Quick Start Guide

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

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life.augmented

Overview

1	**Introduction to the STM32 Open Development Environment**

2	**STM32 Nucleo high power stepper motor driver expansion board** • Hardware overview • Software overview

3	**Documents & related resources**

4	**Setup & demo examples**

Overview

1 Introduction to the STM32 Open Development Environment

2 STM32 Nucleo high power stepper motor driver expansion board
- Hardware overview
- Software overview
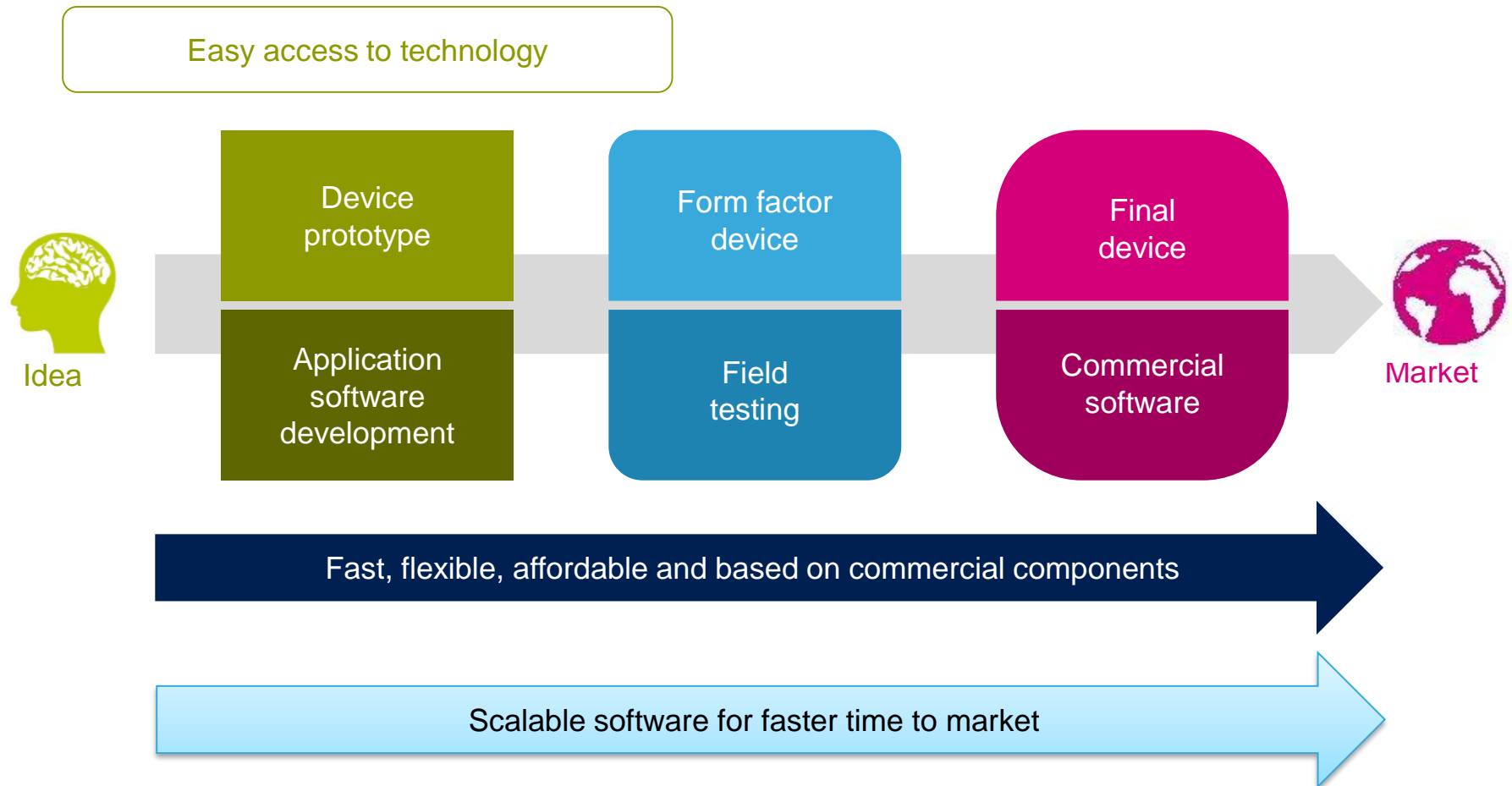
3 Documents & related resources

4 Setup & demo examples

STM32 Open Development Environment
Lowering the barriers for "developers"

Easy access to technology

Idea

| Device prototype | Form factor device | Final device |
| Application software development | Field testing | Commercial software |

Market

Fast, flexible, affordable and based on commercial components

Scalable software for faster time to market

STM32 Open Development Environment

The STM32 Open Development Environment consists of a set of **modular developer boards** and a **software environment** designed around the **STM32 microcontroller** family
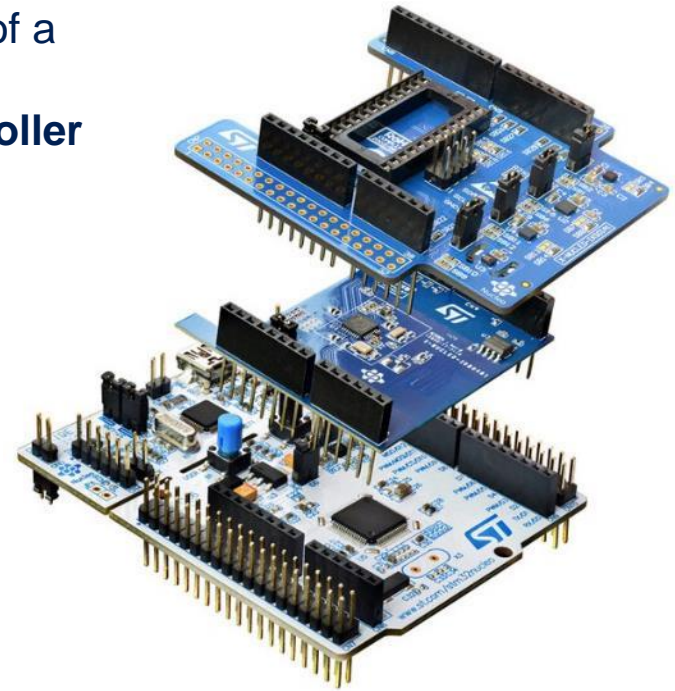
| STM32 Nucleo development boards | STM32Cube development software |

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Compatibility with multiple development evironments
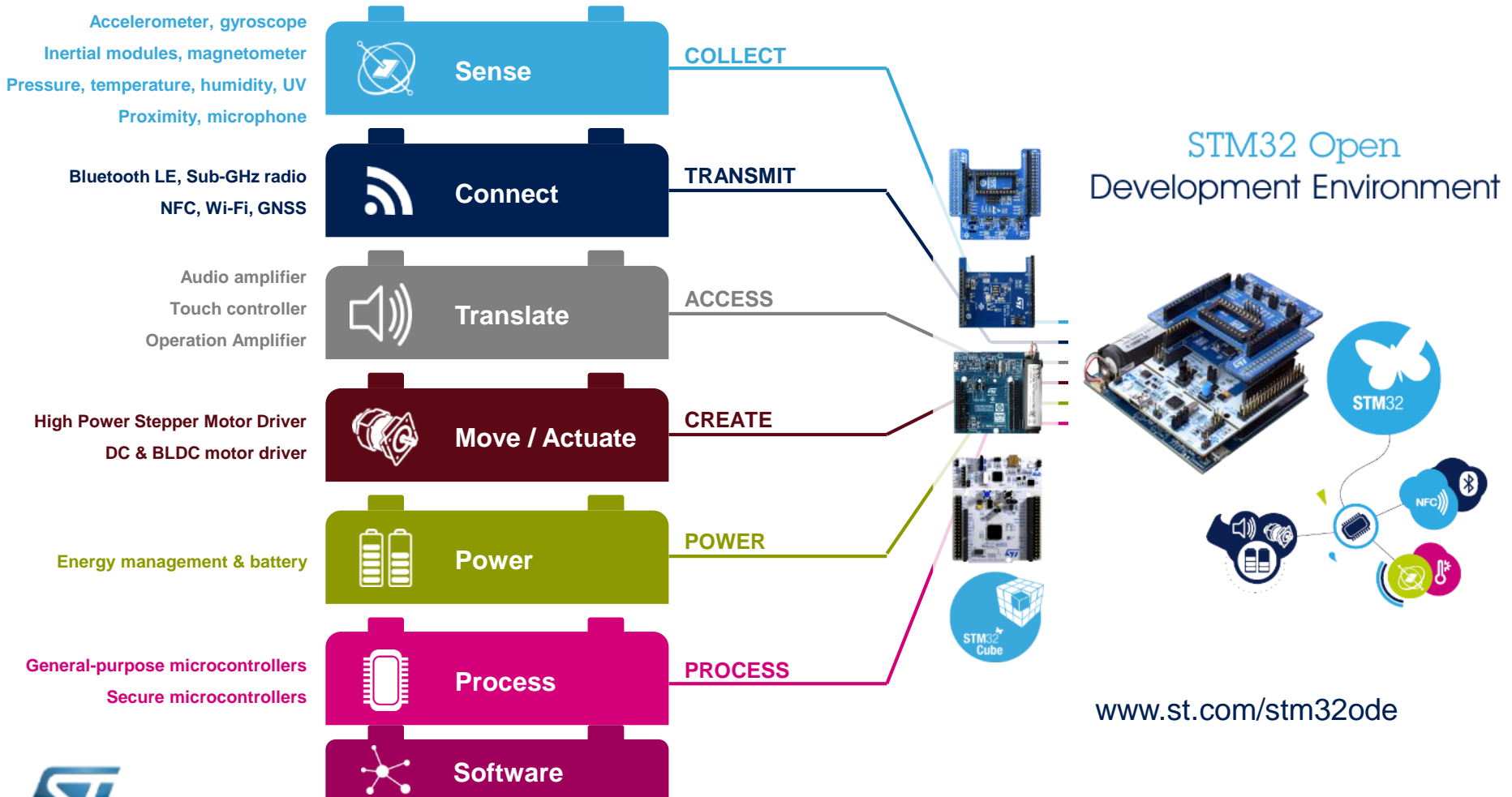
STM32 Open Development Environment
Building block approach

The building blocks	Your need	Our answer

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

Sense — COLLECT

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

Connect — TRANSMIT

Audio amplifier
Touch controller
Operation Amplifier

Translate — ACCESS

High Power Stepper Motor Driver
DC & BLDC motor driver

Move / Actuate — CREATE

Energy management & battery

Power — POWER

General-purpose microcontrollers
Secure microcontrollers

Process — PROCESS

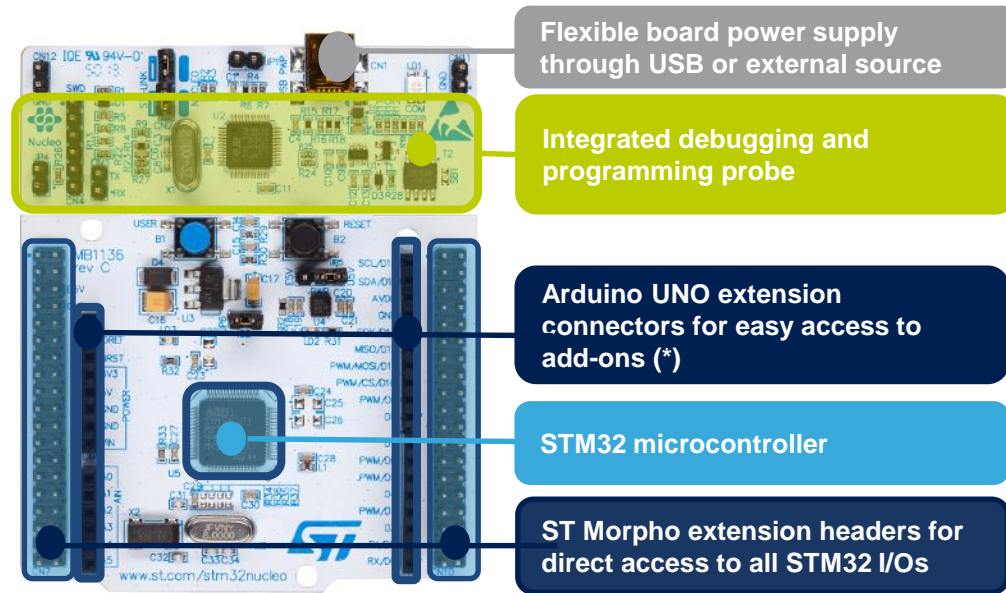**Software**

STM32 Open
Development Environment

STM32
Cube

www.st.com/stm32ode

STM32 Nucleo development board

- Based on ST's 32-bit ARM® Cortex®-M STM32 microprocessors
  - Development board with 1 MCU and hardware to program/debug

- Two connectors for companion chip boards

- For all STM32 families

Flexible board power supply through USB or external source

Integrated debugging and programming probe

Arduino UNO extension connectors for easy access to add-ons (*)

STM32 microcontroller

ST Morpho extension headers for direct access to all STM32 I/Os

STM32 L0 · STM32 L1 · STM32 F0 · STM32 F1 · STM32 F2 · STM32 F3 · STM32 F4 · STM32 F7

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

(*) Thanks to its electrical compatibility, it can be used as a shield for Arduino UNO R3 or similar.

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High-power stepper motor driver expansion board
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
X-NUCLEO-IHM03A1
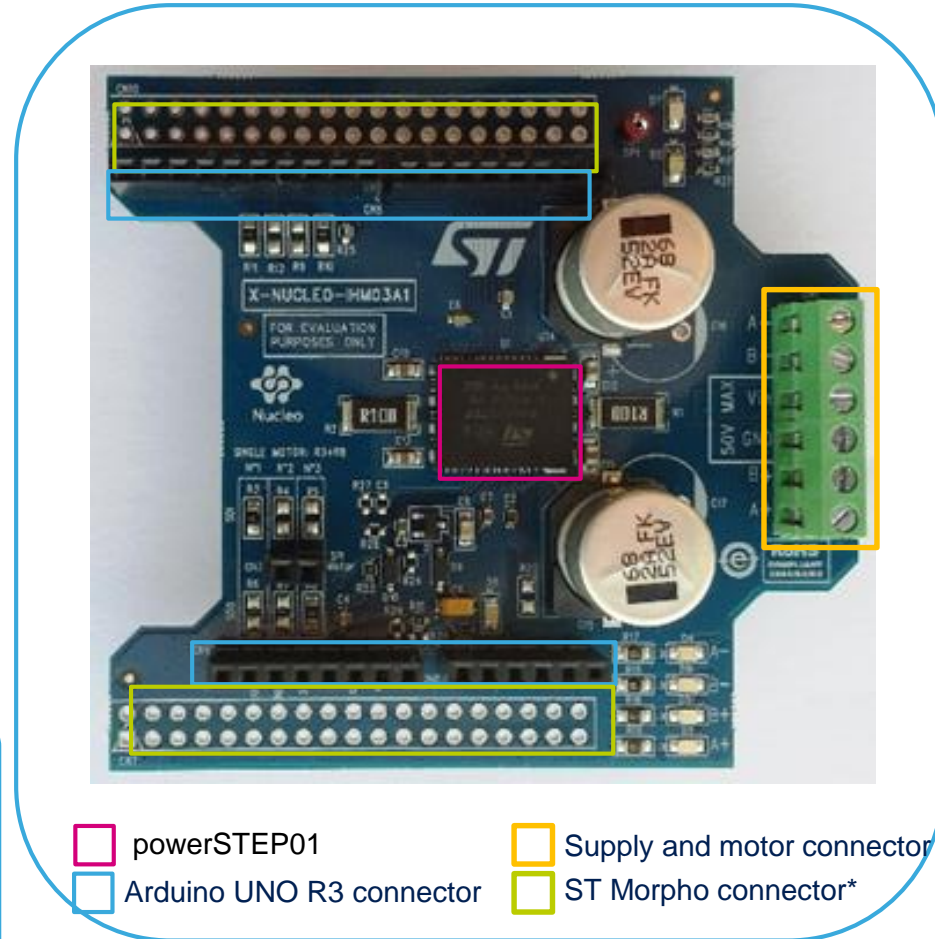
Order code: X-NUCLEO-IHM03A1

(*) Not mounted

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-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 system architecture

| STM32 Nucleo Board | X-NUCLEO-IHM03A1 Expansion Board(s) |

Board Demonstrators

CMSIS

| powerSTEP01 use examples for 1, 2 or 3 motors |

HAL and BSP level examples

| Hardware Abstraction Layer API | Boards Support Packages |

Drivers

| STM32 | powerSTEP01 |

HW Components
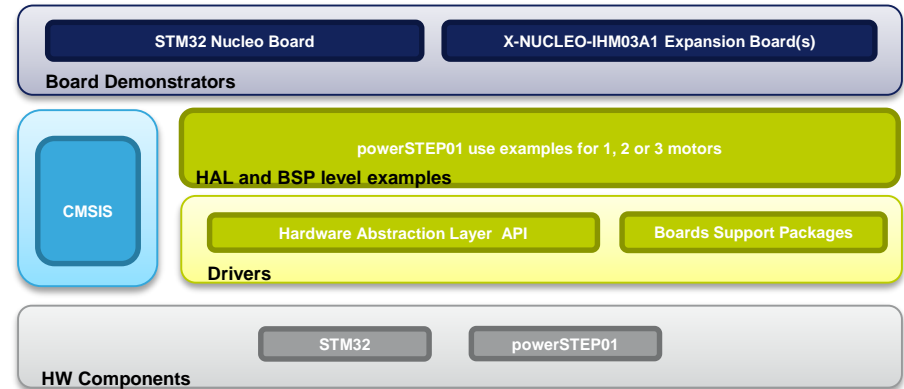
Latest software available at
X-CUBE-SPN3

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Documents & related design resources
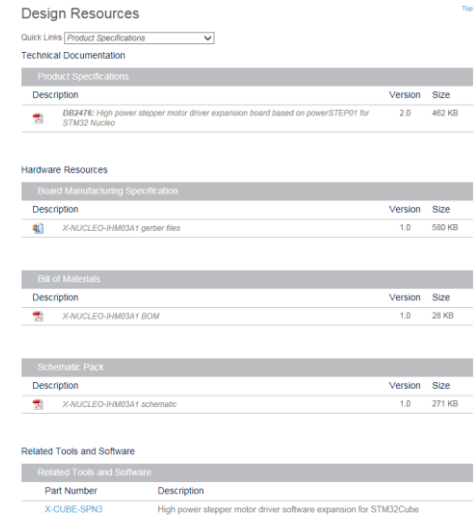
All documents are available in the Design Resources tab of the High Power Stepper Motor Driver expansion board webpage

X-NUCLEO-IHM03A1: Product webpage (Link)

- Gerber files, BOM, and schematics

- **DB2476:** High-power stepper motor driver expansion board based on powerSTEP01 for STM32 Nucleo – Databrief

- **UM1910:** Getting started with high power stepper motor driver expansion board based on powerSTEP01 for STM32 Nucleo – User manual

X-CUBE-SPN3: Product webpage (Link)

- **DB2512:** High-power stepper motor driver software expansion for STM32Cube- Databrief

- **UM1911:** Getting started with the X-CUBE-SPN3 high-power stepper motor driver software expansion for STM32Cube – User manual

- Software setup file

X-NUCLEO-IHM03A1
Product webpage
Design Resources tab

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- STM32 Nucleo board
  (NUCLEO-F401RE, NUCLEO-F030R8 or NUCLEO-L053R8)

- One X-NUCLEO-IHM03A1 expansion board for each stepper motor (up to three)

- Up to three stepper motors

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

- An USB type A to mini-B cable

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

Software prerequisites

- A Windows PC with one of the supported development toolchains:
  - KEIL: MDK-ARM
  - IAR: EWARM
  - GCC-based IDEs (Atollic, TrueStudio…)

- X-CUBE-SPN3 firmware library (Link)

- ST-LINK/V2-1 USB driver (Link)
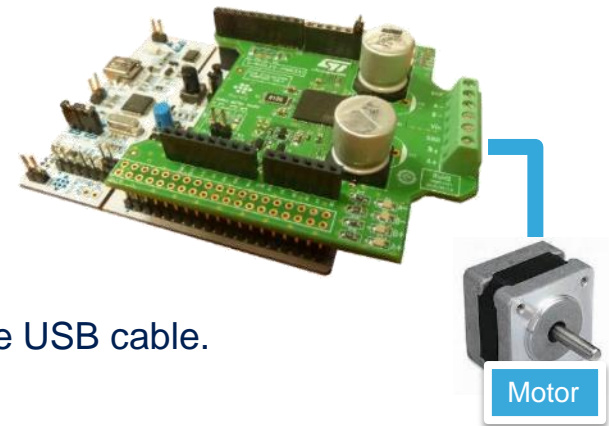
- ST-LINK/V2-1 firmware upgrade (Link)

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.

Motor

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\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)
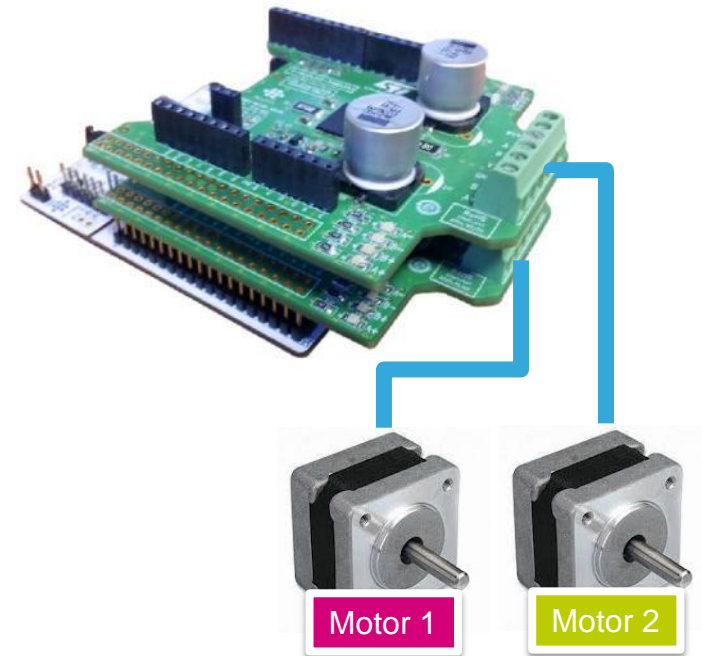- R3, R5, R6 and R7 → Open

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.

Motor 1

Motor 2

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\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.

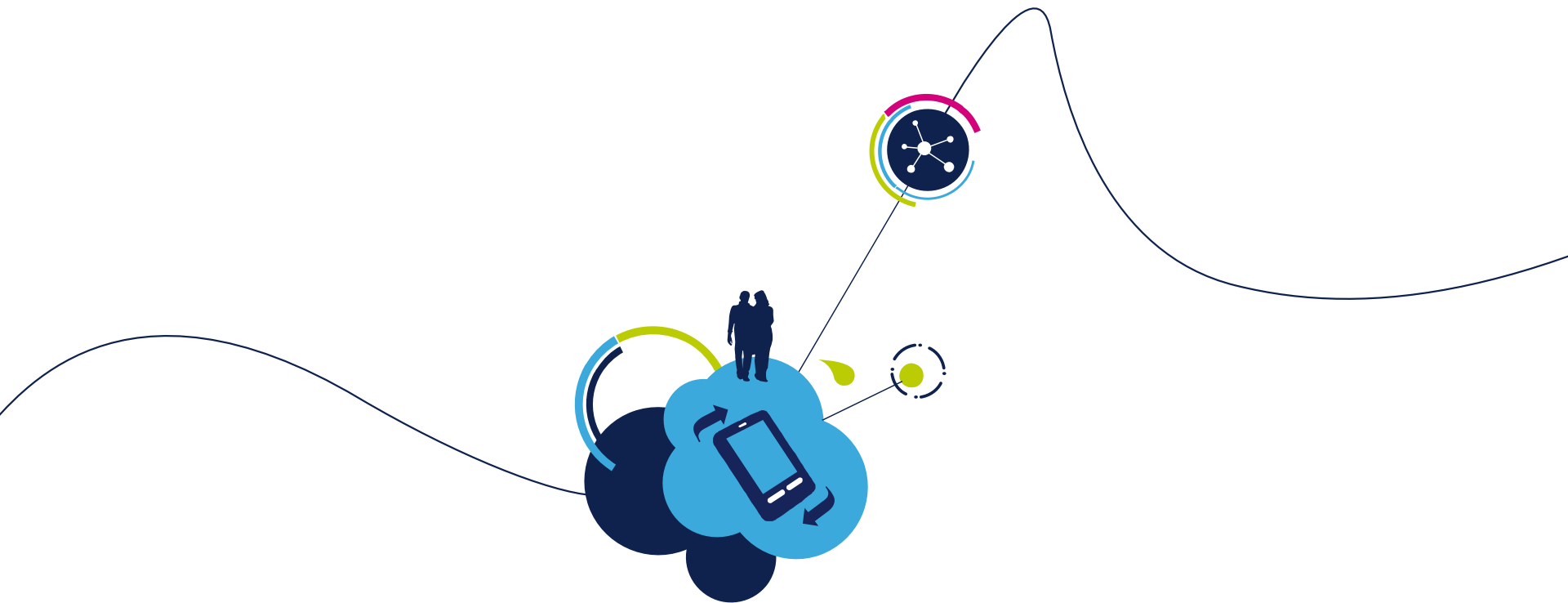**3** Connect the STM32 Nucleo board to the PC using the USB cable.

Motor 1   Motor 2   Motor 3
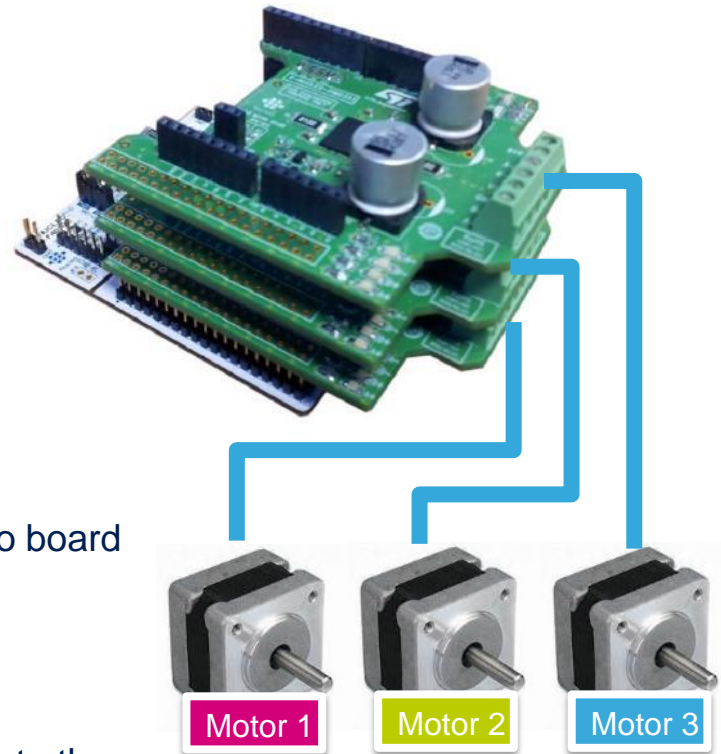
High-power stepper motor driver expansion board
Start coding in just a few minutes with X-CUBE-SPN3

4 Depending on your STM32 Nucleo board, from the examples folder (**\stm32_cube\Projects\Multi\Examples\MotionControl\IHM03A1_ExampleFor3Motors**) open the software project from:
- **\YourToolChainName\STM32F401RE-Nucleo** for Nucleo based on **STM32F401**
- **\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).

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