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High-speed datalogging for motor control & sensors

FP-IND-DATALOGMC Quick Start Guide STM32Cube Function Pack Version 1.1 (Jan '24)



Agenda





1- Application Overview



Datalogging and labeling of heterogeneous data



Comprehensive solution to manage the acquisition of heterogeneous datasets from sensors and motor, including precise timestamps and events tags



Motor Control High Speed Data logger (in short: DATALOGMC) Application overview

DATALOGMC comes with two operating modes:

DATALOGMC via USB

It allows user to control the motor, acquire, stream and plot in real-time via Python Application GUI sensors and motor control data.



It allows user to control the motor, acquire, and save sensors and motor control data to SD Card.





DATALOGMC via USB

Application overview

DATALOGMC via USB allow user to control the motor, acquire, stream and plot in real-time via Python Application GUI sensors and motor control data.

In order to run DATALOGMC via USB you need:

- STEVAL-STWINBX1
- EVLSPIN32G4-ACT
- STEVAL-FLTCB04
 - (4cm flex cable included with EVLSPIN32G4-ACT)
- 3-phase brushless motor (250 W max not included in the kit)
- Power supply (48 V max)
- Laptop/PC with Windows 7, 8 or 10
- USB Type-C cable

For boards programming only:

• <u>STLINK-V3MINIE</u>, <u>STLINK-V3SET</u>, or <u>ST-LINK/V2</u> + adapter





DATALOGMC via BLE + SD Card

Application overview

DATALOGMC via BLE allow user to control the motor, acquire, and save sensors and motor control data to the SD Card.

In order to run DATALOGMC via BLE you need:

- STEVAL-STWINBX1
- EVLSPIN32G4-ACT
- STEVAL-FLTCB04
 - (4cm flex cable included with EVLSPIN32G4-ACT)
- 3-phase brushless motor (250 W max not included in the kit)
- Power supply (48 V max)
- STBLESensor App for Android or iOS
- micro-SD card

For boards programming only:

• <u>STLINK-V3MINIE</u>, <u>STLINK-V3SET</u>, or <u>ST-LINK/V2</u> + adapter





Setup & Application Examples

Software and other prerequisites

- STM32CubeProgrammer Software
 - Download and install <u>STM32CubeProgrammer</u>
- STM32Cube initialization code generator
 - Download and install <u>STM32CubeMX</u>
- Integrated Development Environment for STM32
 - Download and install one among the supported IDEs: <u>STM32CubeIDE</u>, <u>Keil</u>, <u>IAR</u>
- STM32 Motor Control Software Development Kit
 - Download and install <u>X-CUBE-MCSDK-6</u>
- DATALOGMC
 - Download the FP-IND-DATALOGMC 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 (<u>STM32CubeIDE</u>, <u>Keil</u>, <u>IAR</u>)
- ST BLESensor App
 - Download and install ST BLESensor App (for both Android and iOS v5.2 and above)
- Python3 (>=3.10)
 - To save, plot and elaborate data, Python utility scripts are available

DATALOGMC is **not** the default firmware on STWIN.box.

To update the firmware, download the function pack or follow the instructions for <u>Fast FOTA</u>

2- Hardware and Software Overview



Hardware Overview

FP-IND-DATALOGMC requires a STEVAL-STWINBX1, an EVLSPIN32G4-ACT, a 3-phase brushless motor, and a power supply.

STEVAL-STWINBX1





Power supply

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 v5.0 wireless technology (BlueNRG-M2), 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



Latest info available at www.st.com/stwinbox



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

Battery LiPo-752535 - 480mAh

5



STEVAL-C34DIL24



FOR EVALUATION ONLY

EVLSPIN32G4-ACT Hardware Overview

STSPIN32G4 reference design for next generation smart actuators

The EVLSPIN32G4-ACT is a reference design for implementing next generation smart actuators, based on the STSPIN32G4, a system-in-package integrating in a 9x9 mm VFQFPN package, a triple high-performance half-bridge gate driver with a rich set of programmable features and a mixed signal STM32G431 microcontroller.

The board is designed to drive three-phase brushless motors up to 5 Arms output current and 48 V supply input delivering a total power of 250 W in a very compact form factor (62 mm x 50 mm). Monitoring is available for the power stage in case of overheating, overvoltage, and overcurrent. The sensing of motor winding currents can be selected between three-shunt or single-shunt topology. The board is ready for FOC and 6-step control algorithms and can run in sensor-less and sensor-based mode using Hall sensors or quadrature encoder.

Key Features

- Power stage based on the STL60N10F7 power MOSFETs with output current up to 5 Arms and protected to overcurrent condition
- Bus voltage from 10 V to 48 V with dedicated monitoring
- STSPIN32G4, high performance three-phase motor controller with embedded STSPIN32G431 MCU
- · Triple-shunt or single-shunt differential current sensing using embedded operational amplifiers
- Inputs for speed/position feedback by digital Hall sensors or incremental quadrature encoders
- Predisposition for CAN bus
- NTC sensor for power stage temperature monitoring
- Interface with STWIN.box and external sensor boards



Latest info available at www.st.com/evlspin32g4-act



Software Overview

The **DATALOGMC** application requires **two different firmware to run**:

- FP-IND-DATALOGMC for STEVAL-STWINBX1 (see <u>DATALOGMC FW</u>)
- EVLSPIN32G4-ACT firmware generated by <u>STM32 Motor Control Software Development Kit (MCSDK)</u> (see <u>How to program EVLSPIN32G4-ACT</u>)



Motor Control Protocol



FP-IND-DATALOGMC firmware features:

- Motor Control Protocol controller
- USB and BLE communication
- Sensors acquisition and streaming
- SD Card management

MCSDK firmware features:

- Motor Control Protocol target
- Field Oriented Control

FP-IND-DATALOGMC

Software Overview

Software Description

The FP-IND-DATALOGMC function pack for STEVAL-STWINBX1 and EVLSPIN32G4-ACT is a powerful integrated toolkit for the next generation of smart actuators. It is derived from a FP-SNS-DATALOG2 function pack, and it allows the collection of heterogeneous data, combining STWIN.box sensor information with STSPIN32G4 motor control data and it provides a comprehensive view of the system's operational conditions. This enables both real-time monitoring and accurate

performance assessment.

Key features

- High data rate (up to 6 Mbit/s) data capture software suite:
 - Simultaneously log motor control telemetries and sensor data.
 - Python real-time control and data analysis
 - Dedicated Python SDK, ready-to-use for integration into any data science design flow
 - Compatible with ST BLESensor app for system setup and real-time control
 - Synchronized timestamping and labeling mechanisms common to all sensors and motor data
- Motor Control Protocol implementation to interact with EVLSPIN32G4-ACT evaluation board, programmed as through MCSDK (X-CUBE-MCSDK-6)
- AzureRTOS: ThreadX, FileX, USBX
- Firmware modular examples based on eLooM (embedded Light object-oriented fraMework for STM32) to enable code reusability at application level
- Free, user-friendly license terms





Software Description

STM32 MCSDK (motor control software development kit) firmware includes the permanent magnet synchronous motor (PMSM) firmware library (FOC and 6STEP control) and the STM32 motor control workbench (to configure the firmware library parameters), with its graphical user interface (GUI).

STM32 Motor Control Workbench is a PC software that reduces the design effort and time needed for the firmware configuration.

The user generates a project file through the GUI and initializes the library according to the application needs. Some algorithm variables can be monitored and changed in real time.

Key features

- Single/dual simultaneous field-oriented control (FOC)
- Motor profiler and one-touch tuning for a fast startup of unknown motors
- Simplified firmware architecture based on the STM32Cube HAL/LL libraries
- Current reading topologies supported:
 - 1 shunt resistor
 - 3 shunt resistors

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- 2 ICS (isolated current sensor)
- Speed/position sensors (encoder and Hall) and sensorless operation
- Speed and torque control
- MTPA (maximum torque per ampere), flux weakening, feed forward, and start-on-the-fly
- Full customization and real time communication through Motor Control Protocol



X-CUBE-MCSDK-6

Software Overview



3- Hardware and Software Setup









3.2 How to program EVLSPIN32G4-ACT



3.1- How to program STWIN.box (DATALOGMC FW, Controller board)





STEVAL-STWINBX1 FW Setup





STEVAL-STWINBX1 Firmware Setup

To configure and flash properly the STEVAL-STWINBX1 follow the next steps:

1. Download the <u>FP-IND-DATALOGMC</u> function pack from <u>www.st.com</u>

2. Unpack the function pack folder and navigate into STM32CubeFunctionPack_DATALOGMC_V1.0.0.





STEVAL-STWINBX1 Firmware Setup

- 3. User can choose one of the three procedures described below to program the STEVAL-STWINBX1 board with the DATALOGMC firmware:
 - Firmware update via USB
 - Firmware update via STLINK
 - Firmware update via BLE (FOTA)



Firmware update via USB

STEVAL-STWINBX1 can be reprogrammed via USB using the <u>STM32CubeProgrammer</u> "USB mode". To enter "Firmware upgrade" mode you must follow the procedure below:

- Unplug the core system board.
- Press the USER button.
- While keeping the button pressed, connect the USB cable to the PC.
- Now the board is in DFU mode. Open STM32CubeProgrammer, select the binary located under:

Projects\STM32U585AI-STWIN.box\Applications\DATALOGMC\Binary and download the firmware.



For further details, see UM2965



Firmware Update via ST-LINK

To update the firmware via ST-Link follow the procedure below:

- Connect the STEVAL-STWINBX1 board to any STM32 programmer (here we are using <u>STLINK-V3MINIE</u>, for more configuration see <u>STLINK Setup</u>).
- Connect the STEVAL-STWINBX1 and the programmer to a PC through the proper USB cables.
- Open <u>STM32CubeProgrammer</u>, select the binary file (located under: *Projects\STM32U585AI-STWIN.box\Applications\DATALOGMC\Binary*) and download the firmware.





The default firmware for STWIN.box enables the Bluetooth pairing via NFC and Firmware On-The-Air upgrade through ST BLESensor app

- Download the app from the Play Store or the Apple Store
- Power on the board by plugging the USB cable
- Turn on the Bluetooth and the NFC on your smartphone
- Place the smartphone on top of the NFC antenna
- The smartphone will read the Bluetooth pairing information and it will automatically load the App.







- The NFC step is optional, you can also manually open the **ST BLESensor** appn and scan for nearby devices
- The board presents itself as BLEDfFw
- During BLE pairing, if requested, you must insert the following PIN: 123456
- The application shows the environmental data coming from the board (temperature and pressure)
- 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
- · See next slides for details



To update the firmware, follow the procedure below:





Once the download is finished, the new firmware will restart automatically. To reconnect to BLESensor app (if needed), restart the app.

In Board Configuration tab you can also swap between 2 firmware already loaded into the STWIN.box flash, download a new firmware or upgrade the current on with the latest available.

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STLINK Setup

- STWIN.box programming connector is natively compatible with STLINK-V3 debuggers family (<u>STLINK-V3SET</u> or <u>STLINK-V3MINIE</u>). STLINK-V3 programmers are NOT included in the kit.
- Alternatively, in order to offer more alternatives, an adapter to STM32 Nucleo-64 boards (ST-LINK/V2-1) or ARM standard JTAG connector (STLINK/V2) is included in the kit.





3.2- How to program EVLSPIN32G4-ACT





To configure and flash properly the EVLSPIN32G4-ACT follow the next steps:

1. Download and install <u>STM32 Motor Control Software Development Kit</u> (Require <u>STM32CubeMX</u> and one among the supported IDEs: <u>STM32CubeIDE</u>, <u>Keil</u>, <u>IAR</u>)

2. Run MotorControl Workbench







New Proje

General Info Motors Inverter

4. In general Info tab select FOC as Driving Algorithn and Inverter as Hardware and click Next

Project name:		
EVLSPIN32G4-ACT Project		
Description:		
Smart Actuator Project		
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Modular	O Inverter	O Pack
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and Control boards as well as the target motor. The Control board, witch embeds	Inverter boards as well as the target motor. The inverter board contains both the	Combinations of components provided Workbench, each containing a control
the Microcontroller, is responsible for processing signals that drive and sense	control and power components. This mode is meant for users who need space-efficient	board, power board and motor. These combinations are designed to provide
motor spinning. This mode, suitable for	solutions on a all-in-one board ready to	plug-and-play solution for motor cont
easy prototyping, is designed for users who need a highly customizable project	work with a motor.	want a quick and easy setup.
		Conversion 2010/00/00/00/00/00/00/00/00/00/00/00/00/



New Project General Info Motor Motors Q (13 / 13) Search Motors Inverter Shinano LA052-080E3NL1 Allen Bradley I Allen Bradley TL-A220P-HJ32AN Bull Running BR2804-1700kv GimBal GBM2804H-100T I-PMSM Allen Bradley TL-A220P-HJ32AN TL-A220P-HJ32AN External rotor type - 7 poles pairs brushless - DC motor iPower GBM2804H-100T Brushless Gimbal Motor Magnetic Struct.: I-PMSM Magnetic Struct.: SM-PMSM Magnetic Struct.: SM-PMSM Magnetic Struct.: SM-PMSM (\cdot, \cdot) ((\odot Pole Pairs: 4 Pole Pairs: 4 Pole Pairs: 7 Pole Pairs: 7 Max Speed: 15 krom Max Speed: 1.57 krpm Max Speed: 5 krom Max Speed: 5 krom Nominal Voltage: 325 V Nominal Voltage: 325 V Nominal Voltage: 12 V Nominal Voltage: 14.8 V 5. Choose your motor in **Motors** Nominal Current: 2.95 Apk Nominal Current: 2.95 Apk Nominal Current: 1.2 Apk Nominal Current: 5 Apk 日 tab, and click **Next** MAXON EC-I 100W Shinano LA052-080E3NL1 SM-PMSM 320V motor I-PMSM 24V motor brushless DC motor with encoder and Z Index nner rotor type - 2 poles pairs - brushless DC motor wi... lotor high voltage Motor low voltage Magnetic Struct.: SM-PMSM Magnetic Struct.: SM-PMSM Magnetic Struct.: SM-PMSM Magnetic Struct.: I-PMSM ((Pole Pairs: 7 Pole Pairs: 2 Pole Pairs: 4 Pole Pairs: 2 Max Speed: 4.5 krpm Max Speed: 4 krpm Max Speed: 4 krom Max Speed: 4 krpm Nominal Voltage: 36 V Nominal Voltage: 24 V Nominal Voltage: 320 V Nominal Voltage: 24 V Nominal Current: 1.6 Apk Nominal Current: 1.6 Apk Nominal Current: 4 Apk Nominal Current: 1.8 Apk SM-PMSM 24V motor Motor low voltage Magnetic Struct.: SM-PMSM Pole Pairs: 2 Max Speed: 4 krpm Nominal Voltage: 24 V Nominal Current: 1.8 Apk







Project Hw & Info **Power Supply** Bus Voltage Sensing DC Bus: 24 Vdc - 1.6 Apk Stage Motor D Power Supply **Customize** your project: 7. PWM Generation Speed Sensing Selection Current Sensing emperature Supply voltage Α. Bus Voltage Sensing Sensing С Temperature Sensing Speed and position feedback Speed Sensing Config. Β. D T. Driver Protection Drive PWM Drive Settings C. Drive settings and PWM frequency Settings Generation Stage Configuration User Interface Protection thresholds and behavior D. Application Configuration Current Pins Usage & Hw Changes Sensing Π ≶ 主 🔒 Home 🛞 Motor Pilot 🛛 🛈 About Generate the project 8. Click Save and Generate the project Inverter Board EVLSPIN32G4-ACT Project Steps 🖻 STISPIN32G4

Generate the project

🕲 Motor Pilot

Inverter Board EVLSPIN32G4-ACT

(i) About

Home

Project Steps 🖻



FOC

Malog

□___ Digital

Shinano LA052-080E3NL1

Motor

Speed

Sensing

Main

Sensorless

SM-PMSM

В

9. Select your IDE in **Target Toolchain** and click **Generate** to create the project source code (Supported IDEs: <u>STM32CubeIDE</u>, <u>Keil</u>, <u>IAR</u>)

Note: If <u>STM32CubeG4</u> libraries are not installed yet, the code generation procedure could ask you to download and install them.

Project generation					×
SETTINGS					
STM32CubeMX					
6.7.0	*				
Tavat Taalshain					
ST STM32CubeIDE	-				
Firmware Package Version					
STM32 FW V1.5.1 (Recommended)	*				
Selecting "not installed" firmware or "Latest" will require internet connection					
Drive Type					
HAL - Hardware Abstraction Layer					
O LL - Low Level					
		RUN STM32CubeMX	GEN	NERATE	
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	Application	10/17/2023 10:28 AM	File folder	
*	Drivers	10/17/2023 10:28 AM	File folder	
*		10/17/2023 10:28 AM	File folder	
*	IDE .cproject	10/17/2023 10:28 AM	CPROJECT File	27 KB
*	DE .project	10/17/2023 10:28 AM	PROJECT File	15 KB
	STM32G431VBTX_FLASH.Id	10/17/2023 10:28 AM	LD File	5 KB



Note: If you have selected a different toolchain, please refer to its documentation to open and compile the generated project



- 12. Power on the EVLSPIN32G4-ACT (see <u>Hardware setup</u>), **connect** the **programmer** as illustrated in the figure and **download the binary**.
 - The board is now ready to be connected to the STWIN.box.
 - For more detail visit: <u>Getting started with the</u> <u>EVLSPIN32G4-ACT</u>
- 13. In case the STLink-V3 is not available, it's possible to use the STLink-V2 adapter <u>as</u> <u>explained</u> for the STWIN.box





3.3- Hardware Setup



Setup EVLSPIN32G4-ACT plus STEVAL-STWINBX1



the EVLSPIN32G4-ACT by connecting the **red-brown cable** provided in the EVLSPIN32G4-ACT package. In alternative, STEVAL-STWINBX1 can be supply via USB.



Setup EVLSPIN32G4-ACT plus STEVAL-STWINBX1

Connect power supply and motor to the EVLSPIN32G4-ACT.



4- DATALOGMC Demonstration



4.1- USB data streaming Real Time Plot



Python Application for real-time plot

- DATALOGMC provides a Python example for real time control and plot of Sensor and Motor control data such as control current, voltage, speed, faults.
- examples/hsdatalog_MC_GUI.py works within the HSDPython_SDK, developed in Python 3.10 on Windows and Linux environments.
 - HSDPython_SDK requires different Python modules, distributed together with FP-INC-DATALOGMC. By installing them through the provided installers, all the required dependencies are automatically solved see <u>HSDPython_SDK</u> to fully setup your Python environment

Satalog Motor Control SW			- 0
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Device is logging> Board Configuration has been disabled. Now you can label your acquisition using the [Tags Information] C Slow Motor Telemetries	Component 🖉 te	erature 28.0 (Cabius)	 No Error FOC Duration Over Voltage
	or Telemetries	peed 1440.0 [rpm]	Under Voltage Over Heat Start Up failure Speed Feedback
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Execute hsdatalog_MC_GUI.py

Once the two boards have been setup and configured and the Python environment has been properly updated, connect the STWIN.box board via USB and launch the real time plot by just executing *hsdatalog_MC_GUI.py* available in *Utilities/HSDPython_SDK/examples.*

Click on *Connect* button to allow the connection between the board and the PC





Execute *hsdatalog_MC_GUI.py*



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Note: User must start the motor in order to watch motor data telemetries.

Execute hsdatalog_MC_GUI.py





Note: User can select maximun four Fast Motor Telemetries

hsdatalog_MC_GUI.py

hsdatalog_MC_GUI.py allow you to:

- Start/Stop the motor via motor control widget
- Set Motor velocity via motor control widget
- Configure fast and slow motor telemetries
- Enable/disable the needed sensors
- Setup data rate, full scale, timestamps
- Retrieve sensor status
- Save and load a configuration via a JSON file
- Start/stop logging data on the PC
- Tag current acquisition with your label (see next slide)
- Once clicked on *Start Log* button, data are live plotted and the application will create a YYYYMMDD_HH_MM_SS (i.e., 20230128_16_33_00) folder containing the raw data and the JSON configuration file.





hsdatalog_MC_GUI.py

- Tag your acquisition with **TAGS INFO**:
 - choose which tag classes will be used for the next acquisition
 - handle data tagging and labelling of an ongoing acquisition
 - set up the acquisition name and description

Tags Information	~ 2
SW Tag Classes	
SW_TAG_0	SW_TAG_1
SW_TAG_2	SW_TAG_3
SW_TAG_4	





hsdatalog_MC_GUI.py

High Speed Datalog Motor Control S • Once concluded the test, you can Log Controlle 🗸 🧷 Motor Controller also check and plot the entire Start Moto dataset by clicking on *Plot the last* acquisition button USIDWE ACC IL DE22OS DRES P23ABSU M ISM330DHCX ACC Figure 1 Winder for a hard a faith and a second a sheet a second a second a second a second a second a second second second fast_mc_telemetries I A 2000 1000 -1000 -2000 -3000 I B 3000 2000 -1000 -1000 -2000 -3000 Time (s)



x=7.185 y=3.46e+03

4.2- Data logging on SD card, configuration with BLESensor App



ST BLESensor App: Smart Motor Control tab

- DATALOGMC application can be controlled via Bluetooth using the ST BLE Sensor app (for both Android and iOS – v5.2 and above) which lets you manage start/stop motor, set motor velocity, slow and fast telemetries configurations, sensor configurations, start/stop data acquisition on SD card and control data labelling.
- Once connected, the main window allow you to:
 - 1. Start the motor
 - 2. Configure motor telemetries and sensors
 - 3. Start the log





Acquisition settings and control

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



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	Motor Information	
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J	No fault message	
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	Motor Control	Configuration

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Smart Motor Con	trol	:
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Motor Information		
W RUNNING		STOP
No fault message		
Motor Speed		
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Slow Motor Telemetri	es	
Slow Motor Telemetri To stop the acquisition you n motor via the 'STOP' button a with the Stop button Temperature	es hust stop bef ind stop the 27	ore the acquisition °C
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Slow Motor Telemetri To stop the acquisition you n motor via the STOP button a with the Stop button Temperature Speed Ref. Speed Meas. Motor Control	es hust stop befund stop the 27 1440 1434	ore the acquisition *C krpm krpm





4.3- HSDPython_SDK



HSDPython_SDK

- FP-IND-DATALOGMC comes with a dedicated Python SDK, ready-to-use for integration into any data science design flow.
- It is distributed in FP-SNS-DATALOG2 and FP-IND-DATALOGMC and can handle data acquired from both packages.
- HSDPython_SDK has been developed in Python 3.10
- The SDK contains many Python scripts, examples and Jupiter notebooks that can be used to log and elaborate data
- The scripts take advantage for the API provided by the st_dtdl_gui, st_hsdatalog and st_pnpl Python modules.

← → ➤ ↑ 📜 « Utilities > HSDPyt	hon_SDK > v	Ö	, ♀ Search H	SDPython_SD
Name	Date modified	Туре	e	Size
examples	2/16/2023 2:59 PM	File	folder	
st_dtdl_gui	2/16/2023 2:55 PM	File	folder	
st_hsdatalog	2/16/2023 2:55 PM	File	folder	
🧵 st_pnpl	2/16/2023 2:55 PM	File	folder	
BDPython_SDK_install.bat	2/16/2023 2:19 PM	Windows Batch File		2 KI
HSDPython_SDK_install.sh	2/16/2023 2:19 PM	She	ll Script	2 KE
BDPython_SDK_install_noGUI.bat	2/16/2023 2:19 PM	Windows Batch File		2 KE
B HSDPython_SDK_install_noGUI.sh	2/16/2023 2:19 PM	Shell Script		2 KE
HSDPython_SDK_uninstall.bat	2/16/2023 2:19 PM	Win	dows Batch File	2 KE
HSDPython_SDK_uninstall.sh	2/16/2023 2:19 PM	She	II Script	2 KE



HSDPython_SDK

- Before using HSDPython_SDK, Python3 (>=3.10) must be properly installed on your machine.
- The following steps are valid for a Windows machine. Similar approach can be followed on other OS as well.
 - Download the installer from python.org and launch it
 - Select Add python.exe flag and click Install Now. Administrator privileges are needed.
 - Once the setup is complete, you can use Python on your machine

🐌 Python 3.11.3 (64-bit) Setuj	· ×	(
	Install Python 3.11.3 (64-bit) Select Install Now to install Python with default settings, or choose Customize to enable or disable features.	
	Install Now Includes IDLE, pip and documentation Creates shortcuts and file associations	
	→ Customize installation Choose location and features	
python windows	✓ Use admin privileges when installing py.exe ✓ Add python.exe to PATH Cancel	



HSDPython_SDK installation

- The three modules are distributed as Python wheels
- Launch HSDPython_SDK_install.bat (Windows) or HSDPython_SDK_install.sh (Linux)
- The SDK modules and their dependencies will be installed in your Python environment
- For Linux users, further steps are needed.
 - A step-by-step procedure is described in detail in the readme_linux file.





HSDPython_SDK scripts

- The SDK can be used to develop a custom project either by importing the provided modules in a new application or by modifying one of the available scripts
- Here the list of scripts available in the examples folder:
 - hsdatalog_data_export.py can convert data into CSV or TSV files.
 - *hsdatalog_data_export_by_tags.py* can be used for tagged acquisition to convert data into different files, one for each tag used.
 - *hsdatalog_dataframes.py* can save data as pandas dataframe for further processing needs.
 - *hsdatalog_MC_GUI.py* provides an example for real time control and plot.
 - *hsdatalog_plot.py* can plot the desired data.
 - *hsdatalog_to_nanoedge.py* can prepare data to be imported into NanoEdge AI Studio solution.
 - *hsdatalog_to_unico.py* can prepare data to be imported into Unico-GUI.
 - *hsdatalog_to_wav.py* can convert audio data into a wave file.



HSDPython_SDK scripts

- You can execute the scripts in your preferred Python environment
 - i.e.: use the command *python hsdatalog_plot.py*
- Discover the complete list of parameters for each script by executing with the -h option
 - i.e.: python hsdatalog_ploy.py -h

C:\Windows\System32\cmd.exe	_		×
C:\git\ODE\FP\DATALOG2\Firmware Jsage: hsdatalog_plot.py [OPTIO	\Utilities\HSDPython_SDK≻python hsdatalog_plot.py -h NS] ACQ_FOLDER		^
Options:			
-s,sensor_name TEXT	Sensor Name - use "all" to plot all active sensors data, otherwise select a specific sensor by name		
-st,sample_start INTEGER	Sample Start - Data plot will start from this sample		
-et,sample_end INTEGER	Sample End - Data plot will end up in this sample		
-r,raw_data I -l,labeled I	Uses Raw data (not multiplied by sensitivity) Plot data including information about annotations taken during acquisition (if any)		
-p,subplots	Multiple subplot for multi-dimensional sensors		
-d,debug	[DEBUG] Check for corrupted data and timestamps		
-h,help	Show this message and exit.		
help	Show this message and exit.		
-> Script execution examples:			
-> HSDatalog1:			
python hsdatalog_plot.py\	STWIN_acquisition_examples\STWIN_00001		
python hsdatalog_plot.py\	STWIN_acquisition_examples\STWIN_00001 -s all		
python hsdatalog_plot.py	SIWIN_acquisition_examples\SIWIN_00002 -s all -1		
python insuaralog_piot.py	SIMIN_acddisiciou_examples(SIMIN_00005 -1 -h -l.		
-> HSDatalog2:			
python hsdatalog_plot.py\	STWIN.box_acquisition_examples\20221017_13_18_08		
python hsdatalog_plot.py	STWIN.box_acquisition_examples\20221017_13_18_08 -s all		
python hsdatalog_plot.py	SIWIN.box_acquisition_examples\2022101/_13_18_08 -s all -J	t i	
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C:\git\ODE\FP\DATALOG2\Firmware	\Utilities\HSDPython_SDK>		
			~



5- Documents & Related Resources



Documents & Related Resources

All documents are available in the DESIGN tab of the related products webpage

FP-IND-DATALOGMC:

- DB5152: STM32Cube function pack for high-speed datalogging of sensors data and motor control telemetries – databrief
- UM: Getting started with the STM32Cube function pack for high-speed datalogging of sensors data and motor control telemetries— user manual
- Software setup file

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

EVLSPIN32G4-ACT:

- Gerber files, BOM, Schematic
- **DB5035**: STSPIN32G4 reference design for next generation smart actuators databrief
- UM3168: Getting started with the EVLSPIN32G4-ACT user manual



6- STM32 Open Development Environment: Overview



STM32 ODE Ecosystem

FAST, AFFORDABLE PROTOTYPING AND DEVELOPMENT

The <u>STM32 Open Development Environment</u> (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:

- <u>STM32 Nucleo development boards</u>. A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer
- <u>STM32 Nucleo expansion boards</u>. 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
- <u>STM32Cube software</u>. 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
- <u>STM32Cube expansion software</u>. Expansion software provided free of charge for use with STM32 Nucleo expansion boards, and compatible with the STM32Cube software framework
- <u>STM32Cube Function Packs</u>. 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.



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.



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Thank you

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