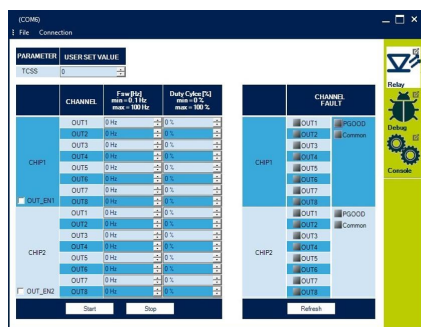


## Demonstration firmware for NUCLEO-F401RE and NUCLEO-F446RE enabling STSW-IFAPGUI on X-NUCLEO-OUT02A1 expansion board



### Features

- Full control of the X-NUCLEO-OUT02A1 expansion board via the STSW-IFAPGUI
- Control of single and dual (daisy chaining) applications
- Per-channel output switching frequency setting
- Per-channel switching duty cycle setting
- Per-channel thermal fault diagnostics
- Embedded RF communication fault diagnostics
- Process side UVLO diagnostics
- Process side power good diagnostics

### Description

The STSW-OUT02 firmware runs on the NUCLEO-F401RE and NUCLEO-F446RE development boards when connected to the X-NUCLEO-OUT02A1 expansion board using the STSW-IFAPGUI graphical user interface.

The STSW-OUT02 contains all the necessary software routines allowing the full control of the X-NUCLEO-OUT02A1 expansion board via the GUI.

The firmware can control a single expansion board or two stacked X-NUCLEO-OUT02A1 configured in daisy chaining mode.

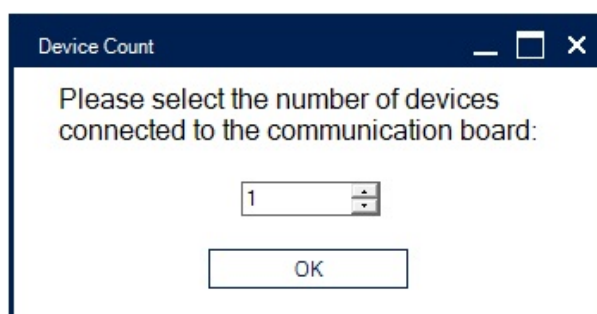
The STSW-IFAPGUI is based on a common engine and several plug-ins designed to communicate with the application layer running on the microcontroller connected to the shield board.

Product summary	
Firmware for STSW-IFAPGUI and X-NUCLEO-OUT02A1 expansion board	STSW-OUT02
Industrial digital output expansion board based on ISO8200AQ for STM32 Nucleo	X-NUCLEO-OUT02A1
Graphical user interface for the industrial IPS expansion boards for STM32 Nucleo	STSW-IFAPGUI
STM32 Nucleo-64 development board with STM32F401RE/STM32F446RE MCUs	NUCLEO-F401RE/ NUCLEO-F446RE
Applications	Industrial Safety Industrial Tools

## 1 How to control a single expansion board

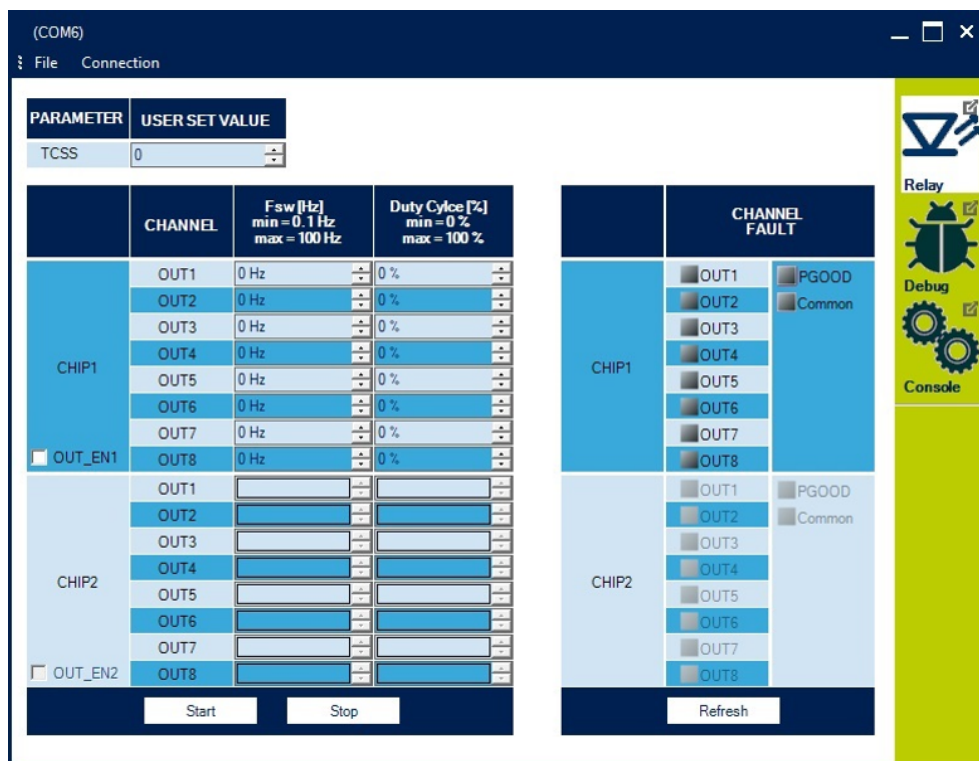
- Step 1.** Connect the **STM32 Nucleo** board flashed with **STSW-OUT02** to the **X-NUCLEO-OUT02A1** through the Arduino connectors.
- Step 2.** Connect the stacked boards to your PC/laptop USB port through a mini-USB cable.  
The STM32 is supplied by 3.3 V from the USB supply and the flashed firmware starts running.  
By default, in the **X-NUCLEO-OUT02A1**, J8 is closed between pins 5-6 and the **ISO8200AQ** digital side is supplied by the same 3.3 V of the microcontroller.
- Step 3.** Launch the **STSW-IFAPGUI**.  
When the application starts, the firmware running on the STM32 is automatically detected and a COM port is opened for communication.
- Step 4.** Click on the GUI STM32 Nucleo icon only after it becomes blue (it is green until the firmware identification is completed).  
The following selection window appears.

**Figure 1. STSW-IFAPGUI selection window for the number of X-NUCLEO-OUT02A1 expansion boards to control**



**Step 5.** Select "1" in the **Device Count** window and then click **[OK]** to activate the control panel.

**Figure 2. STSW-IFAPGUI control panel, single chip**



**Step 6.** Supply the **X-NUCLEO-OUT02A1** power stage with a 24 V rail via J1 connector.

**Step 7.** Click on the GUI **[Refresh]** button to align the application board and the GUI status.

**Step 8.** Select the desired switching frequency and duty cycle of the output channels to be activated (ON/OFF).

*Note:* 0 Hz stands for channel OFF; duty cycle 100% stands for channel always ON.

**Step 9.** Tick the **OUT\_EN1** to activate the **ISO8200AQ** output enable signal.

**Step 10.** Click **[Start]** to activate the SPI communication between the microcontroller and **ISO8200AQ**.

Now the activated output channels start switching according to the setup defined in Step 7 (green LED D5 to D12 will be driven accordingly).

When SPI is active, the right side of the GUI (fault monitoring) is automatically updated every 500 ms.

**Step 11.** The output channels ON/OFF status can be deactivated by unticking the **OUT\_EN1** or by clicking **[Stop]**.

In the first case, the SPI communication between microcontroller and **ISO8200AQ** remains active, while in the second case the SPI communication stops.

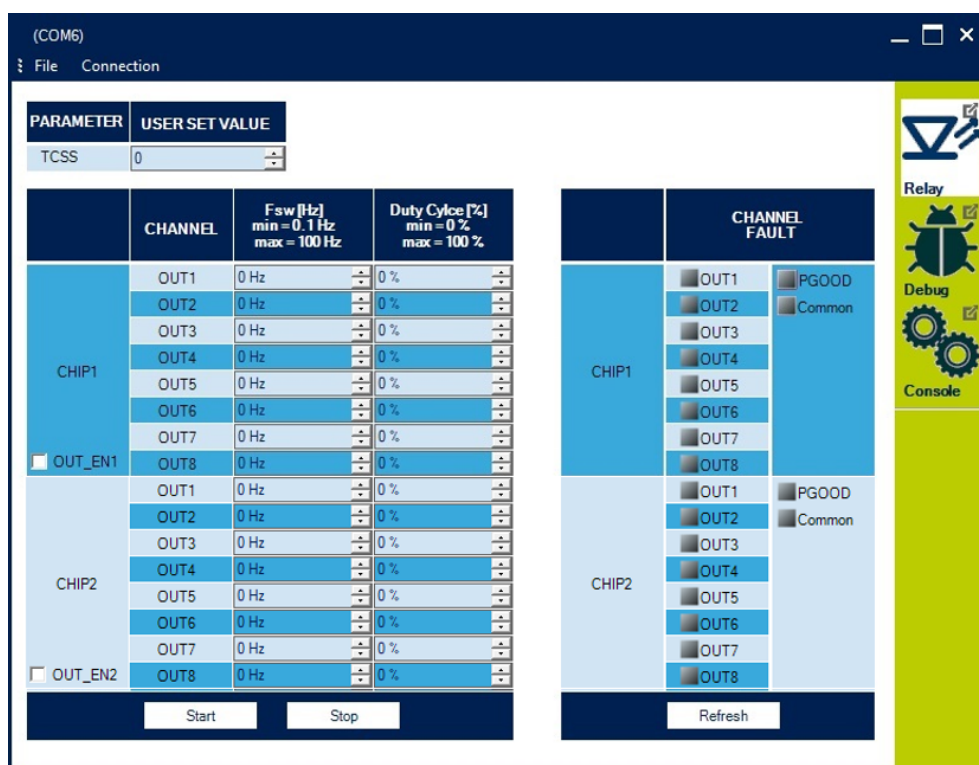
**Step 12.** When the evaluation session finishes, stop the SPI communication, close the GUI, remove the 24 V from J1 and disconnect the USB cable from the **STM32 Nucleo** development board.

## 2 How to control two expansion boards

When two X-NUCLEO-OUT02A1 expansion boards are stacked (daisy chaining), follow the procedure below.

- Step 1.** Set the proper configuration for J6, J7 and OUT\_EN signal on the two X-NUCLEO-OUT02A1 to enable daisy chaining configuration.
- Step 2.** Connect the NUCLEO-F401RE development board flashed with STSW-OUT02 to the two X-NUCLEO-OUT02A1 boards through the Arduino connectors.
- Step 3.** Launch the STSW-IFAPGUI.  
When the application starts, the firmware running on the STM32 is automatically detected and a COM port is opened for communication.
- Step 4.** Click on the GUI STM32 Nucleo icon only after it becomes blue (it is green until the firmware identification is completed).
- Step 5.** Select "2" in the **Device Count** window and then click OK to activate the control panel.

Figure 3. STSW-IFAPGUI control panel, dual chip



- Step 6.** Follow the steps described in Section 1 (from 6 to 12).

### RELATED LINKS

For detailed information on daisy chaining configuration, refer to X-NUCLEO-OUT02A1 web page

## Revision history

**Table 1. Document revision history**

Date	Version	Changes
26-Feb-2019	1	Initial release.
15-Jun-2020	2	Updated cover page product summary table. Added cover page image, <a href="#">Section 1 How to control a single expansion board</a> and <a href="#">Section 2 How to control two expansion boards</a> .

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