAPRO

STEVAL-PROTEUS1 Running Fw:
FP-SNS-DATAPRO1 v1.1.0

Free space on FatFs volume: 255 MB

Battery Status: High

-50 dBm 00:80:E1:26:2F:45



Connected Board

DATAPRO

STEVAL-PROTEUS1 Running Fw:
FP-SNS-DATAPRO1 v1.1.0

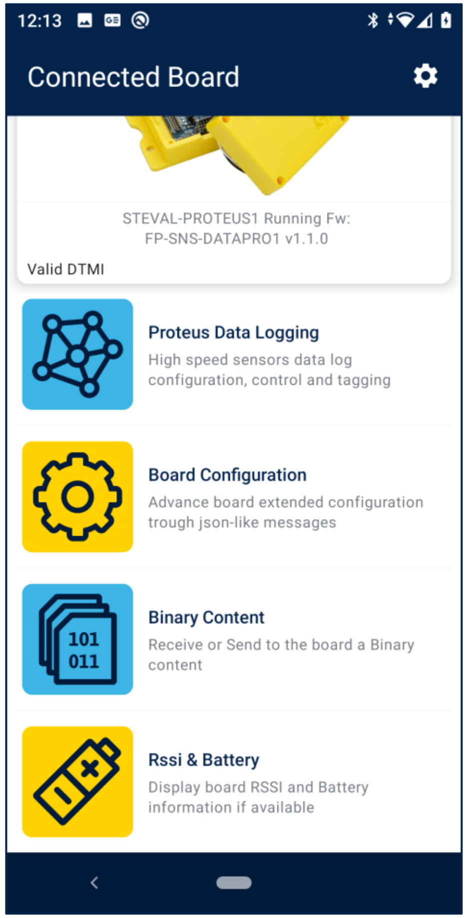
Valid DTMI

Proteus Data Logging
High speed sensors data log configuration, control and tagging

Board Configuration
Advance board extended configuration trough json-like messages

Binary Content
Receive or Send to the board a Binary content

Available Demos



Connected Board

STEVAL-PROTEUS1 Running Fw:
FP-SNS-DATAPRO1 v1.1.0

Valid DTMI

Proteus Data Logging
High speed sensors data log configuration, control and tagging

Board Configuration
Advance board extended configuration trough json-like messages

Binary Content
Receive or Send to the board a Binary content

Rssi & Battery
Display board RSSI and Battery information if available

2.1 – DATAPRO1 Demonstration

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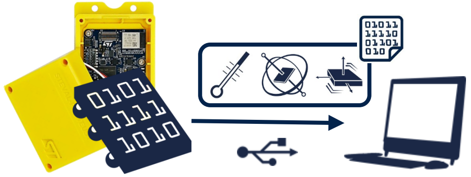
2.1.1 - Command Line Interface example: USB sensor data streaming



Data Logging

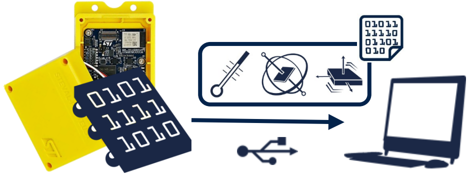
cli installation

	cli
Windows	No installation

Linux 64 bit (*)	Move to:
	`Utilities/SwUtilities/HS_Datalog/cli_example/linux_setup`
	Launch:
	`bash setup.sh`

Raspberry Pi 3 (*)	Move to:
	`Utilities/SwUtilities/HS_Datalog/cli_example/raspberry_setup`
	Launch:
	`bash setup_rpi3b.sh`

(*) To avoid any possible issues while executing the script in Linux environment, we recommend using dos2unix to properly reformat your files. So, please, install it on your system: `sudo apt-get install dos2unix`

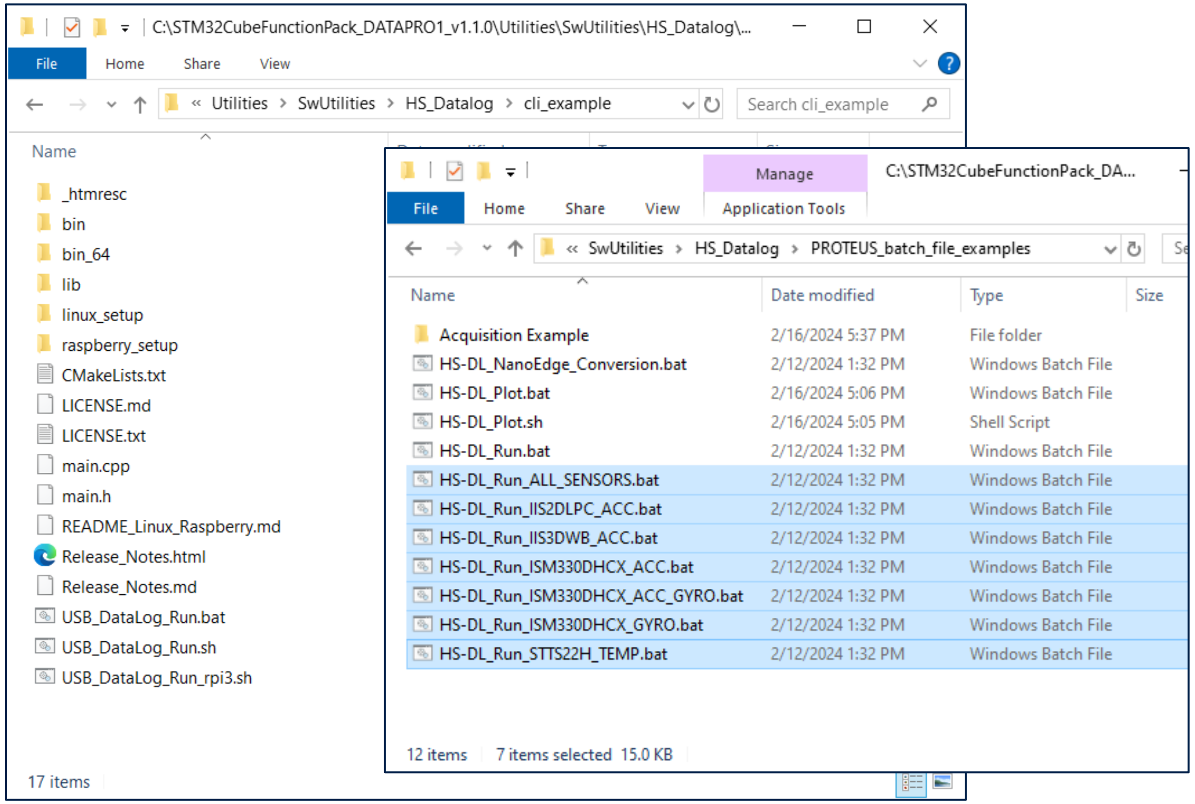


USB Data Logging

cli_example overview

- You can run the example after connecting the STEVAL-PROTEUS to a PC via USB-A to USB-microB cable.
- The command line example is in the 'Utilities' folder. It is available for Windows 32 and 64 bit, Linux 64 bit and Raspberry Pi 3 platforms.
  - *USB_DataLog_Run.bat*, *USB_DataLog_Run.sh* and *USB_DataLog_Run_rpi3.sh* scripts provide a ready-to-use example.
    If needed, the application can receive as parameters: device configuration file (-*f*) and timeout (-*t*).
  - *For Linux or Raspberry, launch the scripts as bash.*

- *Utilities\SwUtilities\HS_Datalog\cli_example* contains the CLI software program.
- *Utilities\SwUtilities\HS_Datalog\PROTEUS_config_examples* contains a lot of device configuration files.
- *Utilities\SwUtilities\HS_Datalog\PROTEUS_batch_file_examples* contains a lot of batch files related to the corresponding configuration files.



C:\STM32CubeFunctionPack_DATAPRO1_v1.1.0\Utilities\SwUtilities\HS_Datalog\...

« Utilities › SwUtilities › HS_Datalog › cli_example

Name
_htmresc
bin
bin_64
lib
linux_setup
raspberry_setup
CMakeLists.txt
LICENSE.md
LICENSE.txt
main.cpp
main.h
README_Linux_Raspberry.md
Release_Notes.html
Release_Notes.md
USB_DataLog_Run.bat
USB_DataLog_Run.sh
USB_DataLog_Run_rpi3.sh

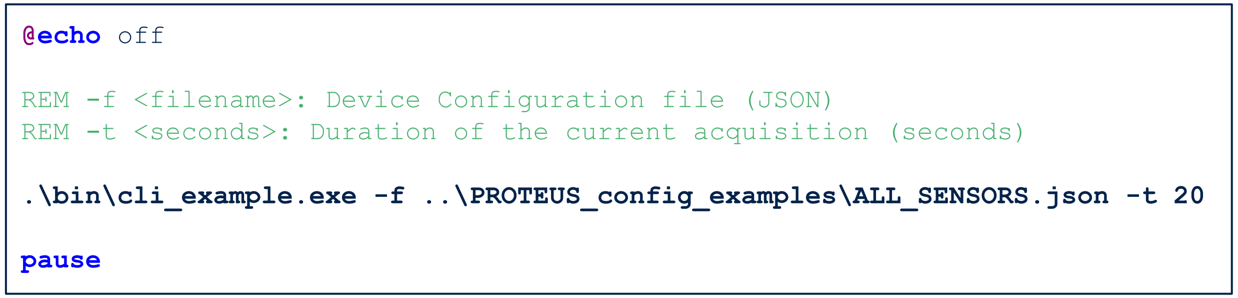
17 items

C:\STM32CubeFunctionPack_DA...

« SwUtilities › HS_Datalog › PROTEUS_batch_file_examples

Name	Date modified	Type	Size
Acquisition Example	2/16/2024 5:37 PM	File folder	
HS-DL_NanoEdge_Conversion.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Plot.bat	2/16/2024 5:06 PM	Windows Batch File	
HS-DL_Plot.sh	2/16/2024 5:05 PM	Shell Script	
HS-DL_Run.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_ALL_SENSORS.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_IIS2DLPC_ACC.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_IIS3DWB_ACC.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_ISM330DHCX_ACC.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_ISM330DHCX_ACC_GYRO.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_ISM330DHCX_GYRO.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_STTS22H_TEMP.bat	2/12/2024 1:32 PM	Windows Batch File	

12 items 7 items selected 15.0 KB



```
@echo off

REM -f <filename>: Device Configuration file (JSON)
REM -t <seconds>: Duration of the current acquisition (seconds)

.\bin\cli_example.exe -f ..\PROTEUS_config_examples\ALL_SENSORS.json -t 20

pause
```

Data Logging Device Configuration File

DeviceConfig.json

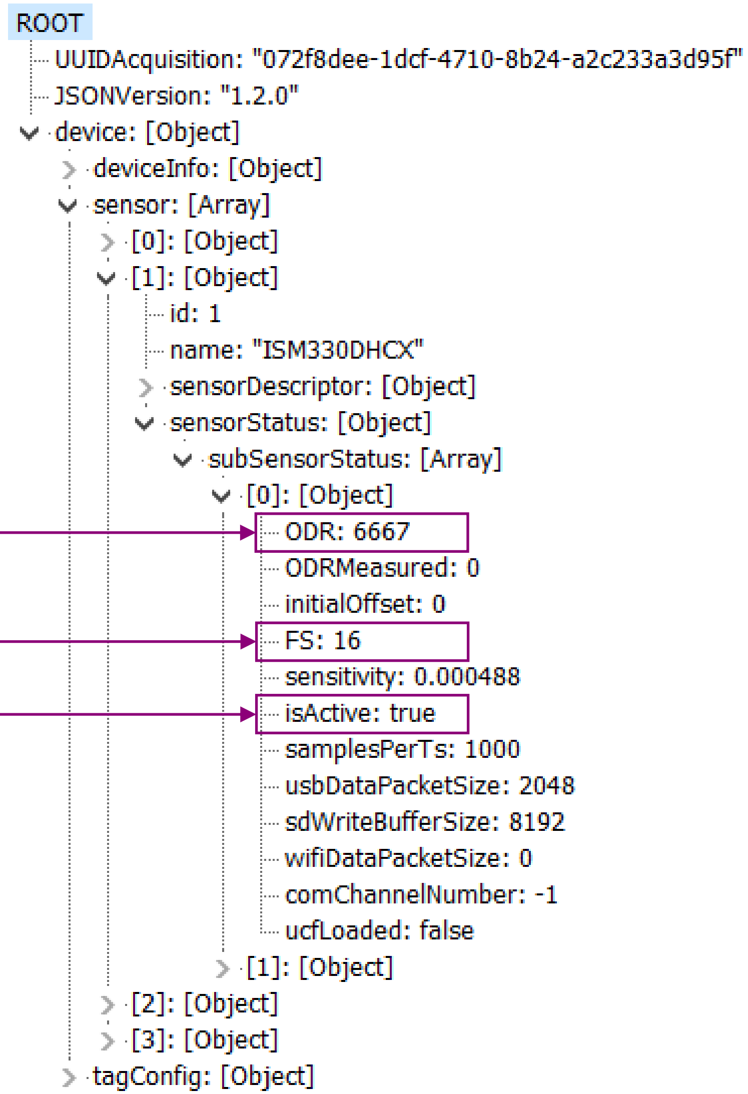
You can use a predefined configuration file to use during the data logging.

By means of this file, for each sensor, you can configure:

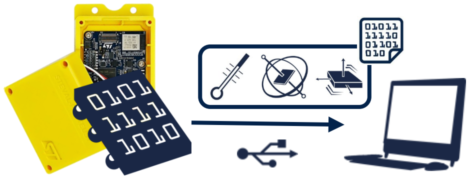
- Output Data Rate
- Full Scale
- Enable / Disable

This file can be passed to the board:

- as parameter in the CLI command for USB data log
- as a file stored in NOR flash memory to use at each system restart (i.e., *\datalog\DeviceConfig.json)*
  This file can be created by STBLESensor app (see here) or copied directly into the appropriate folder in NOR flash memory via USB mass storage.

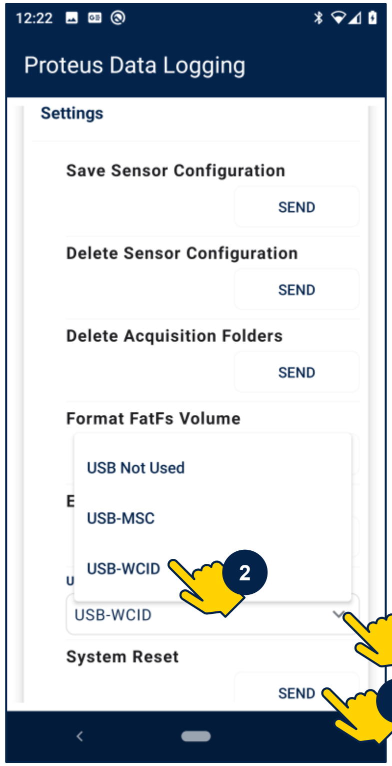


```
ROOT
  UUIDAcquisition: "072f8dee-1dcf-4710-8b24-a2c233a3d95f"
  JSONVersion: "1.2.0"
  device: [Object]
    deviceInfo: [Object]
    sensor: [Array]
      [0]: [Object]
      [1]: [Object]
        id: 1
        name: "ISM330DHCX"
        sensorDescriptor: [Object]
        sensorStatus: [Object]
          subSensorStatus: [Array]
            [0]: [Object]
              ODR: 6667
              ODRMeasured: 0
              initialOffset: 0
              FS: 16
              sensitivity: 0.000488
              isActive: true
              samplesPerTs: 1000
              usbDataPacketSize: 2048
              sdWriteBufferSize: 8192
              wifiDataPacketSize: 0
              comChannelNumber: -1
              ucfLoaded: false
            [1]: [Object]
      [2]: [Object]
      [3]: [Object]
    tagConfig: [Object]
```



USB Data Logging

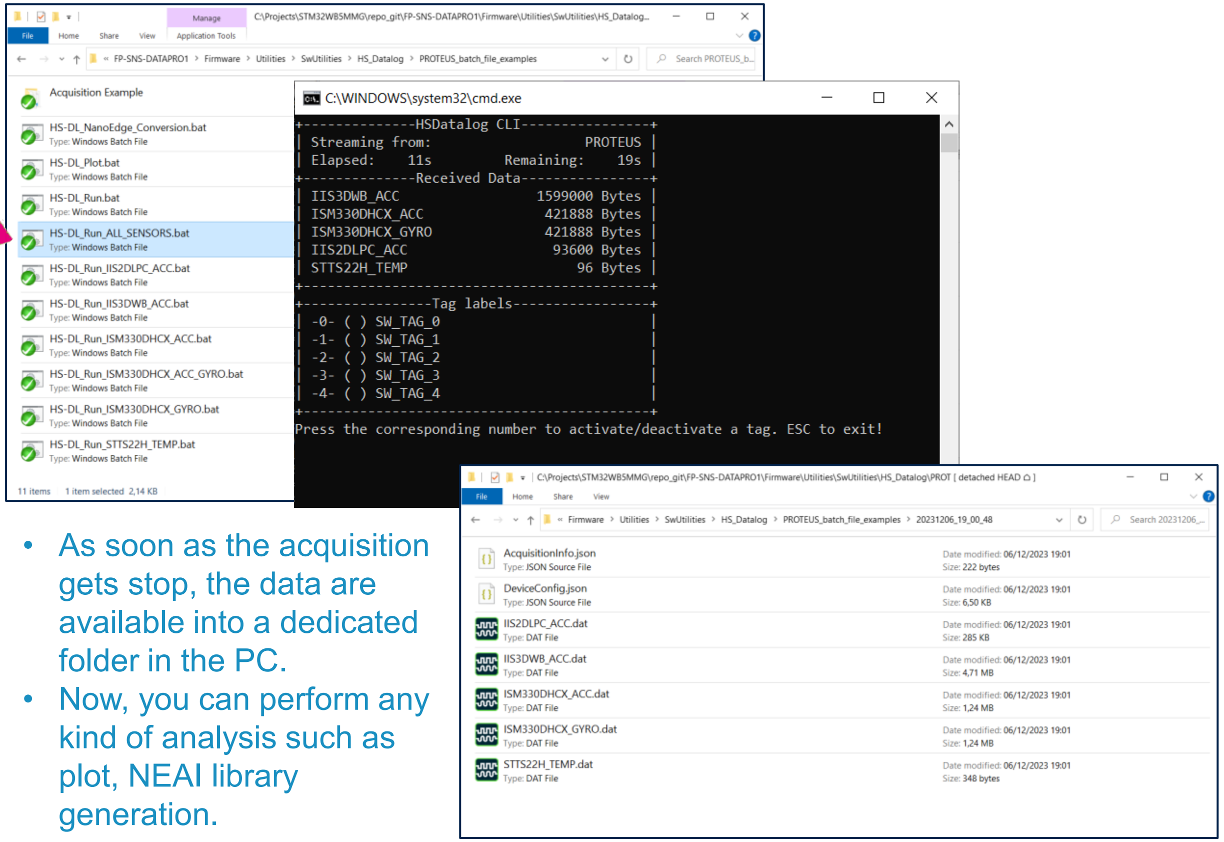
USB Windows Compatible ID Device



The STEVAL-PROTEUS will reboot as

Windows Compatible ID Device

- Connect the STEVAL-PROTEUS to the PC via USB.
- Launch the provided batch file contained into the “Utilities” folder to start the acquisition.
- A command console will open.



C:\Projects\STM32WB5MMG\repo_git\FP-SNS-DATAPRO1\Firmware\Utilities\SwUtilities\HS_Datalog...

« FP-SNS-DATAPRO1 › Firmware › Utilities › SwUtilities › HS_Datalog › PROTEUS_batch_file_examples

Search PROTEUS_b...

Acquisition Example

HS-DL_NanoEdge_Conversion.bat
Type: Windows Batch File

HS-DL_Plot.bat
Type: Windows Batch File

HS-DL_Run.bat
Type: Windows Batch File

HS-DL_Run_ALL_SENSORS.bat
Type: Windows Batch File

HS-DL_Run_IIS2DLPC_ACC.bat
Type: Windows Batch File

HS-DL_Run_IIS3DWB_ACC.bat
Type: Windows Batch File

HS-DL_Run_ISM330DHCX_ACC.bat
Type: Windows Batch File

HS-DL_Run_ISM330DHCX_ACC_GYRO.bat
Type: Windows Batch File

HS-DL_Run_ISM330DHCX_GYRO.bat
Type: Windows Batch File

HS-DL_Run_STTS22H_TEMP.bat
Type: Windows Batch File

11 items 1 item selected 2,14 KB

C:\WINDOWS\system32\cmd.exe

```
+-------------HSDatalog CLI---------------+
| Streaming from:                 PROTEUS |
| Elapsed:     11s        Remaining:    19s |
+-------------Received Data---------------+
| IIS3DWB_ACC               1599000 Bytes |
| ISM330DHCX_ACC             421888 Bytes |
| ISM330DHCX_GYRO            421888 Bytes |
| IIS2DLPC_ACC                93600 Bytes |
| STTS22H_TEMP                   96 Bytes |
+-----------------------------------------+
+---------------Tag labels----------------+
| -0- ( ) SW_TAG_0                        |
| -1- ( ) SW_TAG_1                        |
| -2- ( ) SW_TAG_2                        |
| -3- ( ) SW_TAG_3                        |
| -4- ( ) SW_TAG_4                        |
+-----------------------------------------+
Press the corresponding number to activate/deactivate a tag. ESC to exit!
```

C:\Projects\STM32WB5MMG\repo_git\FP-SNS-DATAPRO1\Firmware\Utilities\SwUtilities\HS_Datalog\PROT [detached HEAD ⌂]

« Firmware › Utilities › SwUtilities › HS_Datalog › PROTEUS_batch_file_examples › 20231206_19_00_48

Search 20231206_...

AcquisitionInfo.json
Type: JSON Source File
Date modified: 06/12/2023 19:01
Size: 222 bytes

DeviceConfig.json
Type: JSON Source File
Date modified: 06/12/2023 19:01
Size: 6,50 KB

IIS2DLPC_ACC.dat
Type: DAT File
Date modified: 06/12/2023 19:01
Size: 285 KB

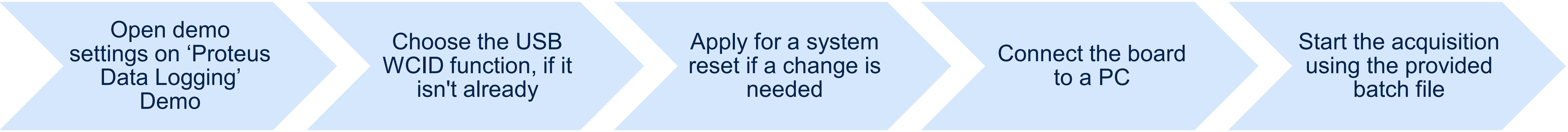
IIS3DWB_ACC.dat
Type: DAT File
Date modified: 06/12/2023 19:01
Size: 4,71 MB

ISM330DHCX_ACC.dat
Type: DAT File
Date modified: 06/12/2023 19:01
Size: 1,24 MB

ISM330DHCX_GYRO.dat
Type: DAT File
Date modified: 06/12/2023 19:01
Size: 1,24 MB

STTS22H_TEMP.dat
Type: DAT File
Date modified: 06/12/2023 19:01
Size: 348 bytes

- As soon as the acquisition gets stop, the data are available into a dedicated folder in the PC.
- Now, you can perform any kind of analysis such as plot, NEAI library generation.



Open demo settings on ‘Proteus Data Logging’ Demo

Choose the USB WCID function, if it isn't already

Apply for a system reset if a change is needed

Connect the board to a PC

Start the acquisition using the provided batch file

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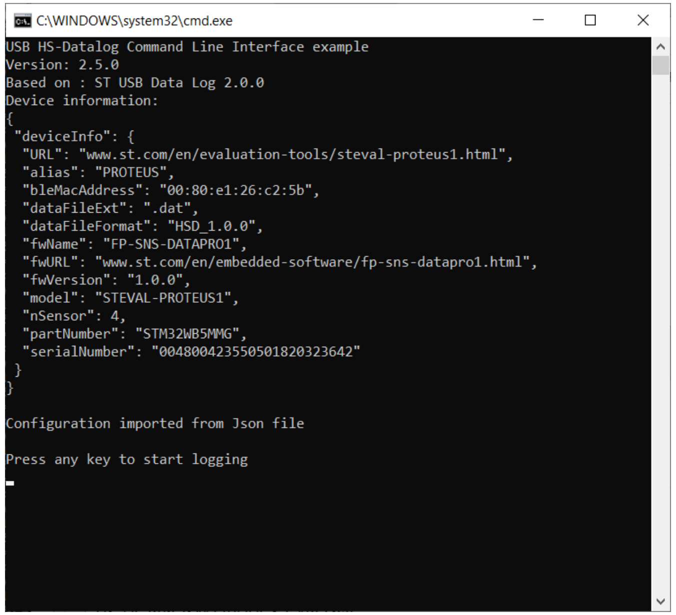
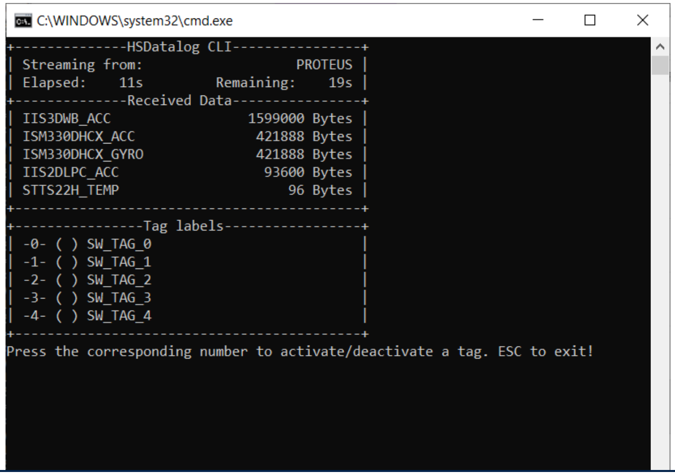
USB Data Logging

Execution



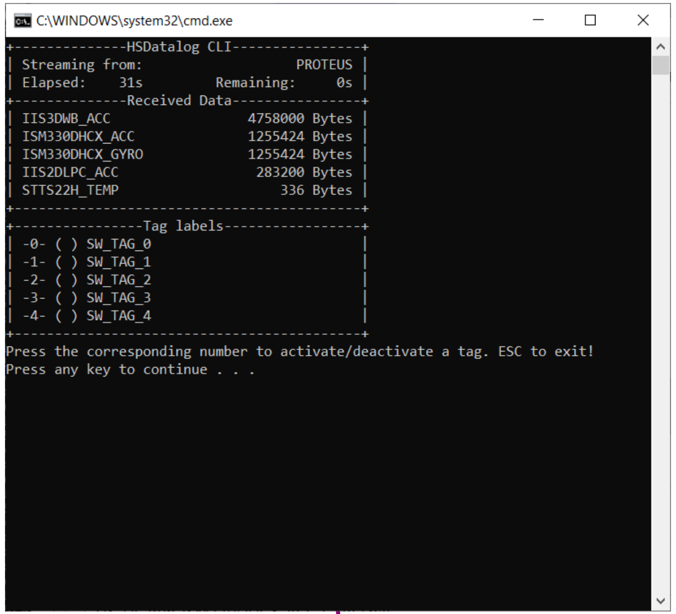
C:\WINDOWS\system32\cmd.exe

```
USB HS-Datalog Command Line Interface example
Version: 2.5.0
Based on : ST USB Data Log 2.0.0
Device information:
{
 "deviceInfo": {
  "URL": "www.st.com/en/evaluation-tools/steval-proteus1.html",
  "alias": "PROTEUS",
  "bleMacAddress": "00:80:e1:26:c2:5b",
  "dataFileExt": ".dat",
  "dataFileFormat": "HSD_1.0.0",
  "fwName": "FP-SNS-DATAPRO1",
  "fwURL": "www.st.com/en/embedded-software/fp-sns-datapro1.html",
  "fwVersion": "1.0.0",
  "model": "STEVAL-PROTEUS1",
  "nSensor": 4,
  "partNumber": "STM32WB5MMG",
  "serialNumber": "004800423550501820323642"
 }
}

Configuration imported from Json file

Press any key to start logging
_
```



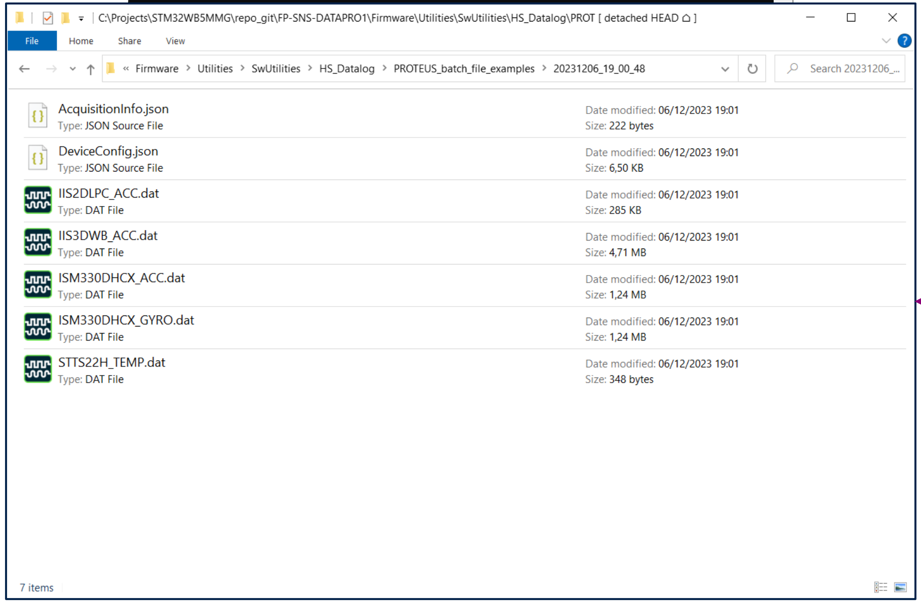
C:\WINDOWS\system32\cmd.exe

```
+-------------HSDatalog CLI---------------+
| Streaming from:                 PROTEUS |
| Elapsed:     11s        Remaining:   19s |
+-------------Received Data---------------+
| IIS3DWB_ACC               1599000 Bytes |
| ISM330DHCX_ACC             421888 Bytes |
| ISM330DHCX_GYRO            421888 Bytes |
| IIS2DLPC_ACC                93600 Bytes |
| STTS22H_TEMP                   96 Bytes |
+-----------------------------------------+
+---------------Tag labels----------------+
| -0- ( ) SW_TAG_0                        |
| -1- ( ) SW_TAG_1                        |
| -2- ( ) SW_TAG_2                        |
| -3- ( ) SW_TAG_3                        |
| -4- ( ) SW_TAG_4                        |
+-----------------------------------------+
Press the corresponding number to activate/deactivate a tag. ESC to exit!
```



C:\WINDOWS\system32\cmd.exe

```
+-------------HSDatalog CLI---------------+
| Streaming from:                 PROTEUS |
| Elapsed:     31s        Remaining:    0s |
+-------------Received Data---------------+
| IIS3DWB_ACC               4758000 Bytes |
| ISM330DHCX_ACC            1255424 Bytes |
| ISM330DHCX_GYRO           1255424 Bytes |
| IIS2DLPC_ACC               283200 Bytes |
| STTS22H_TEMP                  336 Bytes |
+-----------------------------------------+
+---------------Tag labels----------------+
| -0- ( ) SW_TAG_0                        |
| -1- ( ) SW_TAG_1                        |
| -2- ( ) SW_TAG_2                        |
| -3- ( ) SW_TAG_3                        |
| -4- ( ) SW_TAG_4                        |
+-----------------------------------------+
Press the corresponding number to activate/deactivate a tag. ESC to exit!
Press any key to continue . . .
```



C:\Projects\STM32WB5MMG\repo_git\FP-SNS-DATAPRO1\Firmware\Utilities\SwUtilities\HS_Datalog\PROT [detached HEAD ⌂]

« Firmware › Utilities › SwUtilities › HS_Datalog › PROTEUS_batch_file_examples › 20231206_19_00_48

AcquisitionInfo.json
Type: JSON Source File
Date modified: 06/12/2023 19:01
Size: 222 bytes

DeviceConfig.json
Type: JSON Source File
Date modified: 06/12/2023 19:01
Size: 6,50 KB

IIS2DLPC_ACC.dat
Type: DAT File
Date modified: 06/12/2023 19:01
Size: 285 KB

IIS3DWB_ACC.dat
Type: DAT File
Date modified: 06/12/2023 19:01
Size: 4,71 MB

ISM330DHCX_ACC.dat
Type: DAT File
Date modified: 06/12/2023 19:01
Size: 1,24 MB

ISM330DHCX_GYRO.dat
Type: DAT File
Date modified: 06/12/2023 19:01
Size: 1,24 MB

STTS22H_TEMP.dat
Type: DAT File
Date modified: 06/12/2023 19:01
Size: 348 bytes

7 items

As soon as the acquisition gets stop, the data are available into a dedicated folder in the PC.

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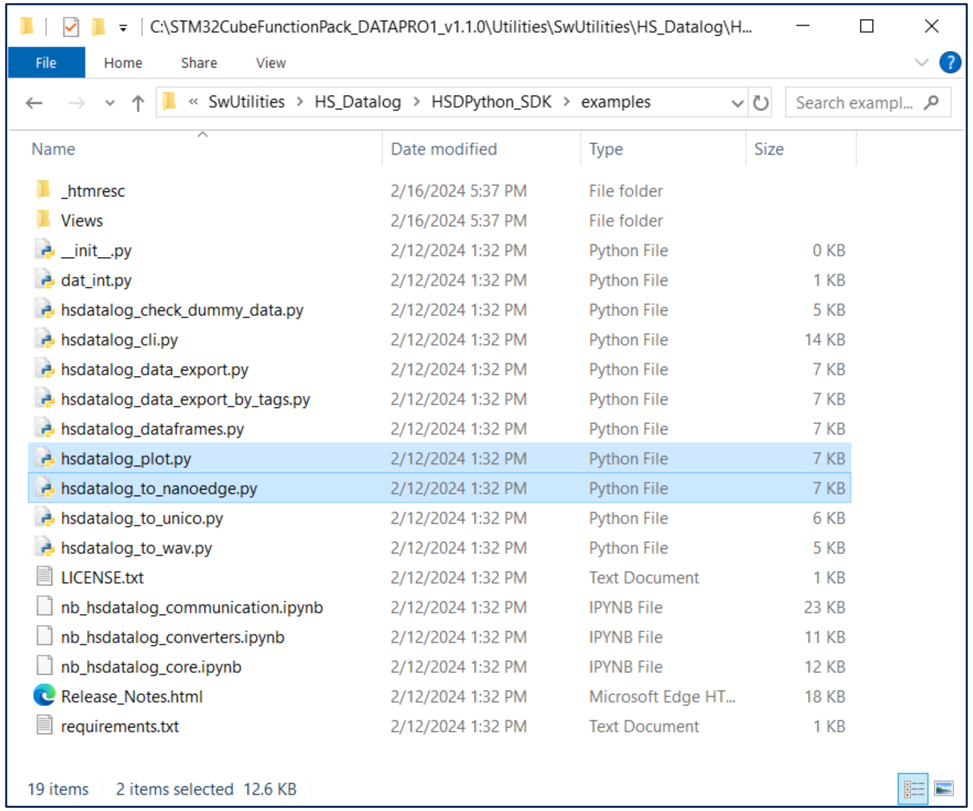
2.1.2 – HSD Python SDK

HSDPython_SDK examples

- FP-SNS-DATAPRO1 comes with a dedicated Python SDK, ready-to-use for integration into any data science design flow.
- HSD_Python_SDK has been developed in Python 3.10
- The SDK contains many Python scripts, examples and Jupiter notebook that can be used to log and elaborate data.
  e.g.:
  - *hsdatalog_plot.py* can plot the desired data.
  - *hsdatalog_to_nanoedge.py* can prepare data to be imported into NanoEdge AI Studio solution.



C:\STM32CubeFunctionPack_DATAPRO1_v1.1.0\Utilities\SwUtilities\HS_Datalog\H...

« SwUtilities › HS_Datalog › HSDPython_SDK › examples

Name	Date modified	Type	Size
_htmresc	2/16/2024 5:37 PM	File folder	
Views	2/16/2024 5:37 PM	File folder	
__init__.py	2/12/2024 1:32 PM	Python File	0 KB
dat_int.py	2/12/2024 1:32 PM	Python File	1 KB
hsdatalog_check_dummy_data.py	2/12/2024 1:32 PM	Python File	5 KB
hsdatalog_cli.py	2/12/2024 1:32 PM	Python File	14 KB
hsdatalog_data_export.py	2/12/2024 1:32 PM	Python File	7 KB
hsdatalog_data_export_by_tags.py	2/12/2024 1:32 PM	Python File	7 KB
hsdatalog_dataframes.py	2/12/2024 1:32 PM	Python File	7 KB
hsdatalog_plot.py	2/12/2024 1:32 PM	Python File	7 KB
hsdatalog_to_nanoedge.py	2/12/2024 1:32 PM	Python File	7 KB
hsdatalog_to_unico.py	2/12/2024 1:32 PM	Python File	6 KB
hsdatalog_to_wav.py	2/12/2024 1:32 PM	Python File	5 KB
LICENSE.txt	2/12/2024 1:32 PM	Text Document	1 KB
nb_hsdatalog_communication.ipynb	2/12/2024 1:32 PM	IPYNB File	23 KB
nb_hsdatalog_converters.ipynb	2/12/2024 1:32 PM	IPYNB File	11 KB
nb_hsdatalog_core.ipynb	2/12/2024 1:32 PM	IPYNB File	12 KB
Release_Notes.html	2/12/2024 1:32 PM	Microsoft Edge HT...	18 KB
requirements.txt	2/12/2024 1:32 PM	Text Document	1 KB

19 items 2 items selected 12.6 KB

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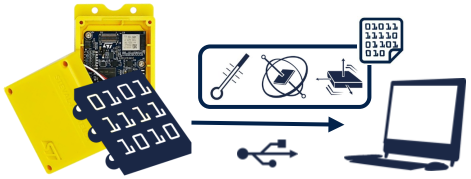
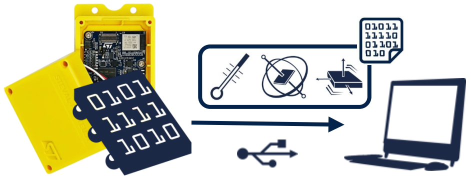


Data Logging

HSDPython_SDK installation

	HSDPython_SDK
Windows	Move to: Utilities\SwUtilities\HS_Datalog\HSDPython_SDK Launch: HSDPython_SDK_install_noGUI.bat
Linux 64 bit (*)	Move to: Utilities/SwUtilities/HS_Datalog/HSDPython_SDK Launch: bash HSDPython_SDK_install_noGUI.sh
Raspberry Pi 3 (*)	No support

(*) To avoid any possible issues while executing the script in Linux environment, we recommend using dos2unix to properly reformat your files. So, please, install it on your system: `sudo apt-get install dos2unix`



Data Logging

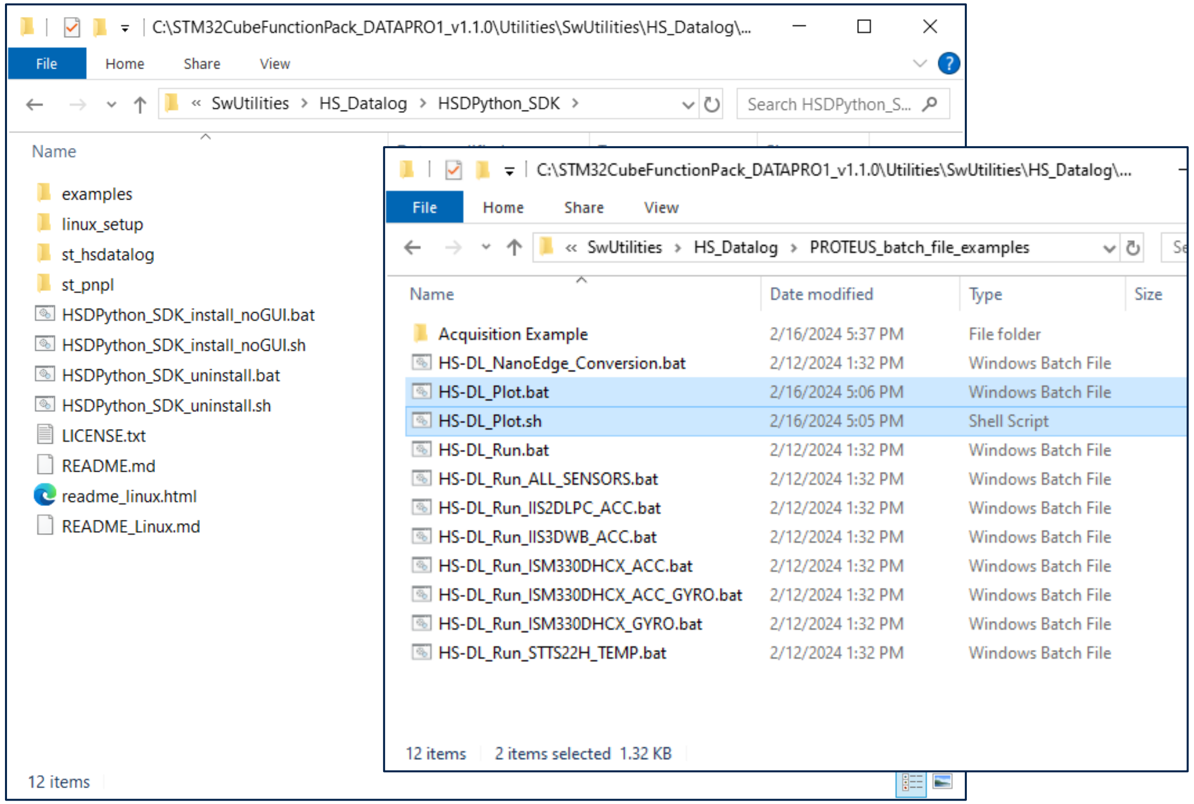
Graph the Acquisition Data (1/3)

- You can use the HSDPython_SDK to analyze an acquisition folder already created.
- The SDK is in the ‘Utilities’ folder. It is available for Windows 32 and 64 bit and Linux 64 bit platforms.

○ *Utilities\SwUtilities\HS_Datalog\HSDPython_SDK* contains different Python scripts and classes that can be used to handle the datasets obtained by the HSDatalog firmware.

○ *Utilities\SwUtilities\HS_Datalog\PROTEUS_batch_file_examples* contains also a scrip to graph related to an acquisition folder:

  - *HS-DL_Plot.bat* and *HS-DL_Plot.sh*.
  - *For Linux, launch the scripts as bash.*



C:\STM32CubeFunctionPack_DATAPRO1_v1.1.0\Utilities\SwUtilities\HS_Datalog\...

Name

- examples
- linux_setup
- st_hsdatalog
- st_pnpl
- HSDPython_SDK_install_noGUI.bat
- HSDPython_SDK_install_noGUI.sh
- HSDPython_SDK_uninstall.bat
- HSDPython_SDK_uninstall.sh
- LICENSE.txt
- README.md
- readme_linux.html
- README_Linux.md

12 items

C:\STM32CubeFunctionPack_DATAPRO1_v1.1.0\Utilities\SwUtilities\HS_Datalog\...

Name	Date modified	Type	Size
Acquisition Example	2/16/2024 5:37 PM	File folder	
HS-DL_NanoEdge_Conversion.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Plot.bat	2/16/2024 5:06 PM	Windows Batch File	
HS-DL_Plot.sh	2/16/2024 5:05 PM	Shell Script	
HS-DL_Run.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_ALL_SENSORS.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_IIS2DLPC_ACC.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_IIS3DWB_ACC.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_ISM330DHCX_ACC.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_ISM330DHCX_ACC_GYRO.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_ISM330DHCX_GYRO.bat	2/12/2024 1:32 PM	Windows Batch File	
HS-DL_Run_STTS22H_TEMP.bat	2/12/2024 1:32 PM	Windows Batch File	

12 items 2 items selected 1.32 KB

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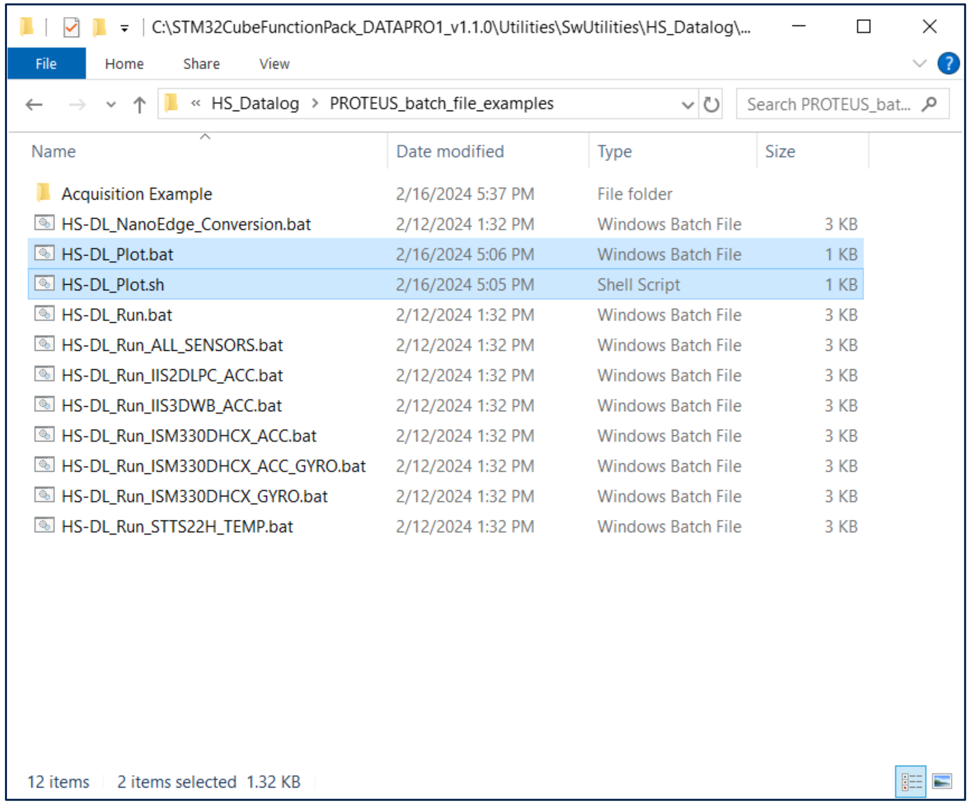
Data Logging

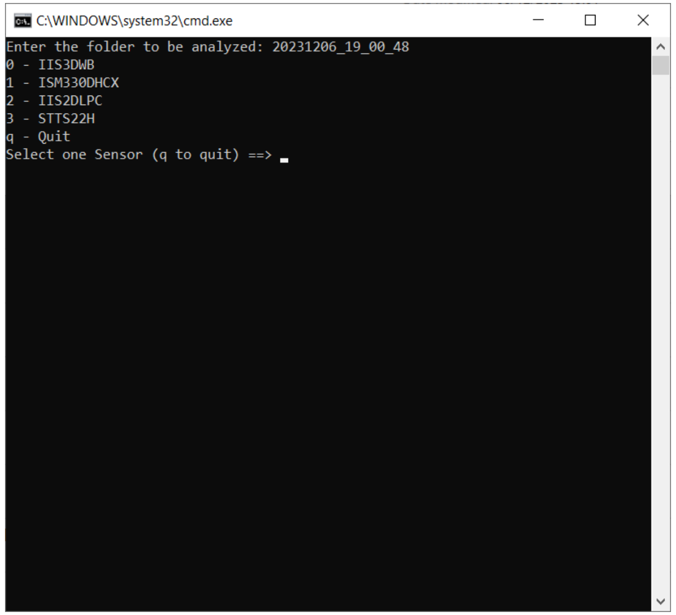
Graph the Acquisition Data (2/3)



C:\STM32CubeFunctionPack_DATAPRO1_v1.1.0\Utilities\SwUtilities\HS_Datalog\...

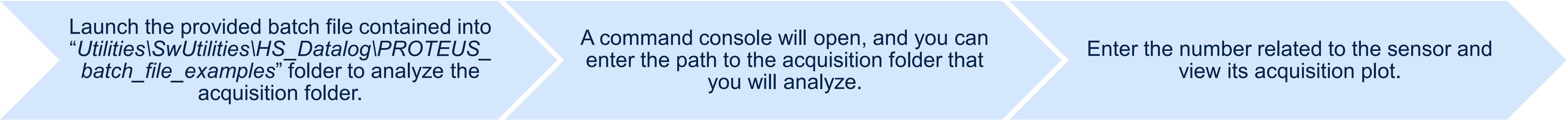
Name	Date modified	Type	Size
Acquisition Example	2/16/2024 5:37 PM	File folder	
HS-DL_NanoEdge_Conversion.bat	2/12/2024 1:32 PM	Windows Batch File	3 KB
HS-DL_Plot.bat	2/16/2024 5:06 PM	Windows Batch File	1 KB
HS-DL_Plot.sh	2/16/2024 5:05 PM	Shell Script	1 KB
HS-DL_Run.bat	2/12/2024 1:32 PM	Windows Batch File	3 KB
HS-DL_Run_ALL_SENSORS.bat	2/12/2024 1:32 PM	Windows Batch File	3 KB
HS-DL_Run_IIS2DLPC_ACC.bat	2/12/2024 1:32 PM	Windows Batch File	3 KB
HS-DL_Run_IIS3DWB_ACC.bat	2/12/2024 1:32 PM	Windows Batch File	3 KB
HS-DL_Run_ISM330DHCX_ACC.bat	2/12/2024 1:32 PM	Windows Batch File	3 KB
HS-DL_Run_ISM330DHCX_ACC_GYRO.bat	2/12/2024 1:32 PM	Windows Batch File	3 KB
HS-DL_Run_ISM330DHCX_GYRO.bat	2/12/2024 1:32 PM	Windows Batch File	3 KB
HS-DL_Run_STTS22H_TEMP.bat	2/12/2024 1:32 PM	Windows Batch File	3 KB

12 items   2 items selected 1.32 KB



C:\WINDOWS\system32\cmd.exe

```
Enter the folder to be analyzed: 20231206_19_00_48
0 - IIS3DWB
1 - ISM330DHCX
2 - IIS2DLPC
3 - STTS22H
q - Quit
Select one Sensor (q to quit) ==> _
```



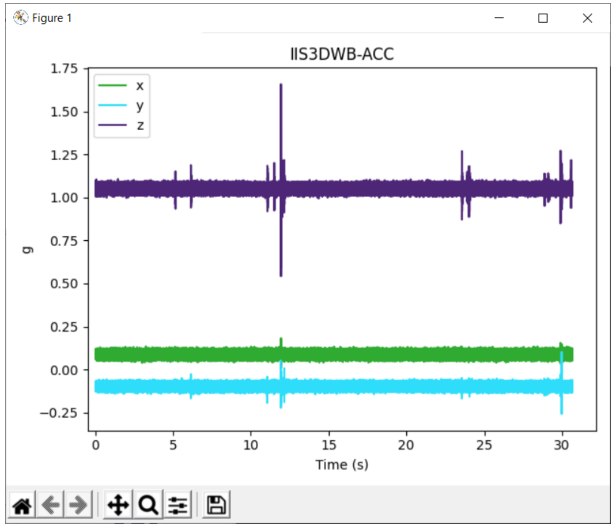
Launch the provided batch file contained into “*Utilities\SwUtilities\HS_Datalog\PROTEUS_batch_file_examples*” folder to analyze the acquisition folder.

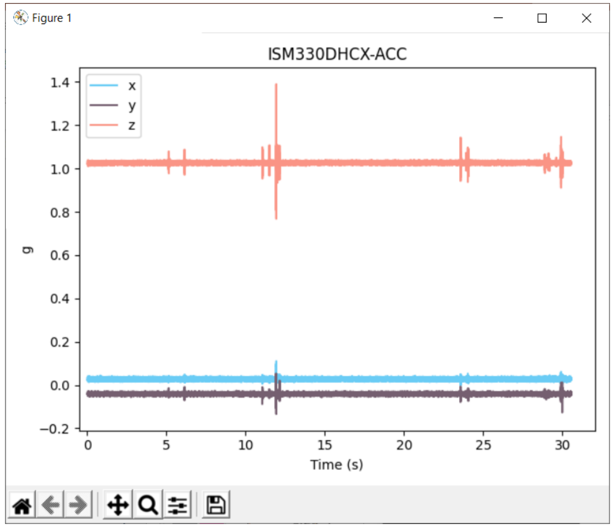
A command console will open, and you can enter the path to the acquisition folder that you will analyze.

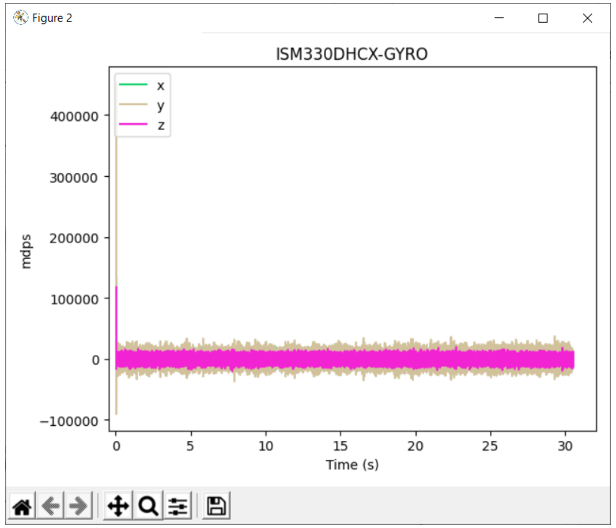
Enter the number related to the sensor and view its acquisition plot.

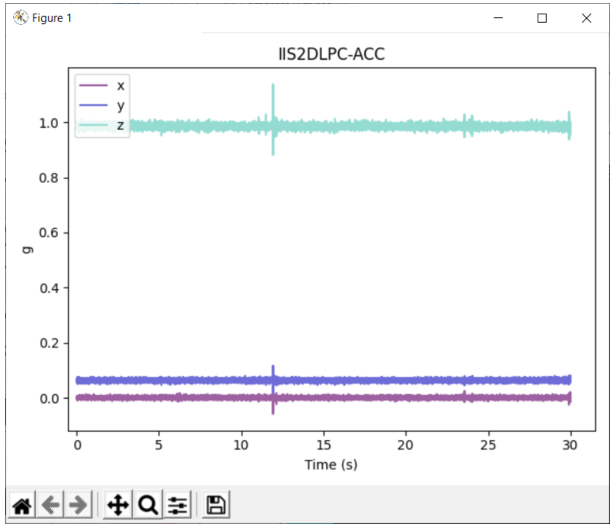
Data Logging

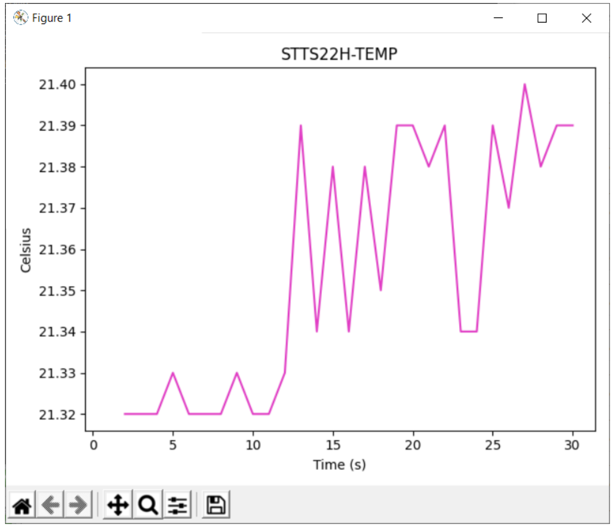
Graph the Acquisition Data (3/3)











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2.1.3 – HS Datalog and BLESensor App: save data on embedded NOR flash

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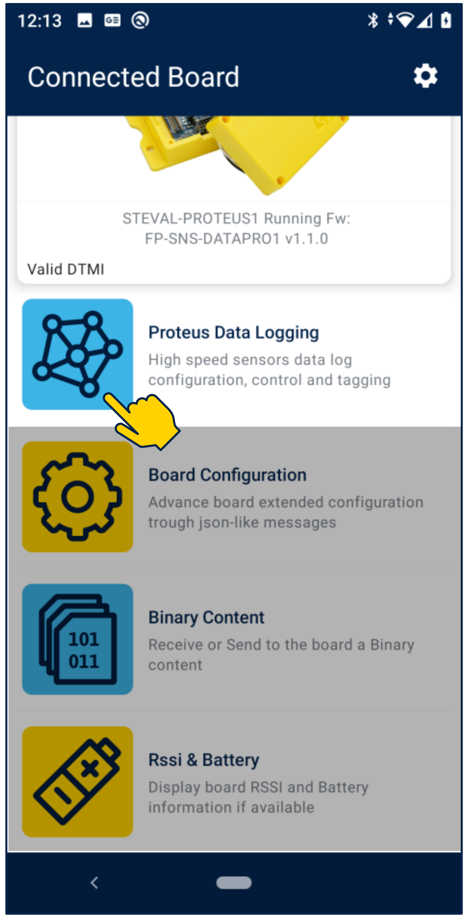
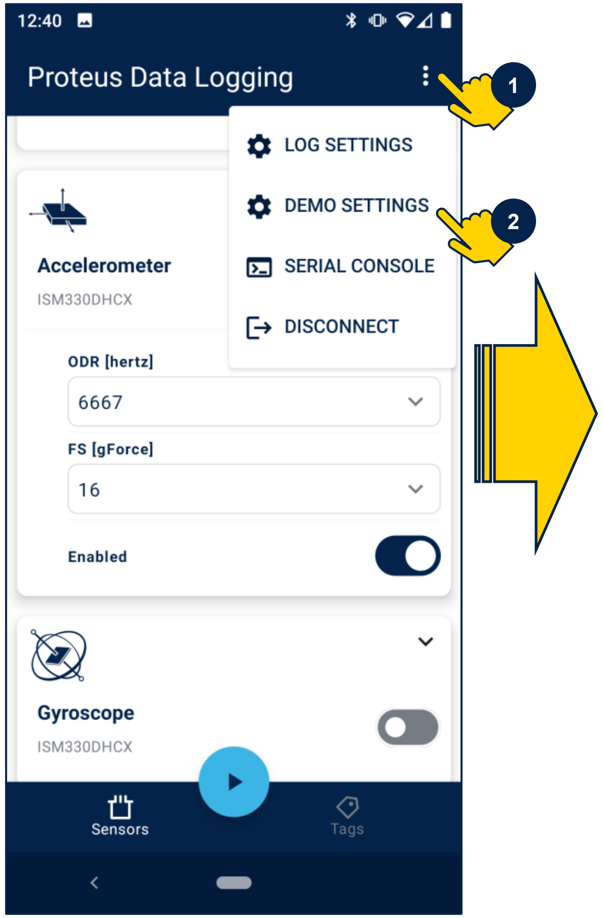
Proteus Data Logging

Demo Settings

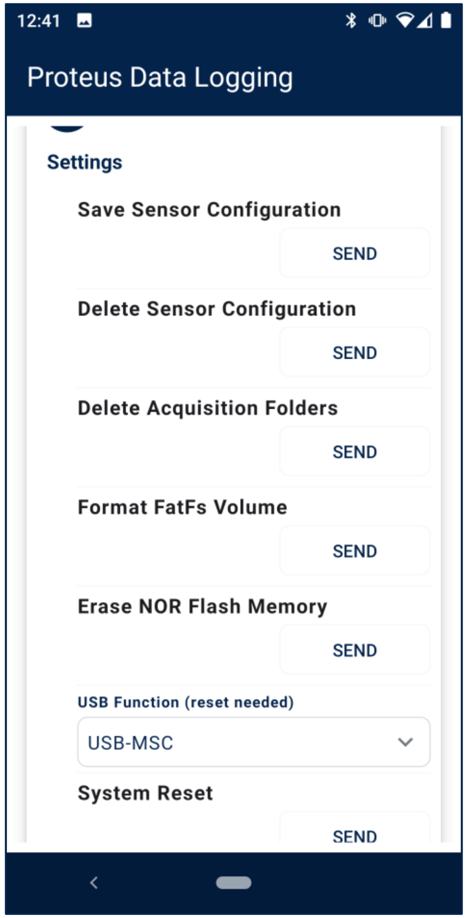

12:13
Connected Board
STEVAL-PROTEUS1 Running Fw:
FP-SNS-DATAPRO1 v1.1.0
Valid DTMI
Proteus Data Logging
High speed sensors data log configuration, control and tagging
Board Configuration
Advance board extended configuration trough json-like messages
Binary Content
Receive or Send to the board a Binary content
101
011
Rssi & Battery
Display board RSSI and Battery information if available



ODR [hertz]: 6667

FS [gForce]: 16

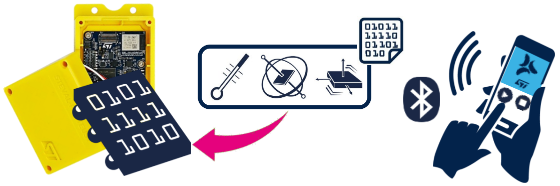
Enabled



USB Function (reset needed): USB-MSC

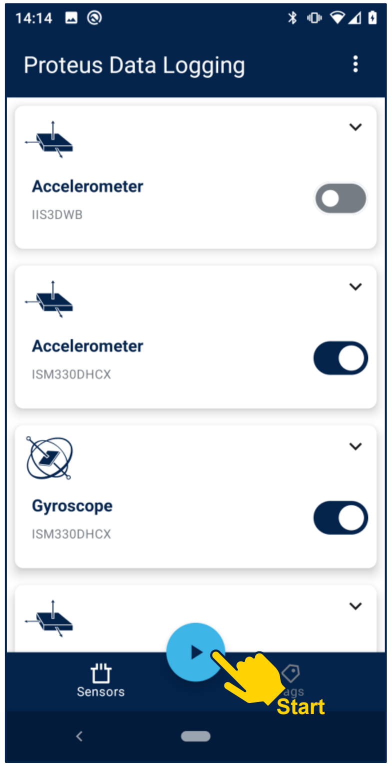
In addition to sensor configurations (i.e., ODR, FS, enabling and disabling), here you can:

- Save the ‘DeviceConfig.json’ into the embedded FatFs volume to be load at each reboot.
- Delete the already stored ‘DeviceConfig.json’.
- Delete all the folders related to the previous acquisitions.
- Perform a quick format of the FatFs volume.
- Perform a complete NOR flash memory erasing and regenerate the FatFs volume.
- Set the USB function to use after the next system reset.
- Perform a system reset.



Proteus Data Logging

Acquisition Execution

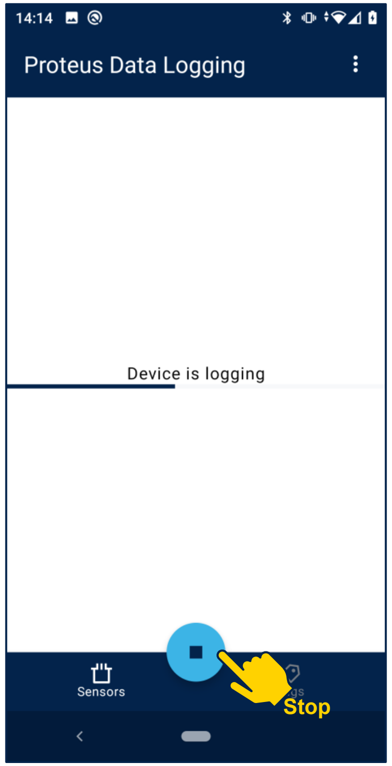

14:14

Proteus Data Logging

Accelerometer
IIS3DWB

Accelerometer
ISM330DHCX

Gyroscope
ISM330DHCX

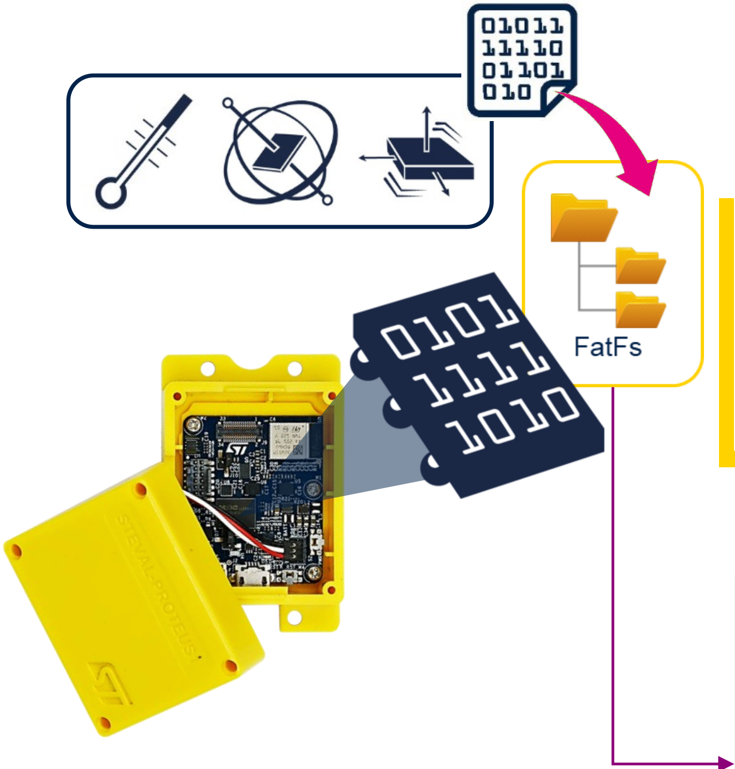

14:14

Proteus Data Logging

Device is logging

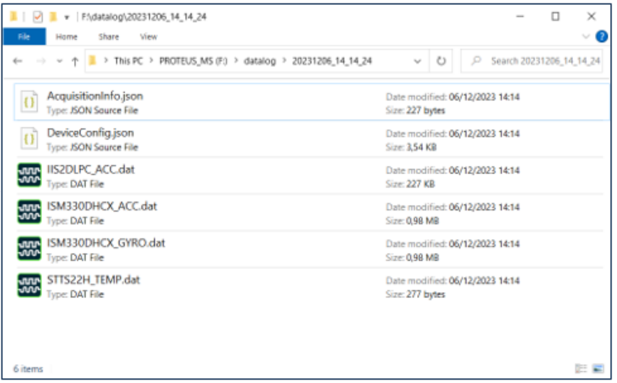
Open ‘Proteus Data Logging’ Demo and tap on ‘Start’ button

Tap on ‘Stop’ button to finish



Acquisition data are available into the FatFs volume allocated in the embedded NOR flash memory.
Note that, while logging data into embedded NOR flash memory, IIS3DWB will be disabled so its data will not be saved.

In a second time, if the STEVAL-PROTEUS1 is recognized as USB mass storage device, you can attach the board to a PC and use a file explorer to navigate into the folders.


F:\datalog\20231206_14_14_24

This PC › PROTEUS_MS (F:) › datalog › 20231206_14_14_24

Search 20231206_14_14_24

AcquisitionInfo.json
Type: JSON Source File
Date modified: 06/12/2023 14:14
Size: 227 bytes

DeviceConfig.json
Type: JSON Source File
Date modified: 06/12/2023 14:14
Size: 3,54 KB

IIS2DLPC_ACC.dat
Type: DAT File
Date modified: 06/12/2023 14:14
Size: 227 KB

ISM330DHCX_ACC.dat
Type: DAT File
Date modified: 06/12/2023 14:14
Size: 0,98 MB

ISM330DHCX_GYRO.dat
Type: DAT File
Date modified: 06/12/2023 14:14
Size: 0,98 MB

STTS22H_TEMP.dat
Type: DAT File
Date modified: 06/12/2023 14:14
Size: 277 bytes

6 items

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2.1.4 – HS Datalog and BLESensor App: auto mode to save data on embedded NOR flash

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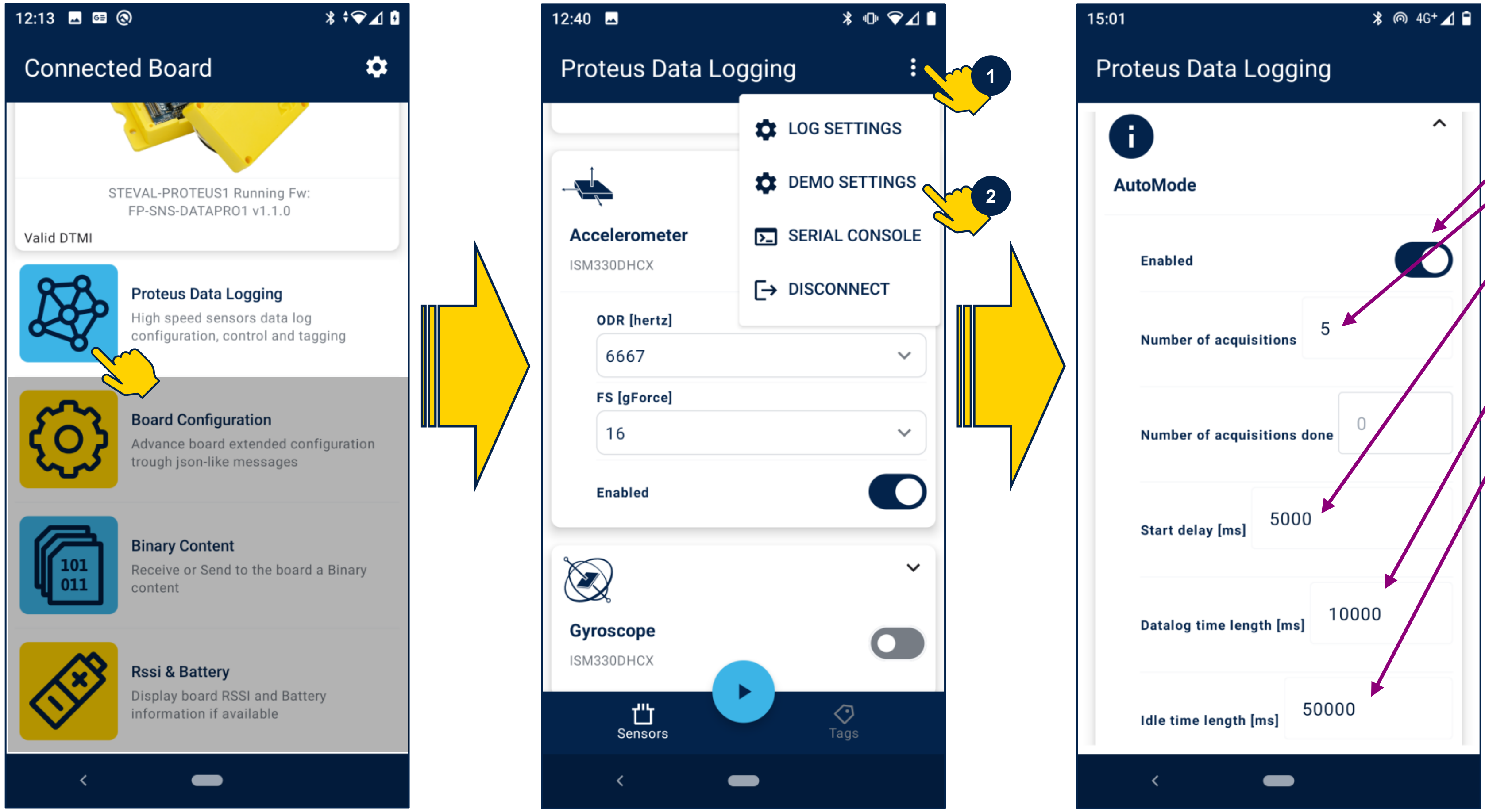
Proteus Data Logging

Automode Configuration



12:13

Connected Board

STEVAL-PROTEUS1 Running Fw: FP-SNS-DATAPRO1 v1.1.0

Valid DTMI

Proteus Data Logging
High speed sensors data log configuration, control and tagging

Board Configuration
Advance board extended configuration trough json-like messages

Binary Content
Receive or Send to the board a Binary content

Rssi & Battery
Display board RSSI and Battery information if available

12:40

Proteus Data Logging

1

2

LOG SETTINGS

DEMO SETTINGS

SERIAL CONSOLE

DISCONNECT

Accelerometer
ISM330DHCX

ODR [hertz]: 6667

FS [gForce]: 16

Enabled

Gyroscope
ISM330DHCX

15:01

Proteus Data Logging

AutoMode

Enabled

Number of acquisitions: 5

Number of acquisitions done: 0

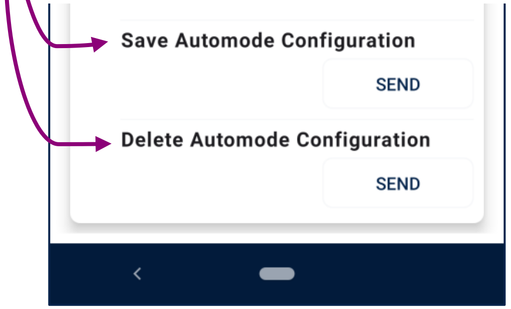
Start delay [ms]: 5000

Datalog time length [ms]: 10000

Idle time length [ms]: 50000

You can:

- Enable or Disable the auto mode.
- Set the number of acquisitions.
- Set the delay between starting auto mode and the first acquisition.
- Set the duration of each acquisition
- Set the delay between two subsequent acquisitions.
- Save ‘AutomodeConfig.json’ into the embedded FatFs volume to be load at each reboot.
- Delete ‘AutomodeConfig.json’.



Save Automode Configuration

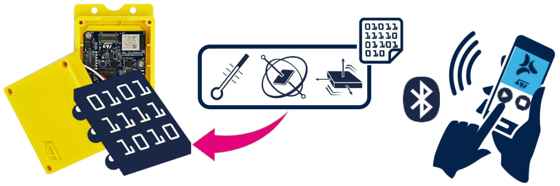
SEND

Delete Automode Configuration

SEND

Below the file “\datalog\AutomodeConfig.json”, the user can modify it to reconfigure the automode feature.

```
{"AutomodeModel":[{"Enabled":true,"NrOfAcquisition":5,"StartDelay":5000,"LoggingPeriod":10000,"IdlePeriod":50000}]}
```



Proteus Data Logging

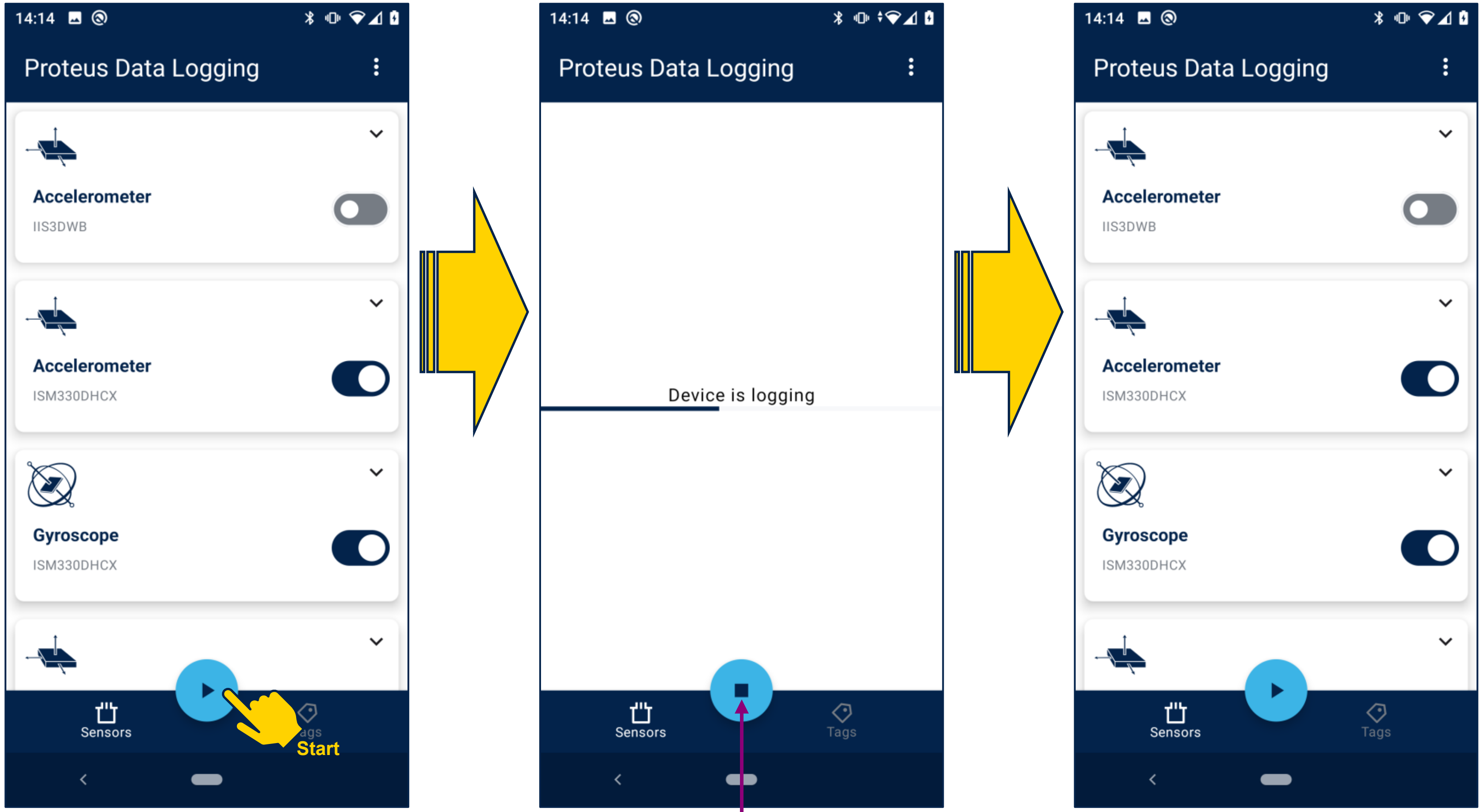
Automode Start / Stop

Since the Automode has been configured and enabled via app or by editing the ‘AutomodeConfig.json’ into the embedded FatFs volume (in this case a reset is needed), you can start the acquisition series:

- By the ‘Proteus Data Logging” demo:
  - Tap on ‘play’ icon
- By user button:
  - Press and hold the USR button for between 3 s and 7 s

The procedure will stop automatically or:

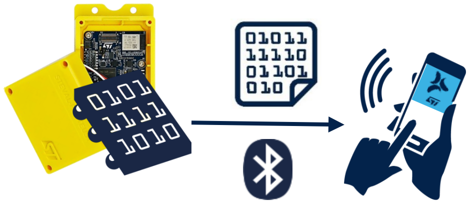
- By the ‘Proteus Data Logging” demo:
  - Tap on ‘stop’ icon
- By user button:
  - Press and hold the USR button for between 3 s and 7 s

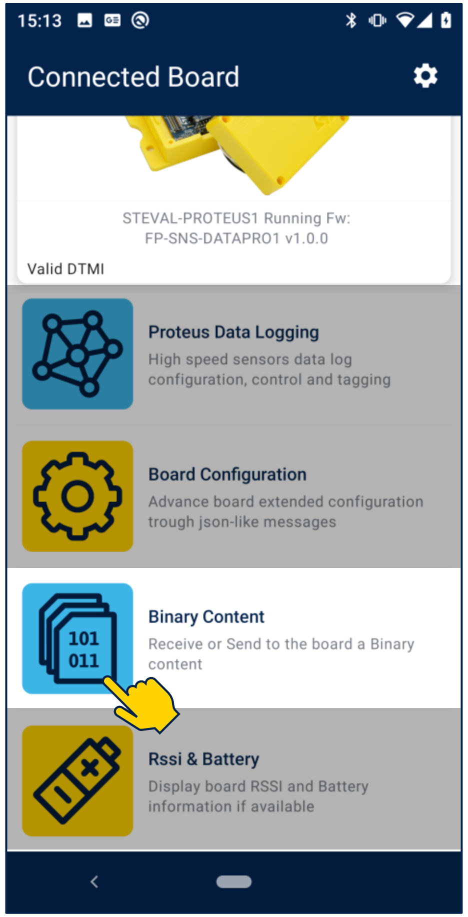


Tap on ‘Stop’ icon only if you want to stop auto mode before the end of the acquisition series.

2.1.5 – HS Datalog and BLESensor App: transfer data from embedded NOR flash

Binary Content
Setup




15:13

Connected Board

STEVAL-PROTEUS1 Running Fw: FP-SNS-DATAPRO1 v1.0.0

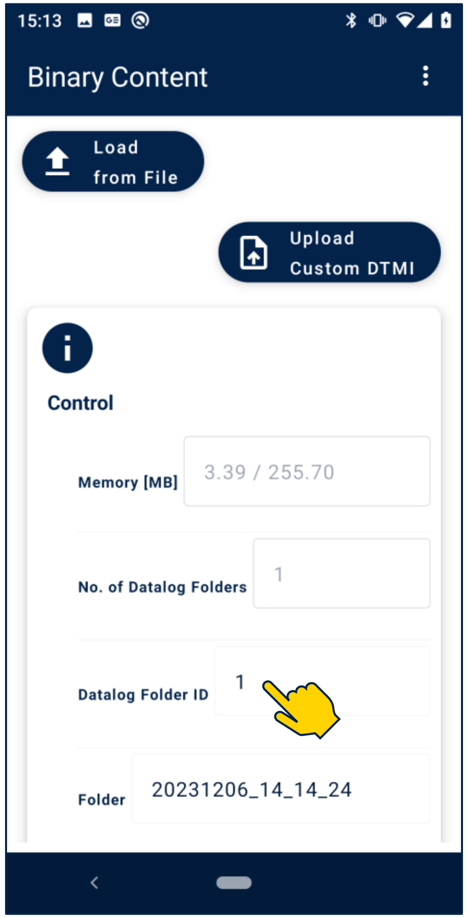
Valid DTMI

Proteus Data Logging
High speed sensors data log configuration, control and tagging

Board Configuration
Advance board extended configuration trough json-like messages

Binary Content
Receive or Send to the board a Binary content

Rssi & Battery
Display board RSSI and Battery information if available


15:13

Binary Content

Load from File

Upload Custom DTMI

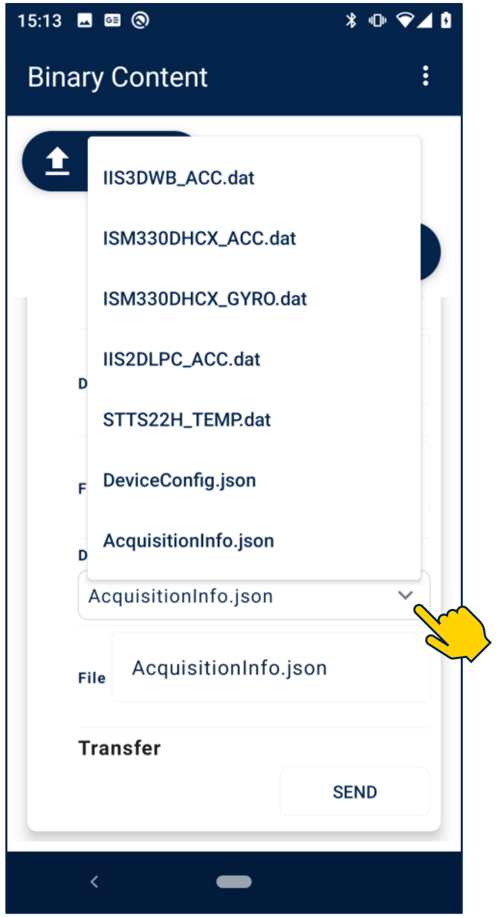
Control

Memory [MB]: 3.39 / 255.70

No. of Datalog Folders: 1

Datalog Folder ID: 1

Folder: 20231206_14_14_24


15:13

Binary Content

- IIS3DWB_ACC.dat
- ISM330DHCX_ACC.dat
- ISM330DHCX_GYRO.dat
- IIS2DLPC_ACC.dat
- STTS22H_TEMP.dat
- DeviceConfig.json
- AcquisitionInfo.json

AcquisitionInfo.json

File: AcquisitionInfo.json

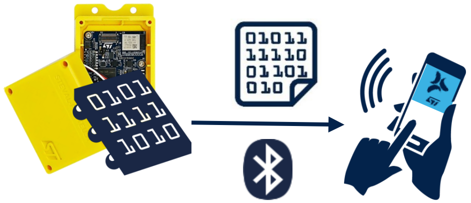
Transfer

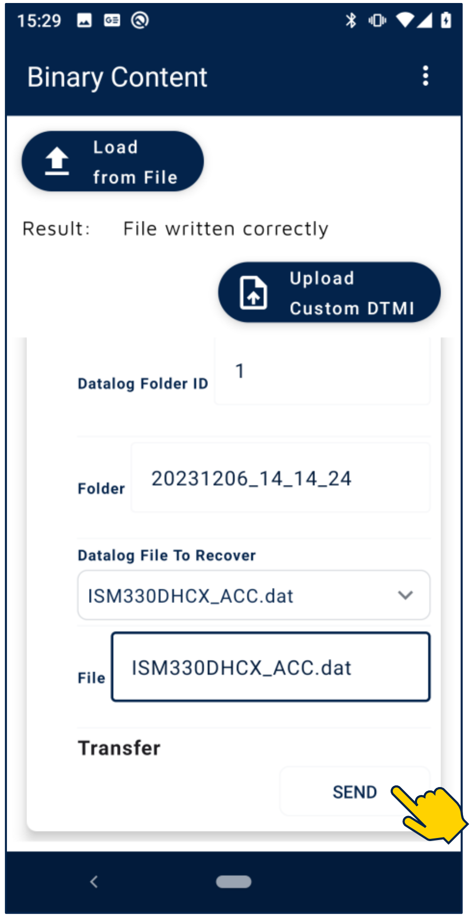
SEND

Choose the acquisition folder

Choose the file you are going to transfer.
You can send one file once

Binary Content
BLE File Transfer




15:29

Binary Content

Load from File

Result: File written correctly

Upload Custom DTMI

Datalog Folder ID 1

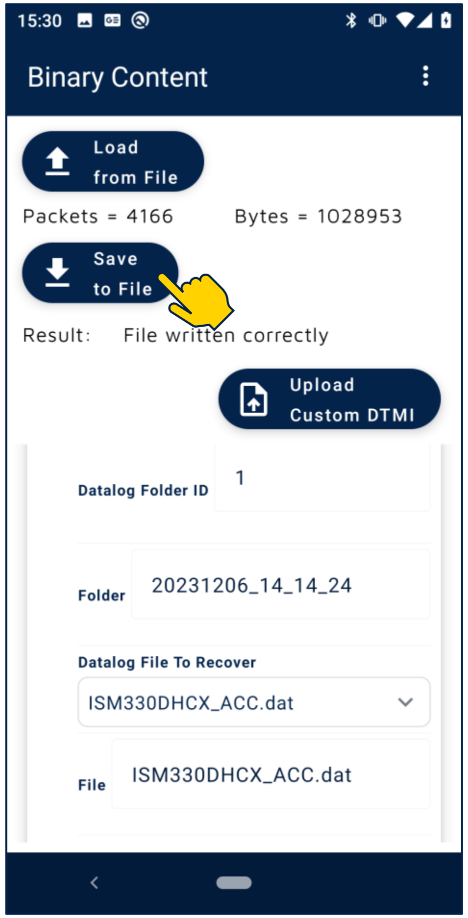
Folder 20231206_14_14_24

Datalog File To Recover ISM330DHCX_ACC.dat

File ISM330DHCX_ACC.dat

Transfer

SEND


15:30

Binary Content

Load from File

Packets = 4166 Bytes = 1028953

Save to File

Result: File written correctly

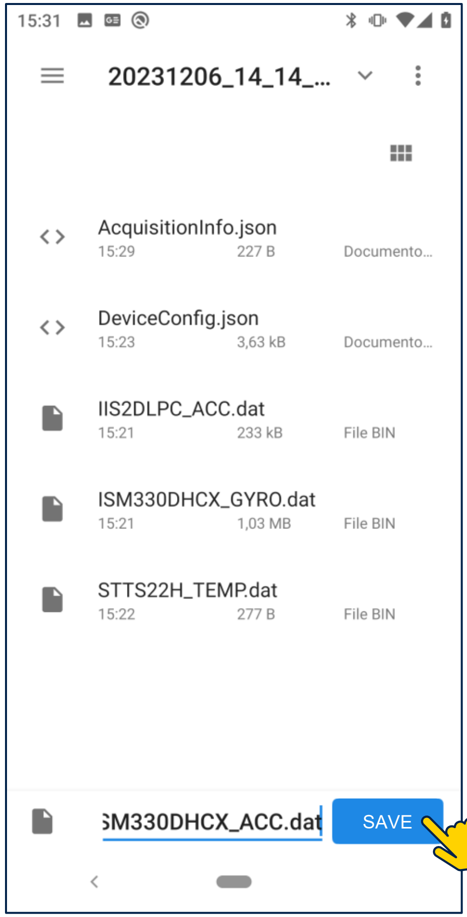
Upload Custom DTMI

Datalog Folder ID 1

Folder 20231206_14_14_24

Datalog File To Recover ISM330DHCX_ACC.dat

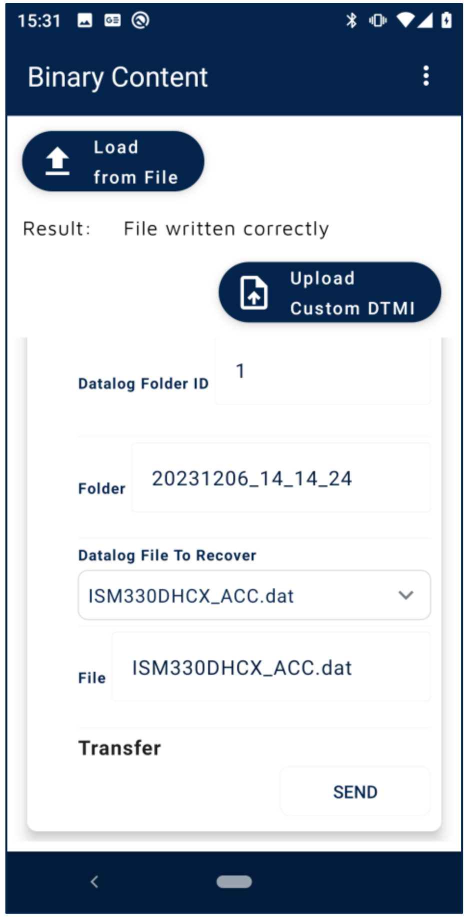
File ISM330DHCX_ACC.dat


15:31

20231206_14_14_...

AcquisitionInfo.json 15:29 227 B	Documento...
DeviceConfig.json 15:23 3,63 kB	Documento...
IIS2DLPC_ACC.dat 15:21 233 kB	File BIN
ISM330DHCX_GYRO.dat 15:21 1,03 MB	File BIN
STTS22H_TEMP.dat 15:22 277 B	File BIN

SM330DHCX_ACC.dat SAVE


15:31

Binary Content

Load from File

Result: File written correctly

Upload Custom DTMI

Datalog Folder ID 1

Folder 20231206_14_14_24

Datalog File To Recover ISM330DHCX_ACC.dat

File ISM330DHCX_ACC.dat

Transfer

SEND

Tap the “SEND” button to start transferring

File has been transferred and can be saved on mobile device

Tap the “Save to File” button

Choose folder and name for the file to be saved and apply

File has been stored

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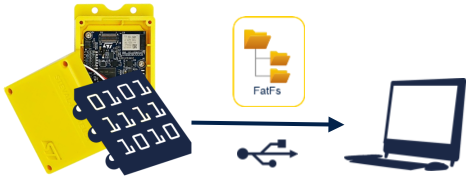
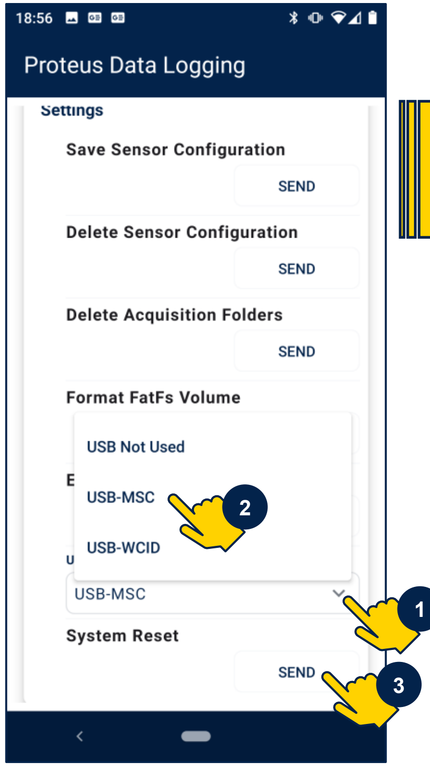


USB Mass Storage Device



18:56

Proteus Data Logging

Settings

Save Sensor Configuration
SEND

Delete Sensor Configuration
SEND

Delete Acquisition Folders
SEND

Format FatFs Volume

USB Not Used

USB-MSC

USB-WCID

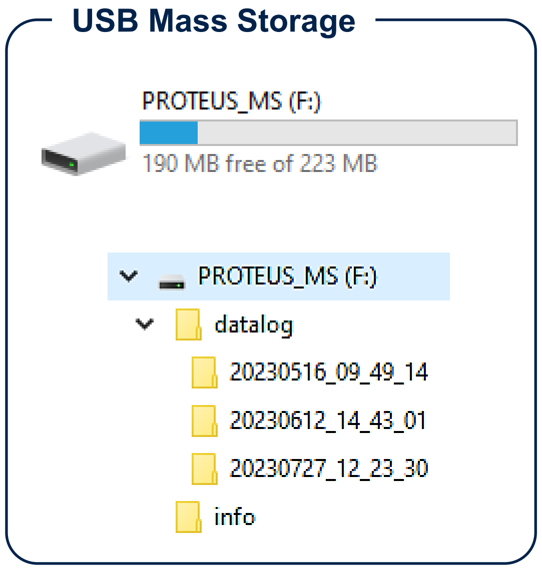
USB-MSC

System Reset
SEND

The STEVAL-PROTEUS will reboot as

USB Mass Storage Device

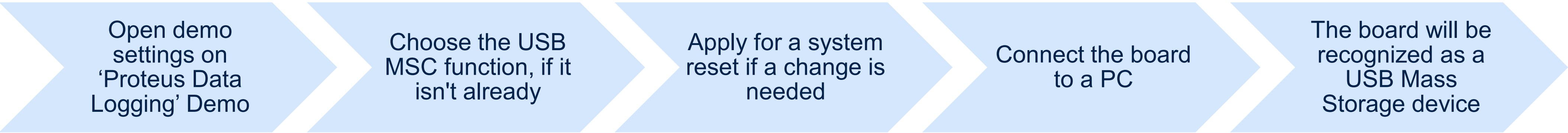
- Connect the STEVAL-PROTEUS to the PC via USB.
- Use a file explorer to navigate into the folders.
- The FatFs volume can be accessed both read and write mode.



USB Mass Storage

PROTEUS_MS (F:)
190 MB free of 223 MB

PROTEUS_MS (F:)
datalog
20230516_09_49_14
20230612_14_43_01
20230727_12_23_30
info



Open demo settings on ‘Proteus Data Logging’ Demo → Choose the USB MSC function, if it isn't already → Apply for a system reset if a change is needed → Connect the board to a PC → The board will be recognized as a USB Mass Storage device

2.1.6 – HS Datalog and BLESensor App: RSSI & Battery

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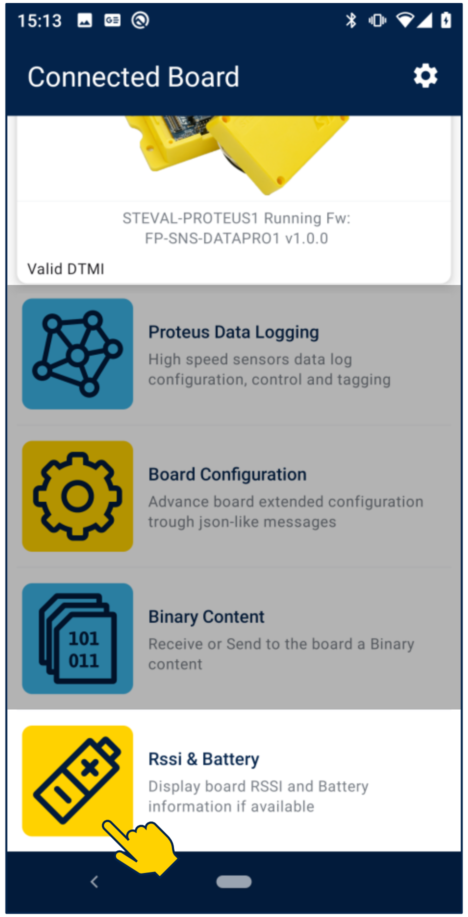
RSSI & Battery



15:13

Connected Board

STEVAL-PROTEUS1 Running Fw:
FP-SNS-DATAPRO1 v1.0.0

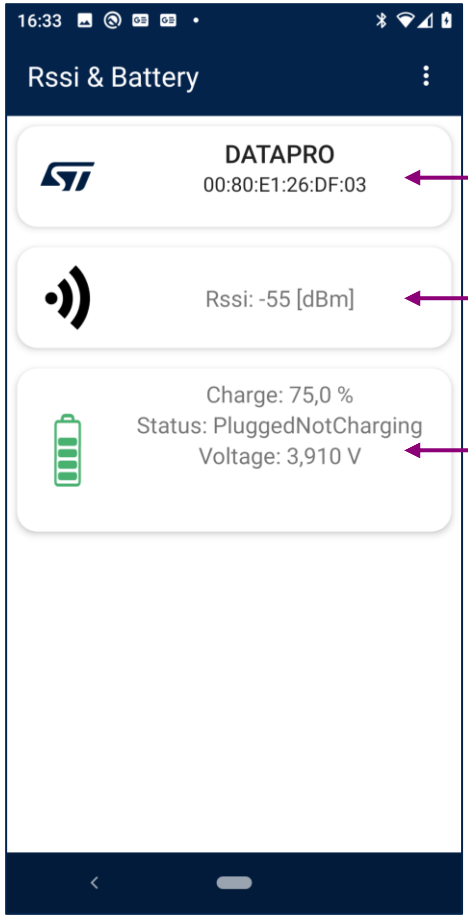
Valid DTMI

Proteus Data Logging
High speed sensors data log configuration, control and tagging

Board Configuration
Advance board extended configuration trough json-like messages

Binary Content
Receive or Send to the board a Binary content

Rssi & Battery
Display board RSSI and Battery information if available



16:33

Rssi & Battery

DATAPRO
00:80:E1:26:DF:03

Rssi: -55 [dBm]

Charge: 75,0 %
Status: PluggedNotCharging
Voltage: 3,910 V

Node MAC Address

RSSI

Battery Information

3 - Documents & Related Resources

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Documents & Related Resources

All documents are available in the related products webpage

- ❑ STEVAL-PROTEUS1
  - ❖ **DB4641**: Industrial sensor evaluation kit for condition monitoring based on the 2.4 GHz STM32WB5MMG module **–** HW Data brief Hardware
  - ❖ **UM3000**: Getting started with the STEVAL-PROTEUS1 evaluation kit for condition monitoring based on the 2.4 GHz STM32WB5MMG module **–** HW User Manual
  - ❖ **Schematics, BOM, Gerber files,** Certifications.
- ❑ FP-SNS-DATAPRO1
  - ❖ **DB5170:** STM32Cube function pack for STEVAL-PROTEUS1 sensor data log and file transfer over BLE and USB.
- ❑ SW TOOLS
  - ❖ **STBLESensor**: application for Android and iOS

4 - STM32 Open Development Environment: Overview

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STM32 ODE Ecosystem

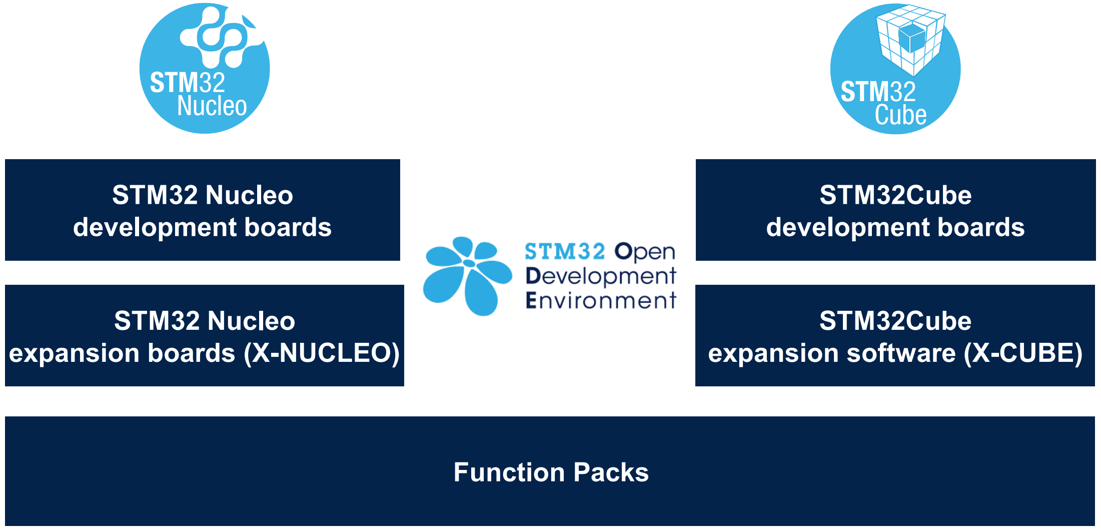
FAST, AFFORDABLE PROTOTYPING AND DEVELOPMENT

The STM32 Open Development Environment (ODE) is an **open**, **flexible**, **easy** and **affordable** way to develop innovative devices and applications based on the STM32 32-bit microcontroller family combined with other state-of-the-art ST components connected via expansion boards. It enables fast prototyping with leading-edge components that can quickly be transformed into final designs.

The STM32 ODE includes the following five elements:

- STM32 Nucleo development boards. A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer
- STM32 Nucleo expansion boards. Boards with additional functionality to add sensing, control, connectivity, power, audio or other functions as needed. The expansion boards are plugged on top of the STM32 Nucleo development boards. More complex functionalities can be achieved by stacking additional expansion boards
- STM32Cube software. A set of free-of-charge tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer, middleware and the STM32CubeMX PC-based configurator and code generator
- STM32Cube expansion software. Expansion software provided free of charge for use with STM32 Nucleo expansion boards, and compatible with the STM32Cube software framework
- STM32Cube Function Packs. Set of function examples for some of the most common application cases built by leveraging the modularity and interoperability of STM32 Nucleo development boards and expansions, with STM32Cube software and expansions.

The STM32 Open Development Environment is compatible with a number of IDEs including IAR EWARM, Keil MDK, mbed and GCC-based environments.



STM32 Nucleo development boards

STM32 Nucleo expansion boards (X-NUCLEO)

STM32Cube development boards

STM32Cube expansion software (X-CUBE)

Function Packs

STM32 Open Development Environment

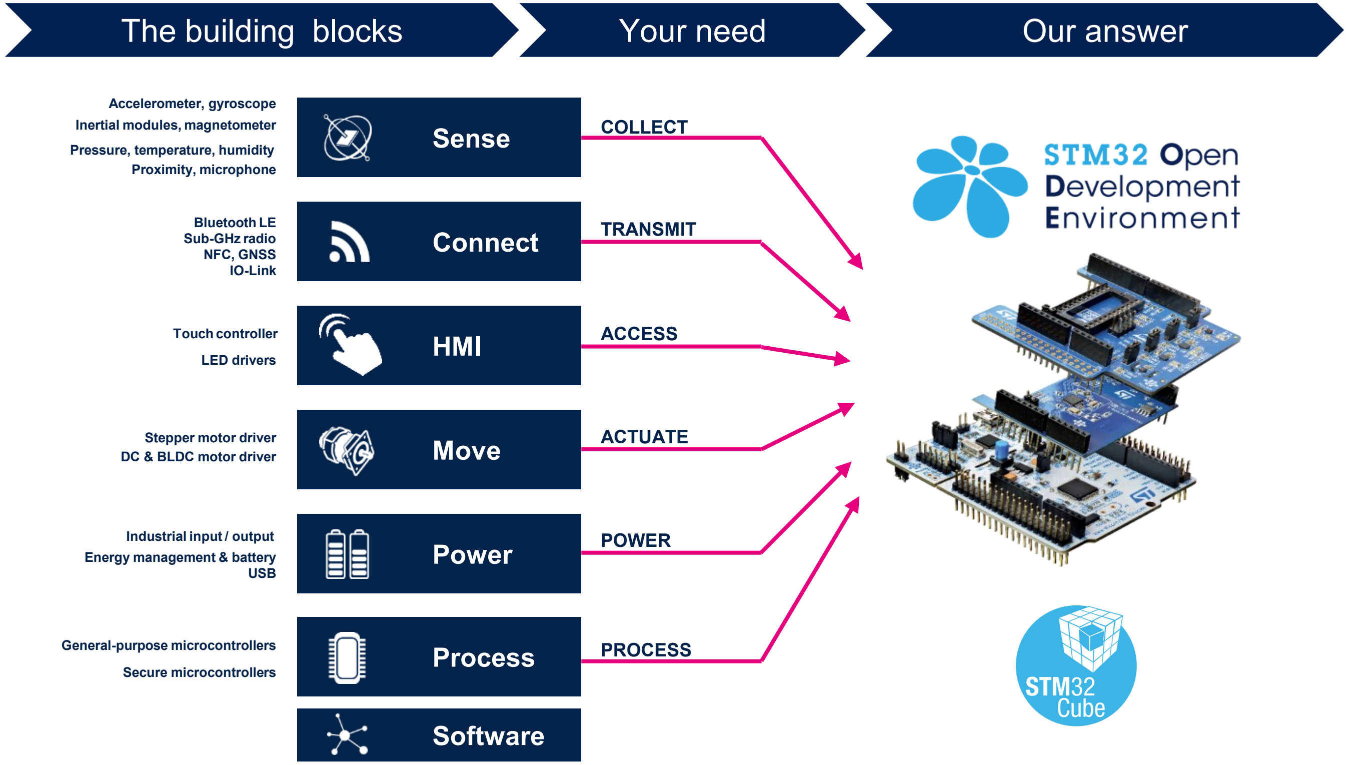
all that you need

The combination of a broad range of expandable boards based on leading-edge commercial products and modular software, from driver to application level, enables fast prototyping of ideas that can be smoothly transformed into final designs.

To start your design:

- Choose the appropriate STM32 Nucleo development board (MCU) and expansion (X-NUCLEO) boards (sensors, connectivity, audio, motor control etc.) for the functionality you need
- Select your development environment (IAR EWARM, Keil MDK, and GCC-based IDEs) and use the free STM32Cube tools and software.
- Download all the necessary software to run the functionality on the selected STM32 Nucleo expansion boards.
- Compile your design and upload it to the STM32 Nucleo development board.
- Then start developing and testing your application.

Software developed on the STM32 Open Development Environment prototyping hardware can be directly used in an advanced prototyping board or in and end product design using the same commercial ST components, or components from the same family as those found on the STM32 Nucleo boards.

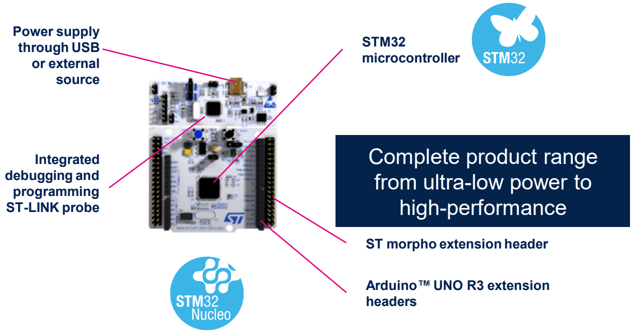


The building blocks		Your need
Accelerometer, gyroscope Inertial modules, magnetometer Pressure, temperature, humidity Proximity, microphone	Sense	COLLECT
Bluetooth LE Sub-GHz radio NFC, GNSS IO-Link	Connect	TRANSMIT
Touch controller LED drivers	HMI	ACCESS
Stepper motor driver DC & BLDC motor driver	Move	ACTUATE
Industrial input / output Energy management & battery USB	Power	POWER
General-purpose microcontrollers Secure microcontrollers	Process	PROCESS
	Software	

Our answer

STM32 Open Development Environment

STM32 Cube



Power supply through USB or external source

Integrated debugging and programming ST-LINK probe

STM32 microcontroller

Complete product range from ultra-low power to high-performance

ST morpho extension header

Arduino™ UNO R3 extension headers

STM32 Nucleo

Thank you

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