STSW-OUT1F4



Data brief

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

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STORED X-NUCLEO-OUTEVO2		Owneel 1		Channel 2
	Sheety State		CN	
Operating Made LOVD		Charles 2		Channel 4
Classed Schematinede	State State		0 Stand Sale 0 M	
COK ALL UNDROCK ALL		Chornel 5		Chennel 6
terf Channels on off	Shady Shafe ON OT		CH Start	
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State clock	Strady State ON OFF		Strate 2000 017	

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

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.



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.

Device: 8200 Port: COM69	☑ Auto detect FW version

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

STSW-IFAPGUI (COM69) i File											– 🗆 ×
life.augmented			Graph	ical Comn	nands	Inter Industrial D	rface f	Or X-NUCL	EO-OUT(01A2 132 Nucleo	Z [₿]
ISO8200BQ X-NUCLEO-OUT01A2			Channel 1					Channel 2	2		IPS
Octal channel high side drivers		Steady State	Frequency [Hz] min 0.1 max 100	Duty Cycle [%] min 0 max = 100	РИМ		Steady State	Frequency [Hz] min 0.1 max 100	Duty Cycle [%] min 0 max 100	РИМ	
		ON	200 000 000 200 000 000 200 000 000	- Andrew Control of the second	ON		ON	and the state of t	a Junior Market	ON	Console
TFQFPN32		OFF	•		OFF		OFF		•	OFF	
Load Operating Mode LOAD			Changel 2					Channel			
Press load for the current mode		Steady	Frequency [Hz]	Duty Cycle [%]	0444		Steady	Frequency [Hz]	Duty Cycle [%]	0444	
Output Enable Pin DISABLED		State	min 0.1 max 100	min 0 max 100	Риии		State	min 0.1 max 100	min 0 max 100	Рим	
ENABLE DISABLE		ON	a nu v	a sulfandar	ON		ON	**************************************	a fundamente	ON	
Channels Selection								100			
		OFF			OFF		OFF	3 ha		OFF	
CHECK ALL UNCHECK ALL			Channel 5	j				Channel 6	6		
Selected Channels ON OFF		Steady State	Frequency [Hz] min 0.1 max 100	Duty Cycle [%] min 0 max 100	РИМ		Steady State	Frequency [Hz] min 0.1 max 100	Duty Cycle [%] min 0 max 100	РИМ	
	1.00	ON	400 000 000 30000000	" and and	ON	100	ON	100 million and	a Soulande a	ON	
Selected Channels ON OFF											
РИМ		OFF	1. C		OFF		OFF			OFF	
Thermal shutdown diagnostic pin											
Status check		Charde	Channel 7	Duty Cuela (%)				Channel 8	Duty Could P(1		
START STOP RESET		State	min 0.1 max 100	min 0 max 100	РИМ		Steady State	min 0.1 max 100	min 0 max 100	PWM	
				□ × <u>→</u>	ON		ON	0 Hz 🛨			
		UN	200	a publication of the second	UN		ON	200 00000000000000000000000000000000000	a suddawala a su	ON	
Commands Reset RESET		OFF			OFF		OFF			OFF	



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.

life.augmented	IPS	Graphi	cal Comm	nands /	Interfac	e for X-NUC	LEO-OUT	01A2 ^{1132 Nucleo}
O8200BQ X-NUCLEO-OUT01A2		Channel 1				Channel	2	
Octal channel ph side drivers TFQFPNI2	Steady State ON OFF	Frequency [Hz] min 0.1 max 100	Duty Cycle [%] min 0 max = 100	ON OFF		Ady Trequency (Hz) min 0.1 max 100 D Hz Trequency (Hz) min 0.1 max 100 D Hz Trequency (Hz) min 0.1 max 100 D Hz Trequency (Hz) Trequency (Hz) T	Duty Cycle [%] min 0 max 100	
Load Operating Mode LOAD		Changel 2				Channel	1	
DIRECT CONTROL MODE	Stoarty	Erequency [Hz]	Duty Cycle [%]		Sta	adv Erequency [Hz]	Puty Cycle [%]	
Output Enable Pin ENABLED ENABLE DISABLE Channels Selection 2 8 2 6 2 6 2 6 2 6 3 6 4 6	State ON OFF	min 0.1 máx 100	min 0 max 100	ON OFF		min 0.1 max 100	min 0 max 100	ON OFF
CHECK ALL UNCHECK ALL		Channel 5				Channel	6	
elected Channels ON OFF Steady State elected Channels ON OFF PVM	Steedy State ON OFF	Frequency (Hz) min 0.1 max 100	Duty Cycle [%] min 0 max 100	ON OFF		Ady Frequency [Hz] min 0.1 max 100 D Hz	Duty Cycle [%] min 0 max 100	ON OFF
Thermal shutdown diagnostic pin		Channel 7				Channel	8	
START STOP RESET	Steady State	Frequency [Hz] min 0.1 max 100	Duty Cycle [%] min 0 max 100			Ady Frequency (Hz) min 0.1 max 100	Duty Cycle [%] min 0 max 100 75 %	

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

⊖ TCP/IP	Host: m	yhost.exai	nple.com		~
	Service: 〇	History Telnet	ТСР ро	rt#: 22	
	۲	SSH	SSH version:	SSH2	
		Other	IP version:	AUTO	
Serial	Port: CO	DM69: STN	licroelectronics	STLink '	/i ∖

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

Tera Term: Terminal setup		×
Terminal size	New-line Receive: CR ~	ОК
Term size = win size	Transmit: CR+LF \sim	Cancel
Terminal ID: VT100 V	🗹 Local echo	Help
Answerback:	Auto switch (VT<->T	EK]
Coding (receive) UTF-8 v	Coding (transmit) UTF-8 ~	
locale: american		

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

For.	COM69	~	New setting
Speed:	115200	~	3
Data:	8 bit	~	Cancel
Parity:	none	~	
Stop bits:	1 bit	~	Help
Flow control:	none	\sim	
0	msec/char	0 п	isec/line



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



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

Figure 8. Command list

🚨 COM69 - Tera Term VT	-	\times
File Edit Setup Control Window Help		_
ST Svitch Console Firmware U01.00.00 (Aug 2 2023 18:44:00) for chip 8200 type "A' to get some help w?		
Switch API commands list: 14: B IPS_SWITCH_API_INIT w0 Instance(IB) Schild(2B) HDBevices(1B) -> Output: status(4B)		
Id: 1 IPS_SWITCH_API_DEINIT w1 Instance(1B) → Output: status(4B)		
ld: 2 IPS_SWITCH_API_READ_ID w2 Instance(1B) → Output: status(6B)		
Id: 3 IPS_SWITCH_API_GET_FV_VERSION w3 Instance(1B) -> Output: status(8B)		
Id: 4 IPS_SWITCH_API_GET_CAPABILITIES v4 Instance(IB) -> Output: status(SB)		
ld: 5 IPS_SWITCH_API_GET_FAULT_STATUS v5 Instance(1B) -> Output: status(SB)		
ld: 6 IPS_SVITCH_API_GET_CHANNEL_STATUS v6 Instance(1B) Chanld(1B) -> Output: status(5B)		
ld: 7 IPS_SWITCH_API_SET_CHANNEL_STATUS w? Instance(1B) Chanld(1B) ChanStatus(1B) -> Output: status(4B)		
ld: 8 IPS_SWITCH_API_GET_ALL_CHANNEL_STATUS w8 Instance(IB) -> Output: status(SB)		
ld: 9 IPS_SVITCH_API_SET_ALL_CHANNEL_STATUS w9 Instance(1B) ChanBitmap(1B) -> Output: status(4B)		
ld: 10 IPS_SWITCH_API_GET_CHANNEL_FREQ w10 Instance(1B) ChanId(1B) -> Output: status(6B)		
ld: 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(SB)		
ld: 13 IPS_SWITCH_API_SET_CHANNEL_DC w13 Instance(1B) ChanId(1B) DutyCycle(1B) -> Output: status(4B)		
Id: 14 IPS_SVITCH_API_GET_PVM_ENABLE v14 Instance(1B) ChanId(1B) -> Output: status(5B)		
ld: 15 IPS_SWITCH_API_SET_PUM_EMABLE 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)		
ld: 18 IPS_SWITCH_API_SET_CTRL_PIN_STATUS w18 Instance(1B) CtrlPinId(1B) CtrlPinStatus(1B) -> Output: status(4B)		
ld: 19 IPS_SVITCH_API_SET_OPERATING_MODE w19 Instance<(1B) -> Output: status(SB)		
		- U

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

Figure 9. Device init



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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