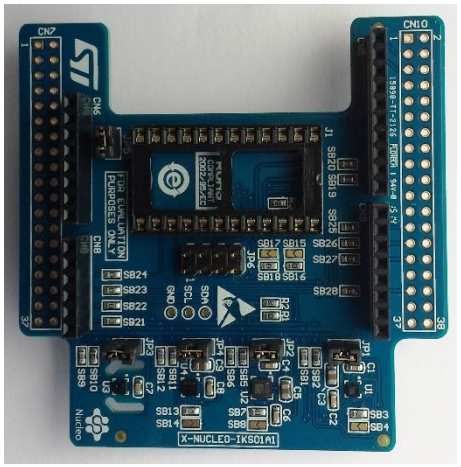
Quick Start Guide

Motion MEMS and environmental sensor expansion board for STM32 Nucleo (X-NUCLEO-IKS01A1)



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Version 1.2.0 (May 26, 2016)

Quick Start Guide Contents

Motion MEMS and environmental sensor expansion board

Hardware overview (1/2)

X-NUCLEO-IKS01A1 Hardware description

- The X-NUCLEO-IKS01A1 is a motion MEMS and environmental sensor evaluation board system.
- It is compatible with the Arduino UNO R3 connector layout, and is designed around ST's latest sensors.

Key products on board

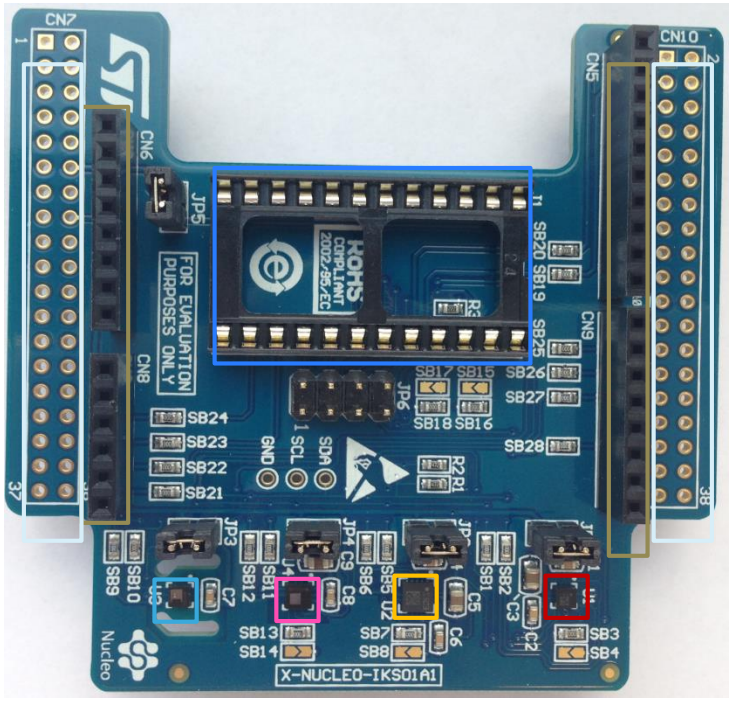
LSM6DS0
MEMS 3D accelerometer (±2/±4/±8 g) + 3D gyroscope (±245/±500/±2000 dps)

LIS3MDL
MEMS 3D magnetometer (±4/ ±8/ ±12/ 16 gauss)

LPS25HB
MEMS pressure sensor, 260-1260 hPa absolute digital output barometer

HTS221
Capacitive digital relative humidity and temperature

DIL 24-pin
Socket available for additional MEMS adapters and other sensors (UV index)



HTS221 LSM6DS0 ST morpho connector**
LPS25HB LIS3MDL Arduino UNO R3 connector
DIL 24-pin

Latest info available at www.st.com
X-NUCLEO-IKS01A1

** Connector for the STM32 Nucleo Board

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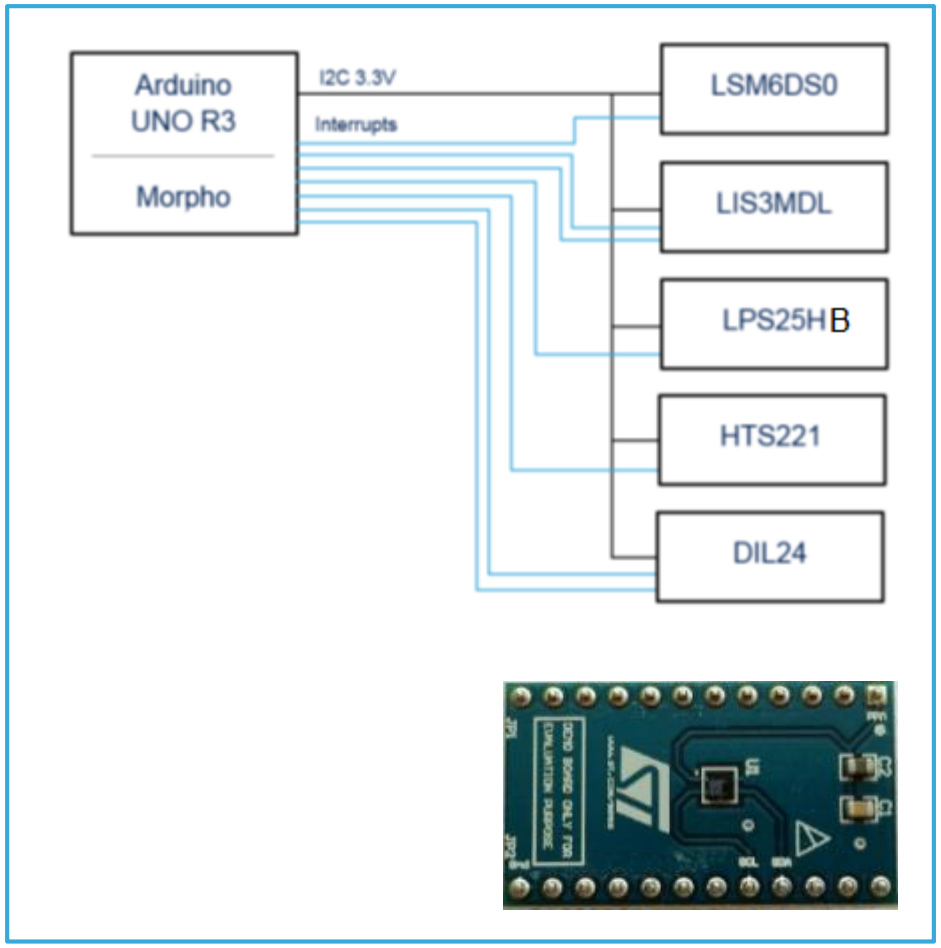
Motion MEMS and environmental sensor expansion board

Hardware overview (2/2)

Key features

- The X-NUCLEO-IKS01A1 is a motion MEMS and environmental sensor evaluation board system.
- All sensor sensors are connected on a single I²C bus
- Sensor I²C address selection
- Each sensor has separate power supply lines allowing power consumption measurements
- Sensor disconnection (disconnects the I²C bus as well as the power supply)
- Interrupt and DRDY signals from sensors
- DIL24 socket (compatible with STEVAL-MKI***V* MEMS adapter boards)



* is used as a wildcard character for related part number

Motion MEMS and environmental sensor expansion board

Software overview (1/2)

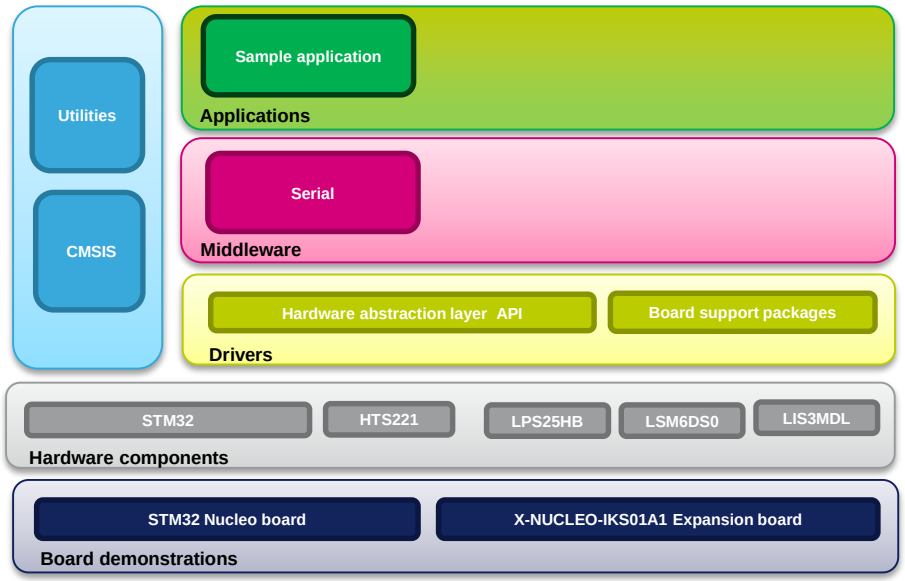
X-CUBE-MEMS1 Software description

- The X-CUBE-MEMS1 software package is an expansion for STM32Cube, associated with the X-NUCLEO-IKS01A1 expansion board.
- It is compatible with NUCLEO-F401RE, NUCLEO-L053R8 or NUCLEO-L152RE

Key features

- Complete middleware to build applications using temperature and humidity sensors (HTS221), pressure sensor (LPS25HB) and motion sensors (LIS3MDL and LSM6DS0)
- Easy portability across different MCU families, thanks to STM32Cube
- Sample application to transmit real-time sensor data to a PC
- PC-based application (Windows®) to log sensor data
- Low-power optimization (suitable for the STM32L0 MCU family)
- Free, user-friendly license terms

Overall Software Architecture



Latest info available at www.st.com
X-CUBE-MEMS1

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Motion MEMS and environmental sensor expansion board

Software overview (2/2)

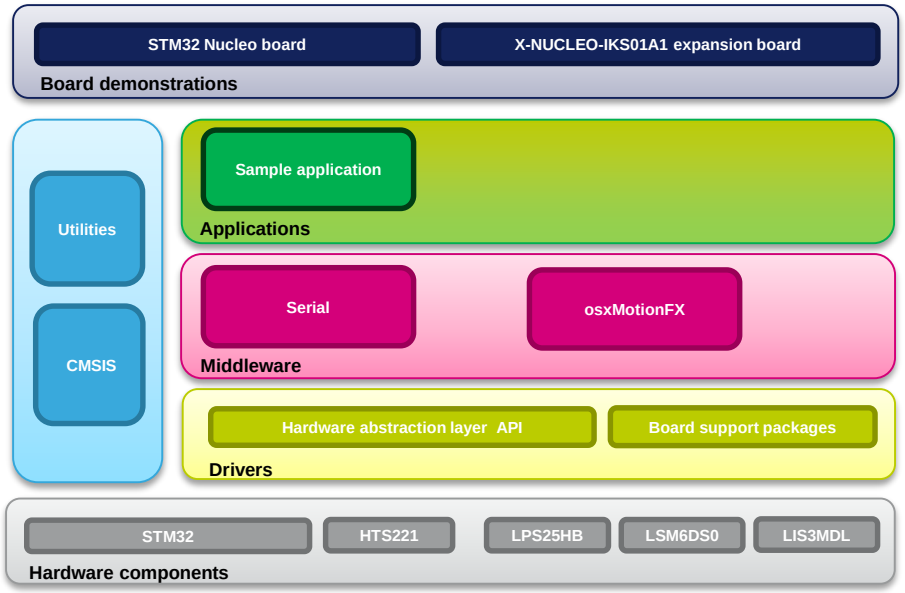
osxMotionFX Software description

- The package is an add-on for X-CUBE-MEMS1 providing real-time motion sensor data fusion and gyroscope bias and magnetometer calibration routines
- The package contains source code examples (Keil, IAR, System Workbench) based only on NUCLEO-F401RE

Key features

- osxMotionFX (iNEMOEngine PRO) real-time motion-sensor data fusion (under OPEN.MEMS license)
- Complete middleware to build applications using temperature and humidity sensor (HTS221), pressure sensor (LPS25HB) and motion sensors (LIS3MDL and LSM6DS0)
- Gyroscope bias and magnetometer calibration routine
- Easy portability across different MCU families, thanks to STM32Cube
- Sample application to transmit real-time both sensor data and sensor fusion data to a PC
- Sample implementation available on board X-NUCLEO-IKS01A1 when connected to NUCLEO-F401RE

Overall Software Architecture



Latest info available at www.st.com
osxMotionFX

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Quick Start Guide Contents

X-NUCLEO-IKS01A1: Motion MEMS and environmental sensor expansion board Hardware and Software overview

Setup & Demo Examples

Documents & Related Resources

STM32 Open Development Environment: Overview

Setup & demo examples
Hardware prerequisites

- 1x Motion MEMS and environmental sensor expansion board (**X-NUCLEO-IKS01A1**)
- 1x STM32 Nucleo development board (**NUCLEO-F401RE or NUCLEO-L053R8 or NUCLEO-L152RE**)
- Windows 8/7 - Laptop/PC
- 1 x USB type A to mini-B USB cable

NUCLEO-F401RE
NUCLEO-L053R8
NUCLEO-L152RE

Mini USB Cable

X-NUCLEO-IKS01A1

Software prerequisites

- **STSW-LINK008:** ST-LINK/V2-1 USB driver
- **STSW-LINK007:** ST-LINK/V2-1 firmware upgrade
- **X-CUBE-MEMS1**
  - Copy the .zip file content into a folder on your PC
  - The package contains source code examples (Keil, IAR, System Workbench) based on **NUCLEO-F401RE or NUCLEO-L053R8 or NUCLEO-L152RE**
- **OSXMotionFX**
  - The package is an add-on for X-CUBE-MEMS1 providing real-time motion sensor data fusion and gyroscope bias and magnetometer calibration routines
  - The package contains source code examples (Keil, IAR, System Workbench) based only on **NUCLEO-F401RE**

Use of Sensors_DataLog GUI with precompiled BIN FW

X-CUBE-MEMS1 for NUCLEO-F401RE or NUCLEO-L053R8 or NUCLEO-L152RE

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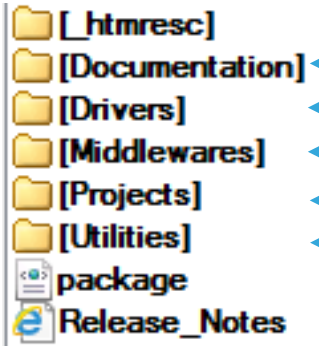
www.st.com

1 www.st.com/x-nucleo

2 Select X-NUCLEO-IKS01A1

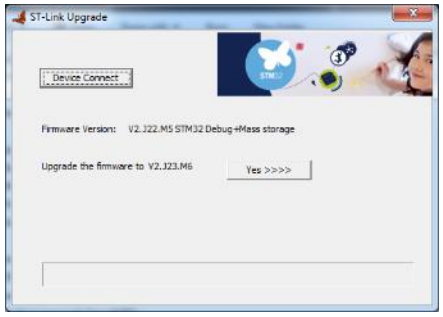
3 Download & unpack X-CUBE-MEMS1

X-CUBE-MEMS1 package structure

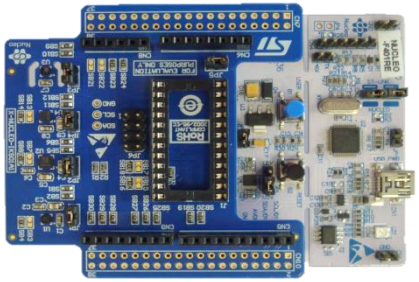


Docs
Low-level sensor drivers
Serial utility
L0 / F4/ L1 DataLog FW src code + binary
PC GUI (Sensors_DataLog)

4 Download & install STM32 Nucleo ST-LINK/V2-1 USB driver STSW-LINK008



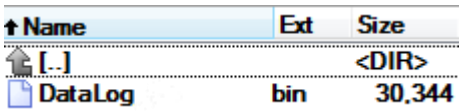
5 Download / Install / Run ST-Link FW Upgrade utility STSW-LINK007



Use of Sensors_DataLog GUI with precompiled BIN fmw

X-CUBE-MEMS1 for NUCLEO-F401RE or NUCLEO-L053R8 or NUCLEO-L152RE

\STM32CubeExpansion_MEMS1_V1.3.0\Projects\Multi\Examples\DataLog\Binary\STM32F401RE-Nucleo
\STM32CubeExpansion_MEMS1_V1.3.0\Projects\Multi\Examples\DataLog\Binary\STM32L053R8-Nucleo
\STM32CubeExpansion_MEMS1_V1.3.0\Projects\Multi\Examples\DataLog\Binary\STM32L152RE-Nucleo



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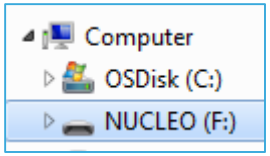
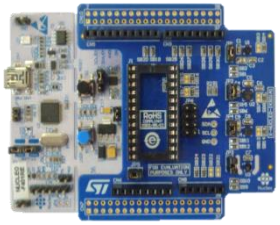
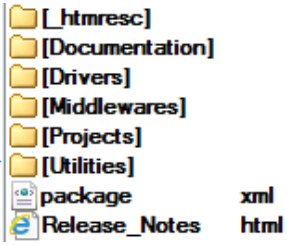
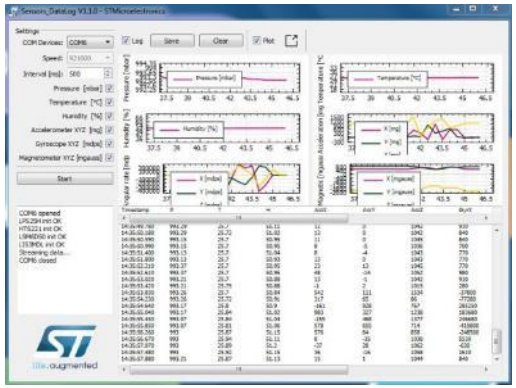
drag and drop
DataLog.bin for F4 or for L0 or for L1
on Nucleo drive





Open Utilities Folder in the X-CUBE-MEMS1 SW package





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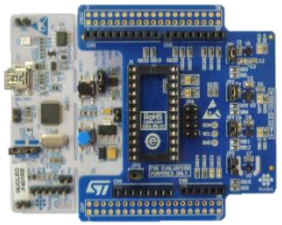
…and Run Sensors_DataLog
PC GUI



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X-CUBE-MEMS1 for NUCLEO-F401RE, NUCLEO-L053R8 or NUCLEO-L152RE

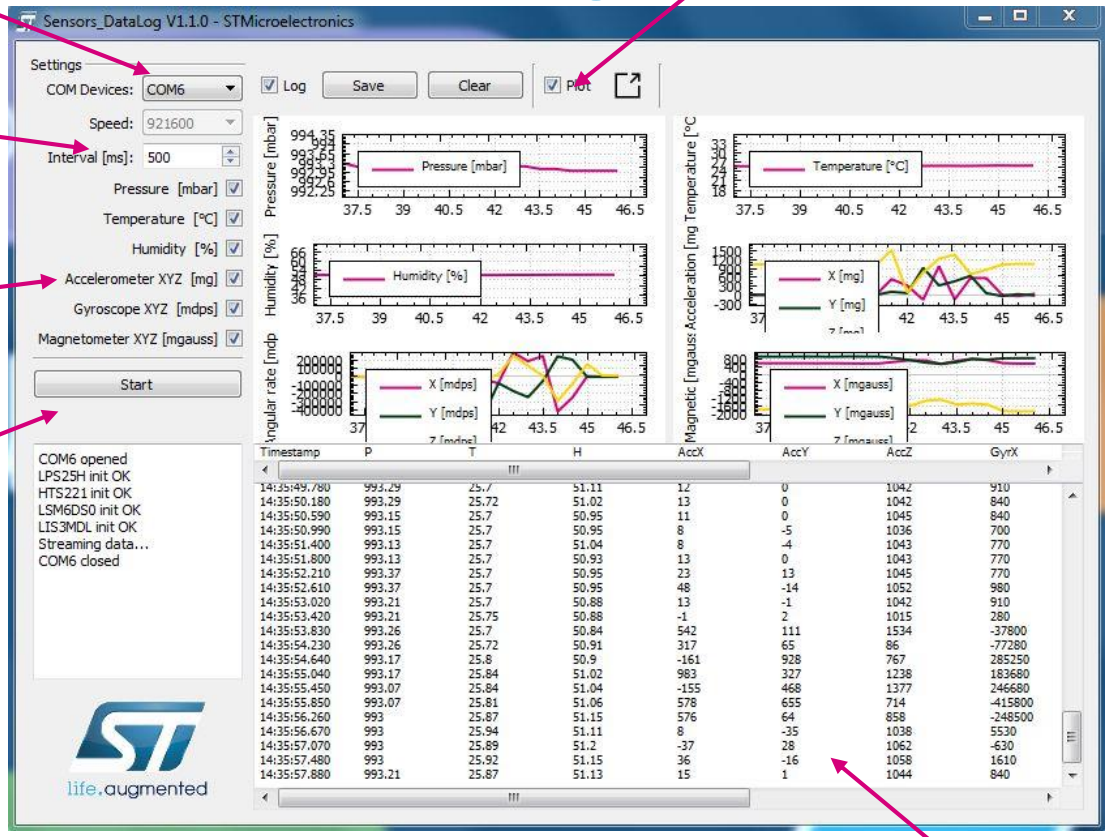
1 Select COM port

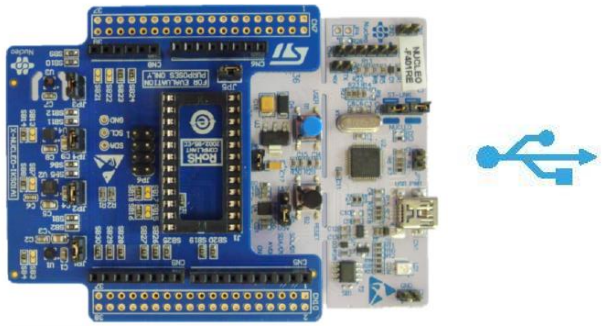
2 Select sensor reading interval

3 Select sensors

4 Select graph plots

5 Start data logging





Data Log Area

Sensors_DataLog **PC GUI**

Compile the DataLog FW using a supported IDE

X-CUBE-MEMS1 for NUCLEO-F401RE, NUCLEO-L053R8 or NUCLEO-L152RE

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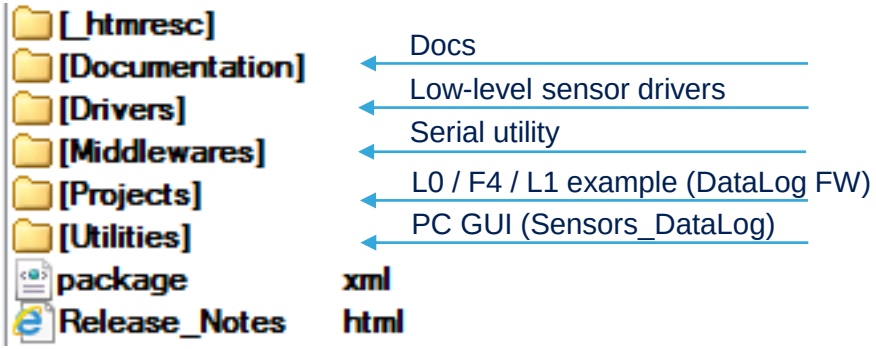
www.st.com

1 www.st.com/x-nucleo

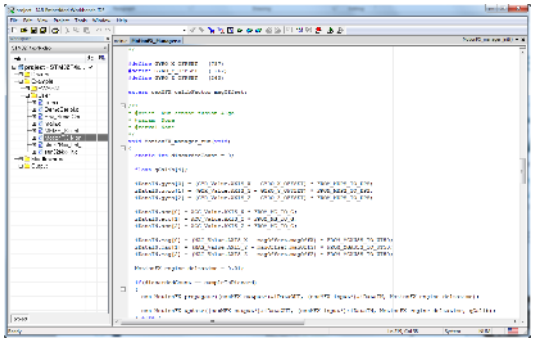
2 Select X-NUCLEO-IKS01A1

3 Download & unpack X-CUBE-MEMS1

X-CUBE-MEMS1 package structure



4 .\STM32CubeExpansion_MEMS1_V1.3.0\Projects\Multi\Examples\DataLog\EWARM\STM32F401RE-Nucleo

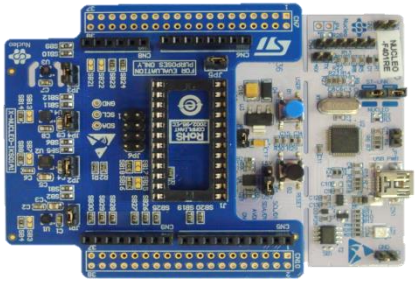


KEIL Tools by ARM

IAR SYSTEMS

OpenSTM32 Tools

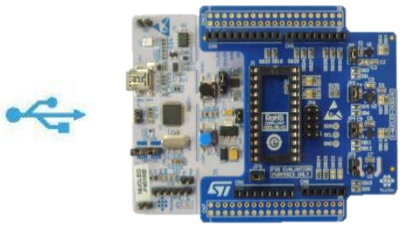
Flash and run the project.

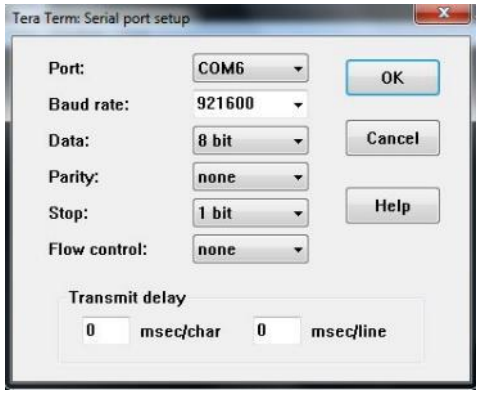


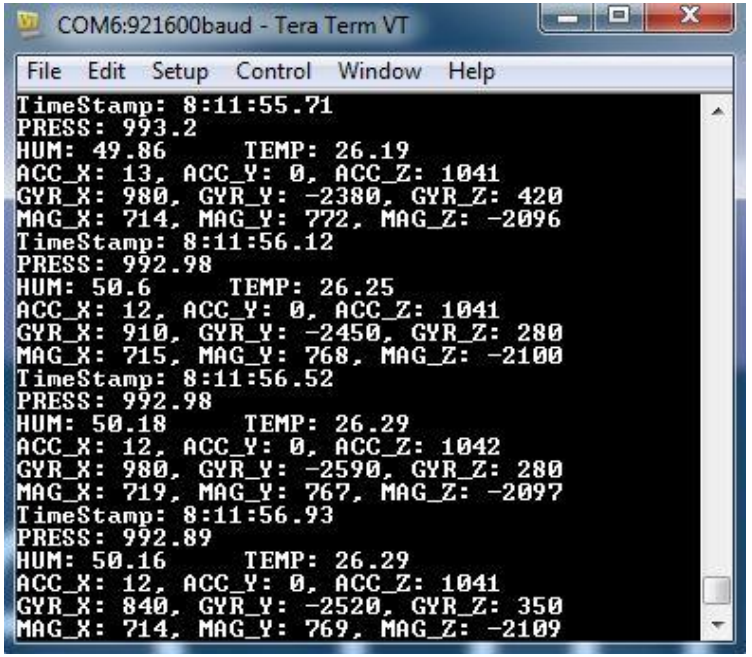
Using serial line monitor – e.g.TeraTerm

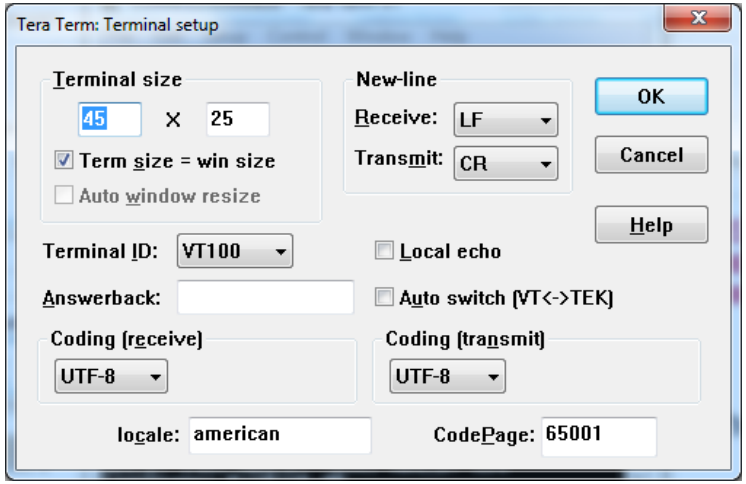
X-CUBE-MEMS1 for NUCLEO-F401RE, NUCLEO-L053R8 or NUCLEO-L152RE

- Close the Sensors_DataLog GUI
- Configure the serial line monitor (speed, LF)
- Press the **BLUE** user button on STM32Nucleo









OSXMotionFX Sensor Fusion license request

OSXMotionFX for NUCLEO-F401RE

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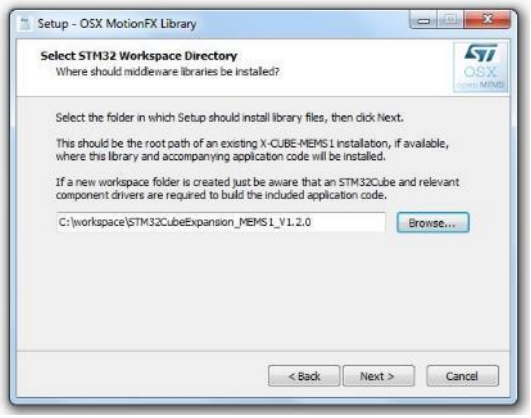
1 Download OSXMotionFX
www.st.com/openmems

OSX MotionFX

2 Installer
OSXMotionFX

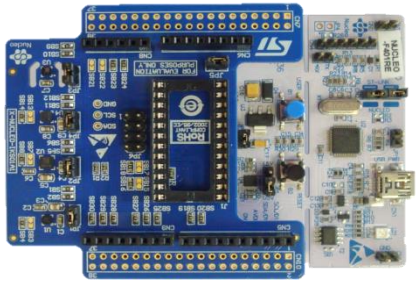
Install OSXMotionFX
in the X-CUBE-MEMS1
workspace

3



OSXMotionFX Sensor Fusion license request

OSXMotionFX for NUCLEO-F401RE

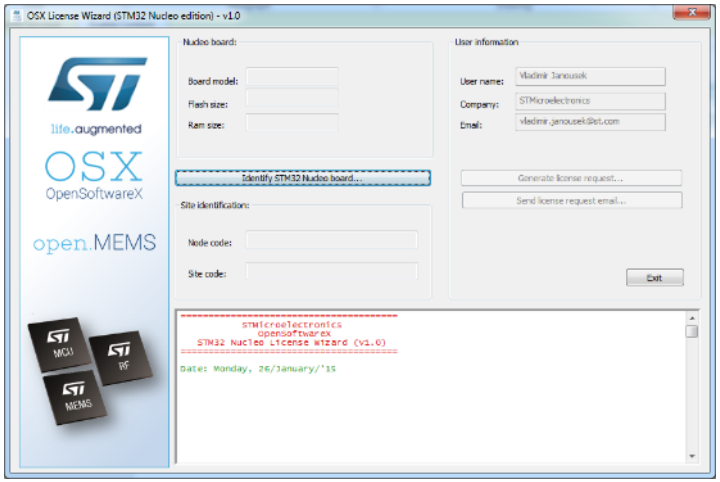


3

OpenSoftwareX.licensing

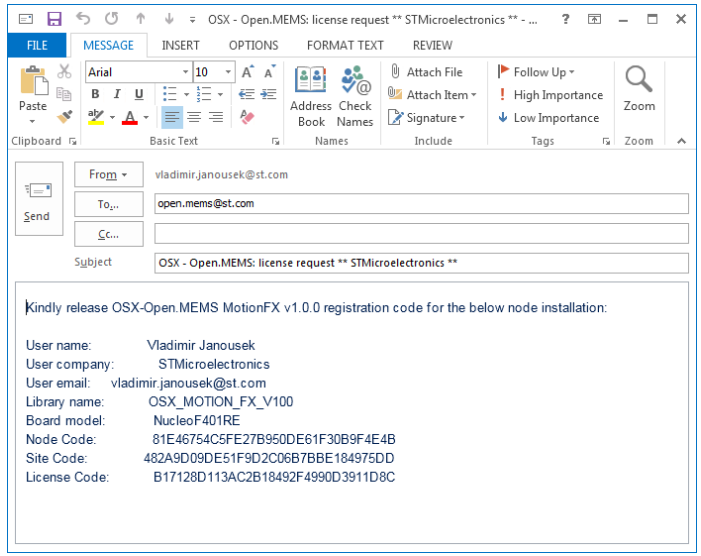
c:\Program Files (x86)\STMicroelectronics\OpenSoftwareX\OSX_LicenseWizard\

4 Run OsX License wizard



- Click: Identify STM32Nucleo board
- Enter user information
- Click: Generate license request

5



Click: Send License request email

6

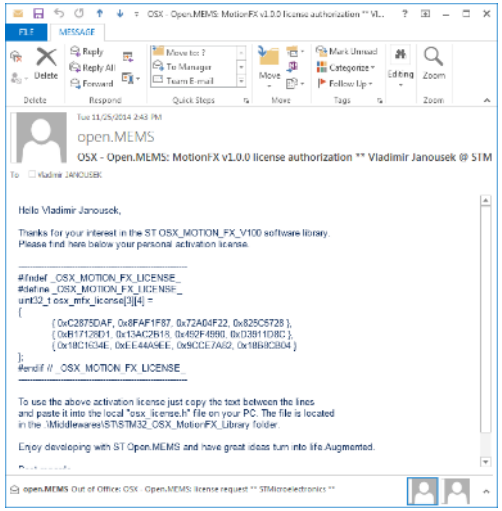
OSXMotionFX in 5 steps

Start using the DataLogFusion or coding your ideas in just few minutes

OSXMotionFX for NUCLEO-F401RE

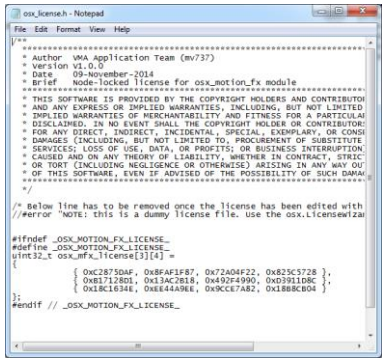
OpenSoftwareX.licensing

1 License activation email received



2 Copy the license key in osx_license.h located in

.\STM32CubeExpansion_MEMS1_V1.3.0\Middlewares\ST\STM32_OSX_MotionFX_Library



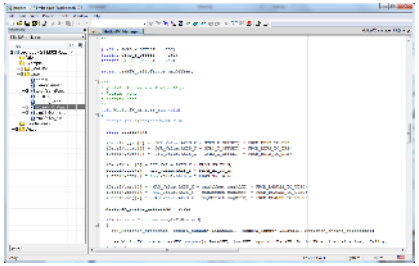
3 Open for example IAR project from

. \STM32CubeExpansion_MEMS1_V1.3.0\Projects\STM32F4xx-Nucleo\Applications\DataLogFusion\EWARM

KEIL™ Tools by ARM

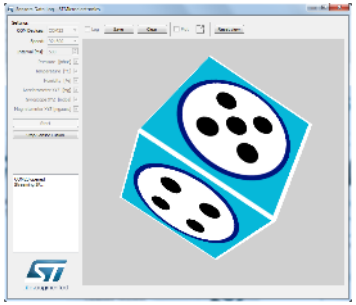
IAR SYSTEMS

Open STM32 Tools



4 Flash and Run the project

5



- Run the X-CUBE-MEMS1 GUI
- Click: Start Sensor Fusion
- Make figure-8 movement to calibrate magnetometer, green LED2 on

. \STM32CubeExpansion_MEMS1_V1.3.0\Utilities\PC_software\Sensors_DataLog

Start developing
(demo project included)

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Documents & related resources

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

X-NUCLEO-IKS01A1:

- **Gerber files, BOM, Schematics**
- **DS10619:** Motion MEMS and environmental sensor expansion board for STM32 Nucleo – **Data brief**
- **UM1820:** Getting started with motion MEMS and environmental sensor expansion board for STM32 Nucleo **– User manual**

X-CUBE-MEMS1:

- **DB2442:** Motion MEMS and environmental sensor software expansion for STM32Cube – **Data brief**
- **UM1859:** Getting started with the X-CUBE-MEMS1 motion MEMS and environmental sensor software expansion for STM32Cube – **User manual**
- Software Setup File

osxMotionFX:

- **DB2531:** Real-time motion-sensor data fusion software expansion for STM32Cube – **Data brief**
- **UM1866:** Getting started with the osxMotionFx fusion and compass library for X-CUBE-MEMS1 expansion for STM32Cube – **User manual**
- Software setup file

Consult www.st.com for the complete list

Quick Start Guide Contents

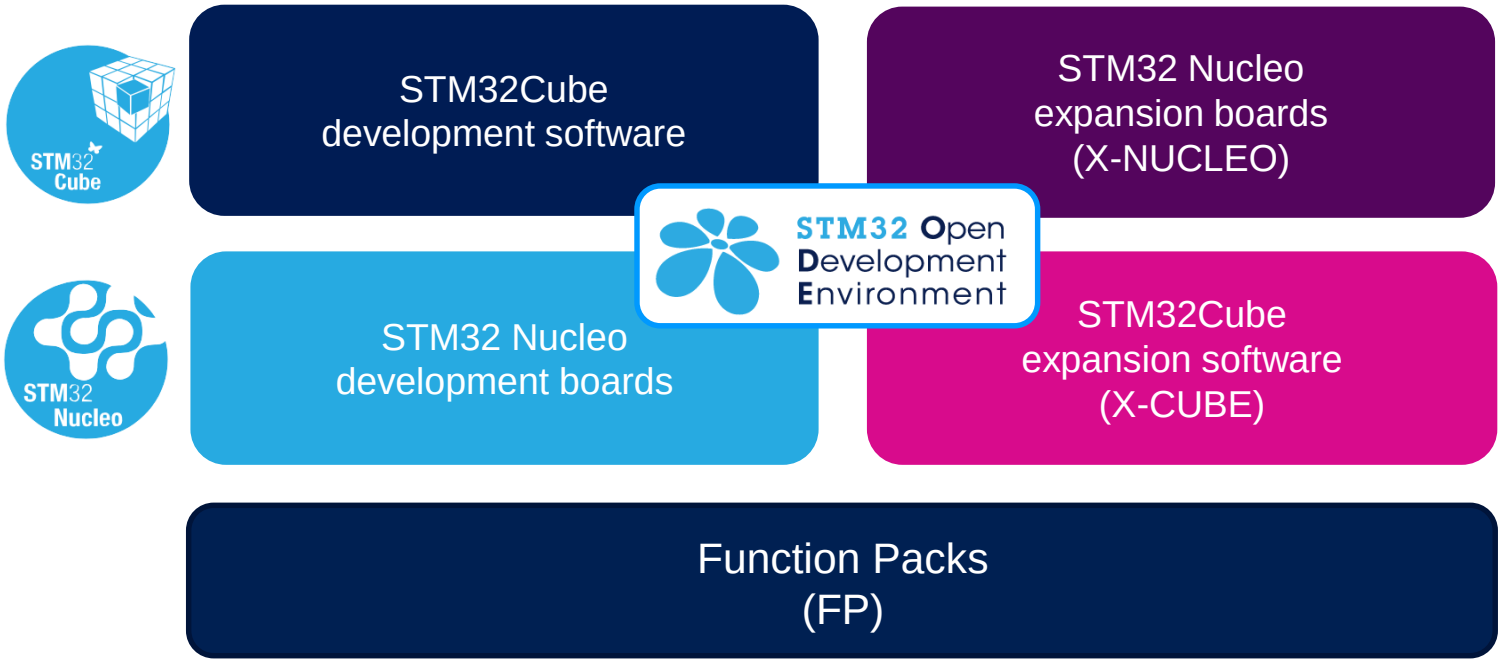
X-NUCLEO-IKS01A1: Motion MEMS and environmental sensor expansion board
Hardware and Software overview

Setup & Demo Examples
Documents & Related Resources

STM32 Open Development Environment: Overview

STM32 Open Development Environment
Fast, affordable Prototyping and Development

- The STM32 Open Development Environment (ODE) consists of a set of stackable boards and a modular open SW environment designed around the STM32 microcontroller family.



www.st.com/stm32ode

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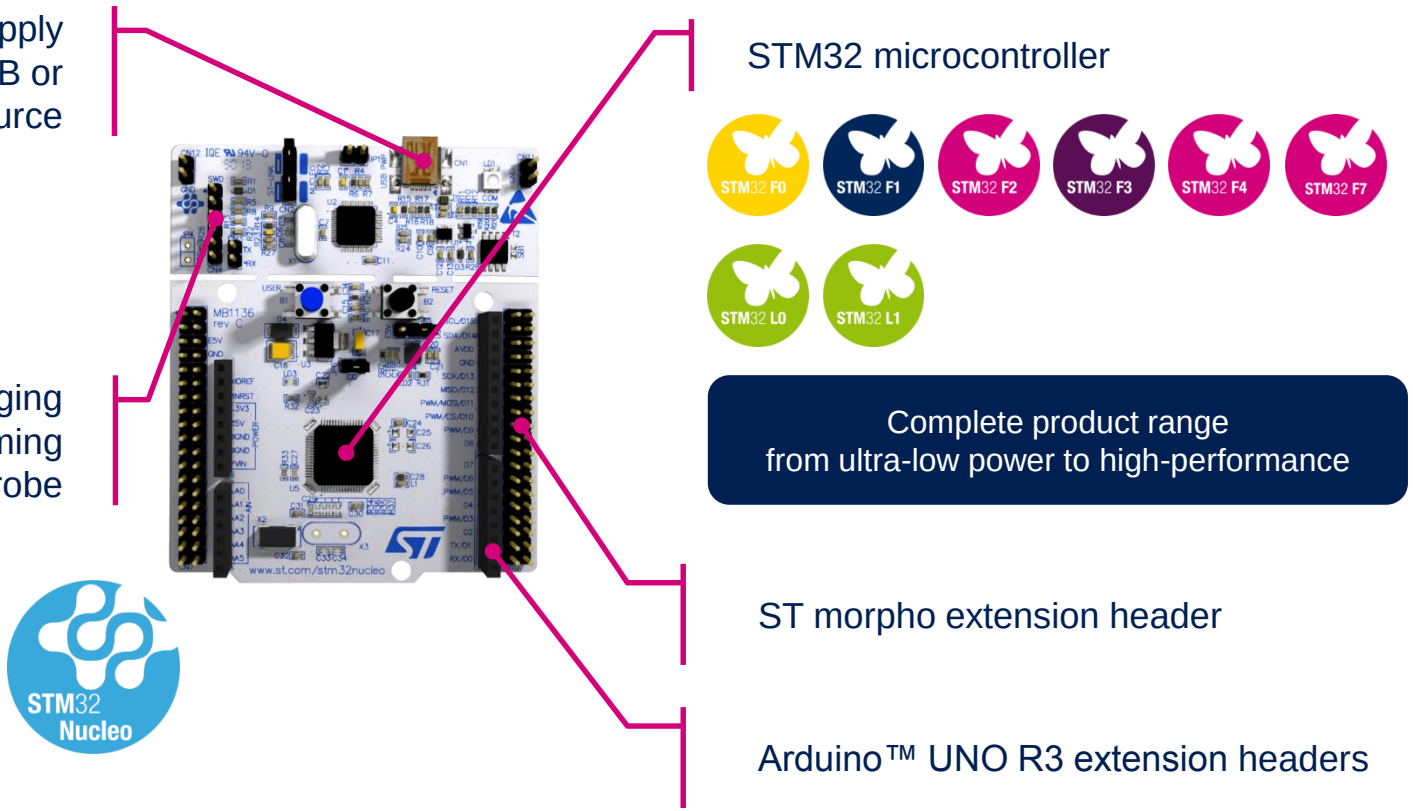
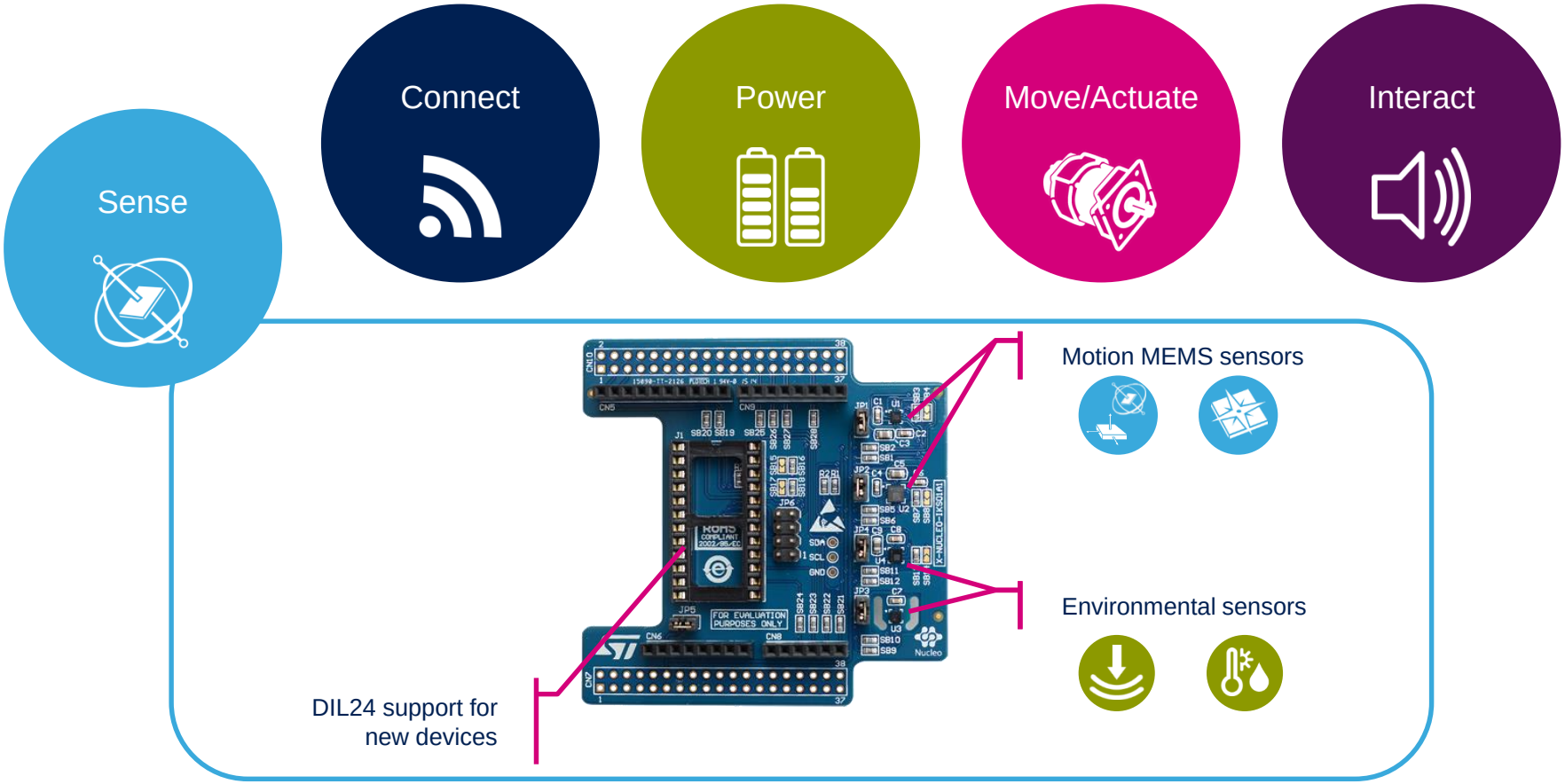
Development Boards (NUCLEO)

- A comprehensive range of affordable development boards for all the STM32 microcontroller series, with unlimited unified expansion capabilities and integrated debugger/programmer functionality.



Expansion Boards (X-NUCLEO)

- Boards with additional functionality that can be plugged directly on top of the STM32 Nucleo development board directly or stacked on another expansion board.



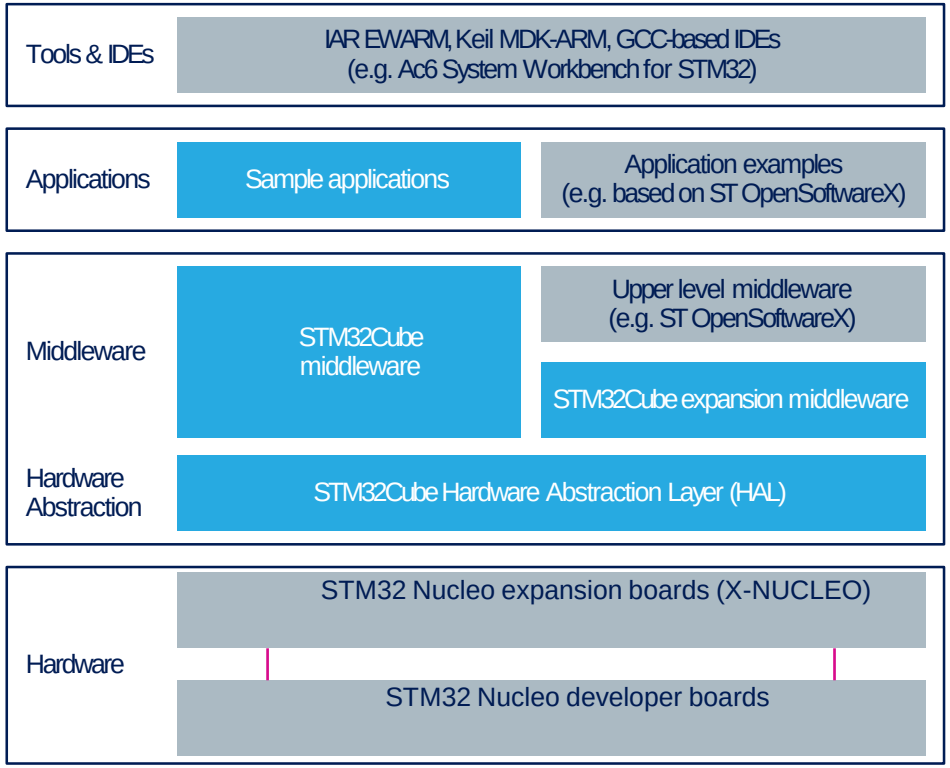
Example of STM32 expansion board (X-NUCLEO-IKS01A1)

STM32 Open Development Environment

Software components

- **STM32Cube software (CUBE)** - A set of free tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer and middleware bricks.

- **STM32Cube expansion software (X-CUBE)** - Expansion software provided free for use with the STM32 Nucleo expansion board and fully compatible with the STM32Cube software framework. It provides abstracted access to expansion board functionality through high-level APIs and sample applications.



- **Compatibility with multiple Development Environments -** The STM32 Open Development Environment is compatible with a number of IDEs including IAR EWARM, Keil MDK, and GCC-based environments. Users can choose from three IDEs from leading vendors, which are free of charge and deployed in close cooperation with ST. These include Eclipse-based IDEs such as Ac6 System Workbench for STM32 and the MDK-ARM environment.

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OPEN LICENSE MODELS: STM32Cube software and sample applications are covered by a mix of fully open source BSD license and ST licenses with very permissive terms.

www.st.com/stm32cube

www.st.com/x-cube

STM32 Open Development Environment
Building block approach

The building blocks	Your need	Our answer

Accelerometer, gyroscope
Inertial modules, magnetometer
Pressure, temperature, humidity
Proximity, microphone

Sense — COLLECT

Bluetooth LE, Sub-GHz radio
NFC, Wi-Fi, GNSS

Connect — TRANSMIT

Audio amplifier
Touch controller
Operation Amplifier

Translate — ACCESS

Stepper motor driver
DC & BLDC motor driver
Industrial input / output

Move / Actuate — CREATE

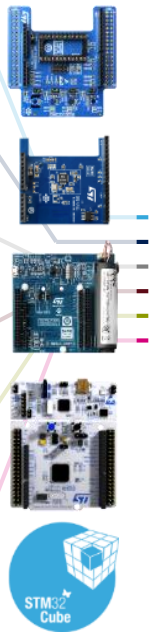
Energy management & battery

Power — POWER

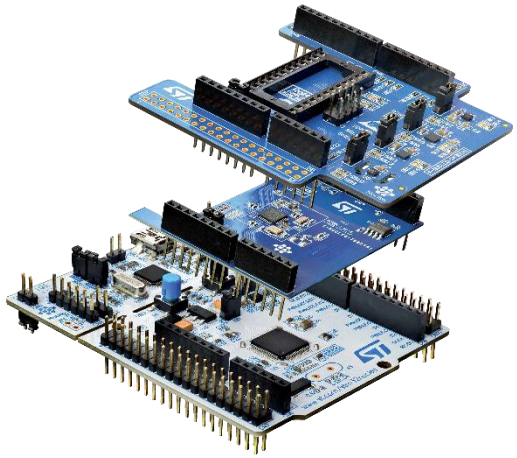
General-purpose microcontrollers
Secure microcontrollers

Process — PROCESS

Software



STM32 Open Development Environment



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