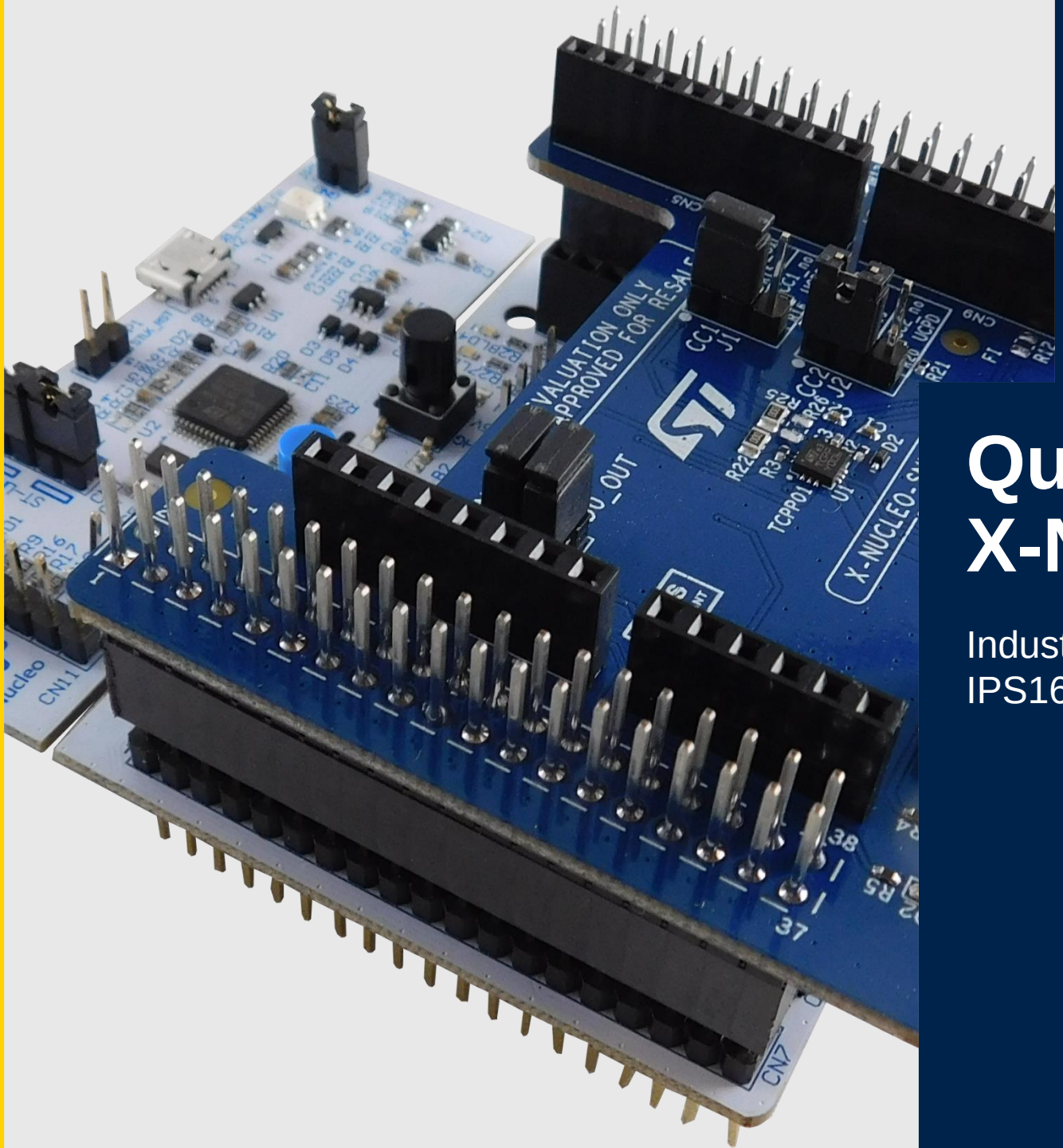

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Quick Start Guide
X-NUCLEO-OUT08A1

Industrial digital output expansion board based on IPS160HF for STM32 Nucleo

STM32 Open Development Environment

Quick Start Guide Contents

X-NUCLEO-OUT08A1 expansion board

Hardware overview 1/2

Hardware Description

The X-NUCLEO-OUT08A1 industrial digital output expansion board for STM32 Nucleo provides a powerful and flexible environment for the evaluation of the driving and diagnostic capabilities of the IPS160HF (60V/2A Single Channel High Side switch with embedded diagnostic for Open Load, Over-Temperature, Over-Load) in a digital output module connected to 2.5 A (max.) industrial loads.

The X-NUCLEO-OUT08A1 interfaces with the microcontroller on the STM32 Nucleo via 3 kV optocouplers driven by GPIO pins and Arduino UNO R3 (default configuration) and ST morpho (optional, not mounted) connectors. The expansion board can be connected to either a NUCLEO-F401RE or NUCLEO-G431RB development board.

It is also possible to evaluate a system composed by up to four stacked boards, X-NUCLEO-OUT08A1 and/or X-NUCLEO-OUT10A1 expansion boards.

Two X-NUCLEO-OUT08A1 expansion boards allows you to evaluate a dual channel digital output module with 2 A capability each, or a 2 A single channel safety digital output module. In the second scenario, the first shield output is connected to the supply of the second one. Dedicated on-board hardware can be enabled or disabled to activate fast discharge of high capacitive loads, output voltage sensing and additional surge pulse output line protection.

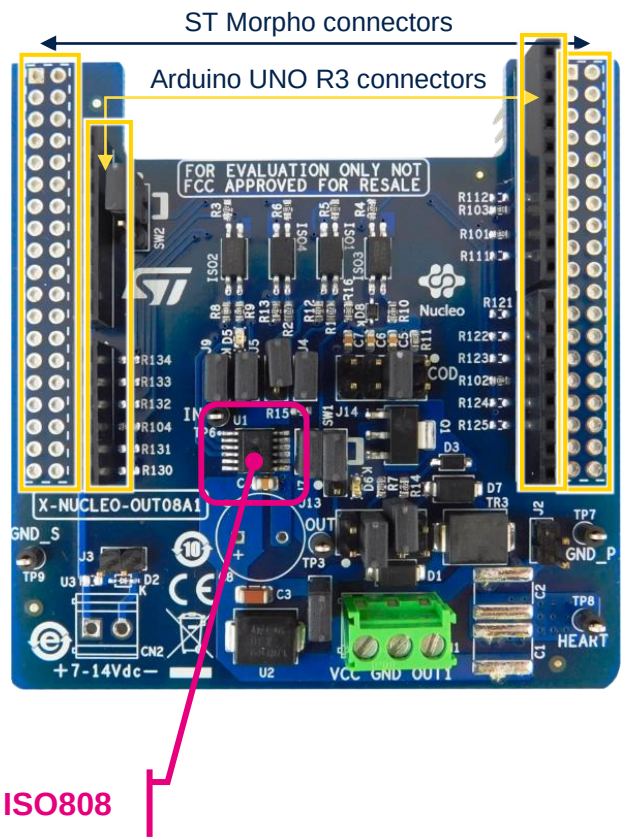
Main Features:

- 4 expansion boards allows you to evaluate a quad-channel digital output module with 2.5 A (max.) capability each
- Operating range up to 60 V/2 A
- Low power dissipation ($R_{ON(MAX)}$ = 120 mΩ)
- Fast decay for inductive loads
- Output propagation delay at start-up < 60us
- Smart driving of capacitive load
- Under-voltage lock-out
- Overload and over-temperature protections
- PowerSSO24 package

Key Products on the Nucleo expansion board:

IPS160HF
2A Single High Side Smart Power Solid State Relay

Latest info available at www.st.com
X-NUCLEO-OUT08A1



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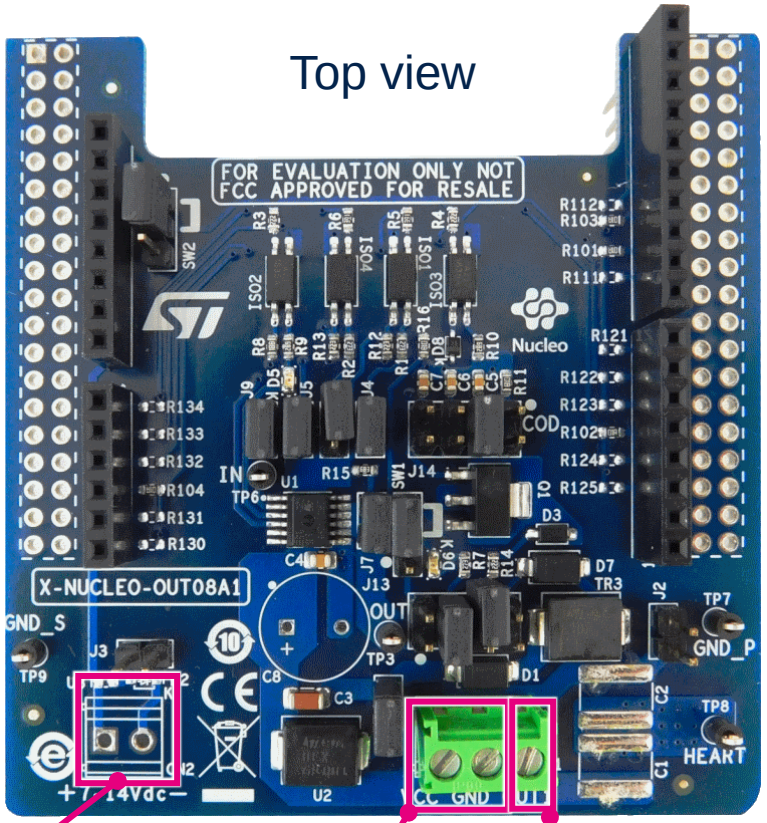
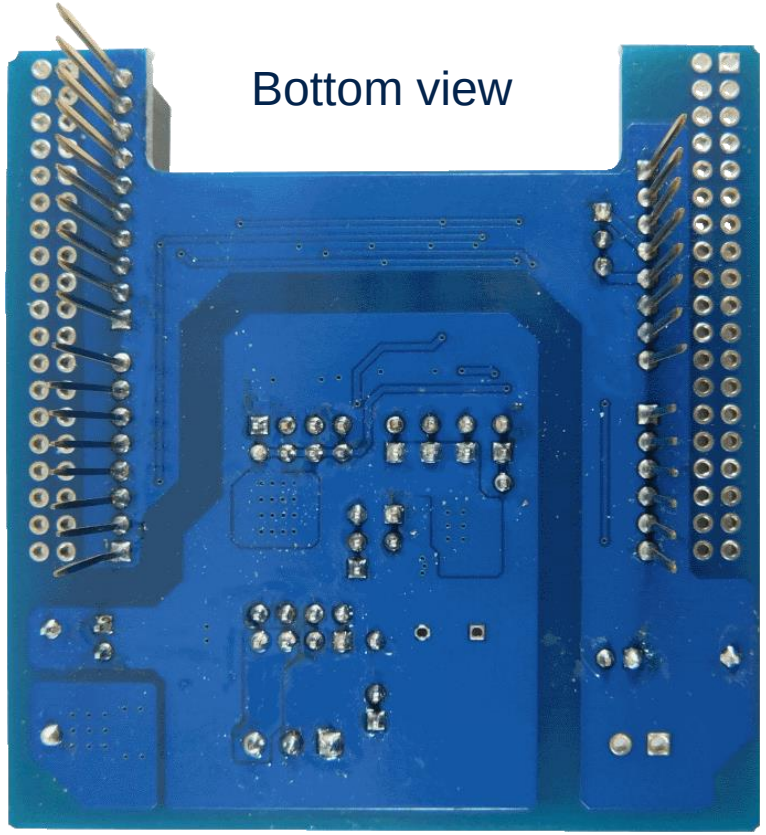
X-NUCLEO-OUT08A1 expansion board
Hardware overview 2/2

Top view



Bottom view



Alternate Nucleo supply

Analog supply

OUT

X-CUBE-IPS software package
SW architecture overview

Software Description :

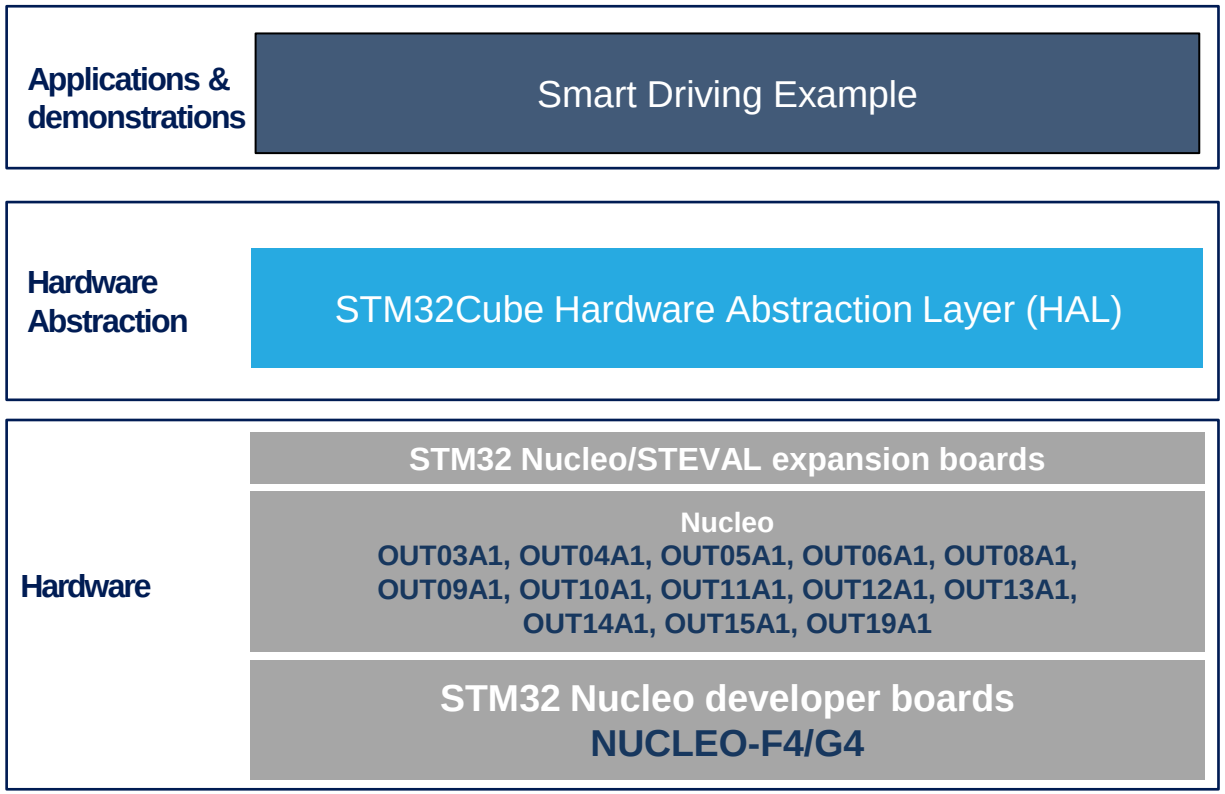
The X-CUBE-IPS expansion software package for STM32Cube runs on the STM32 microcontroller and includes a driver to control the expansion boards hosting Intelligent Power Switches ICs.

The software provides an affordable and easy-to-use solution for the development of single, dual, quad and octal digital output modules for 0.7A, 1.0A, 2.5 A and 5.7A applications, letting you easily evaluate the driving and diagnostic capabilities of the Intelligent Power Switches.

The expansion is built on STM32Cube software technology to ease portability across different STM32 microcontrollers. It is compatible with NUCLEO-F401RE or NUCLEO-G431RB development boards.

Key Features:

- Sample application to evaluate a single channel digital output module by stacking X-NUCLEO-OUT08A1 or X-NUCLEO-OUT10A1. The software also uses a PWM timer to generate the periodic patterns on the output channel for the expansion boards.
- Sample application to interact with the STSW-IFAPGUI PC Software.



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

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Demo Example: Bill Of Material

HW pre-requisites

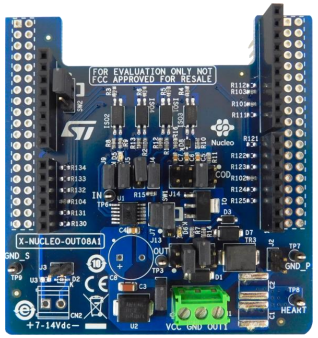
- 1x *description* expansion board (**X-NUCLEO-OUT08A1**)
- 1x STM32 Nucleo development board of **NUCLEO-F401RE, NUCLEO-G431RB**
- 1x USB type A to mini-B cable (for NUCLEO-F401RE)

  or

  1x USB type A to micro-B cable (for NUCLEO-G431RB)
- 1x Laptop/PC with Windows 7, 8 or above

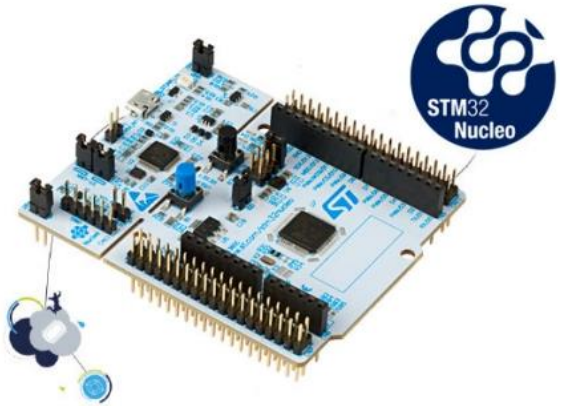
A to mini-B
USB Cable

A to micro-B
USB Cable



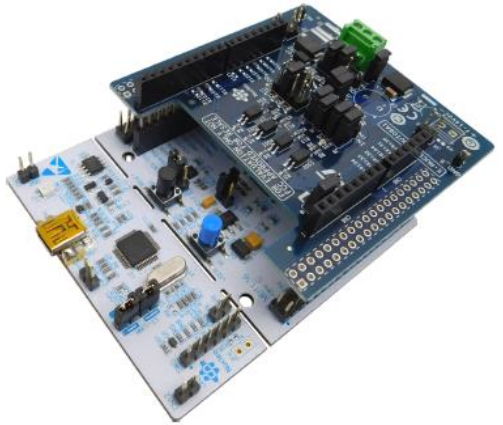
X-NUCLEO-OUT08A1

+



NUCLEO-F401RE or

NUCLEO-G431RB



NUCLEO
stacked solution

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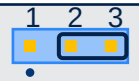
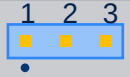
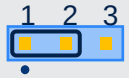
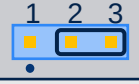
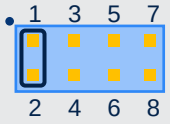
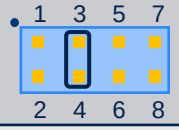
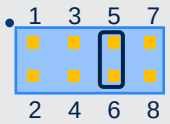
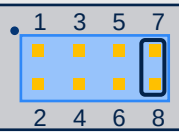
Hardware setup
Jumpers' configuration

SW1 [+ J13 closed 3-4]		to drive the D6 green LED (OUT)
		To disable the path to D6 green LED
J5		to route DIAG signal from device to MCU and drive the D5 red LED
		To disable DIAG signal management by MCU and D5 red LED activation
SW2		3.3V pull-up voltage for DIAG and OUT_FB signals toward MCU
		5.0V pull-up voltage for DIAG and OUT_FB signals toward MCU
J13		to enable OUT_FB signal toward MCU
		to enable activation circuit of green LED D6
		to enable the fast output discharge circuit driven by Nch-DRV signal
		to enable the additional protection against huge inductive loads

More details on pin configurations, power modes and capabilities are contained in ***UM3035, UM2715***

Demo Example: software tools

SW pre-requisites

- STM32CubeProg: All-in-one multi-OS software tool for programming STM32 products or
  STSW-LINK009: ST-LINK/V2-1 (NUCLEO-F401RE), ST-LINK/V3 (NUCLEO-G431RB) USB driver

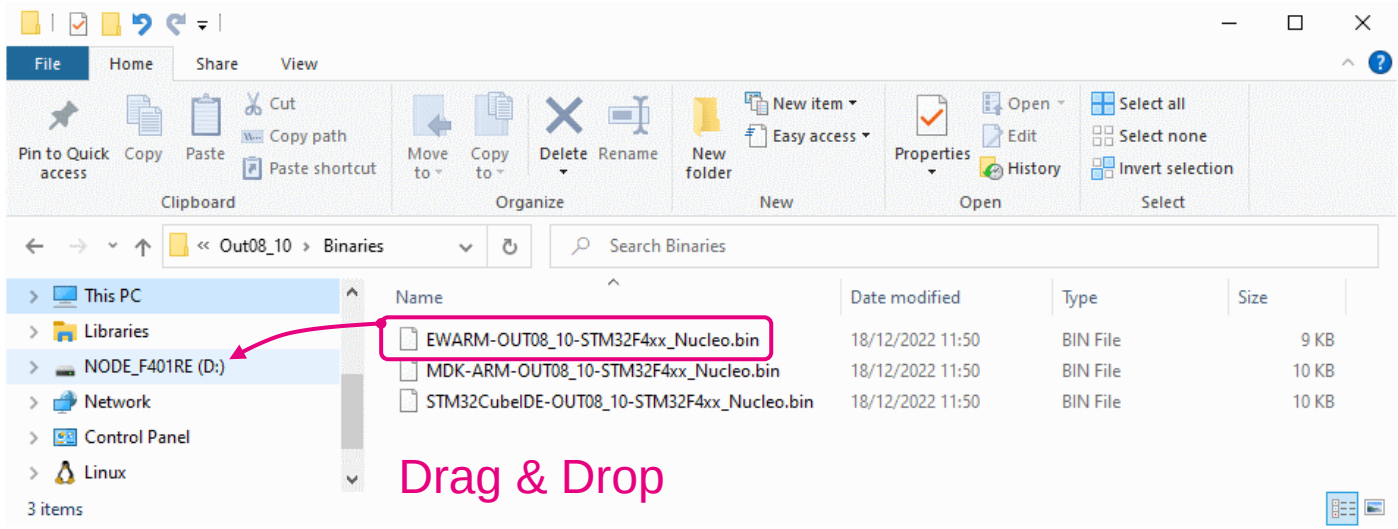
- X-CUBE-IPS: software package including the application examples for NUCLEO-F401RE, NUCLEO-G431RB to be associated with the X-NUCLEO-OUT03A1, X-NUCLEO-OUT04A1, X-NUCLEO-OUT05A1, X-NUCLEO-OUT06A1, X-NUCLEO-OUT08A1, X-NUCLEO-OUT09A1, X-NUCLEO-OUT10A1, X-NUCLEO-OUT11A1, X-NUCLEO-OUT12A1, X-NUCLEO-OUT13A1, X-NUCLEO-OUT14A1, X-NUCLEO-OUT15A1, X-NUCLEO-OUT19A1

Demo Examples for different operating modes

X-NUCLEO-OUT08A1 comes with 2 demo FW binary sets (per nucleo board)

- Application example binaries for the three reference IDEs in the package X-CUBE-IPS
  - EWARM-OUT08_10-STM32F4xx_Nucleo.bin | EWARM-OUT08_10-STM32G4xx_Nucleo.bin
  - MDK-ARM-OUT08_10-STM32F4xx_Nucleo.bin | MDK-ARM-OUT08_10-STM32G4xx_Nucleo.bin
  - STM32CubeIDE-OUT08_10-STM32F4xx_Nucleo.bin | STM32CubeIDE-OUT08_10-STM32G4xx_Nucleo.bin
- Application example binaries (per nucleo boards) compatible with STSW-IFAPGUI
  - STSW-OUT8F4
  - STSW-OUT8G4

Once the Nucleo board is plugged into the PC, an USB_STORAGE like device is detected, the FW binary can be programmed into the Nucleo board by just a drag & drop operation



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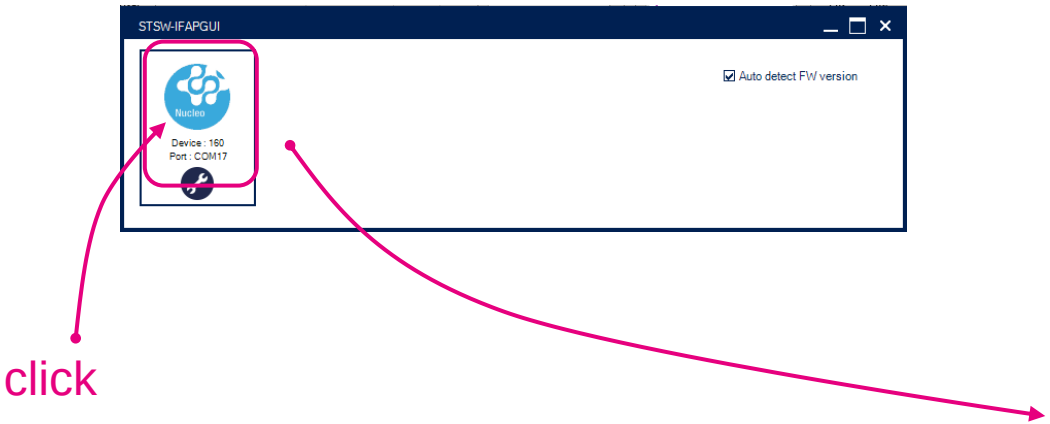
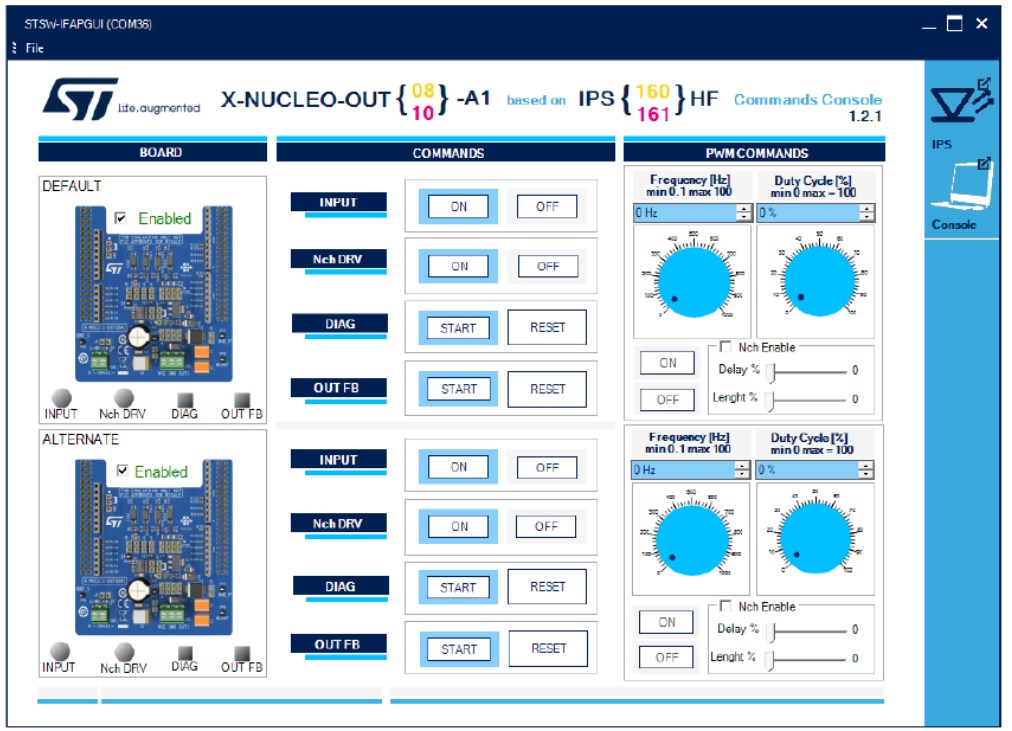
Interact with the STSW-IFAPGUI

- The Firmware binaries STSW-OUT8F4.bin and STSW-OUT8G4.bin allow the interaction of the X-NUCLEO-OUT08A1 with a SW application running on PC (STSW-IFAPGUI).
- The SW app (STSW-IFAPGUI) is available for free download at the following link.
- For the usage of the STSW-IFAPGUI, please refer to the document available at: https://www.st.com/en/embedded-software/stsw-ifapgui.html#documentation





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Documents & related resources

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

X-NUCLEO-OUT08A1

- **DB4175:** Industrial digital output expansion board based on IPS160HF for STM32 Nucleo – **Data Brief**
- **UM2715:** Getting started with the X-NUCLEO-OUT08A1 industrial digital output expansion board for STM32 Nucleo - **User manual**
- Schematics, Gerber files, BOM

X-CUBE-IPS

- **DB4735:** Software expansion for STM32Cube driving industrial digital output based on IPS - **Data Brief**
- **UM3035:** Getting started with X-CUBE-IPS industrial digital output software for STM32 Nucleo - **User manual**

STSW-IFAPGUI

- **DB3775:** Graphical user interface for the industrial IPS evaluation boards based on STM32 Nucleo – **Data Brief**
- **UM2509:** STSW-IFAPGUI, common graphical user interface for the expansion boards of Intelligent Power Switches – **User manual**

STSW-OUT8F4

- **DB4179:** Demonstration firmware for NUCLEO-F401RE enabling STSW-IFAPGUI on X-NUCLEO-OUT08A1 and X-NUCLEO-OUT10A1 expansion boards – **Data Brief**

STSW-OUT8G4

- **DB4180:** Demonstration firmware for NUCLEO-G431RB enabling STSW-IFAPGUI on X-NUCLEO-OUT08A1 and X-NUCLEO-OUT10A1 expansion boards – **Data Brief**

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STM32 ODE Ecosystem

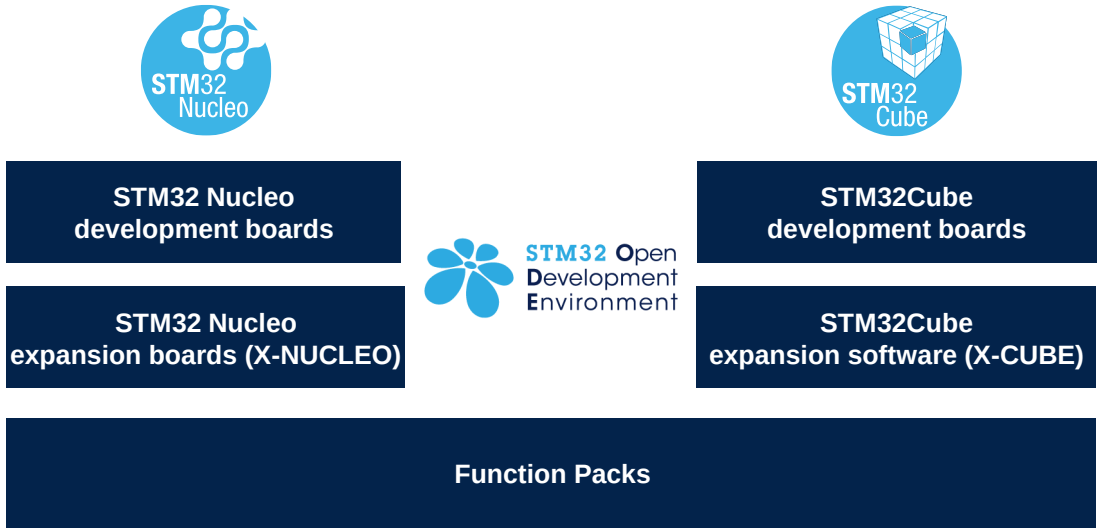
FAST, AFFORDABLE PROTOTYPING AND DEVELOPMENT

The STM32 Open Development Environment (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:

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



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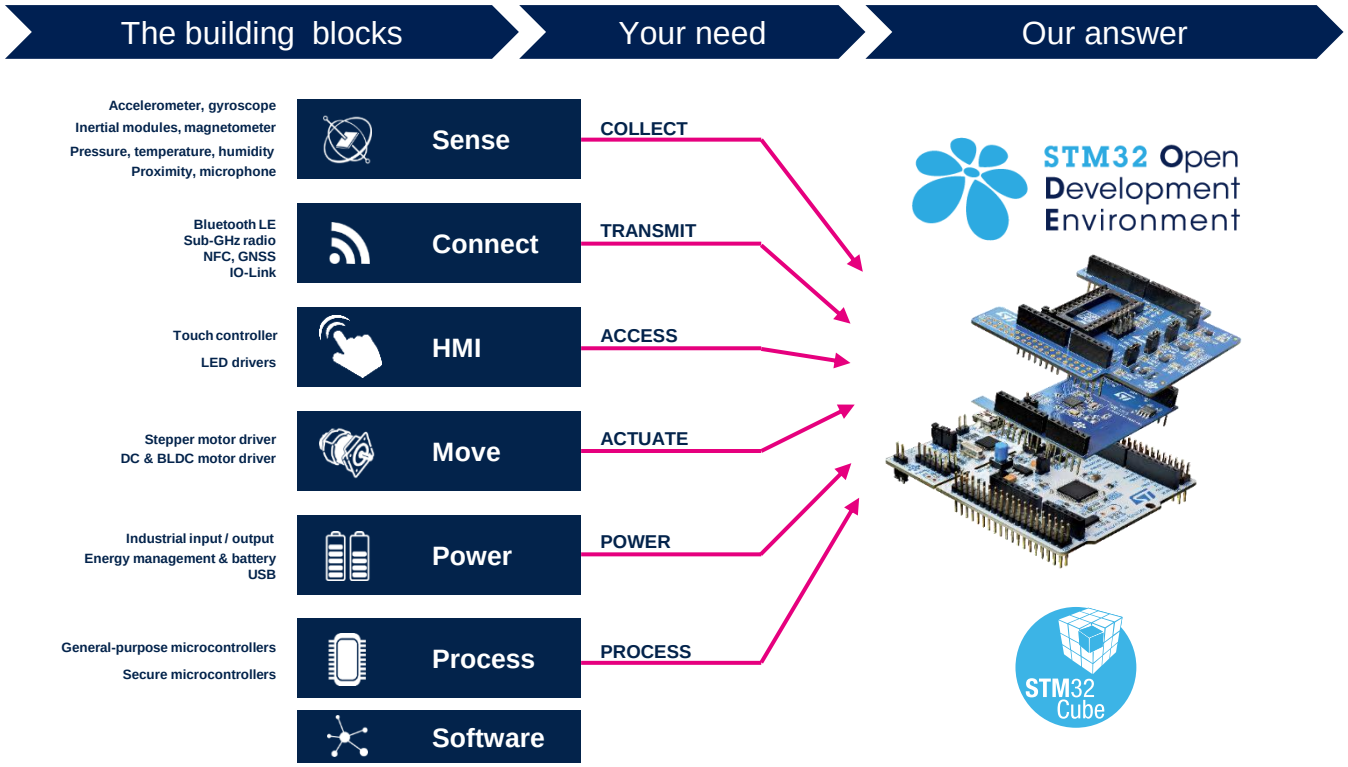
STM32 Open Development Environment: all that you need

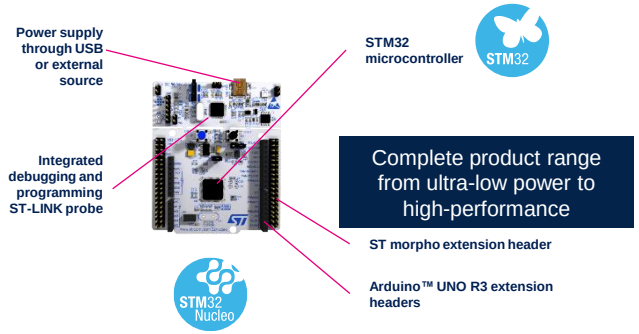
The combination of a broad range of expandable boards based on leading-edge commercial products and modular software, from driver to application level, enables fast prototyping of ideas that can be smoothly transformed into final designs.

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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