Quick Start Guide

High power stepper motor driver expansion board based on powerSTEP01 for STM32 Nucleo (X-NUCLEO-IHM03A1)

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Version 1.1.0 (May 16, 2016)

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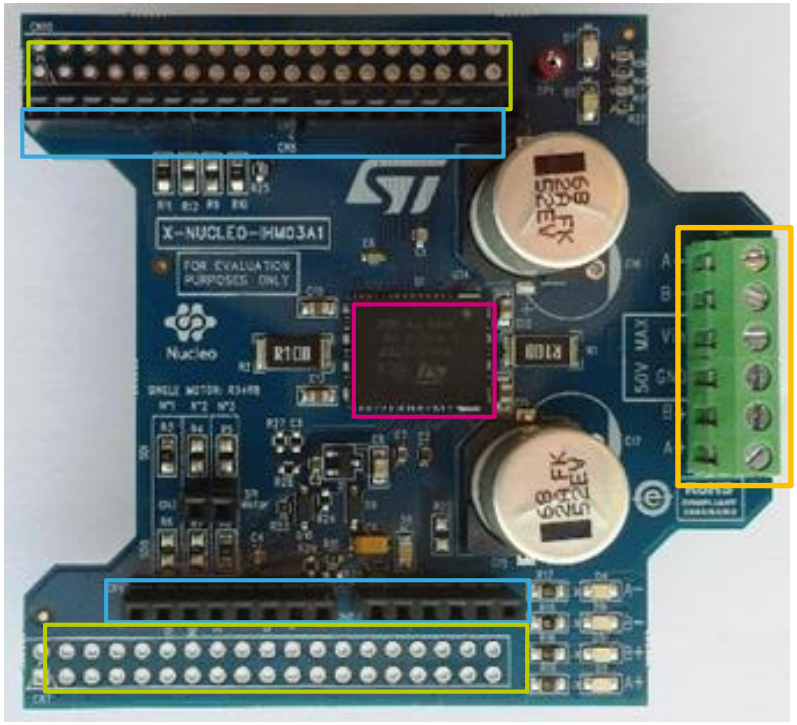
Hardware overview

X-NUCLEO-IHM03A1 Hardware Description

- The X-NUCLEO-IHM03A1 is a high power stepper motor driver expansion board based on powerSTEP01. The fully digital control of the motion through speed profile generation, adding positioning calculations and a complete set of protection features, offer high levels of performance and robustness.
- The X-NUCLEO-IHM03A1 is compatible with the Arduino UNO R3 connector, and supports the addition of other boards which can be stacked to drive up to three stepper motors using a single STM32 Nucleo board.

Key Products on board

powerSTEP01
System-in-package integrating micro stepping controller and 10 A power MOSFETs



powerSTEP01
Arduino UNO R3 connector
Supply and motor connector
ST morpho connector*

Latest info available at www.st.com
X-NUCLEO-IHM03A1

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High-power stepper motor driver expansion board

Software overview

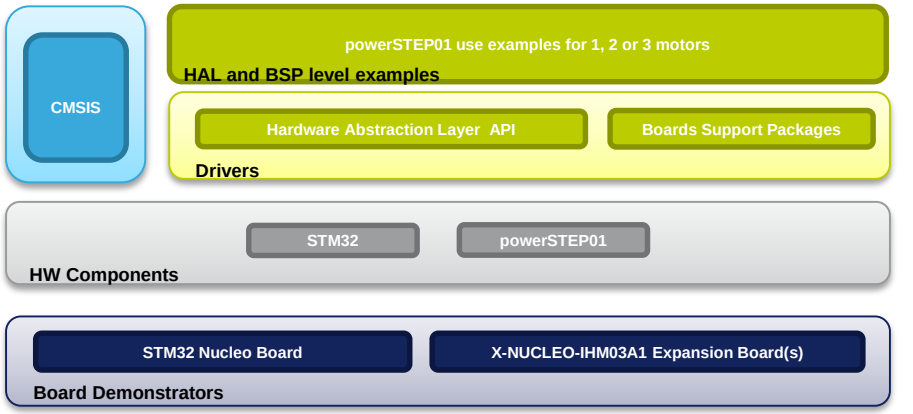
X-CUBE-SPN3 software description

- This X-CUBE-SPN3 is an software expansion for STM32Cube used to recognize powerSTEP01 devices and to enable development of applications using it. The software comes with an example implementation of the drivers to control one stepper motor. It is compatible with NUCLEO-F401RE, NUCLEO-F334R8, NUCLEO-F030R8 or NUCLEO-L053R8 development boards.

Key features

- Complete middleware (driver layer) to build applications using the powerSTEP01 device, which is integrated on the X-NUCLEO-IHM03A1 expansion board
- Examples to control one stepper motor
- Easy portability across different MCU families thanks to STM32Cube
- Free, user-friendly license terms

Overall Software Architecture



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X-CUBE-SPN3

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Hardware prerequisites

- 1x STM32 Nucleo development board (**NUCLEO-F401RE or NUCLEO-F334R8 or NUCLEO-F030R8 or NUCLEO-L053R8**)
- 1x high power stepper motor driver expansion board for each high power stepper motor (up to three) **(X-NUCLEO-IHM03A1)**
- Up to three stepper motors
- 1x Laptop/PC with MS Windows 7 or 8
- 1x external DC power supply with two electric cables (*)
- 1x USB type A to mini-B USB cable

NUCLEO-F401RE
NUCLEO-L053R8
NUCLEO-F334R8
NUCLEO-F030R8

Mini USB Cable

Stepper Motor

X-NUCLEO-IHM03A1

(*) Power stage supply voltage from 10.5 V to 50 V

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Software prerequisites

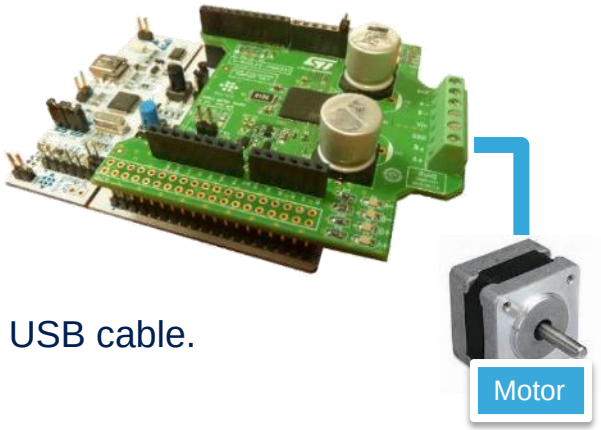
- **STSW-LINK008:** ST-LINK/V2-1 USB driver
- **STSW-LINK007:** ST-LINK/V2-1 firmware upgrade
- A Windows PC with one of the supported development tool chains:
  - KEIL: MDK-ARM
  - IAR: EWARM
  - GCC-based IDE: System Workbench for STM32
- **X-CUBE-SPN3:** firmware

High-power stepper motor driver expansion board
Start coding in just a few minutes with X-CUBE-SPN3

Driving one stepper motor with X-NUCLEO-IHM03A1 and X-CUBE-SPN3

1. Set the X-NUCLEO-IHM03A1 configuration jumpers as follows:
   - R3 and R8 → Closed (0-Ohm resistors)
   - R4, R5, R6 and R7 → Open

2. Stack the X-NUCLEO-IHM03A1 on the STM32 Nucleo board using the Arduino UNO R3 connector and connect the stepper motor (A+/- and B+/-) and the power supply (VIN\GND) to the CN1 connector.



3. Connect the STM32 Nucleo board to the PC through the USB cable.

High-power stepper motor driver expansion board

Start coding in just a few minutes with X-CUBE-SPN3

4. Depending on your STM32 Nucleo board, from the examples folder (**\stm32_cube\Projects\Multi\Examples\MotionControl\IHM03A1_ExampleFor1Motor**) open the software project from:
   - **\YourToolChainName\STM32F401RE-Nucleo** for Nucleo based on **STM32F401**
   - **\YourToolChainName\STM32F334R8-Nucleo** for Nucleo based on **STM32F334**
   - **\YourToolChainName\STM32F030R8-Nucleo** for Nucleo based on **STM32F030**
   - **\YourToolChainName\STM32L053R8-Nucleo** for Nucleo based on **STM32L053**
5. Open the file: **stm32_cube\Drivers\BSP\Components\powerstep01\powerstep01_target_config.h.** and modify the parameters which are post fixed by "_DEVICE_0" according to your target configuration.
6. Build the project and download it into the STM32 memory.
7. Run the example. The motor automatically starts (see main.c for a detailed demo sequence).

High-power stepper motor driver expansion board
Start coding in just a few minutes with X-CUBE-SPN3

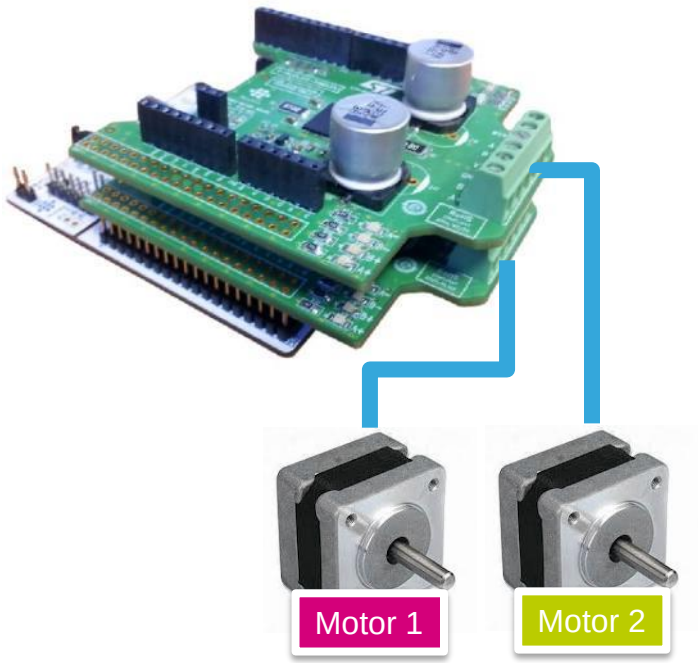
Driving two stepper motors with X-NUCLEO-IHM03A1 and X-CUBE-SPN3

1. Set the **Motor#1** X-NUCLEO-IHM03A1 configuration jumpers as follows:
   - R3 and R6 → Closed (0-Ohm resistors)
   - R4, R5, R7 and R8 → Open

   Set the **Motor#2** X-NUCLEO-IHM03A1 configuration jumpers as follows:
   - R4 and R8 → Closed (0R resistors)
   - R3, R5, R6 and R7 → Open

2. Stack the X-NUCLEO-IHM03A1 on the Nucleo board using the Arduino UNO R3 connector:
   - **Motor#1** board on top of Nucleo board
   - **Motor#2** board on top of **Motor#1** board

   and connect the stepper motors and the power supply to the CN1 connector.



3. Connect the STM32 Nucleo board to the PC using the USB cable.

Start coding in just a few minutes with X-CUBE-SPN3

4. Depending on your STM32 Nucleo board, from the examples folder (**\stm32_cube\Projects\Multi\Examples\MotionControl\IHM03A1_ExampleFor2Motors**) open the software project from:
   - **\YourToolChainName\STM32F401RE-Nucleo** for Nucleo **STM32F401**
   - **\YourToolChainName\STM32F334R8-Nucleo** for Nucleo **STM32F334**
   - **\YourToolChainName\STM32F030R8-Nucleo** for Nucleo **STM32F030**
   - **\YourToolChainName\STM32L053R8-Nucleo** for Nucleo **STM32L053**
5. Open the file: **stm32_cube\Drivers\BSP\Components\powerstep01\powerstep01_target_config.h.** and modify the parameters according to your target configuration:
   - Values post fixed by "_DEVICE_0" refers to **Motor#1**
   - Values post fixed by "_DEVICE_1" refers to **Motor#2**
6. Build the project and download it into the STM32 memory.
7. Run the example. The motor automatically starts (see main.c for a detailed demo sequence).

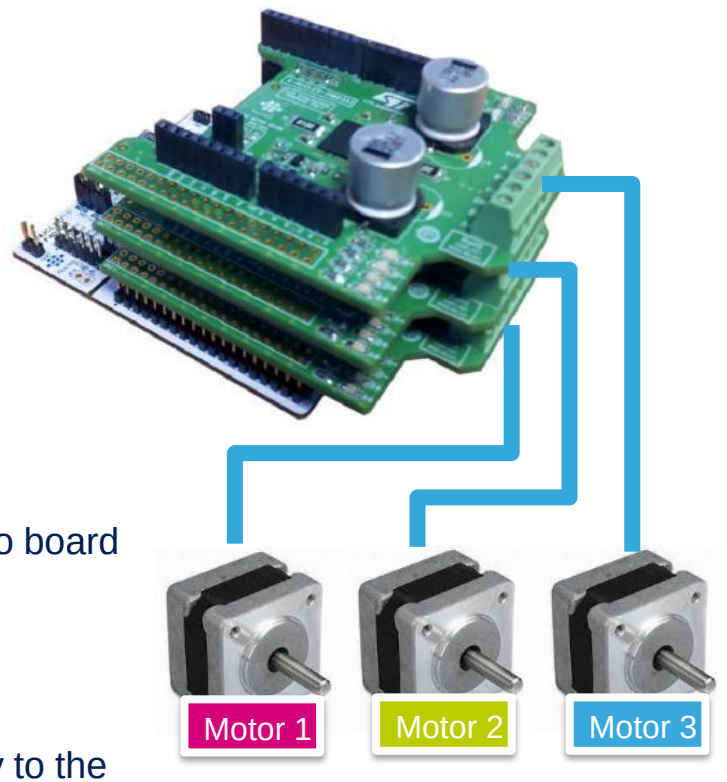
High-power stepper motor driver expansion board
Start coding in just a few minutes with X-CUBE-SPN3

Driving three stepper motor with X-NUCLEO-IHM03A1 and X-CUBE-SPN3

1. Set the **Motor#1** X-NUCLEO-IHM03A1 configuration jumpers as follows:
   - R3 and R6 → Closed (0-Ohm resistors)
   - R4, R5, R7 and R8 → Open

   Set the **Motor#2** X-NUCLEO-IHM03A1 configuration jumpers as follows:
   - R4 and R7 → Closed (0-Ohm resistors)
   - R3, R5, R6 and R8 → Open

   Set the **Motor#3** X-NUCLEO-IHM03A1 configuration jumpers as follows:
   - R5 and R8 → Closed (0-Ohm resistors)
   - R3, R4, R6 and R7 → Open



2. Stack the X-NUCLEO-IHM03A1 on the STM32 Nucleo board using the Arduino UNO R3 connector:
   - **Motor#1** board on top of Nucleo board
   - **Motor#2** board on top of **Motor#1** board
   - **Motor#3** board on top of **Motor#2** board

   and connect the stepper motors and the power supply to the CN1 connector.

3. Connect the STM32 Nucleo board to the PC using the USB cable.

Start coding in just a few minutes with X-CUBE-SPN3

4. Depending on your STM32 Nucleo board, from the examples folder (**\stm32_cube\Projects\Multi\Examples\MotionControl\IHM03A1_ExampleFor3Motors**) open the software project from:
   - **\YourToolChainName\STM32F401RE-Nucleo** for Nucleo based on **STM32F401**
   - **\YourToolChainName\STM32F334R8-Nucleo** for Nucleo based on **STM32F334**
   - **\YourToolChainName\STM32F030R8-Nucleo** for Nucleo based on **STM32F030**
   - **\YourToolChainName\STM32L053R8-Nucleo** for Nucleo based on **STM32L053**
5. Open the file: **stm32_cube\Drivers\BSP\Components\powerstep01\powerstep01_target_config.h.** and modify the parameters according to your target configuration:
   - Values post fixed by "_DEVICE_0" refers to **Motor#1**
   - Values post fixed by "_DEVICE_1" refers to **Motor#2**
   - Values post fixed by "_DEVICE_2" refers to **Motor#3**
6. Build the project and download it into the STM32 memory.
7. Run the example. The motor automatically starts (see main.c for a detailed demo sequence).

Documents & related resources

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

X-NUCLEO-IHM03A1:

- **DB2476:** High-power stepper motor driver expansion board based on powerSTEP01 for STM32 Nucleo – **Data brief**
- **UM1910:** Getting started with high power stepper motor driver expansion board based on powerSTEP01 for STM32 Nucleo – **User manual**
- Gerber files, BOM, and schematics

X-CUBE-SPN3:

- **DB2512:** High-power stepper motor driver software expansion for STM32Cube- **Data brief**
- **UM1911:** Getting started with the X-CUBE-SPN3, high-power stepper motor driver software expansion for STM32Cube – **User manual**
- Software setup file

Consult www.st.com for the complete list

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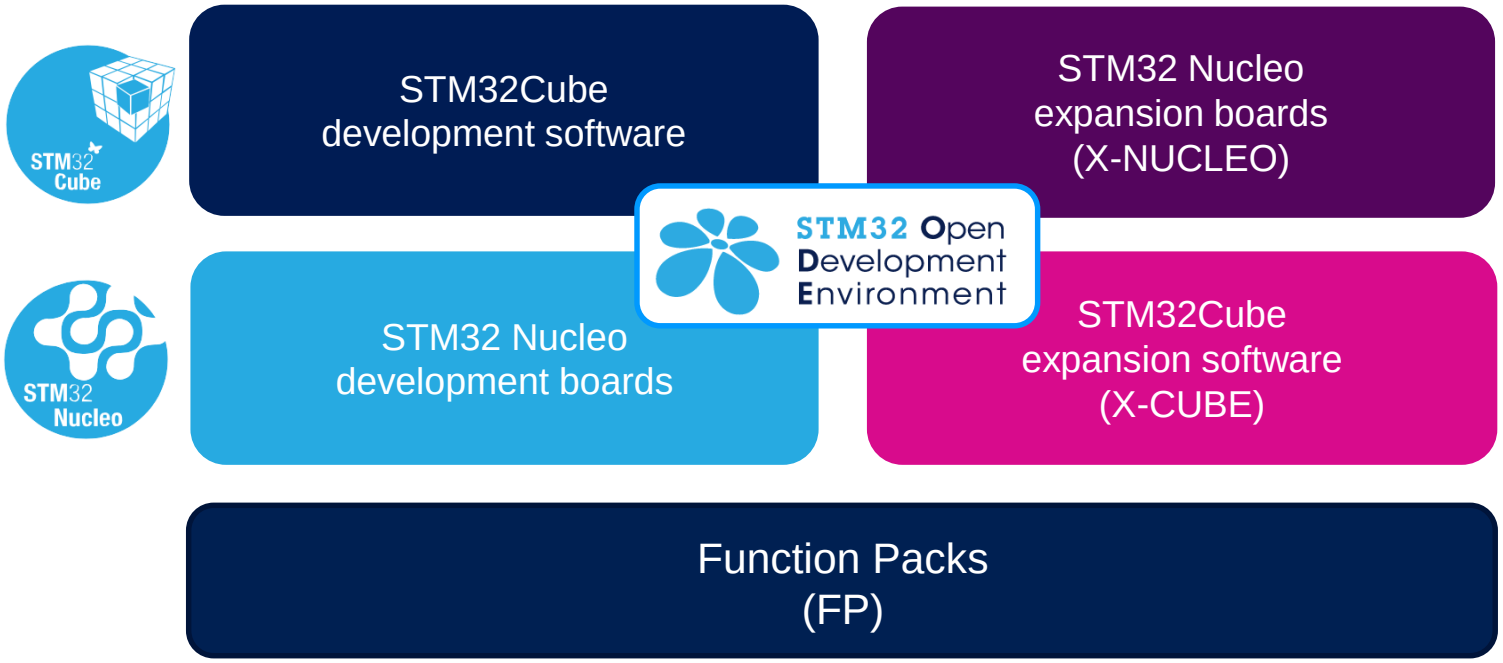
STM32 Open Development Environment: Overview

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.



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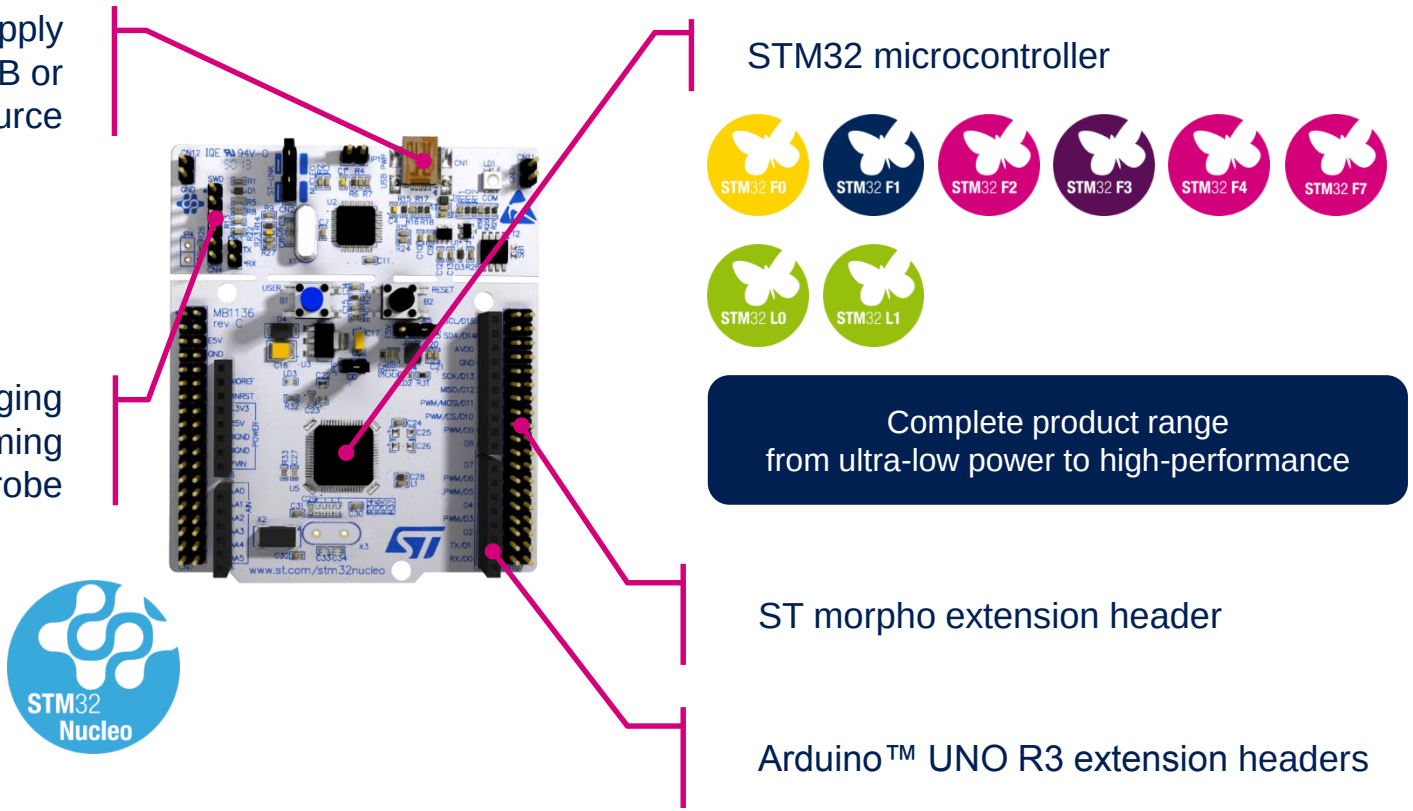
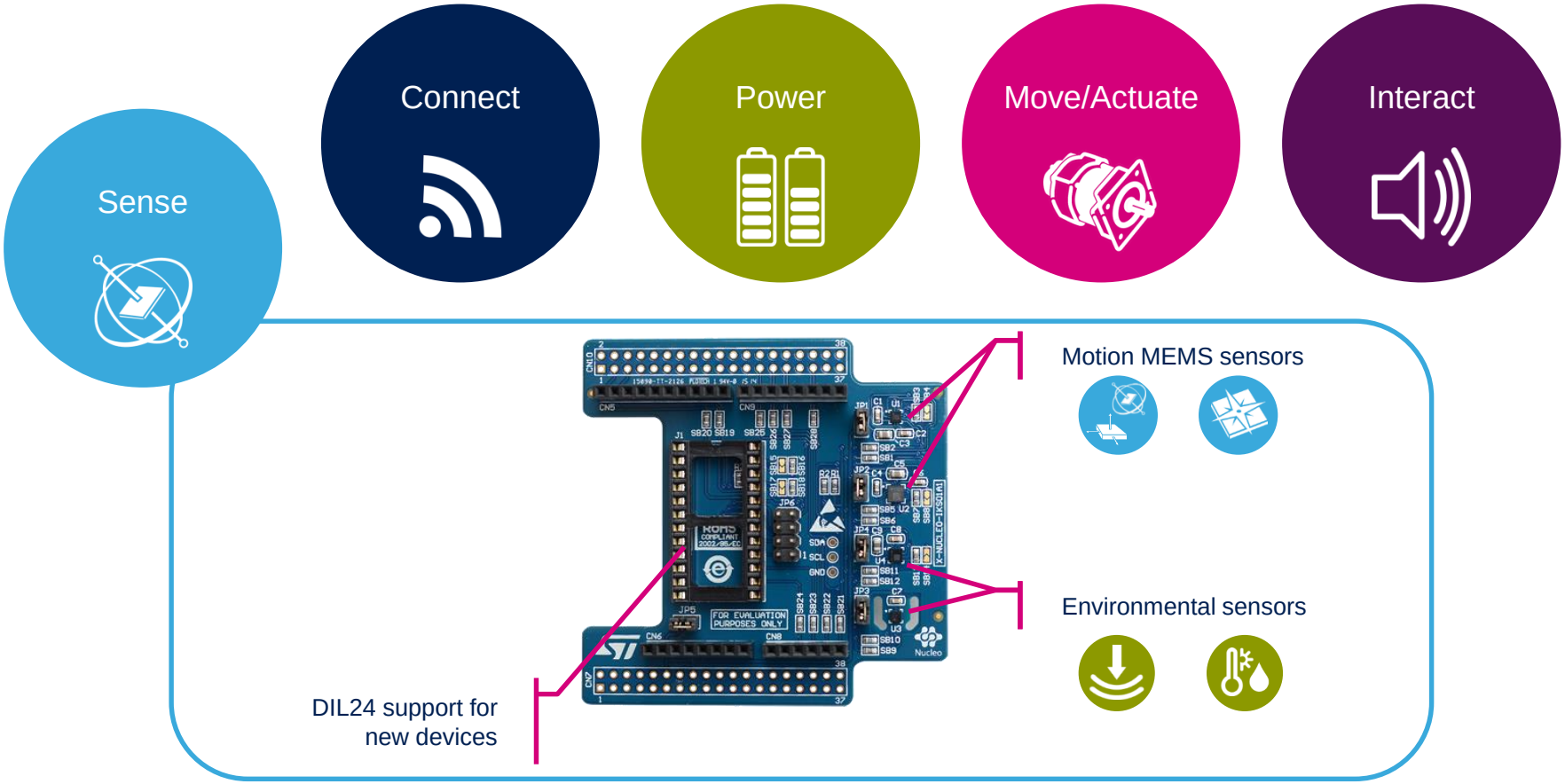
Development Boards (NUCLEO)

- 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.



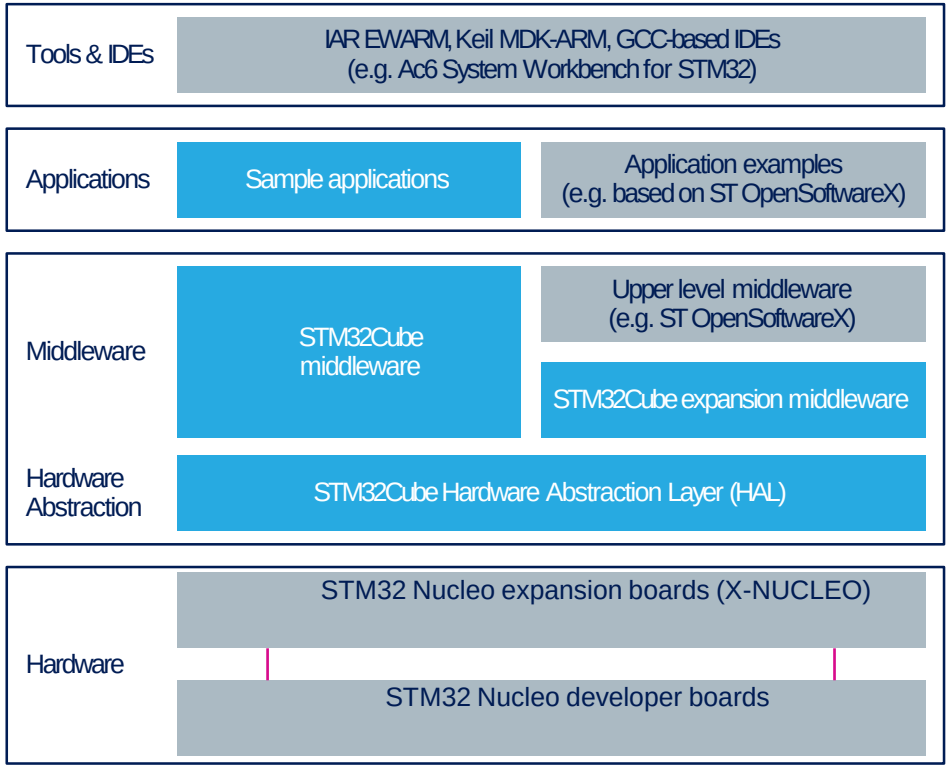
Example of STM32 expansion board (X-NUCLEO-IKS01A1)

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

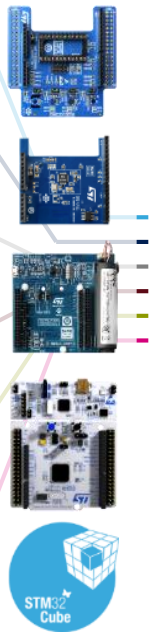
Energy management & battery

Power — POWER

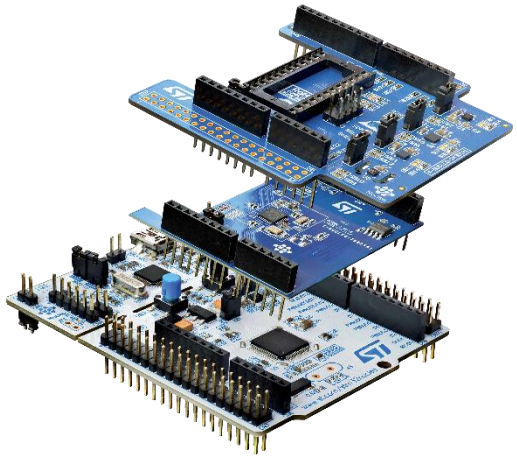
General-purpose microcontrollers
Secure microcontrollers

Process — PROCESS

Software



STM32 Open Development Environment



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