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Quick Start Guide

STM32Cube function pack for high speed datalogging and ultrasound processing (FP-SNS-DATALOG2)

Version 3.1 – Jun ’25

Agenda

1. Hardware and Software overview
2. Setup & Demo Examples
3. Documents & Related Resources

1 - Hardware and Software overview

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STWIN.box development kit - STEVAL-STWINBX1
Hardware Overview

STWIN.box - SensorTile Wireless Industrial Node

The STWIN.box (STEVAL-STWINBX1) is a development kit and reference design that simplifies prototyping and testing of advanced industrial sensing applications in IoT contexts such as condition monitoring and predictive maintenance.
It is an evolution of the original STWIN kit (STEVAL-STWINKT1B) and features a higher mechanical accuracy in the measurement of vibrations, an improved robustness, an updated BoM to reflect the latest and best-in-class MCU and industrial sensors, and an easy-to-use interface for external add-ons.
The STWIN.box kit consists of an STWIN.box core system, a 480mAh LiPo battery, an adapter for the ST-LINK debugger (STEVAL-MKIGIBV4), a plastic case, an adapter board for DIL 24 sensors and a flexible cable.

Key Features

- Multi-sensing wireless platform for vibration monitoring and ultrasound detection
- Built around STWIN.box core system board with processing, sensing, connectivity, and expansion capabilities
- Ultra-low power Arm® Cortex®-M33 with FPU and TrustZone at 160 MHz, 2048 kBytes Flash memory (STM32U585AI)
- MicroSD card slot for standalone data logging applications
- On-board Bluetooth® low energy wireless technology (BlueNRG-M2), 2.4GHz Wi-Fi (EMW3080) and NFC (ST25DV04K)
- Wide range of industrial IoT sensors: Ultra-wide bandwidth (up to 6 kHz), low-noise, 3-axis digital vibration sensor (IIS3DWB), 3D accelerometer + 3D gyro iNEMO inertial measurement unit (ISM330DHCX) with Machine Learning Core, High-performance ultra-low-power 3-axis accelerometer for industrial applications (IIS2DLPC), Ultra-low power 3-axis magnetometer (IIS2MDC), Dual full-scale, 1.26 bar and 4 bar, absolute digital output barometer in full-mold package (ILPS22QS), Low-voltage, ultra low-power, 0.5°C accuracy I²C/SMBus 3.0 temperature sensor (STTS22H), Industrial grade digital MEMS microphone (IMP34DT05), Analog MEMS microphone with frequency response up to 80 kHz (IMP23ABSU)
- Expandable via a 34-pin FPC connector

STEVAL-STWINBX1

Latest info available at
https://www.st.com/en/evaluation-tools/steval-stwinbx1.html

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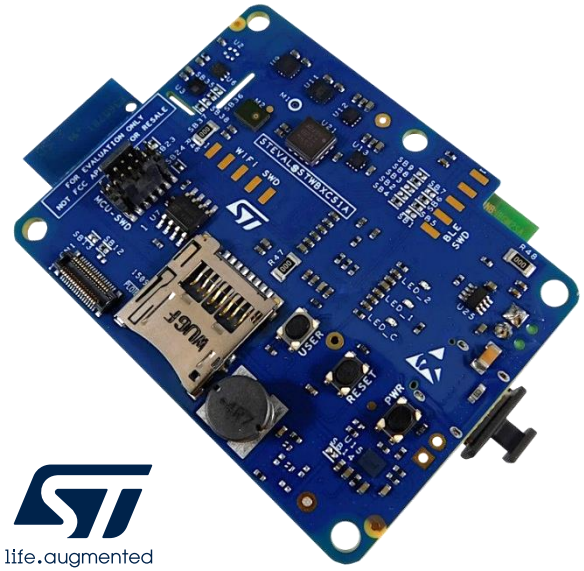
STWIN.box development kit - STEVAL-STWINBX1
Hardware Overview

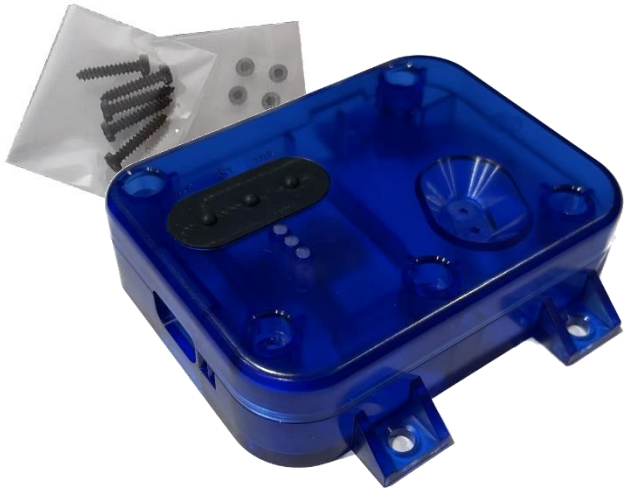
STWIN.box - SensorTile Wireless Industrial Node

The STEVAL-STWINBX1 development kit includes:

- The STEVAL-STWBXCS1 STWIN.box core system (main board);
- A plastic case with M3 bolts;
- A 480 mAh 3.7 V LiPo battery;
- The STEVAL-MKIGIBV4 ST-LINK adapter with programming cable;
- The STEVAL-C34DIL24 adapter board for DIL24 sensors with the STEVAL-FLTCB01 flexible cable.

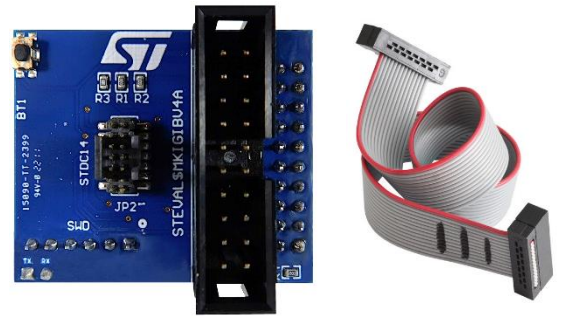
STEVAL-STWBXCS1
STWIN.box Core System





Plastic Case

Battery
LiPo-752535 - 480mAh



STEVAL-MKIGIBV4 + Cable
STLINK Adapter (V2, V2.1)

STEVAL-C34DIL24

STEVAL-FLTCB01
34 pin Flex cable

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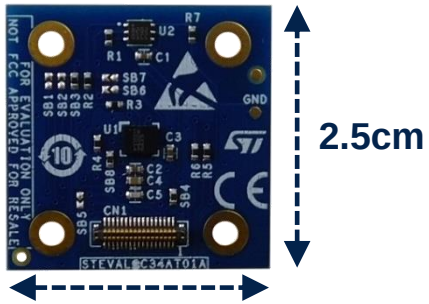
STWIN.box Modular platform expansion - STEVAL-C34KAT1
Hardware Overview

Vibrometer and Temperature Sensors Expansion Board

STWIN.box expansion with Vibrometer (**IIS3DWB**) and Temperature (**STTS22H**) sensors

- Optimal high frequency performance (up to 6kHz)
- Exposed pad on bottom side for thermal coupling
- 34-pin slave connector, compatible with STWIN.box and other ST Evaluation boards
- 34-pin flex cable included
- 4x fixing holes

STEVAL-C34AT01



STEVAL-FLTCB01

Flex cable

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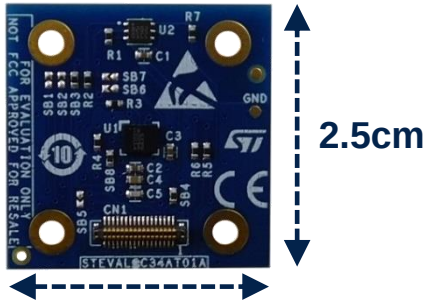
STWIN.box Modular platform expansion - STEVAL-C34KAT2
Hardware Overview

6 axis + ISPU and Temperature Sensors Expansion Board

STWIN.box expansion with 6 axis + ISPU (**ISM330IS**) and Temperature (**STTS22H**) sensors

- Optimal high frequency performance
- Exposed pad on bottom side for thermal coupling
- 34-pin slave connector, compatible with STWIN.box and other ST Evaluation boards
- 34-pin flex cable included
- 4x fixing holes

STEVAL-C34AT02



STEVAL-FLTCB01

Flex cable

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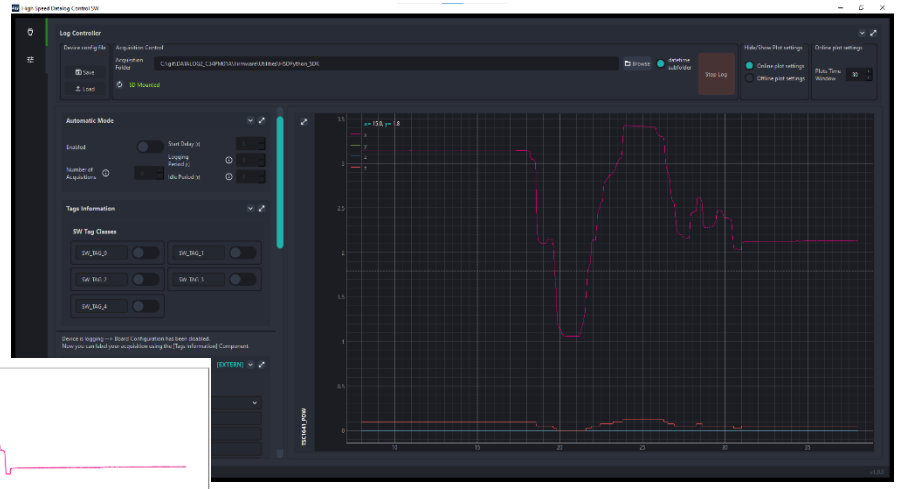
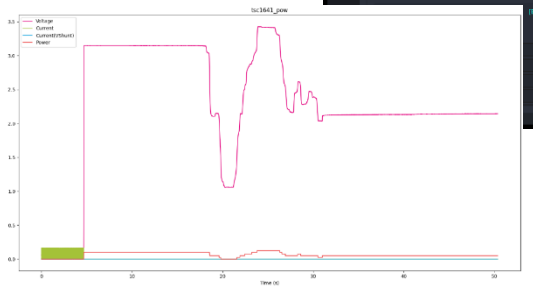
STWIN.box Modular platform expansion - STEVAL-C34KPM01
Hardware Overview

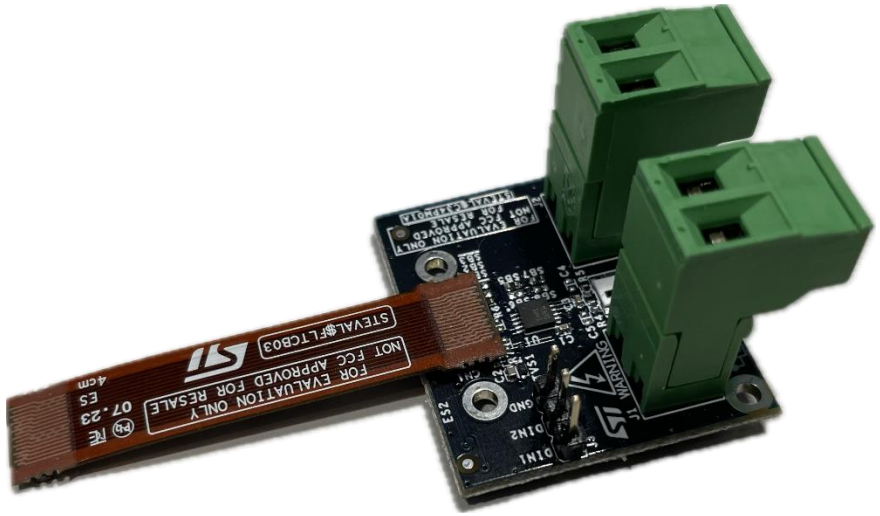
Power monitoring add-on

STWIN.box expansion with high precision current, voltage, power, and temperature monitoring analog front-end (**TSC1641**)

- Total conversion time: 128µs to 32.768ms
- Load voltage sensing: 0 to 60V
- Load current sensing up to 10A
- 34-pin slave connector, compatible with STWIN.box and other ST Evaluation boards
- 34-pin flex cable included
- Fixing holes







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STWIN.box Modular platform expansion - STEVAL-PDETECT1
Hardware Overview

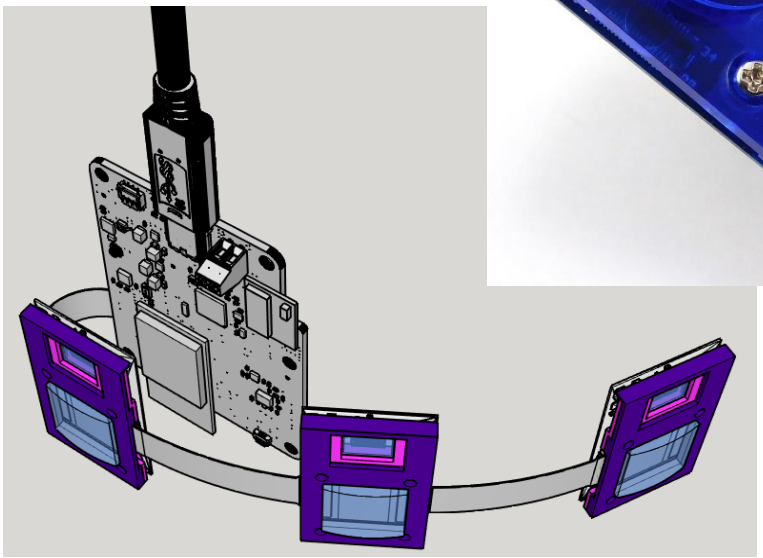
Presence Detection add-on for STWIN.box

Add-on evaluation kit connected to STWIN.box targeting human presence applications.

Key Sensor Products:
- VD6283TX45/1 Ambient Light Sensor
- VL53L8CXV0GC Proximity Sensor
- STHS34PF80 Far Infrared TMOS sensor

The kit includes:
- STEVAL-PDETCS1 board
- TMOS long range Fresnel lens: TMOS63-10
- Plastic case for TMOS63-10 Fresnel lenses
- Time-of-Flight cover glass: IR136C0-IC09-A066
- STEVAL-FLTCB03 flex cable

DATALOG2 for PDETECT can support up to 3 STEVAL-PDETECT1 connected simultaneously for multi sensor tracking



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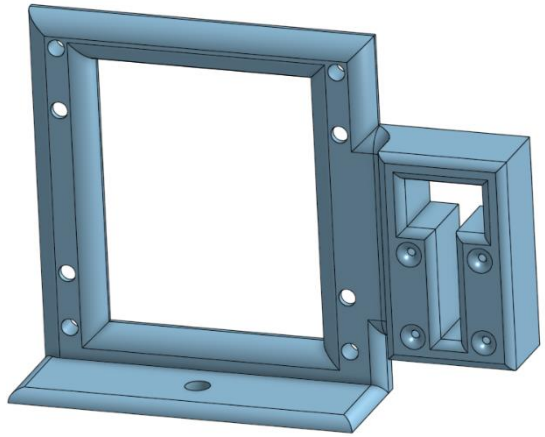
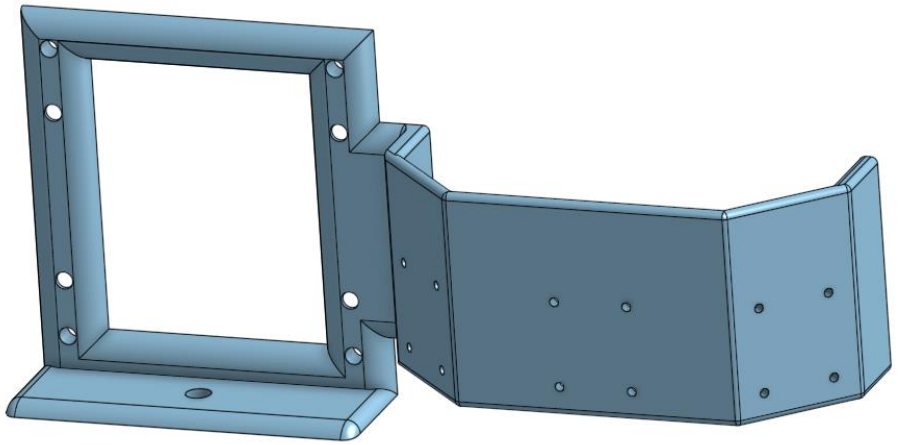
STWIN.box Modular platform expansion - STEVAL-PDETECT1
Optional Mounting Holders

- Example 3D CAD Holders are available on st.com- STEVAL-PDETECT1 page under CAD Resources
- Holder examples available for mounting either 1 STEVAL-PDETECT1 board or 3 STEVAL-PDETECT1 boards along with the STEVAL-STWINBX1
- You can use the holder to mount the sensors onto various positions, such as on the wall, ceiling, desk, and tripod directly for application evaluation + testing





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STWIN development kit - STEVAL-STWINKT1B
Hardware Overview

STWIN - SensorTile Wireless Industrial Node

The STWIN (STEVAL-STWINKT1B) is a development kit and reference design that simplifies prototyping and testing of advanced industrial IoT applications such as condition monitoring and predictive maintenance. The kit supports BLE wireless connectivity through an on-board module and Wi-Fi connectivity through a special plugin expansion board (STEVAL-STWINWFV1), wired RS485 and USB OTG connectivity.

Key Features

- Multi-sensing wireless platform implementing vibration monitoring and ultrasound detection
- Updated version of STEVAL-STWINKT1, now including STSAFE-A110 populated, BlueNRG-M2S module and IMP23ABSU MEMS microphone
- Ultra-low-power ARM Cortex-M4 MCU at 120 MHz with FPU, 2048 kbytes Flash memory (STM32L4R9)
- Micro SD Card slot for standalone data logging applications
- Option to implement Authentication and Brand protection secure solution with STSAFE-A110
- Wide range of industrial IoT sensors: ultra-wide bandwidth (up to 6 kHz), low-noise, 3-axis digital vibration sensor (IIS3DWB), 3D accelerometer + 3D Gyro iNEMO inertial measurement unit (ISM330DHCX) with machine learning core, ultra-low-power high performance MEMS motion sensor (IIS2DH), ultra-low-power 3-axis magnetometer (IIS2MDC), digital absolute pressure sensor (LPS22HH), relative humidity and temperature sensor (HTS221), low-voltage digital local temperature sensor (STTS751), industrial grade digital MEMS microphone (IMP34DT05), analog MEMS microphone with frequency response up to 80 kHz (IMP23ABSU)
- Modular architecture, expandable via on-board connectors: STMOD+ and 40-pin flex general purpose expansions, 12-pin male plug for connectivity expansions, 12-pin female plug for sensing expansions
- Other kit components: Li-Po battery 480 mAh, STLINK-V3MINI debugger with programming cable, Plastic box

Latest info available at
www.st.com/stwin

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SensorTile.box PRO development kit - STEVAL-MKBOXPRO
Hardware Overview

SensorTile.box PRO discovery box

The STEVAL-MKBOXPRO is the new ready-to-use programmable wireless box kit for developing any IoT application based on remote data gathering and evaluation.

The SensorTile.box PRO board fits into a small plastic box with a long-life 480mAh rechargeable battery, for the first time leveraging also on a wireless charger and a programmable NFC tag. The board can be easily connected via Bluetooth to the ST BLE Sensor app on your smartphone, from which the box kit can be enjoyed in Base and Expert mode. In Pro mode, professional users can exploit the firmware programming and debugging interface in the STM32 ODE for developing their firmware from scratch.

STEVAL-MKBOXPRO

Key Features

- All-in-one sensor node in a very small form factor board - Ready-to-go development kit
- Develop apps quickly regardless of your level of expertise:
  - Basic mode: wide range of default IoT and wearable applications
  - Expert mode: build custom applications leveraging the available algorithms
  - Pro mode: develop code in an intuitive way using STM32 open development environment (ODE) and ST function pack libraries
- ST BLE Sensor app on your smartphone (both on the Android Play Store and iOS App Store) allows you to immediately connect to the box kit
- Rechargeable long-life battery
- Windows, LINUX, and MacOS ST software compatibility
- Over the Air (OTA) Firmware upgrade

Latest info available at
https://www.st.com/en/evaluation-tools/steval-mkboxpro.html

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Discovery kit for IoT node - B-U585I-IOT02A
Hardware Overview

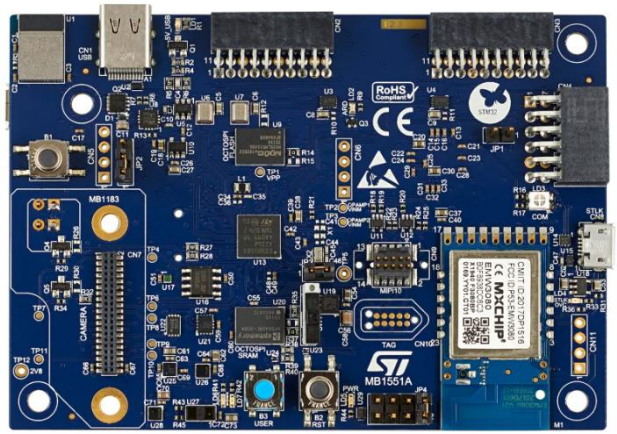
B-U585I-IOT02A Discovery kit

The B-U585I-IOT02A Discovery kit provides a complete demonstration and development platform for the STM32U585AI microcontroller, featuring an Arm® Cortex®-M33 core with Arm® TrustZone® and Armv8-M mainline security extension, 2 Mbytes of Flash memory and 786 Kbytes of SRAM, as well as smart peripheral resources.

This Discovery kit enables a wide diversity of applications by exploiting low-power communication, multiway sensing, and direct connection to cloud servers.

It includes Wi-Fi® and Bluetooth® modules, as well as microphones, temperature and humidity, magnetometer, accelerometer and gyroscope, pressure, time-of-flight, and gesture-detection sensors.

B-U585I-IOT02A



Key Features

- Ultra-low-power STM32U585AII6Q microcontroller based on the Arm® Cortex®-M33 core with Arm® TrustZone®, 2 Mbytes of Flash memory and 786 Kbytes of SRAM, and SMPS in UFBGA169 package
- 512-Mbit Quad-SPI Flash memory, 64-Mbit Octo-SPI PSRAM, 256-Kbit I2C EEPROM
- USB FS, Sink and Source power, 2.5 W power capability
- 802.11 b/g/n compliant Wi-Fi® module from MXCHIP
- Bluetooth® Low Energy from STMicroelectronics
- MEMS sensors from STMicroelectronics
- 2 user LEDs, User and Reset push-button
- On-board STLINK-V3E debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port

Latest info available at
https://www.st.com/en/evaluation-tools/b-u585i-iot02a.html

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Motion and microphone expansion board - X-NUCLEO-IKS02A1
Hardware Overview

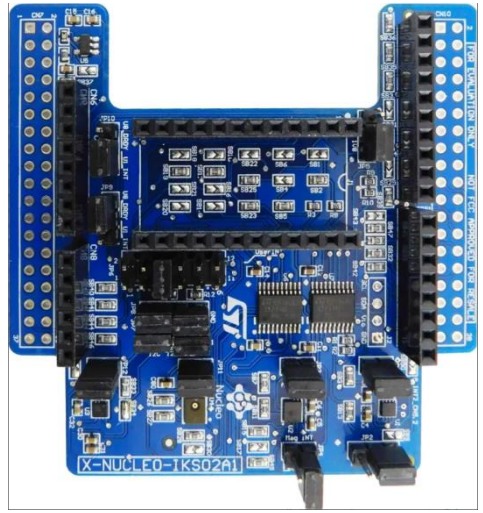
Industrial motion MEMS sensor expansion board

The X-NUCLEO-IKS02A1 industrial motion MEMS sensor expansion board is compatible with the Arduino UNO R3 connector layout.

It embeds the ISM330DHCX 3-axis accelerometer and 3-axis gyroscope, the IIS2MDC 3-axis magnetometer, the IIS2DLPC 3-axis accelerometer, the IMP34DT05 digital microphone.

The X-NUCLEO-IKS02A1 interfaces with the STM32 microcontroller via I²C pin, with the possibility of changing the default I²C port.

X-NUCLEO-IKS02A1



Key Features

- ISM330DHCX MEMS 3D accelerometer (±2/±4/±8/±16 g) plus 3D gyroscope (±125/±250/±500/±1000/±2000 dps)
- IIS2MDC MEMS 3D magnetometer (±50 gauss)
- IIS2DLPC MEMS 3D accelerometer low power (±2/±4/±8/±16 g)
- IMP34DT05 MEMS digital omnidirectional microphone (-26 dBFS, ±3 dB sensitivity)
- DIL 24-pin socket available for additional MEMS adapters and other sensors
- Free comprehensive development firmware library and samples for all sensors compatible with STM32Cube firmware
- Available I²C sensor hub features on ISM330DHCX
- Compatible with STM32 Nucleo boards
- Equipped with Arduino UNO R3 connector
- RoHS and WEEE compliant

Latest info available at
https://www.st.com/en/ecosystems/x-nucleo-iks02a1.html

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Motion and environmental expansion board - X-NUCLEO-IKS4A1
Hardware Overview

Motion MEMS and environmental sensor expansion board

The X-NUCLEO-IKS4A1 is a motion MEMS and environmental sensor evaluation board kit consisting of the main board X-NUCLEO-IQS4A1, which hosts the motion MEMS and environmental sensors, and the detachable addon board STEVAL-MKE001A, which hosts the Qvar swipe electrodes.

There is also the possibility to integrate presence and motion detection with an IR sensor as well as combining the features of multiple sensors through the DIL24 adapter..

Key Features

- LSM6DSO16IS: MEMS 3D accelerometer (±2/±4/±8/±16 g) + 3D gyroscope (±125/±250/±500/±1000/±2000 dps) with ISPU (Intelligent Processing Unit)
- LIS2MDL: MEMS 3D magnetometer (±50 gauss)
- LIS2DUXS12: Ultra low-power MEMS 3D accelerometer (±2/±4/±8/±16 g) with Qvar, AI, & anti-aliasing
- LPS22DF: Low-power and high-precision MEMS pressure sensor, 260-1260 hPa absolute digital output barometer
- SHT40AD1B: High-accuracy, ultra-low-power relative humidity and temperature sensor (by Sensirion)
- STTS22H: Low-voltage, ultralow-power, 0.5 °C accuracy temperature sensor (–40 °C to +125 °C)
- LSM6DSV16X: MEMS 3D accelerometer (±2/±4/±8/±16 g) + 3D gyroscope (±125/±250/±500/±1000/±2000/±4000 dps) with embedded sensor fusion, AI, QvarDIL 24-pin socket available for additional MEMS adapters and other sensors
- I²C sensor hub features on LSM6DSO16IS and LSM6DSV16X available
- Compatible with STM32 Nucleo boards, equipped with Arduino UNO R3 connector
- RoHS, WEEE and UKCA compliant

X-NUCLEO-IKS4A1

Latest info available at
https://www.st.com/en/ecosystems/x-nucleo-iks4a1.html

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FP-SNS-DATALOG2
Software Overview

Software Description

The ST High Speed Datalog (FP-SNS-DATALOG2) is a comprehensive multisensor data capture and visualization toolkit, engineered to facilitate the development of embedded data science applications

ST High Speed Datalog is compatible with STDATALOG-PYSDK, a data-centric design and user-friendly Python SDK, and can run with hardware boards that supply real-time data streams, empowering users with full control of the data acquisition process. The included firmware is compatible with the STBLESensor app, which also lets users manage the board and sensor configurations, start/stop data acquisition on a microSD™ card, and control data labeling.

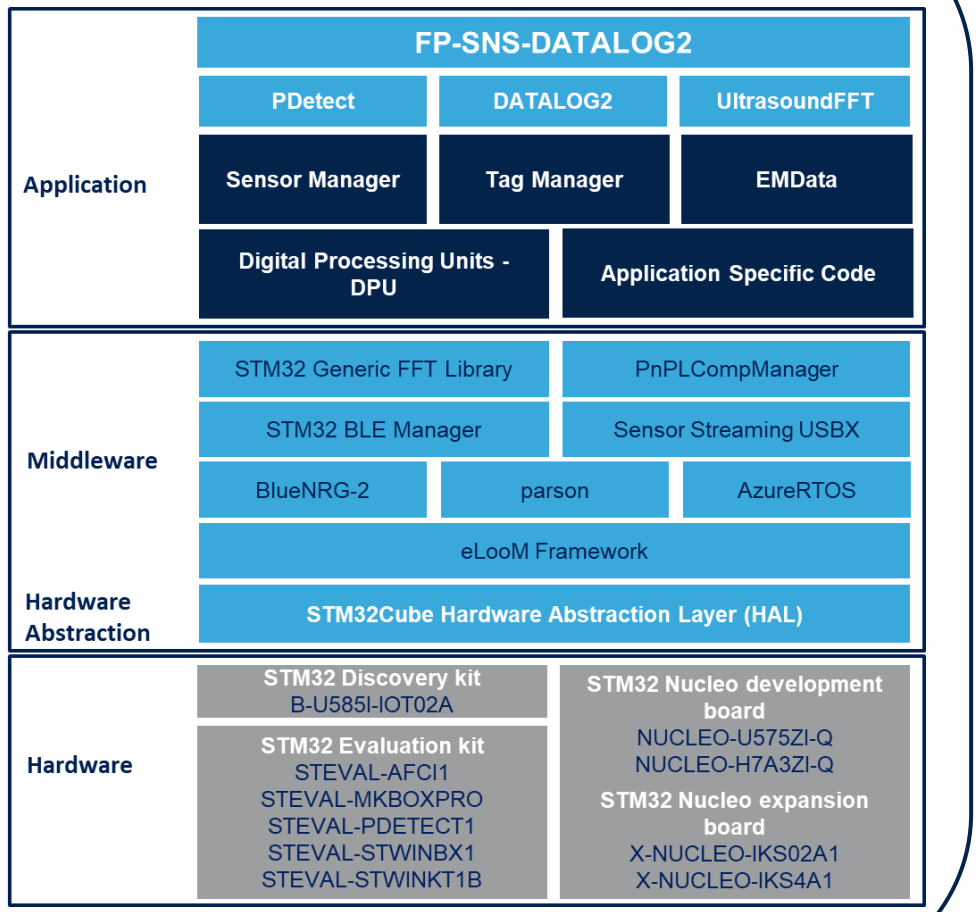
The FP-SNS-DATALOG2 firmware can run on STEVAL-STWINBX1, STEVAL-STWINKT1B, STEVAL-MKBOXPRO, STEVAL-AFCI1, B-U585I-IOT02A, X-NUCLEO-IKS02A1 and X-NUCLEO-IKS4A1 with NUCLEO-U575ZI-Q or with NUCLEO-H7A3ZI-Q.

ST High Speed Datalog also natively supports STEVAL-PDETECT1, STEVAL-C34KAT1, STEVAL-C34KAT2, STEVAL-C34KPM1, STEVAL-C34DIL24, STEVAL-MKI230KA, STEVAL-MKI245KA, STEVAL-MKI246KA and SENSEVAL-SCB4XV1 addons for the STEVAL-STWINBX1.

It also supports STEVAL-MKI153V1, STEVAL-MKI223V1K, STEVAL-MKI229A, STEVAL-MKI234KA, STEVAL-MKI240KA, STEVAL-MKI247A and STEVAL-MKI251A add-ons for STEVAL-MKBOXPRO.

The ST High Speed Datalog is part of the ST Edge AI Suite, which is an integrated collection of software tools designed to facilitate the development and deployment of embedded AI applications.

Overall Software Architecture



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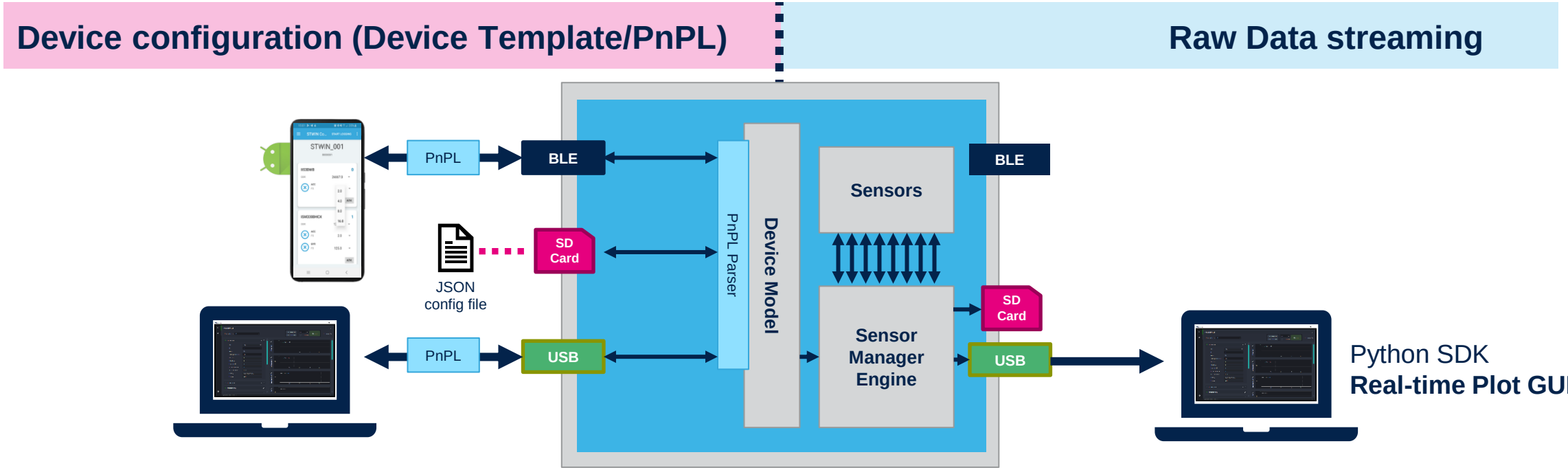
DATALOG2 demonstration

Optimized STM32 FW Supports streaming of all Sensors at Full data rate



- Based on **AzureRTOS**
  - ThreadX, FileX, USBX
- USBX WCID Streaming class and PC DLL

- SD Card
- Full control of acquisition via BLE app
- Control via **PnP-Like** commands

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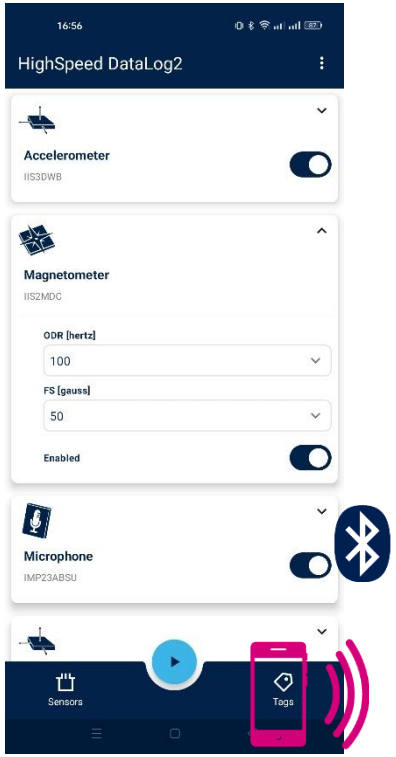
2 - Setup & Demo Examples

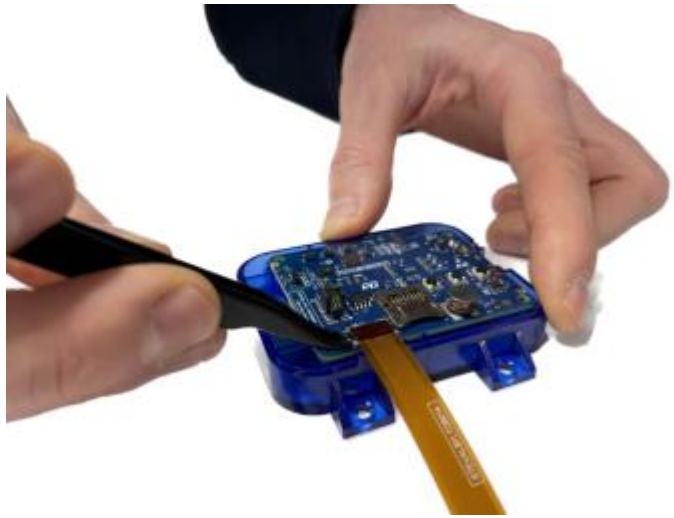
HW prerequisites – STEVAL kits

- 1 STEVAL-STWINBX1, STEVAL-STWINKT1B or STEVAL-MKBOXPRO
- Laptop/PC
- 2 type-C USB cables + 1 STLINK-V3MINIE
  - In alternative it is also possible to directly program the STWIN.box with a single USB-C cable (refer to firmware update – USB)
- 1 micro-SD card
- 1 smartphone with ST BLE Sensor App



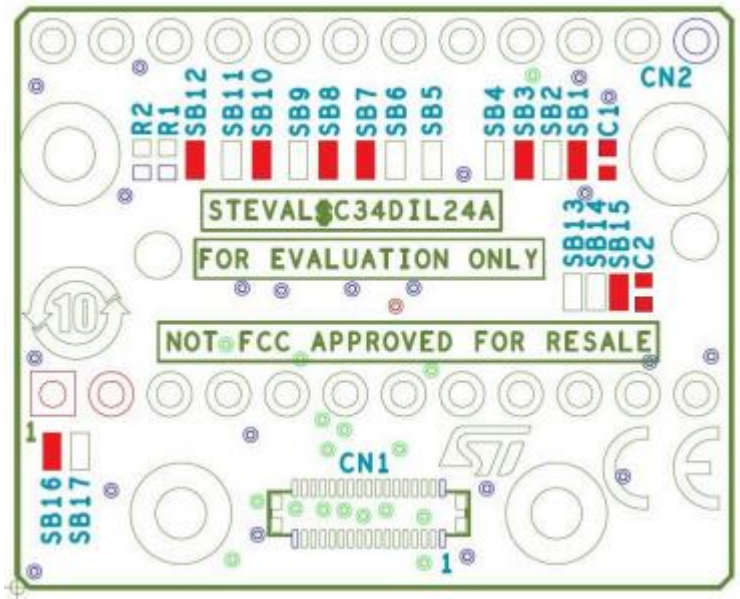
HW prerequisites – STEVAL-STWINBX1

- STEVAL-STWINBX1 is also compatible with external add-ons, like STEVAL-PDETECT1, STEVAL-C34KAT1/2 and STEVAL-C34KPM1
- The included DIL24 adapter (STEVAL-C34DIL24) allows to further expand the capabilities of the STWIN.box
- Notice that hot plug is not supported. Add-ons must be attached to the STEVAL-STWINBX1 before powering it.
- Please be careful when you remove the Flex cable as you may damage it. The safest way to remove it is by pulling it next to the connectors using tweezers.

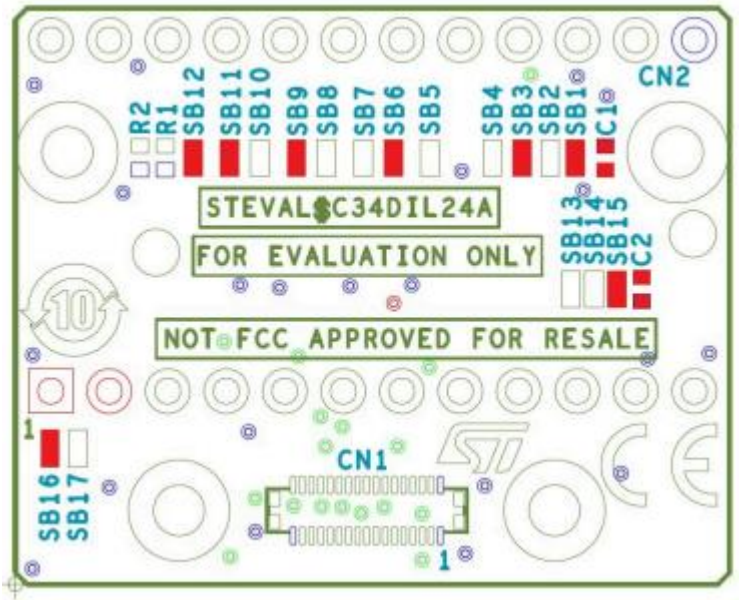


HW prerequisites – STEVAL-STWINBX1

- By default, the DIL24 adapter is configured in SPI mode. Default configuration is valid with STEVAL-MKI230KA and STEVAL-MKI246KA.



- If you need to use I2C sensors (i.e.: with STEVAL-MKI223V1K or SENSEVAL-SCB4XV1), you need to modify the solder bridges as following:
  - Remove SB7, SB8, SB10
  - Solder SB6, SB9, SB11



HW prerequisites – STEVAL-MKBOXPRO

- The SensorTile.box PRO core system board includes a socket DIL24 for easy MEMS adapter connection.
- DATALOG2 supports STEVAL-MKI153V1, STEVAL-MKI223V1K, STEVAL-MKI229A, STEVAL-MKI234KA, STEVAL-MKI240KA, STEVAL-MKI247A and STEVAL-MKI251A add-ons for STEVAL-MKBOXPRO.
- Notice that hot plug is not supported. Add-ons must be attached to the STEVAL-MKBOXPRO before powering it.

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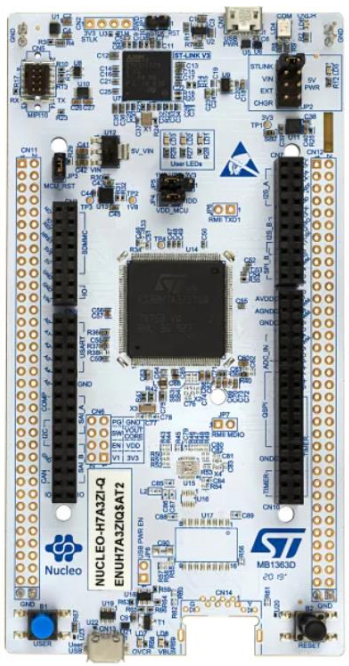
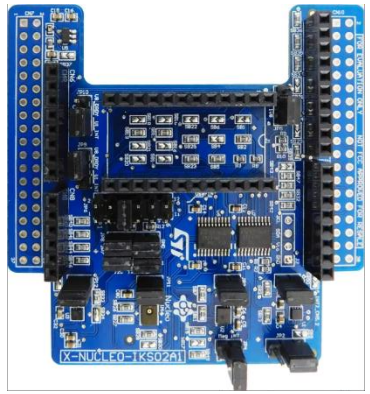
HW prerequisites – Nucleo and Discovery kits

- 1 B-U585I-IOT02A, X-NUCLEO-IKS02A1 or X-NUCLEO-IKS4A1 with NUCLEO-U575ZI-Q or with NUCLEO-H7A3ZI-Q
- Laptop/PC
- 2 USB cables

USB Cables

B-U585I-IOT02A





NUCLEO-H7A3ZI-Q

NUCLEO-U575ZI-Q

X-NUCLEO-IKS02A1
or
X-NUCLEO-IKS4A1

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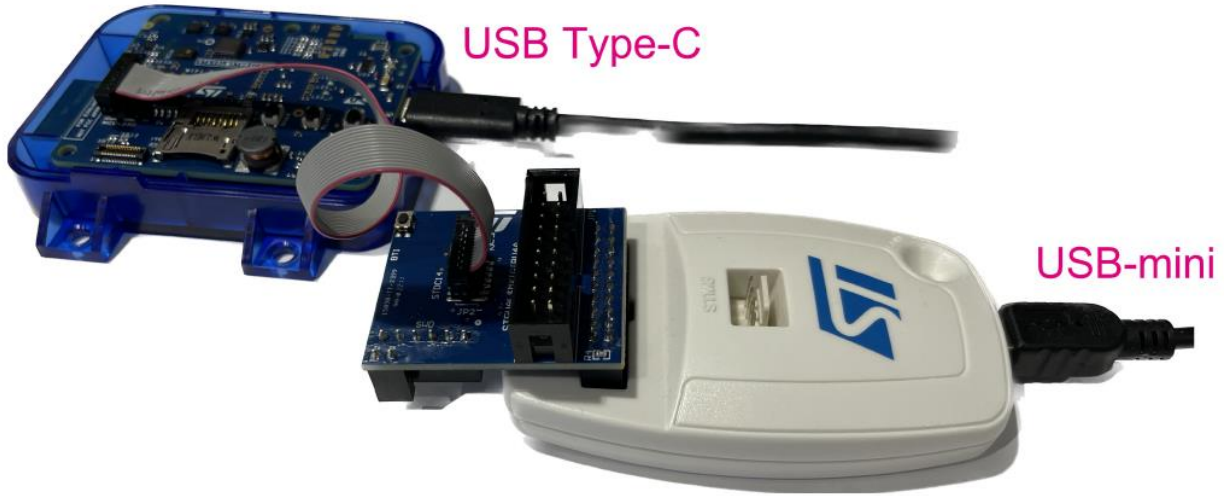
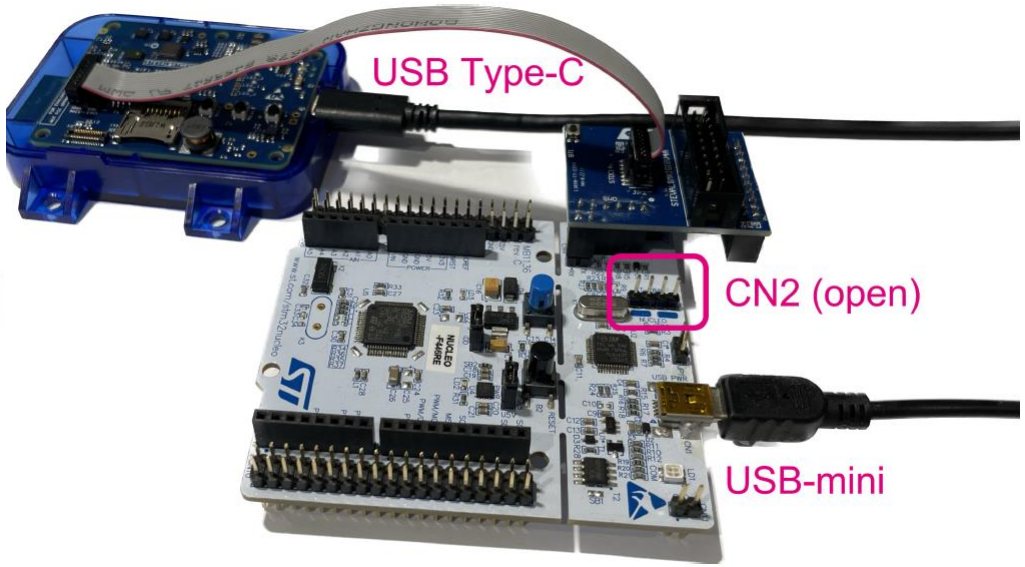
Programming options

- It is possible to directly program the STWIN, STWIN.box and SensorTile.box PRO with a single USB-C cable (refer to firmware update – USB)
- If you are interested in FW debugging, programming connector is natively compatible with STLINK-V3 debuggers family (STLINK-V3SET or STLINK-V3MINI). STLINKV3 programmers are NOT included in STWIN.box and SensorTile.box PRO kits.
- Alternatively, to offer more alternatives, an adapter to ST-Link V2-1 (STM32-Nucleo) or standard JTAG connector is included in the STEVAL-STWINBX1 kit.





Software and other prerequisites

- **STM32CubeProgrammer Software**
  - Download and install STM32CubeProgrammer
- **DATALOG2 – PDetect – UltrasoundFFT**
  - Download the FP-SNS-DATALOG2 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 (Keil, IAR, STM32CubeIDE)
- **ST BLE Sensor App**
  - Download and install ST BLE Sensor App (for both Android and iOS – v5.2 and above)
- **Python**
  - To save, plot and elaborate data, Python utility scripts are distributed in a dedicated SDK called STDATALOG-PYSDK

DATALOG2, PDetect and UltrasoundFFT are **not** the default firmware.
To update the firmware, please follow the instructions for Fast FOTA valid for STWIN, STWIN.box and SensorTile.box PRO

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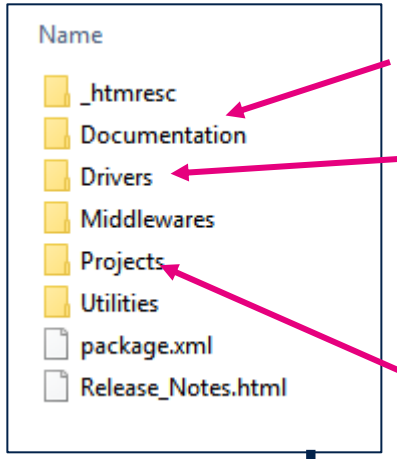
Samples demonstrations

1 www.st.com

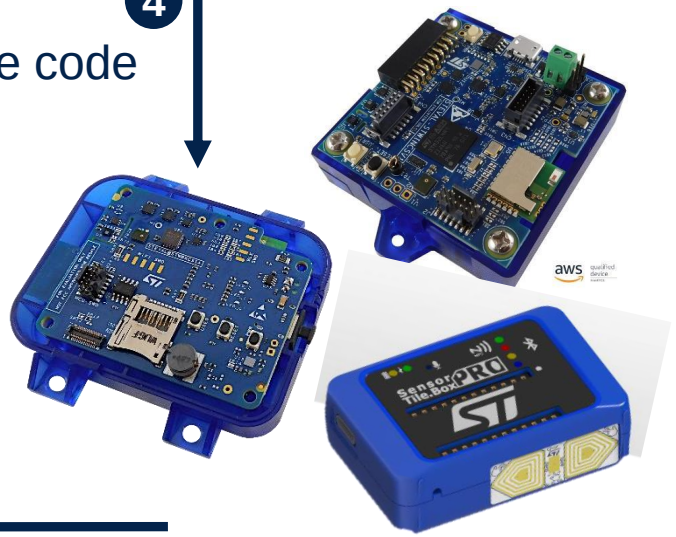
2 Select:
FP-SNS-DATALOG2

3 Download & unpack

Package structure



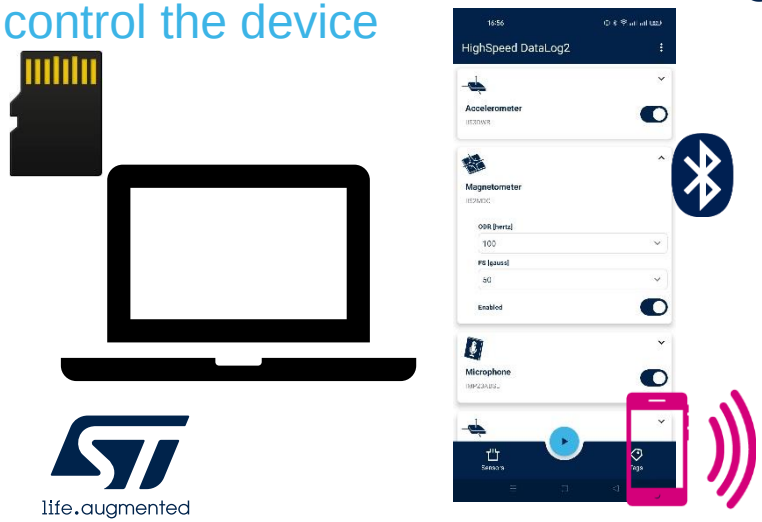
4 Use the pre-compiled binaries or re-compile the code customizing your device configuration



KEIL Tools by ARM · IAR SYSTEMS · STM32 CubeIDE

5

6 Visualize log of sensors data and control the device



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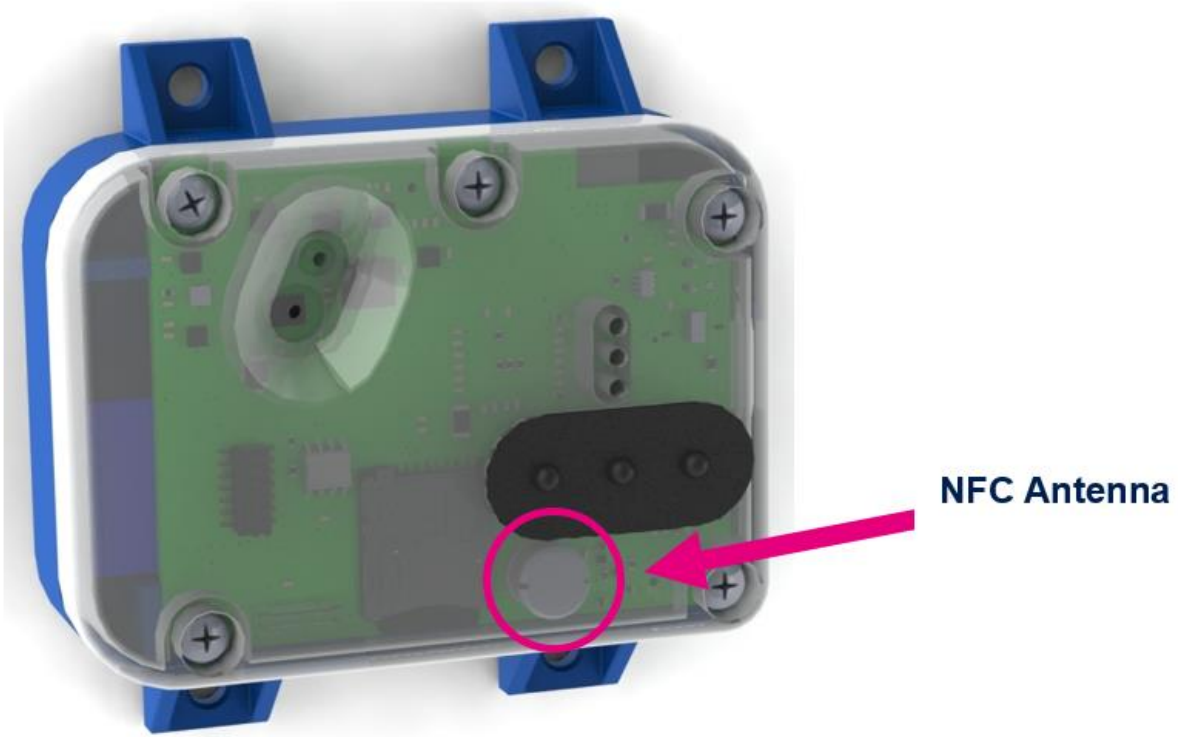
Firmware Update – FFOTA for STWIN.box

DATALOG2 and PDetect **are not** the default firmware, so they need to be downloaded on the board by the user.

The default firmware for STWIN.box enables Bluetooth pairing via **NFC** and fast firmware over-the-air upgrade through the **ST BLE Sensor app**.

By turning on Bluetooth and NFC on the smartphone and placing the smartphone on top of the NFC antenna of the STWIN.box, the smartphone reads the Bluetooth pairing information and automatically loads the ST BLE Sensor.



The above procedure is available only for STWIN.box. STWIN and SensorTile.box PRO default firmware do not enable Bluetooth pairing via NFC.

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Firmware Update – FFOTA for STWIN, STWIN.box and SensorTile.box PRO

STWIN, STWIN.box, and SensorTile.box PRO can be connected to the ST BLE Sensor app by manually opening the application.

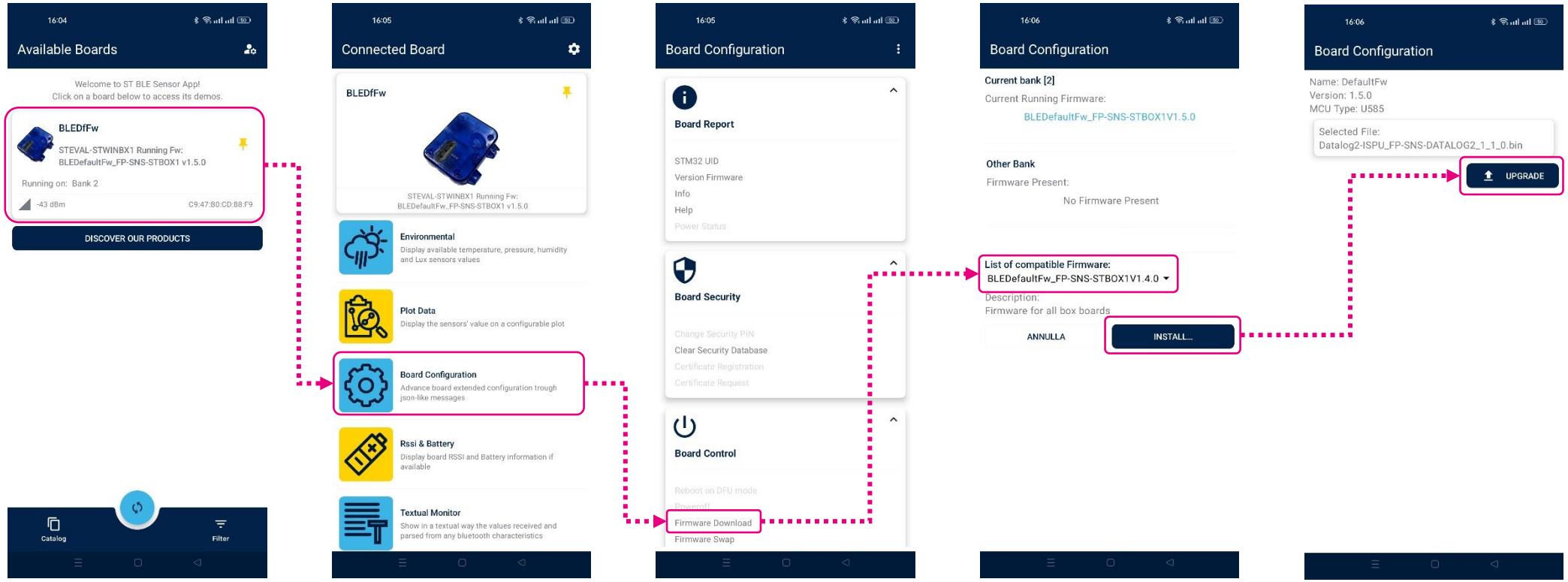
During BLE pairing, if requested, you must insert the following PIN: 123456.

The application shows and plots data coming from the board by selecting the Environmental tab for STWIN.box or Plot data for both STWIN.box and SensorTile.box PRO. For STWIN, only an old-fashioned Datalog tab is shown.

At this point, you can choose to upgrade the firmware on the board directly by using the mobile app, by selecting one of the available firmware.

Firmware Update – FFOTA for STWIN, STWIN.box and SensorTile.box PRO

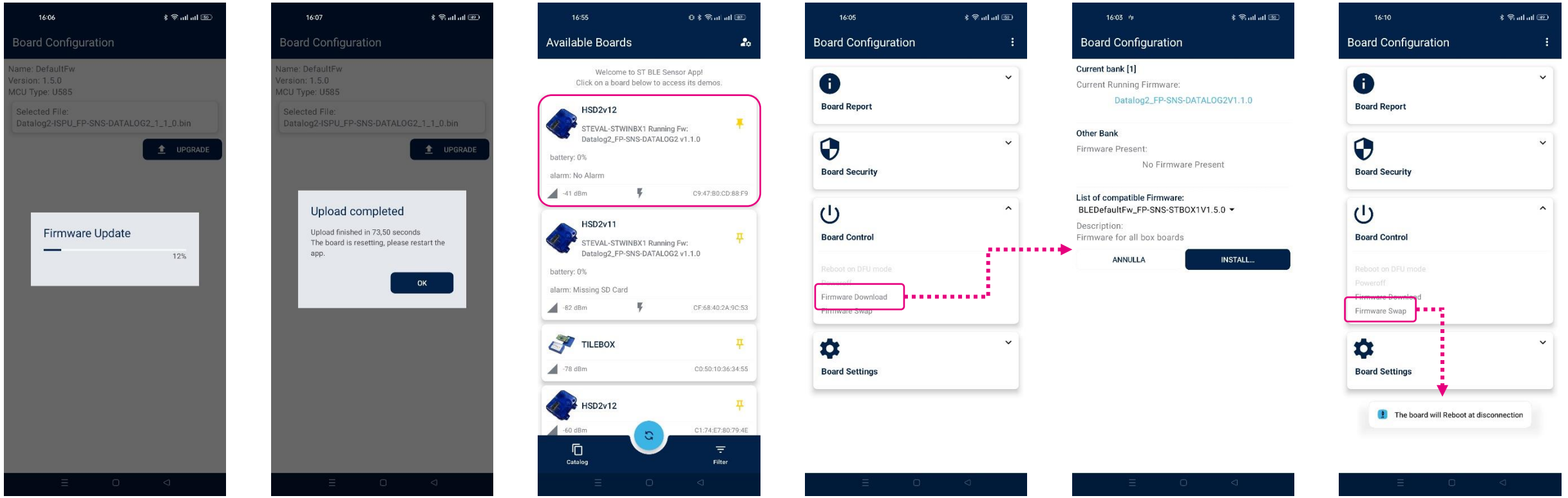
To update the firmware, you can simply follow the above procedure:



Firmware Update – FFOTA for STWIN, STWIN.box and SensorTile.box PRO

Once the download is finished, the new firmware restarts automatically. To reconnect to the BLE Sensor app, restart the app if needed.

In the Board Configuration tab, you can also swap between two firmware versions already loaded into the STWIN, STWIN.box, or SensorTile.box PRO flash, download new firmware, or upgrade the current firmware with the latest available.



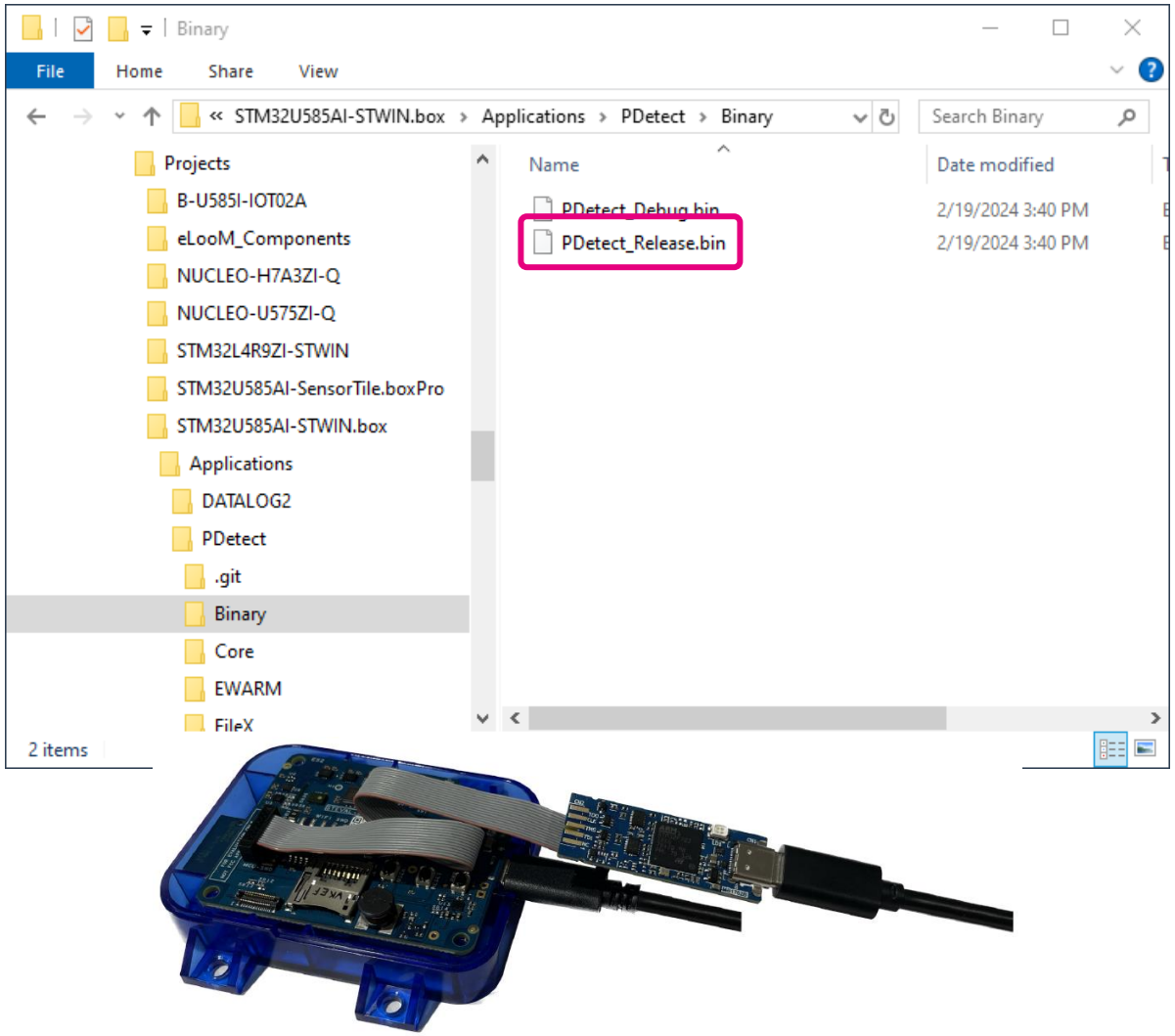
Firmware Update – ST-LINK

An alternative way is to use the **precompiled binary** provided in the package (i.e., *Projects\STM32U585AI-STWIN.box\Applications\PDetect\Binary)*

To update the firmware:

- Connect the board to the preferred programmer (here we are using STLINK-V3MINIE).
- Connect both boards to a PC through the proper USB cables.
- Open STM32CubeProgrammer, select the proper binary file, and download the firmware.

For further details, see **UM2965** for STWIN.box**,** **UM2777** for STWIN, or **UM3133** for SensorTile.box PRO

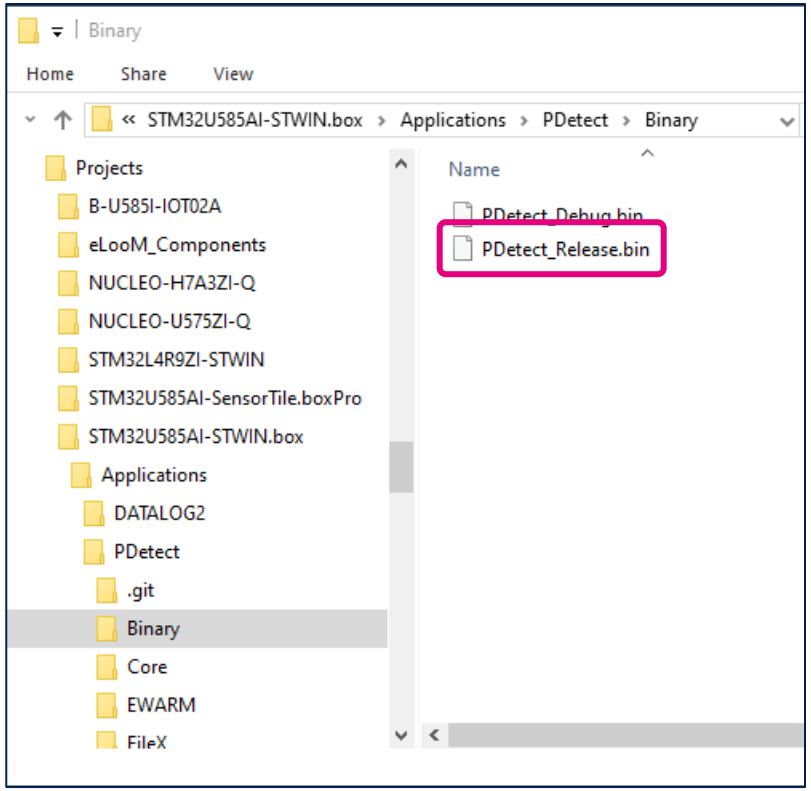


Firmware Update – USB

STEVAL-STWINBX1, STEVAL-STWINKT1B, and STEVAL-MKBOXPRO can also be reprogrammed via USB using the STM32CubeProgrammer in USB mode. To enter firmware upgrade mode, follow the procedure below:

1. Unplug the core system board.
2. Press the USR button in STWIN and STWIN.box, or the DFU button in SensorTile.box PRO.
3. While keeping the button pressed, connect the USB cable to the PC.
4. The board is now in DFU mode. Open STM32CubeProgrammer, select the proper binary file, and download the firmware.

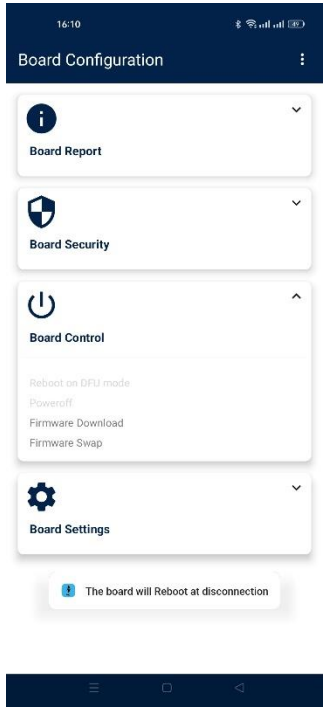
For further details, see **UM2965** for STWIN.box**, UM2777** for STWIN, or **UM3133** for SensorTile.box PRO



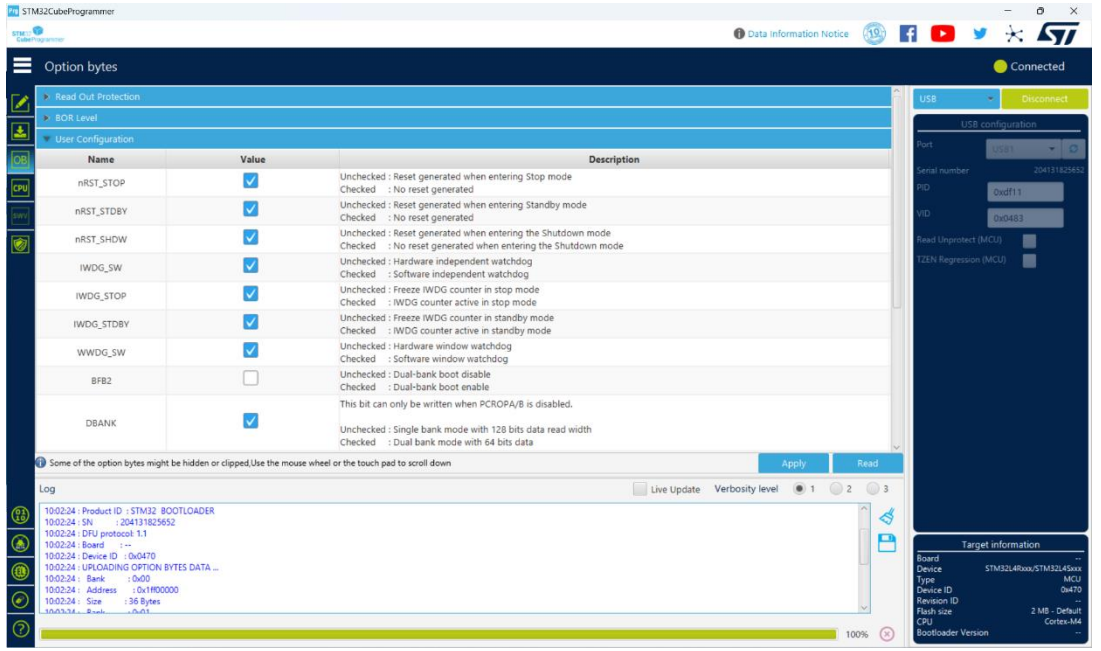
Firmware Update – double-bank flash memory

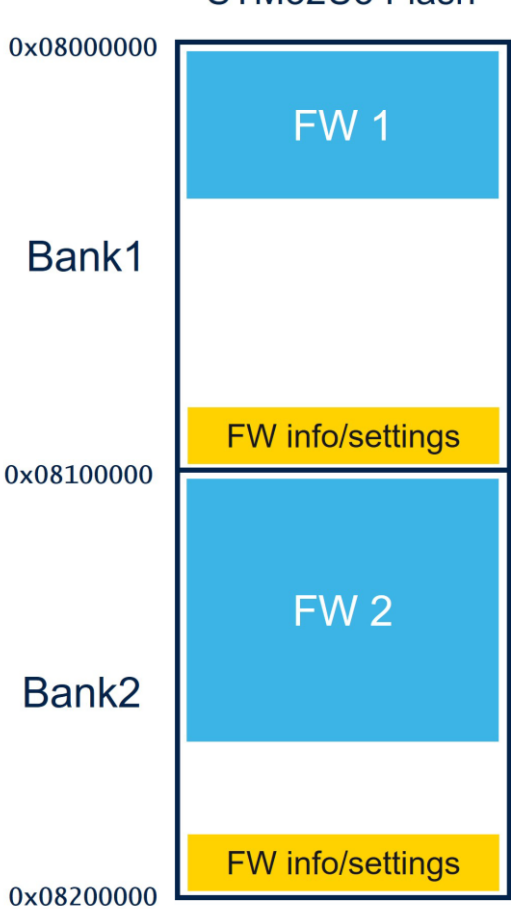
Both STM32L4+ and STM32U5 microcontroller families support double-bank flash memory. Both banks can be used, but to debug the code using one of the compatible IDEs and debuggers, you need to ensure that the active flash bank is the first one by checking:

Via ST BLESensor app in Board Configuration > Firmware Swap



Via STM32CubeProgrammer app in Option bytes > User Configuration > SWAP_BANK or BFB2





2.1 – DATALOG2 and PDetect* Demonstration

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* PDetect available only for STWIN.box

2.1.1 - USB sensor data streaming Command Line Interface

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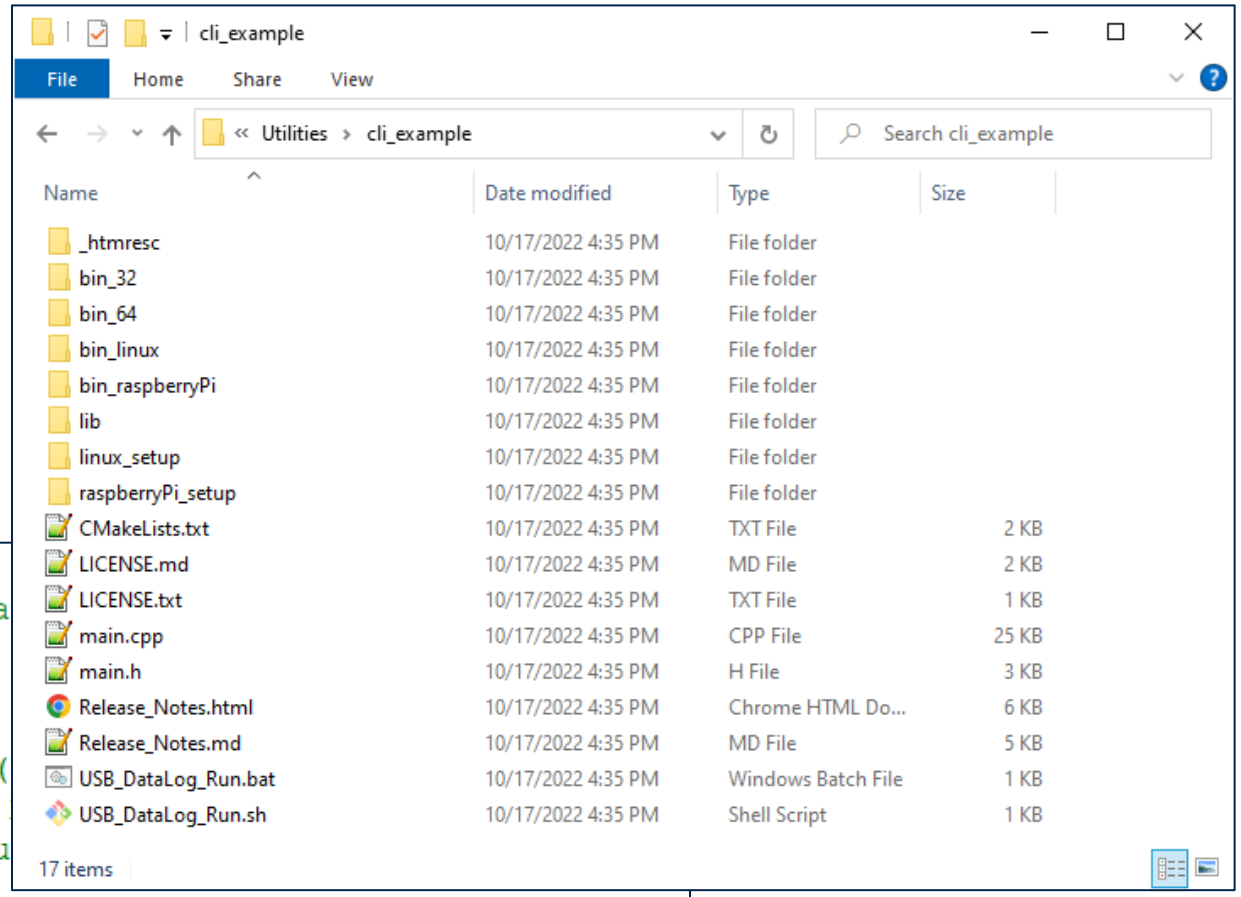
cli_example overview

- The command-line example is in the Utilities folder. It is available for Windows 32-bit and 64-bit, Linux, and Raspberry Pi platforms.
- USB_DataLog_Run.bat and USB_DataLog_Run.sh scripts provide a ready-to-use example.
- If needed, the application can receive the following parameters: timeout (**-t**), device configuration file (**-f**), and UCF file for the machine learning core or intelligent sensor processing unit (**-u**).




```
16 REM
17 REM Welcome to HS_DataLog Command Line Interfa
18 REM Usage: cli_example.exe [-COMMAND [ARGS]]
19 REM Commands:
20 REM -h Show this help
21 REM -f <filename>: Device Configuration file (
22 REM -u <filename>: UCF Configuration file for
23 REM -t <seconds>: Duration of the current acqu
24
25
26 set PATH=%PATH%;.\bin_64\
27
28 cli_example.exe -f ..\STWIN.box_config_examples\device_config.json -t 100
29
30 pause
```

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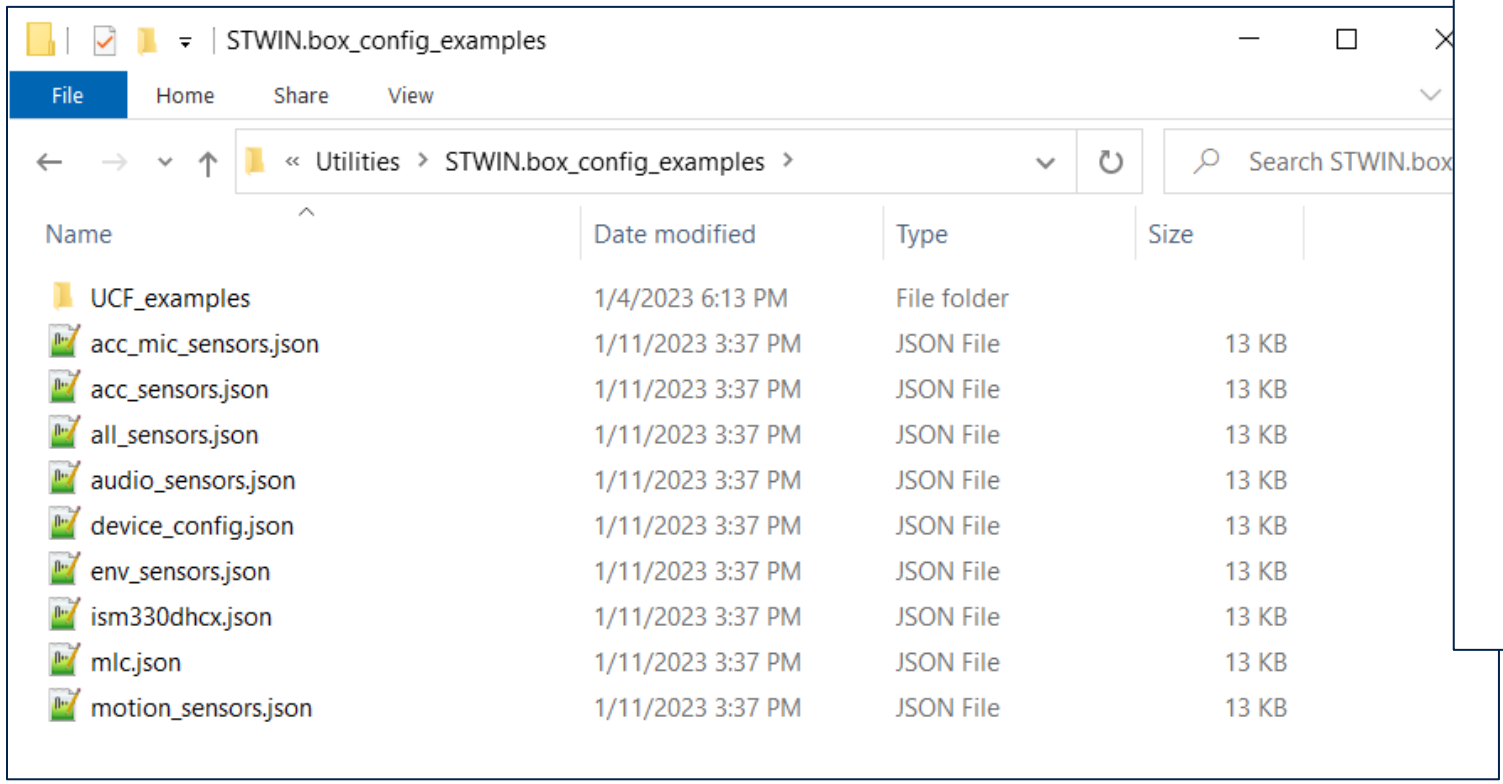
Modify device and sensors configuration

- To configure selected sensors, you can:
  - Use one of the available device configuration examples in Utilities/STWIN.box_config_examples
  - Configure the board through ST BLE Sensor or Real Time Plot GUI




```
        }
    },
    {
        "iis2iclx_acc": {
            "c_type": 0,
            "data_type": "int16",
            "dim": 2,
            "enable": true,
            "ep_id": 4,
            "fs": 1,
            "ioffset": 0.3149999976158142,
            "measodr": 836.601318359375,
            "odr": 6,
            "samples_per_ts": {
                "max": 800,
                "min": 0,
                "val": 800
            },
            "sd_dps": 1536,
            "sensitivity": 9.14999982342124e-05,
            "stream_id": 6,
            "usb_dps": 512
        }
    },
    {
```


For backward compatibility, it is still possible to define a custom sensor configuration by editing one of the available examples. Be aware that it is an error-prone procedure we do not recommend.

Note: ODR (Output Data Rate) and FS (Full Scale) fields are enumerated values defined in the Device Template Model. Please refer to chapter 2.6.6 and DATALOG2 DTM for the mapping between the enum values and the corresponding ODR and FS values.

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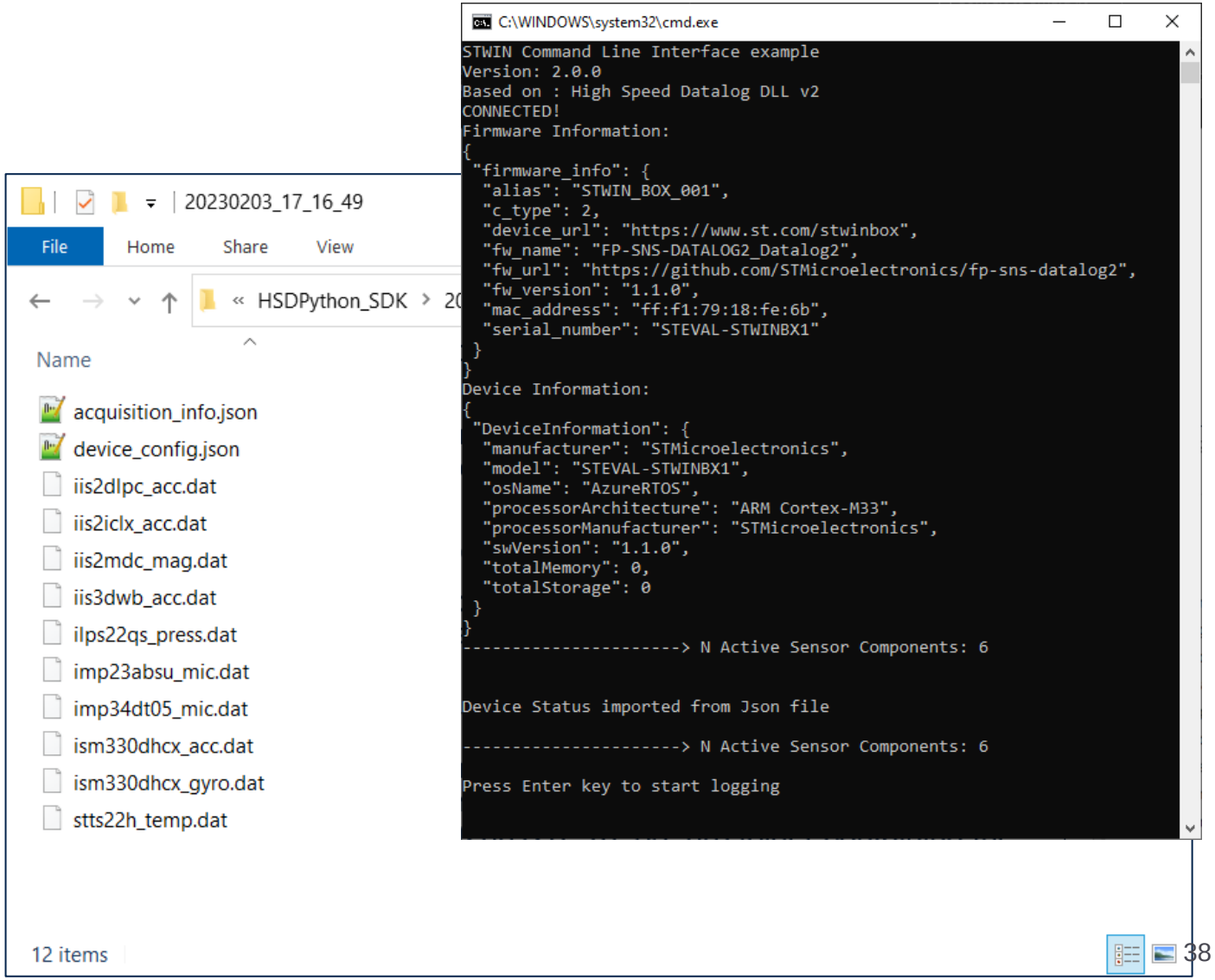
Run the application

- Double-click on the USB_DataLog_Run batch script.
- The application starts, and the command line appears, showing information about the connected board.
- Press [Enter] to start the acquisition.
- The application stops automatically if a timeout is set.
- Otherwise, you can stop the data acquisition by pressing the [ESC] button.
- The application creates a YYYYMMDD_HH_MM_SS (e.g., 20200128_16_33_00) folder containing the raw data and the JSON configuration file.



2.1.2 - USB sensor data streaming Real Time Plot

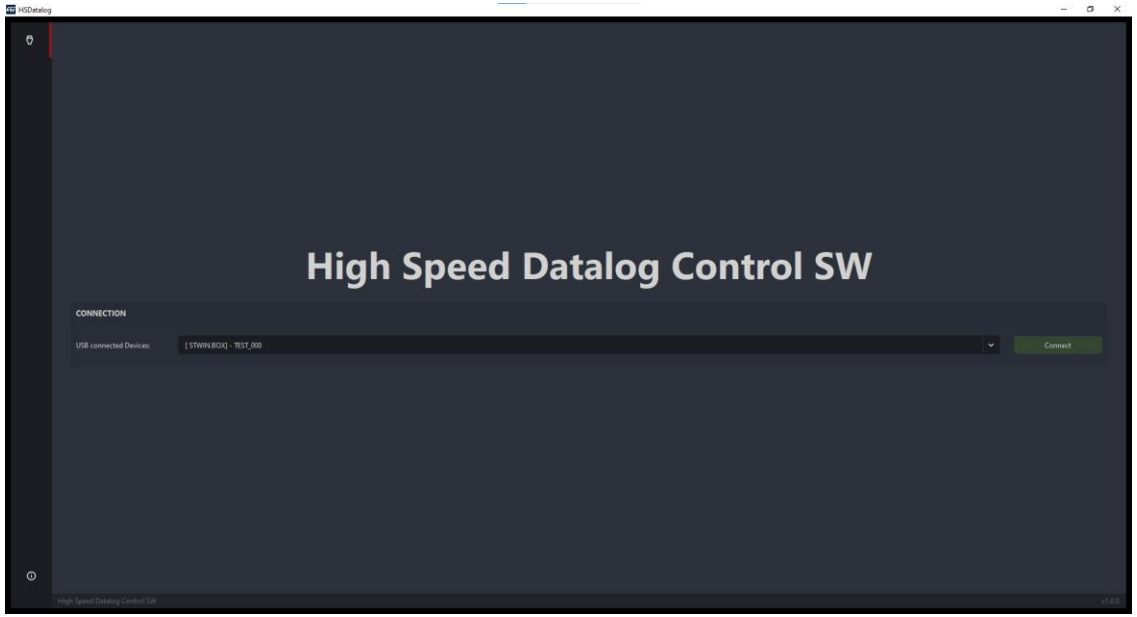
From HSDPython_SDK to STDATALOG-PYSDK

- From FP-SNS-DATALOG2 v3.0.0, HSDPython_SDK has been expanded and moved to a separate software product: STDATALOG-PYSDK
- The STDATALOG-PYSDK is a comprehensive Python framework designed to facilitate the capture, processing, and visualization of data from a wide range of sources, including sensors, algorithms, simulated signals, and telemetry from actuators.
- It is compatible with all firmware examples available in FP-SNS-DATALOG2, FP-IND-DATALOGMC, and FP-SNS-DATALOG1
- The python software development kit (SDK) for data logging has been developed using Python 3.13.
  - It is compatible with Python 3.10, 3.11, and 3.12 also.
  - Python must be already properly installed on the user's machine before installing and running STDATALOG-PYSDK.
  - *STDATALOG-PYSDK* requires different Python modules. The package is distributed with *installers* that solve all the required dependencies
- The next slides show how to use the *stdatalog_GUI.py* script available in the SDK. Please see the full documentation available on the STDATALOG-PYSDK landing page to install the SDK properly on your machine

Execute *stdatalog_GUI.py*

- *stdatalog_GUI.py* works within the STDATALOG-PYSDK, developed in Python 3.13 on Windows, Linux and macOS environments.
  - *STDATALOG-PYSDK* requires different Python modules. The package is distributed with *installers* that solve all the required dependencies
  - Please see the full documentation available on the STDATALOG-PYSDK landing page to install the SDK properly on your machine

- Once the board is connected via USB and the Python environment has been properly updated, you can launch the real-time plot by executing *stdatalog_GUI.py* available in *stdatalog_examples\gui_applications\stdatalog\GUI*.
  - Depending on your local setup, to execute the script, you can open a command shell there and run *python stdatalog_GUI.py*.
- Click on the Connect button to allow the connection between the board and the PC.



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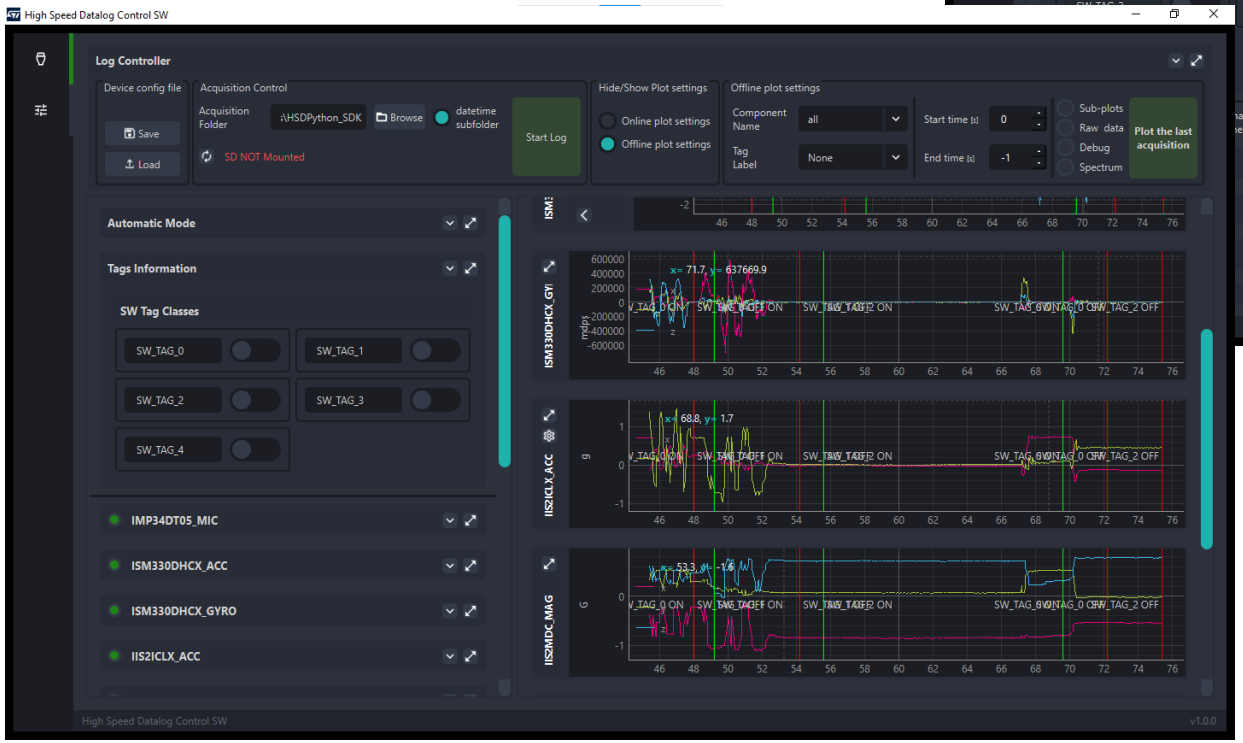
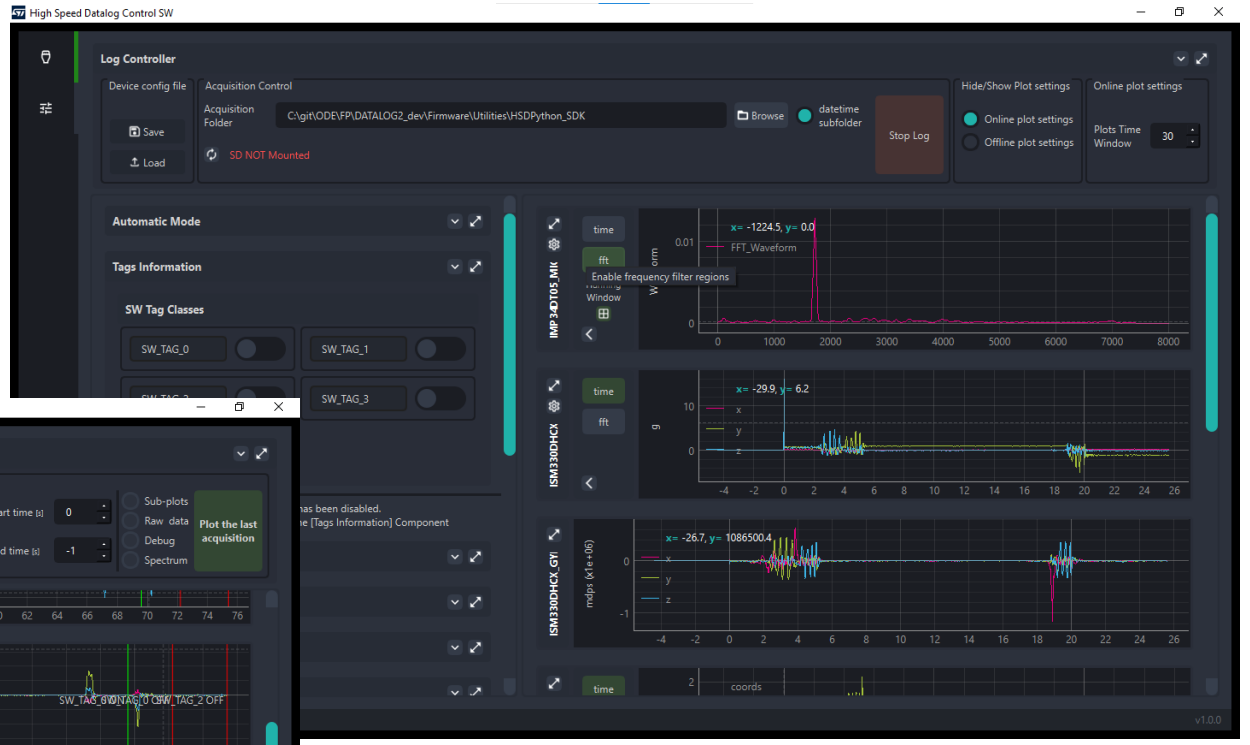
stdatalog_GUI.py

- Once the connection is established, you can:
  - Enable or disable the needed sensors.
  - Set up data rate, full scale, and timestamps.
  - Retrieve sensor status.
  - Load UCF to set up an MLC (machine learning core) or an ISPU (intelligent sensor processing unit).
  - Save and load a configuration via a JSON file.
  - Start or stop logging data on the PC.
- Once you click the *“Start Log”* button, data are live plotted, and the application creates a YYYYMMDD_HH_MM_SS (e.g., 20200128_16_33_00) folder containing the raw data and the JSON configuration file.

stdatalog_GUI.py

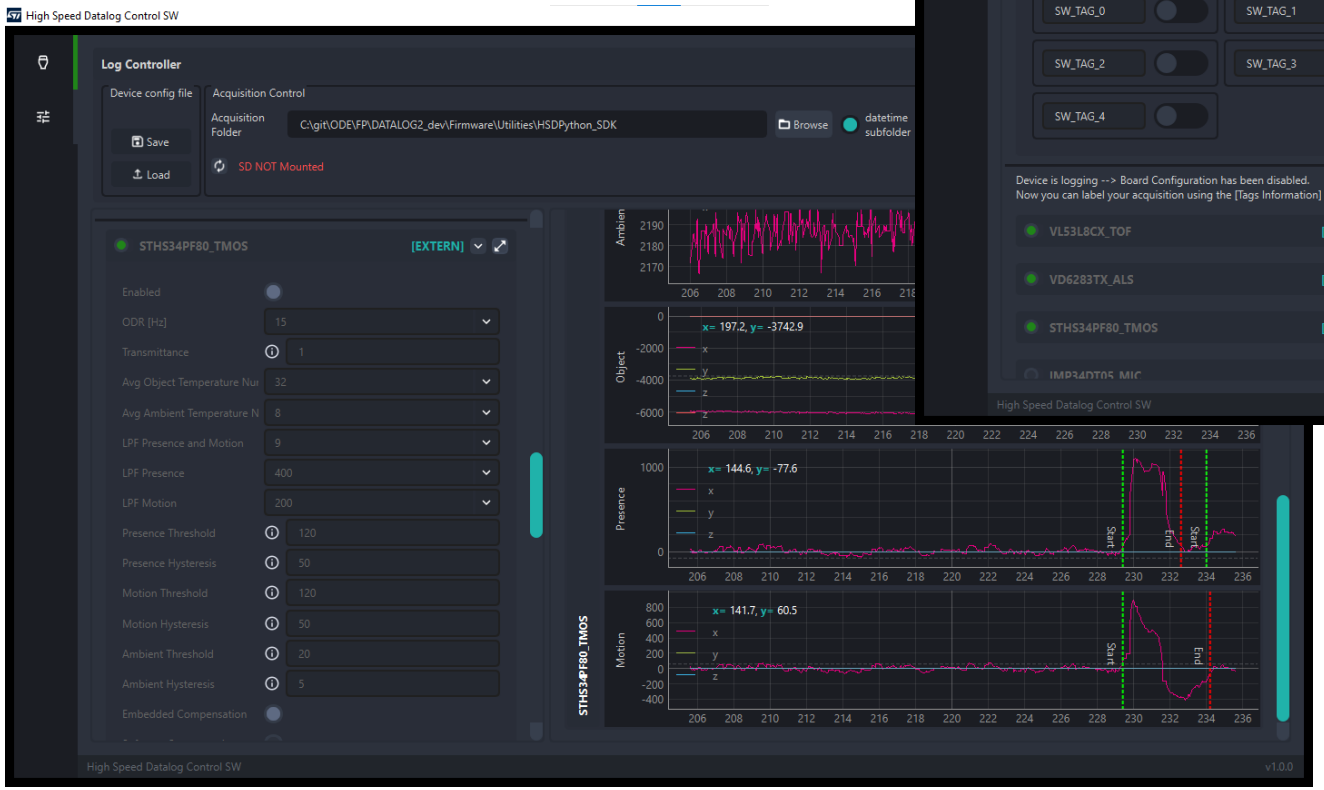
- Real Time Plot GUI also allows you to:
  - Send a UCF configuration file and visualize outputs.
  - Set up tag classes and handle data tagging and labeling of an ongoing acquisition.
  - Enable FFT calculation for accelerometers and microphones.
  - Set up the acquisition name and description.

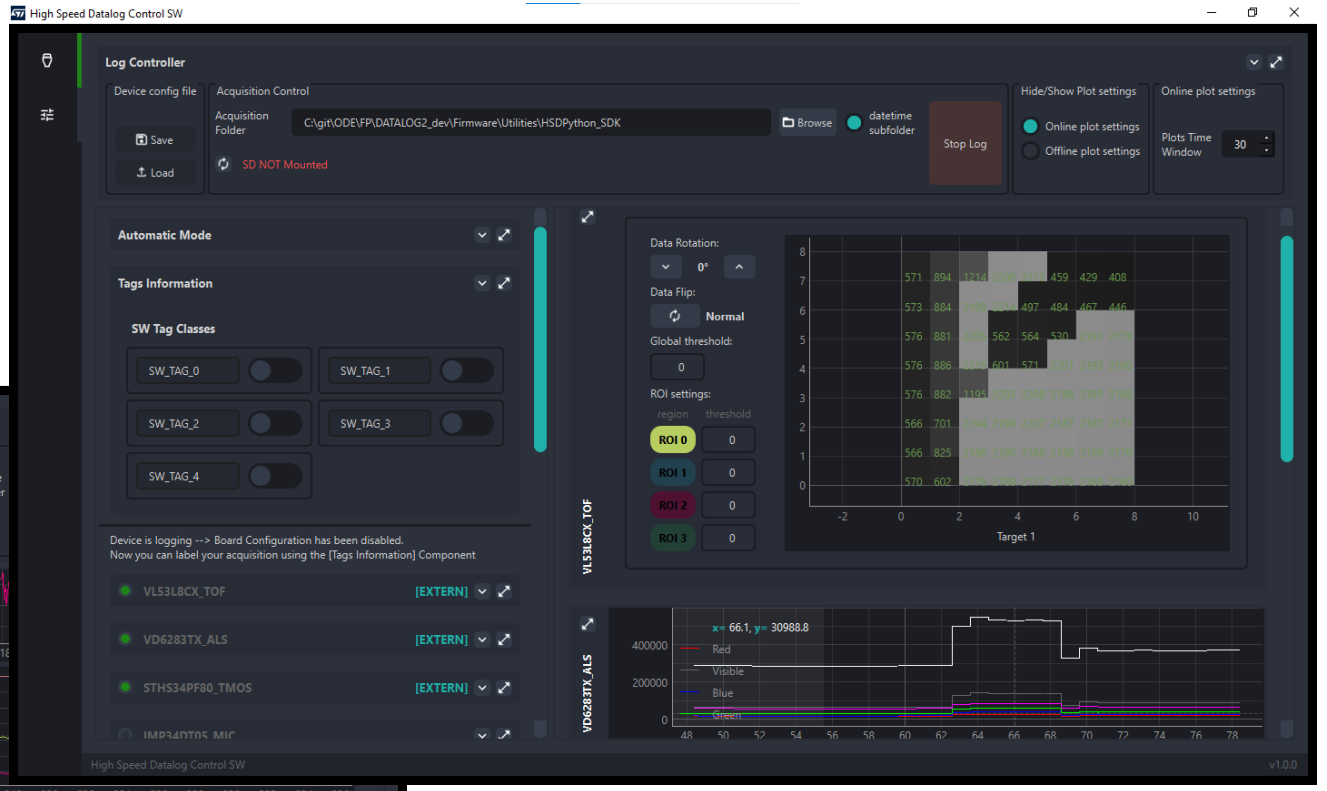




stdatalog_GUI.py

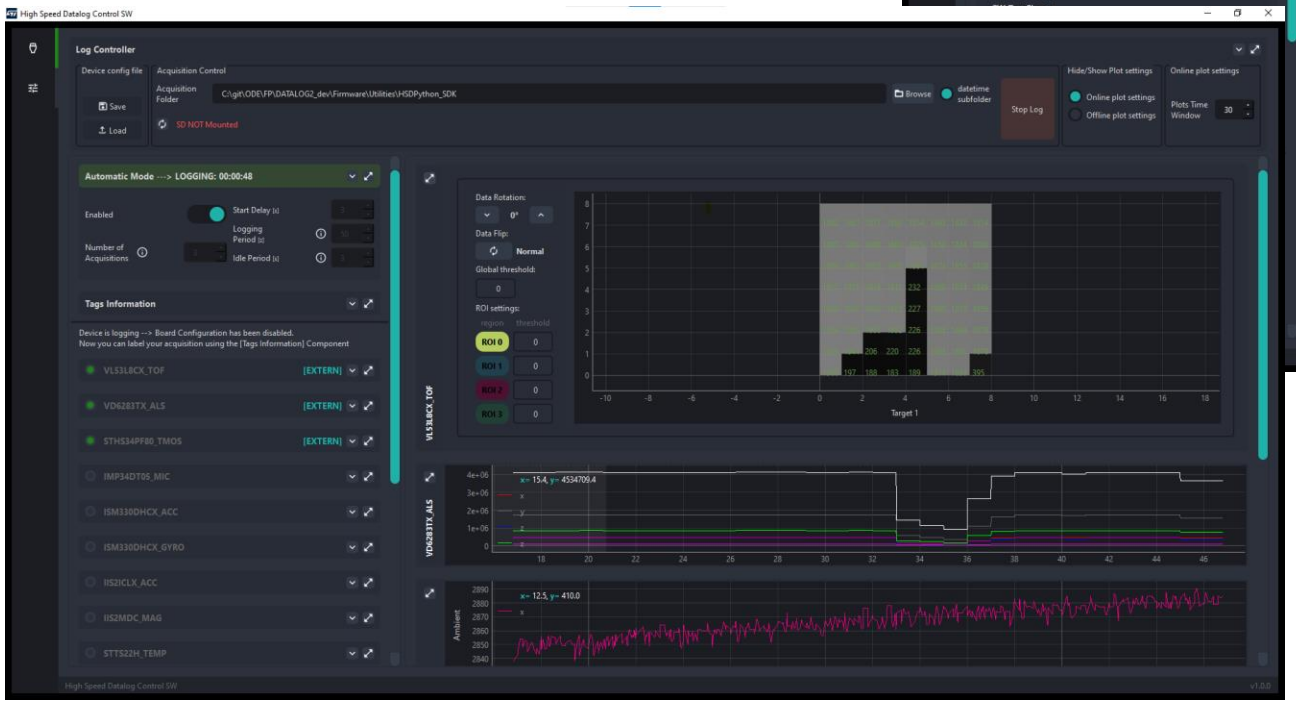
- FP-SNS-DATALOG2 also provides PDetect, a dedicated example for human presence and motion detection.
- A new set of enriched widgets and sensor parameters has been added to fully support the available sensors.

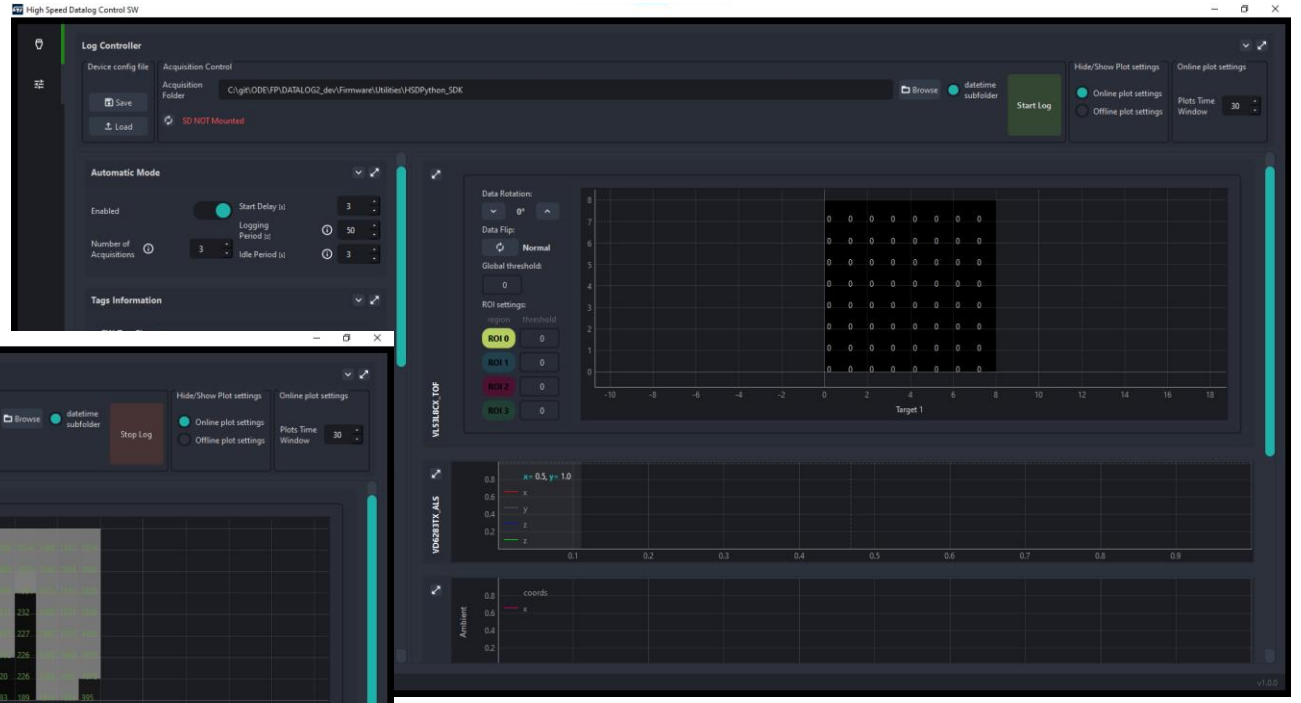




stdatalog_GUI.py

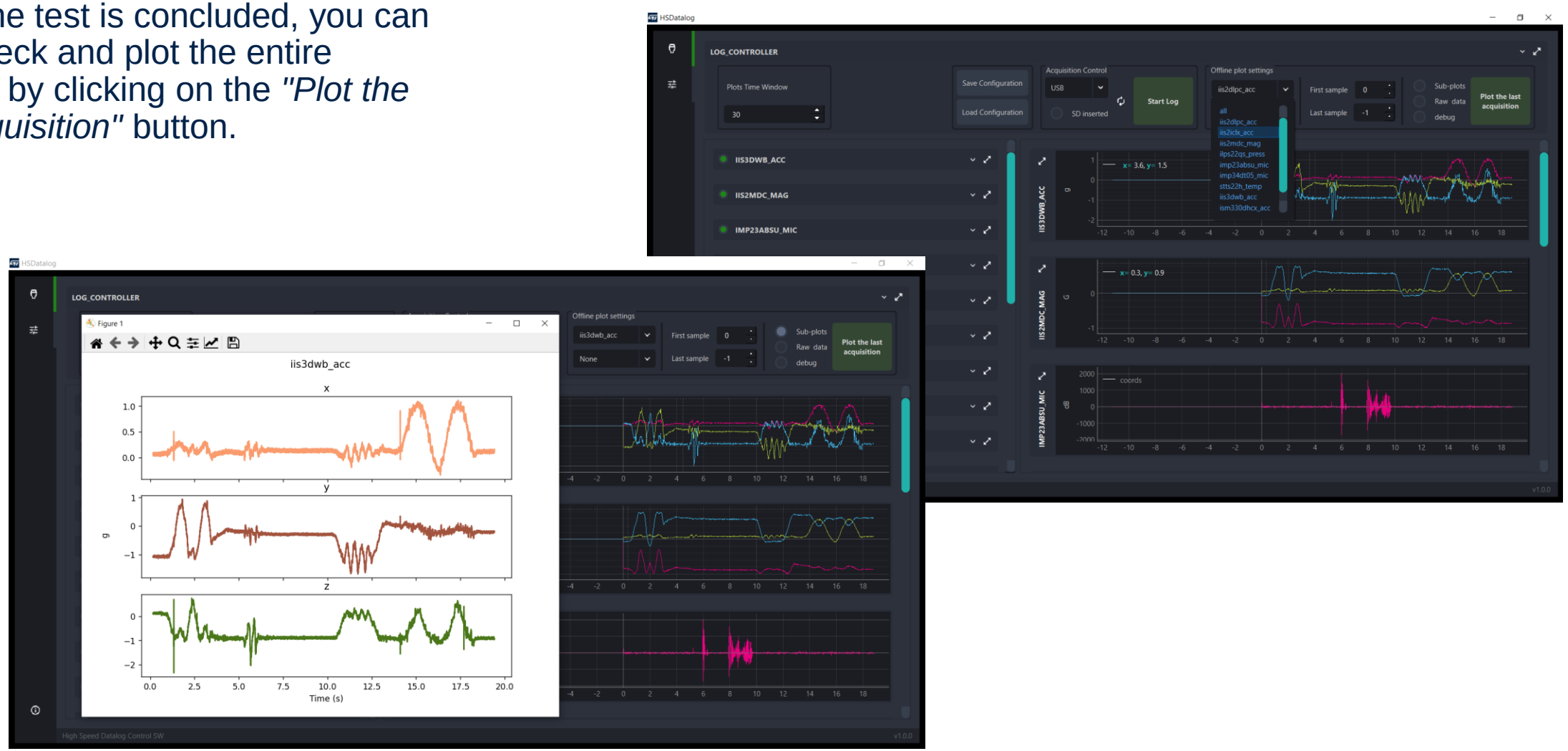
- Furthermore, you can set up Automode to start the datalog operations or to pause all executions for specific periods.
  - Set up the desired values in the Automatic Mode widget
  - See Automode section for further details





stdatalog_GUI.py

- Once the test is concluded, you can also check and plot the entire dataset by clicking on the *"Plot the last acquisition"* button.



2.1.3 – Data logging on SD card, configuration with BLE Sensor App *

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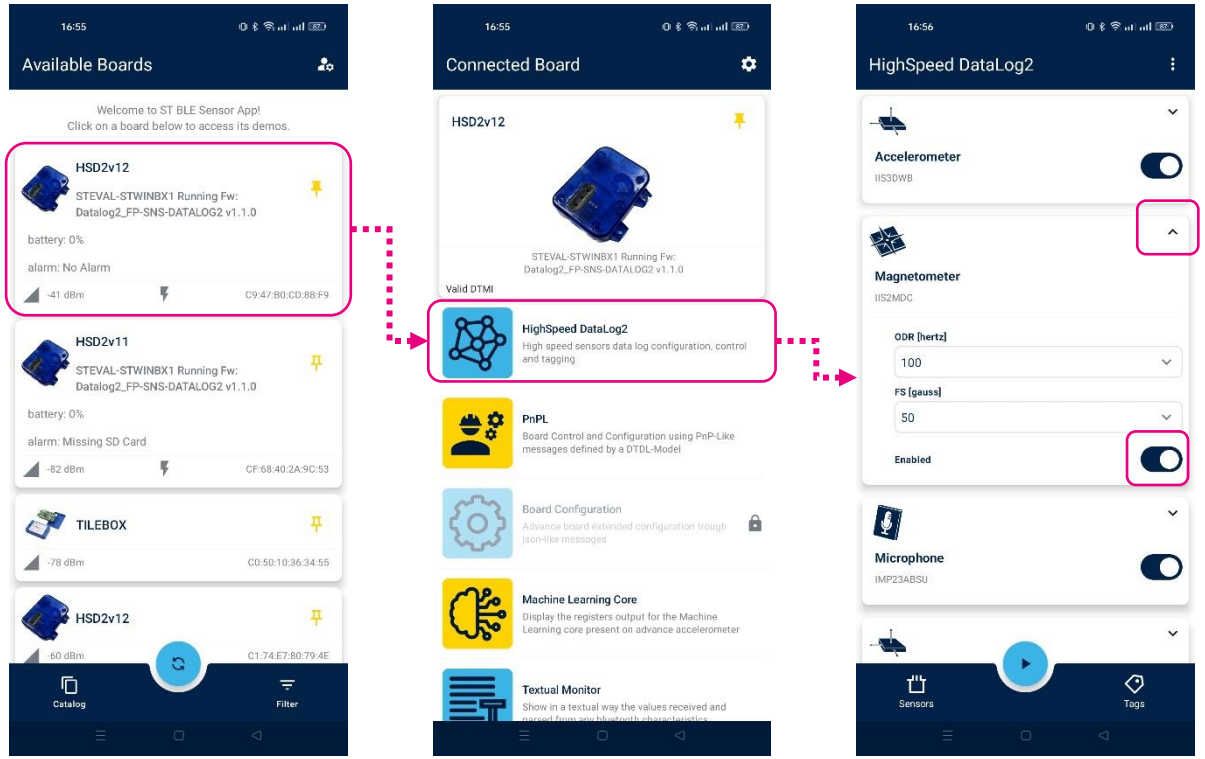
* Only for STWIN.box, STWIN and SensorTile.box PRO

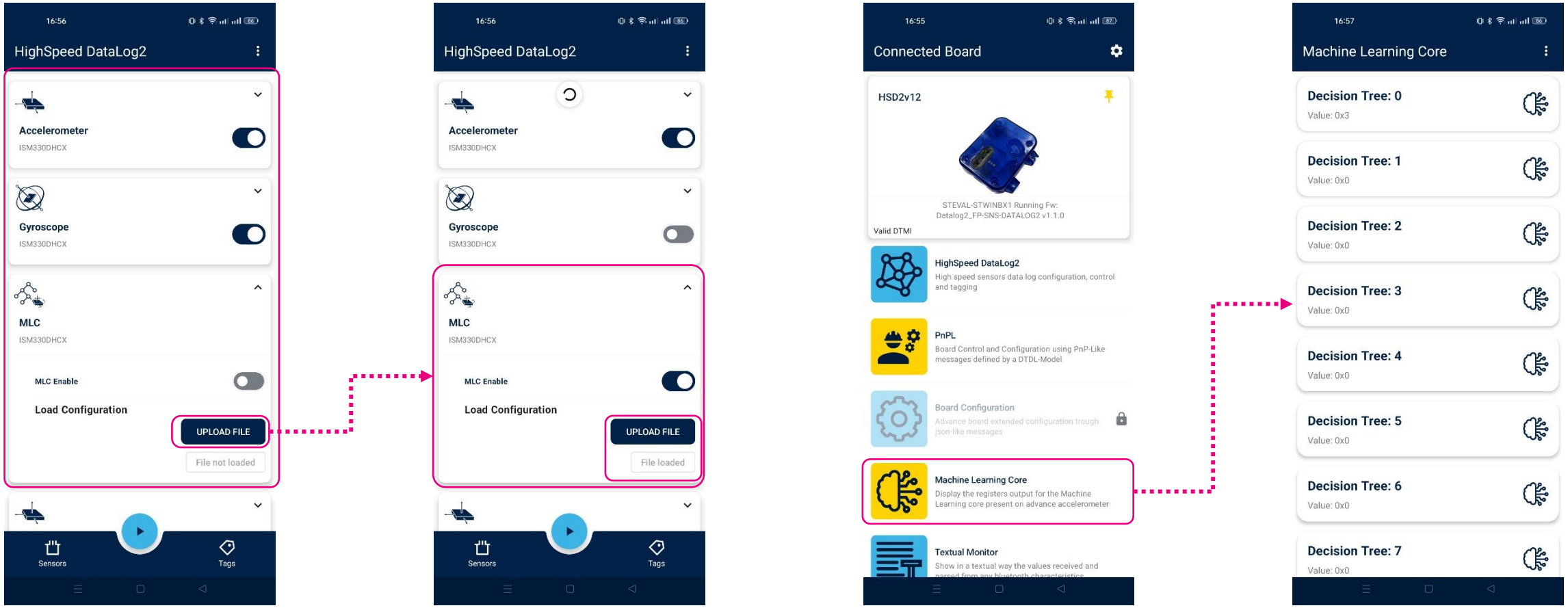
ST BLE Sensor App: DATALOG2 tab

- DATALOG2 and PDetect applications can be controlled via Bluetooth using the ST BLE Sensor app (for both Android and iOS – v5.2 and above), which lets you manage the board and sensor configurations, start/stop data acquisition on the SD card, and control data labeling.
- Once connected, you can configure the device by:
  - enabling/disabling a specific sensor
  - changing sensor parameters



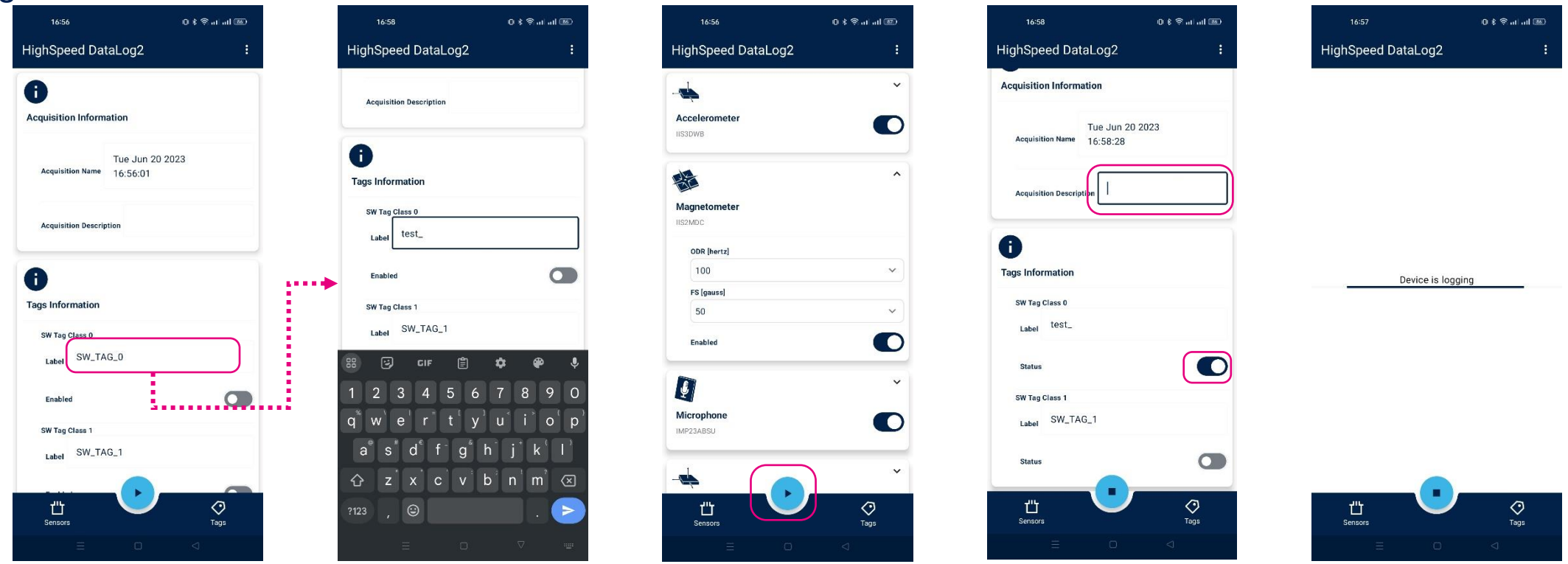
Configure MLC

- You can also:
  - send a UCF configuration file to set up an MLC (Machine Learning Core) or an ISPU (Intelligent Sensor Processing Unit). The UCF file can be retrieved either from the smartphone memory or from cloud storage (e.g., Google Drive, Microsoft OneDrive, etc.)



Acquisition settings and control

- By clicking the tags button, you can switch to the acquisition settings and control tab to:
  - start and stop an acquisition (to an SD card)
  - choose which tag classes will be used for the next acquisition
  - handle data tagging and labeling of an ongoing acquisition
  - set up the acquisition name and description
- A YYYYMMDD_HH_MM_SS (i.e., 20200128_16_33_00) folder containing the raw data and the JSON configuration file will be created on the SD card



2.1.4 – Data logging on SD card, standalone mode

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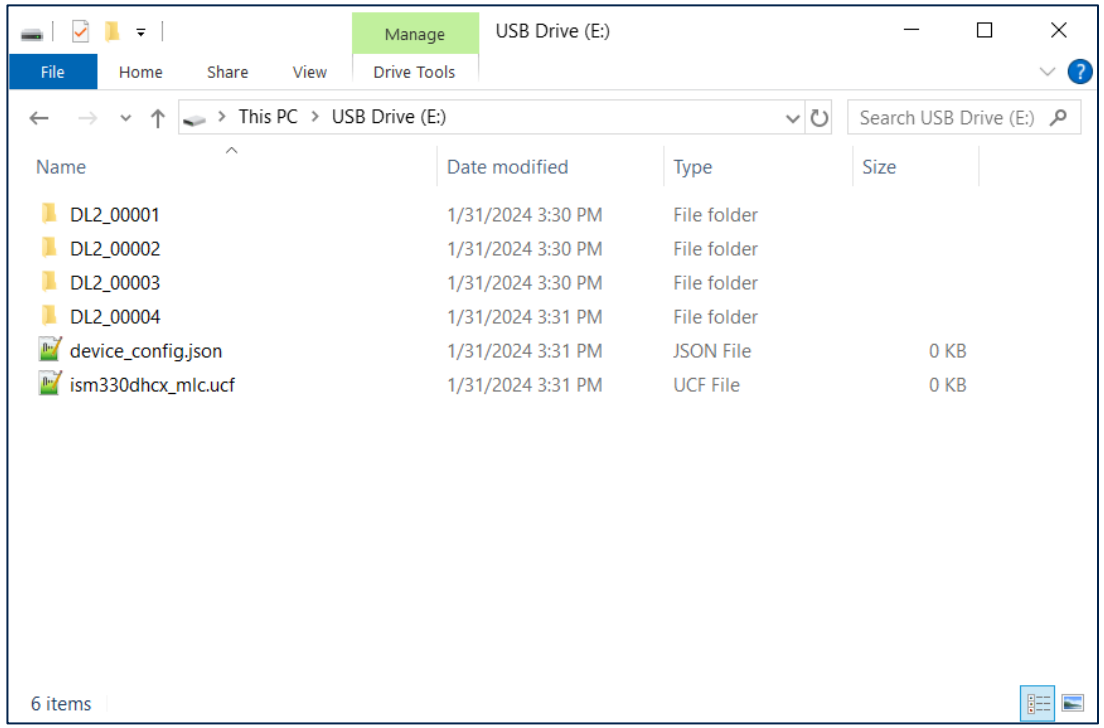
* Only for STWIN.box, STWIN and SensorTile.box PRO

Start an acquisition in standalone mode

- DATALOG2 and PDetect can also work standalone, saving all the sensor data at the highest possible rate onto the SD card.
- DATALOG2 and PDetect can read a custom sensor configuration from the SD card root folder. To do so, you can simply save a JSON configuration file in the root folder of the SD card (same as described in 2.1.1).
- In the same way, you can configure the MLC by saving the proper UCF in the root folder. Start an acquisition in standalone mode
  - Once the firmware is flashed on the board:
    - Insert the SD card
    - If the board is battery-powered and switched off, press the PWR button to switch on the board. Press the RESET button.
    - If the SD card is not inserted properly, the orange LED will be switched off. Otherwise, the orange LED will be switched on.
    - If a JSON configuration file is present in the root folder of the SD card, the custom sensor configuration is loaded from the file itself.
    - Press the USR button to start saving data. During the datalog stage, you will see the green LED blinking at 4 Hz.
    - To stop the data acquisition, press the USR button again. During the idle stage, you will see the green LED blinking at 1 Hz.



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Automode

- DATALOG2 and PDetect also feature the automode, which can be initiated automatically at the device power-up or reset.
- This mode can be used to start the datalog operations or to pause all the executions for a specific period by putting the sensor node in the "idle" phase.
- Automode allows automatically saving data on the SD card, generating different acquisition folders. It can be useful to automate long acquisition setups, avoid datasets that are too large, and reduce SD card errors by avoiding data loss through autosaving.

```
"automode": {
    "enabled": true,
    "nof_acquisitions": 7,
    "start_delay_s": 5,
    "logging_period_s": 30,
    "idle_period_s": 5,
    "c_type": 2
}
```

Automode

- As for the standalone mode, to enable the automode you must set up the automode component properly in the device_config.json:
  - **enabled**: if true, the automode starts after the reset and node initialization. If false, automode is not executed.
  - **nof_acquisitions**: gives the number of times the automode is executed; 0 indicates an infinite loop and it is the default value.
  - **start_delay_s**: indicates the initial delay in seconds applied after reset and before the first execution phase starts. Minimum valid value is 1.
  - **logging_period_s**: specifies the duration in seconds of the datalog phase. Minimum valid value is 1.
  - **idle_period_s**: specifies the duration in seconds of the idle phase. Minimum valid value is 1.
  - **c_type**: describes the component type (0 “sensor”, 1 “algorithm”, 2 “other”).
- Then place it in the root folder of the SD card.
- If the board is battery-powered and switched off, press the PWR button to switch on the board. Press the RESET button.

```
"automode": {
    "enabled": true,
    "nof_acquisitions": 7,
    "start_delay_s": 5,
    "logging_period_s": 30,
    "idle_period_s": 5,
    "c_type": 2
}
```

2.1.5 – FTP Data Retrieving over Wi-Fi *

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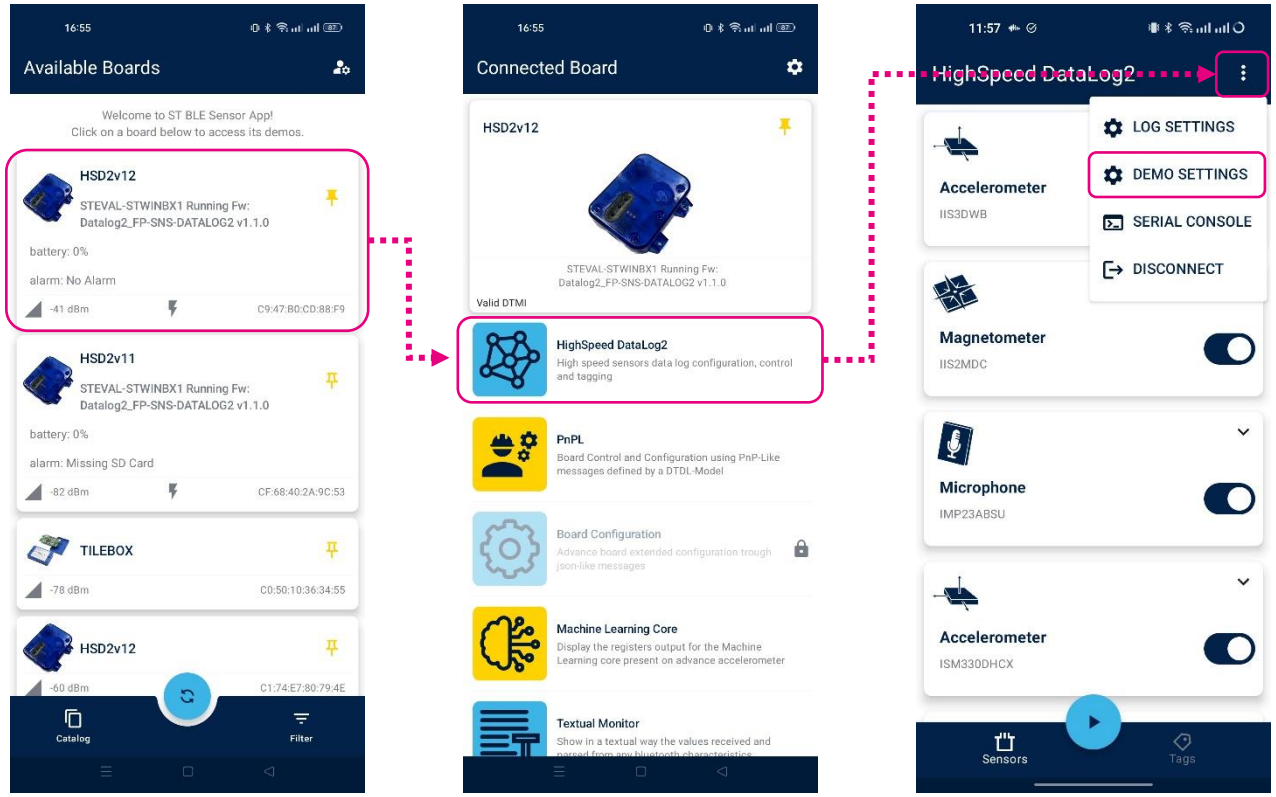
* Only for STWIN.box

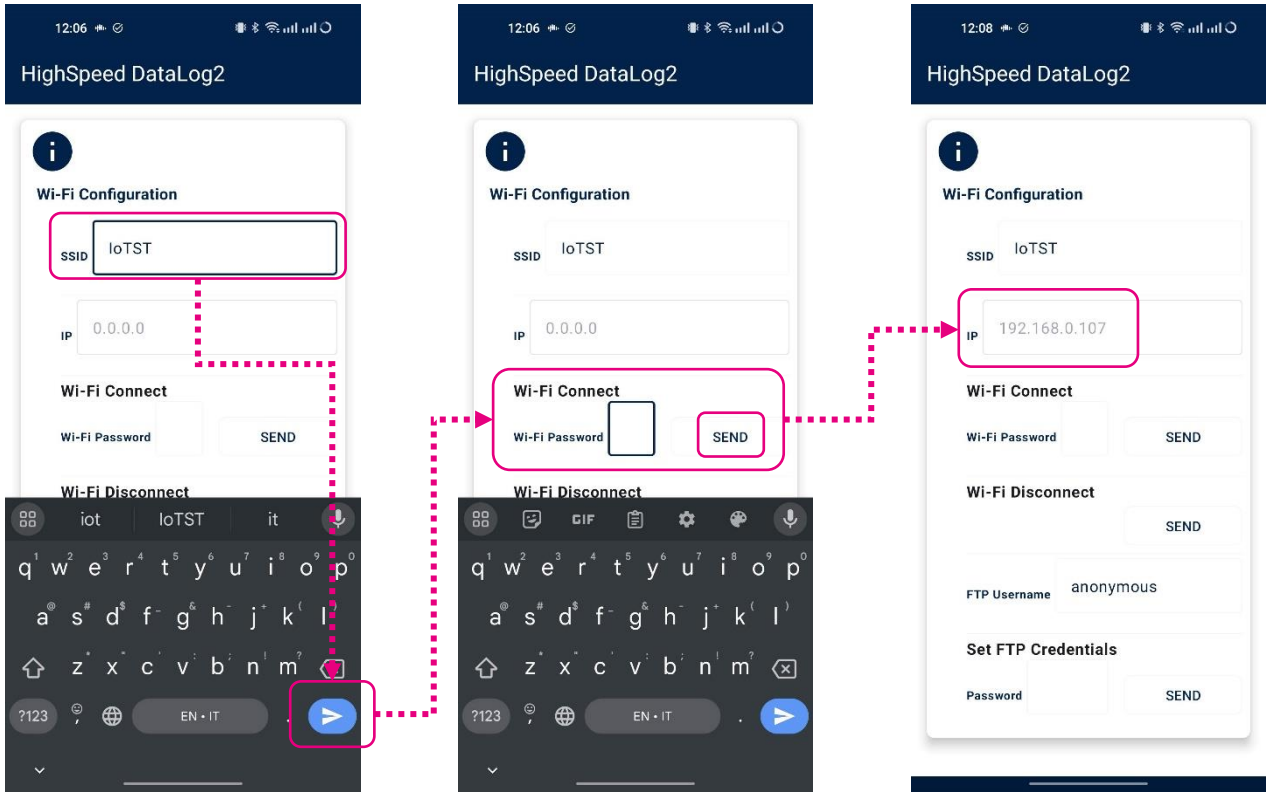
ST BLE Sensor App: Wi-Fi configuration

- On STWIN.box running the DATALOG2 example, the data stored on the SD card can be retrieved via the FTP protocol over Wi-Fi.
- Default Wi-Fi firmware module can’t be compatible with DATALOG2 recent versions. Updated module firmware and procedure are here.
- The Wi-Fi module available on STWIN.box is compatible with the 2.4 GHz band only. It does not work with the 5 GHz band. Select the Wi-Fi connection carefully.
- To activate the FTP server, you just need to set up the Wi-Fi connection.



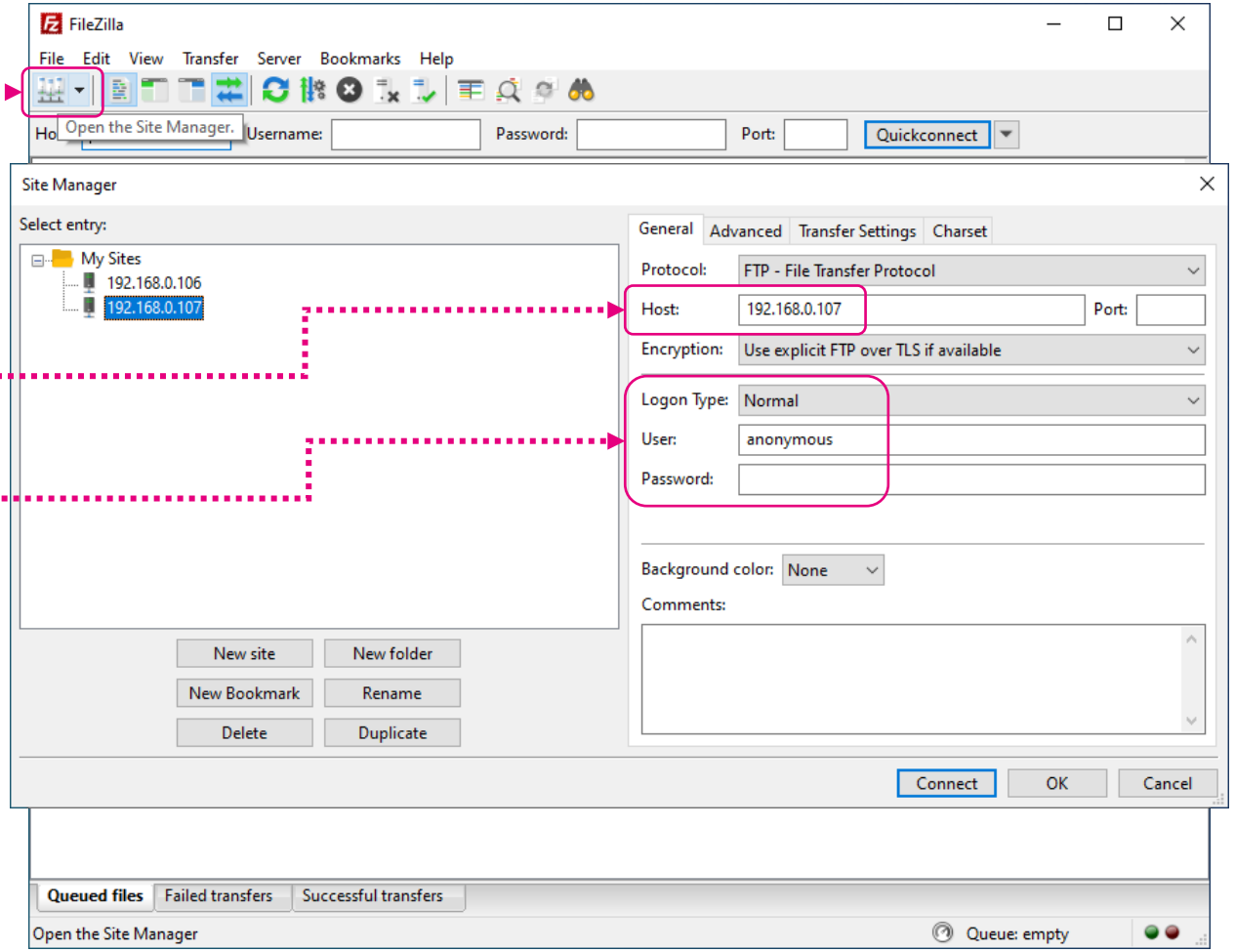
ST BLE Sensor App: Wi-Fi configuration

- Once the Wi-Fi connection is configured, an FTP server is automatically initialized in STWIN.box and the related IP address will be available in the IP field of the BLE widget.
- To retrieve the data stored on the SD card, you can use any FTP client application.
- The FTP client device (PC or mobile) must be connected to the same network configured for the board.



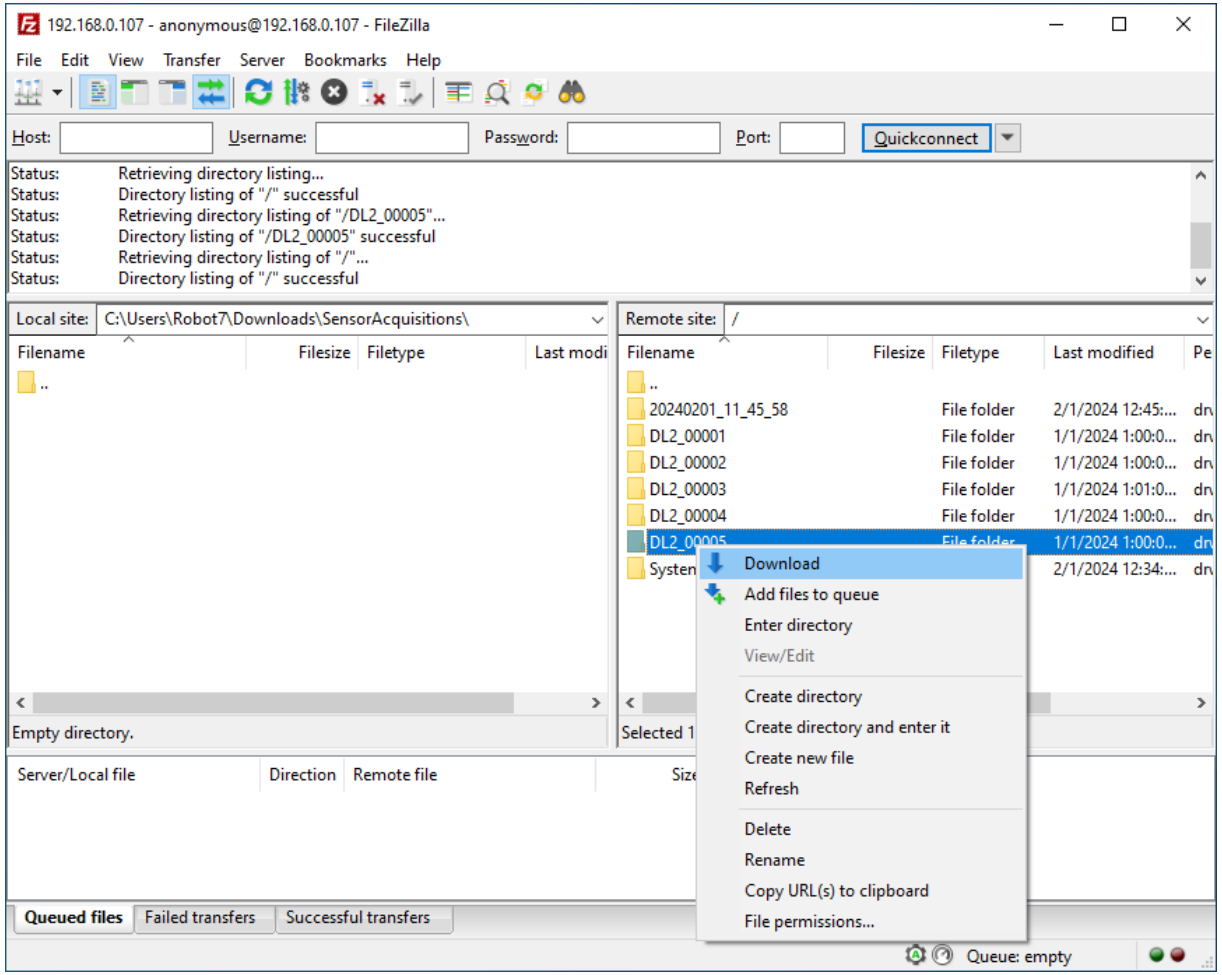
FTP Client – Connection settings

- In this guide we use a Windows 10 PC with FileZilla FTP Client
  - filezilla-project.org
- Go to “Site Manager”
- “New Site”
  - Host: IP address from the mobile App
  - Logon Type: Normal
  - User: “anonymous”
  - Password: leave empty
- Click OK



FTP Client – Data transfer

- The list of available folders and files appears on the right.
- Right-click on one acquisition and click “Download.”
- The folder will be copied to the selected folder on the PC (left).
- It is recommended to transfer the entire folder and not just a single file.



2.3 – UltrasoundFFT for STWIN.box

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FP-SNS-DATALOG2 - UltrasoundFFT

UltrasoundFFT example represents the evolution of the well-known example available for STEVAL-STWINKT1B in X-CUBE-MEMSMIC1 package.

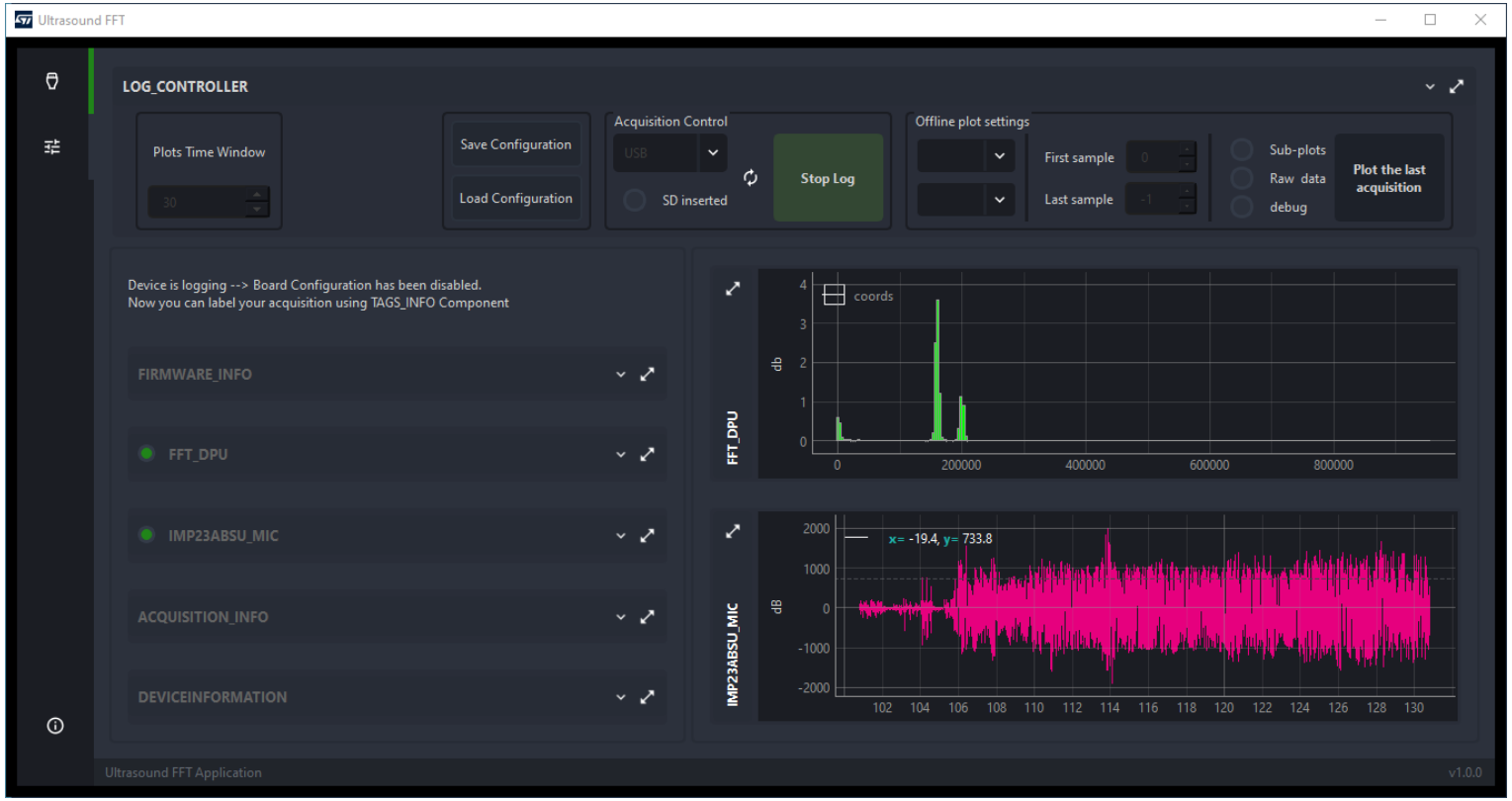
The example has been redesigned to support STEVAL-STWINBX1:

→ New FW:

- Redesigned based on eLooM framework
  - SensorManager + EMData + DPU

→ New GUI:

- Real-time FFT of Analog Microphone signal
  - 192kHz sampling rate, 80kHz bandwidth (ultrasound)
  - Fixed FFT length: 512
- PC Application/GUI
  - New GUI with Datalog Python SDK
  - Based on the same Python framework showed in Real Time Plot GUI
- Additional channel for raw microphone data streaming

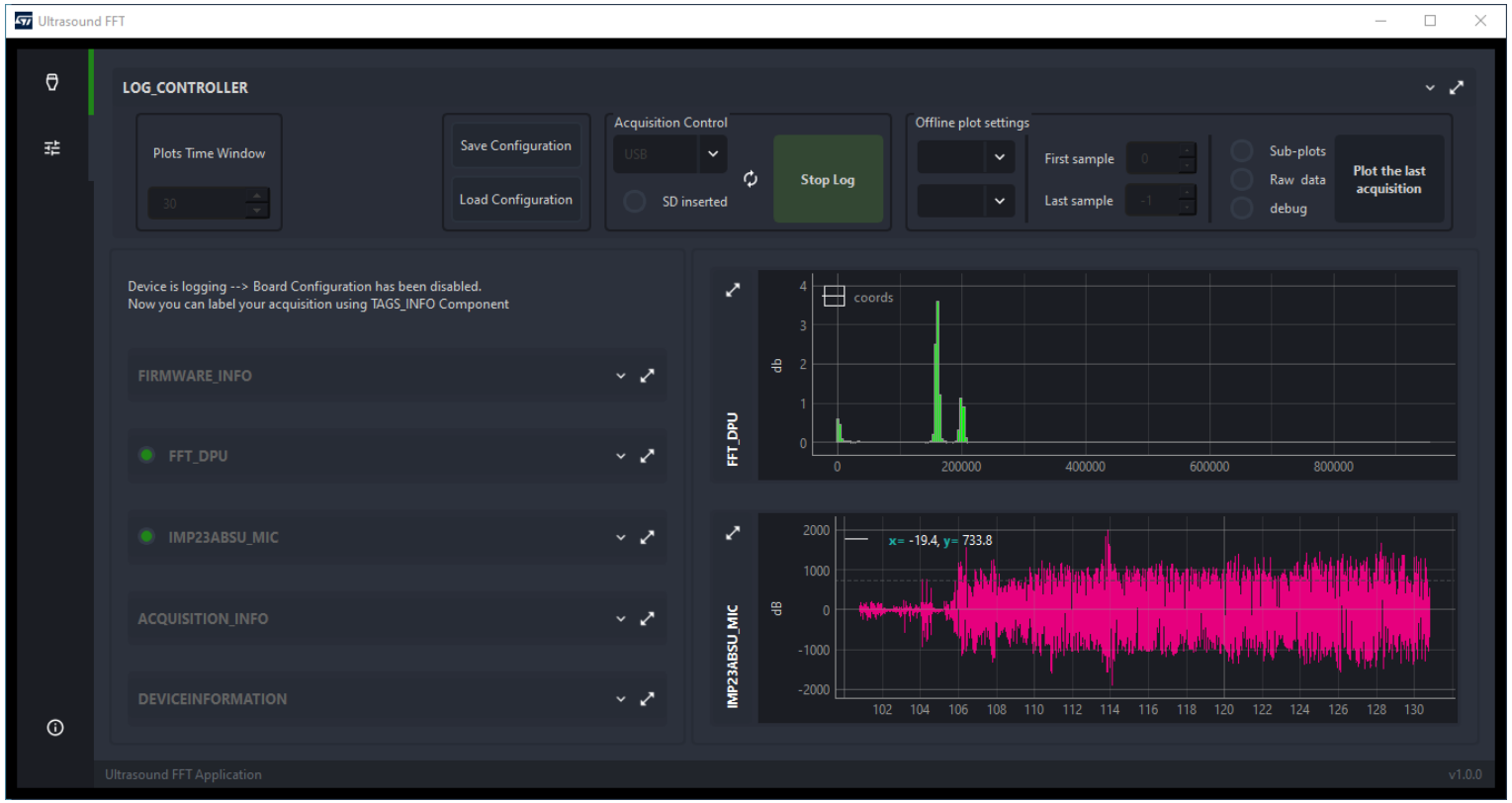


FP-SNS-DATALOG2 - UltrasoundFFT

ultrasound_fft_app.py is based on the same Python SDK and modules developed for *stdatalog_GUI.py*.

Following the same procedure described in 2.1.2, once launched the acquisition, you can:

- Click on *Connect* button to allow the connection between the board and the PC
- Enable/disable FFT or microphone data
- Start/stop logging data on the PC



- Once clicked on *Start Log* button, data are live plotted and the application will create a YYYYMMDD_HH_MM_SS (i.e., 20200128_16_33_00) folder containing the data and the JSON configuration file.

3 - Documents & Related Resources

Documents & Related Resources

FP-SNS-DATALOG2:

- **DB4865:** STM32Cube function pack for high speed datalogging and ultrasound processing– **databrief**
- **UM3106:** Getting started with the STM32Cube function pack for high speed datalogging and ultrasound processing – **user manual**

STEVAL-STWINBX1:

- **Gerber files, BOM, Schematic**
- **DB4598**: STWIN.box - SensorTile Wireless Industrial Node Development Kit– **databrief**
- **UM2965**: Getting started with the STEVAL-STWINBX1 SensorTile wireless industrial node development kit– **user manual**
- **eLearning Course:** STWIN.box hands-on workshop

STEVAL-MXBOXPRO:

- **Gerber files, BOM, Schematic**
- **DB4590**: SensorTile.box PRO discovery box with multi-sensors and wireless connectivity for any intelligent IoT node – **databrief**
- **UM3133**: Getting started with SensorTile.box PRO multi-sensors and wireless connectivity development kit for any intelligent IoT node – **user manual**

Visit www.st.com for the complete list

Documents & Related Resources

STEVAL-PDETECT1:

- **Gerber files, BOM, Schematic**
- **DB5165:** Presence detection add-on for STWIN.box – **databrief**
- **UM3320:** Getting started with the STEVAL-PDETECT1 Presence Detection evaluation board – **user manual**

STEVAL-C34KAT1:

- **Gerber files, BOM, Schematic**
- **DB4593**: Vibrometer and temperature sensor expansion kit – **databrief**
- **UM3021**: Getting started with the STEVAL-C34KAT1 vibrometer and temperature sensor expansion kit – **user manual**

STEVAL-C34KAT2:

- **Gerber files, BOM, Schematic**
- **DB5041**: iNemo inertial module with embedded ISPU and temperature sensor expansion kit – **databrief**
- **UM3192**: Getting started with the STEVAL-C34KAT2, iNemo inertial module with embedded ISPU and temperature sensor expansion kit – **user manual**

Visit www.st.com for the complete list

Documents & Related Resources

STEVAL-STWINKT1B:

- **Gerber files, BOM, Schematic**
- **DB4345**: STWIN SensorTile Wireless Industrial Node development kit and reference design for industrial IoT applications – **databrief**
- **UM2777**: How to use the STEVAL-STWINKT1B SensorTile Wireless Industrial Node for condition monitoring and predictive maintenance applications – **user manual**

B-U585I-IOT02A:

- **Gerber files, BOM, Schematic**
- **DB4410**: Discovery kit for IoT node with STM32U5 series – **databrief**
- **UM2839**: Discovery kit for IoT node with STM32U5 series – **user manual**

X-NUCLEO-IKS02A1:

- **Gerber files, BOM, Schematic**
- **DB4015**: Motion MEMS and microphone MEMS expansion board for STM32 Nucleo – **databrief**
- **UM2633**: Getting started with the X-NUCLEO-IKS02A1 industrial motion MEMS sensor expansion board for STM32 Nucleo – **user manual**

Visit www.st.com for the complete list

Documents & Related Resources

X-NUCLEO-IKS4A1:

- **Gerber files, BOM, Schematic**
- **DB5091**: Motion MEMS and environmental expansion board for STM32 Nucleo – **databrief**
- **UM3239**: Getting started with the X-NUCLEO-IKS4A1 motion MEMS and environmental sensor expansion board for STM32 Nucleo – **user manual**

STDATALOG-PYSDK:

- **DB5446**: Python software development kit (SDK) for data logging: complete toolkit with extensive examples for developers – **databrief**

Visit www.st.com for the complete list

4 - STM32 Open Development Environment: Overview

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STM32 ODE Ecosystem

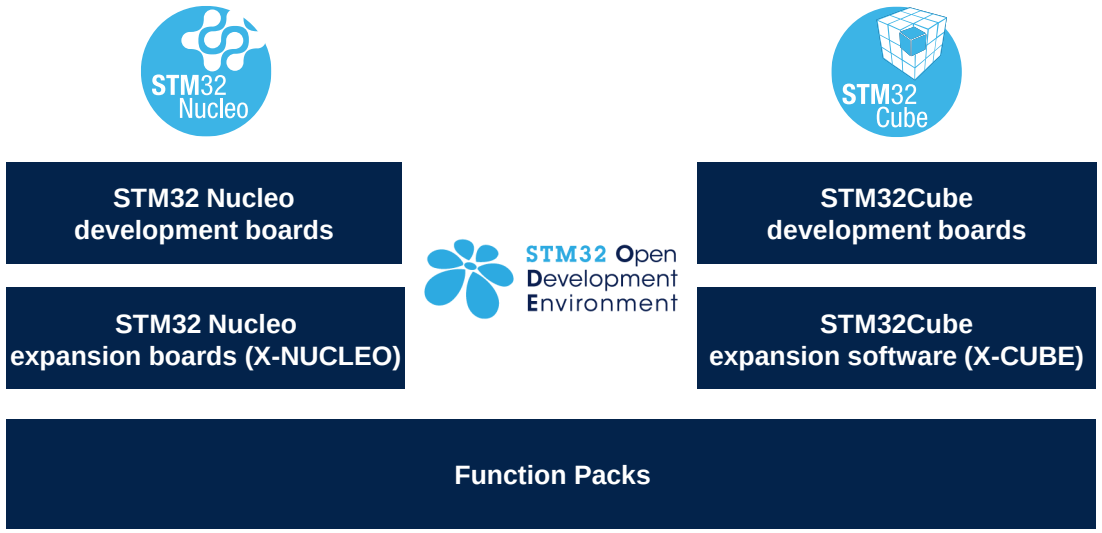
FAST, AFFORDABLE PROTOTYPING AND DEVELOPMENT

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.



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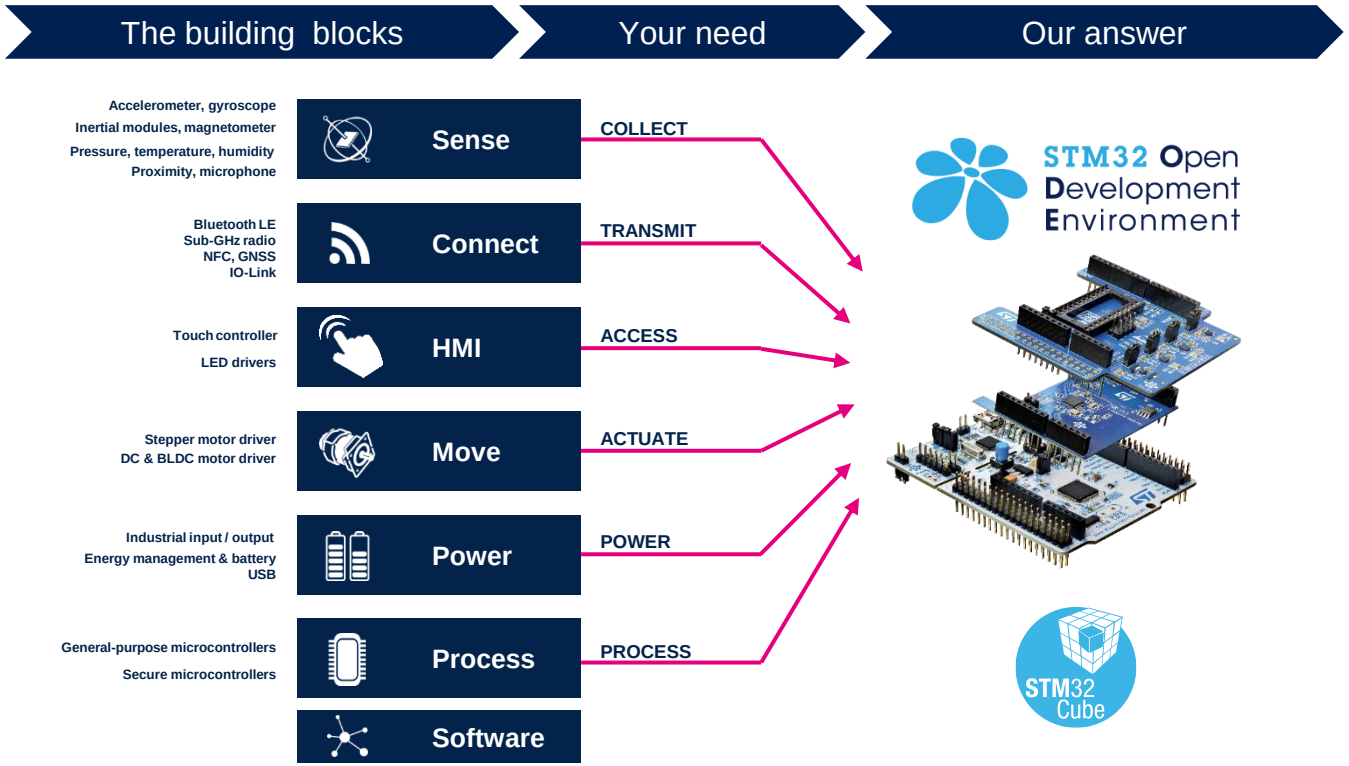
STM32 Open Development Environment: all that you need

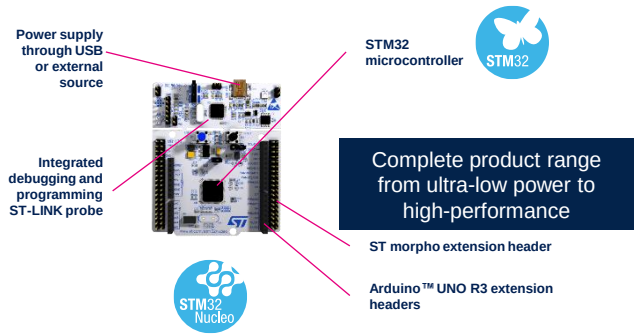
The combination of a broad range of expandable boards based on leading-edge commercial products and modular software, from driver to application level, enables fast prototyping of ideas that can be smoothly transformed into final designs.

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.





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Thank you

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