

Industrial digital output software expansion for STM32Cube

Application	Smart driving example
Hardware Abstraction	STM32Cube Hardware Abstraction Layer (HAL)
Hardware	STM32 Nucleo expansion boards X-NUCLEO-OUT08A1, X-NUCLEO-OUT10A1
	STM32 Nucleo development board NUCLEO-F4/G4



Features

- Complete software to build applications for **IPS160HF** and **IPS161HF** high-side smart power solid-state relay
- GPIOs, PWMs and IRQs
- Fault/Diagnostics interrupt handling
- Sample implementation available on the **X-NUCLEO-OUT08A1** or **X-NUCLEO-OUT10A1** expansion boards when connected to a **NUCLEO-F401RE** or **NUCLEO-G431RB** development board
- Easy portability across different MCU families, thanks to **STM32Cube**
- Free, user-friendly license terms

Description

The **X-CUBE-OUT8** expansion software package for **STM32Cube** runs on the STM32 microcontroller and includes a driver to control the **IPS160HF** and/or the **IPS161HF** (single high-side switches for industrial safety compliant systems).

The software provides an affordable and easy-to-use solution for the development of 2 A (**X-NUCLEO-OUT08A1**) or 0.5 A (**X-NUCLEO-OUT10A1**) digital output modules, letting you easily evaluate the driving and diagnostic capabilities of **IPS160HF** and **IPS161HF** with industrial loads.

The expansion is built on **STM32Cube** software technology to ease portability across different STM32 microcontrollers.

The software comes with an example implementation of a single channel driver running on the **X-NUCLEO-OUT08A1** or **X-NUCLEO-OUT10A1** expansion board connected to a **NUCLEO-F401RE** or **NUCLEO-G431RB** development board.

You can also evaluate a dual channel digital output module by stacking any combination of **X-NUCLEO-OUT08A1** and/or **X-NUCLEO-OUT10A1** with shared or independent supply rail and independent loads.

When two **X-NUCLEO-OUT08A1** expansion boards are stacked and connected so that the output of the first board supplies the second, the software allows you to evaluate **IPS160HF** performance in a 2 A digital output module, also by using the additional signals **OUT_FB** and **Nch_DRV**.

Similarly, **IPS161HF** performance can be evaluated for a 0.5 A safety digital output module when two **X-NUCLEO-OUT10A1** expansion boards are stacked.

When two expansion boards are stacked, the configuration resistors between signals and Arduino connectors must be properly set between default and alternate positions to guarantee the desired control of the hardware.

Product summary	
Industrial digital output software expansion for STM32Cube	X-CUBE-OUT8
Industrial digital output expansion board based on IPS160HF for STM32 Nucleo	X-NUCLEO-OUT08A1
Industrial digital output expansion board based on IPS161HF for STM32 Nucleo	X-NUCLEO-OUT10A1
STM32 Nucleo-64 development board with STM32F401RE/STM32G431RB MCU	NUCLEO-F401RE/NUCLEO-G431RB
Applications	Industrial Safety Industrial Tools

1 Detailed description

1.1 What is STM32Cube?

[STM32Cube](#) is a combination of a full set of PC software tools and embedded software blocks running on STM32 microcontrollers and microprocessors:

- [STM32CubeMX](#) configuration tool for any STM32 device; it generates initialization C code for Cortex-M cores and the Linux device tree source for Cortex-A cores
- [STM32CubeIDE](#) integrated development environment based on open-source solutions like Eclipse or the GNU C/C++ toolchain, including compilation reporting features and advanced debug features
- [STM32CubeProgrammer](#) programming tool that provides an easy-to-use and efficient environment for reading, writing and verifying devices and external memories via a wide variety of available communication media (JTAG, SWD, UART, USB DFU, I2C, SPI, CAN, etc.)
- STM32CubeMonitor family of tools ([STM32CubeMonRF](#), [STM32CubeMonUCPD](#), [STM32CubeMonPwr](#)) to help developers customize their applications in real-time
- [STM32Cube MCU and MPU packages](#) specific to each STM32 series with drivers (HAL, low-layer, etc.), middleware, and lots of example code used in a wide variety of real-world use cases
- [STM32Cube expansion packages](#) for application-oriented solutions

1.2 How does this software complement STM32Cube?

The software supports dual channel digital output applications and safety digital output applications.

The package is based on the [STM32CubeHAL](#), the hardware abstraction layer for the STM32 microcontroller. The package extends [STM32Cube](#) by providing a Board Support Package (BSP) for the [STM32 Nucleo](#) expansion board based on the [IPS160HF](#) and [IPS161HF](#).

The drivers abstract low-level details of the hardware to access the [IPS160HF](#) and [IPS161HF](#) device data in a hardware independent manner.

The software package includes a set of examples that the developer can use to start experimenting with the code. The [IPS160HF](#) and [IPS161HF](#) output channel is controlled via GPIO peripheral and application debugging is supported on the [X-NUCLEO-OUT08A1](#) and [X-NUCLEO-OUT10A1](#) through LEDs, GPIO and interrupt signals for activity and diagnostics.

Revision history

Table 1. Document revision history

Date	Version	Changes
12-Jun-2020	1	Initial release.

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