Quick Start Guide
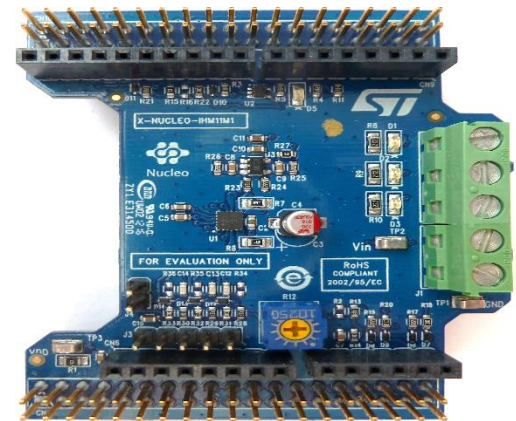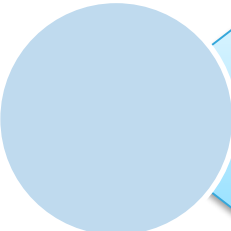
Low voltage three-phase brushless DC motor driver expansion board based on STSPIN230 for STM32 Nucleo (X-NUCLEO-IHM11M1)
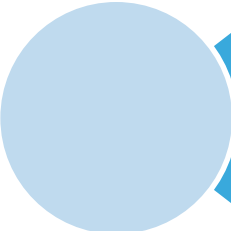

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Version 1.0.0 (September 15, 2016)

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X-NUCLEO-IHM11M1: Low voltage three-phase brushless DC motor driver expansion board
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STM32 Open Development Environment: Overview

Low voltage three-phase brushless DC motor driver expansion board

Hardware Overview

X-NUCLEO-IHM11M1 hardware description

- The X-NUCLEO-IHM11M1 is a low voltage three-phase brushless DC motor driver expansion board based on the STSPIN230 for STM32 Nucleo. It provides an affordable and easy-to-use solution for driving low voltage three-phase brushless DC motor in your STM32 Nucleo project. The expansion board includes motor driver operating in battery low voltage scenarios allowing zero consumption state (the implementation of portable motor driving applications such as thermal printers, robotics, and toys, etc..). The X-NUCLEO-IHM11M1 is compatible with ST morpho connector and supports the addition of other expansion boards with a single STM32 Nucleo board. The board is designed for six-step and FOC algorithms.
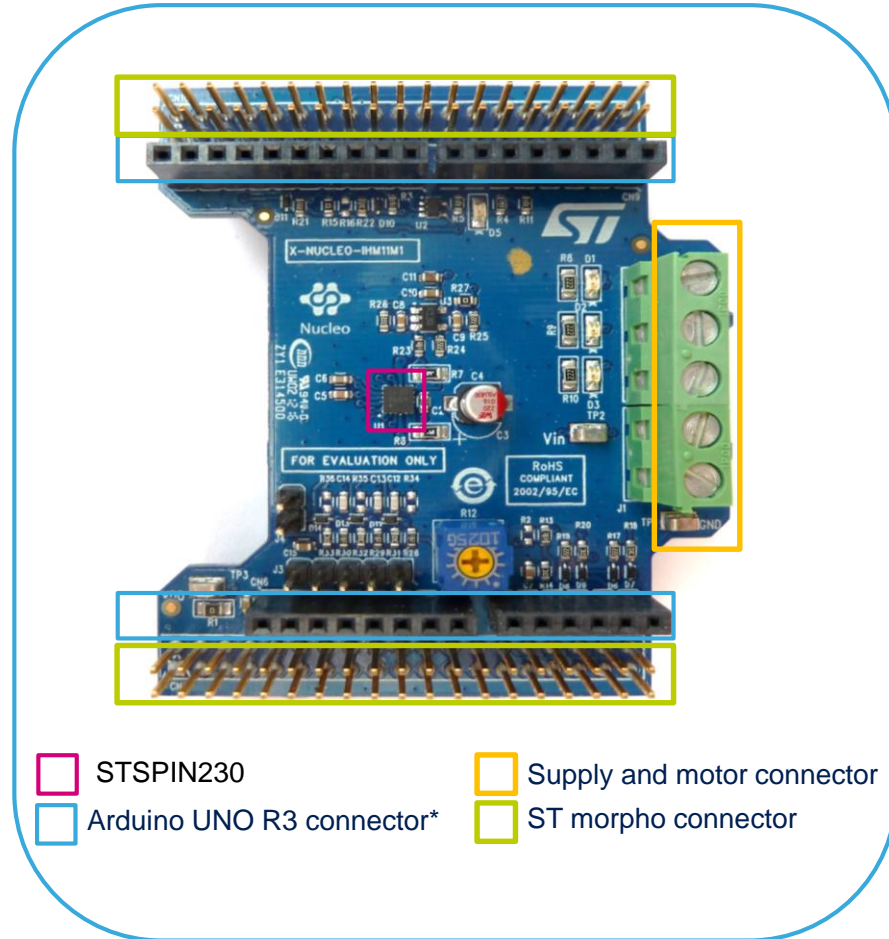
Key features

- Low voltage range from 1.8 V to 10 V
- Current up to 1.3 A r.m.s
- Full protection set:
  - Non-dissipative overcurrent protection
  - Short-circuit protection
  - Thermal

Key products on board

STSPIN230
Low voltage triple half-bridge motor driver for BLDC motors

- ☐ STSPIN230
- ☐ Arduino UNO R3 connector*
- ☐ Supply and motor connector
- ☐ ST morpho connector

Latest info available at www.st.com
X-NUCLEO-IHM11M1

(*) Not mounted

Low voltage three-phase brushless DC motor driver expansion board
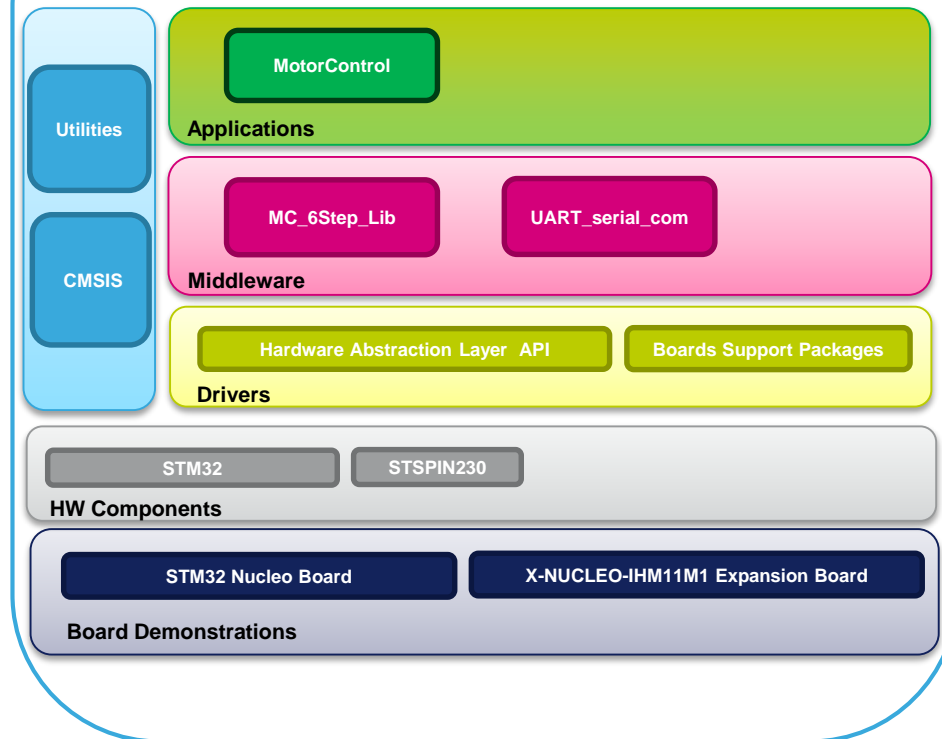
Software Overview

X-CUBE-SPN11 Software Description

- The X-CUBE-SPN11 is a expansion software for STM32Cube. The software runs on the STM32 providing management of STSPIN230 for control low voltage three-phase brushless DC motors. The expansion is built on STM32Cube software technology to ease portability across different STM32 microcontrollers. It is compatible with the NUCLEO-F401RE when plugged into one X-NUCLEO-IHM11M1. The software comes with an example of implementation of the driving of one low voltage three-phase brushless DC motor, with BEMF sensing. The package contains a user interface layer enabling real-time transmission of data to a PC through the terminal.

Key features

- Timers managing t to generate step clock and voltage reference
- Managing min and max speed, direction etc. in device parameters structure.
- GPIOs, PWMs and IRQs configuration
- API function available to send any application command to the motor driver
- User interface utility based on PC terminal to control the motor Speed control by potentiometer
- Motor control by user button
- Easy portability across different MCU families, thanks to STM32Cube
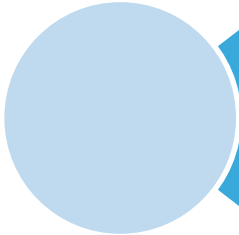- Free, user-friendly license terms

Overall Software Architecture

Utilities	MotorControl	
	Applications	
	MC_6Step_Lib	UART_serial_com
CMSIS	**Middleware**	
	Hardware Abstraction Layer API	Boards Support Packages
	Drivers	

STM32	STSPIN230
HW Components	

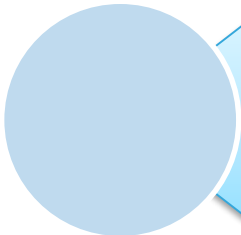| STM32 Nucleo Board	X-NUCLEO-IHM11M1 Expansion Board
Board Demonstrations	

Latest info available at www.st.com
X-CUBE-SPN11

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X-NUCLEO-IHM11M1: Low voltage three-phase brushless DC motor driver expansion board Hardware and Software overview

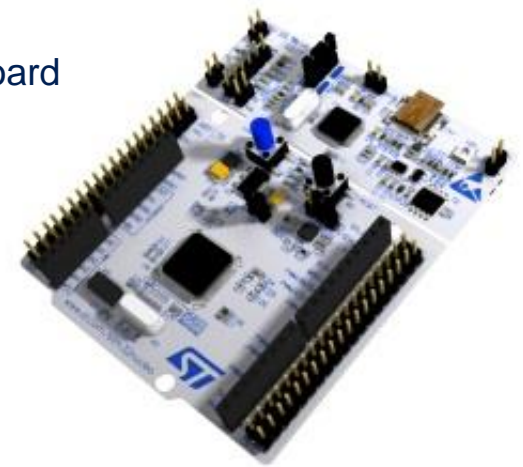Setup & Demo Examples

Documents & Related Resources

STM32 Open Development Environment: Overview

Hardware prerequisites

- 1x Low voltage three-phase brushless DC motor driver expansion board **(X-NUCLEO-IHM11M1)**

- 1x STM32 Nucleo development board **(NUCLEO-F401RE)**

- 1x USB type A to mini-B USB cable

- 1x Three-phase low voltage brushless DC motor

- an external DC power supply with two electric cables (*)

- 1x Windows PC (XP, Win 7, Win 8) – Laptop/PC

NUCLEO-F401RE
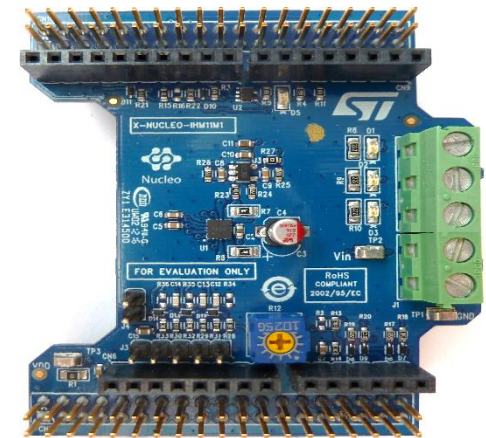
Mini USB Cable

Low voltage 3-phase brushless motor

X-NUCLEO-IHM11M1

(*) Power stage supply voltage from 1.8 V to 10 V

- **STSW-LINK009:** ST-LINK/V2-1 USB driver

- **STSW-LINK007:** ST-LINK/V2-1 firmware upgrade

- A Windows PC with one of the supported development toolchains:
    - KEIL: MDK-ARM
    - IAR: EWARM
    - GCC-based IDE: System Workbench for STM32

- **X-CUBE-SPN11:** expansion software for STM32Cube

Low voltage three-phase brushless DC motor driver expansion board
Start coding in just a few minutes with X-CUBE-SPN11

Driving one three-phase brushless motor with X-NUCLEO-IHM11M1 and X-CUBE-SPN11

1 On the X-NUCLEO-IHM11M1
- Tune R12 potentiometer.
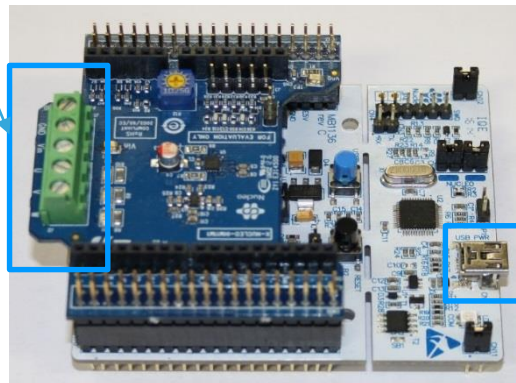- J3 and J4 Opened

2 On the NUCLEO-F401RE
- JP1 off
- JP5 (PWR) on UV5 side
- JP6 (IDD) on

3 Stack the X-NUCLEO-IHM11M1 on the STM32 Nucleo board using the ST morpho connector and connect the three-phase brushless DC motor (U,V,W) and the power supply (VIN\GND) to the CN1 connector.

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

Low voltage three-phase brushless DC motor driver expansion board
Start coding in just a few minutes with X-CUBE-SPN11

5 Open your preferred toolchain (MDK-ARM from Keil, EWARM from IAR, or SW4STM32 from www.openstm32.org)

6 open the software project from **Projects\Multi\Applications\MotionControl \YourToolChainName\STM32F401RE-Nucleo** for Nucleo based on **STM32F401**

7 Open the file **Projects\Multi\Applications\MotorControl\Inc\MC_SixStep_param.h** and modify the parameters according to your target configuration.

8 Build the project and drag and drop or copy the .bin file into the "NUCLEO" disk that shows up as a USB Mass Storage device in your computer.

9 Run the example and push the blue button to start and the black button to stop the motor

You can also use a User interface utility based on PC terminal to send command to the motor (for details please refer to the User Manual)

Documents & Related Resources

> **All documents are available in the DESIGN tab of the related products webpage**
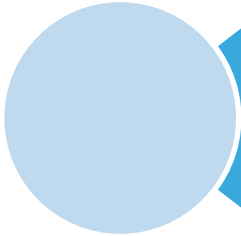
X-NUCLEO-IHM11M1:

- Gerber files, BOM, and schematics

- **DB2988:** Low voltage three-phase brushless DC motor driver expansion board based on STSPIN230 for STM32 Nucleo – **Data brief**

- **UM2095:** Getting started with low voltage three-phase brushless DC motor driver expansion board based on STSPIN230 for STM32 Nucleo – **User manual**
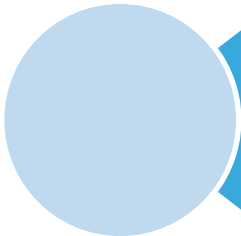
X-CUBE-SPN11:

- **DB3015:** Low voltage three-phase brushless DC motor driver software expansion for STM32Cube – **Data brief**

- **UM2106:** Getting started with the X-CUBE-SPN11, low voltage three-phase brushless DC motor driver software expansion for STM32Cube – **User manual**

- Software Setup File
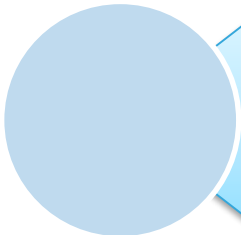
Consult www.st.com for the complete list

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X-NUCLEO-IHM11M1: Low voltage three-phase brushless DC motor driver expansion board
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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.

www.st.com/stm32ode

STM32 Nucleo
Development Boards (NUCLEO)

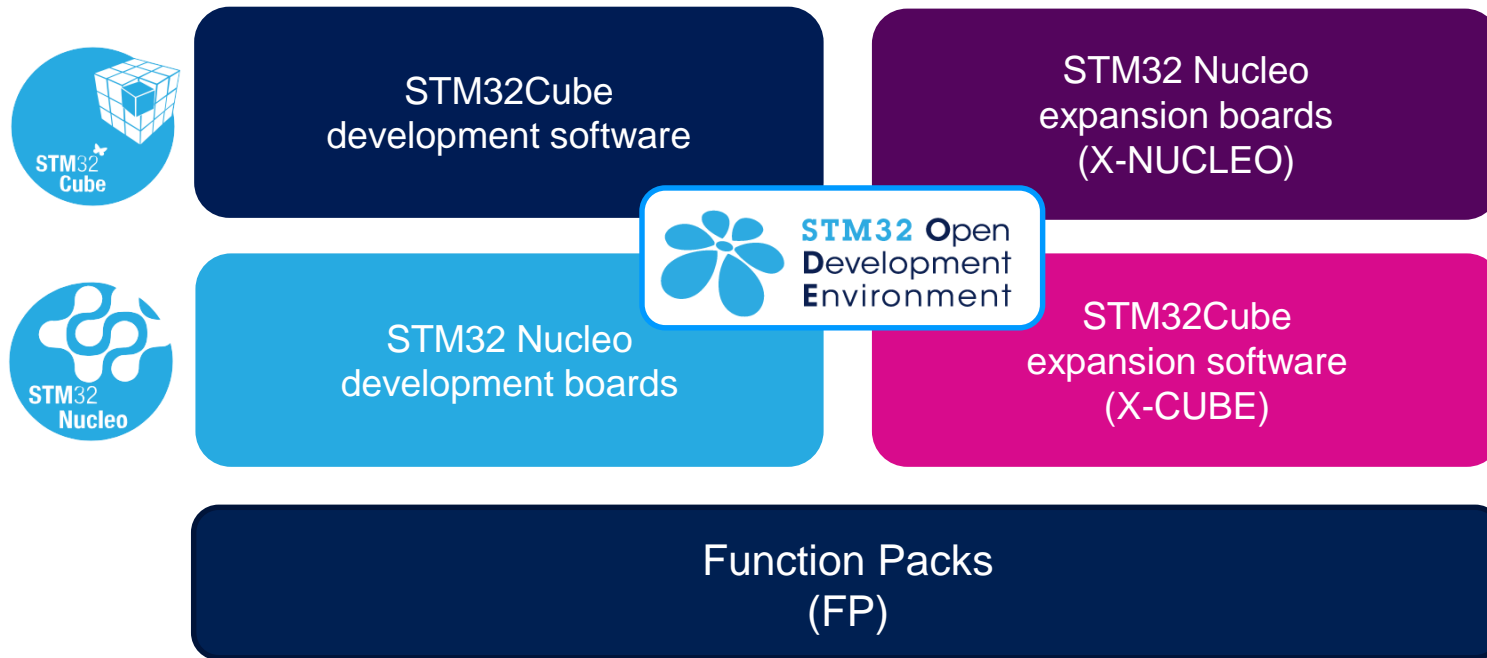- A comprehensive range of affordable development boards for all the STM32 microcontroller series, with unlimited unified expansion capabilities and integrated debugger/programmer functionality.

Power supply through USB or external source

STM32 microcontroller

Integrated debugging and programming ST-LINK probe

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

ST morpho extension header

Arduino™ UNO R3 extension headers

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

Sense

Connect

Power

Move/Actuate

Interact

Motion MEMS sensors

Environmental sensors

DIL24 support for new devices
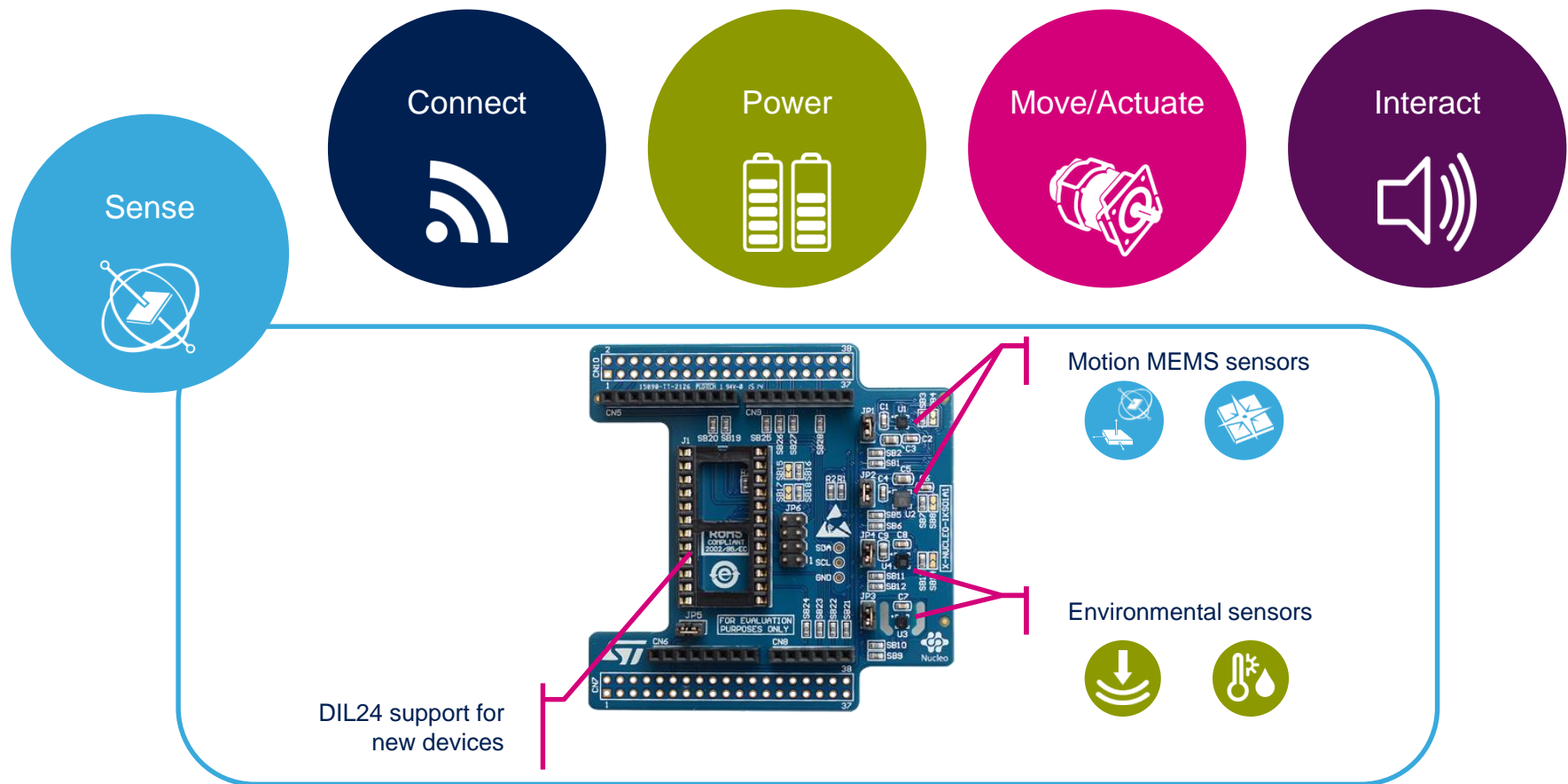
Example of STM32 expansion board (X-NUCLEO-IKS01A1)

www.st.com/x-nucleo

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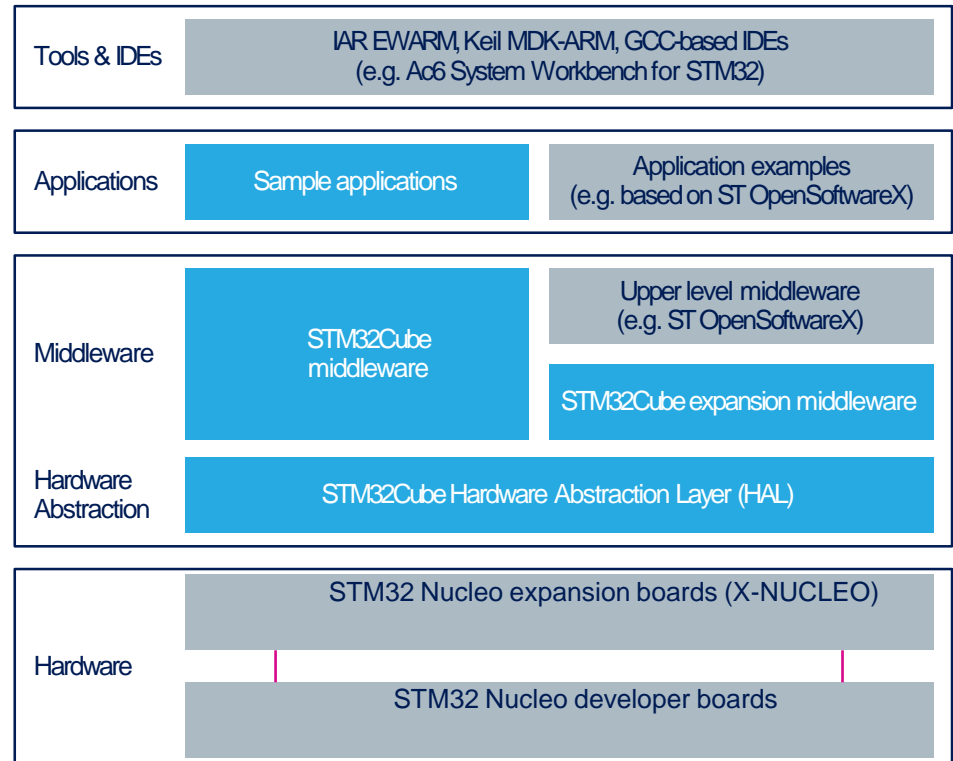
- **STM32Cube expansion software (X-CUBE)** - Expansion software provided free for use with the STM32 Nucleo expansion board and fully compatible with the STM32Cube software framework. It provides abstracted access to expansion board functionality through high-level APIs and sample applications.

Tools & IDEs	IAR EWARM, Keil MDK-ARM, GCC-based IDEs (e.g. Ac6 System Workbench for STM32)	
Applications	Sample applications	Application examples (e.g. based on ST OpenSoftwareX)
Middleware	STM32Cube middleware	Upper level middleware (e.g. ST OpenSoftwareX)
		STM32Cube expansion middleware
Hardware Abstraction	STM32Cube Hardware Abstraction Layer (HAL)	

Hardware	STM32 Nucleo expansion boards (X-NUCLEO)
	STM32 Nucleo developer boards

- **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.
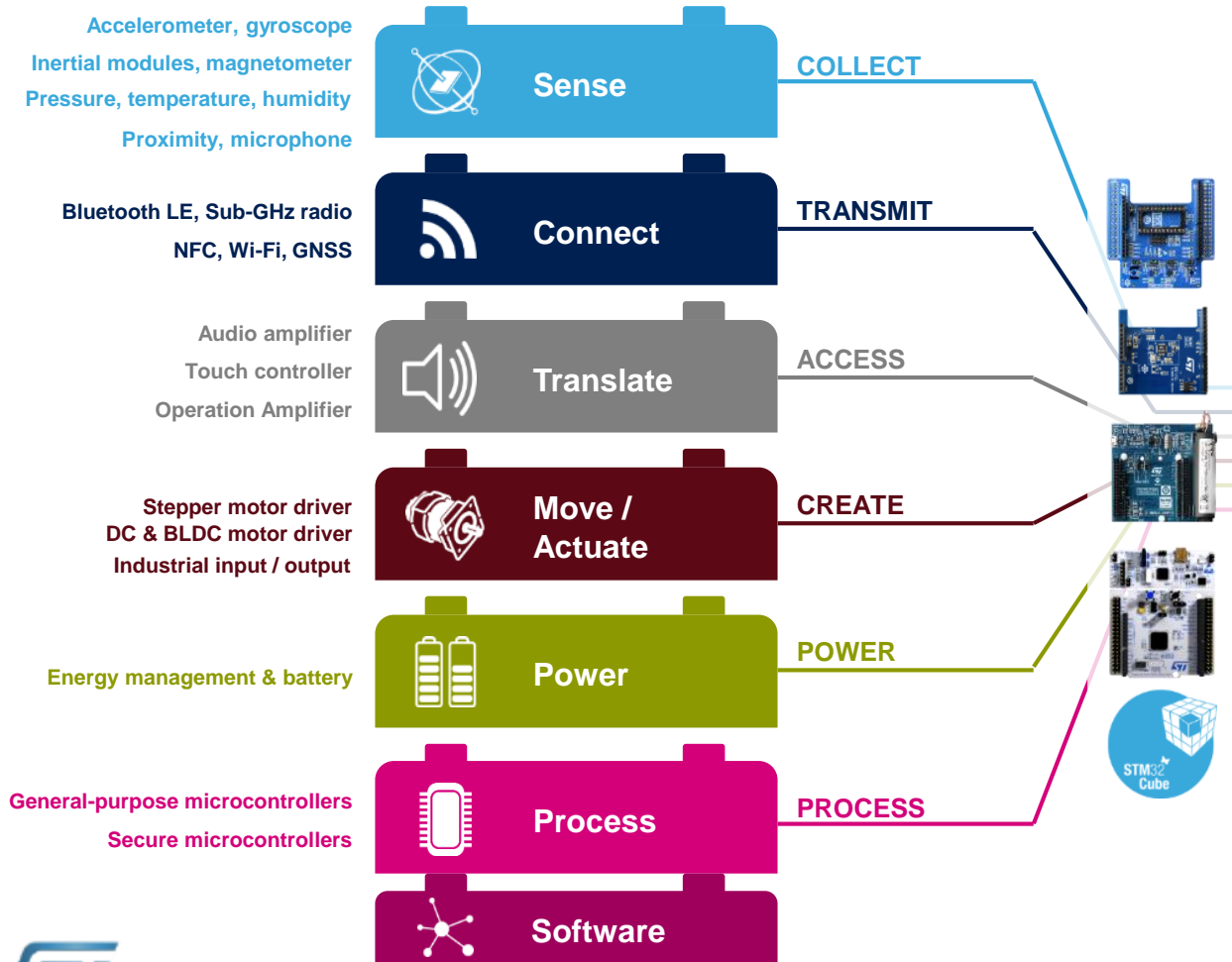
www.st.com/stm32cube

www.st.com/x-cube

STM32 Open Development Environment
Building block approach

The building blocks → **Your need** → **Our answer**

Sense — COLLECT
- Accelerometer, gyroscope
- Inertial modules, magnetometer
- Pressure, temperature, humidity
- Proximity, microphone

Connect — TRANSMIT
- Bluetooth LE, Sub-GHz radio
- NFC, Wi-Fi, GNSS

Translate — ACCESS
- Audio amplifier
- Touch controller
- Operation Amplifier

Move / Actuate — CREATE
- Stepper motor driver
- DC & BLDC motor driver
- Industrial input / output

Power — POWER
- Energy management & battery

Process — PROCESS
- General-purpose microcontrollers
- Secure microcontrollers

Software

STM32 Open Development Environment

STM32 Cube

www.st.com/stm32ode