

Introduction

STM32CubeProgrammer (STM32CubeProg) provides an all-in-one software tool to program STM32 devices in any environment: multi-OS, graphical user interface, or command line interface. It supports a wide choice of connections (JTAG, SWD, USB, UART, SPI, CAN, I2C), with manual operation or automation through scripting.

This document details the hardware and software environment prerequisites, as well as the available STM32CubeProgrammer software features.

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1 Getting started

This section describes the requirements and procedures to install the STM32CubeProgrammer software tool, which supports STM32 32-bit MCUs, based on Arm®(a) Cortex®-M processors, and STM32 32-bit MPUs, based on Arm® Cortex®-A processors.

1.1 System requirements

Supported operating systems and architectures:

- Windows® 10 32 bits (x86) or 64 bits (x64), and Windows® 11 64 bits (x64)
- Linux®: Ubuntu® LTS 22.04 and LTS 24.04, and Fedora® 42
- macOS® 15 (Sequoia), macOS® 26 (Tahoe): x86_64 and ARM-aarch64 architectures

Note: Windows is a trademark of the Microsoft group of companies.

Linux® is a registered trademark of Linus Torvalds.

Ubuntu® is a registered trademark of Canonical Ltd.

Fedora® is a trademark of Red Hat, Inc.

macOS® is a trademark of Apple Inc., registered in the U.S. and other countries and regions.

There is no need to install any Java™ SE Run Time Environment since version 2.6.0. The STM32CubeProgrammer runs with a bundled JRE available within the downloaded package, and no longer with the one installed on your machine.

Note: The bundled JRE is Liberica 8.0.432.

For macOS software the minimum requirements are:

- Rosetta® must be installed on MacOS computers embedding Apple® M1 processor specifically for macOS arch x86_64 package (installed automatically when installing the package)

The minimal supported screen resolution is 1024x768.

1.2 Installing STM32CubeProgrammer

This section describes the requirements and the procedure for the software usage. The setup offers also the optional installation of the “STM32 Trusted Package Creator” tool, used to create secure firmware files for secure firmware install and update. For more information, refer to UM2238 “STM32 Trusted Package Creator tool software description”, available on www.st.com.

arm

a. Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

1.2.1 Linux install

If you are using a USB port to connect to the STM32 device, install the libusb1.0 package by typing the following command:

```
sudo apt-get install libusb-1.0.0-dev
```

When using ST-LINK/J-Link probes or USB DFU to connect to a target, copy the rules files located under *Driver/rules* folder in */etc/udev/rules.d/* on Ubuntu ("sudo cp *.* /etc/udev/rules.d").

Note: libusb1.0.12 version or higher is required to run STM32CubeProgrammer.

Note: Docker and Ubuntu:

When using USB DFU in docker context, it is often needed to have the dev rules installed on the host machine, and create the container (docker run) using the following flags:

```
-v /dev:/dev --device /dev:/dev (to give the container access to the devices on the host machine)  
--net=host (to communicate udev host events to the container).
```

VirtualBox:

For optimal performance when using STM32CubeProgrammer in VirtualBox VM context, it is recommended to switch the USB Controller to USB 3.0 (xHCI) controller (found in Settings → USB).

Fedora:

To Install the libusb package execute the command sudo dnf install libusb1

To install the STM32CubeProgrammer tool, download and extract the zip package on your Linux machine from STM32CubeProg-Linux part number on the website, and execute *SetupSTM32CubeProgrammer-vx.y.z.linux*, which guides you through the installation process. In Ubuntu 20 STM32CubeProgrammer, icon is not enabled by default. To enable it, right click on the icon and choose "Allow launching".

1.2.2 Windows install

To install the STM32CubeProgrammer tool, download and extract the zip package from STM32CubeProg-Win-32bits or STM32CubeProg-Win-64bits for, respectively, Windows 32 bits and Windows 64 bits, and execute *SetupSTM32CubeProgrammer-vx.y.z.exe*, which guides you through the installation process.

1.2.3 macOS install

To install the STM32CubeProgrammer tool, download and extract the zip package from STM32CubeProg-Mac part number on the website and execute *SetupSTM32CubeProgrammer-vx.y.z.app*, which guides you through the installation process.

Note: If the installation fails, launch it in CLI mode using the command

```
./SetupSTM32CubeProgrammer-  
x.y.z.app/Contents/MacOs/SetupSTM32CubeProgrammer-x_y_z_macos.
```

Make sure you have administrator rights, then double-click *SetupSTM32CubeProgrammer-macos* application file to launch the installation wizard.

In case of error, try this fix:

1. Right-Click on SetupSTM32CubeProgrammer-2.12.0
2. Select "Show Package Contents"
3. Navigate to Contents/MacOs
4. Launch SetupSTM32CubeProgrammer-2_12_0_macos

1.2.4 DFU driver

If you are using the STM32 device in USB DFU mode, install the STM32CubeProgrammer DFU driver by running the "STM32 Bootloader.bat" file. This driver is provided with the release package, and can be found in the DFU driver folder.

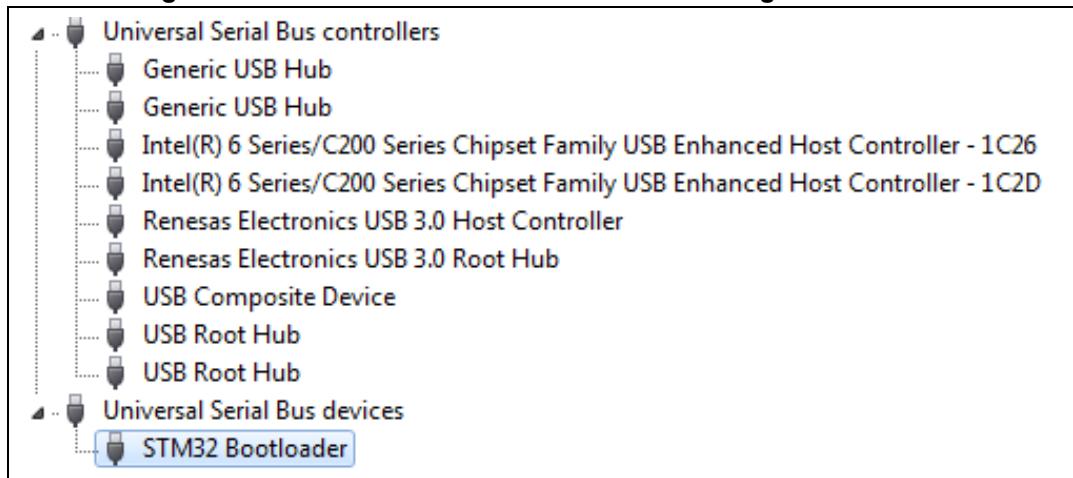
If the DFUSE driver is installed on your machine, first uninstall it, then reboot the machine and run the previously mentioned ".bat" file. Check the "Delete the driver software for this device option" to avoid reinstalling the old driver when, later, a board is plugged in.

Figure 1. Deleting the old driver software



Figure 2. STM32 DFU device with DfuSe driver



Figure 3. STM32 DFU device with STM32CubeProgrammer driver**Note:**

When using USB DFU interface or ST-LINK interface on a Windows 7 PC, ensure that all the drivers of the USB 3.0 controller drivers are updated. Older versions of the drivers may have bugs that prevent access or cause connection problems with USB devices.

1.2.5**ST-LINK driver**

To connect to an STM32 device through a debug interface using ST-LINK/V2, ST-LINKV2-1, ST-LINK-V3, or ST-LINKV3Power, install the ST-LINK driver by running the “*stlink_winusb_install.bat*” file. This driver is provided with the release package, it can be found under the “*Driver/stsw-link009_v3*” folder.

1.2.6**Segger Jlink/Flasher library**

The Segger Jlink/Flasher library is not mandatory for using STM32CubeProgrammer with other interfaces. If you want to build your own package without using it, the library can be deleted without impact on STM32CubeProgrammer.

1.2.7**Installing STM32CubeProgrammer from command line**

An installation from console window can be launched in interactive mode, or with a script generated via the installer.

To perform interactive installation, proceed as follows:

1. Extract (unzip) into a folder the installer file (SetupSTM32CubeProgrammer_win64.exe).
2. Open a Standard console window with administrator rights.
3. Navigate to the extracted folder using the command: cd <folder path>.
4. Run the command jre\bin\java -jar SetupSTM32CubeProgrammer-X.Y.Z.exe -console.

An initial panel is displayed to start the installation process. At each installation step, an answer is requested.

Figure 4. Installation in interactive mode

```
Press anything to continue
Analytics service enabled

STM32CubeProgrammer Components selection

Select the packs you want to install:
[x] Pack 'Core Files' required
-----
[x] Include optional pack 'STM32CubeProgrammer'
-----
Enter Y for Yes, N for No:
y
-----
[x] Include optional pack 'STM32TrustedPackageCreator'
-----
Enter Y for Yes, N for No:
y
Selected Packs [Core Files, STM32CubeProgrammer, STM32TrustedPackageCreator]

Press 1 to continue, 2 to quit, 3 to redisplay
1

STM32CubeProgrammer Package installation

=====
Installation started
Framework: 1.8.0_202-b08 (Oracle Corporation)
Platform: windows,version=10.0,arch=x64,symbolicName=WINDOWS_10,javaVersion=1.8.0_382
[ Starting to unpack ]
[ Processing package: Core Files (1/3) ]
[ Processing package: STM32CubeProgrammer (2/3) ]
[ Processing package: STM32TrustedPackageCreator (3/3) ]
[ Unpacking finished ]
Installation finished
```

1.2.8 Automatic/Silent installation mode

At end of an installation, performed either using STM32CubeProgrammer installer graphical interface or console mode, it is possible to generate an auto-installation script containing user configuration and preferences selected during the installation process.

To launch the installation in automatic/Silent mode, proceed as follows:

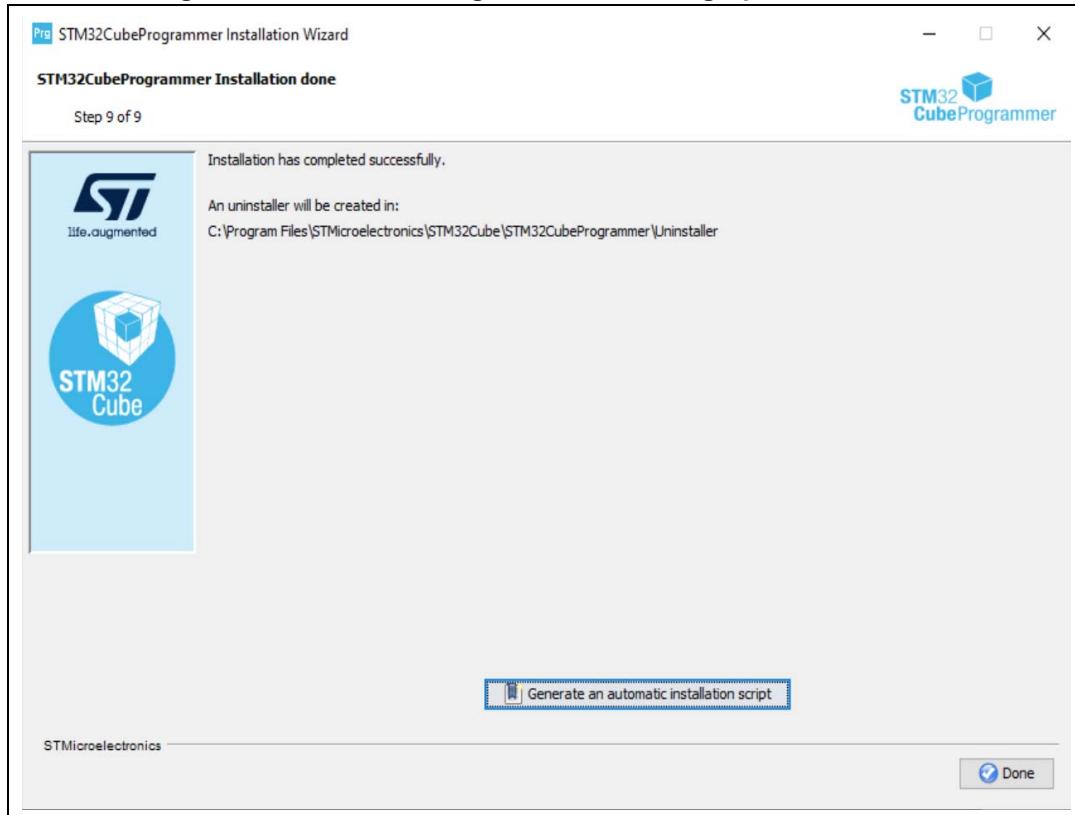
1. Extract (unzip) into a folder the installer file (SetupSTM32CubeProgrammer_win64.exe).
2. Open a Standard console window with administrator rights.
3. Navigate to the extracted folder using the command: cd <folder path>.
4. Run the Command jre\bin\java -jar SetupSTM32CubeProgrammer-X.Y.Z.exe ABSOLUTE_PATH_TO_AUTO_INSTALL.xml.

The installation starts without user interaction.

Figure 5. Auto-install using Console mode

```
-----
Generate an automatic installation script
-----
Enter Y for Yes, N for No:
Y
Select the installation script (path must be absolute)[C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer-Console\auto-install.xml]

Installation was successful
Application installed on C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer-Console
[ Writing the uninstaller data ... ]
[ Console installation done ]
```

Figure 6. STM32CubeProgrammer installer graphical interface

1.2.9 Uninstalling STM32CubeProgrammer standalone version

Uninstalling STM32CubeProgrammer on Windows:

- Through the Windows control panel:
 - a) Select Programs and Features to display the list of installed programs
 - b) Right-click STM32CubeProgrammer and select uninstall
- To perform the uninstallation from a shell prompt:
 - a) Open a Standard console window with administrator rights
 - b) Navigate to the uninstaller folder: cd <STM32CubeProgrammer installation path>\Uninstaller
 - c) Execute "unscript.bat"

Uninstalling STM32CubeProgrammer on Linux:

- From a terminal prompt:
 - a) Navigate to the uninstaller folder: cd <STM32CubeProgrammer installation path>\uninstaller
 - b) Execute the “uninstall.sh”

Uninstalling STM32CubeProgrammer on MacOs:

- Delete STM32CubeProgrammer installation folder

1.3 Language preference

The STM32CubeProgrammer supports multiple languages in addition to default English. Users can change the language by navigating to Help → Language.

The new language settings are applied after restarting the tool. In addition to manual language selection, STM32CubeProgrammer can automatically detect system language.

1.4 Updater

STM32CubeProgrammer updater allows users to make automatic updates of the software and its associated packages. The updater is available in all supported operating systems.

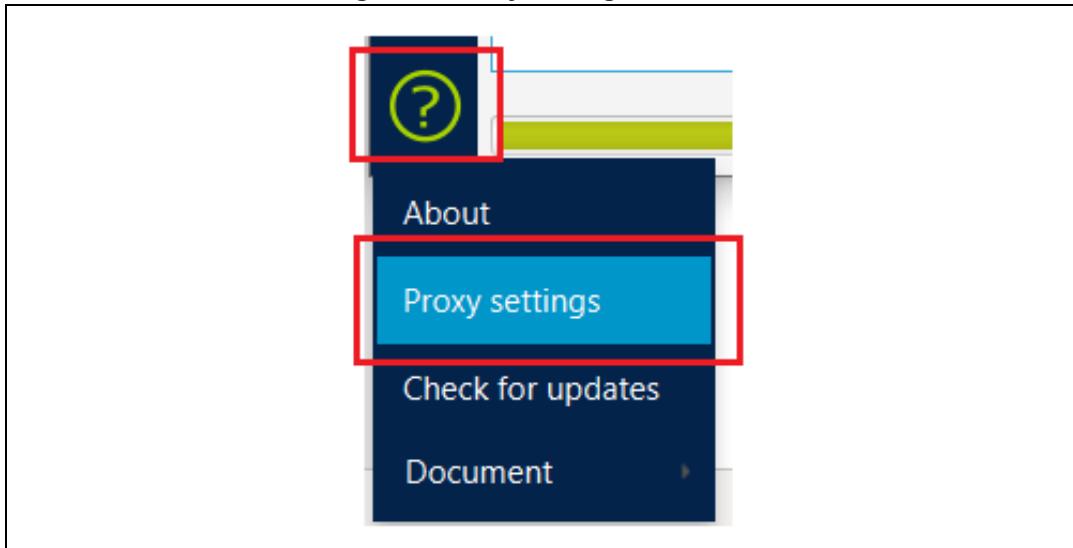
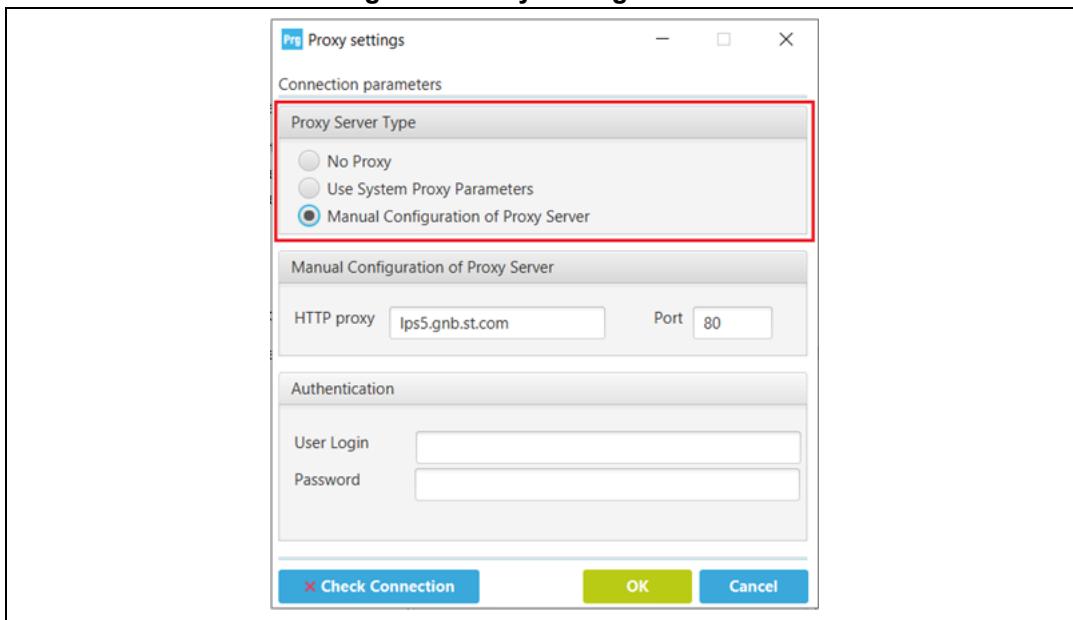
1.4.1 Update steps

1. Check the connection and update its settings if needed.
2. Check for updates.
3. Download the new version.
4. Install the downloaded version (the tool restarts once updated).

1.4.2 Proxy settings

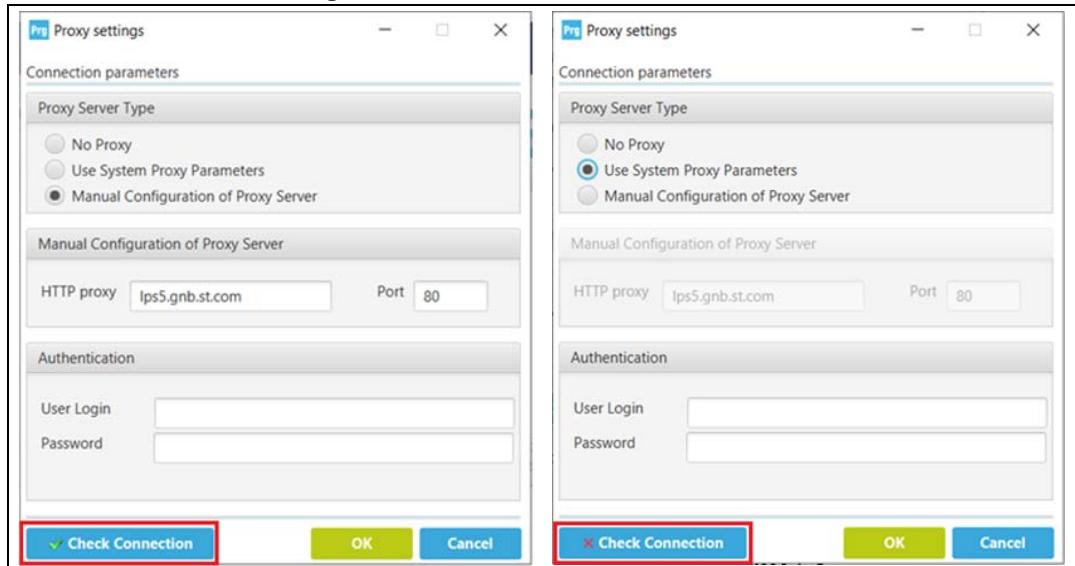
The user can manually check the connection by using the “Proxy Settings” window opened with the submenu available in the help button (see [Figure 7](#)). Three settings are available (see [Figure 8](#)):

- No proxy
- Use the system parameters
- Use manual configuration of server: add the HTTP proxy name, port, and credentials

Figure 7. Proxy settings submenu**Figure 8. Proxy settings window**

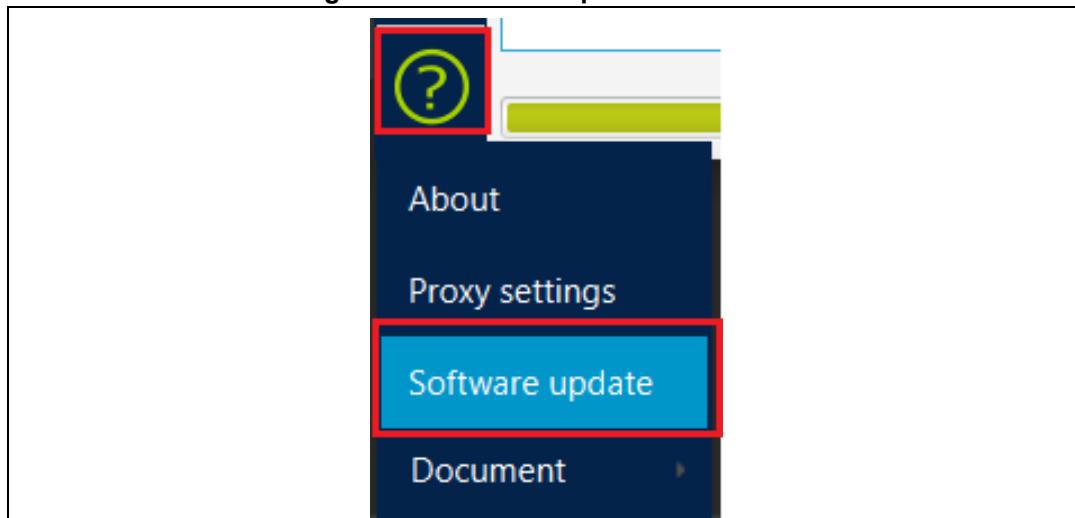
The status of connection check is displayed in the “check Connection” button:

- A green icon indicates success (left side of [Figure 9](#)).
- A red icon indicates that the connection is down (right side of [Figure 9](#)).

Figure 9. Successful connection check

1.4.3 Check for updates

The user can launch the update using the Updater window opened with the submenu “Software update” added in the Help button. Both the STM32CubeProgrammer tool and the components associated with the version currently in use can be updated.

Figure 10. Check for updates submenu

If there is a new version of the tool and/or of the components is available, an update button appears in the main menu ([Figure 11](#)).

Figure 11. Hyperlink button of new version available

Note: *If the user has already updated the STM32CubeProgrammer and the components patch, the hyperlink button is no longer displayed at startup.*

If a new version of the tool and/or of the components patch is available, the user can make updates through the updater window.

This window displays:

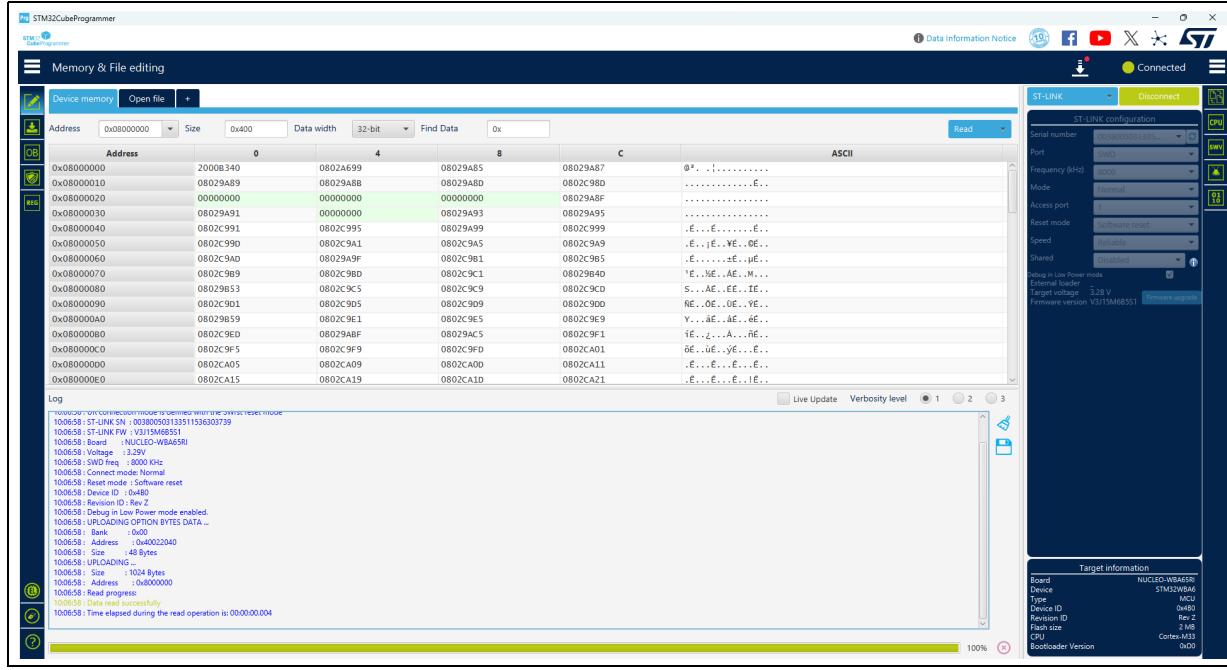
- The current version of the STM32CubeProgrammer and of the components patch
- The available version in server of STM32CubeProgrammer and of the components patch
- Change log (contains the main changes delivered in the new package and/or components patch)
- License
- Last update (contains the date of the last update, or the message “No previous updates are done”)
- The current version of the updater tool
- Refresh button (to check if there is a new version)
- Close button (to stop the installation of the new version)

Note: *Administrator rights are required to download the new package. Once the update is done, the updater window displays only the new version.*

2 STM32CubeProgrammer user interface for MCUs

2.1 Main window

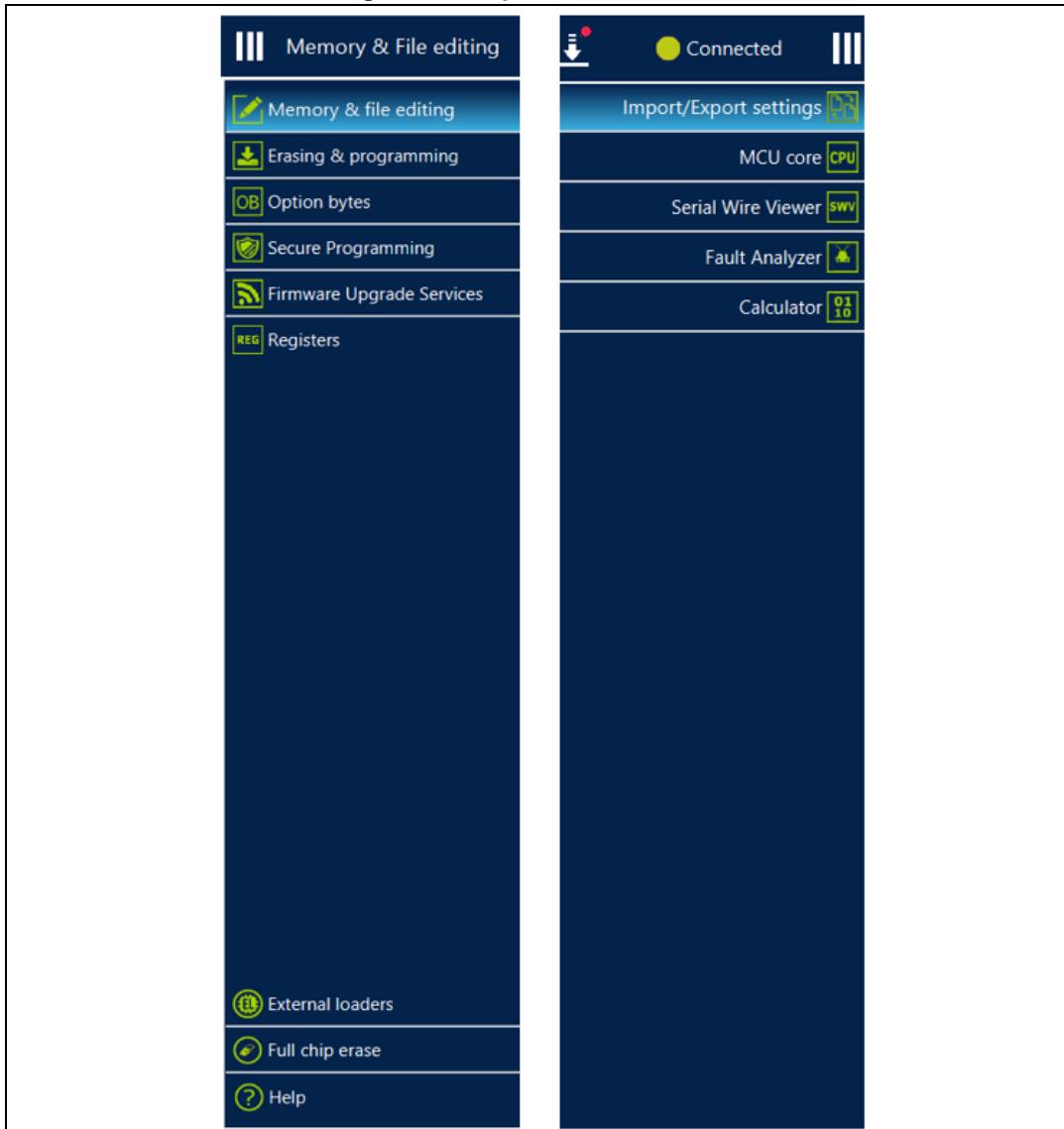
Figure 12. STM32CubeProgrammer main window



The main window is composed of the parts described in the following sections.

2.1.1 Main menu

This menu allows the user to switch between the three main panels of the Memory and file editing, Erasing & programming, and Option bytes tools. The other panels are displayed according to the used device. By clicking on the Hamburger menu (the three-line button) on the top left corner, the menu expands and displays the textual description shown in [Figure 13](#).

Figure 13. Expanded main menu

2.1.2 Log panel

Displays errors, warnings, and informational events related to the operations executed by the tool. The verbosity of the displayed messages can be refined using the verbosity ratio buttons above the log text zone. The minimum verbosity level is 1, and the maximum is 3 (all transactions via the selected interface are logged). All displayed messages are time stamped with the format "hh:mm:ss:ms", where "hh" is for hours, "mm" for minutes, "ss" for seconds and "ms" for milliseconds (in three digits).

On the right of the log panel there are two buttons, the first to clean the log, the second to save it to a log file.

If the selected language of the tool is not English, two log files are saved in the same location, one in English, the other in the selected language.

2.1.3 Progress bar

The progress bar visualizes the progress of any operation or transaction done by the tool (for example, Read, Write, Erase). Ongoing operations can be aborted by pressing the "Stop" button in front of the progress bar.

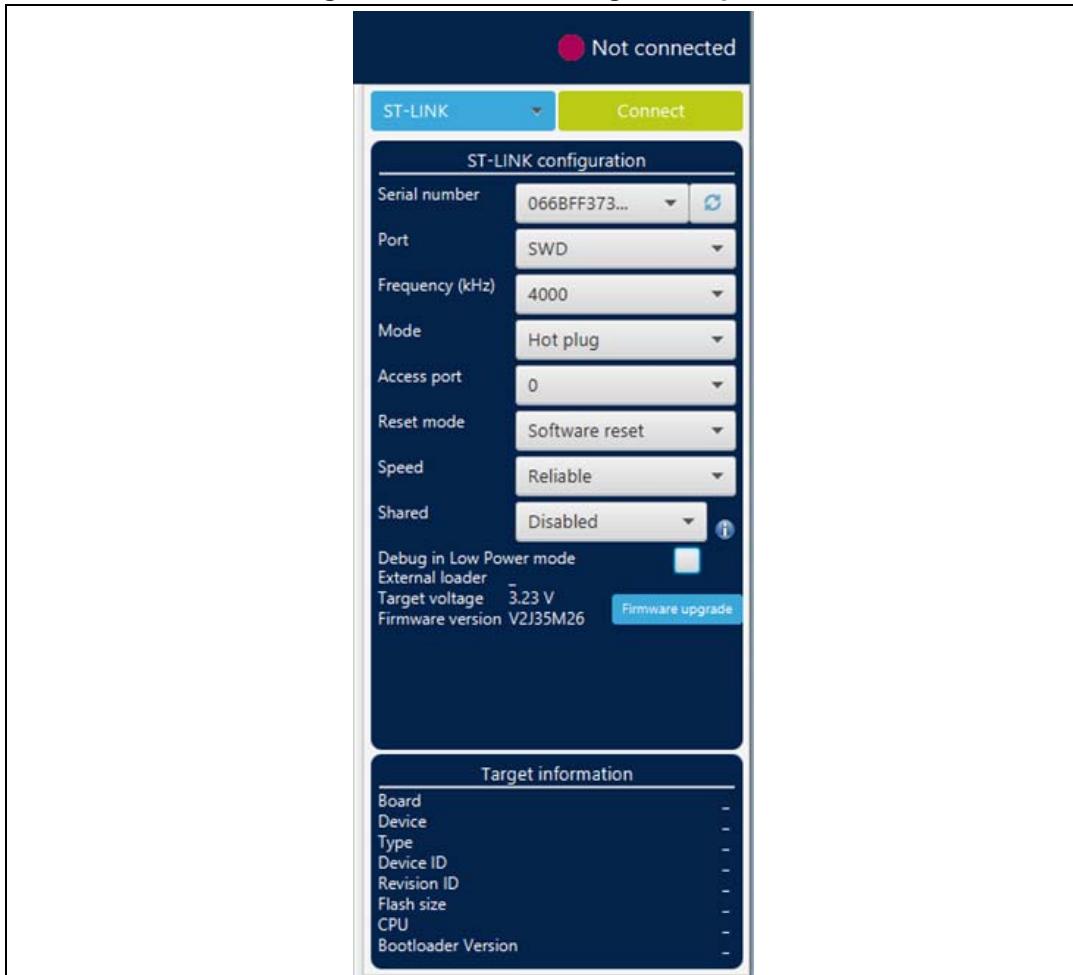
2.1.4 Target configuration panel

This is the first panel to look at before connecting to a target. It allows the user to select the target interface (either the debug interface using ST-LINK/J-Link debug probe, or the bootloader interface over UART, USB, SPI, CAN, or I2C).

With the refresh button the user can check the available interfaces connected to the PC. If this button is pressed while the ST-LINK/J-Link interface is selected, the tool checks the connected ST-LINK/J-Link probes, and lists them in the Serial numbers combo box. If the UART interface is selected, it checks the available communication ports of the PC, and lists them in the Port combo box. If the USB interface is selected, it checks the USB devices in DFU mode connected to the PC, and lists them in the Port combo box. Each interface has its own settings, to set before connection.

ST-LINK settings

Figure 14. ST-LINK configuration panel



- **Serial number:** this field contains the serial numbers of all connected ST-LINK probes. The user can choose one of them, based on its serial number.
- **Port:** ST-LINK probe supports two debug protocols, JTAG and SWD.

Note:

JTAG is not available on all embedded ST-LINK in the STM32 Nucleo or Discovery boards.

- **Frequency:** the JTAG or SWD clock frequency
- **Access port:** selects the access port to connect to. Most of the STM32 devices have only one access port, which is Access port 0.
- **Mode:**
 - **Normal:** with “Normal” connection mode, the target is reset then halted. The type of reset is selected using the “Reset Mode” option.
 - **Connect under reset:** this mode enables connection to the target using a reset vector catch before executing any instructions. This is useful in many cases, for example when the target contains a code that disables the JTAG/SWD pins.
 - **Hot plug:** enables connection to the target without a halt or reset. This is useful for updating the RAM addresses or the IP registers while the application is running.
 - **Power down:** used to put the target in debug mode, even if the application has not

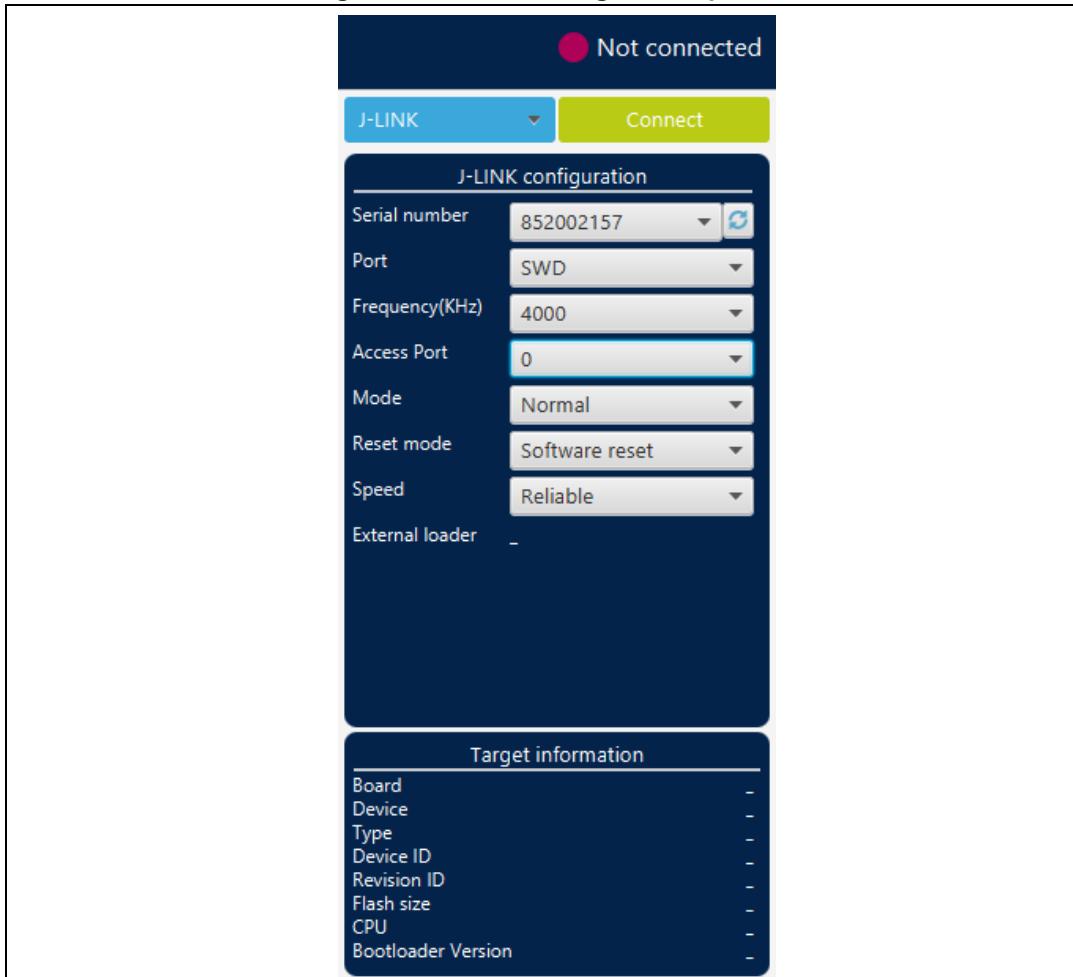
started since the target power-up. The hardware reset signal must be connected between ST-LINK and the target. This feature can be not fully effective on some boards (MB1360, MB1319, MB1361, MB1355) with STMPS2141 power switch.

- **hwRstPulse:** the tool generates a reset pulse, and then connects to the target. This connection mode does not prevent application launch before connection. It is used in some devices where under mode is not available (such as STM32WB0x and STM32WL33)
- **Reset mode:**
 - **Software system reset:** resets all STM32 components except the Debug via the Cortex-M application interrupt and reset control register (AIRCR).
 - **Hardware reset:** resets the STM32 device via the nRST pin. The RESET pin of the JTAG connector (pin 15) must be connected to the device reset pin.
 - **Core reset:** resets only the Cortex-M via the AIRCR^(a).
- **Speed (Cortex-M33 only):**
 - **Reliable:** allows the user to connect with a slow mode.
 - **Fast:** allows the user to connect with a fast mode.
- **Shared:** enables shared mode allowing connection of two or more instances of STM32CubeProgrammer or other debugger to the same ST-LINK probe.
- **Debug in low-power mode** (STM32U5/WB/L4 series only): sets the bits in DBGMCU_CR to 1.
- **External loader:** displays the name of the external memory loader selected in the “External loaders” panel accessible from the main menu (Hamburger menu).
- **Target voltage:** target voltage is measured and displayed.
- **Firmware version:** displays the ST-LINK firmware version. The firmware upgrade button allows you to upgrade the ST-LINK firmware.

a. Core reset does not exist for Cortex-M33, Cortex-M55 and Cortex-M85.

J-Link settings

Figure 15. J-Link configuration panel



- **Serial number:** this field contains the serial numbers of all connected J-Link probes. The user can choose one of them, based on its serial number.
- **Port:** J-Link probe supports only SWD debug protocol.
- **Frequency:** SWD clock frequency (only 4000 kHz is available).
- **Access port:** selects the access port to connect to. Most of the STM32 devices have only one access port (Access port 0).
- **Mode:**
 - **Normal:** the target is reset, then halted. Selected using the “Reset Mode” option.
 - **Connect under reset:** enables connection to the target using a reset vector catch before executing any instructions. Useful in many cases, for example when the target contains a code that disables the SWD pins.
 - **Hot plug:** enables connection to the target without a halt or reset. Useful to update the RAM addresses or the IP registers while the application is running.
- **Reset mode:**
 - **Software system reset:** resets all STM32 components except the Debug via Cortex-M application interrupt and reset control register (AIRCR).

- **Hardware reset**: resets the STM32 device via the nRST pin. The RESET pin of the SWD connector (pin 15) must be connected to the device reset pin.
- **Core reset**: resets only the Cortex-M via the reset control register^(a).
- **Speed** (Cortex-M33 only):
 - **Reliable**: allows the user to connect with a slow mode.
 - **Fast**: allows the user to connect with a fast mode.
- **External loader**: displays the name of the external memory loader selected in the External loaders panel accessible from the main menu (Hamburger menu).

UART settings

Figure 16. UART configuration panel



a. Core reset does not exist for Cortex-M33, Cortex-M55 and Cortex-M85.

- **Port:** selects the com port to which the target STM32 is connected. Use the refresh button to recheck the available com port on the PC.

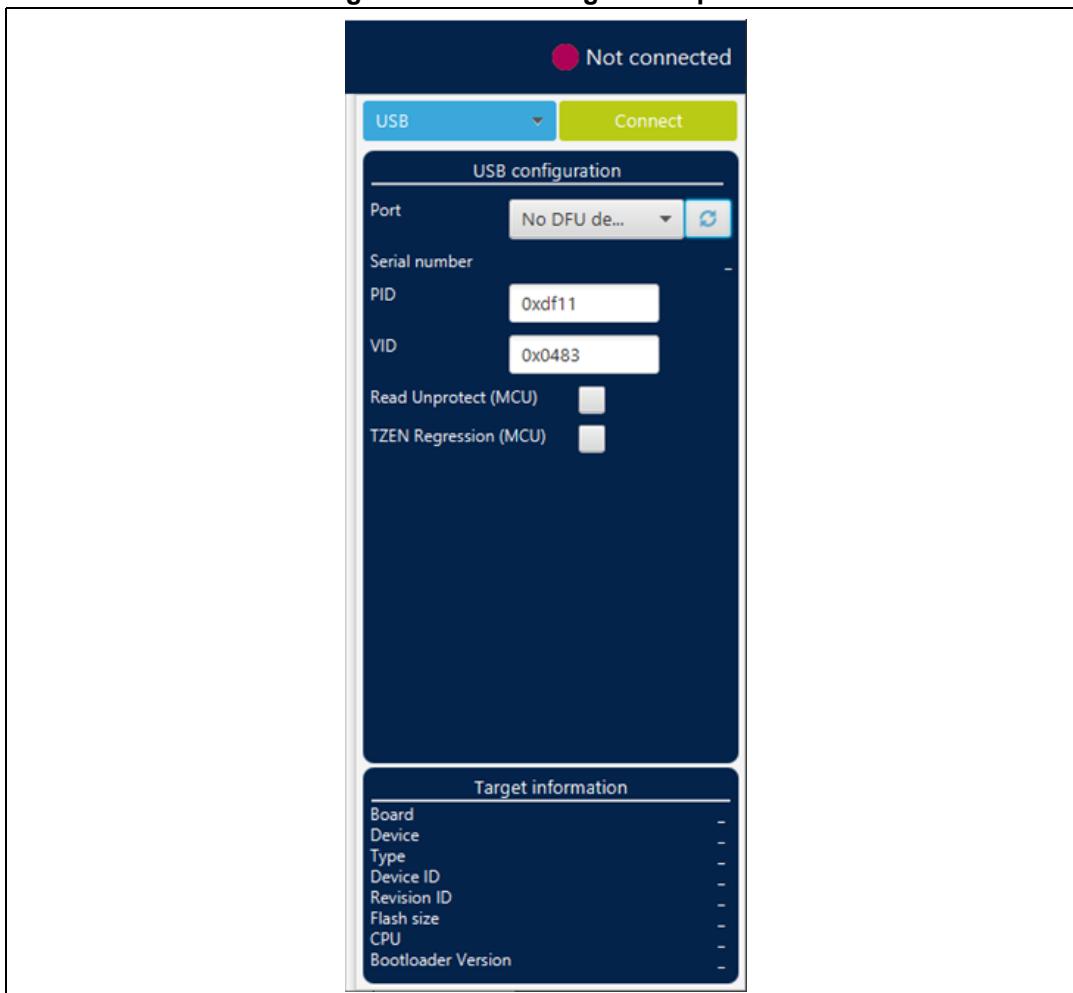
Note:

The STM32 must boot in bootloader mode using boot pins and/or the option bits. Check AN2606 "STM32 microcontroller system memory boot mode", available on www.st.com, for more information on the STM32 bootloader.

- **Baudrate:** selects the UART baud rate.
- **Parity:** selects the parity (even, odd, none), must be "even" for all STM32 devices.
- **Data bits:** must be always 8, only 8-bit data is supported by the STM32.
- **Stop bits:** must be always 1, only 1-bit stop is supported by the STM32.
- **Flow control:** must be always off.
- **RTS** (request to send): sets the COM RTS pin to either high or low level.
- **DTR** (data terminal ready): sets the COM DTR pin to either high or low level.

USB settings

Figure 17. USB configuration panel



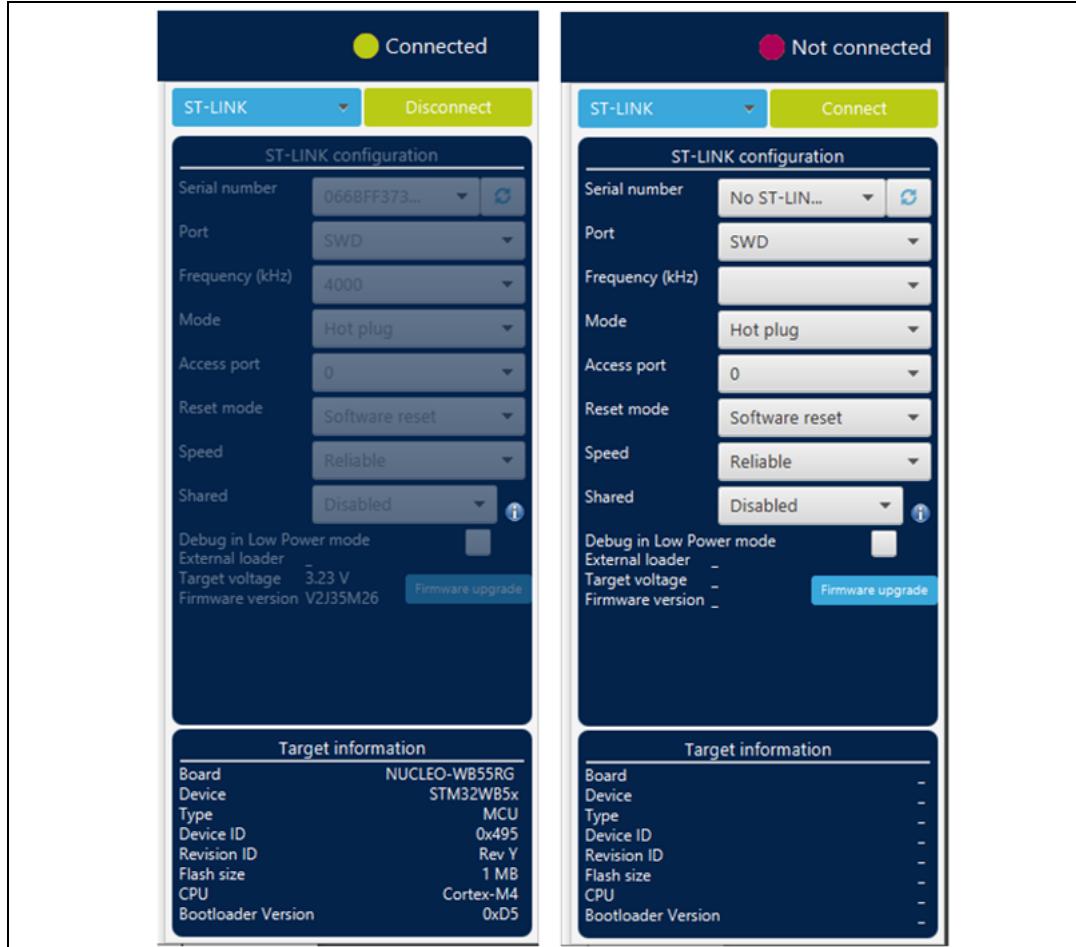
- **Port:** selects the USB devices in DFU mode connected to the PC. You can use the refresh button to recheck the available devices.

Note: The STM32 must boot in bootloader mode using boot pins and/or the option bits. Check AN2606, available on www.st.com, for more information.

Note: Once the correct interface settings are set, click on the “Connect” button to connect to the target interface. If the connection succeeds, it is shown in the indicator above the button, which turns to green.

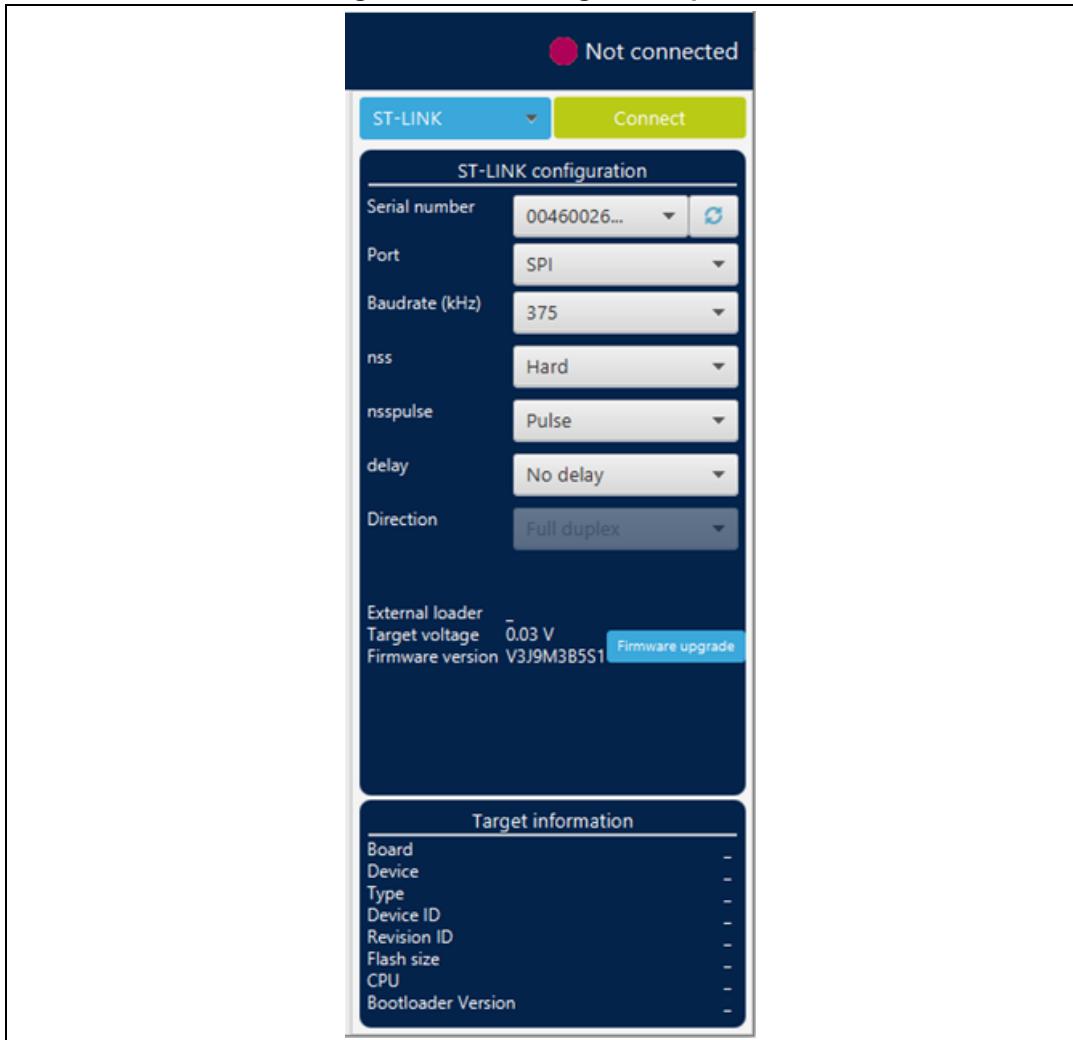
Once connected, the target information is displayed in the device information section below the settings section, which is then disabled, as in *Figure 18*.

Figure 18. Target information panel



SPI settings

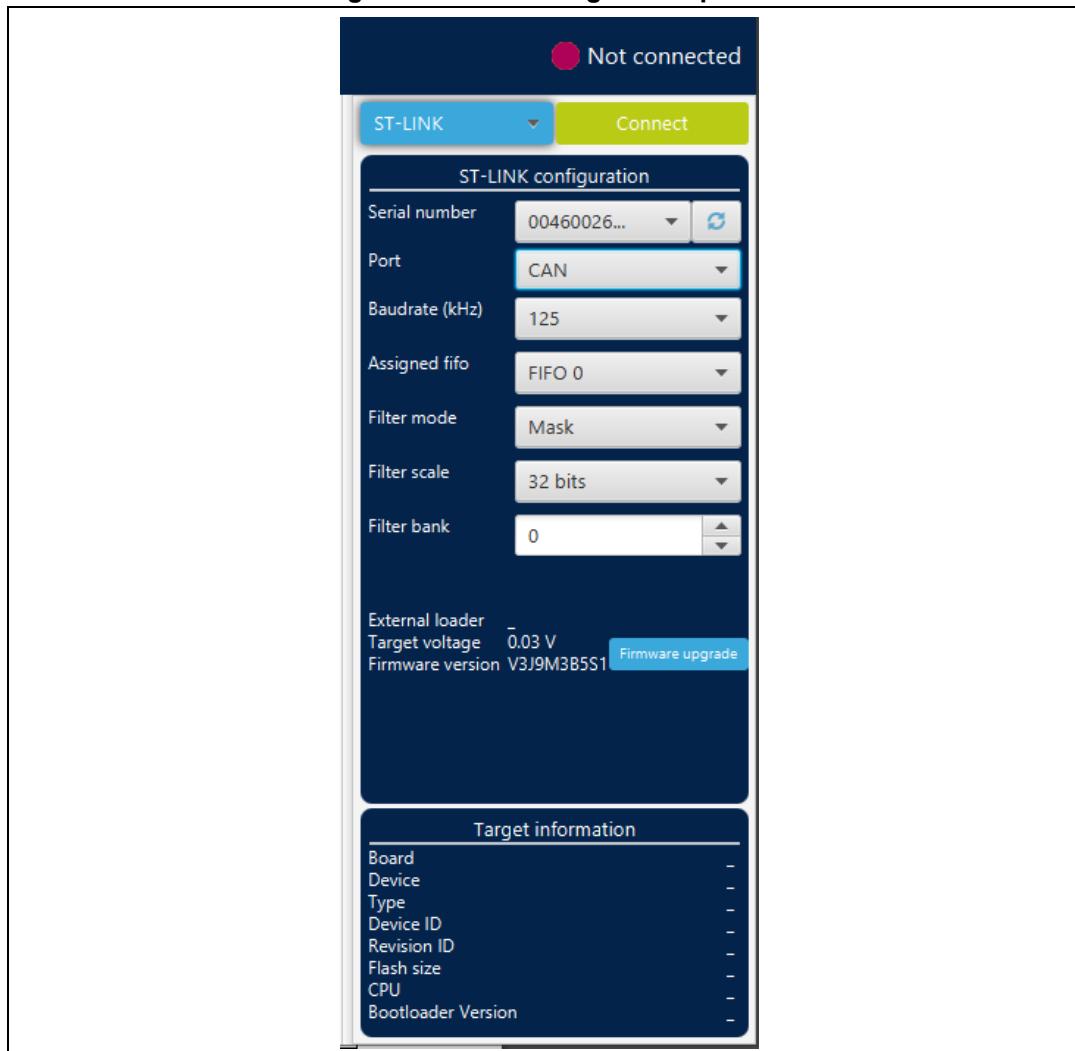
Figure 19. SPI configuration panel



- **Serial number:** this field contains the serial numbers of all connected ST-LINK-V3 probes in case of use of SPI bootloader.
- **Port:** selects the SPI devices connected to the PC. Use the refresh button to recheck the available devices.
- **Baudrate:** selects the SPI baud rate.
- **nss:** slave select software or hardware.
- **nspulse:** the slave selection signal can operate in a pulse mode, where the master generates pulses on nss output signal between data frames for a duration of one SPI clock period when there is a continuous transfer period.
- **Delay:** used to insert a delay of several microseconds between data.
- **Direction:** must be always Full-duplex, both data lines are used, and synchronous data flows in both directions.

CAN settings

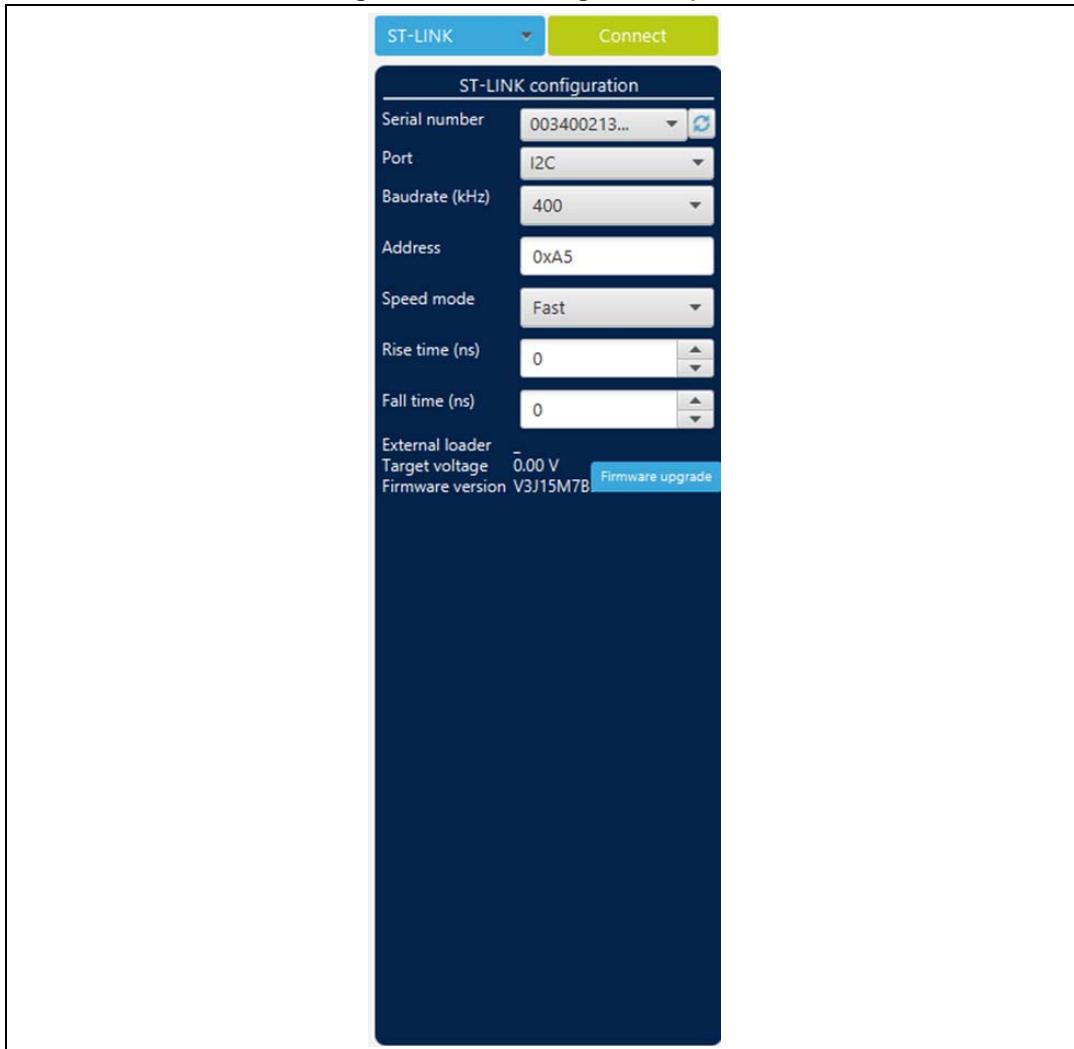
Figure 20. CAN configuration panel



- **Serial number:** this field contains the serial numbers of all connected ST-LINK-V3 probes in case to use CAN bootloader.
- **Port:** selects the CAN devices connected to the PC. You can use the refresh button to recheck the available devices.
- **Baudrate:** selects the CAN baud rate.
- **Assigned FIFO:** selects the receive FIFO memory to store incoming messages.
- **Filter mode:** selects the type of the filter, MASK, or LIST.
- **Filter scale:** selects the width of the filter bank, 16 or 32 bits.
- **Filter bank:** values between 0 and 13, to choose the filter bank number.

I2C settings

Figure 21. I2C configuration panel



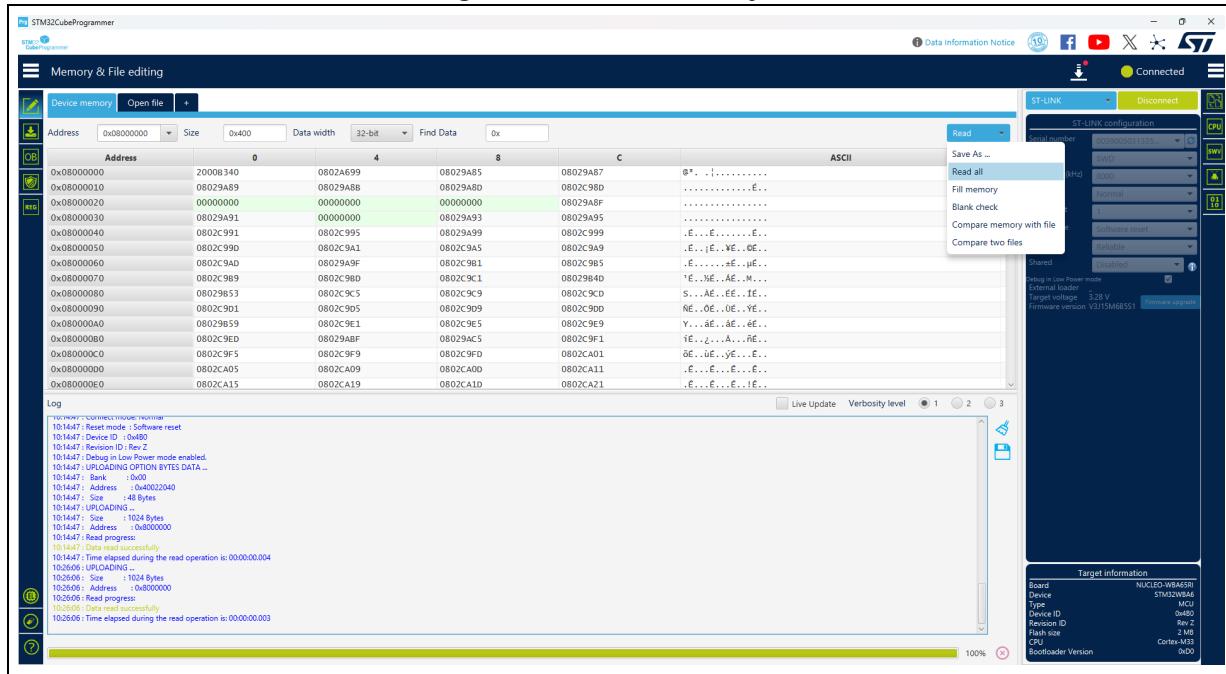
- **Serial number:** this field contains the serial numbers of all connected ST-LINK-V3 probes when using the I2C bootloader.
- **Port:** selects the I2C devices connected to the PC. You can use the refresh button to recheck the available devices.
- **Baudrate:** selects the I2C baud rate.
- **Address:** adds the address of the slave bootloader in hex format.
- **Speed mode:** selects the speed mode of the transmission Standard or Fast.
- **Rise time:** chooses values according to Speed mode, 0-1000 (STANDARD), 0-300 (FAST).
- **Fall time:** chooses values according to Speed mode, 0-300 (STANDARD), 0-400 (FAST).

2.2 Memory & file edition

This panel allows the user to read and display target memory and file contents.

2.2.1 Reading and displaying target memory

Figure 22. Device memory tab

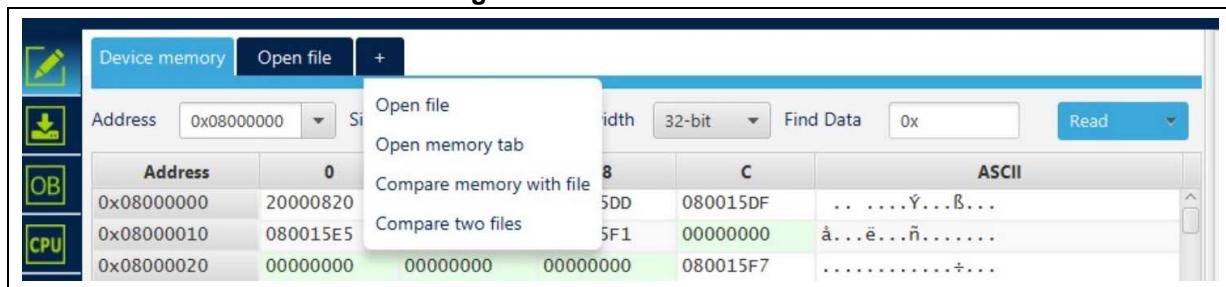


After target connection, the STM32 target memory can be read using this panel. To do this, specify the address and the size of the data to read, then press the Read button in the top-left corner. Data can be displayed in different formats (8-, 16-, and 32-bit) using the “Data width” combo box.

The user can read all the flash memory using the “Read All” button, save the device memory content in a .bin, .hex, or .srec file using the “Save As...” menu from the tab contextual menu or the action button.

Multiple device memory tabs can be opened to display different locations of the target memory. To do this, click on the “+” tab to display a contextual menu that allows you to add a new “Device memory” tab, or to open a file and display it in a “File” tab.

Figure 23. Contextual menu



2.2.2 Reading and displaying a file

To open and display a file, just click on the “+” and select “Open File” menu, as illustrated in [Figure 23](#).

The supported formats are binary files (.bin), ELF files (.elf, .axf, .out), Intel hex files (.hex), and Motorola S-record files (.srec).

Once the file is opened and parsed, it is displayed in a dedicated tab with its name. The file size is displayed in the “Size” field, and the start address of hex, srec, or ELF files, is displayed in the “Address” field (for a binary file it is 0).

The address field can be modified to display the file content starting from an offset. Using the tab contextual menu or the action button, the file can be downloaded using the “Download” button/menu. For a binary file, specify the download address in the “Address” menu. The user can verify if the file is downloaded using the “Verify” menu, and save it in another format (.bin, .hex or .srec).

As for the “Device memory” tab, the user can display the file memory content in different formats (8-, 16-, and 32-bit), using the “Data width” combo box.

2.3 Memory programming and erasing

This panel is dedicated to flash memory programming and erasing operations.

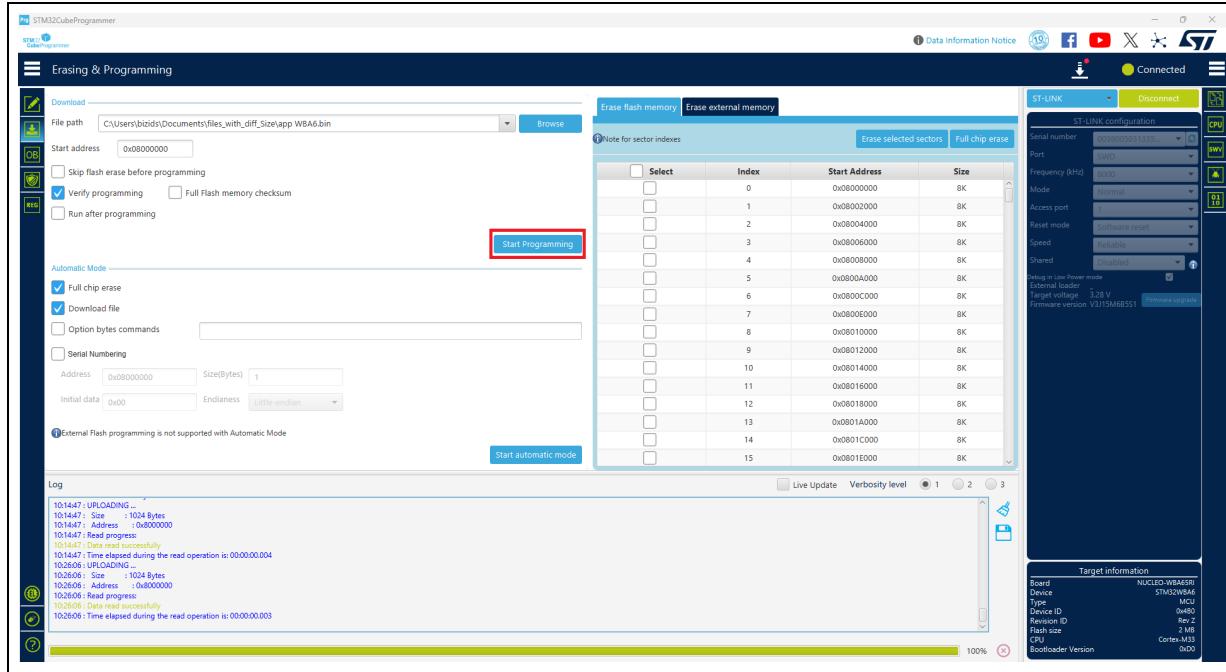
Note:

STM32CubeProgrammer is able to write on aligned memory regions. Flash memory imposes a data alignment described in STM32 reference manual. As an example, for STM32U5 devices, the reference manual indicates in that this MCU supports: "137 bits wide data read and write (128 effective bits plus 9 ECC bits)", which means that data must be aligned on 16 bytes.

2.3.1 Internal flash memory programming

All modifications involving the PC register need a board reset.

Figure 24. Flash memory programming and erasing (internal memory)



Memory programming

To program a memory, go through the following steps:

1. Click on the browse button and select the file to program. The supported formats are binary files (.bin), ELF files (.elf, .axf, .out), Intel hex files (.hex) and Motorola S-record files (.Srec).
2. In case of a binary file, the address must be set.
3. Select the programming options:
 - Verify after programming: read back the programmed memory and compare it byte per byte with the file.
 - Skip flash memory erase before programming: if checked, the memory is not erased before programming. This option must be checked only when you are sure that the target memory is already erased.
 - Run after programming: start the application just after programming.
4. Click on the “Start programming” button.

The progress bar on the bottom of the window shows the progress of the operation.

The user can also edit the memory through the displayed memory grid in the Memory & File Editing tab, by double clicking on the ASCII field or on one of the memory grid cells. The value is padded if necessary.

Memory erasing

Once connected to a target, the memory sectors are displayed in the right-hand panel, showing the start address and the size of each sector. To erase one or more sectors (flash or EEPROM), select them in the first column, and then click on the “Erase selected sectors” button.

Select “Full Flash memory checksum” to enable checksum calculation at the end of the download file.

The “Full chip erase” button erases the whole memory.

2.3.2 External flash memory programming

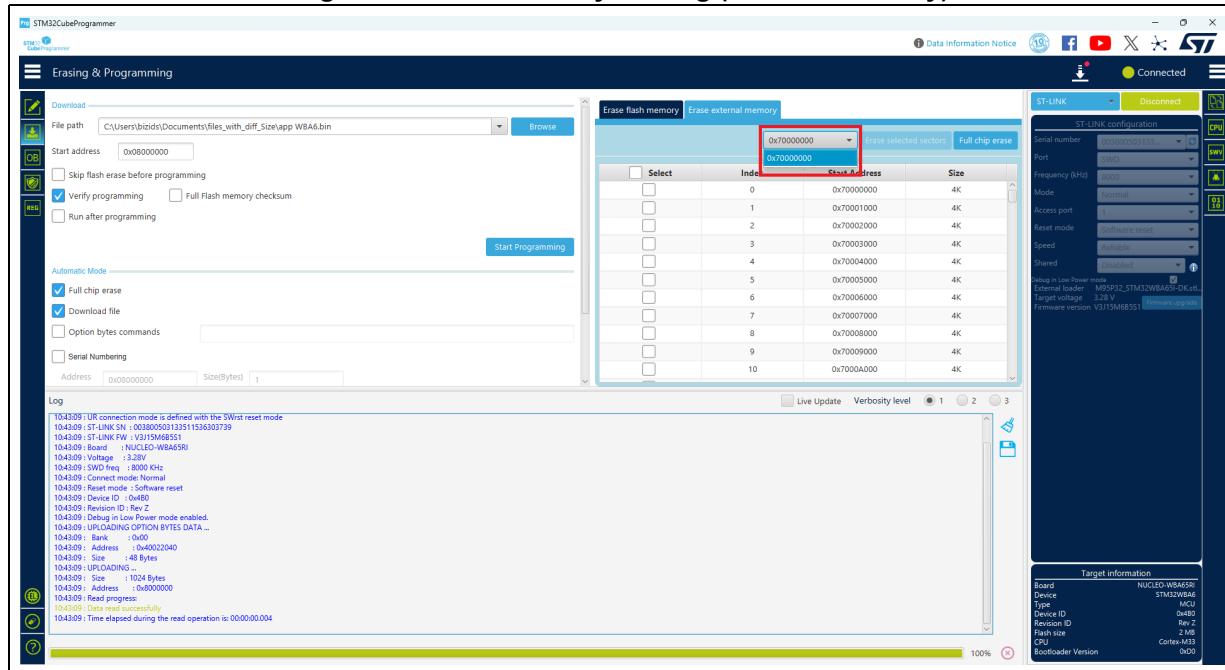
To program an external memory connected to the microcontroller via any of the available interfaces (for example SPI, FMC, FSMC, QSPI, OCTOSPI) you need an external loader.

STM32CubeProgrammer is delivered with external loaders for several STM32 evaluation and discovery boards (refer to the “bin/ExternalLoader” directory). If you need to create a new external loader, see [Section 2.3.3](#) for more details.

To program an external memory, select one (or more) external loader(s) from the “ExternalLoader” panel, which is (are) used by the tool to read, program, or erase external memories. Once selected, the external loader(s) is (are) used for any memory operation in its (their) memory range.

The “External flash erasing” tab on the right of the “Erasing and Programming” panel displays the memory sectors for each selected loader, and enables sector or full-chip erase, as shown in [Figure 25](#).

Figure 25. Flash memory erasing (external memory)



2.3.3 Developing customized loaders for external memory

Based on the examples available on ST Github:

<https://github.com/STMicroelectronics/stm32-external-loader>, users can develop their custom loaders for a given external memory.

The programming mechanism is the same used by the STM32 ST-LINK utility tool. Any flash loader developed for use with the ST-LINK utility is compatible with the STM32CubeProgrammer tool, and can be used without any modification.

To create a new external memory loader, follow the steps below:

1. Update the device information in *StorageInfo* structure in the *Dev_Inf.c* file with the correct information concerning the external memory.
2. Rewrite the corresponding functions code in the *Loader_Src.c* file.
3. Change the output file name.

Note: *Some functions are mandatory and cannot be omitted (see the functions description in the Loader_Src.c file). Linker or scatter files must not be modified.*

After building the external loader project, an ELF file is generated. The extension of this file depends upon the used toolchain (.axf for Keil, .out for EWARM, and .elf for TrueSTUDIO or any gcc-based toolchain).

The extension of the ELF file must be changed to ".stldr" and the file must be copied under the "bin/ExternalLoader" directory.

Loader_Src.c file

The development of an external loader for a memory, based on a specific IP, requires the following functions:

- **Init**

Defines the used GPIO pins connecting the external memory to the device, and initializes the clock of the used IPs.

Returns 1 if success, and 0 if failure.

```
int Init (void)
```

- **Write**

Programs a buffer defined by an address in the RAM range.

Returns 1 if success, and 0 if failure.

```
int Write (uint32_t Address, uint32_t Size, uint8_t* buffer)
```

- **SectorErase**

Erases the memory specified sectors.

Returns 1 if success, and 0 if failure.

```
int SectorErase (uint32_t StartAddress, uint32_t EndAddress)
```

Where "**StartAddress**" equals the address of the first sector to be erased and "**EndAddress**" equals the address of the end sector to be erased.

Note: *This function is not used in case of an external SRAM loader.*

The functions mentioned above must be defined in an external loader. They are used by the tool to erase and program the external memory. For instance, if the user clicks on the program button from the external loader menu, the tool performs the following actions:

- Calls the **Init** function to initialize the interface (such as QSPI) and the flash memory
- Calls **SectorErase()** to erase the needed flash memory sectors
- Calls the **Write()** function to program the memory

It is possible to define additional functions:

- **Read** function

The **Read** function is used to read a specific range of memory, and returns the reading in a buffer in the RAM.

Returns 1 if success, and 0 if failure.

```
int Read (uint32_t Address, uint32_t Size, uint16_t* buffer)
```

Where “**Address**” = start address of read operation, “**Size**” is the size of the read operation and “**buffer**” is the pointer to data read.

Note: For Quad-/Octo-SPI memories, the memory mapped mode can be defined in the *Init* function; in that case, the *Read* function is useless, as data can be read directly from JTAG/SWD interface.

- **Verify** function

The **Verify** function is called when selecting the “verify while programming” mode. This function checks if the programmed memory corresponds to the buffer defined in the RAM. It returns an uint64 defined as follows:

```
Return value = ((checksum<<32) + AddressFirstError)
```

where **AddressFirstError** is the address of the first mismatch, and **checksum** is the checksum value of the programmed buffer.

```
uint64_t Verify (uint32_t FlashAddr, uint32_t RAMBufferAddr,
                 uint32_t Size)
```

- **MassErase** function

The **MassErase** function erases the full memory.

Returns 1 if success, and 0 if failure.

```
int MassErase (void)
```

- A checksum function

All the functions described return 1 in case of a successful operation, 0 in case of a fail.

Dev_Inf.c file

The StorageInfo structure defined in this file provides information on the external memory. An example of the type of information defined by this structure is given below:

```
#if defined (__ICCARM__)
    __root struct StorageInfo const StorageInfo = {
#else
    struct StorageInfo const StorageInfo = {
#endif
        "External_Loader_Name", // Device Name + version number
        MCU_FLASH, // Device Type
        0x08000000, // Device Start Address
        0x00100000, // Device Size in Bytes (1MBytes/8Mbits)
        0x00004000, // Programming Page Size 16KBytes
        0xFF, // Initial Content of Erased Memory
        // Specify Size and Address of Sectors (view example below)
        0x00000004, 0x00004000, // Sector Num : 4, Sector Size: 16KBytes
        0x00000001, 0x00010000, // Sector Num : 1, Sector Size: 64KBytes
        0x00000007, 0x00020000, // Sector Num : 7, Sector Size: 128KBytes
        0x00000000,
    };
}
```

2.3.4 External memory programming with bootloader interfaces on GUI

This feature is supported by STM32H7Rx/7Sx products. Go through the sequence outlined below to successfully program the external memory using bootloader interfaces:

1. Ensure that there is no external loader already selected before connecting the board through STM32CubeProgrammer
2. Choose the bootloader interface (USB and USART are currently supported), then connect
3. Select the external loader operating on your board (only one can be selected)
4. The open bootloader is loaded
5. Write, read, and erase operations can be performed

Note: If the board is disconnected, a hardware reset is needed to connect again to the interface.

Note: Go through step 1 again to perform another external memory programming via bootloader.

2.4 Option bytes

This panel allows the user to read and display target option bytes grouped by categories. The option bits are displayed in tables with three columns containing the bit name, the bit value, and a description of the impact on the device.

The user can modify the option bytes by updating the value fields, then clicking on the Apply button, which programs and then verifies that the bytes are correctly programmed. The user can click at any time on the Read button, to read and refresh the displayed option bytes.

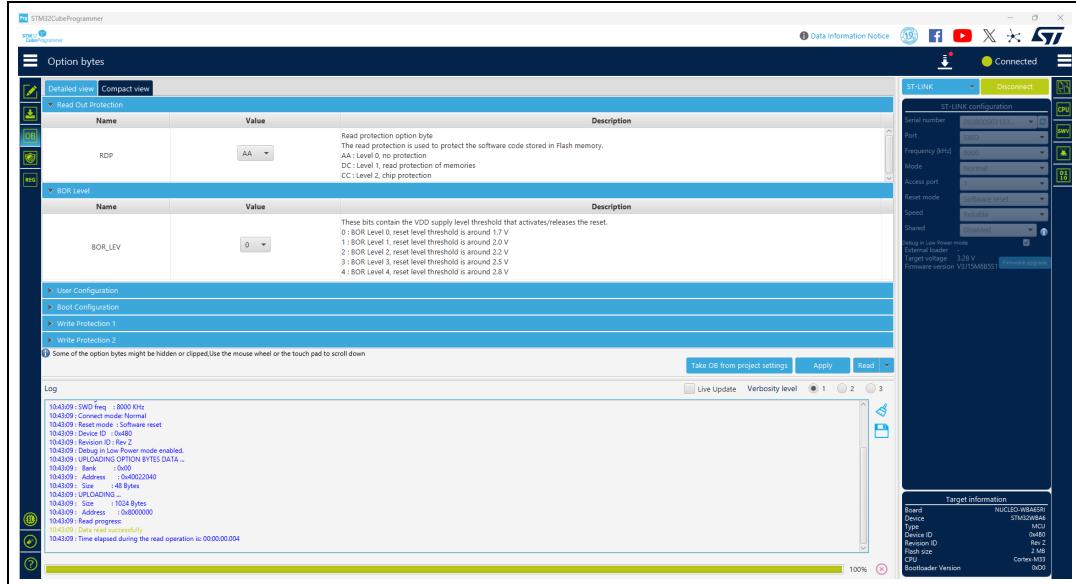
For more details refer to the option bytes section in the programming and reference manuals, available from www.st.com.

2.4.1 Synthetic option bytes view

The user has two ways to display and edit the option bytes

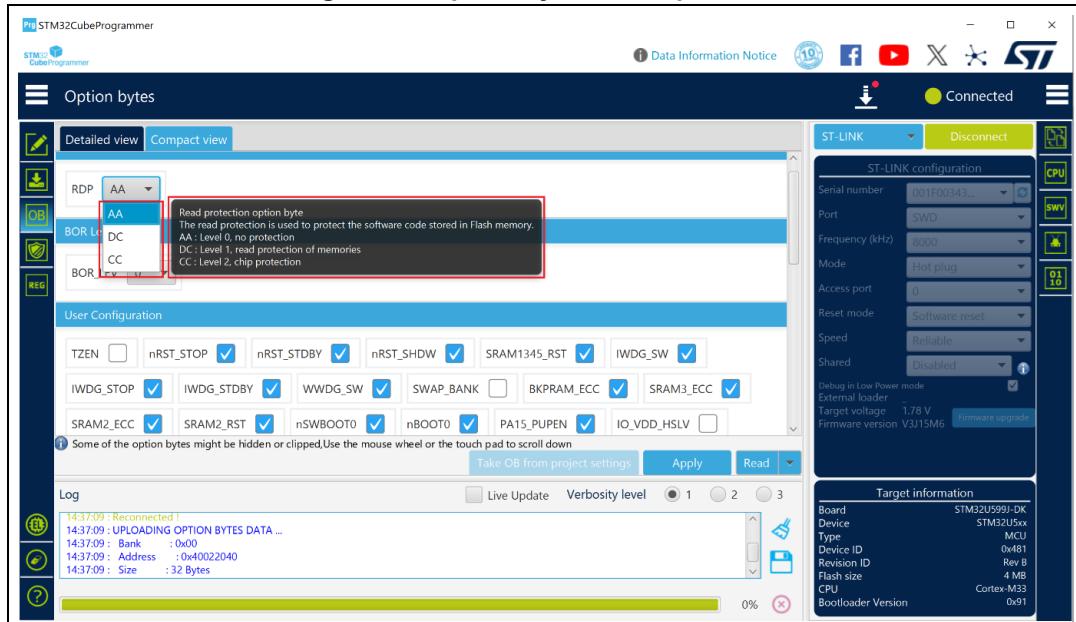
- Detailed (default) view: contains the name, the value, and the description of the option bytes.

Figure 26. Option bytes - Detailed view



- Compact view: presents a lower detail level, tailored for expert users who require a compact overview. It excludes the description field of each option byte, and focuses on presenting a list with their values. The description is displayed as a tooltip.

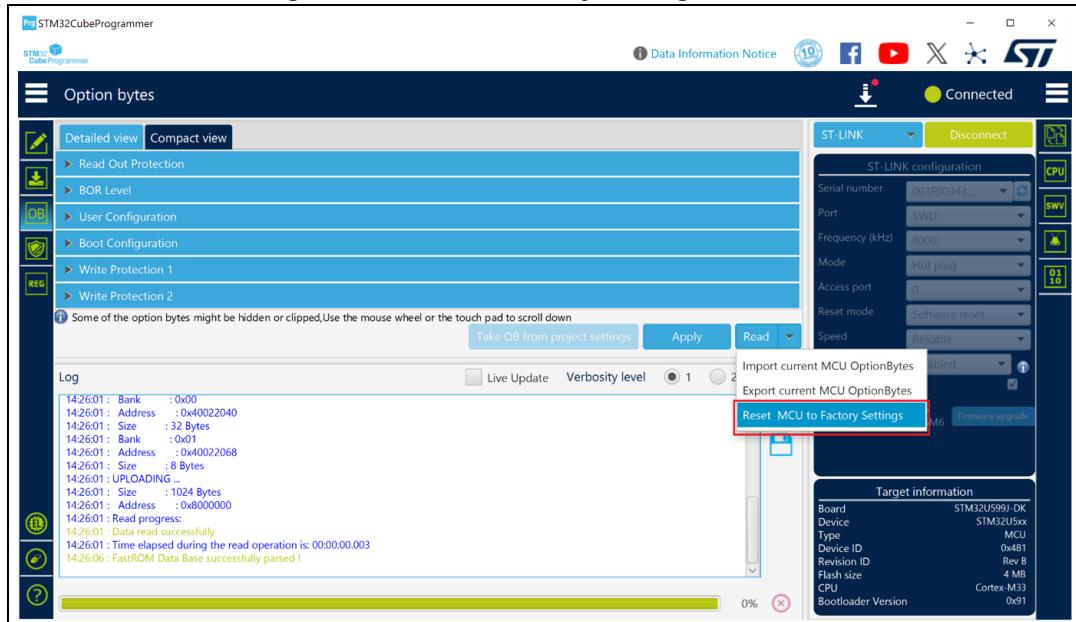
Figure 27. Option bytes - Compact view



2.4.2 Recovery button

Option bytes can be reset to their default values as specified in the reference manual. To use this feature (available for the STM32WBA5/6, STM32U3, STM32U5, and STM32H5 series), select the Option Bytes tab, then choose the “Reset MCU to Factory Settings” option from the “Read” button menu.

Figure 28. Reset to factory settings submenu



After selecting the Reset MCU to Factory Settings sub-menu, a new window appears, displaying a list of operations to perform along with their status.

Clicking the “Start Factory Reset” button initiates the reset operation, and displays all performed operation and their status:

- PENDING: the operation is currently pending and awaiting further user actions
- PASSED: the operation was successfully passed
- FAILED: the attempt failed due to detected issue
- ERROR: an error occurred during the process, causing it to stop unexpectedly
- ABORTED: the operation was aborted before completion, halting all progress

2.4.3 Export/import option bytes

Users can export option bytes using a dedicated split button that can be used also to read them. The export format is JSON, ensuring compatibility and ease of use in data manipulation.

Upon exporting, users are prompted to select a desired name and location for the saved file, offering flexibility in file management.

The JSON configuration files can be seamlessly imported to other targets, provided they share the same device ID, facilitating device configuration consistency. Imported settings are displayed for user review before application. This ensures that users have full control over the changes. The settings are applied only if the user is satisfied with the proposed configuration.

If there are discrepancies (such as missing or surplus values), the tool displays a warning, providing details so that the user can take informed decisions about how to proceed.

2.4.4 MCU unlock (specific for the STM32WL series)

This button is available in the Option Byte panel. The user can unlock the device if bad option bytes are already programmed, by clicking on the “Unlock chip” button (available only for STLink connection). After the unlock a power cycle is needed.

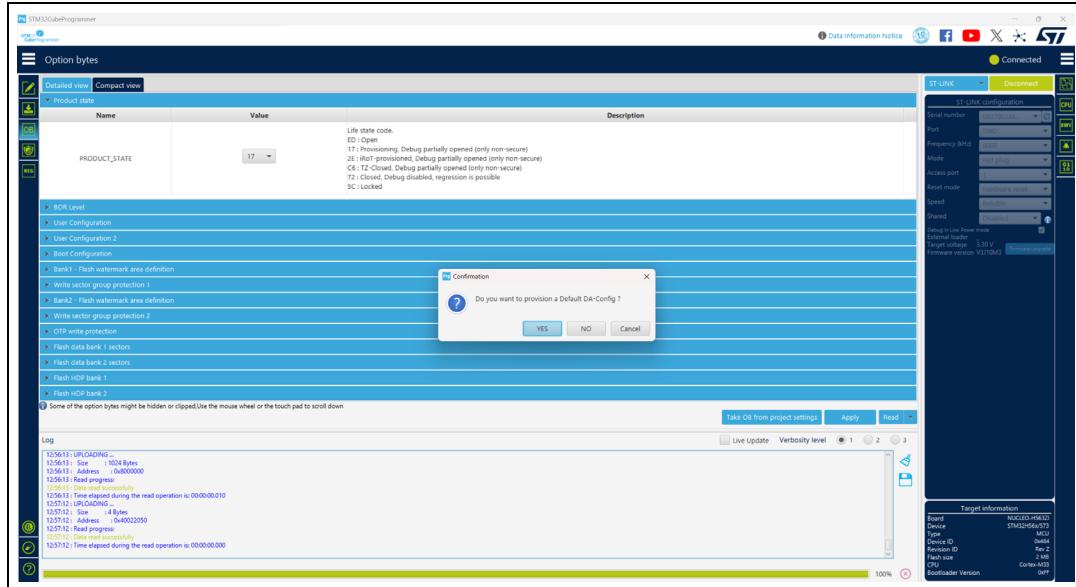
2.4.5 Debug authentication default configuration

The default configuration is used when programming the product state. The user can provision the configuration after programming the product state to any value. Afterwards, the user can provision its own OBK file.

If the user does not configure the debug authentication (DA) and switches PRODUCT_STATE to provisioned/TZ-closed or closed, it is no longer possible to perform regressions, nor to go back to product state open. All debug features are disabled.

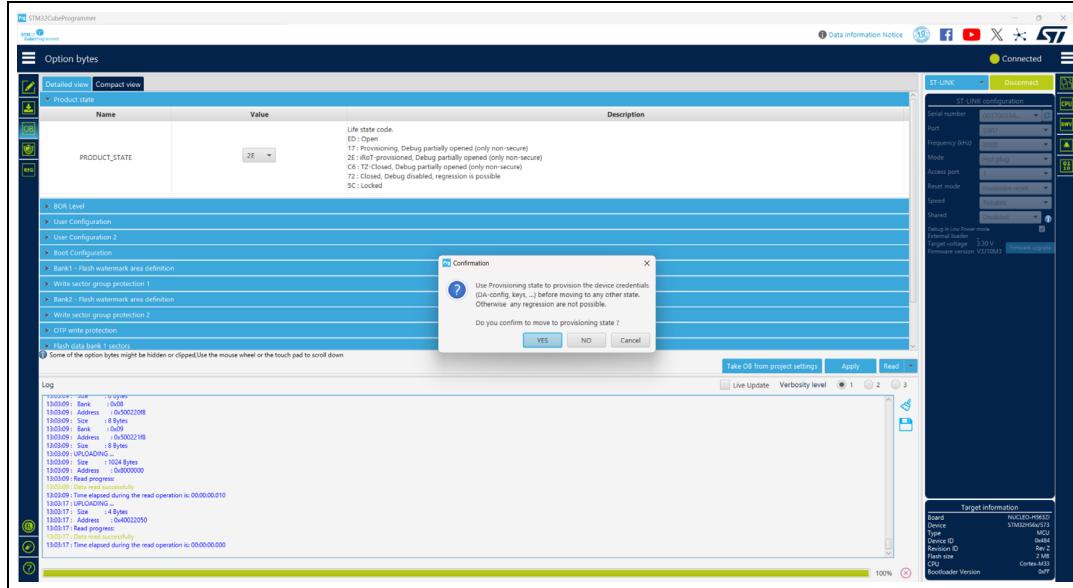
When setting PRODUCT_STATE to 0x17 (provisioning), the user is asked to provision the DA default configuration, or to use its own (see [Figure 29](#)).

Figure 29. DA default configuration when switching product state to provisioning



When switching PRODUCT_STATE from 0xED (open) to values different from 0x17 (provisioning), the user is asked to pass by the provisioning state first ([Figure 30](#)).

Figure 30. Configuration when switching product state to values different from 0x17



If the user chooses to provision a default DA configuration, the tool provisions the OBK file under the “bin/ DA_Default_Config” directory. To perform debug authentication, the files under “bin/DA_Default_Config” directory are required.

2.4.6

Debug authentication configuration (STM32H503 only)

If the user does not configure the DA and switches to PRODUCT_STATE provisioned or closed, it is no longer possible to perform regressions, nor to go back to product state open. All debug features are disabled.

When setting PRODUCT_STATE to 0x17 (provisioning), the tool checks if there is a password provisioned in OTP. If not, a popup asks the user to set a configuration, to be able to perform a regression later.

When switching PRODUCT_STATE from 0xED (open) to values different from 0x17 (provisioning), the tool checks if there is a password provisioned in OTP. If not, the user is asked to pass by the provisioning state first. Refer to [Figure 29](#) for GUI details.

2.5

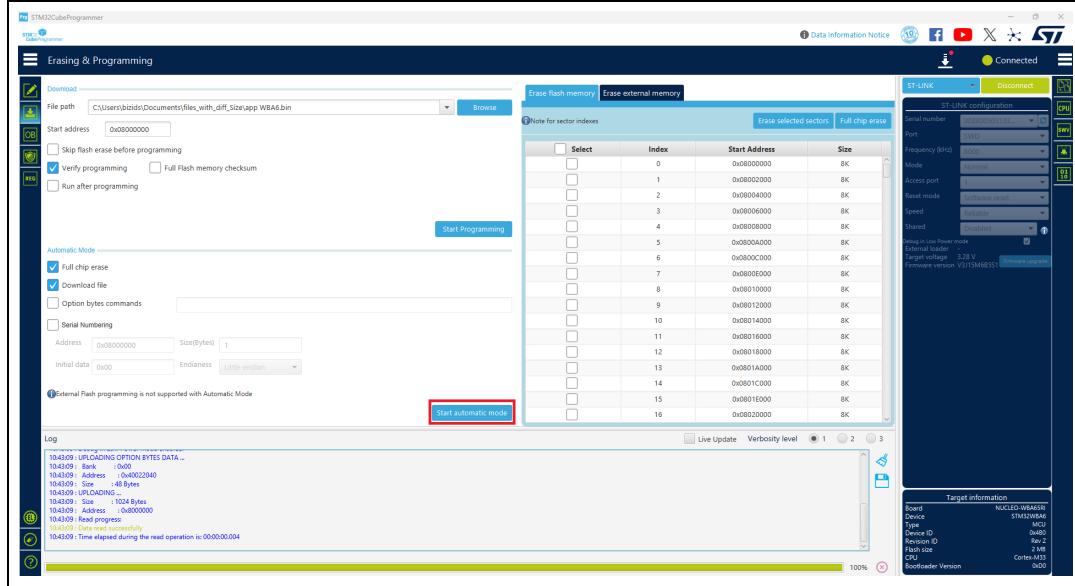
Automatic mode

This feature, shown in Erasing & Programming window (see [Figure 31](#)), allows the user to program and configure STM32 devices in loop. Allowed actions:

- Full chip erase: erases the whole flash memory
- Download file: activates and sets programming options from Download section:
 - File path
 - Start address
 - Skip erase before programming
 - Verify programming

- Run after programming
- Option bytes commands: configures the device by setting option bytes command line

Figure 31. Automatic mode in Erasing & Programming window



All automatic mode traces are indicated in the Log panel, to show the process evolution and user intervention messages.

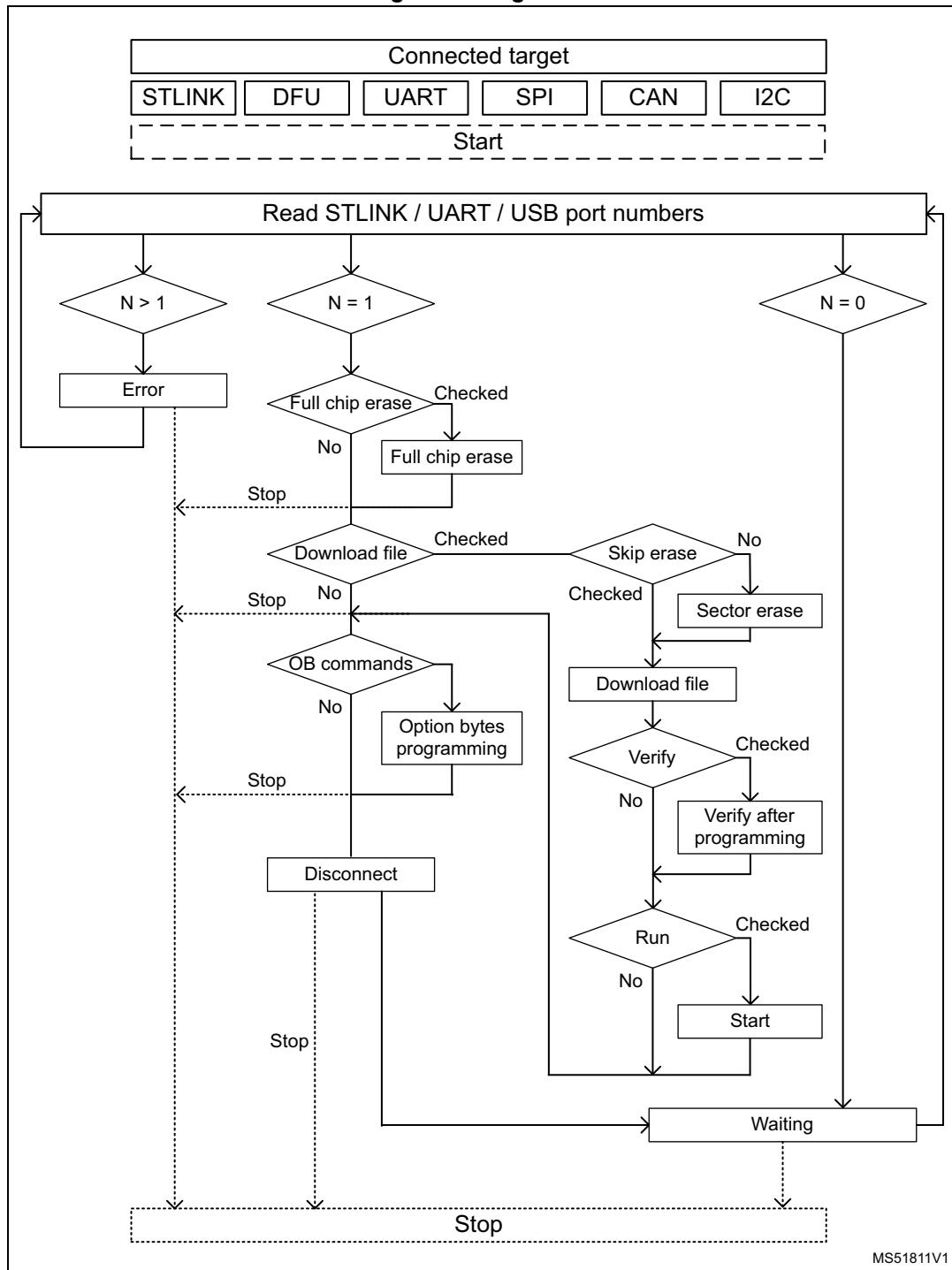
Graphical guide

- Connection to a first target must be established before performing automatic mode to collect connection parameters values associated to all next devices.
- If the Download file is checked, the system takes all Download file options in consideration, otherwise any Download option is performed.
- If the Option bytes commands is checked, the text field is activated, then the user can insert option bytes (like CLI) commands, and make sure that there are no white spaces at the beginning:
`-ob [OptionByte=value] [OptionByte=value] [OptionByte=value] ...`
- Example of Option bytes command: “`-ob BOR_LEV=0 nBOOT0=1`”
- If the Start automatic mode button is pressed, the system enters in a loop, until a system stop is called.
- While the automatic mode is in execution state, all graphical objects are disabled.
- The user can stop the process at any time by pressing Cancel or Stop automatic mode buttons.

Log messages

- “Starting Automatic Mode...”
Indicates that the system successfully entered the automatic process.
- “More than one ST-LINK probe detected! Keep only one ST-LINK probe! “
The automatic mode cannot be used if more than one ST-LINK probe is connected to the computer when using JTAG/SWD interfaces. A message is displayed, asking the user to keep only one ST-LINK probe connected to continue using this mode.
- “More than one ST-LINK Bridge detected! Keep only one ST-LINK Bridge!”
The automatic mode cannot be used if more than one ST-LINK bridge is connected to the computer when using bootloader interface SPI/CAN/I²C interfaces. A message is displayed, asking the user to keep only one ST-LINK bridge connected to continue using this mode.
- “More than one ST-LINK USB DFU detected! Keep only one USB DFU!”
The automatic mode cannot be used if more than one USB DFU is connected to the computer when using USB bootloader interface. A message is displayed, asking the user to keep only one USB DFU connected to continue using this mode.
- “More UART ports detected than last connection!”
During the first connection the automatic mode calculates the number of the available serial ports, and puts it as a reference, to detect correctly that only one port UART is used for each STM32 device.
- “Please disconnect device and connect the next...”
If the system finishes the first process, and whatever the result, disconnect the current device to prepare the second device connection.
- “Waiting for device...”
Once the connection to the previous device is correctly lost, the system keeps searching for a new device.
- “Automatic Mode is stopped.”
Indicates that there is a cancel request, and the system stops the process.

Figure 32. Algorithm



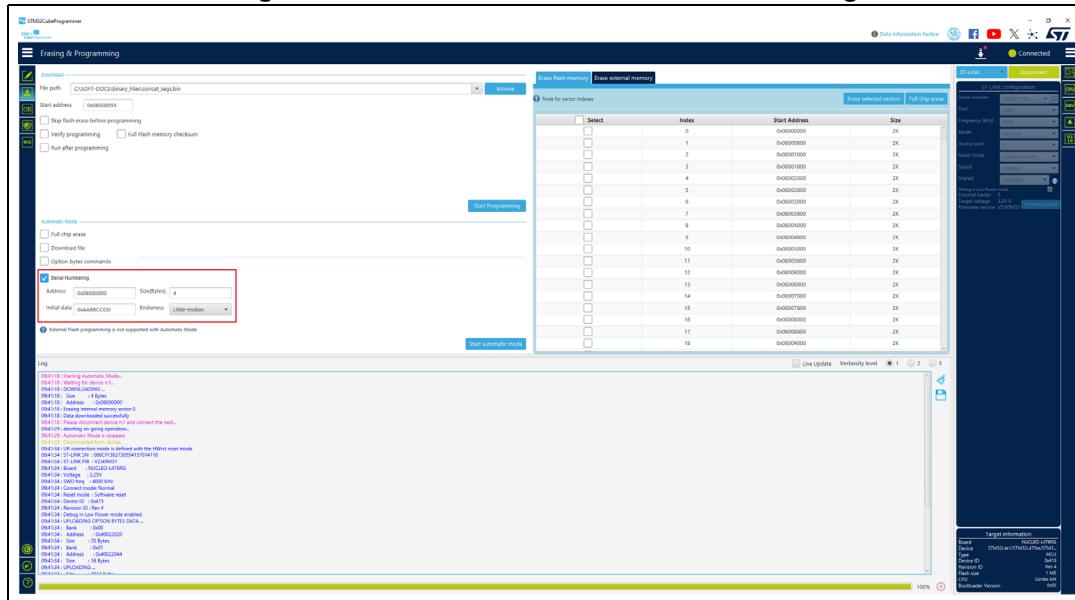
Serial numbering

The automatic mode can be performed with this feature enabled, granting the user the capability to assign unique identifiers to targets in a sequential manner (for tracking and reference purposes). Three fields are needed:

1. Address: contains the serial numbers.
2. Initial data: hexadecimal number, incremented sequentially by 1 for each target in the automatic mode.
3. Size: the number of bytes used for the serial numbering.
4. Endianness: the user can choose little- or big-endian for the increment (default is little-endian).

When the maximum serial number for the input size is reached, the automatic mode stops, and the user is asked to click the Stop button.

Figure 33. Automatic mode with serial numbering



2.6 In application programming (IAP/USBx)

STM32CubeProgrammer supports IAP/USBx only with USB DFU connection mode. When USB connection is chosen and the boot is from flash memory, STM32CubeProgrammer detects the IAP/ USBx like DFU bootloader and after connection an IAP/USBx message appears in the log panel.

Note: *Option byte, memory edition, and sector erase are not available with IAP/USBx.*

Sample IAPs/USBx are available in CubeFW/CubeAzure on www.st.com.

2.7 Flash the wireless stack using the graphical interface

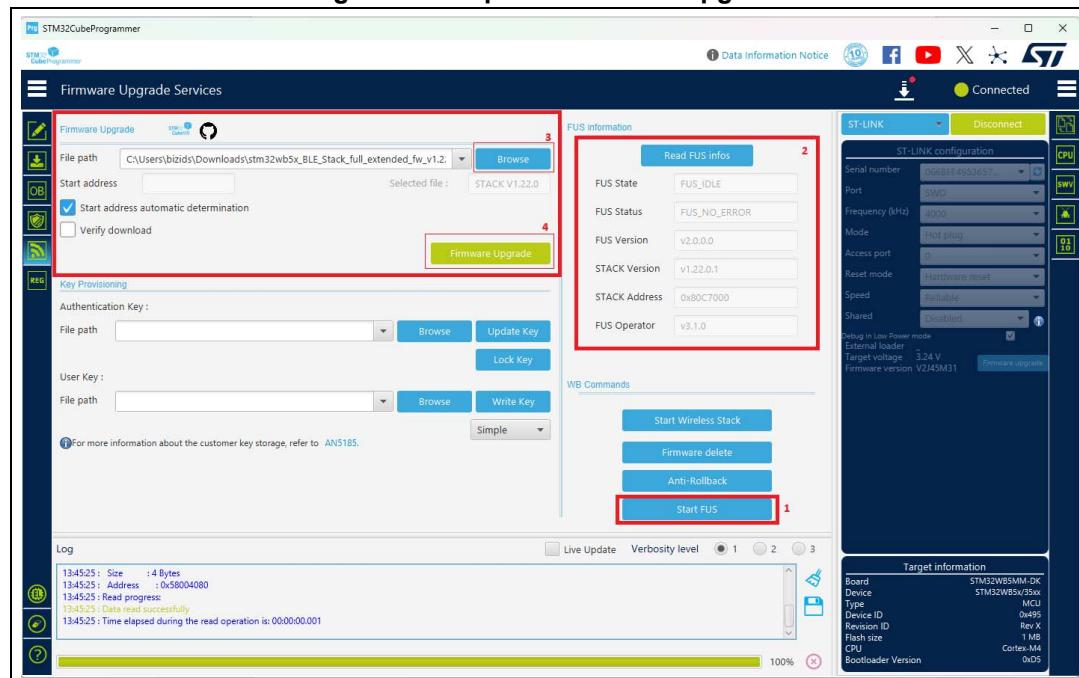
2.7.1 FUS/stack upgrade

1. Use STM32CubeProgrammer (version 2.4 or higher).
2. Access the SWD/bootloader USB interface.
3. Delete the current wireless stack.
4. Upgrade the FUS version the same way you would download the stack when there is not an updated version.
5. Download the new FUS.
6. Download the new wireless stack (a pop-up must appear to ensure successful upgrade).

Note: *STM32CubeProgrammer (version 2.7 or higher) allows the user to install only new firmware (Stack v1.11.0 or higher). To install the old firmware, use STM32CubeProgrammer v2.6.0.*

To download WB stacks and FUS from www.st.com, press on the logo.

Figure 34. Steps for firmware upgrade

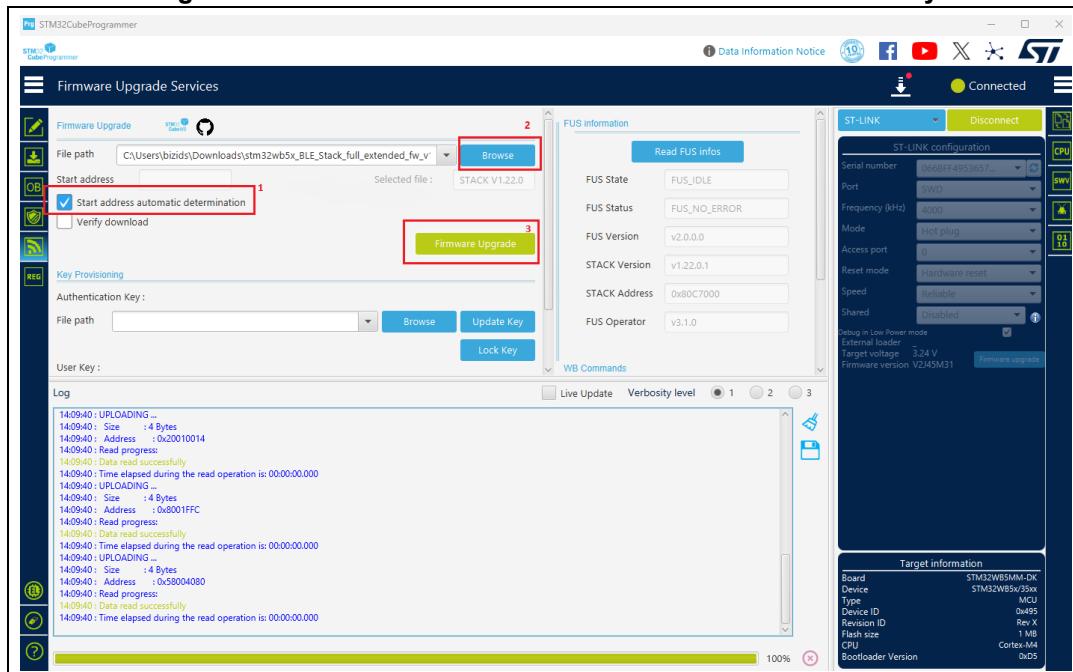


STM32CubeProgrammer can install FUS or wireless stack in two modes:

1. Manual: specify the desired installation address by entering it in the “Start Address” field (refer to the release notes for STM32WB Copro Wireless Binaries).
2. Automatic: STM32CubeProgrammer automatically calculates the optimal installation address based on the provided Stack/FUS file. To activate this option, check “Start address automatic determination” checkbox, then select the binary file using the Browse button.

After selecting the desired mode, click the “Firmware Upgrade” button to begin the upgrade process (refer to [Figure 35](#)).

Figure 35. Automatic load address determination functionality



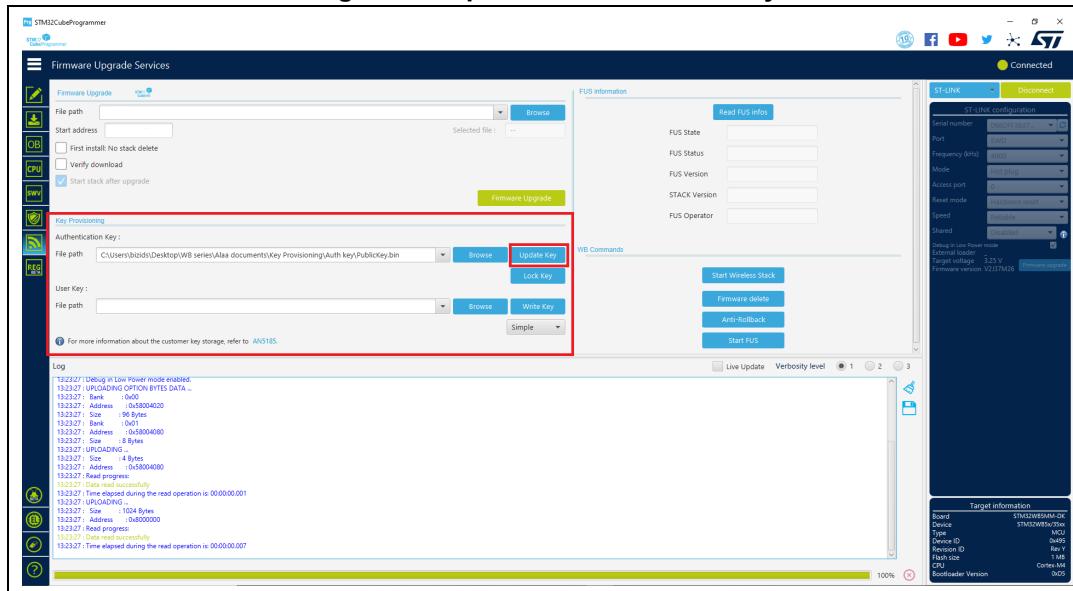
2.7.2 Key provisioning

STM32CubeProgrammer allows the user to add a customized signature (encrypted and signed by STMicroelectronics) to any image.

User authentication

FUS window allows a user authentication key to be stored through the Update Key button.

Figure 36. Update authentication key



Once the user authentication key is installed, it can be changed, unless the lock user authentication key button is selected. The install or upgrade services must be done with the double signed FUS/Stack, or it is rejected.

Customer key storage

STM32CubeProgrammer allows customer keys to be stored in the dedicated FUS flash memory area in binary format (user key types: simple, master, or encrypted).

For more information about the customer key storage, refer to AN5185 “*ST firmware upgrade services for STM32WB Series*”. For complete documentation on these products visit the dedicated pages on www.st.com.

2.8

Serial wire viewer (SWV)

The serial wire viewer window (see [Figure 37](#)) displays the printf data sent from the target through SWO, and useful information on the running firmware.

Note:

The serial wire viewer is available only through SWD interface.

Before starting to receive SWO data, the user has to specify the exact target System clock frequency (in MHz) to allow the tool to correctly configure the ST-LINK and the target for the correct SWO frequency. The “Stimulus port” combo box allows the user to choose a given ITM Stimulus port (from port 0 to 31), or to receive data simultaneously from all of them.

The user can optionally specify a “.log” file to save the SWV trace log by using the “Browse” button, the default is
“\$USER_HOME/STMicroelectronics/STM32CubeProgrammer/SWV_Log/swv.log”.

The user can optionally check the “Activate colors” checkbox to enable colored traces output. This feature requires the original traces to contain the color codes listed below:

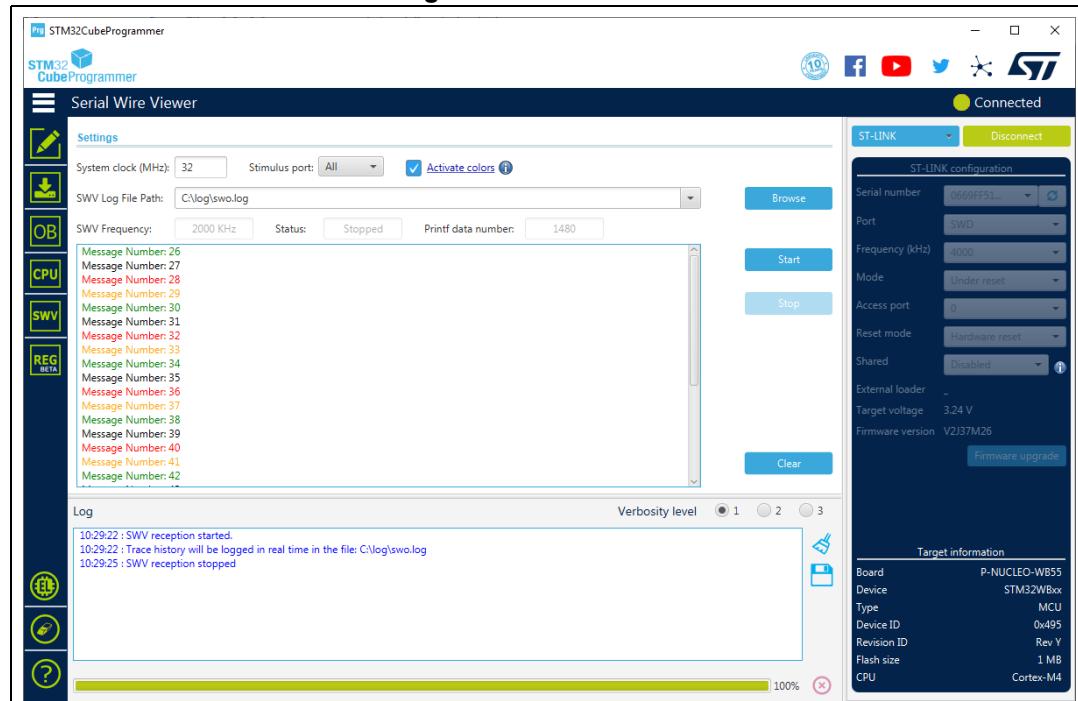
- #GRN# for green color
- #RED# for red color
- #ORG# for orange color

Example:

```
printf("#GRN#This outputs a green message!");
```

A help window that demonstrates the feature and shows how to use it can be accessed by clicking on the “Info icon” button next to the “Activate colors” checkbox.

Figure 37. SWV window



After specifying the SWV configuration, SWV reception can be started or stopped using the “Start” and “Stop” buttons. The SWO data is displayed in the dedicated area, which can be cleared by using the “Clear” button.

The SWV information bar displays useful information on the current SWV transfer, such as the SWO frequency (deduced from the system clock frequency), and the received printf data number (expressed in bytes).

Note: Some SWV bytes can be lost during transfer, due to ST-LINK hardware buffer size limitation.

2.9 Secure programming interface

2.9.1 Introduction

This window facilitates STM32CubeProgrammer CLI commands for secure programming:

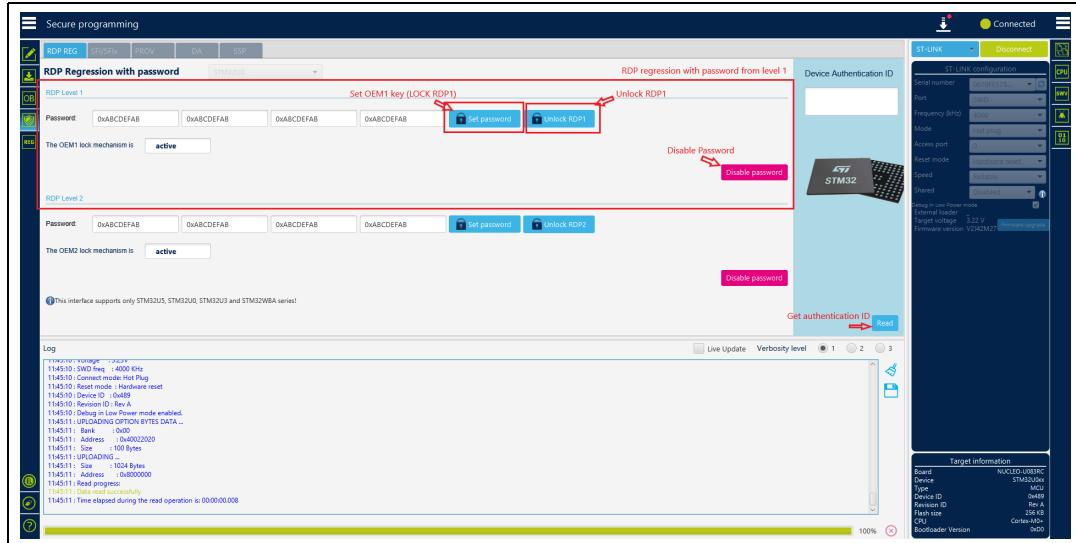
- RDP regression with password feature: available for STM32U5 series
- SFI/SFIx feature: available for STM32H7, STM32U5, and STM32L5 series

2.9.2 RDP regression with password

Some STM32 products (such as those of the STM32U0 and STM32U5 series) offer the possibility to use an optional password-based RDP level regression, including RDP level 2 . Detailed information about this hardware mechanism is available in reference manuals.

For the J-Link interface, only 64-bits passwords are supported (such as for STM32U5).

Figure 38. RDP regression with password tab



STM32U5

- RDP level 1: the OEM1 RDP lock mechanism is active when the OEM1 key is set. It blocks the regression from the RDP level1.
 - To unlock the RDP from level 1 regression, the user must write the OEM1 password, press on “RDP regression” button and then perform the RDP regression from “Option Bytes” interface.
 - To remove RDP regression with password from level 1, the user must press on “Disable password” button.
- RDP level 2: provision OEM2KEY to authorize RDP level 2 to level 1 regression: “Set password” button.
 - To unlock the RDP from level 2 regression, the user must write the OEM2 password, press on “RDP regression” button, and then try to connect with

STM32CubeProgrammer. If this key matches the OEM2KEY value, the RDP regression to level 1 is launched by hardware.

- To remove RDP regression with password from level 2, the user must press on “Disable password” button.
- Device authentication ID: Get device identification. Unless the JTAG port is deactivated (OEM2LOCK = 0 and RDP level = 2), a 32-bit device specific quantity can be always read through the JTAG port. The OEM can use this 32-bit information to derive the expected OEM password keys to unlock the device.

STM32U0

- RDP level 1: the OEM1 RDP lock mechanism is active when the OEM1 key is set. It blocks the regression from the RDP level1
 - To unlock the RDP from level 1 regression, the user must connect in hotplug mode on access port 1, write the OEM1 password, press on “RDP regression” button, and then perform the RDP regression from “Option Bytes” interface.
 - To remove RDP regression with password from level 1, the user must press on “Disable password” button.
- RDP level 2: provision OEM2KEY to authorize RDP level 2 to level 1 regression: “Set password” button.
 - To unlock the RDP from level 2 regression, write the OEM2 password, press on “RDP regression” button, and then try to connect with STM32CubeProgrammer. If the key matches the OEM2KEY value, the RDP regression to level 1 is launched by hardware. In this use case, the connection is done with ap = 1.
 - To remove RDP regression with password from level 2, the user must press on the “Disable password” button.

2.9.3 SFI/SFIx

SFI GUI

1. Use STM32CubeProgrammer (version 2.11 or higher).
2. Access the SWD/bootloader interface.
3. Open Secure Programming interface, then SFI tab (see [Figure 39](#)).
4. Select the license source (from a license file or directly from your connected HSM).
5. Select the sfi file, once selected, the sfi parsed info is displayed (see [Figure 41](#)).
6. Select the RSSe file (if needed).
7. Start sfi sequence (see [Figure 40](#)).

Note: To open TPC to generate the sfi file, press on the TPC logo.

Figure 39. SFI/SFix tab

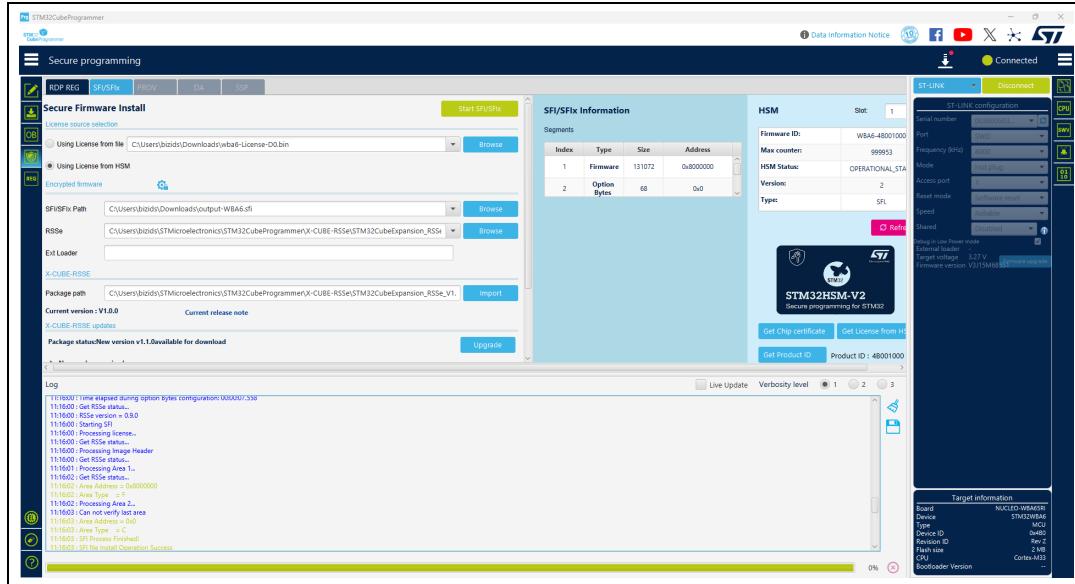


Figure 40. Steps for SFI programming

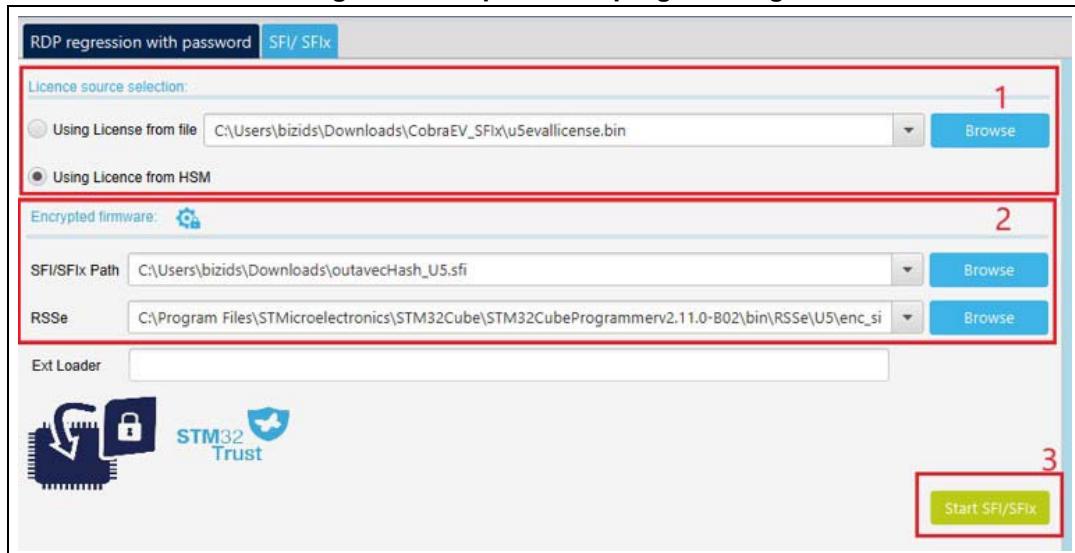


Figure 41. SFI parsed info

SFI/SFix Information			
Segments			
Index	Type	Size	Address
1	Firmware	64	0x800a000
2	Firmware	6240	0x8100000
3	Firmware	4048	0xc000000
4	Firmware	16	0xc0fe000
5	Pause	32	0x80f0000
6	Resume	32	0x80f0000
7	External Firmware	272	0x70000000
8	Pause	32	0x80f0020
9	Resume	32	0x80f0020
10	Option Bytes	64	0x0

SFix GUI

To perform a successful sfifx operation using this graphical interface, perform the same steps described in [SFI GUI](#), with two minor modifications:

1. Select an sfifx (not an sfi).
2. Select the external loader via External loaders window. Once done, the name is displayed automatically in the text field below ([Figure 42](#)).

Then you can start the sfifx sequence.

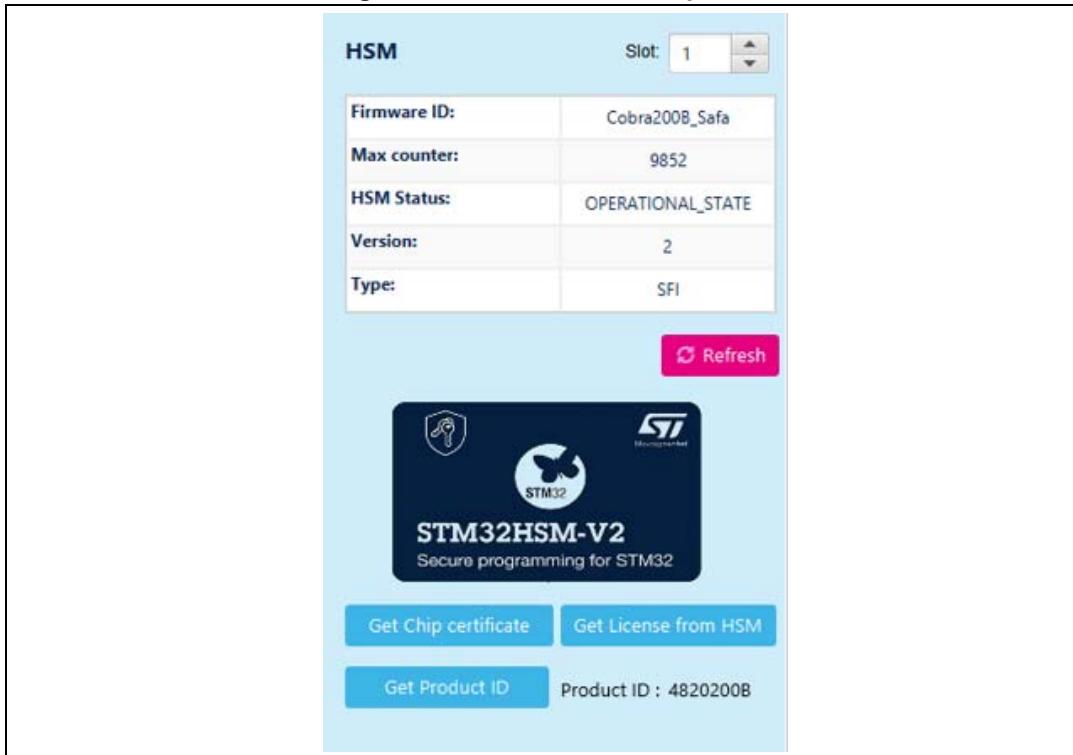
Figure 42. Display external loader name



HSM related info

This panel contains all the needed information in the sfi process. It allows the user to read the available HSM information when a card is detected, get the license from HSM, get the chip certificate, and read the product ID.

Figure 43. HSM-related info panel



For more details refer to AN5054 “Secure programming using STM32CubeProgrammer”, available on www.st.com.

SFI/SFIx GUI for devices supporting Secure Manager

The tool displays additional fields, giving the option of passing a module to the SFI/SFIx and an external module to the SFIx:

- Modules: .mcsv file containing the list of internal modules
- exModules: .ecsv file containing the list of external modules

Figure 44. SFI/SFIx modules for STM32H5

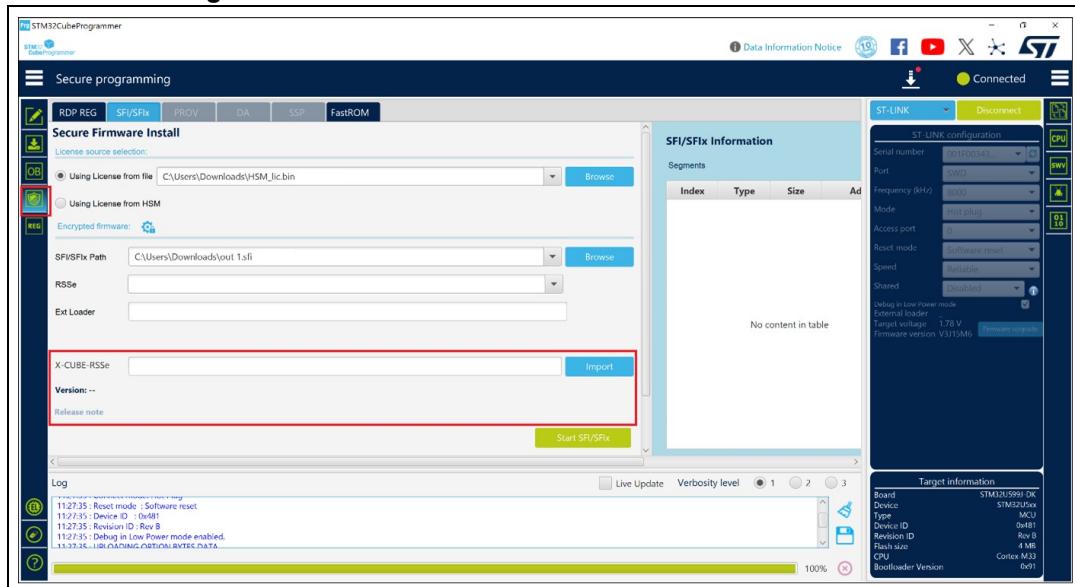
SFI/SFIx Path	C:\STM32\out.sfi	Browse
RSSe	C:\Users\STMicroelectronics\STM32CubeProgrammer\X-CUBE-RSSe\STM32CubeExpansion_RSSe_V1.0.i	Browse
Ext Loader		
Modules	C:\STM32\modules.mcsv	Browse
exModules	C:\STM32\exModules.ecsv	Browse

X-CUBE-RSSe

The X-CUBE-RSSe comes in zip format and can be directly imported. This package contains:

- RSSe binaries: Root Security Services Extension needed to perform the SFI/Key Wrapping
- Personalization data: encrypted binaries to be programmed into HSM depending upon the used MCU
- Option bytes CSV: template for OB CSV files to be used for SFI files creation

Figure 45. X-CUBE-RSSe interface in the SFI/SFIx window



The user can import this package from the SFI/SFIx window within the Secure Programming window. This window contains:

- Imported package path: automatically populated after importing the package
- Package version: automatically filled after importing the package
- Release note link: the hyperlink is enabled after importing the package

After successfully importing the package, a populated list of available RSSe binaries is automatically filled in its respective fields.

X-CUBE-RSSe and STM32MPUSSP-UTIL upgrade

In the SFI/SFIx and SSP tab, the user can check for the latest version of the package available for download.

After accepting the software license, if the download and upgrade of the new version are successful, the package status is marked as up-to-date and the new RSSe files are automatically filled in their respective fields.

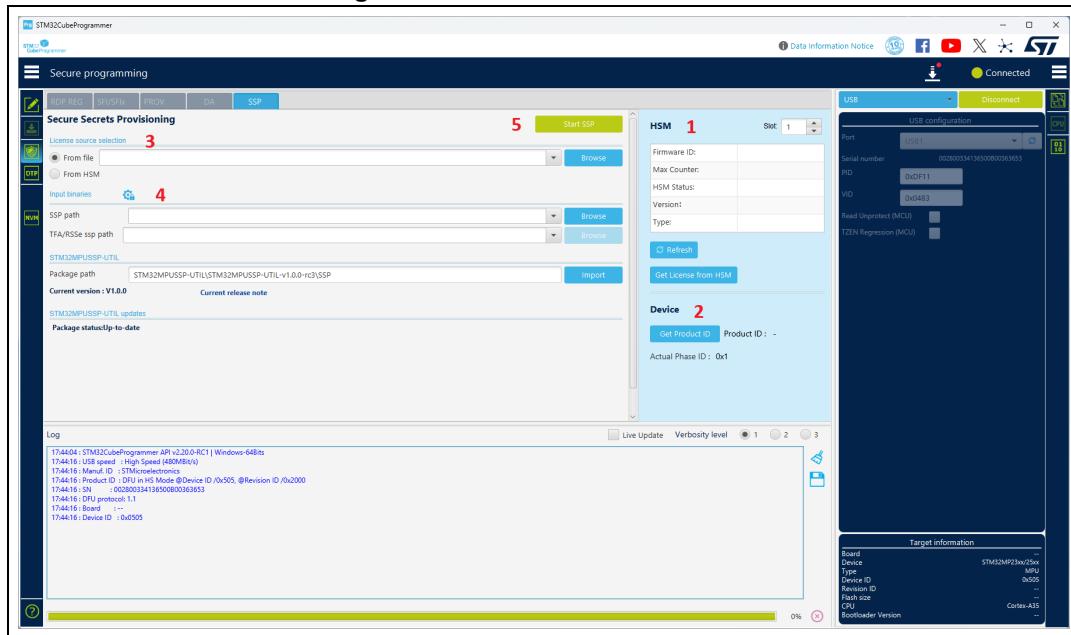
For users using proxy to connect to the web, proxy settings must be configured.

2.9.4 SSP

STM32CubeProgrammer user interface (UI) exports several capabilities that can be used to execute the SSP flow.

To open the SSP window, connect an MPU device via DFU interface, click on security panel, and then choose the SSP tab. The window contains the graphical components needed to perform SSP operations.

Figure 46. SSP PRG user interface



The UI is composed of five elements:

1. *HSM section*
2. *Device section*
3. *Input license*
4. *SSP input binaries*
5. *Verify and Start SSP install*

HSM section

This section allows the user to read HSM information when the smart card is detected in the slot selected by the user. With this tab it is also possible to get a license from HSM.

Press “Refresh” button to read and display the related information for the plugged HSM.

Device section

This part allows to get the product ID of the connected device, needed to choose the correct personalization package to be provisioned in the HSM card by the STM32Trusted Package Creator.

If the device is not in a configuration adequate to get the chip certificate, it is mandatory to provide a tfa-ssp file in the “SSP inputs” section. STM32CubeProgrammer will then set the device in the correct state.

The current phase ID is displayed to highlight the device configuration.

Input license

The user must select the source of the license to be used in the SSP flow. Possible sources:

- From file: to select a binary file already generated by the HSM.
- From HSM: the SSP procedure extracts the license directly from the HSM.

SSP input binaries

This part is needed to select the secure input files:

- SSP file: an encrypted SSP image generated by STM32Trusted Package Creator
- tfa-ssp: binary file with .bin or .stm32 extension

To generate an SSP image, launch directly the SSP generation window of STM32Trusted Package Creator tool by clicking on the TPC icon.

Verify and Start SSP install

When the user clicks on “Start SSP” button, STM32CubeProgrammer verifies all mandatory inputs and starts the SSP procedure.

If the operation is successful, an informative popup is displayed, and the device is disconnected.

If an error occurs at any step, the operation stops the flow and displays an error.

Note: *At the end of the flow STM32CubeProgrammer does not make any verification step for the OTP fused words. If the mentioned tfa-ssp is not the adequate one, the SSP flow fails.*

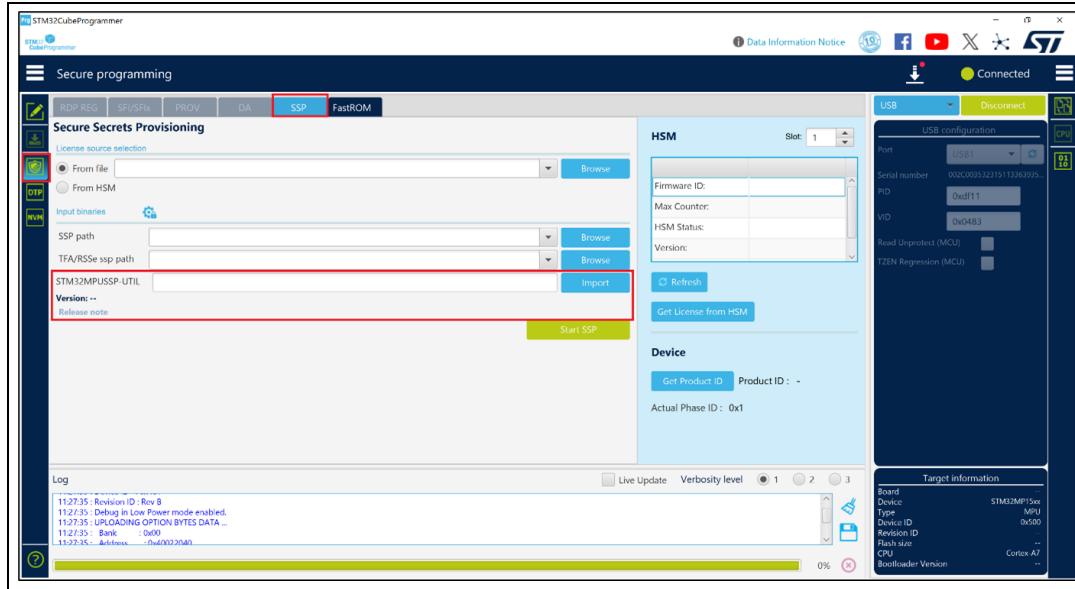
The STM32MPUSSP-UTIL comes in zip format and can be directly imported in the STM32TustedPackageCreator. This package contains:

- RSSe SSP binaries: Root Security Services Extension needed to perform Secure Secret Provisioning
- Personalization data: encrypted binaries to be programmed into HSM depending on used MPU

The user can import the STM32MPUSSP-UTIL package from the SSP window within the Secure Programming window. This window contains:

- Package version: automatically filled after importing the package
- Imported package path: automatically populated after importing the package
- Release note link: the hyperlink is enabled after importing the package

Figure 47. STM32MPUSSP-UTIL interface in the SSP window



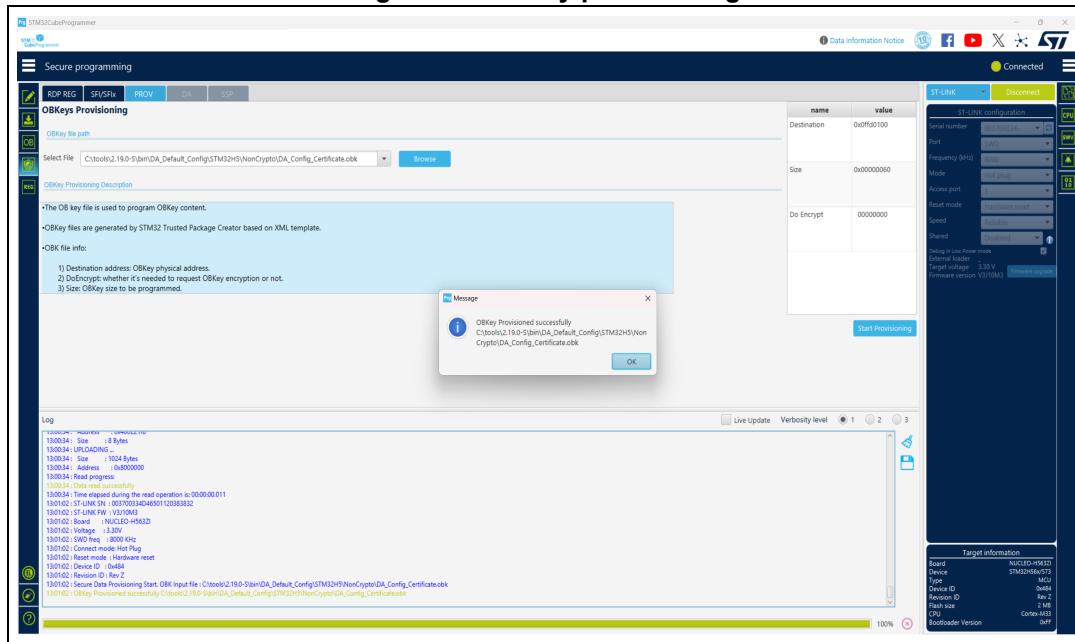
2.9.5 OBKey provisioning

This is a security feature that allows to program OBKey content. The file generation is managed by STM32 Trusted Package Creator. For more information, refer to UM2238.

There are two possible cases of OBK provisioning for debug authentication:

- Provisioning with password: before launching it, set TZEN at “0xC3” (disabled), and product state at “0x17” (provisioning)
- Provisioning with certificate: before launching it, set TZEN at “0xB4” (enabled) and product state at “0x17” (provisioning)

Figure 48. OBKey provisioning



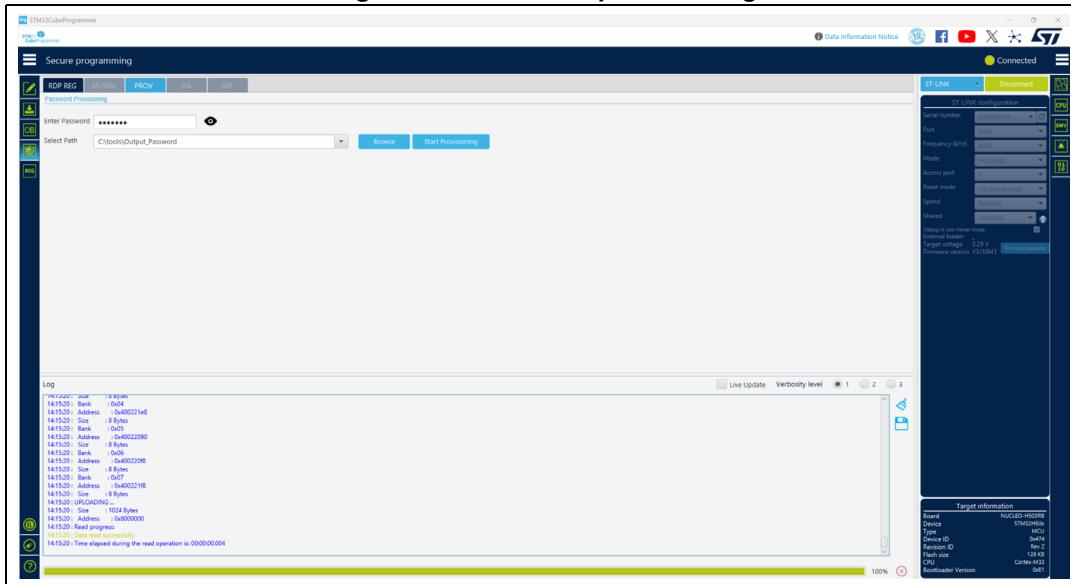
2.9.6 OTP provisioning panel

Debug authentication - Password provisioning

For devices supporting debug authentication without TrustZone, the password hash (hash256) is stored in OTP. This panel allows password provisioning, to do it enter a password value (size must be between 4 and 16 bytes) and a password path.

Once the OTP is written, the corresponding block is locked. The password value is used to calculate the hash to store in OTP. The password path is the location where to save the "password.bin" file, needed to open the device in a Debug Authentication sequence.

Figure 49. Password provisioning

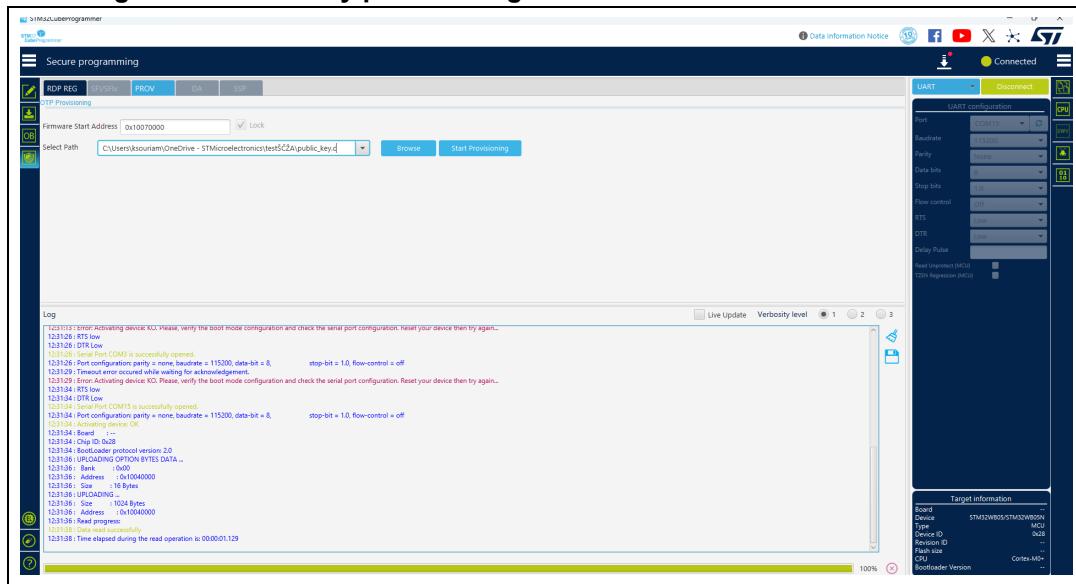


Password provisioning can be performed only once for each device, as the password is stored in OTP.

Public key provisioning for STM32WB0x/STM32WL3x devices

This panel is used to provision authentication public key used in secure boot scenario. The input key is generated by STM32TrustedPackage Creator, the associated private key is used to sign the firmware stored in the flash memory. For more information refer to AN5471 "The BlueNRG-LP, BlueNRG-LPS UART bootloader protocol", available on www.st.com.

Figure 50. Public key provisioning for STM32WB0x/STM32WL3x devices



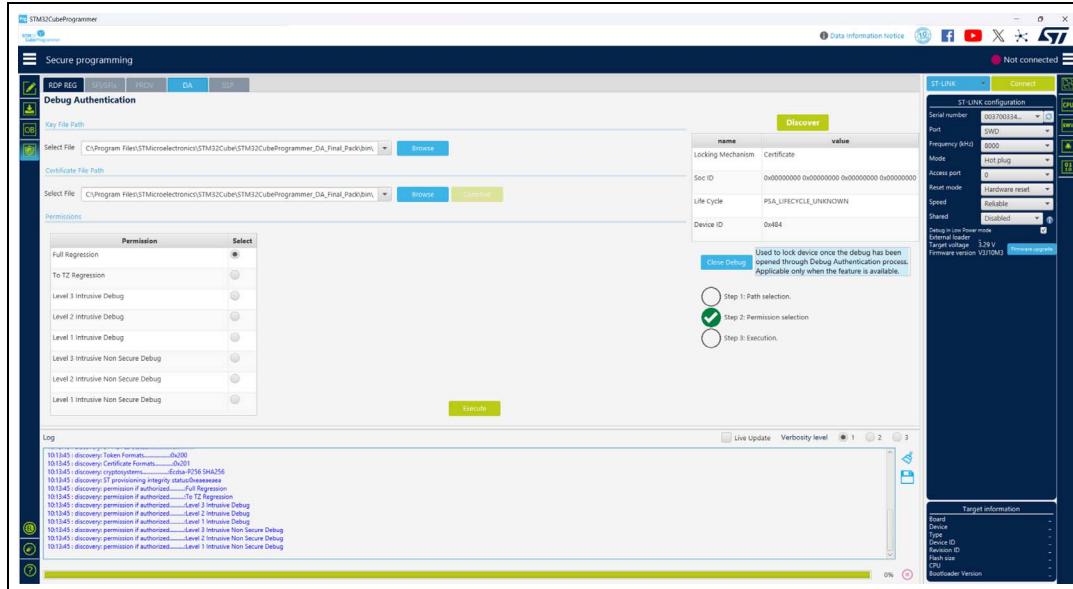
2.9.7 Debug authentication

This feature allows regression or open debug when the target is provisioned. The user must provide the needed credentials by following these steps:

1. Discovery: this operation displays the info about the target.
To make sure that provisioning is correctly performed, “Integrity status” field must be checked: it must indicate “0xEAEEAEAE” as value (displayed in the log). This operation cannot be launched while the target is connected.
2. Credentials input: beside discovery related data, debug authentication panel displays at this step a form including the necessary inputs:
 - a) Target provisioned with password: the panel includes only the password file path.
 - a) Target provisioned with certificate: the panel includes key and certificate path inputs. In this case, the user can select the possible permission/actions (multiple choices can be checked for some cases).
3. For devices supporting debug authentication with TrustZone, the user can close the debug after opening it (instead of powering off/on the target). To close debug, use the “Close Debug” button included in Debug Authentication panel.

Note: For STM32H503, only a full regression with password is available.

Figure 51. Debug authentication with certificate



2.10 STM32CubeProgrammer Script Manager platform for MCUs

2.10.1 Introduction for the usage scenarios of Script Manager

The Script Manager platform allows to automate STM32CubeProgrammer CLI commands and adds macros to manipulate data read from STM32 MCU.

2.10.2 Script Manager usage

Create a file with a prg extension, then start writing the command line interface (CLI) supported by all STM32 MCUs and the specific script macros. Once you have finished filling the script, connect the STM32 board and start execution with the `-script` command in CLI mode.

Usage example: `STM32_Programmer_CLI -script myScript.prg`

The Script Manager can apply mathematical and logical operations (see [Table 1](#)).

Table 1. Operations supported by Script Manager

Mathematical	Logical
<code>- +</code> (addition)	<code>- &&</code> (logical AND)
<code>- -</code> (subtraction)	<code>- </code> (logical OR)
<code>- *</code> (multiplication)	<code>- &</code> (bitwise AND)
<code>- /</code> (division)	<code>- </code> (bitwise OR)
	<code>- ^</code> (XOR)
	<code>- << >></code> (left and right shift)

Using command line interface (CLI): in this script we can use all CLI supported by STM32 MCUs (see [Section 3](#)).

Using specific Script Manager macros, to analyze, display and modify data, each macro starts with #. Supported macros are described below.

#Write macro:

```
#Write32(Address,data)
#Write16(Address,data)
#Write8(Address,data)
#WriteX(Address,#var)           (where X is 8/16/32)
```

Description: Downloads the specified (32/16/8-bit) data into flash memory starting from a specified address.

#Read macro:

```
#Read(Address)
#variable=#Read(Address)
```

Description: Reads 32-bit data memory from a specified address or reads 32-bit data memory from a specified address, and puts it in the used variable.

#Display macro:

```
#Display("message")
#Display(#errorLevel)
#Display(#variable)
```

Description: Displays any message, data, error level and the content of variables already used in the script.

#Delay macro:

```
#Delay(Time)
```

Description: Allows user to put the system in standby for a period in (ms).

Calculate macro:

```
#variable=[var1] op [var2]
#variable=var1 shift (number of bits to shifted)
```

Description: Calculates with mathematical and logical operations in script manager.

Disconnection command

```
--scriptdisconnect
```

Description: Allows user to disconnect the device and reconnect to another port in the same script.

Note: *Comments in the Script Manager can be added by using “//”, as shown in the examples.*

Script Manager example 1 (CLI and Script macro), see [Figure 52](#)

```
-c port=swd
-e 0 1
#Write32(0x08000000,0xAAAABBBB)
#var0=#Read(0x08000000)
#Display(#var0)
```

Script Manager example 2, see [Figure 53](#)

```
-c port=swd
#Write32(0x08000000,0xAAAABBBB)
--scriptdisconnect
#Delay(5000)
-c port=COM17
#Write16(0x08000004,0xCCCC)
```

Script Manager example 3

```
-c port=swd
#Display ("Hello World!")
-e 0 1
#Write32(0x08000000,0xAAAABBBB)
#Read(0x08000000)
-r32 0x08000000 0x50
#var0=#Read(0x08000000)
#Display(#errorLevel)
#Display(#var0)
#Write32(0x08000004,#var0)
#Delay(3000)
#Write16(0x08000008,0xCCCC)
#Read(0x08000004)
#Display(#errorLevel)
#var1=#Read(0x08000008)
#Display(#var1)
#Write8(0x08000010,0xDD)
#Delay(5000)
#var2=#Read(0x08000010)
#Display(#var2)
#var3=((0xbb*1)+(1-1))/1
#Display(#var3)
#Write8(0x08000014,#var3)
#var4=((0xbb & 0xaa) | 0xbb )
#Display(#var4)
#var5=((0xbb && 0xaa) || 0xbb )
#Display(#var5)
#var6=(0xbb >>1)
```

```
#Display(#var6)
-e 0 1
-w32 0x08000000 0xAAAAAAA
-r32 0x08000000 0x50
```

Figure 52. Output of Script Manager - Example 1

```
--- Script Manager BEGIN ---
Operation [1]: -c port=swd

ST-LINK SN   : 066BFF565251887067053951
ST-LINK FW   : V2J33M25
Board        : NUCLEO-F429ZI
Voltage      : 3.27V
SWD freq    : 4000 KHz
Connect mode: Normal
Reset mode   : Software reset
Device ID    : 0x419
Revision ID  : Rev 3
Device name  : STM32F42xxx/F43xxx
Flash size   : 2 MBytes
Device type  : MCU
Device CPU   : Cortex-M4
BL Version   : --

Operation [2]: -e 0 1

Erase sector(s) ...
Existing specified sectors are erased successfully
Protected sectors are not erased

Operation [3]: #Write32(0x08000000,0xAAAAABBB)

DOWNLOADING ...
  Size       : 4 Bytes
  Address    : 0x08000000
Data downloaded successfully

Operation [4]: #var0=#Read(0x08000000)

UPLOADING ...
  Size       : 4 Bytes
  Address    : 0x80000000
Read progress:  100%
Data read successfully
Time elapsed during the read operation is: 00:00:00.001

Operation [5]: #Display(#var0)

#var0 = 0xAAAAABBB
Device is disconnected

--- Script Manager END ---
```

Figure 53. Output of Script Manager - Example 2

```
*** Script Manager BEGIN ***

Operation [1]: -c port=swd

ST-LINK SN   : 066BFF565251887067053951
ST LINK FW   : V2J33M2S
Board        : NUCLEO-F429ZI
Voltage      : 3.27V
SWD freq     : 4000 KHz
Connect mode : Normal
Reset mode   : Software reset
Device ID    : 0x419
Revision ID  : Rev 3
Device name  : STM32F42xxx/F43xxx
Flash size   : 2 MBytes
Device type  : MCU
Device CPU   : Cortex-M4
BL Version   : --

Operation [2]: #write32(0x08000000,0XAAAAABBBB)

DOWNLOADING ...
  Size       : 4 Bytes
  Address    : 0x08000000

Erasing internal memory sector 0
Data downloaded successfully

Operation [3]: #Delay(5000)

The system go to sleep for 5000 ms.

Operation [4]: -c port=COM17

Serial Port COM17 is successfully opened.
Port configuration: parity = even, baudrate = 115200, data-bit = 8,
                      stop-bit = 1.0, flow-control = off

Timeout error occurred while waiting for acknowledgement.
Activating device: OK
Board        : --
Chip ID: 0x419
BootLoader protocol version: 3.1
Device name  : STM32F42xxx/F43xxx
Flash size   : 2 MBytes (default)
Device type  : MCU
Revision ID  : --
Device CPU   : Cortex-M4

Operation [5]: #Write16(0x08000004,0xCCCC)

DOWNLOADING ...
  Size       : 2 Bytes
  Address    : 0x08000004

Erasing internal memory sector 0
Device is disconnected                                Data downloaded successfully
*** Script Manager END ***
```

2.10.3 Loops and conditional statements

The Script Manager supports three macros for looping and conditional statements:

```
#Start           #Start           #Start
While (***)      for (***)       if (***)
{
  Command Line or macros   {
}
#End             #End           }
                           }

#Start           #Start           #Start
if (***)         for (***)       Command Line or macros
{
  Command Line or macros   {
}
else
{
  Command Line or macros
}
#End
```

To use the conditional statements (If, Else) and the loopings (While, For), begin with **#Start**, and finish with **#End**.

If-else condition example

```
-c port=swd
-e 0
#x=#Read(0x08000000)

#Start
if (#x > 0x1000)
{
  #Display("Condition 1")
  #Display(#x)
  #Write32(0x08000000,0x1123)
}
else
{
  #Display("Condition 2")
  #Display(#x)
  #Write32(0x08000008,0x1124)
}

#End
```

If-else if condition example

```
-c port=swd
-e 0
#VAR=0x11111111
#Write32(0x08000000,#VAR)
#x=#Read(0x08000000)
```

```
#Display(#x)

#Start
if(#x==0x22222222)
{
#Display("Condition 1")
}
else if(#x==0x11111111)
{
#Display("Condition 2")
}
else
{
#Display("Condition 3")
}
#End
```

For loop

```
-c port=swd
#ADD=0x08000004
#x=#Read(0x08000004)

#Start
for (#ADD=0x08000000; #ADD<0x0800000C; #ADD=#ADD+4)
{
    #x=#Read(#ADD)
    #Display(#x)
}
#End
```

While loop (example 1)

```
-c port=swd
-e 0
#Write32(0x08000008,0xCCCCCCCC)
#ADD=0x08000000
#x=#Read(#ADD)

#Start
while(#x!=0xCCCCCCCC)
{
    #Display(#x)
    #ADD=([#ADD]+(4))
    #x=#Read(#ADD)
}
#End
```

While loop (example 2)

```
-c port=swd

-e 0

#Write32(0x08000000,0xAAAAAAA,0xBBBBBBBB,0xCCCCCCCC,0xDDDDDDDD)
#ADD=0x08000000
#x=#Read(#ADD)
#Display(#x)

#Start

while(#x!=0xDDDDDDDD)
{
    #Display(#x)
    #ADD=([#ADD]+(4))
    #x=#Read(#ADD)
}

#End
```

2.11 DFU IAP/USBx with custom PID and VID

STM32CubeProgrammer DFU IAP/USBx supports not only ST product IDs while connecting via DFU IAP.

Before starting the DFU connection using a new product ID, sign your USB driver (for more info visit <http://woshub.com>).

When USB connection with a new product ID is chosen and the boot is from flash memory, STM32CubeProgrammer detects the IAP/USBx like DFU bootloader and after connection an IAP message appears in the log panel.

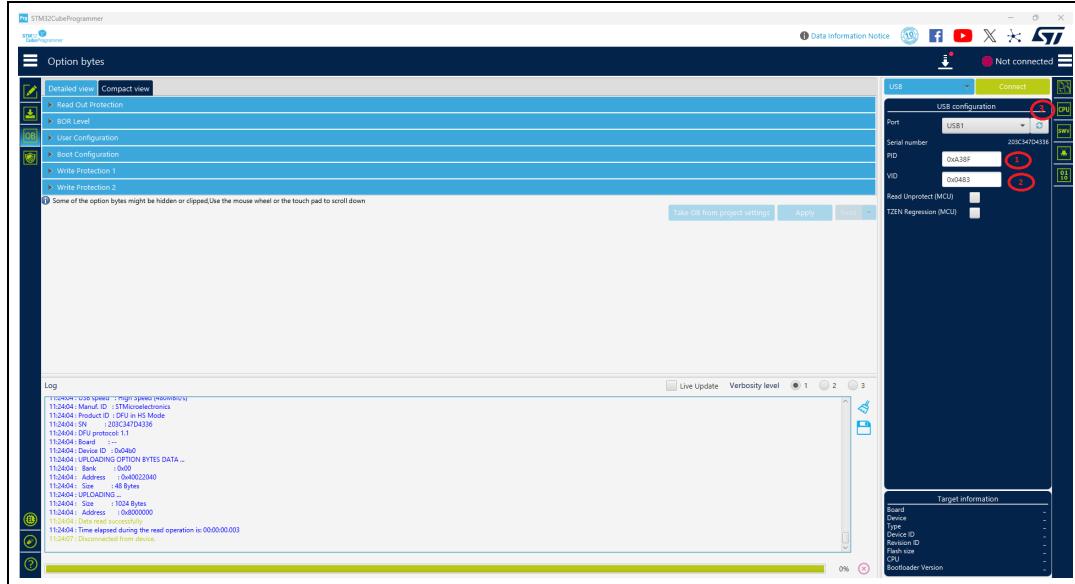
To connect via the new USB DFU follow this sequence:

1. Modify the default product ID.
2. Modify the default vendor ID.
3. Click on refresh button then on the connect button.

Note: If the user does not enter a PID or VID value, STM32CubeProgrammer takes the default values of ST products (PID = 0xDF11, VID = 0x0483).

Figure 54 shows the steps to connect via the new USB DFU panel.

Figure 54. Connect via USB DFU panel



Note: For CLI mode check [Section 3.2.1: Connect command](#).

2.12 SigFox™ credentials

As soon as an STM32WL device is connected, the window shown in [Figure 55](#) is displayed. This window displays the chip certificate, having the size of 136 bytes. The user can save it in binary file and copy the data to the clipboard.

After extracting the chip certificate, a back-end web-service verifies the data and returns two SigFox credentials: binary and header files.

Case 1: Binary-Raw

Use the binary file returned by the back-end web-service. The size of this file must be equal to 48 bytes, it is written at the default address 0x0803E500.

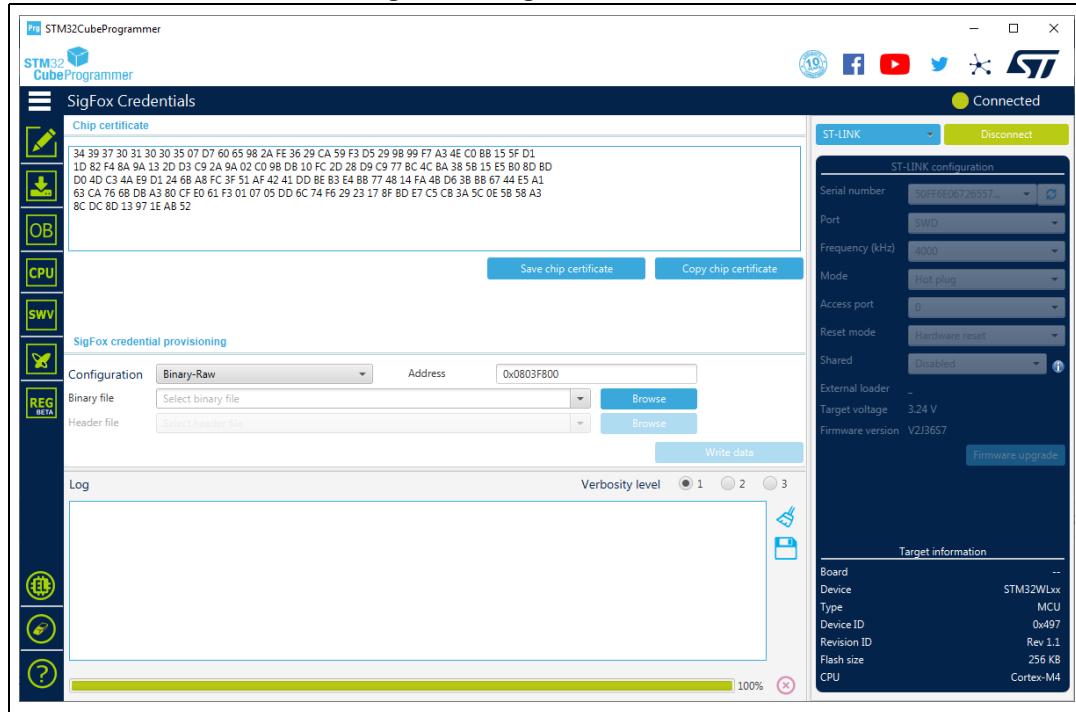
Case 2: Binary KMS

Use the header file returned by the back-end web-service. It is written at the default address 0x0803E500.

Note:

To access ST SigFox server using STM32CubeProgrammer, user must click on “Open Sigfox page”. A web page opens, the user must manually copy the certificate and then generate the SigFox credentials (binary and header files).

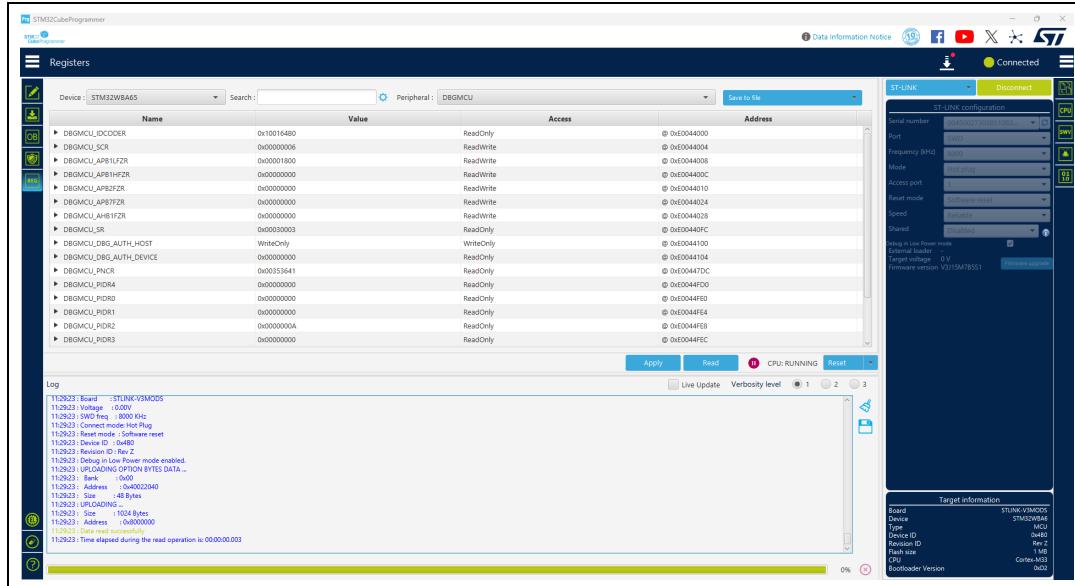
Figure 55. SigFox credentials



2.13 Register Viewer

STM32CubeProgrammer supports the Register Viewer feature (see [Figure 56](#)), allowing the user to visualize all the MCU and core registers in real time while running the application. It also allows the modification of MCU registers values or saving them into a log file.

Figure 56. Register Viewer window



Note:

Register Viewer is available only through SWD/JTAG interfaces.

Register Viewer has as input a list of files containing the data describing the mapping of the core and STM32 registers ("svd" files).

2.14 Hard Fault analyzer

2.14.1 Description

The STM32CubeProgrammer Fault analyzer feature interprets information extracted from the Cortex-M based device to identify the reasons that caused a fault.

This information is visualized in the Fault analyzer window in GUI mode or in CLI mode. It helps to identify system faults occurring when the CPU is driven into a fault condition by the application software.

Possible detected fault exceptions:

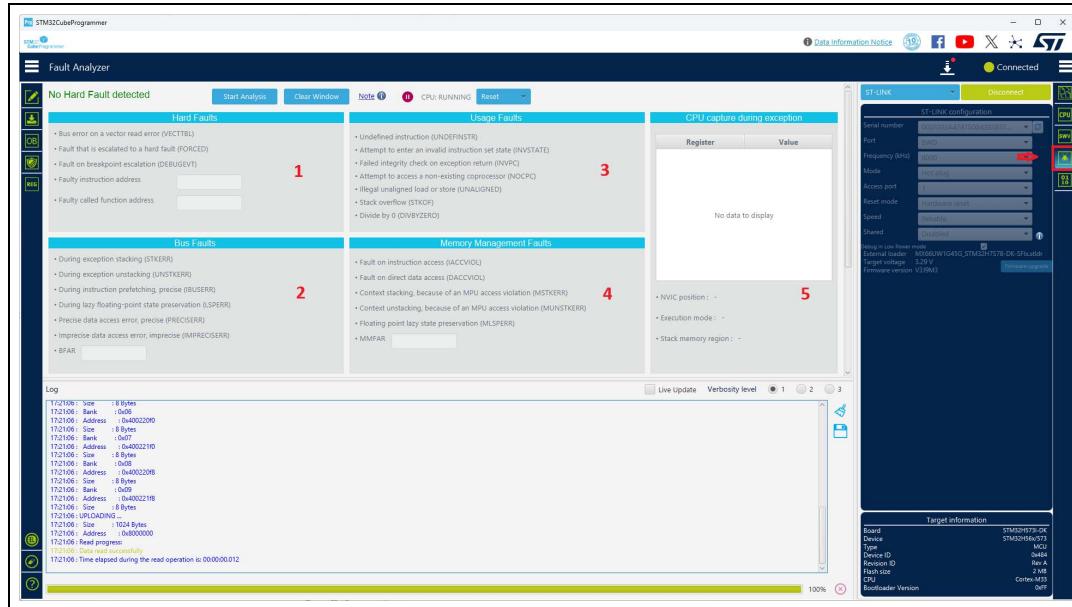
- Hard Fault: default exception, can be triggered by an error during exception processing by Bus Fault, Memory Management Fault, or Usage Fault if their handler cannot be executed.
- Memory Management Fault: detects memory access violations to regions defined in the memory management unit (MPU), such as code execution from a memory region with read/write access only.
- Bus Fault: detects memory access errors on instruction fetch, data read/write, interrupt vector fetch, and register stacking (save/restore) on interrupt (entry/exit).
- Usage Fault: detects execution of undefined instructions, unaligned memory access for load/store multiple. When enabled, divide-by-zero and other unaligned memory accesses are detected.
- Secure Fault: provides information about security related faults for Cortex-M33 based devices.

Note:

Fault analyzer is available only for ST-LINK interfaces.

As shown in *Figure 57*, the Fault Analyzer window has five main sections.

Figure 57. Fault Analyzer window



1. Hard Faults details: indicates the type of occurred fault, locates the instruction and the called function addresses.
2. Bus Faults details: shows the status of bus errors resulting from instruction fetches and data accesses and indicates memory access faults detected during a bus operation. An address should be displayed on the BFAR text field.
3. Usage Faults details: contains the status for some instruction execution faults, and for data access.
4. Memory Management Faults details: indicates a memory access violation detected by the MPU. If this fault was triggered by a faulty address, access is displayed on the MMFAR text field.
5. CPU capture during exception: shows the CPU state when an exception was generated to have an overview for CPU registers and some helpful information.
 - b) NVIC position: indicates the number of the interrupt imposing the error, if it is “-” the interrupt/exception vector has no specific position.
 - c) Execution mode: indicates the operation mode Handler/Thread.
 - d) Stack memory region: indicates the used stack memory during the fault, Main or Process stack.

2.14.2 Example

Develop a simple application that generates a usage fault, set an instruction making a divide by zero (a non-permitted operation) in the main program function.

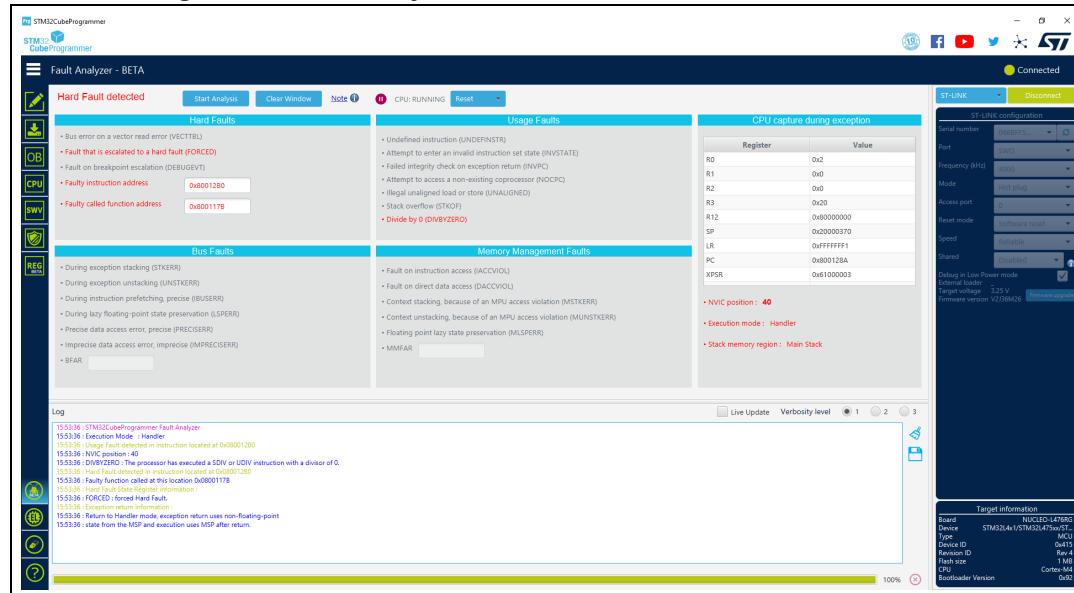
- int a = 4, b = 0, c = 0
- c = a / b

Open the Fault Analyzer window, press the “Start Analysis” button to start the fault detection algorithm, the reason of the error is displayed.

In this example, it displays “Hard Fault Detected”, and the label “divide by zero (DIVBYZERO)” is highlighted with additional informations:

- Faulty instruction address: 0x8000FF0
- Faulty called function address: 0x8000D40, indicates the address calling the faulty instruction
- NVIC position: 0, window watchdog interrupt
- Execution mode: handler
- Stack memory region: main stack

Figure 58. Fault analyzer GUI view when Hard Fault is detected

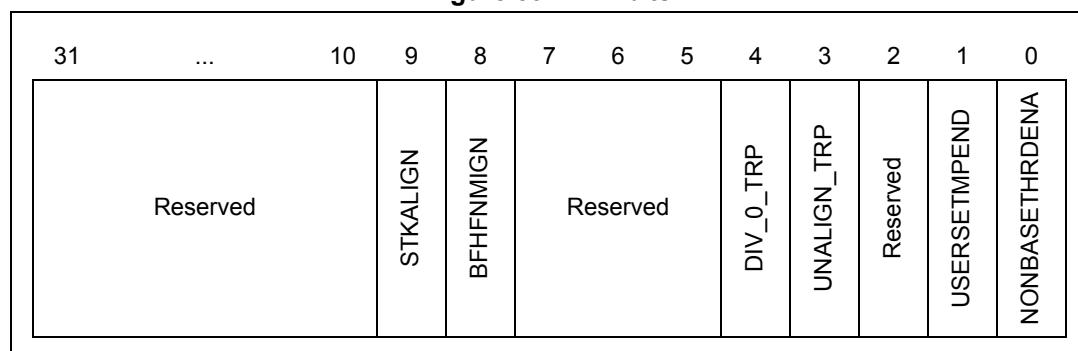


2.14.3 Fault analyzer note

Fault analyzer can be unable to detect untracked faults not enabled by software.

The configuration and control register (CCR) controls the behavior of the Usage Fault for divide by-zero and unaligned memory accesses, and it is used mainly to control customizable fault exceptions.

Figure 59. CCR bits



The following bits of the CCR control the behavior of the Usage Fault:

- DIV_0_TRP: Enable Usage Fault when the processor executes an SDIV or UDIV instruction with a 0 divider.
 - 0 = do not trap divide by 0; a divide by 0 returns a quotient of 0.
 - 1 = trap divide by 0.
- UNALIGN_TRP: enable usage fault when a memory access to unaligned addresses is performed.
 - 0 = do not trap unaligned half-word and word accesses
 - 1 = trap unaligned half-word and word accesses; an unaligned access generates a usage fault.

Note that unaligned accesses with LDM, STM, LDRD, and STRD instructions always generate a usage fault, even when UNALIGN_TRP is set to 0.

STM32CubeProgrammer enables the required bits at the analysis startup, if no fault is detected an informative popup is displayed to indicate that you must reproduce the scenario and restart the analysis.

2.14.4 Secure Fault analyzer for Cortex-M33

STM32CubeProgrammer provides information about security related faults for Cortex-M33 based devices for both CLI and GUI interfaces.

A new field named “Secure Faults” is added to Fault Analyzer window when connecting a Cortex-M33-based device (such as an MCUs of the STM32L5 series).

The result analysis is based on Secure Fault Status Register (SFSR) settings and a fault is triggered if an error occurs:

- INVEP: this bit is set if a function call from the nonsecure state or exception targets a non-SG instruction in the secure state. This bit is also set if the target address is a SG instruction, but there is no matching SAU/IDAU region with the NSC flag set.
- INVIS: this bit is set if the integrity signature in an exception stack frame is found to be invalid during the unstacking operation.
- INVER: set to 1 when returning from an exception in the nonsecure state.
- AUVIOL: attempt was made to access parts of the address space that are marked as secure with NS-Req for the transaction set to nonsecure. This bit is not set if the violation occurred during lazy state preservation.
- INVTRAN: indicates that an exception was raised due to a branch not flagged as being domain crossing causing a transition from secure to nonsecure memory.
- LSPERR: Indicates that an SAU or IDAU violation occurred during the lazy preservation of floating-point state.
- SFARVALID: this bit is set when the SFAR register contains a valid value.
- LSERR: indicates that an error occurred during lazy state activation or deactivation.
- SFAR: indicates the address value when a secure fault is raised.

2.15 Fill memory command

-fillmemory

Description: This command allows the user to fill memory with a given pattern from the chosen address.

Syntax: -fillmemory <start_address> [size=<value>] [pattern=<value>] [datawidth=8|16|32]

<start_address>: Start address for write.
The address 0x08000000 is used by default.

[size=<value>]: Size of the data to write.

[pattern=<value>]: The pattern value to write.

[datawidth=8|16|32]: Filling data size, can be 8, 16, or 32 bits.
The selected value by default is 8 bits.

- Example 1:

```
STM32_Programmer_CLI.exe -c port=swd -fillmemory 0x08000000  
size=0x10 pattern=0XAA datawidth=16 (Figure 60)
```

- Example 2:

```
STM32_Programmer_CLI.exe -c port=swd -fillmemory 0x08000000  
size= 0x10 pattern=0XCC datawidth=32 (Figure 61)
```

Figure 60. Fill memory command - Example 1

The screenshot shows the STM32_Programmer_CLI terminal window. It displays device information and the execution of a memory fill operation.

```
ST-LINK SN : 0670FF554949677067035117
ST-LINK FW : V2J30M20
Board      : STM32H743 -EV
Voltage    : 3.23V
SWD freq   : 4000 KHz
Connect mode: Normal
Reset mode  : Software reset
Device ID   : 0x450
Revision ID : Rev Z
Device name  : STM32H7xx
Flash size   : 2 MBytes
Device type  : MCU
Device CPU   : Cortex-M7

Filling memory operation:
Start address          : 0x08000000
Size(Bytes)           : 0x00000010
Data value             : 0x000000AA
Filling data size(Bytes): 16 bits

Erasing internal memory sector 0
100%

Downloading 16-bit data achieved successfully
The filling memory operation achieved successfully
```

Figure 61. Fill memory command - Example 2

```

ST-LINK SN : 0670FF554949677067035117
ST-LINK FW : V2J30M20
Board : STM32H743 -EV
Voltage : 3.22V
SWD freq : 4000 KHz
Connect mode: Normal
Reset mode : Software reset
Device ID : 0x450
Revision ID : Rev Z
Device name : STM32H7xx
Flash size : 2 MBytes
Device type : MCU
Device CPU : Cortex-M7

Filling memory operation:
Start address : 0x08000000
Size(Bytes) : 0x00000010
Data value : 0x000000CC
Filling data size(Bytes): 32 bits

Erasing internal memory sector 0
100%

Downloading 32-bit data achieved successfully
The filling memory operation achieved successfully

```

2.16 Fill memory operation

The user can open the Fill memory window from different sub-menus.

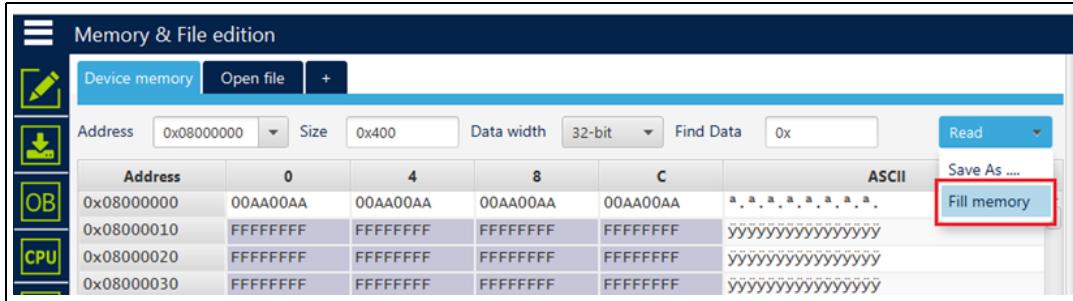
Figure 62. Sub-menu displayed from Read combo-box

Figure 63. Sub-menu displayed with right click on Device memory tab

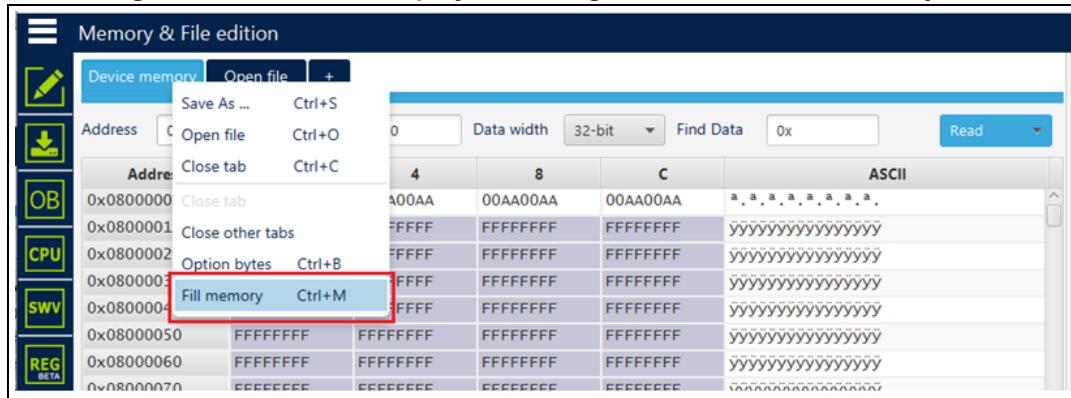
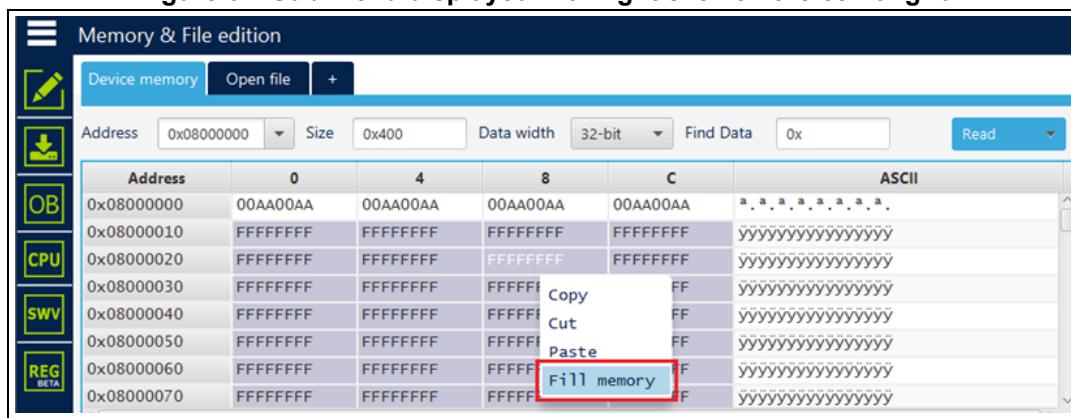


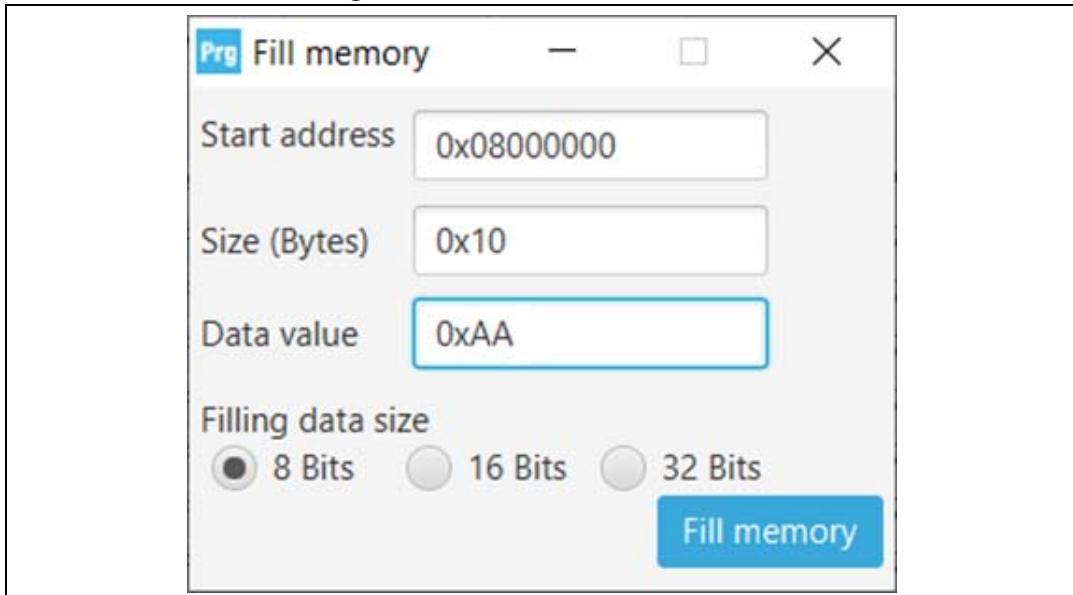
Figure 64. Sub-menu displayed with right click on the cell of grid



Note: *In addition to sub-menus to display this window, user can open it directly by using the key combination "Ctrl+M".*

After clicking on "Fill memory" option, a window is displayed so that the user can initialize the parameters of the operation (see [Figure 65](#)).

Figure 65. Parameters initialization



2.17 Blank check command

-blankcheck

Description: This command allows the user to verify that the STM32 flash memory is blank. If this is not the case, the first address with data is highlighted in a message.

Syntax: **-blankcheck**

Examples: STM32_Programmer_CLI.exe -c port=swd -blankcheck

Figure 66. Example 1: memory is not blank at address 0x08000014

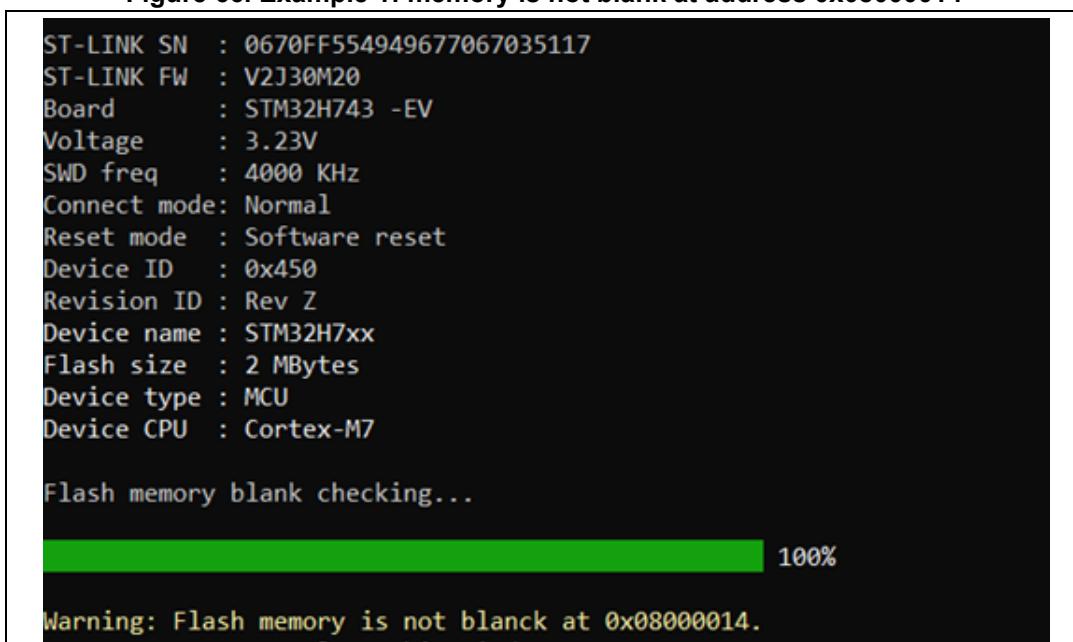


Figure 67. Example 1: memory is blank

The screenshot shows the STM32CubeProgrammer interface. At the top, there is a series of status lines:
ST-LINK SN : 0670FF554949677067035117
ST-LINK FW : V2J30M20
Board : STM32H743 -EV
Voltage : 3.22V
SWD freq : 4000 KHz
Connect mode: Normal
Reset mode : Software reset
Device ID : 0x450
Revision ID : Rev Z
Device name : STM32H7xx
Flash size : 2 MBytes
Device type : MCU
Device CPU : Cortex-M7

Below this, a message says "Flash memory blank checking...". A green progress bar is shown at 100%. At the bottom, the text "Flash memory is blank." is displayed in green.

2.18 Blank check operation

The user can open the Fill memory window from different sub-menus.

Figure 68. Sub-menu displayed from “Read” combo-box

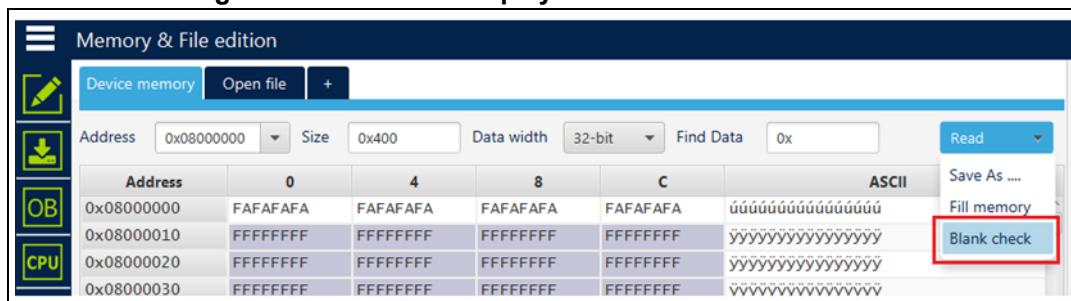


Figure 69. Sub-menu displayed with right click on “Device memory” tab

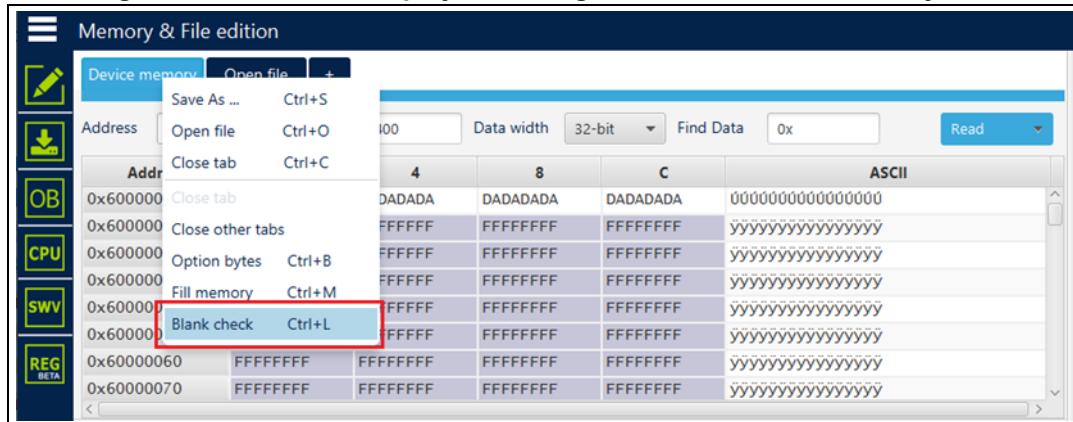
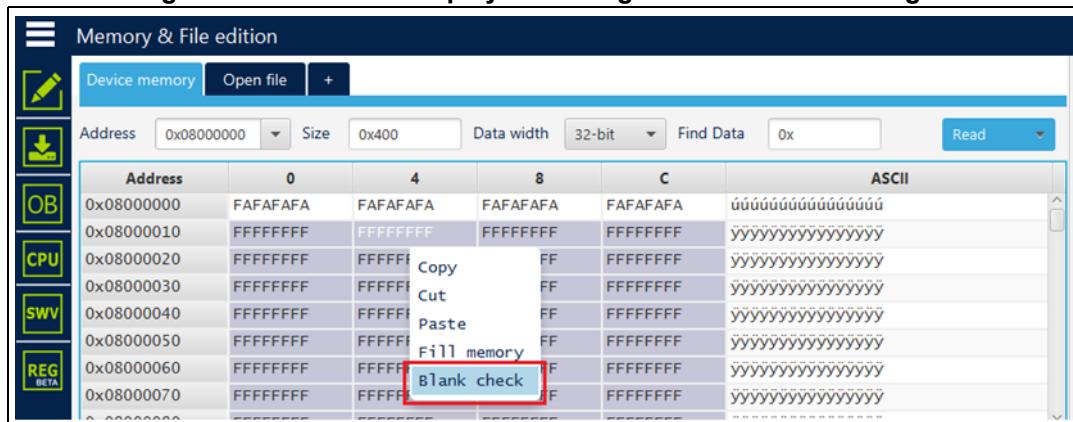


Figure 70. Sub-menu displayed with right click on the cell of grid



Note: In addition to sub-menus to display this window, user can launch the operation directly by using the key combination Ctrl+L.

After clicking on “Blank check” sub-menu, the process starts to verify that the STM32 flash memory is blank. If the flash memory is not blank, the first address with data is highlighted in a message, as shown in [Figure 71](#).

The expected results are shown in figures [72](#) and [73](#).

Figure 71. First address with data

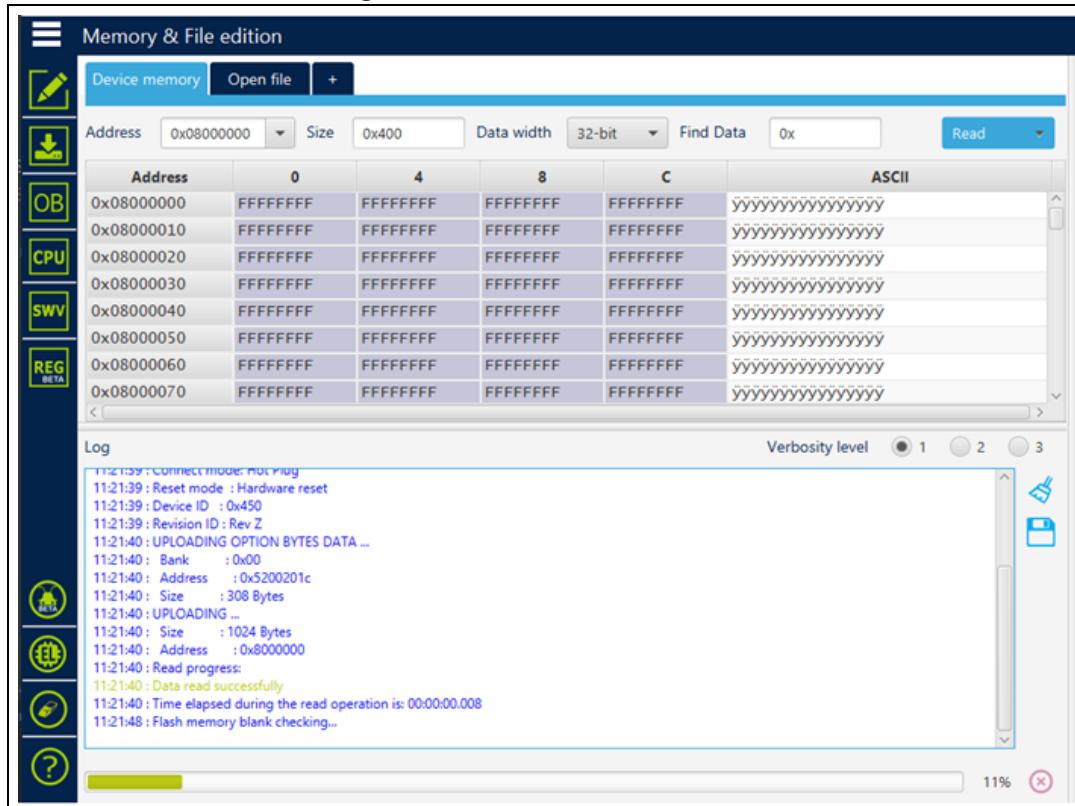


Figure 72. Example 1: memory is blank

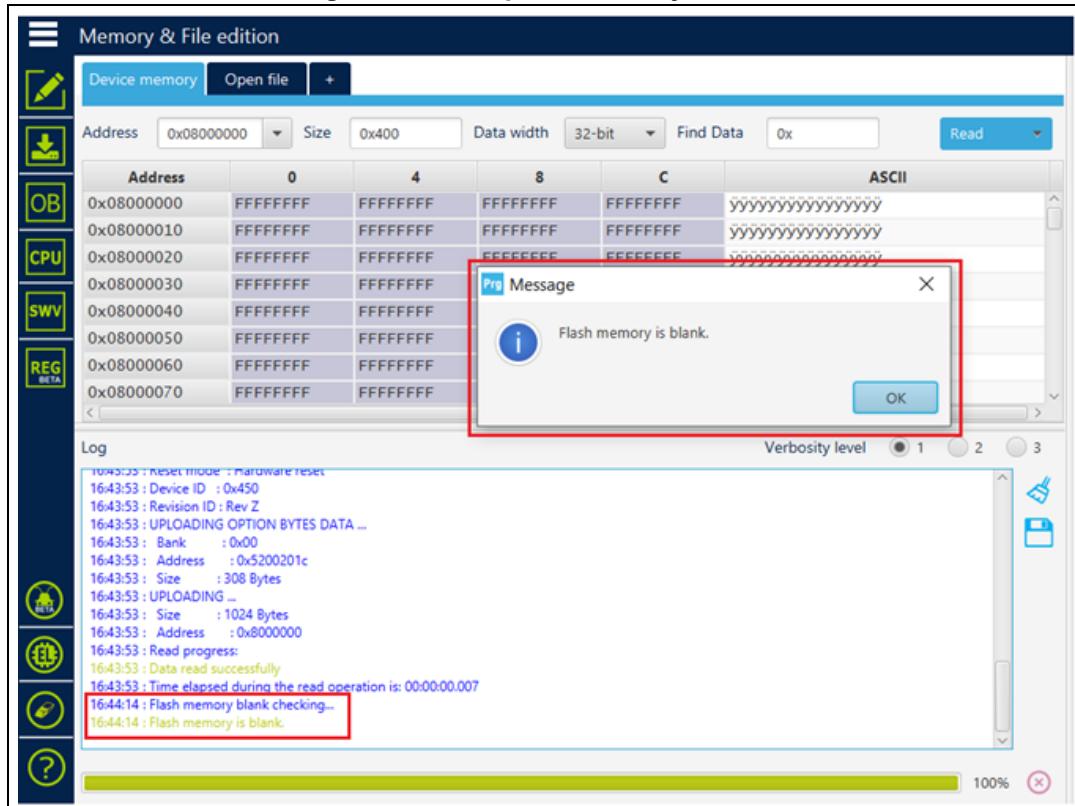
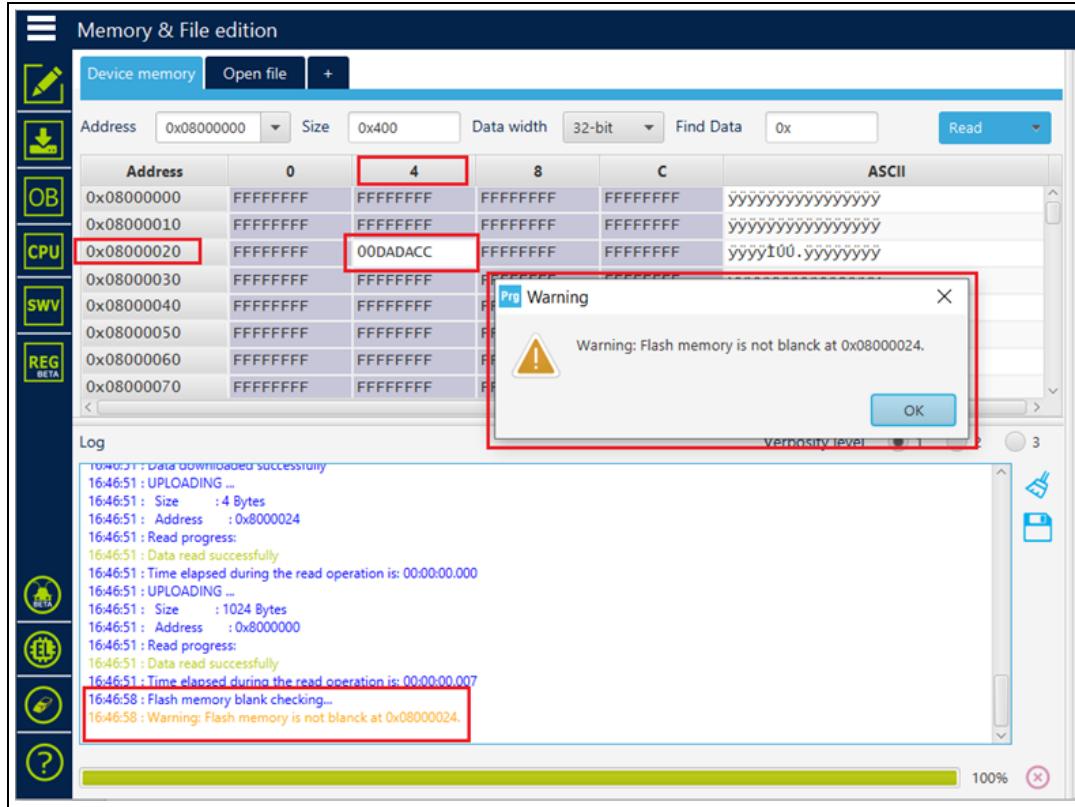


Figure 73. Example 2: memory is not blank



2.19 Compare flash memory with file

Description: Compares the MCU device memory content with a binary, hex, srec, elf, out and axf file. The difference is shown in red in the file and in the flash memory panel.

The user can open the comparison window from different sub-menus.

Figure 74. Sub-menu displayed from “Read” combo-box

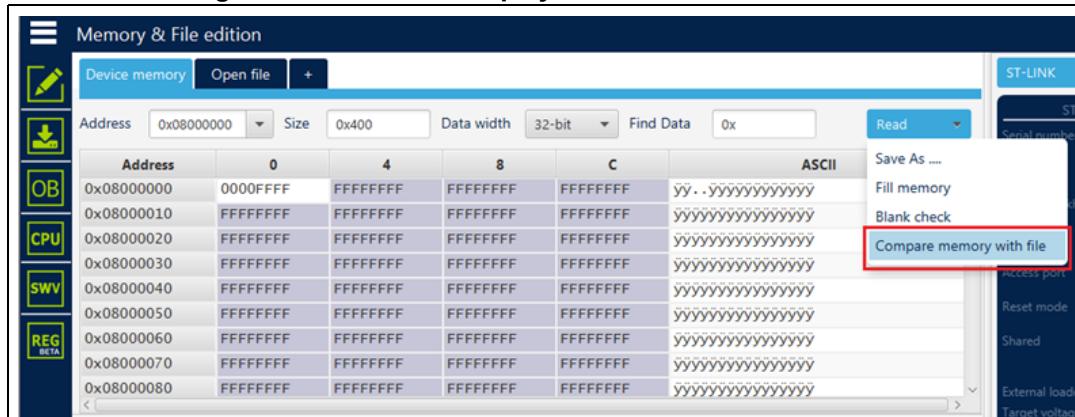


Figure 75. Sub-menu displayed with right click on “Device memory” tab

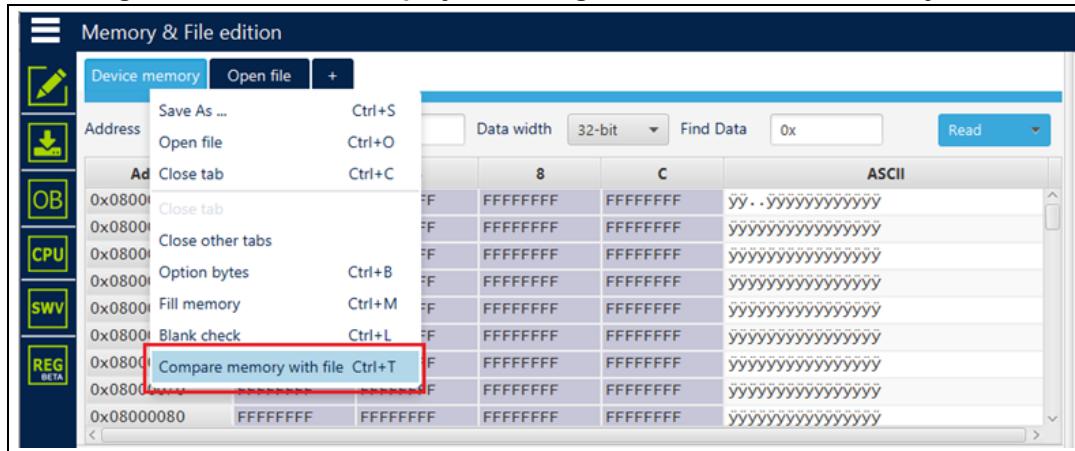


Figure 76. Sub-menu displayed with right click on the cell of grid

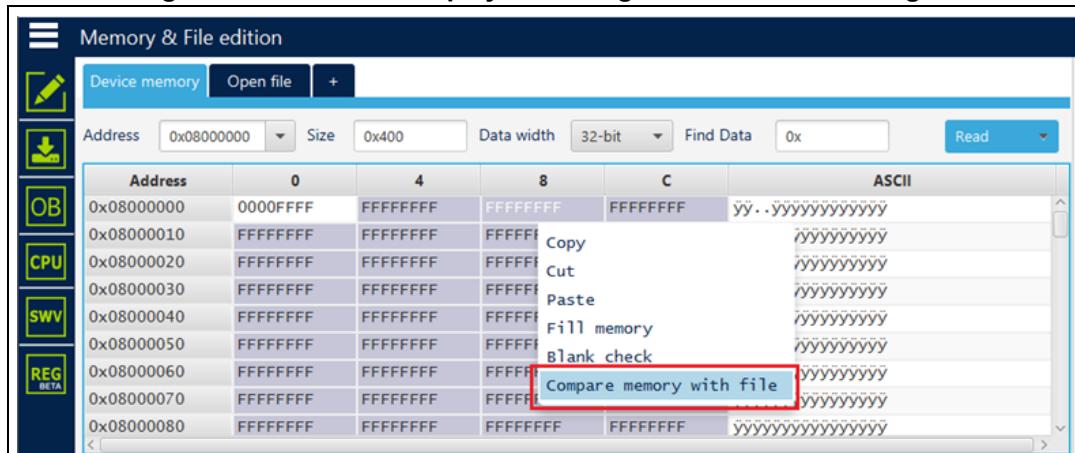


Figure 77. Sub-menu displayed with add tab button

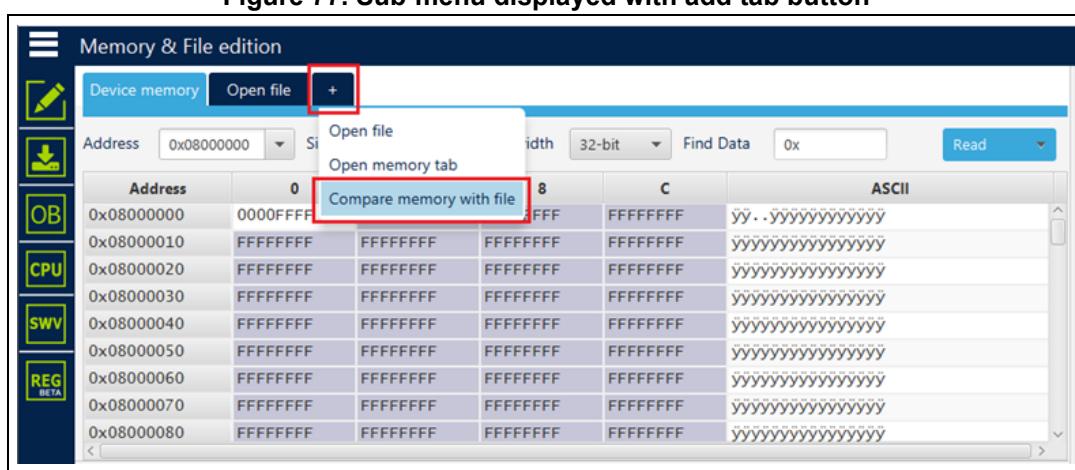


Figure 78. Sub-menu displayed with right click on the opened file tab

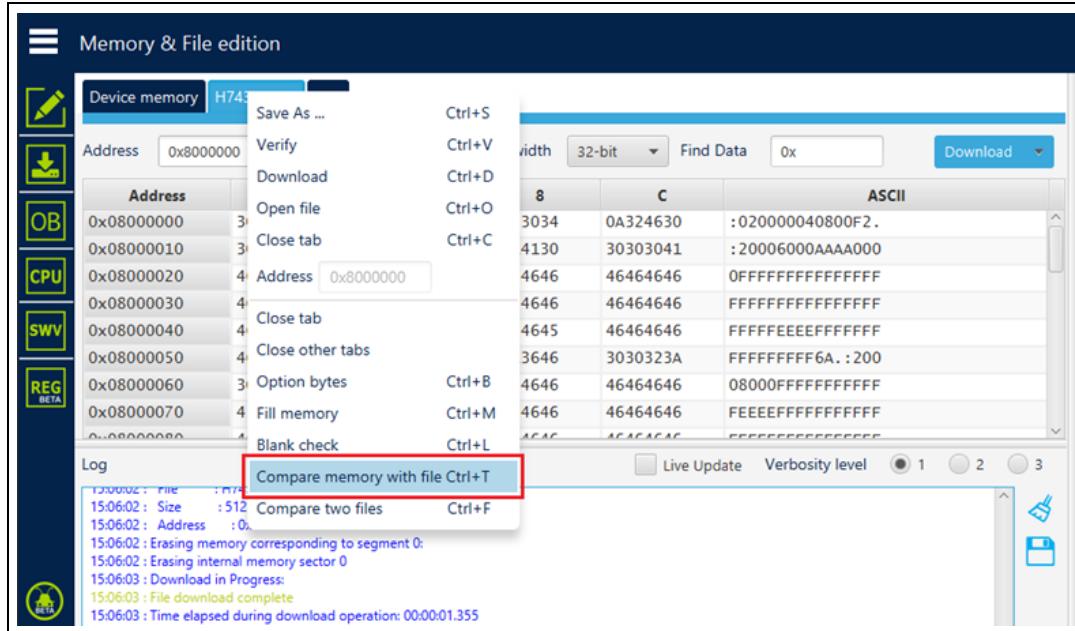
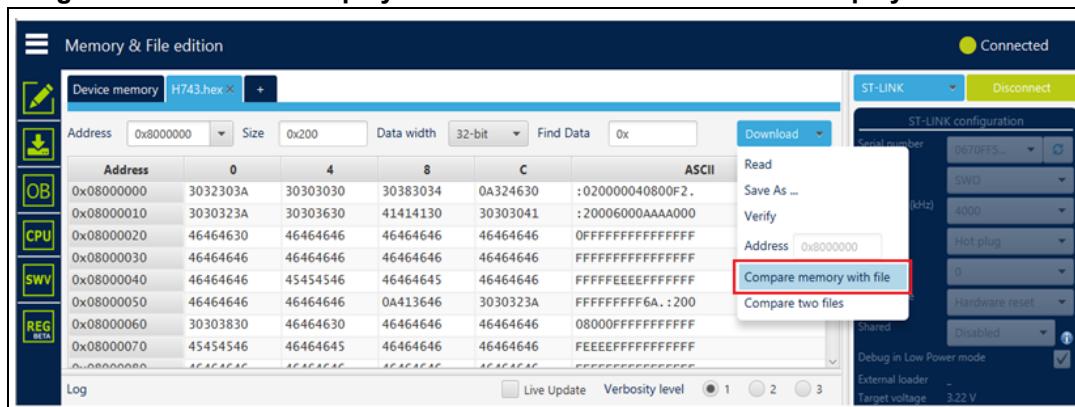


Figure 79. Sub-menu displayed from “Download” combo-box displayed in file tab

**Note:**

In addition to sub-menus to display this window, the user can launch the operation directly by using the key combination Ctrl+T.

Example 1: Difference between internal flash memory and binary file

Figure 80. Data width: 32 bits

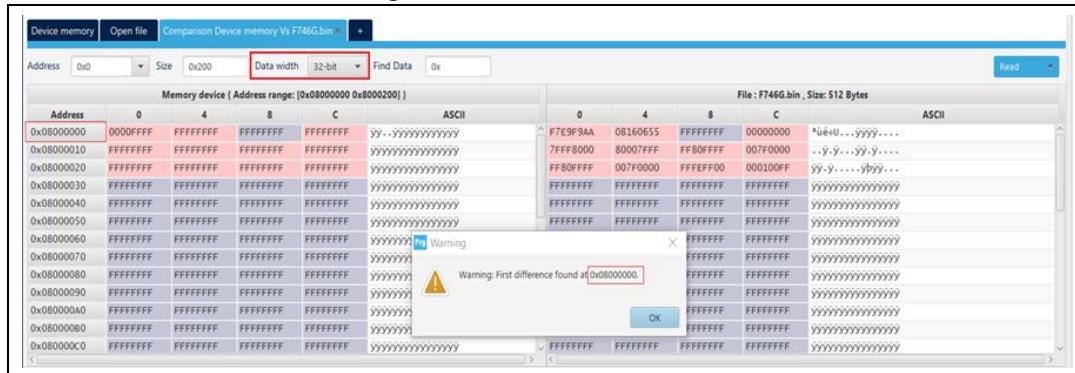


Figure 81. Data width: 16 bits

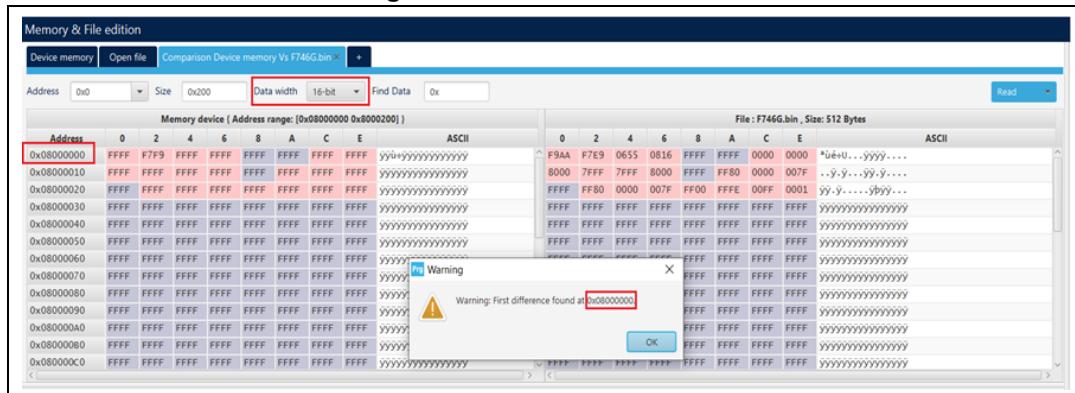
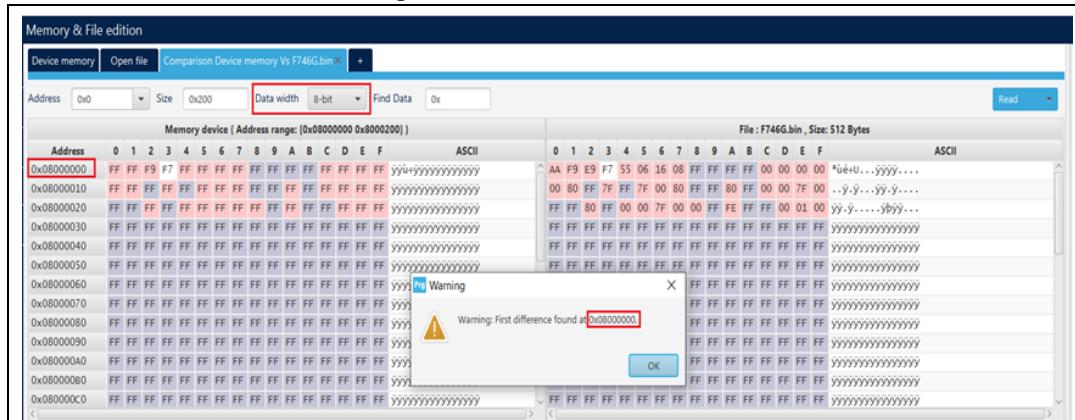


Figure 82. Data width: 8 bits



Example 2: Difference between external flash memory and hex file

Figure 83. Data width: 32 bits

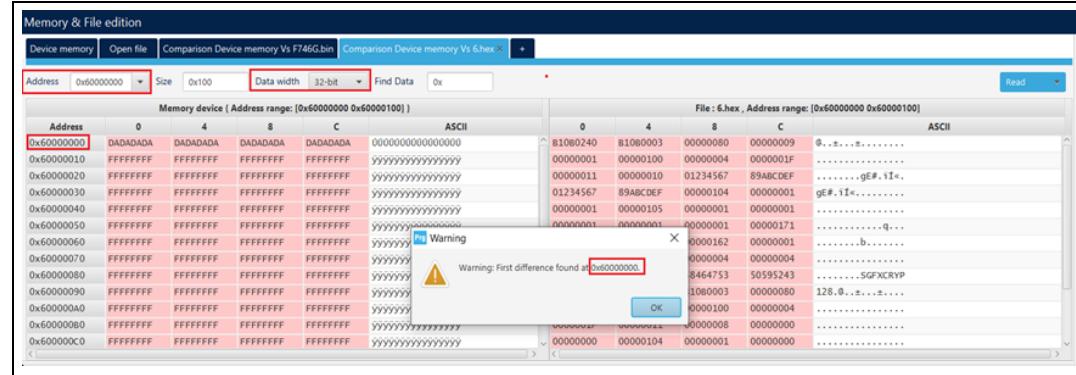


Figure 84. Data width: 16 bits

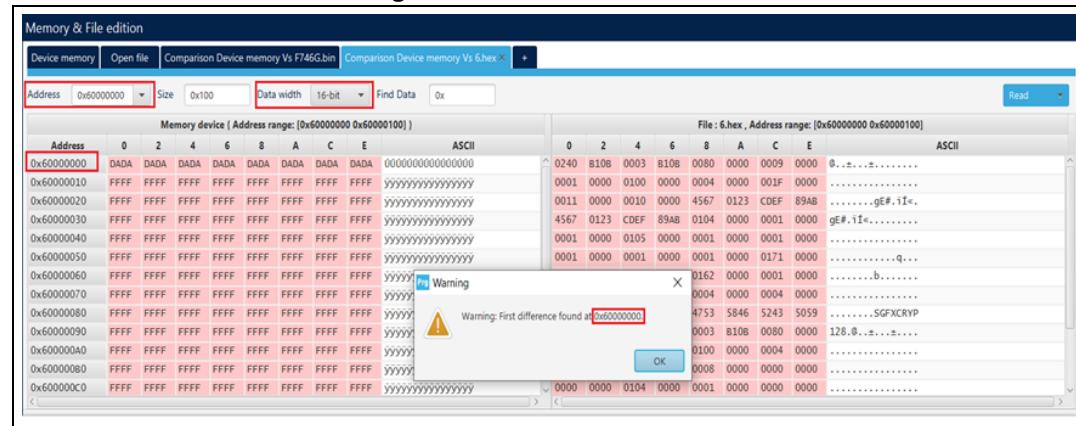
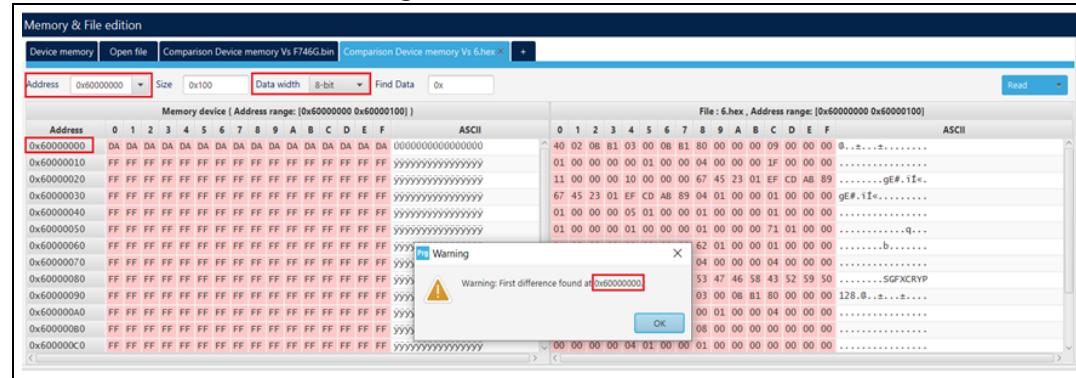


Figure 85. Data width: 8 bits



After launching the comparison between the flash memory and file, and the edit of data in the memory, the user must make an update in the comparison tab using the read button.

Example 3: Update comparison between flash memory and file after editing

Figure 86. Before editing the flash memory

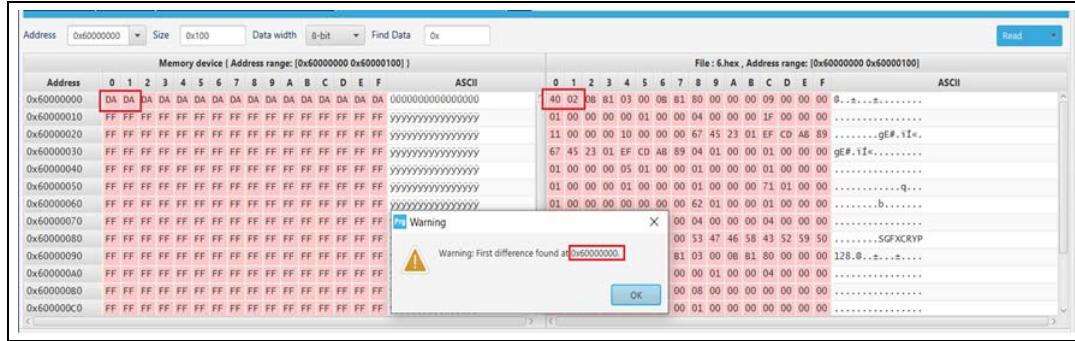
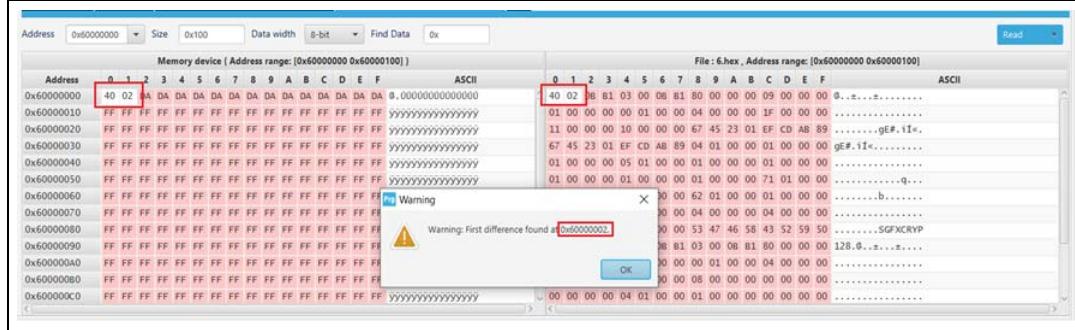


Figure 87. After editing the flash memory



Note:

The user can make multiple comparisons between flash memory and files.

Figure 88. Multiple comparisons



2.20 Comparison between two files

Description: Compares the content of two different files (binary, hex, srec, elf, out and axf). The difference is colored in red in the grid panel of each file.

This operation does not need a connected board.

The used files can be of different sizes and types.

The user can open the comparison window from different sub-menus.

Figure 89. Sub-menu displayed from “Read” combo-box in device memory tab

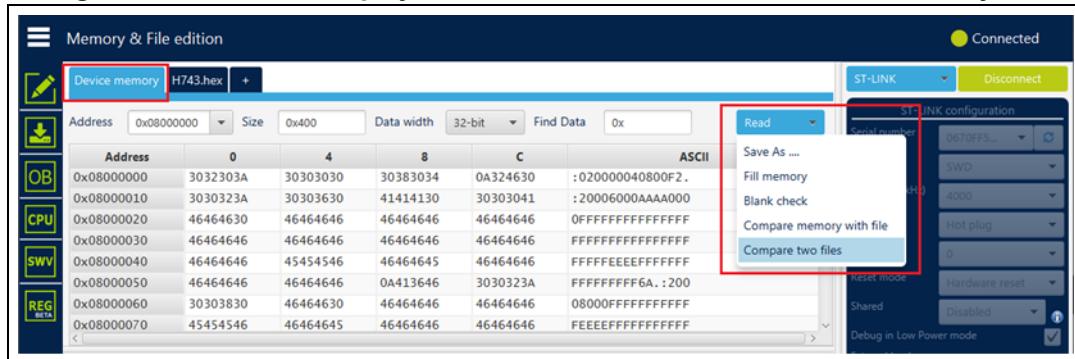


Figure 90. Sub-menu displayed with right click on “Device memory” tab

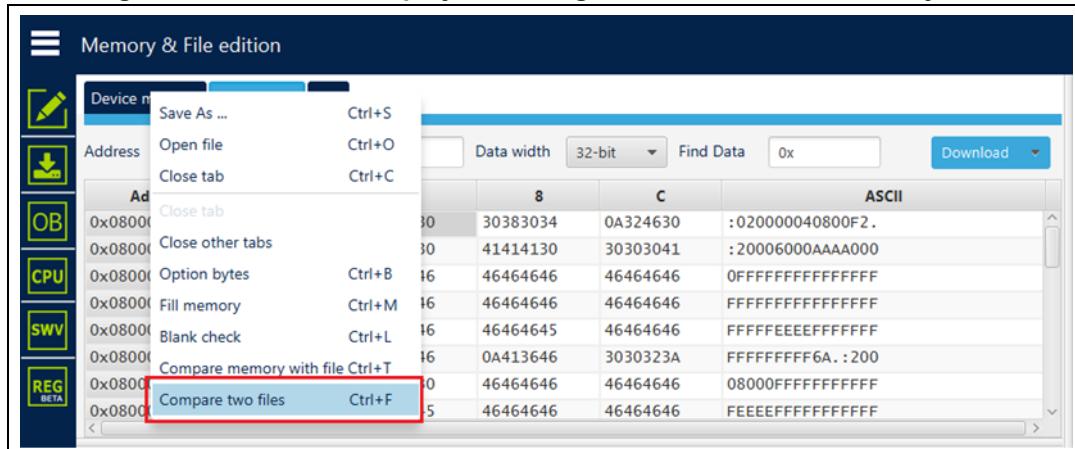


Figure 91. Sub-menu displayed with right click on the cell of grid

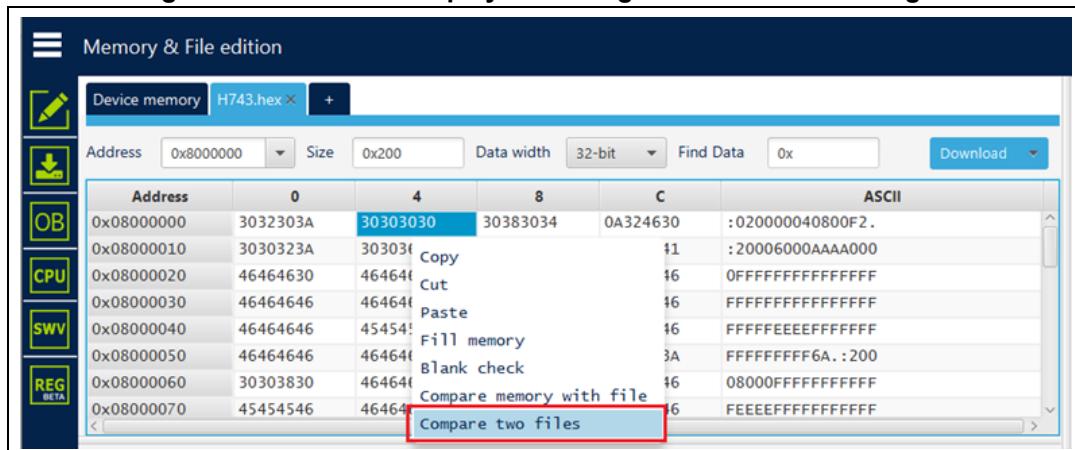


Figure 92. Sub-menu displayed with add tab button

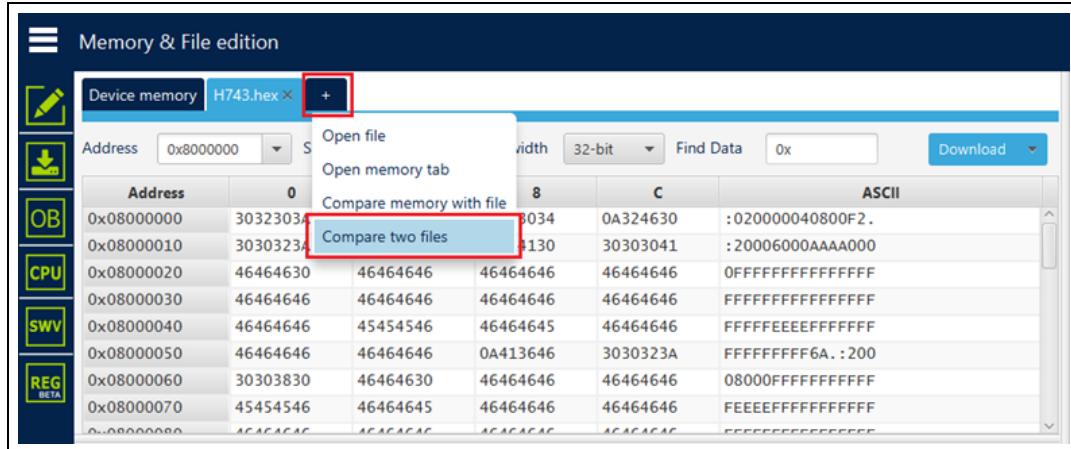


Figure 93. Sub-menu displayed with right click on the opened file tab

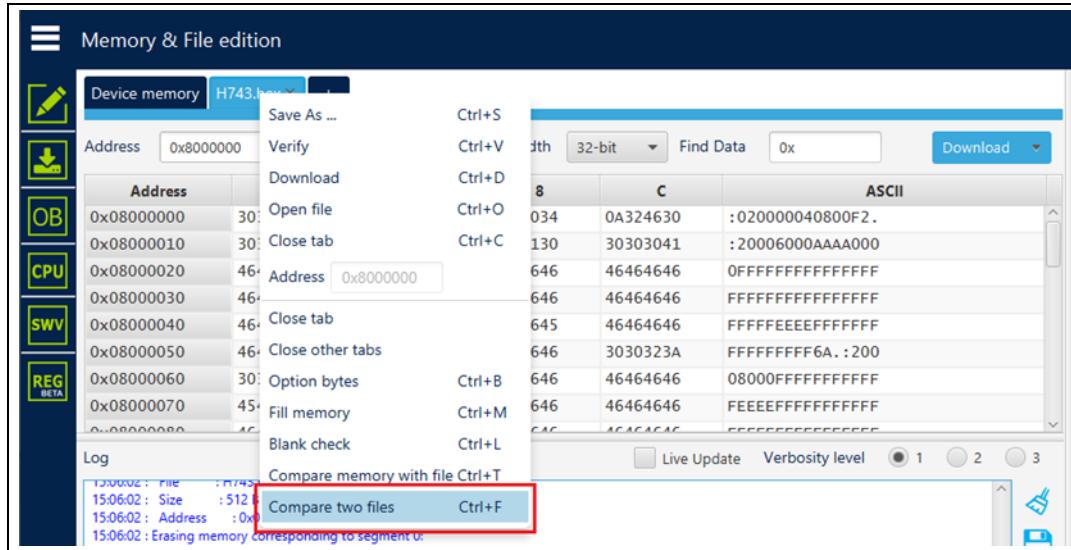
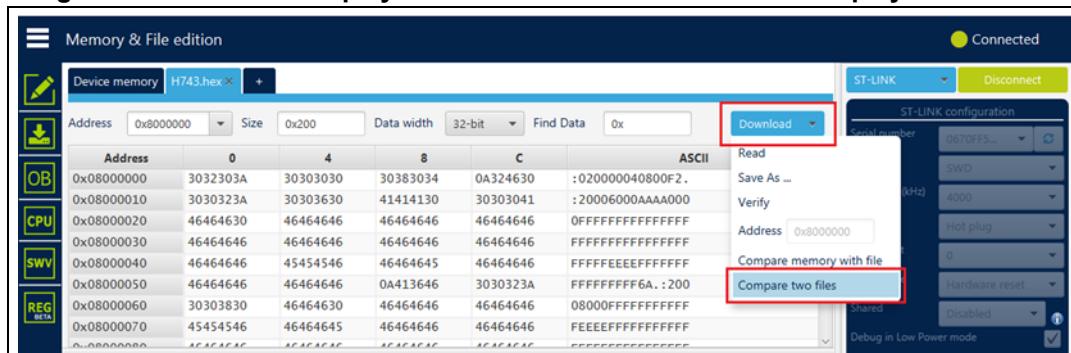


Figure 94. Sub-menu displayed from "Download" combo-box displayed in file tab

**Note:**

In addition to sub-menus to display this window, the user can open it directly by using the key combination **Ctrl+F**.

Example: Difference between two files of the same type and different sizes

Figure 95. Data width: 32 bits

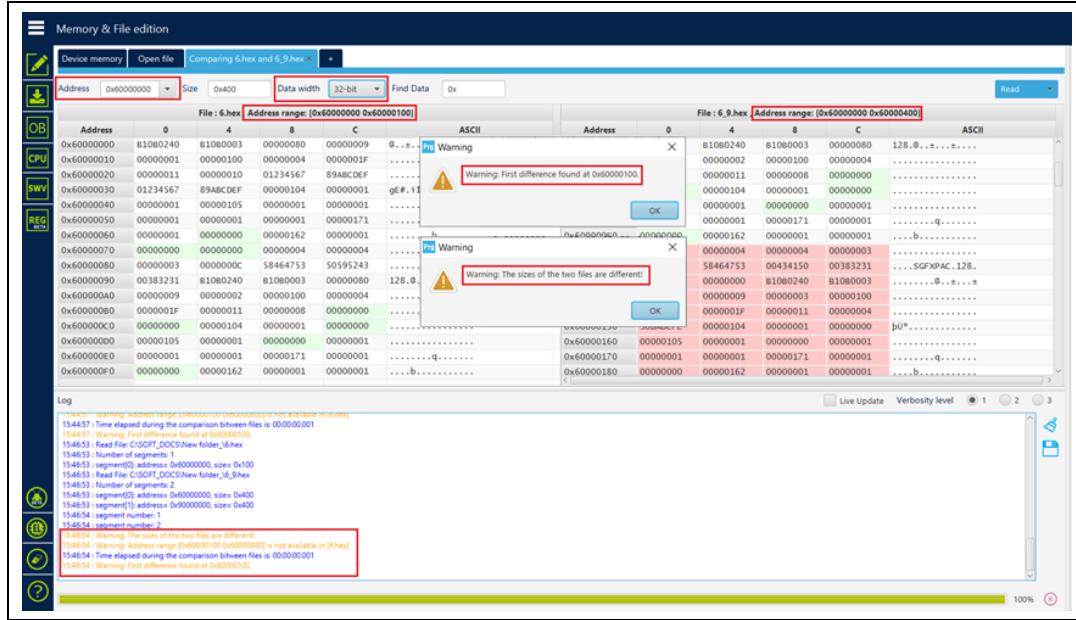


Figure 96. Data width: 16 bits

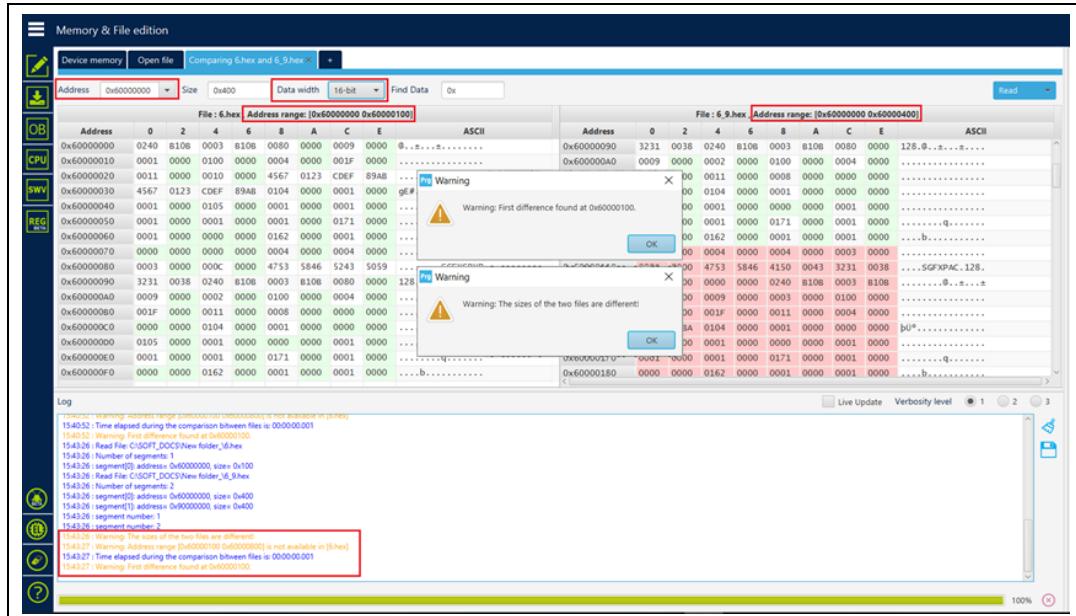
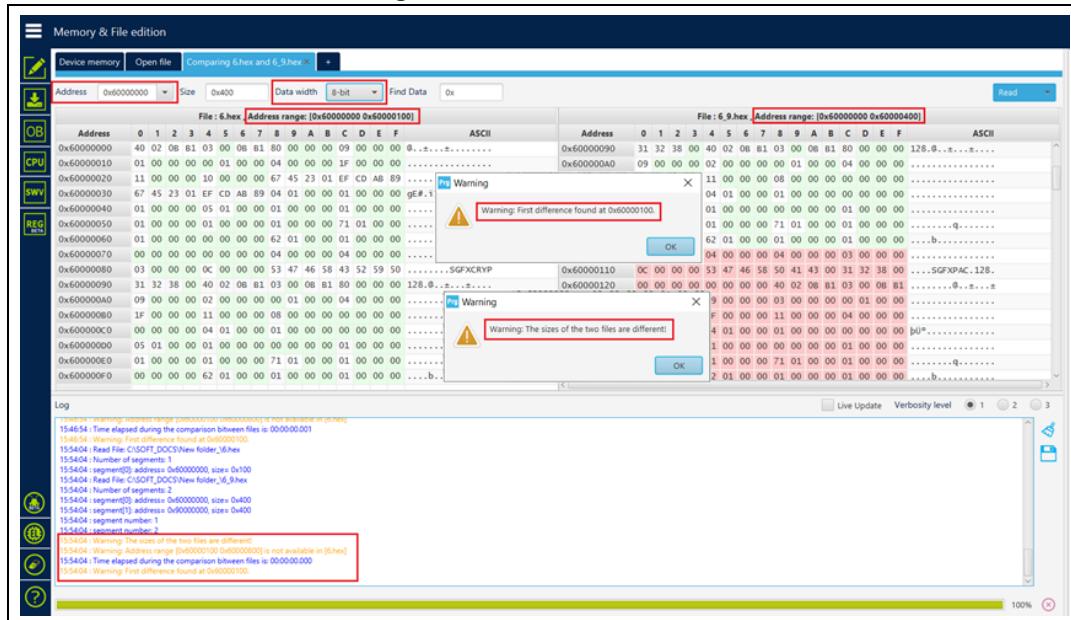


Figure 97. Data width: 8 bits



Note: The user can make multiple comparisons between files.

Figure 98. Multiple comparisons



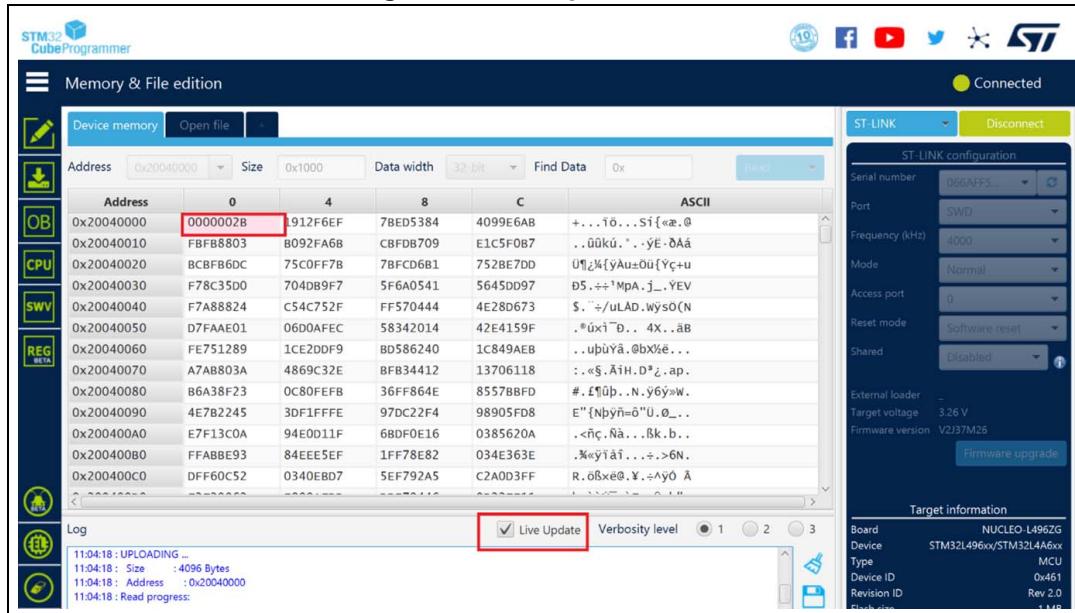
2.21 LiveUpdate feature

-liveUpdate checkbox

Description: When this feature is used the device memory grid is updated in real time and the modified data are highlighted in pink.

Once the device is connected, the user can check the liveUpdate checkbox, memory data are updated in real time.

Figure 99. Live update of data

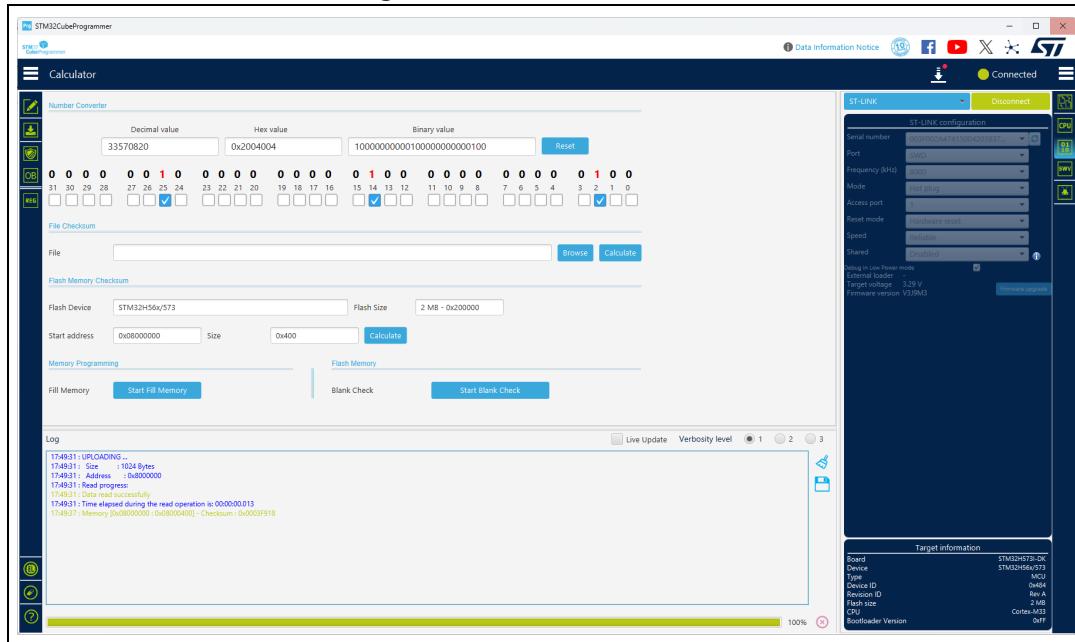


2.22 Calculator

Description: The Calculator window, created for general purposes, is always available, even if the device is not connected. The user interface has three main goals:

1. Number converter
 - Composed by several graphical components, to facilitate the number conversion between decimal, hexadecimal, and binary formats.
 - Use the 32 check boxes, representing a word of 32 bits, to activate or deactivate the relevant bit(s).
 - Use the “Reset” button to reinitialize the number to 0.
 - Any time a bit is changed, the number value is updated.
2. Checksum calculation
 - To calculate the checksum value, based on addition algorithm applicable on the file content or on the flash memory.
 - File Checksum: choose your binary file and click on “Calculate” button to display the corresponding result on the log panel.
 - Flash Memory Checksum: calculates the checksum value of a region (based on start address and size of the desired region) once the device is connected.
 - To calculate the full flash memory checksum retrieve the memory size, displayed in the “Flash size” field.
3. Memory programming
 - To expose the generic memory edition options
 - Fill memory: see [Section 2.16](#)
 - Blank check: see [Section 2.18](#)

Figure 100. Calculator window



Number converter and *File checksum* can be used even if there is no device connected. *Flash Memory Checksum*, *Fill Memory*, and *Blank Check* are applicable only if a device is already connected.

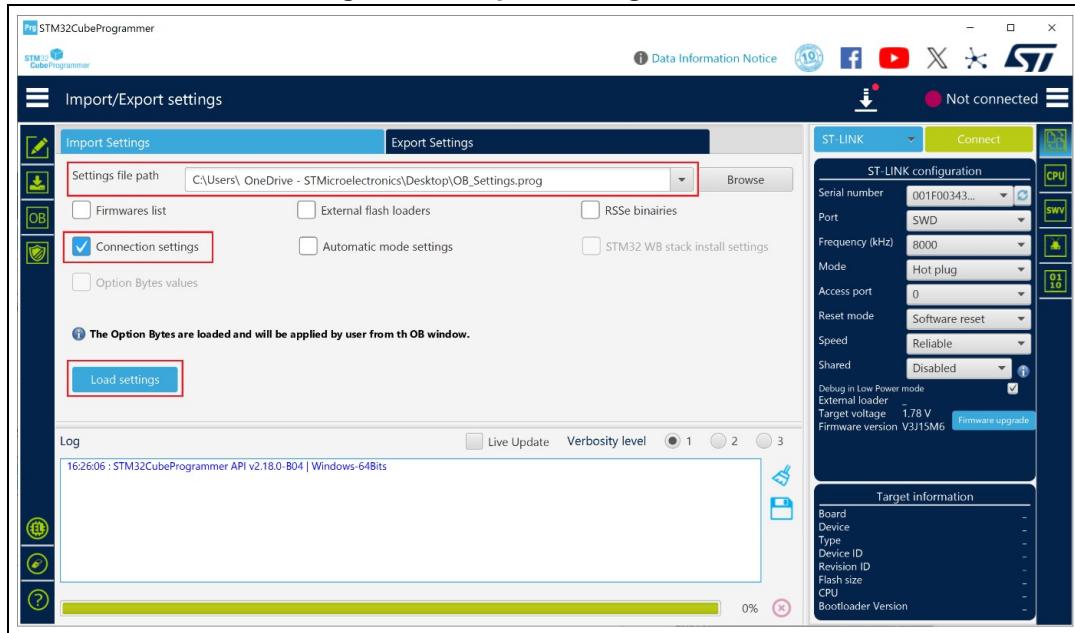
2.23 Import/Export project settings

The user can load/store the settings below from/to a “.prog” project file:

- Connection settings (only if the board is connected)
- Firmware’s list
- External flash loaders
- Settings used for the automatic mode
- Settings of STM32WB stack install (only when connecting STM32WB devices)
- RSSe binaries
- Option bytes values (only if the board is connected)

To import the settings, choose the settings file path and check at least one option.

Figure 101. Import settings interface



If the device ID saved in the imported project settings does not match the connected device, a warning message appears.

After importing the option bytes settings from the “Import/Export Settings” tab, apply them from the Option Bytes tab by clicking the “Take OB from Project Settings” button.

To export the settings, choose at least one MS58000MS.

2.24 OTP programming window for STM32N6

For generic usage of this window, refer to [Section 4.3](#). STM32N6 devices support 367 OTP words, and the STM32CubeProgrammer allows users to program these OTP with the same commands as MPU or the user interface.

- Via Debug interfaces: use the external loader OTP_FUSES_STM32N6xx from the "ExternalLoader" panel, selected by default when you connect via ST-Link.
- Via BootROM: STM32CubeProgrammer needs the TSV file that includes the OpenBootloader for OTP programming, refer to openBootloader Github for more details: STMicroelectronics/stm32-mw-openbl.

Example of OTP programming

The tool loads the OpenBootloader as requested in the TSV file using the embedded BOOTROM. Once the OpenBootloader is running, you can manipulate the entire OTP using the same commands as the MPU.

Command for launching the OpenBootloader: -c port=USB1 -d file.tsv

Example of TSV file to launch the OpenBootloader:

#Opt	Id	Name	Type	IP	Offset	Binary
P	0x1	FSBL	Binary	none	0x0	OpenBootloader_STM32N6-DK OTP_Cut2-Signed.stm32

2.25 External flash memory window for STM32N6

STM32N6 devices can be connected via ST-Link (JTAG/SWD) and via BootROM (USB/UART). The external flash memory can be programmed in two ways:

1. Via ST-Link: select the corresponding external flash loader from the “ExternalLoader” in GUI panel to perform programming, write, erase and read operations with an external memory.
2. Via BootROM: this is used to sequentially load the partitions requested by the BootROM. To achieve this, STM32CubeProgrammer requires the TSV file, which contains the OpenBootloader for the external memory programming, the corresponding external flash loader and the data to be loaded, refer to GitHub for more details.

3 STM32CubeProgrammer command line interface (CLI) for MCUs

3.1 Command line usage

The following sections describe how to use the STM32CubeProgrammer from the command line.

To launch command line interface, call

macOS: STM32CubeProgrammer.app/Contents/MacOs/bin/STM32_Programmer_CLI

Windows: ..\STMicroelectronics\STM32Cube\STM32CubeProgrammer\bin
 \STM32_Programmer_CLI.exe

Linux: ./STMicroelectronics/STM32Cube/STM32CubeProgrammer/bin
 /STM32_Programmer_CLI

3.2 Generic commands

This section presents the set of commands supported by all STM32 MCUs.

3.2.1 Connect command

-c, --connect

Description: Establishes the connection to the device. This command allows the host to open the chosen device port (UART/USB/JTAG/SWD/JLINK/SPI/CAN/I2C).

Syntax: `-c port=<Portname> [noinit=<noinit_bit>] [options]`

port=<Portname> Interface identifier, ex COMx (for Windows), /dev/ttySx for Linux), usbx for USB interface, SPI, I2C and CAN for, respectively, SPI, I2C and CAN interfaces.

[noinit=<noinit_bit>] Set No Init bits, value in {0, 1} ..., default 0. Noinit = 1 can be used if a previous connection is active.

- ST-LINK options

[freq=<frequency>] Frequency (in kHz) used in connection. Default value is 4000 kHz for SWD port, and 9000 kHz for JTAG port.

[reset=<mode>] Reset mode. Possible values are {SWrst/HWrst/Crst}. The default value is SWrst. When using UR connection mode, the reset mode is HWrst.

HWrst Hardware reset. Performed by the STLink, which physically drives the NRST pin of the MCU. The NRST pin of the STLink must be connected to the MCU.

SWrst Software reset (a system reset via Cortex registers)

Crst Core reset (via Cortex registers)

Note: *The entered frequency values are rounded to correspond to those supported by ST-LINK probe.*

[index=<index>] Index of the debug probe. Default index value is 0.

[sn=<serialNumber>] Serial number of the debug probe. Use this option if you need to connect to a specific ST-LINK probe of which you know the serial number. Do not use this option with Index option in the same Connect command.

[mode=<mode>] Connection mode. Value in {NORMAL/UR/HOTPLUG}. Default value is NORMAL.

Normal With “Normal” connection mode, the target is reset, then halted. The type of reset is selected using the “Reset Mode” option.

UR The “Connect Under Reset” mode enables connection to the target using a reset vector catch before executing any instruction. This is useful in many cases, for example when the target contains a code that disables the JTAG/SWD pins.

HOTPLUG The “Hot Plug” mode enables connection to the target without a halt or reset. This is useful for updating the RAM addresses or the IP registers while the application is running.

POWERDOWN Allows to put the target in debug mode, even if the application has not started since the target power up. The hardware reset signal must be connected between ST-Link and the target. This feature might be not fully effective on some boards (MB1360, MB1319, MB1361, MB1355) with STMPS2141 power switch.

hwRstPulse The tool generates a reset pulse and then connects to the target. This connection mode does not prevent application launch before connection. It is used in devices where under mode is not available, such as STM32WB0x and STM32WL33.

[ap=<accessPort>] Access port index. Default access port value is 0.

[speed=] Connection speed. Default is Reliable.
Available only for Cortex-M33.

Reliable Allows the user to connect with a slow mode.

Fast Allows the user to connect with a fast mode.

[shared] Enables shared mode allowing connection of two or more instances of STM32CubeProgrammer or other debugger to the same ST-LINK probe.

[tcpport=<Port>] Selects the TCP Port to connect to an ST-Link server. Shared option must be selected. Default value is 7184.

[dLPM / LPM] Disable/enable the debug in Low power mode (default configuration is enabled for the supported devices (STM32U5/WB/L4 series).

[getAuthID] Get device identification (only for STM32U5 series): is a 32-bit device specific quantity that can be read through the JTAG port. This 32-bit information is used to derive the expected OEM password keys to unlock this specific device. This command is not applicable when RDP level = 0 (MCU constraint).

Note: *Shared mode is supported only on Windows.*

- USB options

The connection under the DFU interface supports two options, namely product and vendor ID (default values PID = 0xDF11, VID = 0x0483).

- SPI options

[br=<baudrate>] Baudrate (for example 187, 375, 750), default 375

Note: *To use SPI on high speed, an infrastructure hardware must be respected to ensure the proper connection on the bus.*

[cpha=<cpha_val>] 1Edge or 2Edge, default 1Edge

[cpol=<cpol_val>] Low or high, default low

[crc=<crc_val>] Enable or disable (0/1), default 0

[crcpol=<crc_pol>] CRC polynomial value

[datasize=<size>] 8- or 16-bit, default 8-bit

[direction=<val>] 2LFULLDuplex/2LRxOnly/1LRx/1LTx

[firstbit=<val>] MSB/LSB, default MSB

[frameformat=<val>] Motorola/TI, default Motorola

[mode=<val>] Master/slave, default master

[nss=<val>] Soft/hard, default hard

[nsspulse=<val>] Pulse/NoPulse, default Pulse

[delay=<val>] Delay/NoDelay, default Delay

- J-Link options

[reset=<mode>] Reset mode. Possible values are {SWrst/HWrst/Crst}. The default value is SWrst. When using UR connection mode, the reset mode is HWrst.

HWrst Hardware reset. Performed by the STLink, which physically drives the NRST pin of the MCU. The NRST pin of the STLink must be connected to the MCU.

SWrst Software reset (a system reset via Cortex registers)

Crst Core reset (via Cortex registers)

[sn=<serialNumber>] Serial number of the debug probe. Use this option if you need to connect to a specific ST-LINK probe of which you know the serial number.

[mode=<mode>]	Connection mode. Value in {NORMAL/UR/HOTPLUG}. Default value is NORMAL.
Normal	With “Normal” connection mode, the target is reset, then halted. The type of reset is selected using the “Reset Mode” option.
UR	The “Connect Under Reset” mode enables connection to the target using a reset vector catch before executing any instructions. This is useful in many cases, for example when the target contains a code that disables the JTAG/SWD pins.
HOTPLUG	The “Hot Plug” mode enables connection to the target without a halt or reset. This is useful for updating the RAM addresses or the IP registers while the application is running.
[ap=<accessPort>]	Access port index. Default access port value is 0.
[speed=]	Connection speed. Default is Reliable. Available only for Cortex-M33.
Reliable	Allows the user to connect with a slow mode.
Fast	Allows the user to connect with a fast mode.

- I2C options

[add=<ownadd>] Slave address: address in hex format

Note: I2C address option must be always inserted, otherwise the connection is not established.

[br=<sbaudrate>] Baudrate: 100 or 400 kbps, default 400 kbps.

[sm=<semode>] Speed Mode, STANDARD or FAST, default FAST.

[am=<addmode>] Address Mode: 7 or 10 bits, default 7.

[af=<afilter>] Analog filter: ENABLE or DISABLE, default ENABLE.

[df=<dfilter>] Digital filter: ENABLE or DISABLE, default DISABLE.

[dnf=<dnfilter>] Digital noise filter: 0 to 15, default 0.

[rt=<rtime>] Rise time: 0-1000 (STANDARD), 0-300 (FAST), default 0.

[ft=<ftime>] Fall time: 0-300 (STANDARD), 0-300 (FAST), default 0.

- CAN options

[br=<rbaudrate>] Baudrate: 125, 250..., default 125.

[mode=<canmode>] Mode: NORMAL, LOOPBACK..., default NORMAL.

Note: The software must request the hardware to enter Normal mode to synchronize on the CAN bus and start reception and transmission between the Host and the CAN device. Normal mode is recommended.

[ide=<type>] Type: STANDARD or EXTENDED, default STANDARD

[rtr=<format>] Frame format: DATA or REMOTE, default DATA

[**fifo=<afifo>**] Assigned FIFO: FIFO0 or FIFO1, default FIFO0
[**fm=<fmode>**] Filter mode: MASK or LIST, default MASK
[**fs=<fscale>**] Filter scale: 16 or 32, default 32
[**fe=<fenable>**] Activation: ENABLE or DISABLE, default ENABLE
[**fbn=<fbanknb>**] Filter bank number: 0 to 13, default 0

- Using UART

```
./STM32_Programmer.sh -c port=/dev/ttyS0 br=115200
```

The result of this example is shown in [Figure 102](#).

Figure 102. Connect operation using RS232

```
$ ./STM32_Programmer.sh -c port=/dev/ttyS0 br=115200
Serial Port /dev/ttyS0 is successfully opened.
  Port configuration: parity = none, baudrate = 115200, data-bit = 8,
                      stop-bit = 1.0, flow-control = off
  Activating device: OK
  Chip ID: 0x500
  BootLoader version: 3.1
```

STM32CubeProgrammer provides the possibility to configure RTS and DTR pins:

- RTS, used as follows: rts=low
- DTR, used as follows: dtr=high

Example: STM32_Programmer_CLI.exe -c port=COM27 dtr=high (see [Figure 103](#)).

Figure 103. Enabling COM DTR pin

```
Serial Port COM27 is successfully opened.
  Port configuration: parity = even, baudrate = 115200, data-bit = 8,
                      stop-bit = 1.0, flow-control = off

  Timeout error occurred while waiting for acknowledgement.
  Activating device: OK
  Chip ID: 0x421
  BootLoader protocol version: 3.1
  Device name : STM32F446xx
  Flash size  : 512 KBytes (default)
  Device type : MCU
  Device CPU  : Cortex-M4
  Dtr: High
```

Example using USB

```
./STM32_Programmer.sh -c port=usb1
```

The result of this example is shown in *Figure 104*.

Figure 104. Connect operation using USB

establishing connection with the target device					
AREA NAME	SECT.NBR	ADDRESS	SIZE	TYPE	
Internal Flash	0000	0x08000000	0016 KB	REW	
	0001	0x08004000	0016 KB	REW	
	0002	0x08008000	0016 KB	REW	
	0003	0x0800c000	0016 KB	REW	
	0004	0x08010000	0064 KB	REW	
	0005	0x08020000	0128 KB	REW	
	0006	0x08040000	0128 KB	REW	
	0007	0x08060000	0128 KB	REW	
	0008	0x08080000	0128 KB	REW	
	0009	0x080a0000	0128 KB	REW	
	0010	0x080c0000	0128 KB	REW	
	0011	0x080e0000	0128 KB	REW	
	0012	0x08100000	0016 KB	REW	
	0013	0x08104000	0016 KB	REW	
	0014	0x08108000	0016 KB	REW	
	0015	0x0810c000	0016 KB	REW	
	0016	0x08110000	0064 KB	REW	
	0017	0x08120000	0128 KB	REW	
	0018	0x08140000	0128 KB	REW	
	0019	0x08160000	0128 KB	REW	
	0020	0x08180000	0128 KB	REW	
	0021	0x081a0000	0128 KB	REW	
	0022	0x081c0000	0128 KB	REW	
	0023	0x081e0000	0128 KB	REW	
Option Bytes	0000	0x1fffec000	0016 B	RW	
	0001	0x1fffec000	0016 B	RW	
OTP Memory	0000	0x1fff7800	0512 B	RW	
	0001	0x1fff7a00	0016 B	RW	
Device Feature	0000	0xfffff0000	0004 B	RW	

Note:

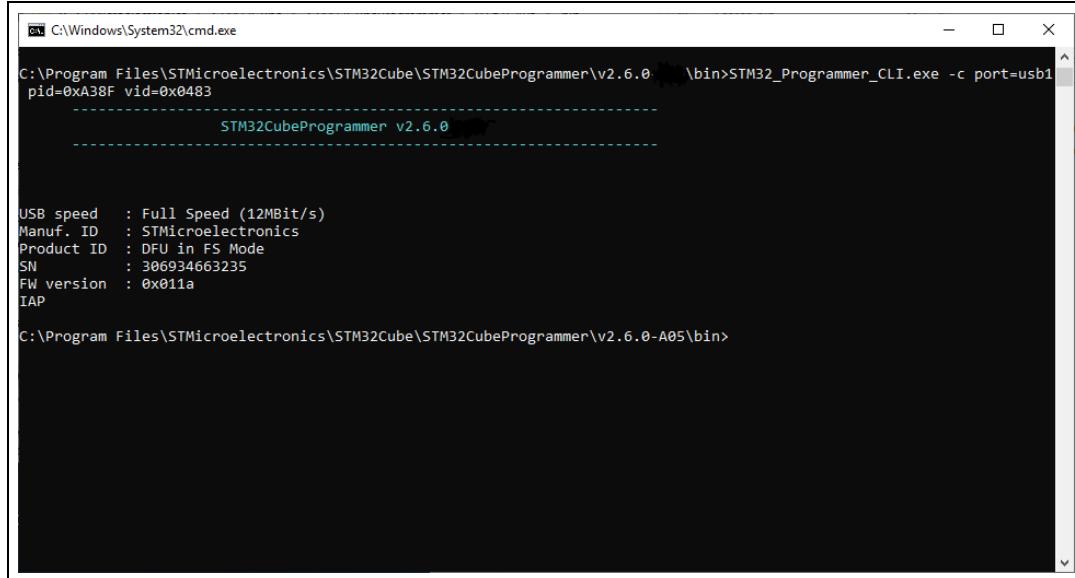
When using a USB interface, all the configuration parameters (such as baud rate, parity, data-bits, frequency, index) are ignored. To connect using a UART interface the port configuration (baudrate, parity, data bits, stop bits, and flow-control) must have a valid combination, depending upon the used device.

Example using DFU IAP/USBx options

```
/STM32_Programmer.sh -c port=usb1 pid=0xA38F vid=0x0438
```

The result of this example is shown in *Figure 105*.

Figure 105. Connect operation using USB DFU options



```
C:\Windows\System32\cmd.exe
C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer\v2.6.0\bin>STM32_Programmer_CLI.exe -c port=usb1
pid=0xA38F vid=0x0438
-----
STM32CubeProgrammer v2.6.0
-----

USB speed : Full Speed (12MBit/s)
Manuf. ID : STMicroelectronics
Product ID : DFU in FS Mode
SN : 306934663235
FW version : 0x011a
IAP

C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer\v2.6.0-A05\bin>
```

Note: The default value of product ID and vendor ID are ST products values (PID = 0xDF11, VID = 0x0483).

Example using JTAG/SWD debug port

To connect using port connection mode with ST-LINK probe it is necessary to mention the port name with at least the connect command (for example: `-c port=JTAG`).

Note: Make sure that the device being used contains a JTAG debug port when trying to connect through the JTAG.

There are other parameters used in connection with JTAG/SWD debug ports that have default values (see the Help menu of the tool for more information about default values).

The example below shows a connection example with an STM32 with device ID 0x415.

Figure 106. Connect operation using SWD debug port



```
ST-LINK SN : 066BFF574857847167114941
ST-LINK FW : U2J30M20
Voltage : 3.25V
SWD freq : 4000 KHz
Connect mode: Normal
Reset mode : Software reset
Device ID : 0x415
Device name : STM32L415xx/STM32L4175xx/STM32L4176xx/STM32L4186xx
Device type : MCU
Device CPU : Cortex-M4
```

The corresponding command line for this example is `-c port=SWD freq=3900 ap=0`

In the connect command (`-c port=SWD freq=3900 ap=0`)

- The <port> parameter is mandatory.
- The index is not mentioned in the command line. The Index parameter takes the default value 0.
- The frequency entered is 3900 kHz, however the connection is established at 4000 kHz. This is due to the fact that ST-LINK probe has fixed values with SWD and JTAG debug ports.
- ST-LINK v2/v2.1
 - SWD (4000, 1800, 950, 480, 240, 125, 100, 50, 25, 15, 5) kHz
 - JTAG (9000, 4500, 2250, 1125, 562, 281, 140) kHz
- ST-LINK v3
 - SWD (24000, 8000, 3300, 1000, 200, 50, 5)
 - JTAG (21333, 16000, 12000, 8000, 1777, 750)

If the value entered does not correspond to any of these values, the next highest one is considered. Default frequency values are:

- SWD: STLinkV2: 4000 kHz, STLinkV3: 24000 kHz
- JTAG: STLinkV2: 9000 kHz, STLinkV3: 21333 kHz

Note: *JTAG frequency selection is only supported with ST-LINK firmware versions from V2J23 onward.*

To connect to access port 0 the ap parameter is used in this example, so any command used after the connect command is established through the selected access port.

Note: *The ST-LINK probe firmware version is shown when connecting to the device. Make sure that you have the latest version of ST-LINK firmware V2J28M17 (STSW-LINK007), available on www.st.com.*

Example using J-Link debug port

To connect using port connection mode with ST-LINK probe it is necessary to mention the port name with at least the connect command (for example: `-c port=JLINK`).

Only Flash and Option Bytes (OB) programming are supported via J-Link, other features are not supported.

Note: *There are other parameters used in connection with J-Link debug port that have default values (see the Help menu of the tool for more information about default values).*

The example below shows a connection example with an STM32 with device ID 0x480.

Figure 107. Connect operation using J-Link debug port

```
Connecting to J-Link Probe
Device=Cortex-M7
Device ID    : 0x480
Voltage      : 3.32V
Flash size   : 2 MBytes
```

The corresponding command line for this example is `-c port=JLINK ap=0`.

In the connect command (-c port=JLINK ap=0)

- The <port> parameter is mandatory
- The default frequency value is 4000

Note: To connect to access port 0 the ap parameter is used in this example, so any command used after the connect command is established through the selected access port.

Example using SPI

```
STM32_Programmer_CLI -c port=SPI br=375 cpha=1edge cpol=low
```

The result of this example is shown in [Figure 108](#).

Figure 108. Connect operation using SPI port

ST-LINK FW	:	U3J1M1
Voltage	:	0.00V
Bridge freq	:	48000 KHz
Baudrate	:	375 KHz
BL version	:	1.1
Device ID	:	0x462
Device name	:	STM32L45x
Device type	:	MCU
Device CPU	:	Cortex-M4

Note: Make sure that the used device supports a SPI bootloader when trying to connect through the SPI.

There are other parameters used in connection with SPI port that have default values, and some others must have specific values (see the help menu of the tool for more information).

Example using CAN

```
STM32_Programmer_CLI -c port=CAN br=125 fifo=fifo0 fm=mask fs=32
fe=enable fbn=2
```

The result of this example is shown in [Figure 109](#).

Figure 109. Connect operation using CAN port

ST-LINK FW	:	U3J1M1
Voltage	:	0.00V
Bridge Freq	:	48000 KHz
Baudrate	:	125 Kbps
BL version	:	2.0
Device ID	:	0x419
Device name	:	STM32F42xxx/F43xxx
Device type	:	MCU
Device CPU	:	Cortex-M4

Note: Not all devices implement this feature, make sure the one you are using supports a CAN bootloader.

There are other parameters used in connection with CAN port that have default values and some others must have specific values (see the help menu of the tool for more information).

Example using I2C

```
STM32_Programmer_CLI -c port=I2C add=0x38 br=400 sm=fast
```

In the connect command:

- The parameter <add> changes from a device to another, refer to AN2606 to extract the correct one. In this case, the STM32F42xxx has a bootloader address equal to 0x38.
- The baudrate parameter
 depends directly upon the speed mode parameter <sm>, for example, if sm = standard then the baudrate does not support the value 400.

The result of this example is shown in *Figure 110*.

Figure 110. Connect operation using I2C port

```
ST-LINK FW : U3J1M1
Voltage   : 0.00V
Bridge freq : 192000 KHz
Baudrate  : 400 KHz
BL version : 1.1
Device ID  : 0x419
Device name : STM32F42xxx/F43xxx
Device type : MCU
Device CPU  : Cortex-M4
```

Note: For each I2C connection operation the address parameter is mandatory.

Note: Not all devices implement this feature, make sure that the device supports an I2C bootloader.

There are other parameters used in connection with I2C port that have default values and some others must have specific values (see the help menu of the tool for more information).

Note: For the parallel programming of more than one STM32 device using multiple instances of STM32CubeProgrammer, it is mandatory to add the serial number of each device in the suitable instance, as shown in the following example:

- “–c port=swd/usb sn=SN1” (instance 1 of STM32CubeProgrammer)
- “–c port=swd/usb sn=SN2” (instance 2 of STM32CubeProgrammer)
- “–c port=swd/usb sn=SN3” (instance 3 of STM32CubeProgrammer)

3.2.2 Erase command

-e, --erase

Description: According to the given arguments, this command can be used to erase specific sectors or the whole flash memory. This operation can take a second or more to complete, depending on the involved size.

Syntax:

- | | |
|-------------------------------|--|
| [all] | Erase all sectors. EEPROM area is excluded. |
| [<sectorsCodes>] | Erase the sectors identified by codes (for example 0,1,2 to erase sectors 0, 1 and 2). For EEPROM: ed1 & ed2 . |
| [<[start end]>] | Erase the specified sectors starting from start code to end code, for example -e [5 10] . |

Example

```
./STM32_Programmer.sh --connect port=/dev/ttys0 -e 2 4
```

This command erases only sectors 2 and 4.

Note: *In the case of multiplicity of external loaders, the first selected is the one that will be taken into account during erasing of the external memory.*

Note: *In macOS erasing range of sectors is not possible with zsh Terminal Interpreter, the user must switch to bash to get this command working.*

3.2.3 Download command

-w, --write, -d, --download

Description: Downloads the content of the specified binary file into the memory of the device. The download operation is preceded by the erase operation. A write address is needed to download binary files.

Syntax: `-w <file_path> [start_address]`

`[file_path]` Path of the file to be downloaded

`[start_address]` Start address of download

Example

```
-c port=COM4 -w RefSMI_MDK/All_Flash_0x1234_256K.bin 0x08008000
```

This command programs the binary file “All_Flash_0x1234_256K.bin” at address 0x08008000. The result is shown in [Figure 111](#).

Figure 111. Download operation

```
Serial Port COM4 is successfully opened.
Port configuration: parity = none, baudrate = 115200, data-bit = 8,
stop-bit = 1.0, flow-control = off
Activating device: OK
Chip ID: 0x450
BootLoader version: 3.1

Memory Programming ...
File : RefSMI_MDK/All_Flash_0x1234_256K.bin
Size : 262144 Bytes
Address : 0x08008000

Download in Progress:
[Progress Bar] 100%
File download complete
Time elapsed during the download operation is: 00:01:06.793
Press <RETURN> to close this window...
```

Note: *To verify that the download has been successful, call the verify option (-v or –verify) just after the write command, otherwise the verify option is ignored.*

Note: *STM32CubeProgrammer can write on aligned memory regions. Flash memory imposes a data alignment described in reference manuals. As an example, for STM32U5 devices, the reference manual indicates that this MCU supports: “137 bits wide data read and write (128 effective bits plus 9 ECC bits)”, which means that data must be aligned on 16 bytes.*

Mechanisms for programming command

The programming command supports two mechanisms, legacy and incremental, each with its own approach.

In the legacy mechanism, the STM32CubeProgrammer reprograms all the flash memory sectors. This process involves erasing and reprogramming the whole memory.

The incremental mechanism programs only the modified sectors. This process involves calculating checksums for each sector of the new firmware and the flash memory, comparing them to identify modified sectors, and then selectively erasing and programming only those sectors. This approach significantly reduces the programming time.

Example:

```
-c port=COM4 -w 1MG.bin 0x08000000 incremental
```

This command programs the binary file “1MG.bin” at address 0x08000000 using the incremental mechanism. If the new firmware already exists on the flash memory, no flashing is done.

3.2.4 Verify command

-v, --verify, -v fast, --verify fast

Description: Used for validation of data integrity, has two mechanisms.

- Legacy mechanism: uses a bit-by-bit comparison to verify data integrity.
- Fast mechanism: uses a sector-by-sector comparison. If the device does not support checksums, the legacy mechanism is used instead.

3.2.5 Download 32-bit data command

-w32

Description: Downloads the specified 32-bit data into flash memory starting from a specified address.

Syntax: `-w32 <start_address> <32_data_bits>`

`<start_address>` Start address of download.

`<32_data_Bits>` 32 data bits to be downloaded. Data must be separated by escape.

Example

```
./STM32_Programmer.sh -c port=/dev/ttyS0 br=9600 -w32 0x08000000  
0x12345678 0xAABBCCFF 0x12AB34CD --verify
```

Note: *This command makes it possible to write the 32 data bits (0x12345678, 0xAABBCCFF, 0x12AB34CD) into the flash memory starting from address 0x08000000.*

Note: *STM32CubeProgrammer can write on aligned memory regions. Flash memory imposes data alignment described in reference manual. As an example, STM32U5 devices support “137 bits wide data read and write (128 effective bits plus 9 ECC bits)”, which means that data must be aligned on 16 bytes.*

Note: *To write into the flash memory, it must be already erased. The -w32 command does not erase the flash memory.*

3.2.6 Read command

-r, --read, -u, --upload

Description: Reads and uploads the device memory content into a specified binary file starting from a specified address.

Syntax: --upload <start_address> <size> <file_path>

<start_address> Start address of read.

<size> Size of memory content to be read.

<file_path> Binary file path to upload the memory content.

Example

```
./STM32_Programmer.sh -c port=/dev/ttyS0 br=9600 --upload
0x20007000 2000 "/local/benayedh/Binaries/read2000.bin"
```

This command makes it possible to read 2000 bytes, starting from address 0x20007000, and uploads the content to a binary file “/local/benayedh/Binaries/read2000.bin”

-r32

Description: Read 32-bit data memory.

Syntax: -r32 <start_address> <size>

<start_address> Start address of read.

<size> Size of memory content to be read.

Example

```
./STM32_Programmer.sh -c port=SWD -r32 0x08000000 0x100
```

Figure 112. Read 32-bit operation

```
ST-LINK Firmware version : V2J28M17
SWD frequency = 4000K
Connection mode: Normal
Device ID: 0x450

@0x08000000 : 0x20000600 0x08006BA9 0x08005ADD 0x08005ADD
@0x08000010 : 0x08005AAA 0x08005ADD 0x08005ADD 0x00000000
@0x08000020 : 0x00000000 0x00000000 0x00000000 0x08005ADD
@0x08000030 : 0x08005ADD 0x00000000 0x08005AEB 0x08006E3
@0x08000040 : 0x08005B0D 0x08005B0D 0x08005B0D 0x08005AF9
@0x08000050 : 0x08005B0D 0x08005B0D 0x08005AF9 0x08005AF9
@0x08000060 : 0x08005AF9 0x08005AF9 0x08005AF9 0x08003AB9
@0x08000070 : 0x08003ACB 0x08003ADD 0x08003AF1 0x08003B05
@0x08000080 : 0x08003B19 0x08003B2D 0x08005B0D 0x08005B0D
@0x08000090 : 0x08005B0D 0x08005B0D 0x08005BBB 0x08005ABB
@0x080000A0 : 0x08005AF9 0x08004689 0x08005AF9 0x08005B0D
@0x080000B0 : 0x08005AF9 0x08005AF9 0x0800469F 0x08005B0D
@0x080000C0 : 0x08005B0D 0x08005B0D 0x08005B0D 0x08005B0D
@0x080000D0 : 0x08005B0D 0x080040AB 0x08005AF9 0x08005AF9
@0x080000E0 : 0x08005AF9 0x08005B0D 0x08005B0D 0x08005AF9
@0x080000F0 : 0x08005AF9 0x08005AF9 0x08005B0D 0x08005B0D
```

Note: The maximum size allowed with the -r32 command is 32 Kbytes.

3.2.7 Start command

-g, --go, -s, --start

Description: This command enables execution of the device memory starting from the specified address.

Syntax: `--start [start_address]`

`[start_address]` Start address of application to be executed.

Example

```
. /STM32_Programmer.sh --connect port=/dev/ttyS0 br=9600 --start  
0x08000000
```

This command runs the code specified at 0x08000000.

3.2.8 Debug commands

The following commands are available only with the JTAG/SWD debug port.

-rst

Description: Executes a software system reset;

Syntax: `-rst`

-hardRst

Description: Generates a hardware reset through the RESET pin in the debug connector.

The RESET pin of the JTAG connector (pin 15) must be connected to the device reset pin.

Syntax: `-hardRst`

-halt

Description: Halts the core.

Syntax: `-halt`

-step

Description: Executes one instruction.

Syntax: `-step`

-score

Description: Displays the Cortex-M core status.

The core status can be one of the following: "Running", "Halted", "Locked up", "Reset", "Locked up" or "Kept under reset"

Syntax: `-score`

-coreReg

Description: Read/write Cortex-M core registers. The core is halted before a read/write operation.

Syntax: `-coreReg [<core_register>]`
`R0/. . . /R15/PC/LR/PSP/MSP/XPSR/APSR/IPSR/EPSR/PRIMASK/BASEPRI/`
`FAULTMASK/CONTROL`

[`core_reg=<value>`] : The value to write in the core register for a write operation. Multiple registers can be handled at once.

Example

<code>-coreReg</code>	This command displays the current values of the core registers.
<code>-coreReg R0 R8</code>	This command displays the current values of R0 and R8.
<code>-coreReg R0=5 R8=10</code>	This command modifies the values of R0 and R8.

3.2.9 List command

-l, -list

Description: This command lists all available UART, DFU and STLink interfaces.

Syntax: `-l, --list`

Example (result shown in [Figure 113](#)):

`./STM32_Programmer.sh --list`

3.2.10 SWD Multidrop

SWD (Serial Wire Debug) Multidrop is an enhancement to the standard SWD protocol, commonly used to debug microcontrollers based on Cortex-M cores. This feature allows a single SWD interface (from a debugger or programmer) to communicate with multiple target devices connected on the same SWD bus.

Only flash and option bytes (OB) programming are supported.

-getTargetSelList

Description: Lists all the devices currently connected via ST-LINK on the same SWD bus supporting the SWD multidrop.

Syntax: `-getTargetSelList`

Example (result shown in [Figure 114](#))

Note: If no board is detected, the command returns "No STM32 Target Found!"

If the connected boards use an outdated ST-LINK firmware, the command returns "Too Old Firmware, please upgrade your STLINK!"

Once the ST-LINK firmware is updated, all connected devices supporting the SWD Multidrop are correctly listed.

Limitation: only devices with different TargetSel can be connected simultaneously to the same ST-LINK.

New option in Connect command: TargetSel

Description: Specifies the target device by its TargetSel value.

Syntax: `TargetSel=<TargetSelValue>`

Example

```
./STM32_Programmer_CLI -c port=swd sn="002F00373038510934333935" TargetSel=0x04540041 -d "C:\Users\path.bin" 0x08000000
```

Note: If multiple boards are connected via the ST-LINK bus you can perform read, write, download operations on each board by selecting the appropriate TargetSel.

Switching between devices can be done without hardware intervention only by selecting the TargetSel value.

If multiple ST-LINKs are connected, you must specify the serial number (sn) in addition to TargetSel in the command line.

It is not possible to insert several targets that cannot be selected only by the SWD multi-drop selection sequence. This means that all devices on the lines must have different TargetSel values.

For more details refer to AN6382 “Introduction to SWD multi-drop for STM32 with ST-LINK”, available on www.st.com.

Figure 113. List of available serial ports

```
===== DFU Interface =====  
No STM32 device in DFU mode connected  
  
===== STLink Interface =====  
----- Connected ST-LINK Probes List -----  
  
ST-Link Probe 0 :  
  ST-LINK SN   : 002200144741500220383733  
  ST-LINK FW   : V3J8M3  
  Access Port Number : 2  
-----  
  
===== UART Interface =====  
Total number of serial ports available: 2  
  
Port: COM47  
Location: \\.\COM47  
Description: STMicroelectronics STLink Virtual COM Port  
Manufacturer: STMicroelectronics  
  
Port: COM3  
Location: \\.\COM3  
Description: Intel(R) Active Management Technology - SOL  
Manufacturer: Intel
```

Figure 114. List of connected devices via different ST-LINK

```

-Found ST-Link device:
Serial: "0028002C3233510F39363634" , Name: "V3J16M8"
SWD multidrop devices found, List of Targetsel: 2
0x04810041                               STM32U5A + STM32U57
0x04820041
-Found ST-Link device:
Serial: "0010002D4D46501520383832" , Name: "V3J16M8"
SWD multidrop devices found, List of Targetsel: 2
0x04800041                               STM32H7A3 + STM32H563
0x04840041
-Found ST-Link device:
Serial: "066FFF303435554157103027" , Name: "V2J46M32"
No device detected supporting the SWD multidrop      STM32L476
Press <RETURN> to close this window...

```

3.2.11 QuietMode command

-q, --quietMode

Description: This command disables the progress bar display during download and read commands.

Syntax: `-q, --quietMode`

Example

```
/STM32_Programmer.sh -c port=/dev/ttys0 br=115200 --quietMode -w
binaryPath.bin 0x08000000
```

3.2.12 Bootloader reset command

Description: Enables a reset function compatible with all bootloader interfaces. The connection must be established while performing the operation.

Syntax: `-rstbl`

Example (for SPI)

```
-c port=spi -rstbl
```

3.2.13 Verbosity command

-vb, --verbosity

Description: This command makes it possible to display more messages, to be more verbose.

Syntax: `-vb <level>`

`<level>` : Verbosity level, value in {1, 2, 3} default value vb=1

Example (result shown in [Figure 115](#)):

```
./STM32_Programmer.sh -c port=/dev/ttys0 br=115200 -vb 3
```

Figure 115. Verbosity command

```
$ ./STM32_Programmer.sh -c port=/dev/ttyS0 br=115200 -vb 3
Serial Port /dev/ttyS0 is successfully opened.
  Port configuration: parity = none, baudrate = 115200, data-bit = 8,
                      stop-bit = 1.0, flow-control = off
  Sending init command:
    byte 0x7F sent successfully to target
  Received response from target: 0x79
  Activating device: OK
  Sending GetID command and its XOR:
    byte 0x02 sent successfully to target
    byte 0xFD sent successfully to target
  Received response from target: 0x79
  Received response from target: 0x01050079
  Chip ID: 0x500
  Sending Get command and its XOR:
    byte 0x00 sent successfully to target
    byte 0xFF sent successfully to target
  Received response from target: 0x79
  Received response from target: 0x07
  Received response from target: 0x07310001020311213179
  BootLoader version: 3.1
```

3.2.14 Log command

-log, --log

Description: This traceability command makes it possible to store the whole traffic (with maximum verbosity level) into a log file.

Syntax: `-log [filePath.log]`

`[filePath.log]` Path of log file, default is \$HOME/.STM32CubeProgrammer/trace.log.

Example (result shown in [Figure 116](#)):

```
./STM32_Programmer.sh -c port=/dev/ttyS0 br=115200 -log trace.log
```

Figure 116. Log command

```
$ ./STM32_Programmer.sh -c port=/dev/ttyS0 br=115200 -log trace.log
Log output file: trace.log
  Serial Port /dev/ttyS0 is successfully opened.
  Port configuration: parity = none, baudrate = 115200, data-bit = 8,
                      stop-bit = 1.0, flow-control = off
  Activating device: OK
  Chip ID: 0x500
  BootLoader version: 3.1
```

The log file trace.log contains verbose messages, as shown in [Figure 117](#).

Figure 117. Log file content

```

16:41:19:345
Log output file: trace.log
16:41:19:368 Serial Port /dev/ttyS0 is successfully opened.
16:41:19:368 Port configuration: parity = none, baudrate = 115200, data-bit = 8,
16:41:19:368 stop-bit = 1.0, flow-control = off
16:41:19:368 Sending init command:
16:41:19:368 byte 0x7F sent successfully to target
16:41:19:369 Received response from target: 0x79
16:41:19:369 Activating device: OK
16:41:19:369 Sending GetID command and its XOR:
16:41:19:369 byte 0x02 sent successfully to target
16:41:19:369 byte 0xFD sent successfully to target
16:41:19:370 Received response from target: 0x79
16:41:19:370 Received response from target: 0x01050079
16:41:19:370 Chip ID: 0x500
16:41:19:370 Sending Get command and its XOR:
16:41:19:370 byte 0x00 sent successfully to target
16:41:19:370 byte 0xFF sent successfully to target
16:41:19:371 Received response from target: 0x79
16:41:19:371 Received response from target: 0x07
16:41:19:371 Received response from target: 0x07310001020311213179
16:41:19:371 BootLoader version: 3.1

```

3.2.15 External loader command

-el

Description: This command allows to enter the path of one or more external memory loaders, to perform programming, write, erase, and read operations with an external memory.

Syntax: -el [externalLoaderFilePath1.stldr] Absolute path of external loader file.

-el [externalLoaderFilePath1.stldr]... -el [externalLoaderFilePath10.stldr] Absolute path of external loader files.

Example 1:

```
./STM32_Programmer.sh -c port=swd -w "file.bin" 0x90000000 -v -el
"/local/user/externalLoaderPath.stldr"
```

Example 2:

```
./STM32_Programmer.sh -c port=swd -e all -el
"/local/user/externalLoaderPath.stldr"
```

Example 3:

```
./STM32_Programmer.sh -c port=swd -w "file.bin" 0x90000000 -v -el
"/local/user/externalLoaderPath1.stldr"
"/local/user/externalLoaderPath2.stldr"
```

Note: This command is supported only with SWD/JTAG ports.

Note: A maximum of ten external loaders can be used.

Note: It is recommended to use the normal connection mode when trying to download data in an external memory.

3.2.16 External loader command with bootloader interface

-elbl

Description: With this command the user can provide the path of an external memory loader used to perform programming, write, erase, and read operations using bootloader interfaces. The command is used for both SFI and external memory programming via bootloader interfaces. When accessing the external memory via bootloader, the open bootloader is loaded into RAM to perform all the operations using bootloader interfaces.

Syntax: -elbl [externalLoaderFilePath.stldr] Absolute path of external loader file.

Example 1:

```
>STM32_Programmer_CLI.exe -c port=usb1 -elbl MX25LM51245G_STM32L552E-EVALSFIX-BL.stldr -sfi out.sfix hsm=0 license.bin -rsse
RSSe\L5\enc_signed_RSSe_sfi_jtag.bin
```

Example 2 (external memory programming):

```
STM32_Programmer_CLI.exe -c port=usb1 -elbl MX66UW1G45G_STM32H7S78-DK-SFIx.stldr -w file.bin 0x70000000
```

Note: This command is supported only with bootloader interfaces to program an external memory in a SFIx or OpenBootloader-STM32H7R/S scenarios.

Note: To program an external memory via bootloader, each time the device is disconnected perform a HW reset. For STM32H7RS products, the external loaders to choose are those ending with “-SFIx”.

External loader for SFIx

The external loader for SFIx operation is aligned with the RSSe_SFI_CallNsFunction, as a result, all the functions used inside the external loader must have the same signature of this function.

rsse_sfi_ns_call_t

rsse_sfi_ns_call_t description in C coding language :

```
typedef uint32_t (*rsse_sfi_ns_call_t)(void * input_param);
```

As a consequence the implementation of these function inside the external loader must be slightly modified to be synchronized with input parameters.

Example of Sector erase function after modification:

```
KeepInCompilation int SectorErase (uint32_t *params)
{
    int result = 0;
    uint32_t BlockAddr;
    uint32_t EraseStartAddress = params[0];
    uint32_t EraseEndAddress = params[1];
```

3.2.17 Read unprotect command

-rdu, --readunprotect

Description: This command removes the memory read protection by changing the RDP level from level 1 to level 0.

Syntax: `--readunprotect`

Example

```
./STM32_Programmer.sh -c port=swd -rdu
```

3.2.18 TZ regression command

-tzenreg, --tzenregression

Description: This command removes TrustZone protection by disabling TZEN from 1 to 0.

Syntax: `--tzenregression`

Example

```
./STM32_Programmer.sh -c port=usb1 -tzenreg
```

Note: *This command is only supported for bootloader interface and MCUs with trusted zone.*

3.2.19 Option bytes command

-ob, --optionbytes

Description: This command allows the user to manipulate the device option bytes by displaying or modifying them.

Syntax: `-ob [displ] / -ob [OptByte=<value>]`

`[displ]:` Allows the user to display the whole set of option bytes.

`[OptByte=<value>]:` Allows the user to program the given option byte.

Example

```
./STM32_Programmer.sh -c port=swd -ob rdp=0x0 -ob displ
```

Note: *For more information about the device option bytes, refer to the dedicated section in the programming manual and reference manual, both available on www.st.com.*

3.2.20 Safety lib command

-sl, --safelib

Description: This command allows a firmware file to be modified by adding a load area (segment) containing the computed CRC values of the user program.

Supported formats: bin, elf, hex and Srec.

Syntax: `-sl <file_path> <start_address> <end_address> <slice_size> <pattern>`

<file_path>	File path (bin, elf, hex or Srec)
<start_address>	Flash memory start address
<end_address>	Flash memory end address
<slice_size>	Size of data per CRC value (only 0x400 is supported)
<pattern>	Optional pattern value from 0x00 to 0xFF (default is 0x00)

Example (result shown in *Figure 118*):

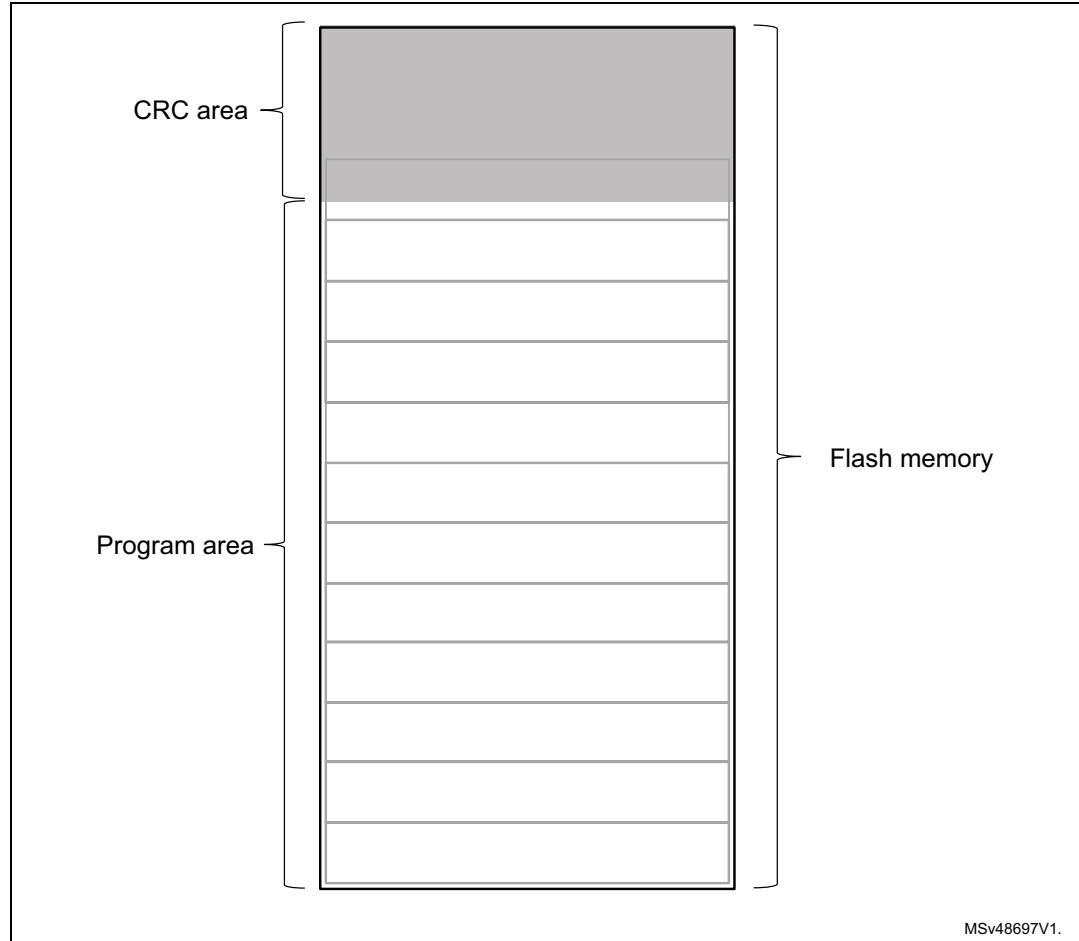
```
STM32_Programmer_CLI.exe -sl TestCRC.axf 0x8000000 0x8010000 0x400
```

Figure 118. Safety lib command

```
C:\>STM32_Programmer_CLI.exe -sl TestCRC.axf 0x8000000 0x8010000 0x400
STM32CubeProgrammer v0.4.0-RC1
Warning: The ELF file will be overwritten
CRCs area injected successfully
```

The flash program memory is divided into slices, whose size is given as a parameter to the safety lib command as shown in the example above. For each slice a CRC value is computed and placed in the CRC area. The CRC area is placed at the end of the memory, as shown in [Figure 119](#).

Figure 119. Flash memory mapping



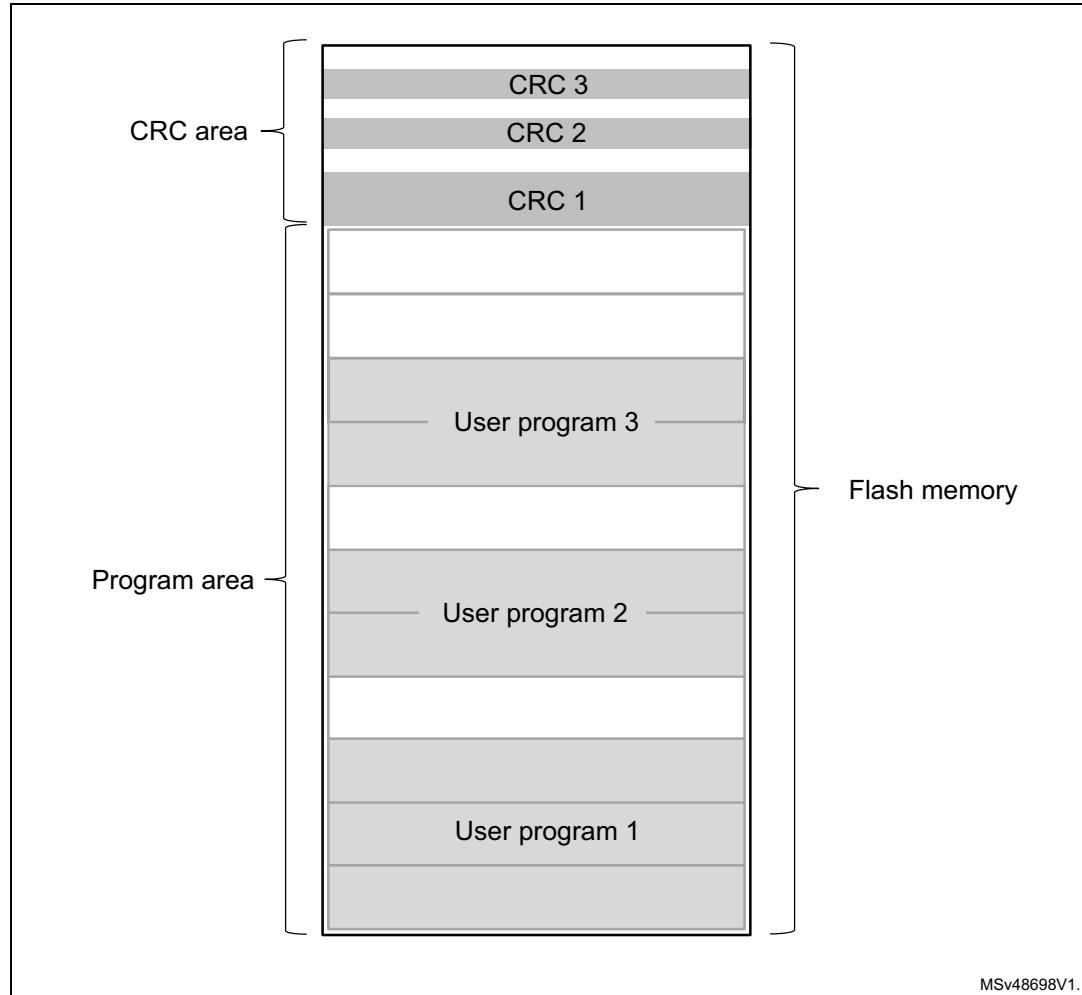
The address and size of the CRCs area are determined as follows:

$$\text{CRCs_Area_Size} = \text{Flash_Size} / \text{Slice_Size} * 4 \text{ bytes}$$

$$\text{CRCs_Start_Address} = \text{Flash_End_Address} - \text{CRCs_Area_Size}$$

The CRC values in the CRC area are placed according to the position(s) of the user program in the flash memory, see [Figure 120](#).

Figure 120. Flash memory mapping example



The address of a CRCs region inside the CRCs area is calculated as:

$$@ = \text{CRCs_Start_Address} + \left(\frac{\text{UserProg_Start_Address} - \text{Flash_Start_Address}}{\text{Slice_Size}} \cdot 4 \text{ bytes} \right)$$

The tool checks the syntax and the processing of the command, and marks a failure if there is a parameters mismatch or a problem in the CRC calculation by displaying various error message:

- “Invalid file path or wrong file extension”
`<file_path>` has an unrecognized extension: .bin .binary .hex .srec .s19 .elf .axf .out
- “The safety lib command is missing parameters”
The passed command does not respect the parameters number
- “Invalid flash start address”
`<start_address>` is not correct (exceeds 0xFFFFFFFF as max value) or is not in hexadecimal format
- “Invalid flash end address”
`<end_address>` is not correct (exceeds 0xFFFFFFFF as max value) or is not in hexadecimal format
- “Invalid slice size”
`<slice_size>` is not correct (exceeds 0xFFFF as max value) or is not in hexadecimal format
- “Invalid pattern”
`<pattern>` is not in the range [0x00 to 0xFF] or is not in hexadecimal format
- “The slice size is larger than the flash size”
`<slice_size>` is larger than the dedicated flash size (`<end_address>` - `<start_address>`)
- “The slice size is invalid”
The dedicated flash memory is not aligned (based on `<slice_size>`)
- “File is Read Only”
The input file `<file_path>` is not editable.
- “No segments in this file”
The input `<file_path>` does not contain any data segment
- “The segment {x} of {y} does not start at the beginning of a flash slice”
The current treated segment does not start at the beginning of the flash slice

3.2.21 Secure programming SFI specific commands

Secure firmware install (SFI) is a feature supporting secure firmware flashing, available on some STM32 devices. The firmware provider has the possibility to protect its internal firmware against any illegal access, and to control the number of devices that can be programmed.

The protected firmware installation can be performed using different communication channels, such as JTAG/SWD or bootloader interfaces (UART, SPI and USB). For more details refer to AN5054.

-sfi, --sfi

Description: Programs an sfi file

Syntax: `-sfi [<protocol=Ptype>] <.sfi file_path> [hsm=0|1]`
`<lic_path|slot=slotID> [<licMod_path>|slot=slotID]`

<code>[<protocol=Ptype>]</code>	Protocol type to be used: static/live (only static protocol is supported so far), default: static.
<code><file_path></code>	Path of sfi file to be programmed.
<code>[hsm=0 1]</code>	Sets user option for HSM use value {0 (do not use HSM), 1 (use HSM)}, default: hsm = 0.
<code><lic_path slot=slotID></code>	Path to the SFI license file (if hsm = 0) or reader slot ID if HSM is used (hsm = 1).

-rsse, --rsse

Description: This command allows the user to select the root secure services extension library (RSSe). Mandatory for devices using RSSe to make secure firmware install (SFI). The RSSe binary file can be found in STM32CubeProgrammer bin/RSSe folder.

Syntax: `-rsse <file_path>`

`<file_path>` Path of RSSe file

-a, --abort

Description: This command allows the user to clean a not properly finished process. The currently ongoing operation stops and the system returns to idle state.

Syntax: `-a`

-mcsv, --mcsv

Description: This command allows the user to select the modules file including the list of modules to be installed with SFI. This option is mandatory when the SFI image integrates at least one module (area of type m).

Syntax: `-mcsv <module_path.mcsv>`

`<module_path.mcsv>` : Path of mcsv file

3.2.22 Secure programming SFIx specific commands

Secure firmware install (SFIx) is a feature supporting secure external firmware flashing, available on some STM32 devices with OTFDEC capability. The firmware provider has the possibility to protect its external firmware/data against any illegal access, and to control the number of devices that can be programmed.

The SFIx secure programming can be carried out only with JTAG/SWD interface. For more details refer to AN5054.

-sfi, --sfi

Description: Programs an sfix file

Syntax: `-sfi [<protocol=Ptype>] <.sfix file_path> [hsm=0|1]<lic_path|slot=slotID> [<licMod_path>|slot=slotID]`

`[<protocol=Ptype>]` Protocol type to be used: static/live (only static protocol is supported so far), default: static.

`<file_path>` Path of sfi file to be programmed.

`[hsm=0|1]` Sets user option for HSM use value {0 (do not use HSM), 1 (use HSM)}, default: hsm = 0.

`<lic_path|slot=slotID>` Path to the SFI license file (if hsm = 0) or reader slot ID if HSM is used (hsm = 1).

`-el --extload` Selects a custom external memory-loader, only for the JTAG/SWD interfaces

`<file_path>` External memory-loader file path

`-elbl --extloadbl` Selects a custom external memory-loader for the bootloader interface

`<file_path>` External memory-loader file path

-rsse, --rsse

Description: This command allows the user to select the root secure services extension library (RSSe). Mandatory for devices using RSSe to make secure firmware install (SFI). The RSSe binary file can be found in STM32CubeProgrammer bin/RSSe folder.

Syntax: `-rsse <file_path>`

`<file_path>` Path of RSSe file

-a, --abort

Description: This command allows the user to clean a not properly finished process. The ongoing operation stops and the system returns to idle state.

Syntax: `-a`

Note: The ExternalLoader is different for SFIx use case, as some initializations are already done by RSS, and it is marked with –SFIX at the end of the External FlashLoader name.

-mcsv, --mcsv

Description: This command allows the user to select the modules file including the list of modules to be installed with SFI. This option is mandatory when the SFI image integrates at least one module (area of type m).

Syntax: `-mcsv <module_path.mcsv>`

`<module_path.mcsv>` : Path of mcsv file

-ecsv, --ecsv

Description: This command is used for Secure Manager Secure Modules install in external flash. It allows the user to select the modules file including the list of external modules to be installed with SFIx. This option is mandatory when the SFI image integrates at least one external module (area of type e).

Syntax: `-ecsv <exmodule_path.ecsv>` : Path of csvfile

`<exmodule_path.ecsv>` : Path of csvfile

3.2.23 HSM related commands

To control the number of devices that can be programmed ST offers a secure firmware flashing service based on HSM (hardware secure module) as a license generation tool to be deployed in the programming house.

Two HSM versions are available:

- HSMv1: static HSM, it allows the user to generate firmware licenses for STM32 secure programming of devices selected in advance.
- HSMv2: dynamic HSM, it is an updated version of the previous one, allows the generation of firmware licenses targeting STM32 secure programming of devices chosen via personalization data at the OEM site.

Before using the HSM, it must be programmed using Trusted Package Creator, this tool can program both versions with some specific input configurations, as detailed in UM2238. For more details refer to AN5054.

-hsmgetinfo

Description: Reads the HSM available information

Syntax: `-hsmgetinfo [slot=<SlotID>]`

`[slot=<SlotID>]` Slot ID of the smart card reader

Default value: slot = 1 (the PC integrated SC reader)

-hsmgetcounter

Description: Reads the current value of the license counter

Syntax: `-hsmgetcounter [slot=<SlotID>]`

`[slot=<SlotID>]` Slot ID of the smart card reader

Default value: slot = 1 (the PC integrated SC reader)

-hsmgetfwid

Description: Reads the Firmware/Module identifier

Syntax: -hsmgetfwid [slot=<SlotID>]

[slot=<SlotID>] Slot ID of the smart card reader
Default value: slot = 1 (the PC integrated SC reader)

-hsmgetstatus

Description: Reads the current card life-cycle state

Syntax: -hsmgetstatus [slot=<SlotID>]

[slot=<SlotID>] Slot ID of the smart card reader
Default value: slot = 1 (the PC integrated SC reader)

-hsmgetlicense

Description: Gets a license for the current chip if counter is not null

Syntax: -hsmgetlicense <file_path> [slot=<SlotID>] [protocol=<Ptype>]

<file_path> File path into where the received license is stored

[slot=<SlotID>] Slot ID of the smart card reader
Default value: slot = 1 (the PC integrated SC reader)

[<protocol=Ptype>] Protocol type to be used: static/live
Only static protocol is supported so far
Default value: static

-hsmgetlicensefromcertifbin, -hsmglfcb

Description: Gets a license for the current certificate binary file if counter is not null.

Syntax: -hsmglfcb <certif_file_path.bin> <license_file_path.bin>
[slot=<SlotID>] [protocol=<Ptype>]

<certif_file_path.bin> File path from which the input certificate is read.

<license_file_path.bin> File path where the received license is stored

[slot=<SlotID>] Slot ID of the smart card reader.
Default value: slot = 1 (the PC integrated SC reader)

3.2.24 STM32WB specific commands

-antirollback

Description: Perform the antirollback operation

Syntax: **-antirollback**

-startfus

Description: Start the FUS

Syntax: **-startfus**

-getuid64

Description: Read the device unique identifier (UID)

Syntax: **-getuid64**

-fusgetstate

Description: Read the FUS state

Syntax: **-fusgetstate**

-fusopgetversion

Description: Read the FUS operator version

Syntax: **-fusopgetversion**

Note:

FUS operator version is not available via bootloader interfaces.

-fwdelete

Description: Delete the BLE stack firmware

Syntax: **-fwdelete**

-fwupgrade

Description: Upgrade of BLE stack firmware or FUS firmware.

Syntax: **-fwupgrade <file_path> <address> [firstinstall=0|1] [startstack=0|1] [-v]**

<file_path> New firmware image file path

<address> Start address of download

[firstinstall=0|1] 1 for the first installation, otherwise 0
Optional, default value **firstinstall=0**

[startstack=0|1] 1 to start the stack after the upgrade, otherwise 0
Optional, default value **startstack=1**

[-v] Verify if the download operation is completed successfully
before starting the upgrade

-startwirelessstack

Description: Start the wireless stack

Syntax: **-startwirelessstack**

-authkeyupdate

Description: Authentication key update

Syntax: **-authkeyupdate <file_path>**

<file_path> Authentication key file path.

This is the public key generated by STM32TrustedPackageCreator when signing the firmware using **-sign** command.

-authkeylock

Description: Authentication key lock

Once locked, it is no longer possible to change it using **-authkeyupdate** command

Syntax: **-authkeylock**

-wusrkey

For more information about the customer key storage, refer to already cited AN5185.

Syntax: **-wusrkey <file_path> <keytype=1|2|3>**

<file_path>: customer key in binary format

<keytype=1|2|3>: User key type values: 1 (simple), 2 (master) or 3 (encrypted)

-startwirelessstack

Description: Starts the wireless stack

Syntax: **-startwirelessstack**

Note: These commands are available only through SWD, USB DFU and UART interfaces.

Note: Under Reset mode is mandatory.

Usage example for SWD interface

- FUS upgrade:

```
STM32_Programmer_CLI.exe -c port=swd mode=UR -ob nSWboot0=0
nboot1=1 nboot0=1 -fwupgrade stm32wb5x_FUS_fw.bin 0x080EC000
firstinstall=1
```

- Stack install:

```
STM32_Programmer_CLI.exe -c port=swd mode=UR -ob nSWboot0=0
nboot1=1 nboot0=1 -fwupgrade stm32wb5x_BLE_Stack_fw.bin
0x080EC000
```

- User application install:

```
STM32_Programmer_CLI.exe -c port=swd mode=UR -d
UserApplication.bin 0x08000000 -v
```

Note: -antirollback command is available starting from FUS v1.2.0.

3.2.25 Serial wire viewer (SWV) command

-SWV

Description: This command allows the user to access the serial wire viewer console mode, which displays the printf data sent from the target through SWO.

In this mode (see *Figure 121*) the user can start and stop the reception of the SWO data by pressing, respectively, the “R” and “S” buttons on the keyboard. The received SWO data are displayed in the console. Pressing the “E” button allows the user to exit the serial wire viewer console mode, and to terminate the reception session.

Figure 121. SWV command

```
C:\Qt\Qt5.14.1\Tools\QtCreator\bin\qtcreator_process_stub.exe
STM32CubeProgrammer v2.5.0

ST-LINK SN : 0669FF515350827867194516
ST-LINK FW : V2J36M26
Board : P-NUCLEO-WB55
Voltage : 3.25V
SWD freq : 4000 KHz
Connect mode: Normal
Reset mode : Software reset
Device ID : 0x495
Revision ID : Rev Y
Device name : STM32WB55xx
Flash size : 1 MBytes
Device type : MCU
Device CPU : Cortex-M0+/M4

Entering Serial Wire Viewer reception mode :
Press R to Start the reception
Press S to Stop the reception
Press E to Exit this mode
```

Syntax: `swv <freq=<frequency>> <portnumber=0-32> [<file_Path.log>]`

`<freq=<frequency>>` System clock frequency in MHz.

`<portnumber=0-31|all>` ITM port number, values: 0-31, or “all” for all ports.

`[<file_Path.log>]` Path of the SWV log file (optional). If not specified, default is `“$USER_HOME/STMicroelectronics/STM32Programmer/SWV_Log/swv.log”`.

`[-RA]` Option that automatically starts SWV data reception.

Example:

```
STM32_Programmer_CLI.exe -c port=swd -swv freq=32 portnumber=0
C:\Users\ST\swvLog\example.log
```

Note: The serial wire viewer is available only through SWD interface.

Note: Some SWV bytes can be lost during transfer due to ST-LINK hardware buffer size limitation.

-startswv

Description: This command allows the user to access the serial wire viewer console mode.

Syntax: `startswv <freq=<frequency>> <portnumber=0-32> [<file_Path.log>]`

`<freq=<frequency>>` System clock frequency in MHz.

`<portnumber=0-31|all>` ITM port number, values: 0-31, or “all” for all ports.

`[<file_Path.log>]` Path of the SWV log file (optional). If not specified, default is
“\$USER_HOME/STMicroelectronics/STM32Programmer
/SWV_Log/swv.log”

Example:

```
STM32_Programmer_CLI.exe -c port=swd -startswv freq=32 portnumber=0
C:\example.log
```

Figure 122. startswv command

The screenshot shows the STM32CubeProgrammer v2.11.0 interface. The terminal window displays the following information:

```
STM32CubeProgrammer v2.11.0

ST-LINK SN  : 066FFF535550755187243307
ST-LINK FW  : V2J33M25
Board       : NUCLEO-F446RE
Voltage     : 3.27V
SWD freq    : 4000 KHz
Connect mode: Normal
Reset mode   : Software reset
Device ID   : 0x421
Revision ID : Rev A
Device name  : STM32F446xx
Flash size   : 512 KBytes
Device type  : MCU
Device CPU   : Cortex-M4
BL Version   : --

Press S to Stop the reception
Press E to Exit this mode

Reception Started
Hello world
```

3.2.26 Specific commands for STM32WL

Before performing the encrypted firmware installation, set the device in its default status, i.e. with security disabled (ESE = 0x0), and all the option bytes at their default values.

STM32CubeProgrammer allows the user to perform these steps using two command lines:

1. **dsecurity**: allows the user to disable security.

Example:

```
STM32_Programmer_CLI.exe -c port=swd mode=hotplug -dsecurity
```

2. **setdefaultob**: this command allows the user to configure option bytes to their default values.

Example:

```
STM32_Programmer_CLI.exe -c port=swd mode=hotplug -setdefaultob
```

3. **-ob unlockchip**: this command allows the user to unlock the device if bad option bytes are programmed.

Example:

```
STM32_Programmer_CLI.exe -c port=swd -ob unlockchip
```

Figure 123. Output of *unlockchip* command

```
C:\Windows\System32\cmd.exe
-----
STM32CubeProgrammer v2.10.0-B04

ST-LINK SN : 002F004D3038510534333935
ST-LINK FW : V3J5M2
Board : NUCLEO-WL55JC
Voltage : 3.27V
SMD freq : 12000 KHz
Connect mode: Normal
Reset mode : Software reset
Device ID : 0x497
Revision ID : Rev Z
Device name : STM32WLxx
Flash size : 256 KBytes
Device type : MCU
Device CPU : Cortex-M4
BL Version : 0xc3

UPLOADING OPTION BYTES DATA ...

Bank : 0x00
Address : 0x58004020
Size : 96 Bytes
[Progress Bar: 100%]
Bank : 0x01
Address : 0x58004080
Size : 8 Bytes
[Progress Bar: 100%]

0x5800040C : 0x00000000
0x58004014 : 0xC0000000
0x58004008 : 0x45670123
0x58004008 : 0xDEF89A8
0x5800400C : 0x0B192A38
0x5800400C : 0x4C506E7F
0x58004020 : 0x3FFFF1B8
0x58004014 : 0x00020000
0x58004014 : 0x00020000

Reconnecting...
Reconnected!
0x58004014 : 0xC0000000
0x58004008 : 0x45670123
0x58004008 : 0xDEF89A8
0x58004000 : 0x0B192A38
0x5800400C : 0x4C506E7F
0x58004020 : 0x3FFFF0AA
0x58004024 : 0xFFFFFFFF
0x58004028 : 0xFFFFFFF00
0x58004034 : 0x00
0x58004038 : 0x00
0x58004014 : 0x00020000
0x58004014 : 0x00020000

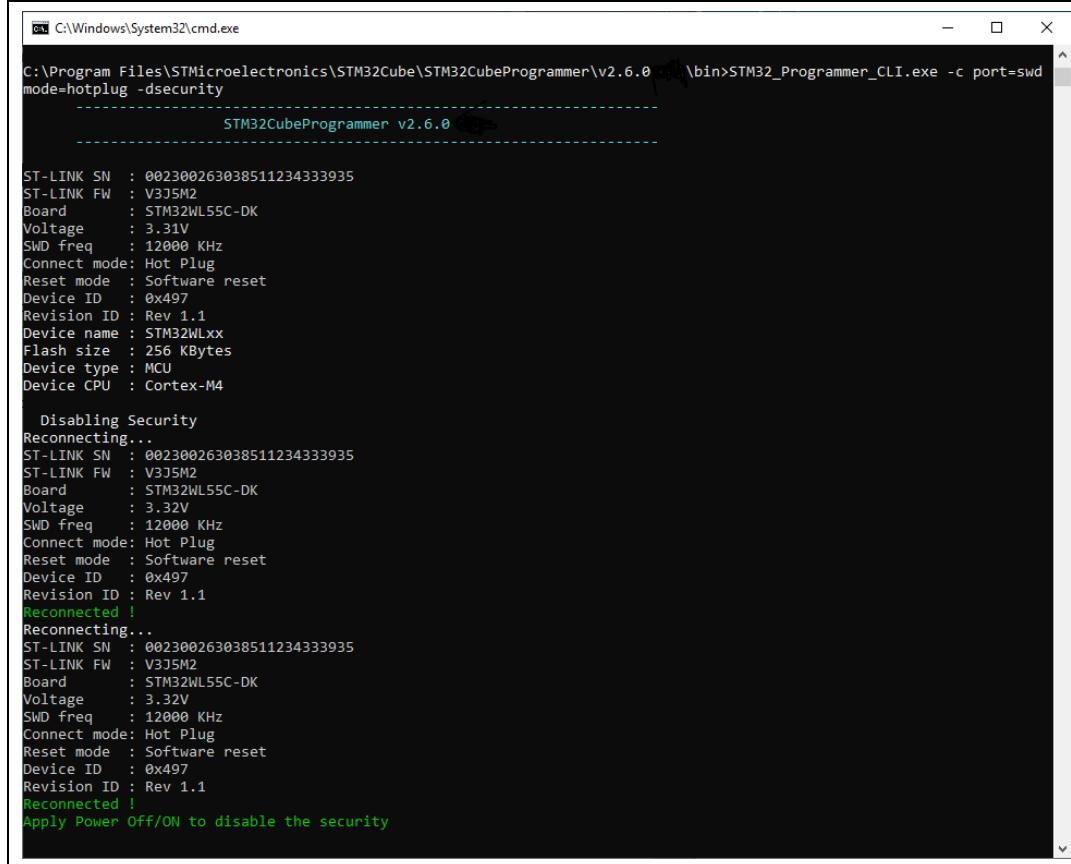
Reconnecting...
Reconnected!
Warning: Apply Power Off/On to Unlock Chip
Success to unlock chip
```

Note: *Unlockchip command is available only for STLink connection.*

After the execution of these commands, go through a power OFF / power ON sequence. These two commands allow the user to unlock the board in case of inability to change option bytes using the usual method.

Figure 124 and *Figure 125* show the results of these command lines.

Figure 124. Disable security



```
C:\Windows\System32\cmd.exe
C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer\v2.6.0\bin>STM32_Programmer_CLI.exe -c port=swd mode=hotplug -dsecurity
STM32CubeProgrammer v2.6.0

ST-LINK SN : 002300263038511234333935
ST-LINK FW : V3JSM2
Board      : STM32WL55C-DK
Voltage    : 3.31V
SWD freq   : 12000 KHz
Connect mode: Hot Plug
Reset mode  : Software reset
Device ID   : 0x497
Revision ID : Rev 1.1
Device name : STM32WLxx
Flash size  : 256 KBytes
Device type : MCU
Device CPU  : Cortex-M4

Disabling Security
Reconnecting...
ST-LINK SN : 002300263038511234333935
ST-LINK FW : V3JSM2
Board      : STM32WL55C-DK
Voltage    : 3.32V
SWD freq   : 12000 KHz
Connect mode: Hot Plug
Reset mode  : Software reset
Device ID   : 0x497
Revision ID : Rev 1.1
Reconnected !
Reconnecting...
ST-LINK SN : 002300263038511234333935
ST-LINK FW : V3JSM2
Board      : STM32WL55C-DK
Voltage    : 3.32V
SWD freq   : 12000 KHz
Connect mode: Hot Plug
Reset mode  : Software reset
Device ID   : 0x497
Revision ID : Rev 1.1
Reconnected !
Apply Power Off/ON to disable the security
```

Figure 125. Configure option bytes to their default values

```
C:\Windows\System32\cmd.exe
C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer\v2.6.0\bin>STM32_Programmer_CLI.exe -c port=swd
mode=hotplug -setdefaultob

STM32CubeProgrammer v2.6.0

ST-LINK SN : 002300263038511234333935
ST-LINK FW : V3J5M2
Board      : STM32WL55C-DK
Voltage    : 3.31V
SWD freq   : 12000 KHz
Connect mode: Hot Plug
Reset mode : Software reset
Device ID  : 0x497
Revision ID: Rev 1.1
Device name: STM32WLxx
Flash size  : 256 KBytes
Device type: MCU
Device CPU : Cortex-M4

Set default OB for STM32WL
Reconnecting...
ST-LINK SN : 002300263038511234333935
ST-LINK FW : V3J5M2
Board      : STM32WL55C-DK
Voltage    : 3.31V
SWD freq   : 12000 KHz
Connect mode: Hot Plug
Reset mode : Software reset
Device ID  : 0x497
Revision ID: Rev 1.1
Reconnected !
Apply Power ON/OFF to set default OB for STM32WL

C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer\v2.6.0-A05\bin>
```

If the user locks the board and is unable to unlock it with these two commands, there are specific scripts to unlock it. These scripts are under “..../bin/STM32WLScripts”, they contain a command line using –wdbg option to write directly scripts in the OPTR register.

The folder STM32Scripts contains two files and the Readme.txt:

1. “SetRDPLevelCM0.bat” to unlock the board via Cortex M0+
2. “SetRDPLevelCM4.bat” to unlock the board via Cortex M4

Note: *If SFI command finishes with a fail, the STM32WL chip must be set in its default status using the disable security command line (-dsecurity), then the set default option byte command line (-setdefaultob).*

3.2.27 SigFox credential commands

These commands are supported only for STM32WL devices.

-ssigfoxc

Description: This command allows to user to save the chip certificate to a binary file.

Syntax: **-ssigfoxc <binary_file_path>**

Example: STM32_Programmer_CLI.exe -c port=swd -ssigfoxc “/local/user/chip_certif.bin”

Figure 126. Example of -ssigfoxc command

```

ST-LINK SN   : 50FF6E067265575458302067
ST-LINK FW   : V2J37S7
Board       : --
Voltage     : 3.24V
SWD freq    : 4000 KHz
Connect mode: Normal
Reset mode   : Software reset
Device ID    : 0x497
Revision ID  : Rev 1.1
Device name  : STM32WLxx
Flash size   : 256 KBytes
Device type  : MCU
Device CPU   : Cortex-M4

SigFox certificate File   : C:\test\sigfox.bin
Data read successfully
The SigFox certificate file is saved successfully: C:\test\sigfox.bin

```

-wsigfoxc

Description: This command allows to user to write the chip certificate at address 0x0803E500

Syntax: `-wsigfoxc <binary_file_path> <address>` [The address is optional, by default is 0x0803E500]

Example 1: STM32_Programmer_CLI.exe -c port=swd -wsigfoxc "/local/user/sigfox_data.bin"0x0803E500

Figure 127. Example 1 of -wsigfoxc command

```

SigFox credential file : C:\SOFT_DOCS\KmsCredentials\sigfox_data.bin

Memory Programming ...
Opening and parsing file: sigfox_data.bin
  File        : sigfox_data.bin
  Size        : 48 Bytes
  Address     : 0x0803E500

Erasing memory corresponding to segment 0:
Erasing internal memory sector 31
Download in Progress:
                                         100%
File download complete
Time elapsed during download operation: 00:00:00.045

Verifying ...

Read progress:
                                         100%
Download verified successfully

```

Example 2: STM32_Programmer_CLI.exe -c port=swd -wsigfoxc "/local/user/sigfox_data.h"

Figure 128. Example 2 of -wsigfoxc command

```
SigFox credential file : C:\SOFT_DOCS\KmsCredentials\sigfox_data.h

Memory Programming ...
Opening and parsing file: Sigfox_EmbKey.bin
  File        : Sigfox_EmbKey.bin
  Size        : 592 Bytes
  Address     : 0x0803E500

Erasing memory corresponding to segment 0:
Erasing internal memory sector 31
Download in Progress:
  [Progress Bar] 100%
File download complete
Time elapsed during download operation: 00:00:00.052

Verifying ...

Read progress:
  [Progress Bar] 100%
Download verified successfully
```

3.2.28 Register viewer

-regdump

Description: Reads and dumps core and MCU registers

Syntax: `-regdump <file_path.log> [choice=<number>]`

`<file_path.log>` Log file path

`[choice=<number>]` Device number from the list of compatible devices (optional). This list is displayed if the command is performed without this optional argument.

Example: STM32_Programmer_CLI.exe -c port=swd -regdump C:\test\STM32F072.log

Figure 129. Read core and MCU registers

```
C:\Program Files (x86)\STMicroelectronics\STM32Cube\STM32CubeProgrammer\v2.7.0\bin>STM32_Programmer_CLI.exe -c port=swd mode=hotplug -regdump C:\test\STM32F072.log
STM32CubeProgrammer v2.7.0

getDebugInterfaceInfo
this->index = 0
ST-LINK SN : 0675FF555354885087101431
ST-LINK FW : V2332M2
Board : NUCLEO-F072RB
Voltage : 3.24V
SWD freq : 4000 KHz
Connect mode: Hot Plug
Reset mode : Software reset
Device ID : 0x448
Revision ID : Rev Z
Device name : STM32F07x
Flash size : 128 KBytes
Device type : MCU
Device CPU : Cortex-M0

You can automatically select a device from this list by adding the parameter "choice=<device_number>" to the command.

Please select your device number from the list:

1. STM32F0x0
2. STM32F0x1
3. STM32F0x2
4. STM32F0x8
1

Choice: STM32F0x0.svd

Getting the registers information...
Read progress: 100%
Registers information saved !
```

3.2.29 Hard fault analyzer

To start the analysis (see [Section 2.14](#)), use a specific command line.

Syntax: **-hf**

The output trace contains different kinds of essential information to better understand the reason(s) that caused a particular fault.

An informative message “STM32CubeProgrammer Fault Analyzer” is displayed to indicate that the detection flow has started.

Note: Connection to target must be established before performing Fault Analyzer command.

Example

Using the same example as GUI mode (division by 0).

Command: **-c port=swd mode=hotplug -hf**

From the command line output, a Green message indicates a “Hard Fault Detected” and “The processor has executed a SDIV or UDIV instruction with a divisor of 0”.

Useful informations can be extracted:

- Faulty instruction address: 0x80002E4
- Faulty instruction called by a function located at this address: 0x800022D
- NVIC position: 0, Window watchdog interrupt
- Execution mode: Handler
- Core registers capture

Figure 130. Fault analyzer CLI view when Hard Fault is detected

```
STM32CubeProgrammer Fault Analyzer

Core Registers :

r ap 0 reg  0  0x48000000
r ap 0 reg  1  0x00000000
r ap 0 reg  2  0x00000000
r ap 0 reg  3  0x00000000
r ap 0 reg  4  0x00000000
r ap 0 reg  5  0x00000000
r ap 0 reg  6  0x00000000
r ap 0 reg  7  0x00000000
r ap 0 reg  8  0x00000000
r ap 0 reg  9  0x00000000
r ap 0 reg 10  0x00000000
r ap 0 reg 11  0x00000000
r ap 0 reg 12  0x00000000
r ap 0 SP   13  0x200003E0
r ap 0 LR   14  0xFFFFFFFF9
r ap 0 PC   15  0x08000032E
r ap 0 XPSR 16  0x21000003
r ap 0 MSP   -  0x200003E0
r ap 0 PSP   -  0x00000000
r ap 0 CR   20  0x00000000

Execution Mode : Handler

Usage Fault detected in instruction located at 0x080002E4

NVIC position : 0

DIVBYZERO : The processor has executed a SDIV or UDIV instruction with a divisor of 0.

Hard Fault detected :

Faulty function called at this location 0x0800022D

Hard Fault State Register information :

FORCED : forced Hard Fault.

Exception return information :

Return to Thread mode, exception return uses non-floating-point
state from MSP and execution uses MSP after return.
```

3.2.30 File checksum

Description: Calculates the checksum value for the entire file content using an addition algorithm, and then displays the resulting value.

Syntax: `-fchecksum, --file-checksum <file_path>`

`<file_path>` The input file path to deploy (supports files with multiple segments)

Figure 131. Example of File checksum command

```
===== File Checksum Calculator =====

File : myFile.hex
Segments total number : 2
+ Segment [0] :
  Address   = 0x08000000
  Size      = 17.54 KB
  Checksum  = 0x001B1E36
+ Segment [1] :
  Address   = 0x90000000
  Size      = 16.41 KB
  Checksum  = 0x001B0C26
Segments total checksum : 0x00362A5C
```

File checksum calculation may be done even if there is no device connected.

The output for this command contains:

- File description (see)
- The checksum value is calculated for each segment separately.
- The entire checksum calculated value for all segments (.bin file always contains one segment)

3.2.31 Memory checksum

Description: Calculates the checksum value for any accessible memory type (including internal flash memory), and displays the resulting output.

Syntax: `-checksum, --checksum <address> <size>`

`<address>` and `<size>` are not mandatory, if not indicated, the tool calculates the checksum for the full internal flash memory.

Example 1:

`STM32_Programmer_CLI.exe -c port=swd -checksum` (see [Figure 132](#))

Example 2:

`STM32_Programmer_CLI.exe -c port=swd -checksum 0x90000000 0x200 -el MX25L512G_STM32F769I-DISCO.stldr` (see [Figure 133](#))

Example3:

`STM32_Programmer_CLI.exe -c port=swd -w data.bin 0x08000000 -checksum` (see [Figure 134](#))

Figure 132. Checksum command output for the internal flash memory

```
ST-LINK SN : 066AFF313331464257041920
ST-LINK FW : V2J40M27
Board       : 32F769IDISCOVERY
Voltage     : 3.24V
SWD freq    : 4000 KHz
Connect mode: Normal
Reset mode   : Software reset
Device ID    : 0x451
Revision ID  : Rev Z
Device name  : STM32F76x/STM32F77x
Flash size   : 2 MBytes
Device type  : MCU
Device CPU   : Cortex-M7
BL Version   : 0x93

Memory checksum calculating ...
Memory [0x08000000 : 0x08200000] - Checksum : 0x1FDFF4DC
```

Figure 133. Checksum command output for an external memory

```
ST-LINK SN : 066AFF313331464257041920
ST-LINK FW : V2J40M27
Board       : 32F769IDISCOVERY
Voltage     : 3.24V
SWD freq    : 4000 KHz
Connect mode: Hot Plug
Reset mode   : Software reset
Device ID    : 0x451
Revision ID  : Rev Z
Device name  : STM32F76x/STM32F77x
Flash size   : 2 MBytes
Device type  : MCU
Device CPU   : Cortex-M7
BL Version   : 0x93

Memory checksum calculating ...
Memory [0x90000000 : 0x90000200] - Checksum : 0x0001FE00
```

Figure 134. Checksum command output at the end of file download

```

Memory Programming ...
Opening and parsing file: data[2KB].bin
File      : data[2KB].bin
Size      : 2.00 KB
Address   : 0x08000000

Erasing memory corresponding to segment 0:
Erasing internal memory sector 0
Download in Progress:  100%

File download complete
Time elapsed during download operation: 00:00:00.374
Memory checksum calculating ...
Memory [0x08000000 : 0x08200000] - Checksum : 0x1FD8433F

```

3.2.32 RDP regression with password

Some STM32 products offer the possibility to use an optional password-based RDP level regression, including RDP level 2.

Detailed information about this hardware mechanism is available in reference manuals.

Password lock and unlock CLI commands for devices of the STM32U5 series are:

- lockRDP1, -setOEM1KEY

Description: Allows the user to lock the RDP regression from level 1 with a password.

Syntax: `- lockRDP1 <OEM1 least significant bytes key> <OEM1 most significant bytes key>`

Example:

```
STM32_Programmer_CLI -c port=swd mode=hotplug -lockRDP1 0x12345678
0xDEADBEEF
```

- lockRDP2, -setOEM2KEY

Description: This command allows the user to lock the RDP regression from level 2 with a password.

Syntax: `- lockRDP2 <OEM2 least significant bytes key> <OEM2 most significant bytes key>`

Example:

```
STM32_Programmer_CLI -c port=swd mode=hotplug - lockRDP2 0x12345678
0xDEADBEEF
```

- unlockRDP1

Description: This command allows to unlock the RDP regression from level 1 with a password.

Syntax: `- unlockRDP1 <OEM1 least significant bytes key> <OEM1 most significant bytes key>`

Example:

```
STM32_Programmer_CLI -c port=swd mode=hotplug -unlockRDP1  
0x12345678 0xDEADBEEF
```

- unlockRDP2

Description: Allows the user to unlock the RDP regression from level 2 with a password.

Syntax: - unlockRDP2 <OEM2 least significant bytes key> <OEM2most significant bytes key>

Example:

```
STM32_Programmer_CLI -c port=swd mode=hotplug - unlockRDP2  
0x12345678 0xDEADBEEF
```

Note: After unlocking the RDP, the user must perform an RDP regression, as the listed commands do not include the RDP regression operation.

Note: To remove RDP regression with password, the user must use the Lock command and a password with value 0xFFFFFFFF 0xFFFFFFFF, such as `STM32_Programmer_CLI -c port=swd mode=hotplug -lockRDP1 0xFFFFFFFF 0xFFFFFFFF`.

Note: RDP regression with password is supported only via ST-LINK.

Password lock and unlock CLI commands for devices of the STM32U0 series are:

- lockRDP1

Description: Allows the user to lock the RDP regression from level 1 with a 128-bit password.

Syntax: - lockRDP1 <Password first 32 bits> <Password second 32 bits> <Password third 32 bits> <Password forth 32 bits>

Example:

```
STM32_Programmer_CLI -c port=swd mode=hotplug -lockRDP1 0x12345678  
0xDEADBEEF 0x12345678 0xDEADBEEF
```

- lockRDP2

Description: Allows the user to lock the RDP regression from level 2 with a 128-bit password.

Syntax: - lockRDP2 <Password first 32 bits> <Password second 32 bits> <Password third 32 bits> <Password forth 32 bits>

Example:

```
STM32_Programmer_CLI -c port=swd mode=hotplug - lockRDP2 0x12345678  
0xDEADBEEF 0x12345678 0xDEADBEEF
```

- unlockRDP1

Description: Allows the user to unlock the RDP regression from level 1 with a 128-bit password on access port 1 in hotplug mode.

Syntax: - unlockRDP1 <Password first 32 bits> <Password second 32 bits> <Password third 32 bits> <Password forth 32 bits>

Example:

```
STM32_Programmer_CLI -c port=swd mode=hotplug ap=1 -unlockRDP1 0x12345678
0xDEADBEEF 0x12345678 0xDEADBEEF
```

- unlockRDP2

Description: Allows the user to unlock the RDP regression from level 2 with a 128 bit password on access port 1 in hotplug mode.

Syntax: - unlockRDP2 <Password first 32 bits> <Password second 32 bits>
<Password third 32 bits> <Password forth 32 bits>

Example:

```
STM32_Programmer_CLI -c port=swd mode=hotplug ap=1 - unlockRDP2 0x12345678
0xDEADBEEF 0x12345678 0xDEADBEEF
```

Note: After unlocking the RDP, the user must perform an RDP regression, as the listed commands do not include the RDP regression operation.

Note: To remove RDP regression with password, the user must use the Lock command and a password with value 0xFFFFFFFF 0xFFFFFFFF 0xFFFFFFFF 0xFFFFFFFF, such as STM32_Programmer_CLI -c port=swd mode=hotplug -lockRDP1 0xFFFFFFFF 0xFFFFFFFF 0xFFFFFFFF 0xFFFFFFFF.

3.2.33 GetCertif command**-gc**

Description: This command allows the user to read the chip certificate.

Syntax: -gc certification.bin

3.2.34 Write DBG MCU authentication command**-w32dbgmcu**

Description: Downloads the specified 32-bit data into the DBGMCU AUTH HOST register to be able to place a message in the mailbox shared between the device and the host.

Syntax: -w32dbgmcu <32_data_bits>

Example:

```
-w32dbgmcu 0x12345678
```

Only STM32H5 devices support this command, use the verbosity to check the message, DBG MCU address, and the verification process for write trace.

Note: After the upcoming reset, the device is able to interpret the message.

3.2.35 OBKey provisioning**-sdp**

Description: This is a security feature to program OBKey content.

Syntax: -sdp [OBKey_File_Path.obk]

[OBKey_File_Path.obk]	Path of OBK file
-----------------------	------------------

Example:

```
/STM32_Programmer_CLI.exe -c port=swd mode=hotplug -sdp "C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer_DA_password\bin\DA_Default_Config\NonCrypto\DA_Config_Certificate.obk"
```

Figure 135. OBKey provisioning example

The screenshot shows a terminal window with the following text output:

```

SWD Freq : 8000 KHz
Connect mode: Hot Plug
Connect mode: Software reset
Device ID : 0x484
Revision ID : Rev Z
Device name : STM32H5xx
Device size : 16 Mbytes
Device type : MCU
Device CPU : Cortex-M33
BL Version : 0x02

secure Data Provisioning Start. OBK Input file : C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer_DA_password\bin\DA_Default_Config\NonCrypto\DA_Config_Certificate.obk
OBKey Provisioned successfully

```

OBKey file generation is managed by STM32 Trusted Package Creator.

3.2.36 Password provisioning (STM32H503 only)**-pwd**

Description: This command provisions the password in OTP, and generates a password.bin file, to be used later for regression.

Syntax: `-pwd value=[Password_Value] path=[Password_Path]`

Password value	Value that will be programmed in OTP
Password path	Location where to save “password.bin” file

Example:

```
STM32_Programmer_CLI.exe -c port=swd -pwd value=1mc4l path=C:\my_folder
```

The password size must be between 4 and 16 bytes.

Once the target is successfully provisioned, the “password.bin” file is generated, to be used while performing debug authentication.

Password programming can be executed only once for each target.

3.2.37 Debug authentication commands

The following commands are available only with the JTAG/SWD debug port.

[Debugauth=<value>]

Discovery: `debugauth=2`

Launches discovery, to display information about the target.

Example:

```
/STM32_Programmer_CLI.exe -c port=swd debugauth=2
```

Figure 136. Discovery log

```

Start Debug Authentication Sequence
SDM 0.6.0 Init Sequence
Open SDM Lib
open_comms          : 434 : open      : Asserting target reset
open_comms          : 438 : open      : Writing magic number
open_comms          : 446 : open      : De-asserting target reset
open_comms          : 492 : open      : Communication with the target established successfully

response_packet_lock
discovery: target ID.....:0x484
discovery: SoC ID.....:0x0 0x0 0x0 0x0
discovery: SDA version.....:1.0.0
discovery: Vendor ID.....:STMicroelectronics
discovery: PSA lifecycle.....:ST_LIFECYCLE_PROVISIONING
discovery: PSA auth version.....:1.0
discovery: ST HDPL1 status.....:0xffffffff
discovery: ST HDPL2 status.....:0xffffffff
discovery: ST HDPL3 status.....:0xffffffff
discovery: Token Formats.....:0x200
discovery: Certificate Formats.....:0x201
discovery: cryptosystems.....:Ecdsa-P256 SHA256
discovery: ST provisioning integrity status:0xeaeaaeae

Debug Authentication: Discovery Success

```

Authentication: **debugauth=1**

Performs debug authentication using credential files.

Credential files (passwords, keys, and certificates) are generated by STM32 Trusted Package Creator.

Syntax: `pwd=[password_path.bin] debugauth=1` (authentication with password)

Example:

```
STM32_Programmer_CLI.exe -c port=swd pwd=C:\password.bin debugauth=1
```

Figure 137. Debug authentication with password

```

Start Debug Authentication Sequence
SDM 0.6.0 Init Sequence
Open SDM Lib
open_comms          : 434 : open      : Asserting target reset
open_comms          : 438 : open      : Writing magic number
open_comms          : 446 : open      : De-asserting target reset
open_comms          : 492 : open      : Communication with the target established successfully

[0%]   discovery command
[10%]  sending discovery command
[20%]  receiving discovery
response_packet_lock
[40%]  loading credentials
[50%]  sending challenge request
[60%]  receiving challenge
response_packet_lock
[70%]  signing token
SDMAuthenticate     : 1131 : client    : Found 3 certificates

response_packet_lock
response_packet_lock
response_packet_lock
[80%]  sending response
[90%]  receiving status
response_packet_lock
SDMAuthenticate     : 1229 : client    : Authentication successful

[100%] finished authentication

Debug Authentication Success

```

Syntax: `per=[Permission] key=[Key_Path.pem] cert=[Certificate_Path.b64]`
`debugauth=1` (authentication with certificate)

Permission selection

- Permissions or actions must be identified using either letters or bit numbers.
- To set the permission field ("per" in command line) with the correct permission/actions you must find the complete list of identifiers using one of the following options:
 - Use the discovery menu using debugauth=2.
 - Launch debug authentication using debugauth=1 without choosing permissions. This displays the available permissions, and the "per" field will be requested during runtime.

Full regression example (single permission)

- Letter identifier:
 - Format: `per=<letter>`
 - Example: `per=A` (Equivalent to full regression)
- Bit number identifier:
 - Format: `per=<bit_number>`
 - Example: `per=14` (Equivalent to full regression)

Selecting multiple permissions

- With bit numbers: combine multiple permissions by listing each bit number, separated by commas without spaces.
 - Format: `per=<bit_number1>,<bit_number2>,...`
 - Example: `per=2,4,6`
- With letters: combine multiple permissions by concatenating each corresponding letter without separators.
 - Format: `per=<letter1><letter2>...`
 - Example: `per=ABF`

When specifying permissions with bit numbers, use commas to separate them without adding spaces. When using letters, simply concatenate them without any separators or spaces.

Example:

```
STM32_Programmer_CLI.exe -c port=swd per=a key=C:\key_3_leaf.pem  
cert=C\cert_leaf_chain.b64 debugauth=1
```

Figure 138. Debug authentication with certificate

```

Start Debug Authentication Sequence

SDM 0.6.0 Init Sequence
Open SDM Lib
open_comms          : 434 : open      : Asserting target reset
open_comms          : 438 : open      : Writing magic number
open_comms          : 446 : open      : De-asserting target reset
open_comms          : 492 : open      : Communication with the target established successfully

[00%]   discovery command
[10%]   sending discovery command
[20%]   receiving discovery
response_packet_lock
[40%]   loading credentials
[50%]   sending challenge request
[60%]   receiving challenge
response_packet_lock
SDMAuthenticate     : 1131 : client    : Found 1 certificates

[80%]   sending ST password
[90%]   receiving response
response_packet_lock
[100%]  authentication successful
SDMAuthenticate     : 1195 : client    : Authentication successful

Debug Authentication Success

```

Note: For interactive mode, the command to execute is `./STM32_Programmer_CLI.exe -c port=SWD ap=0 mode=Hotplug debugauth=1 per=a key=private-key.pem cert=DA_cert.b64`. If this command is not executed as shown, the user will be required to select the Debug Authentication parameters during runtime.

3.2.38 Force no debug authentication command

--force_no_da

Description: This option allows to pass an information to the tool, to force the product state to OB programming, even if the debug authentication is not configured (password not programmed in OTP). In this case, it is no longer possible to perform regression, all debug features are disabled.

This option is available only for STM32H50x devices, it is handled only if there is a request for OB programming.

Syntax: `--force_no_da`

Prompt a warning message to highlight the case:

```
> You are trying to modify the PRODUCT_STATE while OTP are not set,
> Force No DA option is active!
```

If this option is not used and you are trying to modify the product state with OTP not configured, to avoid damages the tool stops the execution and prompts an error message:

```
> You are trying to modify the PRODUCT_STATE while OTP are not set, data
won't be downloaded.

> Please configure your device and try again.
```

3.2.39 Debug Authentication - Password provisioning

Description: For devices supporting debug authentication without TrustZone, the password hash (hash256) is stored in OTP.

This command allows password provisioning, to do it enter a password value and a password path.

Once the OTP is written, the corresponding OTP block is locked. The password value is used to calculate the hash to store in OTP. The password path is the location where to save “password.bin” file, needed to open the device in a Debug Authentication sequence.

Syntax: `-pwd value=<password> path=<PasswordOPPath>`

<password> Used while programming OTP

<PasswordOPPath> Represents the location where to save “password.bin” file, used to open the device in a debug authentication sequence.

Example:

```
-pwd value=12345 path="C:\Users\User_name\my_folder"
```

The password size must be between 4 and 16 bytes.

Password provisioning can be performed only when product state is provisioning, and only once for each device.

3.2.40 Debug authentication - Close debug

For devices supporting debug authentication with TrustZone, the user can close the debug after performing Debug opening (instead of powering off/on the target).

Syntax: `debugauth=3`

Example:

```
STM32_Programmer_CLI.exe -c port=swd debugauth=3
```

3.2.41 Secure Manager - Install and update module

In devices that support Secure Manager, it is possible to install and update a module, with HSM (hardware security module), or with a global license.

Syntax: `installipmodule [file_path] [hsm=0|1] [slot=slotID] [address]`

<file_path> Path of smu file to be programmed

Set user option for HSM use

<hsm=0|1> Value: {0 (do not use HSM), 1 (use HSM)}

Default value: hsm=0

<lic_path|slot[slotID]> Path to the license file (if hsm = 0) or reader slot ID if HSM is used (hsm = 1). In case of global license, use hsm = 0 with license path.

<address> Destination address of the smu module

Install module with HSM (product specific)

Example:

```
STM32_Programmer_CLI.exe -c port=swd mode=hotplug ap=1 -installipmodule
C:\Users\User\module_chip_specific.smu HSM=1 1 0x8174000
```

If the sequence ends successfully, *IP Module install done successfully* is displayed.

Install module without HSM (global license)

Example:

```
STM32_Programmer_CLI.exe -c port=swd mode=hotplug ap=1 - installipmodule
C:\Users\User\module_Global_License.smu HSM=0 C:\ C:\Users\User\License.bin
0x08000000
```

If the sequence ends successfully, *IP Module install done successfully* is displayed.

Update module

Syntax: updateipmodule <file_path> <address>

-updateipmodule, --updateipmodule update ip module

<file_path> Path of smu file to be programmed

<address> Destination address of the smu module

Example:

```
STM32_Programmer_CLI.exe -c port=swd mode=hotplug ap=1 -updateipmodule
C:\Users\User\module_update.smu 0x8174000
```

If the sequence ends successfully, *IP update install done successfully* is displayed.

3.2.42 SkipErase command

--skiperase

Description: Skips sector erase before programming

Syntax: exe --skiperase

Example: STM32_Programmer_CLI.exe -c port=swd --skipErase -d C:\example.bin
0x08000000

3.2.43 OTP store command

--storekeyotp, --storekeyotp

Description: Stores authentication public key in the OTP. Applies only to STM32WB0x and STM32WL33 devices. This command can be performed only with UART interface.

Syntax: -storekeyotp <key_path> <start_address>

<key_path> Folder with the public_key.py file to store in OTP

<start_address> Start FW address

Example:

```
STM32_Programmer_CLI.exe -c port=COM41 br=115200 p=none -storekeyotp
"C:\file1.c" 0x10070800
```

3.2.44 Key wrapping command

-rssekw

Description: Allows the user to select the root secure services extension library for key wrapping (RSSeKW), and execute the wrapping of the private key provisioned or provided by the user under specific configuration.

Syntax: `-rssekw <rssekw .bin file path> <wrapping output file path>`
`[KeyType=eccchipfu|eccchiplu] [ExportPublicKey=yes|no]`
`[WrappingKeySelect=dhuk] [KeyUsage=ecc_usage_sign|ecc_usage_scalar_mul]`
`[SecAttr=secure|non_secure] [PrivAttr=privilege]`

<.bin file_path>	RSSe key wrapping file path
<.bin file_path>	Output .bin file path
[KeyType=<eccchipfu eccchiplu>]	Private key to wrap
[ExportPublicKey=<Yes No>]	Generate or not the public Key
[WrappingKeySelect=<DHUK >]	Method used to wrap the private key
KeyUsage=<ECDSA_USAGE_SIGN ECC_USAGE_SCALAR_MUL>[]	Usage of the private key
[SecAttr=<SECURE NON_SECURE>]	Secure or nonsecure context
[PrivAttr=<PRIVILEGE NON_PRIVILEGE>]	Privileged or unprivileged context Value = Privilege for ECC chip

3.2.45 OTP programming commands for STM32N6

For generic usage of this window refer to [Section 5.1.12](#).

STM32N6 devices support 367 OTP words, and the STM32CubeProgrammer allows users to program these OTP using the same commands as MPU or the user interface.

- Via Debug interfaces: to program the OTP via ST-Link, use the external loader `OTP_FUSES_STM32N6xx` using the “-el” command. Example: `-c port=swd -el <pathToSTM32CubeProgrammerInstall>\ExternalLoader\OTP_FUSES_STM32N6xx.s tldr`
- Via BootROM: STM32CubeProgrammer needs the TSV file that includes the OpenBootloader for OTP programming, refer to openBootloader Github for more details: [STMicroelectronics/stm32-mw-openbl](https://github.com/STMicroelectronics/stm32-mw-openbl).

Example

The tool loads the OpenBootloader as requested in the TSV file using the embedded BOOTROM. Once the OpenBootloader running, you can manipulate the entire OTP using the same commands as the MPU.

Command for launching the OpenBootloader: `-c port=USB1 -d file.tsv`

Example of TSV file to launch the OpenBootloader:

#Opt	Id	Name	Type	IP	Offset	Binary
P	0x1	FSBL	Binary	none	0x0	OpenBootloader_STM32N6-DK OTP_Cut2-Signed.stm32

Then you can use OTP command described in [Section 5.1.12](#).

3.2.46 External flash memory commands for STM32N6

STM32N6 devices can be connected via ST-Link (JTAG/SWD) and via BootROM (USB/UART). The external flash memory can be programmed in two ways:

1. Via ST-Link: select the corresponding external flash loader using the “-el” command to perform programming, write, erase and read operations with an external memory.
2. Via BootROM: this is used to sequentially load the partitions requested by the BootROM. To achieve this, STM32CubeProgrammer requires the TSV file, which contains the OpenBootloader for the external memory programming, the corresponding external flash loader and the data to load, refer to GitHub for more details.

3.2.47 Fast read command

Description: Fast read 32-bit data memory.

Syntax: `-r32fast`

Example

```
./STM32_Programmer_CLI -c port=SWD -r32fast 0x20000000 0x100
```

This command can be used only for internal memories. It offers a better read performance compared with the `-r32` command, a feature useful in scripts needing frequent target access. The command is not supported with bootloader interfaces. The maximum allowed size is 32 Kbytes.

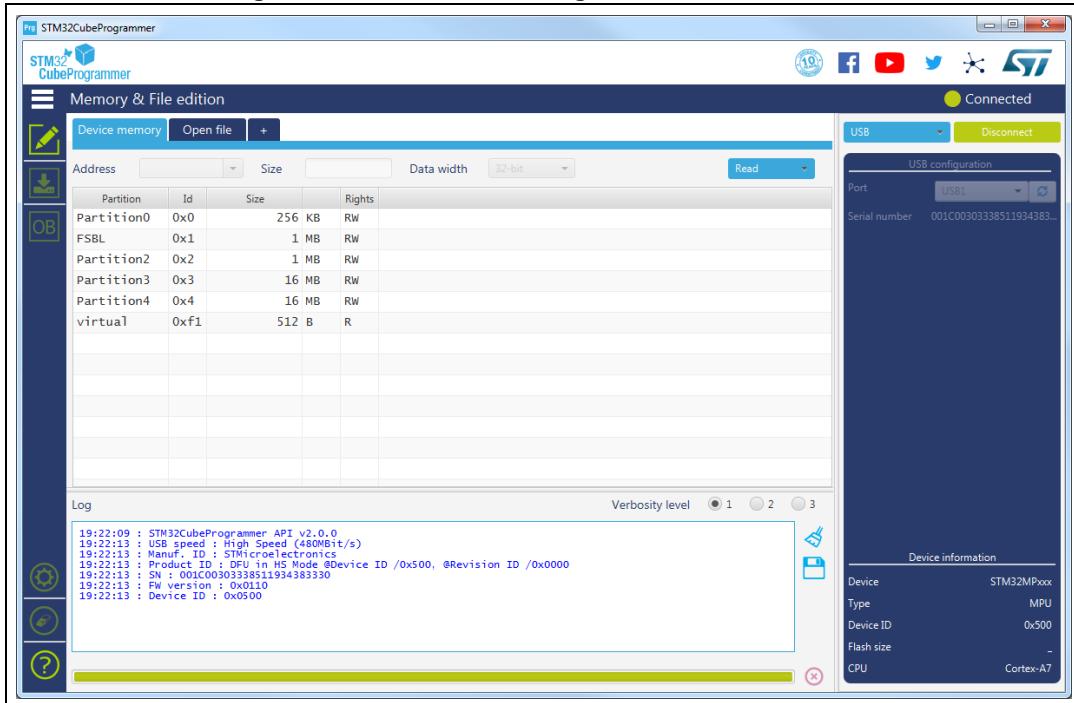
The command must be indicated exclusively with `-c/--connect` command, without mentioning any other command.

There is no check for the index range when mentioning the `index=` option, and on access port number when `ap=` is specified.

4 STM32CubeProgrammer user interface for MPUs

4.1 Main window

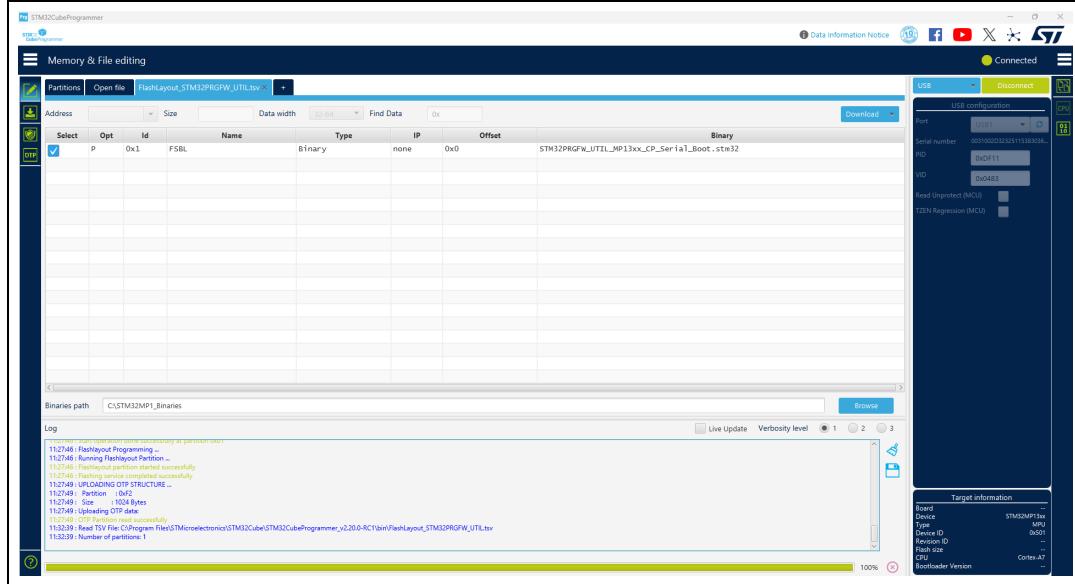
Figure 139. STM32CubeProgrammer main window



The main window allows the user to select the interface used to connect to STM32MPxx BootROM, possible interfaces are USB-DFU and UART (programming through STLink interface is not possible with STM32MPxx devices). Once connected (using Connect button), available partitions are displayed, and the user is able to open a TSV file for programming.

4.2 Programming windows

Figure 140. TSV programming window



To program TSV files the user must perform the following operations:

- Open a TSV file by using “Open file” tab, if TSV file format is correct then TSV content is displayed in the main window. TSV files are available in STM32MP1 Linux distributions, refer to STM32MP1 wiki for more details.
- Specify binaries path in “Binaries path” text box.
- Select the list of partitions to be programmed in “select” column, by default all partitions are selected.
- Launch download using “Download” button.

For more details concerning flashing operations refer to AN5275, available on www.st.com.

4.3 OTP programming window

The OTP window is available exclusively for MPUs and STM32N6 devices. It extracts the OTP partition [ID 0xF2] using STMPRGFW-UTIL interface to read, display and fuse the OTP registers.

STM32MP1xx devices have 3072 OTP (one time programmable) bits, which can be read-accessed in 96 words: OTP_x (x = 0 to 95). STM32MP2xx and STM32N6 devices have 368 words: OTP_x (x = 0 to 367).

Some OTP words are programmed during manufacturing (product differentiation or keys).

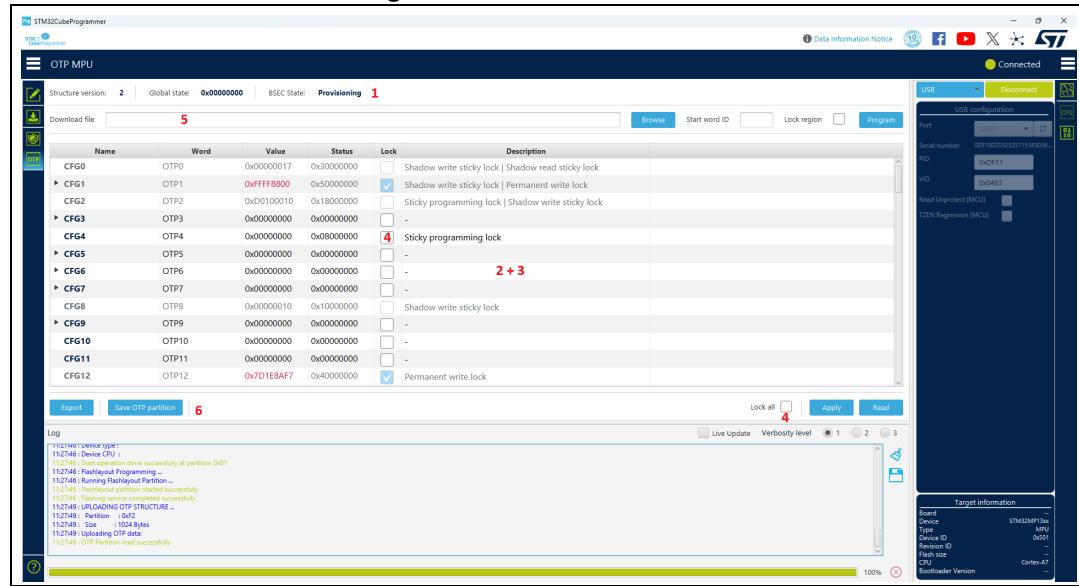
Note: *The OTP window is accessible through USB/UART interfaces for STM32M. For STM32N6 it is available via Debug/USB/UART interfaces.*

The UI has six main goals:

1. Get OTP structure information
2. Read and display words in table view format
3. Edit and fuse OTP registers
4. Lock specific/all words
5. Program binary files (frequently for keys fuse)
6. Save the OTP partition in output binary file (for debug)

Open the OTP window by pressing the “OTP” button from the main window to start reading the OTP partition, when this is correctly executed, it displays the words in table view.

Figure 141. OTP MPU window



4.3.1 Get OTP structure information

This section displays an overview of the connected device.

- Structure version
- Global state
- State: Secure open / Secure closed / Invalid

Note: The OTP UI is available only for structure version 2.

4.3.2 Read and display words

After checking of the OTP partition, the tool decodes and shows the words in table view format including five columns:

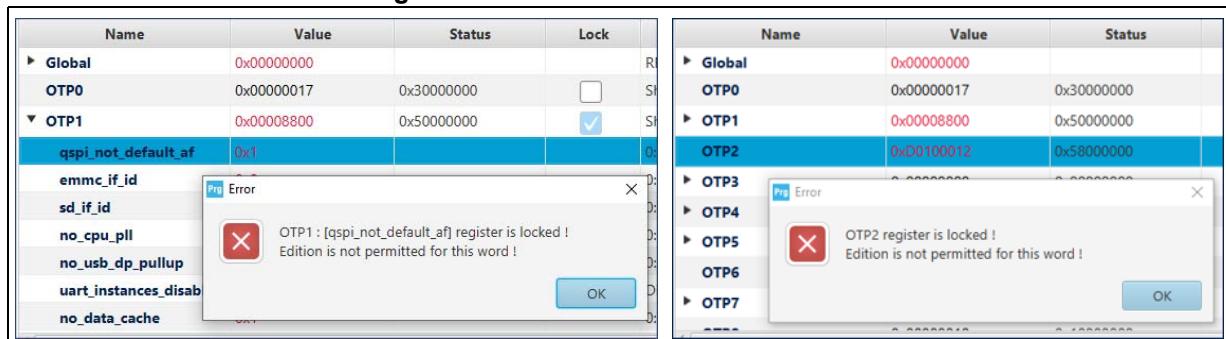
- Name: OTP word name.
- Word: OTP word ID as a tree component.
- Value: hexadecimal value (red color for locked words) as editable field.
- Status: hexadecimal value.
- Lock: indicate the lock state of the considered word as checkbox component. Checked if the item is locked, otherwise it will be unchecked. The column is disabled if the item is in permanent write lock state.
- Description: decodes the status of the OTP word and displays a brief description for children's items.

Note: Press “Read” button to refresh all table fields or to discard changes.

4.3.3 Edit and fuse words

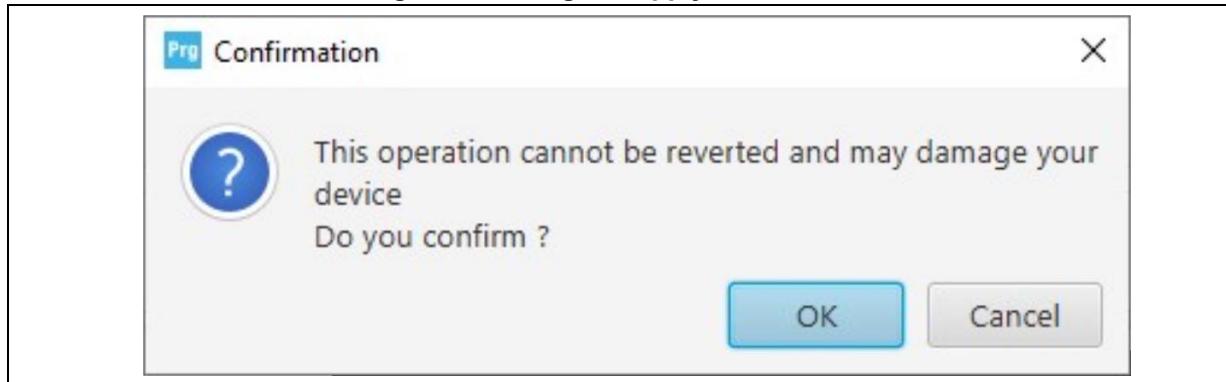
It is possible to directly edit the “Value” table cell to write a new value (press Enter after each change). The tool verifies the syntax of the input item to respect hexadecimal format and item width, then it checks the locking state of the current item before start fusing.

Figure 142. Edit denial for locked words



After modification, press “Apply” button and confirm the operation to start the update and refresh the table view.

Figure 143. Program Apply confirmation



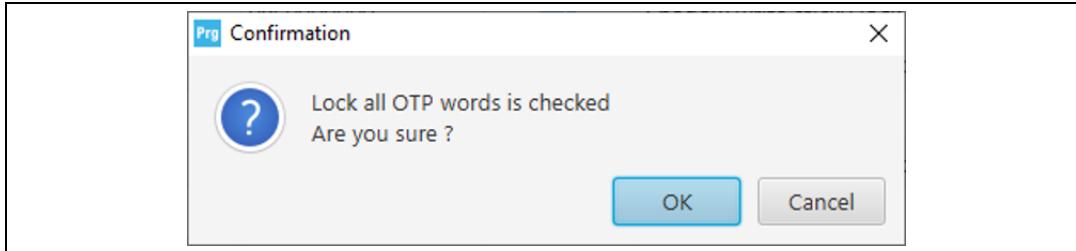
4.3.4 Lock specific/all words

The lock operation allows the user to close the write programming against any modification of the considered OTP word. It is possible to lock several words on one-shot by setting the assigned checkboxes, then clicking on “Apply” to start the operation.

Note: To go faster to the initial OTP lock state, it is recommended to press the “Read” button.

It is possible to lock all words at once by setting the “Lock all” checkbox. A message ([Figure 144](#)) pops up asking to confirm the start of the procedure, which results in all words being closed and no further changes allowed.

Figure 144. Lock all words confirmation



If the operation is successful, the table view is disabled for all “Lock” columns.

4.3.5 Program binary file

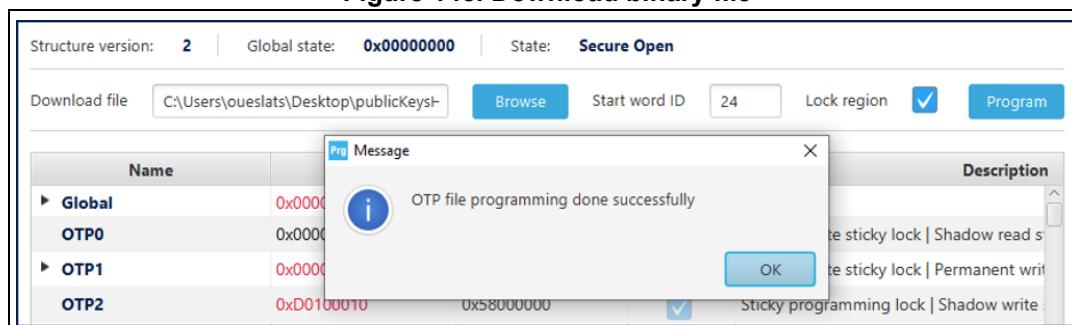
This section contains different graphical components, needed to program a binary file on the OTP registers starting from a word ID, and based on the following steps:

1. Choose the adequate binary file (with .bin extension) by clicking on “Browse”
2. Mention the start word ID in decimal format (0 to 95)
3. Check/Uncheck the “Lock region” checkbox to indicate the operation type (update or write permanent lock)
4. Press “Program” button to start the download flow

If the procedure is completed correctly, an informational dialog appears to confirm that the operation is completed.

Note: *The input binary is a 32-bit aligned file, the tool adds padding values if the file is not aligned (a warning message is displayed in the log panel).*

Figure 145. Download binary file

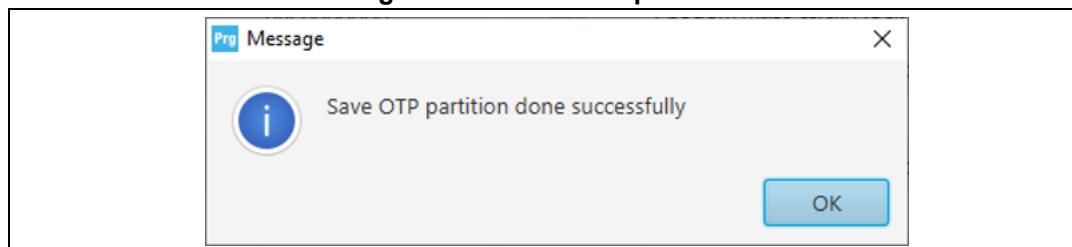


4.3.6 Save OTP partition

The user can save the whole current OTP partition in a binary file (.bin extension), which can be used for future analysis or to archive the current device configuration.

Press on “Save OTP partition” button and choose the desired output name and directory (check permissions). If the save is completed correctly, an informational dialog appears to confirm that the operation is completed.

Figure 146. Save OTP partition



Note: *The size of the output file must be 1024 bytes.
U-boot program must be installed before launching OTP window, which is necessary to expose the OTP partition.
Words 32 to 95 do not have child fields, can be edited only once, and must be permanently locked after programming.
Word editing and Lock operation can be performed at the same time, after clicking “Apply”.*

4.4 PMIC NVM programming

The STM32CubeProgrammer PMIC NVM window is available exclusively for MPU devices, it extracts the PMIC partition [ID 0xF4] using PRGFW-UTIL interface in order to read, display and program the PMIC NVM registers. STPMIC1 with 8 registers and STPMIC25 with 40 registers (each register has a 1-byte size).

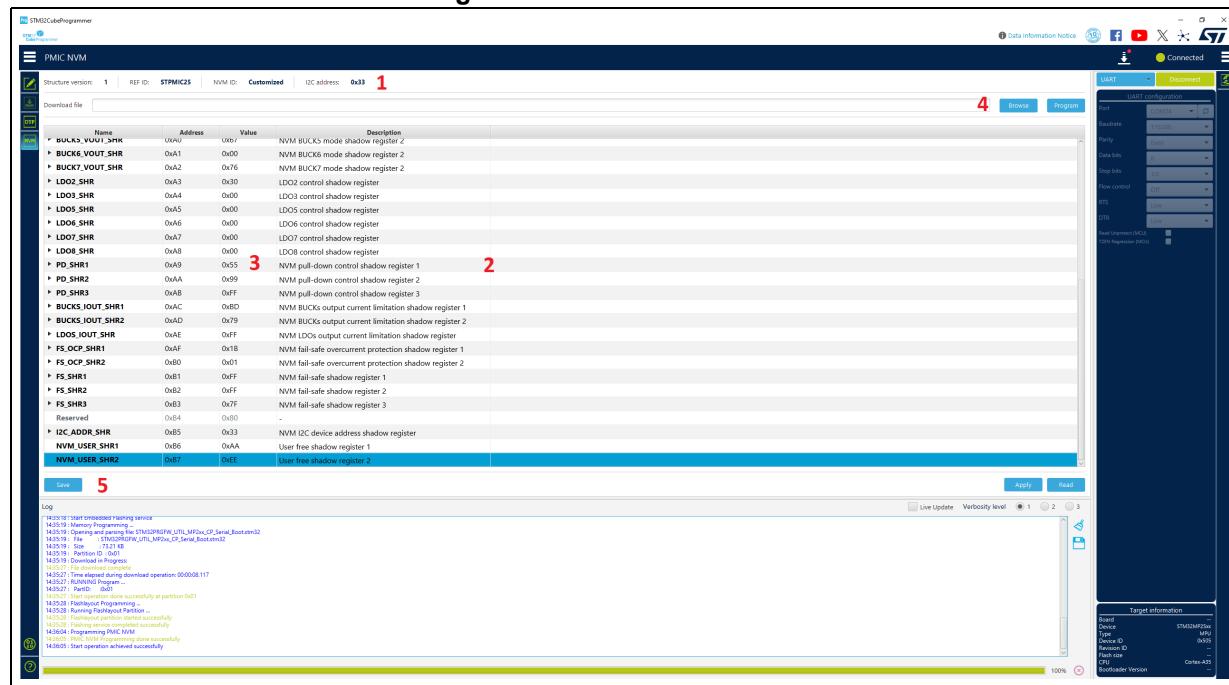
PRGFW-UTIL can be downloaded for ST GitHub: STMicroelectronics/STM32PRGFW-UTIL.

The UI has five main features (see *Figure 147*):

1. Get the PMIC information.
2. Read and display PMIC registers.
3. Edit and program PMIC registers.
4. Program binary file (only the entire PMIC registers, partial registers programming not supported).
5. Save/export the PMIC registers (NVM partition) in output binary file.

To begin reading the PMIC partition, open the PMIC NVM window by pressing the “NVM” button located in the main window. Once the partition is successfully read, data are displayed in a table format.

Figure 147. PMIC NVM window



4.4.1 Get PMIC NVM structure information

This section displays an overview of the device.

- Structure version: version 1 so far.
- Ref ID: STPMIC1, STPMIC25, STPMIC2L or STPMIC1L.
- NVM ID: Customized, A, B, or C.
- I2C address: the address that PRGFW-UTIL uses to communicate with PMIC.

4.4.2 Read and display words

After checking of the PMIC partition, the tool decodes and shows the words in table view format including four columns:

- Name: NVM register name.
- Address: hexadecimal value representing the address in the NVM.
- Value: hexadecimal value (editable).
- Description: displays the description of the register and its fields.

Note: Press “Read” button to refresh all table fields or to discard changes.

The value and name cells expose a tooltip message to add description (name, hex value, bin value representation).

4.4.3 Edit and program registers

There are two ways to edit the Value of the register:

1. Using the Combo box with a list of possible values.
2. By directly writing the register value in the Text field and pressing Enter after each change.

The modified element will be highlighted in red.

After modification, it is mandatory to press “Apply” button and confirm the operation to start the update and refresh the table view.

4.4.4 Program binary file

To program a binary file into the PMIC NVM register, it is necessary to take care about:

1. Selecting the adequate binary having a “.bin” extension.
2. The file size must have the exact size of the PMIC NVM registers partition (For example: STPMIC1 8 Bytes, STPMIC25 40 Bytes).
3. Using an incorrect file may risk damaging the board.
4. Press “Program” button to start the download sequence.

Note: If the binary file contains the same content as the NVM registers, the tool will take no action.

4.4.5 Save/Export PMIC NVM partition

This capability allows to save the whole content of PMIC NVM partition into a binary file (.bin extension) or into an output text file in human readable format which can be used for future analysis or to archive the current device configuration.

Press “Save” or “Export” button and choose the desired output file name and directory (Check file permissions).

If the save operation is completed successfully, an informational dialog will appear to confirm the completion of the process.

Note: PRGFW-UTIL Firmware should be installed before launching PMIC NVM Window which is necessary to expose the PMIC partition.

Note: It is mandatory to use the adequate version of PRGFW-UTIL that supports the new format of PMIC structure (version 1 or later), otherwise the tool will show an error message.

5 STM32CubeProgrammer CLI for MPUs

5.1 Available commands for STM32MP1

This section details the commands supported on STM32MP1 devices.

5.1.1 Connect command

-c, --connect

Description: Establishes the connection to the device. This command allows the host to open the chosen device port (UART/USB)

Syntax: `-c port=<Portname> [noinit=<noinit_bit>] [br=<baudrate>] [P=<Parity>] [db=<data_bits>] [sb=<stop_bits>] [fc=<flowControl>]`

<code>port=<Portname></code>	Interface identifier: – ex COMx (for Windows) – /dev/ttySx (for Linux) – usbx for USB interface
<code>[noinit=<noinit_bit>]</code>	Sets No Init bits, value in {0,1}, default 0. Noinit = 1 can be used if a previous connection is active (no need to send 0x7F).
<code>[br=<baudrate>]</code>	Baudrate, (for example 9600, 115200), default 115200.
<code>[P=<Parity>]</code>	Parity bit, value in (EVEN, NONE, ODD), default EVEN.
<code>[db=<data_bits>]</code>	Data bit, value in (6, 7, 8), default 8.
<code>[sb=<stop_bits>]</code>	Stop bit, value in (1, 1.5, 2), default 1.
<code>[fc=<flowControl>]</code>	Flow control, value in (OFF, Software, Hardware). Software and Hardware flow controls are not yet supported for STM32MP1 series, default OFF.

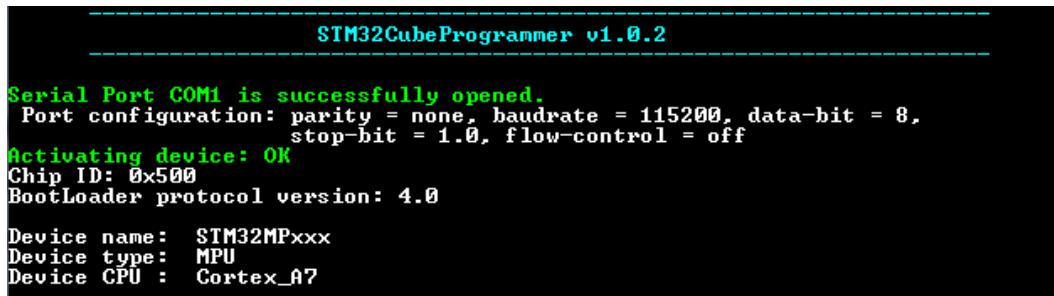
Example

Using UART:

```
./STM32_Programmer.sh -c port=/dev/ttyS0 p=none
```

The result of this example is shown in [Figure 148](#).

Figure 148. Connect operation using RS232



```

-----  

STM32CubeProgrammer v1.0.2  

-----  

Serial Port COM1 is successfully opened.  

Port configuration: parity = none, baudrate = 115200, data-bit = 8,  

stop-bit = 1.0, flow-control = off  

Activating device: OK  

Chip ID: 0x500  

BootLoader protocol version: 4.0  

Device name: STM32MPxxx  

Device type: MPU  

Device CPU : Cortex_A7

```

Note: When using the USB interface, all the configuration parameters (such as baudrate, parity, data-bits, frequency, index) are ignored.

Note: To connect using UART interface, the port configuration (baudrate, parity, data-bits, stop-bits and flow-control) must have a valid combination.

5.1.2 GetPhase command

-p, --phaseID

Description: This command allows the user to know the next partition ID to be executed.

Syntax: `--phaseID`

Example

```
./STM32_Programmer.sh -c port=/dev/ttyS0 p=none br=115200 --phaseID
```

5.1.3 Download command

-w, --write, -d, --download

Description: Downloads the content of the specified binary file into a specific partition in the flash or SRAM memories.

Syntax: `-w <file_path> [partitionID]`

[file_path] File path to be downloaded (bin, stm32, vfat, jffs2, ubi, ext2/3/4 and img file extensions).

[partition_ID] Partition ID to be downloaded.

Example

```
./STM32_Programmer.sh -c port=/dev/ttyS0 p=none -d atf.stm32 0x01
```

This command allows the user to download the atf binary file at Atf partition (partition ID: 0x01).

The result of this example is shown in [Figure 149](#).

Figure 149. Download operation

```

Memory Programming ...
File          : atf.stm32
Size         : 225216 Bytes
Partition ID : 0x01

Download in Progress: 100%

File download complete
Time elapsed during the download operation is: 00:00:22.690

```

Note: For U-boot with USB interface, to program the nonvolatile memory (NVM) with the loaded partition using download command, the user must execute a start command with the partition ID. Besides, to execute an application loaded in the NVM, the start address. must be specified

Example: Download and manifestation on alternate 0x1

```
./STM32_Programmer.sh -c port=usb0 -w atf.stm32 0x1 -s 0x01
```

5.1.4 Flashing service

Description: The embedded flashing service aims to load sequentially the partitions requested by the bootloader. To do this STM32CubeProgrammer needs the TSV file, which contains information about the requested partitions to be loaded.

STM32CubeProgrammer downloads and starts the requested partition ID until the end of operation (phaseID = 0xFE).

Syntax: `-w < tsv file_path >`

`<tsv file_path>` Path of the tsv file to be downloaded.

Figure 150. TSV file format

#Opt	Id	Name	Type	IP	Offset	Binary
-	0x01	fsbl1-boot	Binary	none	0x0	tf-a-stm32mp157c-dk2-trusted.stm32
-	0x03	ssbl-boot	Binary	none	0x0	u-boot-stm32mp157c-dk2-trusted.stm32
P	0x04	fsbl1	Binary	mmc0	0x00004400	tf-a-stm32mp157c-dk2-trusted.stm32
P	0x05	fsbl2	Binary	mmc0	0x00044400	tf-a-stm32mp157c-dk2-trusted.stm32
P	0x06	ssbl	Binary	mmc0	0x00084400	u-boot-stm32mp157c-dk2-trusted.stm32
P	0x21	bootfs	System	mmc0	0x00284400	st-image-bootfs-openstlinux-weston-extra-stm32mp1.ext4
P	0x22	vendorfs	FileSystem	mmc0	0x04284400	st-image-vendorfs-openstlinux-weston-extra-stm32mp1.ext4
P	0x23	rootfs	FileSystem	mmc0	0x05284400	st-image-weston-openstlinux-weston-extra-stm32mp1.ext4
P	0x24	usersfs	FileSystem	mmc0	0x340F0400	st-image-usersfs-openstlinux-weston-extra-stm32mp1.ext4

Example

```
./STM32_Programmer.sh -c port=/dev/ttyS0 p=none br=115200 -d
Flashlayout.tsv
```

Note: While programming the Flashlayout.tsv file, U-boot can spend a long time to start correctly, for this reason configure the timeout value by using the timeout command (-tm <timeout>).

5.1.5 Start command

`-g, --go, -s, --start`

Description: This command allows executing the device memory starting from the specified address.

Syntax: `--start [start_address/Partition_ID]`

[start_address] Start address of application to be executed. If not specified with STM32MP and UART interface, last loaded partition is started.

[Partition_ID] This parameter is needed only with STM32MP devices. It specifies the partition ID to be started.

Example

```
./STM32_Programmer.sh --connect port=/dev/ttyS0 p=none br=115200 --start 0x03
```

This command allows the user to run the code specified at partition 0x03.

Note: For U-boot with USB interface, to program the NVM with the loaded partition using download command, you need to execute a start command with the partition ID. To execute an application loaded in the NVM, you need to specify the start address.

Example 1: Download and manifestation on alternate 0x1

```
./STM32_Programmer.sh -c port=usb0 -w atf.stm32 0x01 -s 0x01
```

Example 2: Execute code at a specific address

```
./STM32_Programmer.sh -c port=usb0 -s 0xC0000000
```

5.1.6 Read partition command

-rp, --readPart

Description: Reads and uploads the specified partition content into a specified binary file starting from an offset address. This command is supported only by U-boot.

Syntax: `--readPart <partition_ID> [offset_address] <size> <file_path>`

<partition_ID> Partition ID

[offset_address] Offset address of read

<size> Size of memory content to be read

<file_path> Binary file path to upload the memory content

Example:

```
./STM32_Programmer.sh -c port=/dev/ttyS0 p=none br=115200 -rp 0x01 0x200 0x1000 readPart1.bin
```

This command allows the user to read 0x1000 bytes from the sebl1 partition at offset address 0x200 and to upload its content to a binary file “readPart1.bin”

5.1.7 List command

-l, -list

Description: This command lists all available communication interfaces UART and USB.

Syntax: `-l, --list <interface_name>`

<uart/usb>: UART or USB interface

Example:

```
./STM32_Programmer.sh -list uart
```

5.1.8 QuietMode command

-q, --quietMode

Description: This command disables the progress bar display during Download and Read partition commands.

Syntax: `-q, --quietMode`

Example:

```
./STM32_Programmer.sh -c port=/dev/ttyS0 p=none br=115200 --quietMode -w  
binaryPath.bin 0x01
```

5.1.9 Verbosity command

-vb, --verbosity

Description: This command allows the user to display more messages, to be more verbose.

Syntax: `-vb <level>`

`<level>` : Verbosity level, value in {1, 2, 3} default value vb=1

Example:

```
./STM32_Programmer.sh -c port=/dev/ttyS0 p=none br=115200 -vb 3
```

5.1.10 Log command

-log, --log

Description: This traceability command allows the user to store the whole traffic (with maximum verbosity level) into log file.

Syntax: `-log [filePath.log]`

`[filePath.log]` : path of log file (default is \$HOME/.STM32CubeProgrammer/trace.log)

Example:

```
./STM32_Programmer.sh -c port=/dev/ttyS0 p=none br=115200 -log trace.log
```

This command generates a log file “trace.log” containing verbose messages (see an example in [Figure 151](#)).

Figure 151. Log file content

```

16:41:19:345
Log output file: trace.log
16:41:19:368 Serial Port /dev/ttyS0 is successfully opened.
16:41:19:368 Port configuration: parity = none, baudrate = 115200, data-bit = 8,
16:41:19:368 | stop-bit = 1.0, flow-control = off
16:41:19:368 Sending init command:
16:41:19:368 byte 0x7F sent successfully to target
16:41:19:369 Received response from target: 0x79
16:41:19:369 Activating device: OK
16:41:19:369 Sending GetID command and its XOR:
16:41:19:369 byte 0x02 sent successfully to target
16:41:19:369 byte 0xFD sent successfully to target
16:41:19:370 Received response from target: 0x79
16:41:19:370 Received response from target: 0x01050079
16:41:19:370 Chip ID: 0x500
16:41:19:370 Sending Get command and its XOR:
16:41:19:370 byte 0x00 sent successfully to target
16:41:19:370 byte 0xFF sent successfully to target
16:41:19:371 Received response from target: 0x79
16:41:19:371 Received response from target: 0x07
16:41:19:371 Received response from target: 0x07310001020311213179
16:41:19:371 BootLoader version: 3.1

```

5.1.11 OTP programming

Description: These commands allow the user to program the OTP from a host computer. Their functionality (such as downloading or uploading a full OTP image, modifying an OTP value or proprieties) is explained below.

Note: *The following commands are not supported in JTAG/SWD debug port connection mode.*

- Loading shadow registers values to the tool
For load operation, the host requests the OTP partition data and the platform replies with the structure described on https://wiki.st.com/stm32mpu/index.php/STM32CubeProgrammer OTP_management.
- Writing the modified shadow registers to the target
This operation is executed by performing the following sequence:
 - a) The user types in the value and the status of each chosen OTP shadow register.
 - b) The tool updates the OTP structure with the newly given OTP shadow registers values and status.
 - c) The tool proceeds with sending the updated structure, with bit0 in the “Write/read conf” field set to 0 (“Write/read conf” is word number 7 in the OTP structure).
 - d) Once the structure is sent, the shadow register values are reloaded to update the OTP structure in the tool.
- Programming the OTP with the modified shadow registers values
Once the user updates the OTP values and the OTP structure is refreshed, the host sends the OTP structure with bit0 in the “Write/read conf” field (word number 7 in the OTP structure) set to 1.

- Reloading the OTP value to the shadow registers
Once the OTP words are successfully programmed, the host uploads the OTP structure to update the OTP shadow registers. This operation allows the host to verify the status of the last SAFMEM programming via bit4 in the "Status" field.
- BSEC control register programming
Once the user updates the values of the given BSEC control register (Configuration, Debug configuration, Feature configuration and General lock configuration) the host updates the OTP structure and sends it to the device with bit0 in the "Write/read conf" field set to 0.
- OTP programming CLI
The user is given a set of commands to perform a chosen sequence of operations on the OTP partition. Each one of these commands is described below.

5.1.12 Programming OTP commands

STM32CubeProgrammer exports several capabilities that can be used to manage the OTP region via various commands based on the OTP structure version, as detailed below.

The OTP window is accessible through USB/UART interfaces for STM32M. For STM32N6 it's available via Debug/USB/UART interfaces.

OTP structure 2

Programming SAFMEM

Description: This command allows the user to program SAFMEM memory by modifying the OTP words. Can write up to 96 words in the same command line.

Syntax: `-otp write {lock} {word=[index] value=[val]}...`

{lock} Optional, to indicate that a lock has been requested. If lock option is mentioned, all words passed in line are locked.

- With lock: writes the word, then performs permanent lock
- Without lock: updates the word

[index] The word index can be written in decimal or hex format

[val] The value option accepts hex values

The tool prints the requests, the user can verify the operation before going on. It will then prompt a confirmation message, the user can press yes/y or no/n to, respectively, continue or stop the write operation.

Example

```
STM32_Programmer_CLI.exe --connect port=usb1 -otp write word=52
value=0xAAAAAAA word=0x50 value=0xBCCCCCCC
```

Figure 152. OTP write command for OTP structure v2

```
Uploading OTP data:
[Progress Bar]

OTP Partition read successfully

OTP Write command:
You are trying to write on OTP partition with the following inputs :
-----
Word      | Value
-----
052      | 0xAAAAAAA
080      | 0xBBB BBBB
Lock     | NO
-----
Warning: This operation cannot be reverted and may damage your device.
Warning: Do you confirm ? [yes/no]
yes
The operation was confirmed...
[Progress Bar]
```

Lock OTP command

Description: This command allows to permanent lock the mentioned words, already written. Up to 96 words can be written in the same command line.

Syntax: `-otp lock {word=[index]...}`

[index] The word index can be written in decimal or hex format.

The tool prints the requested modifications, and the user can verify the operation before going ahead (use yes/y or no/n to continue or to stop)

Example

```
STM32_Programmer_CLI.exe --connect port=usb1 -otp lock word=20 word=0x30
```

Display command

Description: This command allows the user to display all or parts of the OTP structure.

Syntax: `-otp displ {word=[index]...}`

{word=[index]...} Optional, able to display up to 96 specific words in the same command,
The index value used to indicate the OTP word ID is in decimal or hex format.

-otp displ Displays all OTP words (version + Global State + OTP words).
Highlights the status word containing a state information (prog lock, read lock, read error, invalid).

Example

```
STM32_Programmer_CLI.exe --connect port=usb1 -otp displ
                           word=8 word=0x10
```

```
STM32_Programmer_CLI.exe --connect port=usb1 -otp displ
```

Figure 153. OTP write command for OTP structure v2

```
OTP Partition read successfully

OTP DATA WORDS :

STRUCT VERSION           : | version      : 0x00000002
OTP GLOBAL STATE          : | Value        : 0x00000000
                           | State        : Secure Open
                           | Hardware Key Set : N
                           | Encrypted data   : N

OTP REGISTERS:

+-----+-----+-----+
| ID   | value | status          |
+-----+-----+-----+
| 00   | 0x00000017 | 0x30000000
|       |          | |_[28] Shadow write sticky lock
|       |          | |_[29] Shadow read sticky lock
| 01   | 0x00000000 | 0x10000000
|       |          | |_[28] Shadow write sticky lock
| 02   | 0xD0100000 | 0x18000000
|       |          | |_[27] Sticky programming lock
|       |          | |_[28] Shadow write sticky lock
| 03   | 0x00000000 | 0x00000000
| 04   | 0x00000000 | 0x08000000
|       |          | |_[27] Sticky programming lock
| 05   | 0x00000000 | 0x00000000
| 06   | 0x00000000 | 0x00000000
| 07   | 0x00000000 | 0x00000000
| 08   | 0x00000010 | 0x10000000
|       |          | |_[28] Shadow write sticky lock
```

Download file command

Description: to fuse a binary file from a start word ID

Syntax: `-otp fwrite {lock} [path.bin] word=[index]`

{lock} Optional, to indicate the operation type, update, or permanent lock.

[path,bin] 32-bit aligned file, the tool makes padding values if the file is not aligned
(a warning message is displayed).

[index] Value in hex/dec format (from 0 to 95 in decimal).

Example

Program a PKH binary file starting from word number 24

```
STM32_Programmer_CLI.exe --connect port=usb1 -otp fwrite lock
/usr/home/pkh.bin word=24
```

```
OTP File write command:  
You are trying to program a binary file on OTP partition with the following  
inputs:  
-----  
File name      | pkh.bin  
File size      | 32 Bytes  
Start word ID | 24  
Lock          | YES  
-----
```

5.1.13 Detach command

Description: This command allows the user to send detach command to USB DFU.

Syntax: -detach

5.1.14 GetCertif command

Description: This command can be used to read the chip certificate and save the data to a binary file. The resulting file is required to obtain the associated device product ID, which can then be used to select the appropriate personalization data for the HSM card before using the SSP procedure.

Syntax: -gc <Output_Path>

This command can be used only if a specific firmware (tfa-ssp) is installed, as it is the basis to retrieve the stored certificate. Go through the following steps:

For STM32MP15xx

- STM32_Programmer_CLI -c port=usb1 -d tf-a-ssp-trusted.stm32 0x01 -s
- STM32_Programmer_CLI -c port=usb1 -gc "Certificate.bin"

For STM32MP13xx

- STM32_Programmer_CLI -c port=usb1 -d tf-a-ssp-trusted.stm32 0x01 -s
- STM32_Programmer_CLI -c port=usb1 -detach
- STM32_Programmer_CLI -c port=usb1 -d tf-a-ssp-trusted.stm32 0x01 -s
- STM32_Programmer_CLI -c port=usb1 -gc "Certificate.bin"

Figure 154. Get certificate output file

00000007	00 01 02 03 04 05 06 07	08 09 0a 0b 0c 0d 0e 0f	
00000000	35 30 20 30 32 30 20 41	13 bb a9 2b f3 64 86 ab	5000200A.w+ödt«
00000010	4b fa 7f b4 31 1c 21 f1	6a 78 de 0a 20 31 9f 2d	Kü! '1.!ñjxP. 1Ý-
00000020	fd 33 66 91 15 c5 18 2e	49 15 02 ce 1b 5b 3c 41	ý3f'..I..í..[<A
00000030	49 b3 90 b7 0a 18 7d 5f	bc ed 44 29 93 d6 48 b9	I' ..]_ñid)~ÖH'
00000040	08 cb 77 39 9d 51 55 08	5e 10 56 7d 75 6c 6a c2	.Éw9 QU.^ .V)uljå
00000050	2b 0a c4 2b 54 82 8e ee	60 3f aa e8 09 7b bb 1d	+.Ä+T,ži?äè. [».
00000060	e6 fe 1b ea 3c 2b 3b 8a	55 da c8 77 e6 c7 d6 59	ep.é<+,SUÚÈmaçÖY
00000070	89 58 fd 82 73 49 bc 7f	0a 63 8a e2 3c fe ad 9b	wXý,sIñl.cšk<p->
00000080	d5 41 c7 7d af 52 d4 42	ÖAç)~RÖB.....
00000090

5.1.15 Write blob command

Description: This command allows the user to send the blob (secrets and license).

Syntax: -wb blob.bin

5.2 Secure programming SSP specific commands

Secure secret provisioning (SSP) is a feature supporting secure secret flashing procedure, available on STM32 MPU devices. STM32MP1 series supports protection mechanisms allowing the user to protect critical operations (such as cryptography algorithms) and critical data (such as secret keys) against unexpected accesses.

This section gives an overview of the STM32 SSP command with its associated tools ecosystem and explains how to use it to protect OEM secrets during the CM product manufacturing stage. For more details refer to AN5054.

STM32CubeProgrammer exports a simple SSP command with some options to perform the SSP programming flow.

-ssp, --ssp

Description: Program an SSP file

Syntax: -ssp <ssp_file_path> <ssp-fw-path> <hsm=0|1>
<license_path|slot=slotID>

<ssp_file_path> SSP file path to be programmed, bin or ssp extensions.

<ssp-fw-path> SSP signed firmware path.

<hsm=0|1> Set user option for HSM use (do not use / use HSM). Default value: hsm = 0.

- <license_path|slot=slotID>**
 - Path to the license file (if hsm = 0)
 - Reader slot ID if HSM is used (if hsm = 1)

Example using USB DFU bootloader interface:

```
STM32_Programmer_CLI.exe -c port=usb1 -ssp "out.ssp" "tf-a-ssp-
stm32mp157f-dk2-trusted.stm32" hsm=1 slot=1
```

Note: All SSP traces are shown on the output console.

Figure 155. SSP successfully installed

```
Requesting Chip Certificate...
Get Certificate done successfully
requesting license for the current STM32 device
Init Communication ...
ldm_LoadModule(): loading module "stlibp11_SAM.dll" ...
ldm_LoadModule(WIN32): OK loading library "stlibp11_SAM.dll": 0x62000000 ...
C_GetFunctionList() returned 0x00000000, g_pFunctionList=0x62062FD8
P11 lib initialization Success!

Opening session with slot ID 1...
Succeed to Open session with reader slot ID 1
Succeed to generate license for the current STM32 device
Closing session with reader slot ID 1...
Session closed with reader slot ID 1
Closing communication with HSM...
Communication closed with HSM
Succeed to get License for Firmware from HSM slot ID 1
Starting Firmware Install operation...
Writing blob

Blob successfully written
Start operation achieved successfully
Send detach command
Detach command executed
SSP file out.ssp Install Operation Success
```

If there is any faulty input the SSP process is aborted, and an error message is displayed to indicate the root cause of the issue.

6 STM32CubeProgrammer C++ API

In addition to the graphical user interface and to the command line interface STM32CubeProgrammer offers a C++ API that can be used to develop your application and benefit of the wide range of features to program the memories embedded in STM32 microcontrollers, either over the debug interface or the bootloader interface (USB DFU, UART, I²C, SPI and CAN).

For more information about the C++ API, read the help file provided within the STM32CubeProgrammer package under API\doc folder.

7 Revision history

Table 2. Document revision history

Date	Revision	Changes
15-Dec-2017	1	Initial release.
02-Aug-2018	2	<p>Updated:</p> <ul style="list-style-type: none"> – Section 1.1: System requirements – Section 1.2.3: macOS install – Section 1.2.4: DFU driver <p>Added:</p> <ul style="list-style-type: none"> – Section 3.2.8: Debug commands – Figure 1: macOS “Allow applications downloaded from:” tab – Figure 2: Deleting the old driver software
12-Sep-2018	3	<p>Added SPI, CAN and I2C settings on cover page and in Section 2.1.4: Target configuration panel.</p> <p>Updated:</p> <ul style="list-style-type: none"> – Figure 14: ST-LINK configuration panel – Figure 133: STM32CubeProgrammer: available commands. – Figure 106: Connect operation using SWD debug port <p>Replaced Section 3.2.1: Connect command.</p>
16-Nov-2018	4	<p>Updated Section 2.1.4: Target configuration panel, Section 2.2.1: Reading and displaying target memory, Section 2.2.2: Reading and displaying a file and Section 2.3.2: External flash memory programming.</p> <p>Updated Figure 12: STM32CubeProgrammer main window, Figure 13: Expanded main menu, Figure 14: ST-LINK configuration panel, Figure 16: UART configuration panel, Figure 17: USB configuration panel, Figure 18: Target information panel, Figure 19: SPI configuration panel, Figure 20: CAN configuration panel, Figure 21: I2C configuration panel, Figure 22: Device memory tab, Figure 24: File display, Figure 24: Flash memory programming and erasing (internal memory) and Figure 27: Flash memory programming (external memory).</p> <p>Minor text edits across the whole document.</p>
03-Jan-2019	5	<p>Updated Section 1.2.4: DFU driver.</p> <p>Added Section 3.2.21: Secure programming SFI specific commands, Section 3.2.23: HSM related commands and Section 6: STM32CubeProgrammer C++ API.</p> <p>Minor text edits across the whole document.</p>
04-Mar-2019	6	<p>Updated Introduction and Section 1: Getting started.</p> <p>Updated title of Section 2: STM32CubeProgrammer user interface for MCUs and of Section 3: STM32CubeProgrammer command line interface (CLI) for MCUs.</p> <p>Added Section 2.5: Automatic mode, Section 2.6: STM32WB OTA programming, Section 4: STM32CubeProgrammer user interface for MPUs, Section 5: STM32CubeProgrammer CLI for MPUs and their subsections.</p>

Table 2. Document revision history (continued)

Date	Revision	Changes
19-Apr-2019	7	Updated Section 1.1: System requirements , Section 2.2.2: Reading and displaying a file , Section 2.6.2: OTA update procedure , Section 3.2.21: Secure programming SFI specific commands , Section 3.2.23: HSM related commands and Section 3.2.24: STM32WB specific commands . Updated Figure 24: Flash memory programming and erasing (internal memory) .
11-Oct-2019	8	Updated Graphical guide , Section 3.2.21: Secure programming SFI specific commands , Section 3.2.23: HSM related commands and Section 3.2.24: STM32WB specific commands . Added Section 2.6: In application programming (IAP/USBx) . Minor text edits across the whole document.
08-Nov-2019	9	Updated Section 1.2.1: Linux install , Section 3.2.24: STM32WB specific commands and Section 5.1.6: Read partition command . Minor text edits across the whole document.
07-Jan-2020	10	Updated Section 1.1: System requirements , Section 1.2.3: macOS install and Section 3.2.21: Secure programming SFI specific commands . Added Section 3.2.18: TZ regression command and Section 3.2.22: Secure programming SFIx specific commands . Removed former Section 5.2.12: Writing to BSEC command . Minor text edits across the whole document.
24-Feb-2020	11	Added Section 2.7: Flash the wireless stack using the graphical interface and its subsections.
23-Jul-2020	12	Added Section 2.8: Serial wire viewer (SWV) , Section 3.2.25: Serial wire viewer (SWV) command and Section 5.2: Secure programming SSP specific commands . Updated Section 3.2.1: Connect command and Section 3.2.2: Erase command . Minor text edits across the whole document.
17-Nov-2020	13	Updated Section 1.1: System requirements , Section 1.2.1: Linux install , Section 1.2.2: Windows install , Section 1.2.3: macOS install , Section 2.3.2: External flash memory programming , Section 2.8: Serial wire viewer (SWV) , Section 3.2.1: Connect command , Section 3.2.2: Erase command , Section 3.2.15: External loader command , Section 3.2.23: HSM related commands , Section 3.2.22: Secure programming SFIx specific commands , Section 3.2.24: STM32WB specific commands and Section 5.1.1: Connect command . Added Section 2.11: DFU IAP/USBx with custom PID and VID , Section 2.12: SigFox™ credentials , Example using DFU IAP/USBx options , Section 3.2.5: Download 64-bit data command , Section 3.2.16: External loader command with bootloader interface , Section 3.2.26: Specific commands for STM32WL and Section 5.2.5: Flashing service via USB serial gadget . Updated Figure 27: Flash memory programming (external memory) , Figure 37: SWV window and Figure 66: Available commands for MPUs .
19-Nov-2020	14	Updated Section 5.1.1: Connect command . Removed former Section 5.1: Command line usage and Section 5.2.5: Flashing service via USB serial gadget .

Table 2. Document revision history (continued)

Date	Revision	Changes
11-Mar-2021	15	<p>Updated Section 1.1: System requirements, Section 1.2.1: Linux install, Section 1.2.3: macOS install, Section 2.12: SigFox™ credentials and Section 3.2.24: STM32WB specific commands.</p> <p>Added Section 2.13: Register Viewer, Section 2.14: Hard Fault analyzer with its subsections, Section 3.2.28: Register viewer and Section 3.2.29: Hard fault analyzer.</p> <p>Minor text edits across the whole document.</p>
22-Jul-2021	16	<p>Updated Section 2.1.4: Target configuration panel, Section 3.2.1: Connect command, Section 3.2.2: Erase command and Section 3.2.24: STM32WB specific commands.</p> <p>Added Section 2.15: Fill memory command, Section 2.16: Fill memory operation, Section 2.17: Blank check command, Section 2.18: Blank check operation, Section 2.19: Compare flash memory with file, Section 2.20: Comparison between two files, Section 2.21: LiveUpdate feature and Section 3.2.32: RDP regression with password.</p> <p>Updated Figure 16: UART configuration panel and Figure 103: Enabling COM DTR pin.</p> <p>Added Figure 104: Connect operation using USB.</p> <p>Minor text edits across the whole document.</p>
17-Nov-2021	17	<p>Added Section 2.10: STM32CubeProgrammer Script Manager platform for MCUs and its subsections.</p> <p>Updated Section 2.1.1: Main menu, Section 2.1.4: Target configuration panel, Section 2.6: In application programming (IAP/USBx), Section 2.7: Flash the wireless stack using the graphical interface and its subsections, Section 2.10: STM32CubeProgrammer Script Manager platform for MCUs, Section 3.2.1: Connect command and Section 3.2.24: STM32WB specific commands.</p> <p>Removed former Section 2.6: STM32WB OTA programming.</p> <p>Updated Figure 12: STM32CubeProgrammer main window, Figure 13: Expanded main menu, Figure 14: ST-LINK configuration panel and Figure 18: Target information panel.</p> <p>Minor text edits across the whole document.</p>
28-Feb-2022	18	<p>Added Section 1.4: Updater with its subsections, Section 2.4.4: MCU unlock (specific for the STM32WL series), and Section 3.2.33: GetCertif command.</p> <p>Updated Section 1.1: System requirements, Section 2.1.4: Target configuration panel, Section 2.7.2: Key provisioning, Section 3.2.1: Connect command, Section 3.2.9: List command, Section 3.2.24: STM32WB specific commands, and Section 3.2.26: Specific commands for STM32WL.</p> <p>Updated Figure 113: List of available serial ports.</p>

Table 2. Document revision history (continued)

Date	Revision	Changes
29-Jun-2022	19	<p>Added Section 2.9: Secure programming interface, Section 4.3: OTP programming window, and their subsections.</p> <p>Updated Section 2.1.1: Main menu, I2C settings, Section 3.2.1: Connect command, Section 3.2.26: Specific commands for STM32WL, Section 3.2.28: Register viewer, Section 5.1.12: Programming OTP commands, and Section 5.1.14: GetCertif command.</p> <p>Removed former Section 5.1.16: Display command.</p> <p>Updated figures 12 to 21 and 45 to 53.</p> <p>Minor text edits across the whole document.</p>
28-Nov-2022	20	<p>Updated Section 1.2.3: macOS install, Section 2.2.1: Reading and displaying target memory, Section 2.7.1: FUS/stack upgrade, Section 3.2.5: Download 32-bit data command, Section 3.2.11: QuietMode command, Section 3.2.24: STM32WB specific commands, Section 3.2.25: Serial wire viewer (SWV) command, and Section 3.2.32: RDP regression with password.</p> <p>Updated figures 21 to 23, 34 to 48, 36 to 53, Figure 143: Program Apply confirmation, and Figure 175: All OTP fields are locked.</p> <p>Added Section 2.9.4: SSP, Section 2.10.3: Loops and conditional statements, and their subsections.</p> <p>Minor text edits across the whole document.</p>
24-Feb-2023	21	<p>Updated Section 1.2.5: ST-LINK driver and Section 3.2.25: Serial wire viewer (SWV) command.</p> <p>Added Section 2.4.5: Debug authentication default configuration, Section 2.4.6: Debug authentication configuration (STM32H503 only), Section 2.9.5: OBKey provisioning, Section 2.9.7: Debug authentication, Section 2.22: Calculator, and sections 3.2.34 to 3.2.38.</p> <p>Updated figures 38 to 60 in Section 2.9.2: RDP regression with password.</p> <p>Minor text edits across the whole document.</p>
10-Jul-2023	22	<p>Updated Section 1.1: System requirements, Section 2.9.3: SFI/SFIx, Section 3.2.20: Safety lib command, Section 3.2.21: Secure programming SFI specific commands, and Section 3.2.22: Secure programming SFIx specific commands.</p> <p>Added Figure 44: SFI/SFIx modules for STM32H5.</p> <p>Added Section 2.9.6: OTP provisioning panel, Section 3.2.39: Debug Authentication - Password provisioning, and Section 3.2.41: Secure Manager - Install and update module.</p>
13-Nov-2023	23	<p>Updated Section 2.3.1: Internal flash memory programming, Section 2.7.1: FUS/stack upgrade, Section 3.1: Command line usage, and Section 3.2.1: Connect command.</p> <p>Added Section 3.2.30: File checksum and Section 3.2.31: Memory checksum.</p> <p>Updated Figure 24: Flash memory programming and erasing (internal memory) and added Figure 35: Automatic load address determination functionality.</p> <p>Minor text edits across the whole document.</p>

Table 2. Document revision history (continued)

Date	Revision	Changes
21-Mar-2024	24	<p>Updated Section 1.1: System requirements, Section 1.2.1: Linux install, Memory erasing, Section 2.4.5: Debug authentication default configuration, Section 2.9.2: RDP regression with password, Section 2.9.5: OBKey provisioning, Section 2.9.7: Debug authentication, Section 2.10.3: Loops and conditional statements, Section 3.2.1: Connect command, Section 3.2.16: External loader command with bootloader interface, Section 3.2.32: RDP regression with password, Section 3.2.35: OBKey provisioning, and Section 3.2.37: Debug authentication commands.</p> <p>Added J-Link settings, Section 2.3.4: External memory programming with bootloader interfaces on GUI, Example using J-Link debug port, and Section 3.2.42: SkipErase command.</p> <p>Minor text edits across the whole document.</p>
25-Jun-2024	25	<p>Updated Section 1.1: System requirements, ST-LINK settings, Section 2.3.1: Internal flash memory programming, Section 2.5: Automatic mode, Section 2.9.2: RDP regression with password, Section 2.9.6: OTP provisioning panel, Section 3.2.1: Connect command, Section 3.2.15: External loader command, Section 3.2.32: RDP regression with password, - unlockRDP2, - unlockRDP1, and - unlockRDP2.</p> <p>Added Serial numbering, Section 2.4.3: Export/import option bytes, Public key provisioning for STM32WB0x/STM32WL3x devices, and Section 3.2.43: OTP store command.</p> <p>Removed former Section 3.2.5: Download 64-bit data command and OTP structure 1.</p> <p>Minor text edits across the whole document.</p>
19-Nov-2024	26	<p>Updated Section 1.1: System requirements, Section 2.7: Flash the wireless stack using the graphical interface, Section 2.9.3: SFI/SFIx, Section 2.9.7: Debug authentication, Section 3.2.16: External loader command with bootloader interface, Section 3.2.21: Secure programming SFI specific commands, Section 3.2.22: Secure programming SFIx specific commands, Section 3.2.37: Debug authentication commands, and Section 4.3: OTP programming window.</p> <p>Added notes to Section 2.3: Memory programming and erasing, Section 3.2.2: Erase command, Section 3.2.3: Download command, and to Section 3.2.5: Download 32-bit data command.</p> <p>Added Section 1.2.8: Automatic/Silent installation mode, Section 2.4.1: Synthetic option bytes view, Section 2.4.2: Recovery button, Section 2.23: Import/Export project settings, Section 2.24: OTP programming window for STM32N6, Section 3.2.45: OTP programming commands for STM32N6, Section 3.2.46: External flash memory commands for STM32N6, Section 4.4: PMIC NVM programming, and their subsections.</p>
28-Feb-2025	27	<p>Updated Section 1.1: System requirements, Section 1.2.1: Linux install, Section 2.3.1: Internal flash memory programming, Serial numbering, and Section 3.2.32: RDP regression with password.</p> <p>Added X-CUBE-RSSe and STM32MPUSSP-UTIL upgrade, Mechanisms for programming command, Section 3.2.4: Verify command, and Section 3.2.44: Key wrapping command.</p> <p>Updated Figure 33: Automatic mode with serial numbering.</p>

Table 2. Document revision history (continued)

Date	Revision	Changes
30-Jun-2025	28	<p>Updated Section 1.1: System requirements, Section 2.1.4: Target configuration panel, Section 2.3.3: Developing customized loaders for external memory, Section 2.4.2: Recovery button, Note: in Section 2.6, Section 2.7.1: FUS/stack upgrade, SFI/SFIx GUI for devices supporting Secure Manager, Section 3.2.5: Download 32-bit data command, Section 3.2.20: Safety lib command, Section 3.2.32: RDP regression with password, and Section 3.2.44: Key wrapping command.</p> <p>Added Section 1.2.6: Segger Jlink/Flasher library, Section 1.3: Language preference, and Section 3.2.12: Bootloader reset command.</p> <p>Updated Figure 12: STM32CubeProgrammer main window, Figure 13: Expanded main menu, Figure 21: I2C configuration panel, Figure 22: Device memory tab, figures 24 to 26, Figure 30: Configuration when switching product state to values different from 0x17, Figure 31: Automatic mode in Erasing & Programming window, Figure 34: Steps for firmware upgrade, Figure 35: Automatic load address determination functionality, Figure 38: RDP regression with password tab, Figure 39: SFI/SFIx tab, Figure 44: SFI/SFIx modules for STM32H5, Figure 46: SSP PRG user interface, figures 48 to 51, Figure 54: Connect via USB DFU panel, Figure 56: Register Viewer window, Figure 57: Fault Analyzer window, Figure 100: Calculator window, and figures 139 to 141.</p> <p>Removed former Figure 24: File display, Figure 26: Direct ASCII field edition, Figure 27: Flash memory programming (external memory), Figure 29: External memory programming with bootloader interface, Figure 30: Option bytes panel, Figure 34: Option bytes import/export options, Figure 35: Unlock chip button, Figure 38: Switching product state to provisioning, Figure 39: Switching product state to values different from 0x17, Figure 41: Automatic mode log traces, Figure 44: STM32CubeProgrammer in IAP mode, Figure 45: STM32CubeProgrammer API SWD connection, Figures 47 to 49, figures 51 to 53, figures 56 to 63, Figure 65: Disable passwords, Figure 69: Open TPC from STM32CubeProgrammer, Figure 79: Debug authentication with password, Figure 81: Close debug, Figure 85: Main window after the connection, Figure 133: STM32CubeProgrammer: available commands, and Figure 175: All OTP fields are locked.</p> <p>Minor text edits across the whole document.</p>
03-Nov-2025	29	<p>Updated Section 1.1: System requirements, Section 1.4.3: Check for updates, Section 2.1.2: Log panel, Section 2.4.2: Recovery button, Section 3.2.31: Memory checksum, Section 3.2.36: Password provisioning (STM32H503 only), and Section 4.1: Main window.</p> <p>Added Section 1.2.9: Uninstalling STM32CubeProgrammer standalone version, Section 3.2.10: SWD Multidrop, and Section 3.2.47: Fast read command.</p>

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