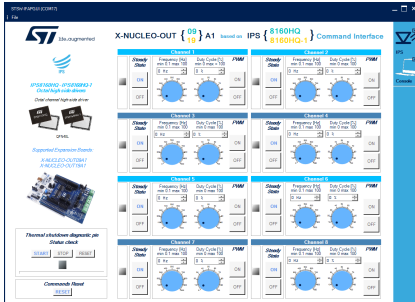


Demonstration firmware for NUCLEO-G431RB enabling STSW-IFAPGUI on X-NUCLEO-OUT09A1 and X-NUCLEO-OUT19A1 expansion boards



Features

- Full control of the X-NUCLEO-OUT09A1 and X-NUCLEO-OUT19A1 expansion boards via the STSW-IFAPGUI graphical user interface
- Control of:
 - output channel switching frequency and duty cycle configuration
 - visualization of diagnostic signal (overtemperature diagnostic)

Description

The STSW-OUT9G4 firmware runs on the NUCLEO-G431RB development board and allows the control of the X-NUCLEO-OUT09A1 or X-NUCLEO-OUT19A1 expansion boards using the STSW-IFAPGUI graphical user interface.

The STSW-OUT9G4 contains the software routines that enable the USB-based communication between NUCLEO-G431RB and the system where STSW-IFAPGUI runs, and the control of the X-NUCLEO-OUT09A1 or X-NUCLEO-OUT19A1.

The firmware can control a single expansion board (X-NUCLEO-OUT09A1 or X-NUCLEO-OUT19A1).

The STSW-IFAPGUI is based on a common engine and several plug-ins designed to communicate through USB connection with the application layer running on the NUCLEO-G431RB development board stacked with the expansion board.

Product summary	
Demonstration firmware for NUCLEO-G431RB enabling STSW-IFAPGUI on X-NUCLEO-OUT09A1 and X-NUCLEO-OUT19A1 expansion boards	STSW-OUT9G4
Industrial digital output expansion board based on IPS8160HQ for STM32 Nucleo	X-NUCLEO-OUT09A1
Industrial digital output expansion board based on IPS8160HQ-1 for STM32 Nucleo	X-NUCLEO-OUT19A1
STM32 Nucleo-64 development board with STM32G431RB MCU, supports Arduino and ST morpho connectivity	NUCLEO-G431RB
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 X-NUCLEO-OUT09A1 (or X-NUCLEO-OUT19A1).

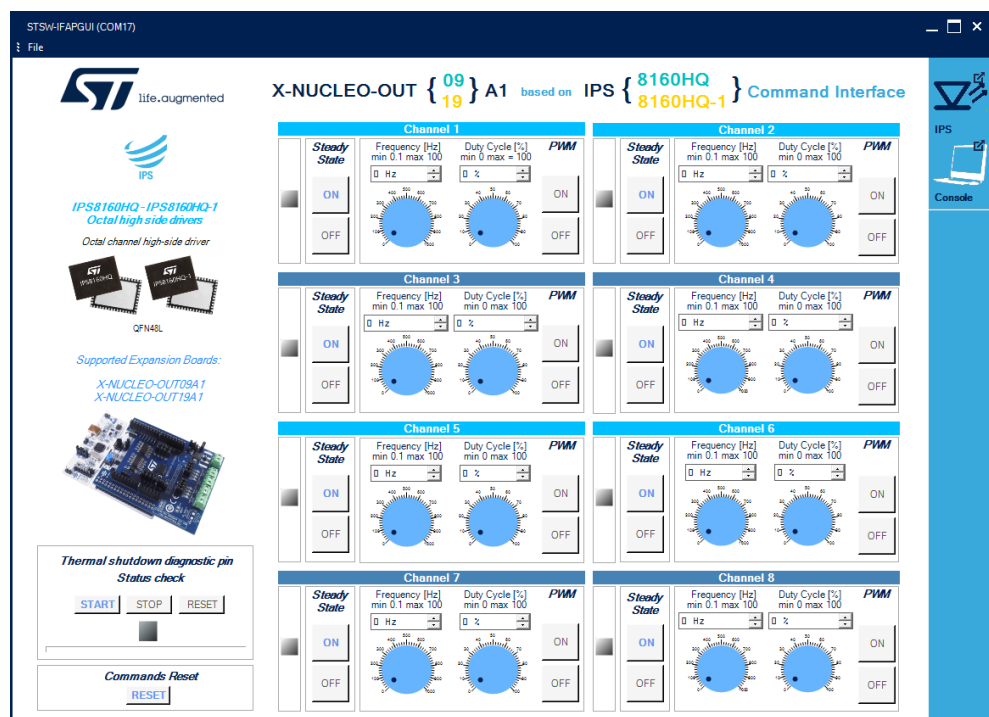
- Step 1.** Stack the X-NUCLEO-OUT09A1 (or X-NUCLEO-OUT19A1) on the NUCLEO-G431RB board flashed with the STSW-OUT9G4 firmware through the Arduino connectors.
- Step 2.** Connect the two stacked boards to your PC or laptop USB port through a micro-USB cable. The STM32 is supplied via USB (3.3 V) and the flashed firmware starts running. Press the black button on the NUCLEO-G431RB 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

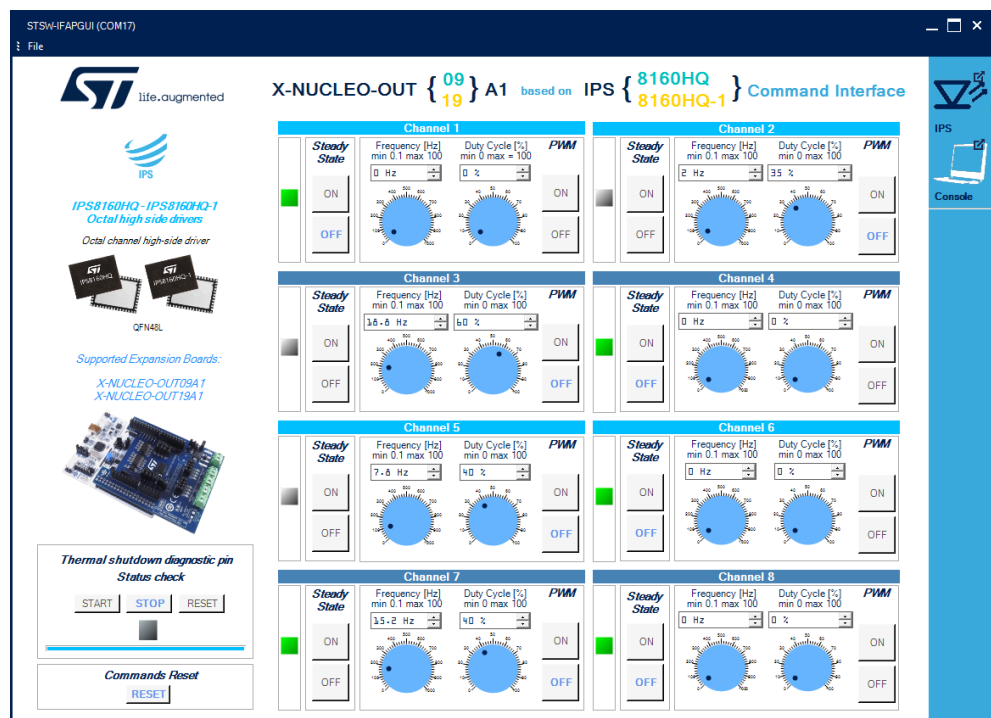


- Step 4.** Click on the GUI STM32 Nucleo icon after it turns blue (it remains green until the firmware identification is complete).
The STSW-IFAPGUI appears on the screen.

Figure 2. STSW-IFAPGUI main control panel



- Step 5.** Use the dedicated section of the GUI for the desired channel of IPS8160HQ (or IPS8160HQ-1)
- In each channel section use the left part to manage channel steady state
 - In each channel section use the right part to manage channel PWM settings
 - [**Commands Reset**] button, available in bottom left side of the GUI, can be used to reset any channel setting and also the diagnostic pin status check
- Step 6.** Connect the load and supply the power stage of the X-NUCLEO-OUT09A1 (or X-NUCLEO-OUT19A1) 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 [**Frequency**] and [**Duty Cycle**] input controls on the PWM part of desired channel section and then press the [**ON**] button to enable PWM feature for the current channel (or press the [**OFF**] button to turn off the PWM feature for the current channel).
- Step 8.** The desired output channel steady state can be activated / deactivated by clicking on the [**ON / OFF**] buttons on the left part of the desired channel section in the [**Steady State**] part.
- Step 9.** Click on the [**START**] button on the left side of the GUI to monitor the on/off status on the STATUS pin on IPS8160HQ (or IPS8160HQ-1)
- You can stop monitoring the fault status by clicking on the [**STOP**] button.
Press [**RESET**] button to reset the related fault status.

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-OUT09A1 (or X-NUCLEO-OUT19A1).

- Step 1.** Plug the X-NUCLEO-OUT09A1 or the X-NUCLEO-OUT19A1 expansion board on top of the NUCLEO-G431RB board, flashed with the STSW-OUT9G4 firmware, through the Arduino connectors.
- Step 2.** Connect the two stacked boards to your PC or laptop USB port through a micro-USB cable. The STM32 is supplied via USB (3.3 V) and the flashed firmware starts running. Press the black button on the NUCLEO-G431RB board to reset the firmware.
- Step 3.** Launch the serial communication terminal application (Tera Term). When the application starts, the serial communication must be configured as follows:

Figure 4. Tera Term: select serial communication method

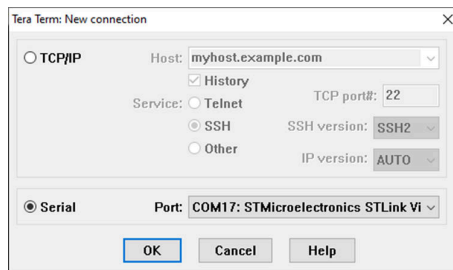


Figure 5. Tera Term: Setup/Terminal

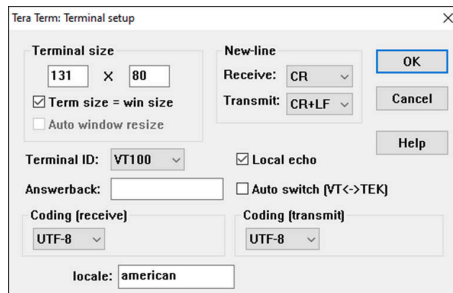
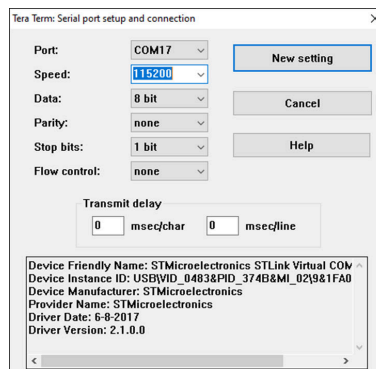
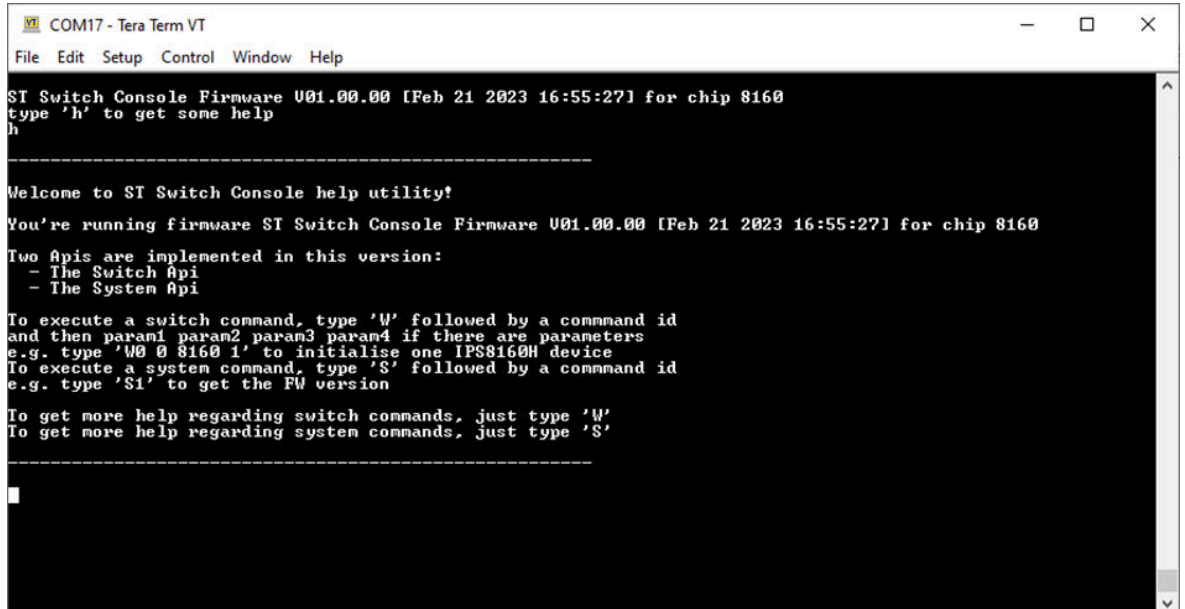


Figure 6. Tera Term: Setup/Serial port



Step 4. Press [Enter] and type [h] for help:

Figure 7. CLI help



```
COM17 - Tera Term VT
File Edit Setup Control Window Help
ST Switch Console Firmware U01.00.00 [Feb 21 2023 16:55:27] for chip 8160
type 'h' to get some help
h
-----
Welcome to ST Switch Console help utility!
You're running firmware ST Switch Console Firmware U01.00.00 [Feb 21 2023 16:55:27] for chip 8160
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 8160 1' to initialise one IPS8160H device
To execute a system command, type 'S' followed by a command id
e.g. type 'S1' to get the FW 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 available commands:

Figure 8. Command list

```

COM17 - Tera Term VT
File Edit Setup Control Window Help
ST Switch Console Firmware U01.00.00 [Feb 21 2023 16:55:27] for chip 8160
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>
    
```

Step 6. Initialize the device using [w0] command:

Figure 9. Device initialization

```

COM17 - Tera Term VT
File Edit Setup Control Window Help
w0 0 8160 1
0
    
```

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
24-May-2023	1	Initial release.

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