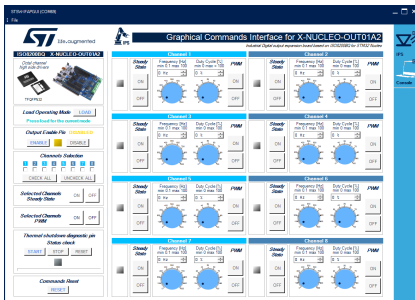


Demonstration firmware for NUCLEO-F401RE enabling STSW-IFAPGUI on X-NUCLEO-OUT01A2 expansion board



Features

- Full control of the X-NUCLEO-OUT01A2 expansion board via the STSW-IFAPGUI graphical user interface
- Control of:
 - output channel switching frequency and duty cycle configuration
 - visualization of diagnostic signal (common overtemperature/communication error)
 - both Direct Control Mode and Synchronous Control Mode management

Description

The STSW-OUT1F4 firmware runs on the NUCLEO-F401RE development board and allows controlling the X-NUCLEO-OUT01A2 expansion board using the STSW-IFAPGUI graphical user interface.

The STSW-OUT1F4 contains the software routines that enable the USB-based communication between the NUCLEO-F401RE and the system where the STSW-IFAPGUI runs, and the control of a single X-NUCLEO-OUT01A2.

The STSW-IFAPGUI is based on a common engine and several plug-ins designed to communicate through the USB connection with the application layer running on the NUCLEO-F401RE development board stacked with the expansion board.

Product summary	
Demonstration firmware for NUCLEO-F401RE enabling STSW-IFAPGUI on X-NUCLEO-OUT01A2 expansion board	STSW-OUT1F4
Industrial digital output expansion board based on ISO8200BQ for STM32 Nucleo	X-NUCLEO-OUT01A2
STM32 Nucleo-64 development board with STM32F401RE MCU, supports Arduino and ST morpho connectivity	NUCLEO-F401RE
Graphical user interface for the industrial IPS evaluation boards based on STM32 Nucleo	STSW-IFAPGUI
Applications	Industrial Safety Industrial Tools

1 How to control a single expansion board with IFAPGUI

This application scenario is based on the default on-board switches and resistors configuration of the X-NUCLEO-OUT01A2.

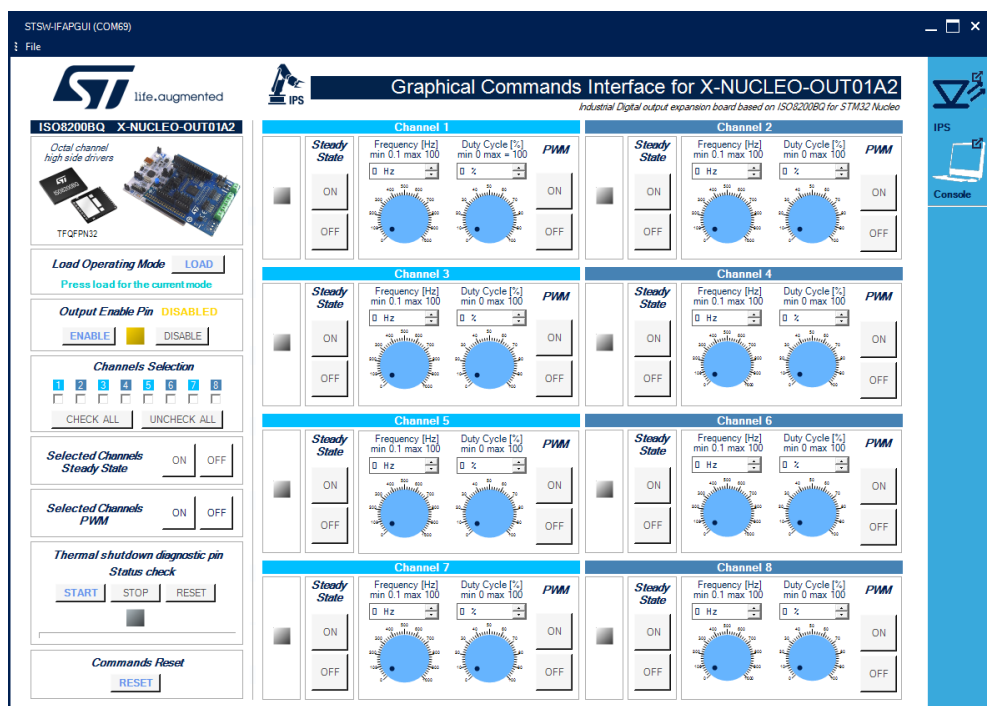
- Step 1.** Stack the X-NUCLEO-OUT01A2 on the NUCLEO-F401RE board flashed with the STSW-OUT1F4 firmware through the Arduino connectors.
- Step 2.** Connect the two stacked boards to your PC or laptop USB port through a mini-USB cable. The STM32 is supplied via USB (3.3 V) and the flashed firmware starts running. Press the black button on the NUCLEO-F401RE board to reset the firmware.
- 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.

Figure 1. STSW-IFAPGUI COM port opened

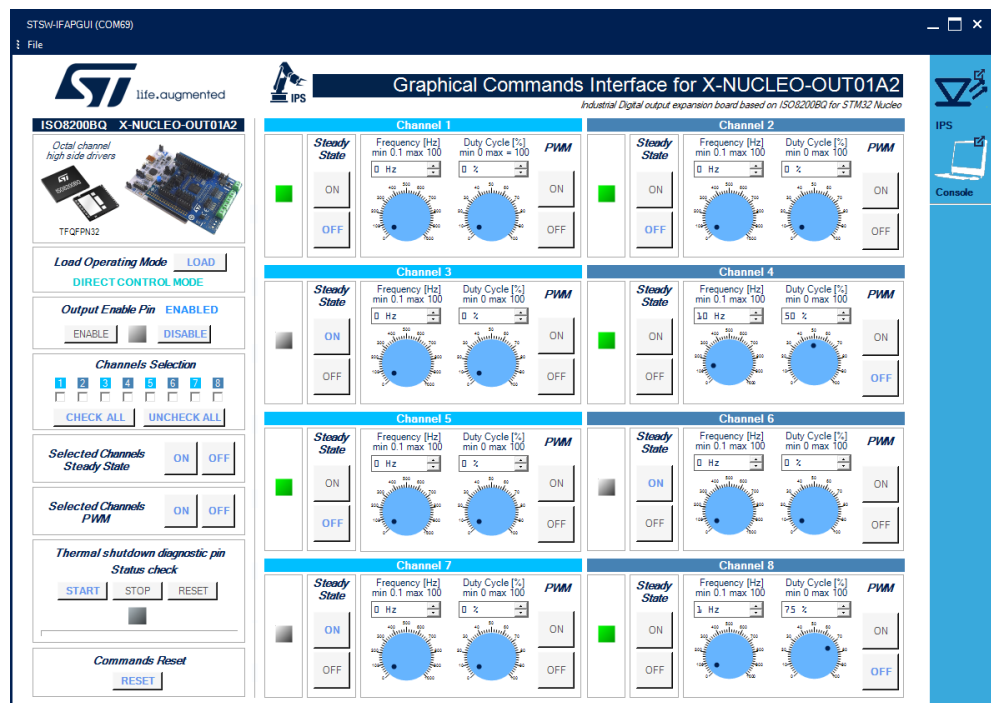


- Step 4.** Click on the GUI STM32 Nucleo icon after it turns blue (it remains green until the firmware identification is complete).
The STSW-IFAPGUI appears on the screen.

Figure 2. STSW-IFAPGUI main control panel



- Step 5.** Use the dedicated section of the GUI for the desired channel of ISO8200BQ to:
- Manage channel steady state (the left part in each channel section).
 - Manage channel PWM settings (the right part in each channel section).
- Use the bottom left side of the GUI to:
- Select the Control Mode to be used (DCM or SCM, last one is the default).
 - Enable/disable outputs, properly setting the Output Enable pin.
 - Enable/disable and reset diagnostic pin polling activity.
 - Reset all channel features to OFF state.
- Step 6.** Connect the load and supply the power stage of the X-NUCLEO-OUT01A2 with a 24 V rail via the CN1 connector.
- Step 7.** Select the desired switching frequency and duty cycle of the desired output channel through the [Pulse Width Modulation] controls in the right part of desired channel section.
- Step 8.** The desired output channel steady state can be activated/deactivated by clicking on the [ON/OFF] buttons in the left part of the desired channel section in the [Steady State] sub-section.
- Step 9.** Click on the [START] button in the [Thermal shutdown diagnostic pin Status check] area on the bottom left side of the GUI to monitor the on/off status on the FAULT pin on ISO8200BQ. You can stop monitoring the fault status by clicking on the [STOP] button in the same section. Press the [RESET] button to reset the fault status.
- Step 10.** Click on [Enable] button in [Output Enable Pin] section to drive the output pins. Click on [Disable] in the same section to turn off all output pins.
- Step 11.** Click on [RESET] button in [Commands Reset] section to reset any channel setting and also the diagnostic pin status monitoring.

Figure 3. STSW-IFAPGUI in action


2 How to control a single expansion board with Command Line Interface

This application scenario is based on the default on-board switches and resistors configuration of X-NUCLEO-OUT01A2.

- Step 1.** Plug the X-NUCLEO-OUT01A2 expansion board on top of the NUCLEO-F401RE board, flashed with the STSW-OUT1F4 firmware, through the Arduino connectors.
- Step 2.** Connect the two stacked boards to your PC or laptop USB port through a mini-USB cable. The STM32 is supplied via USB (3.3 V) and the flashed firmware starts running. Press the black button on the NUCLEO-F401RE board to reset the firmware.
- Step 3.** Launch the serial communication terminal application (TeraTerm in our notes). When the application starts, the serial communication must be configured as follows:

Figure 4. Tera Term: select serial communication method

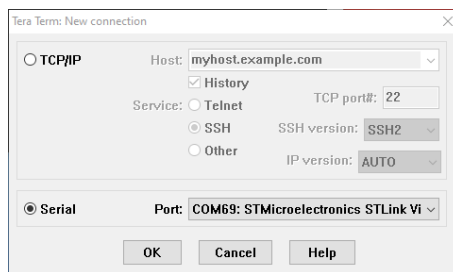


Figure 5. Tera Term: Setup / Terminal...

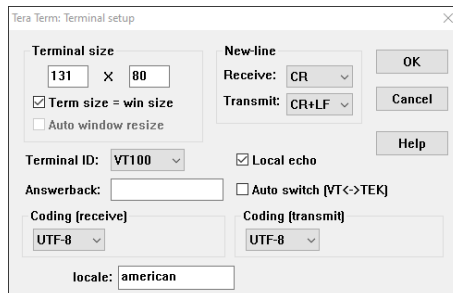
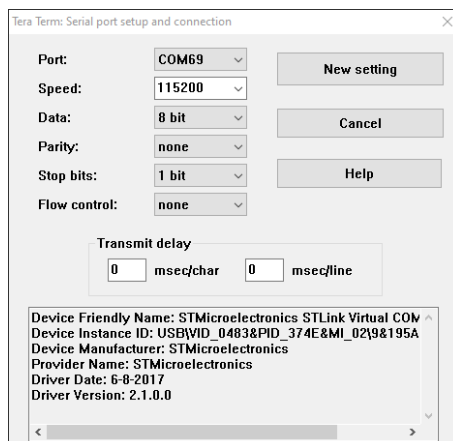


Figure 6. Tera Term: Setup / Serial port...



Step 4. Press Enter and then type 'h' for help:

Figure 7. CLI help

```

COM69 - Tera Term VT
File Edit Setup Control Window Help
ST Switch Console Firmware 001.00.00 [Aug 2 2023 18:44:00] for chip 8200
Type 'h' to get some help
h

-----
Welcome to ST Switch Console help utility!
You're running Firmware ST Switch Console Firmware 001.00.00 [Aug 2 2023 18:44:00] for chip 8200
Two apis are implemented in this version:
- The Switch Api
- The System Api

To execute a switch command, type 'W' followed by a command id
and then param1 param2 param3 param4 if there are parameters
e.g. type 'W0 0 8200 1' to initialize one 8200 device
To execute a system command, type 'S' followed by a command id
e.g. type 'S1' to get the PU version

To get more help regarding switch commands, just type 'W'
To get more help regarding system commands, just type 'S'
    
```

Step 5. Type 'w?' for a list of commands available:

Figure 8. Command list

```

COM69 - Tera Term VT
File Edit Setup Control Window Help
ST Switch Console Firmware 001.00.00 [Aug 2 2023 18:44:00] for chip 8200
Type 'h' to get some help
w?

Switch API commands list:
Id: 0 IPS_SWITCH_API_INIT
W0 Instance<1B> ChipId<2B> NbDevices<1B> -> Output: status<4B>
Id: 1 IPS_SWITCH_API_DEINIT
W1 Instance<1B> -> Output: status<4B>
Id: 2 IPS_SWITCH_API_READ_ID
W2 Instance<1B> -> Output: status<6B>
Id: 3 IPS_SWITCH_API_GET_FW_VERSION
W3 Instance<1B> -> Output: status<8B>
Id: 4 IPS_SWITCH_API_GET_CAPABILITIES
W4 Instance<1B> -> Output: status<5B>
Id: 5 IPS_SWITCH_API_GET_FAULT_STATUS
W5 Instance<1B> -> Output: status<5B>
Id: 6 IPS_SWITCH_API_GET_CHANNEL_STATUS
W6 Instance<1B> ChanId<1B> -> Output: status<5B>
Id: 7 IPS_SWITCH_API_SET_CHANNEL_STATUS
W7 Instance<1B> ChanId<1B> ChanStatus<1B> -> Output: status<4B>
Id: 8 IPS_SWITCH_API_GET_ALL_CHANNEL_STATUS
W8 Instance<1B> -> Output: status<5B>
Id: 9 IPS_SWITCH_API_SET_ALL_CHANNEL_STATUS
W9 Instance<1B> ChanBitmap<1B> -> Output: status<4B>
Id: 10 IPS_SWITCH_API_GET_CHANNEL_FREQ
W10 Instance<1B> ChanId<1B> -> Output: status<6B>
Id: 11 IPS_SWITCH_API_SET_CHANNEL_FREQ
W11 Instance<1B> ChanId<1B> Freq<2B> -> Output: status<4B>
Id: 12 IPS_SWITCH_API_GET_CHANNEL_DC
W12 Instance<1B> ChanId<1B> -> Output: status<5B>
Id: 13 IPS_SWITCH_API_SET_CHANNEL_DC
W13 Instance<1B> ChanId<1B> DutyCycle<1B> -> Output: status<4B>
Id: 14 IPS_SWITCH_API_GET_PWM_ENABLE
W14 Instance<1B> ChanId<1B> -> Output: status<5B>
Id: 15 IPS_SWITCH_API_SET_PWM_ENABLE
W15 Instance<1B> ChanId<1B> PwmEnable<1B> -> Output: status<4B>
Id: 17 IPS_SWITCH_API_GET_CTRL_PIN_STATUS
W17 Instance<1B> CtrlPinId<1B> -> Output: status<5B>
Id: 18 IPS_SWITCH_API_SET_CTRL_PIN_STATUS
W18 Instance<1B> CtrlPinId<1B> CtrlPinStatus<1B> -> Output: status<4B>
Id: 19 IPS_SWITCH_API_SET_OPERATING_MODE
W19 Instance<1B> -> Output: status<5B>
    
```

Step 6. Initialize the device as first action using w0 command:

Figure 9. Device init

```

COM69 - Tera Term VT
File Edit Setup Control Window Help
ST Switch Console Firmware 001.00.00 [Aug 2 2023 18:44:00] for chip 8200
Type 'h' to get some help
W0 0 8200 1
    
```

Step 7. Continue to interact with the device using commands from the available command list (see above).

Revision history

Table 1. Document revision history

Date	Revision	Changes
26-Sep-2023	1	Initial release.

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