STM32PRGFW-UTIL Firmware utility to manage One-Time Programmable (OTP) memories

Table of Contents

Warning

Please use **v1.0.2 tag and later** from now as an important fix done to avoid **bricking your device**.

Project overview

STM32PRGFW-UTIL package provides embedded SW applications to manage the One-Time Programmable (OTP) memories on **STM32MP13xx, STM3MP15xx devices** as described in the following wiki page

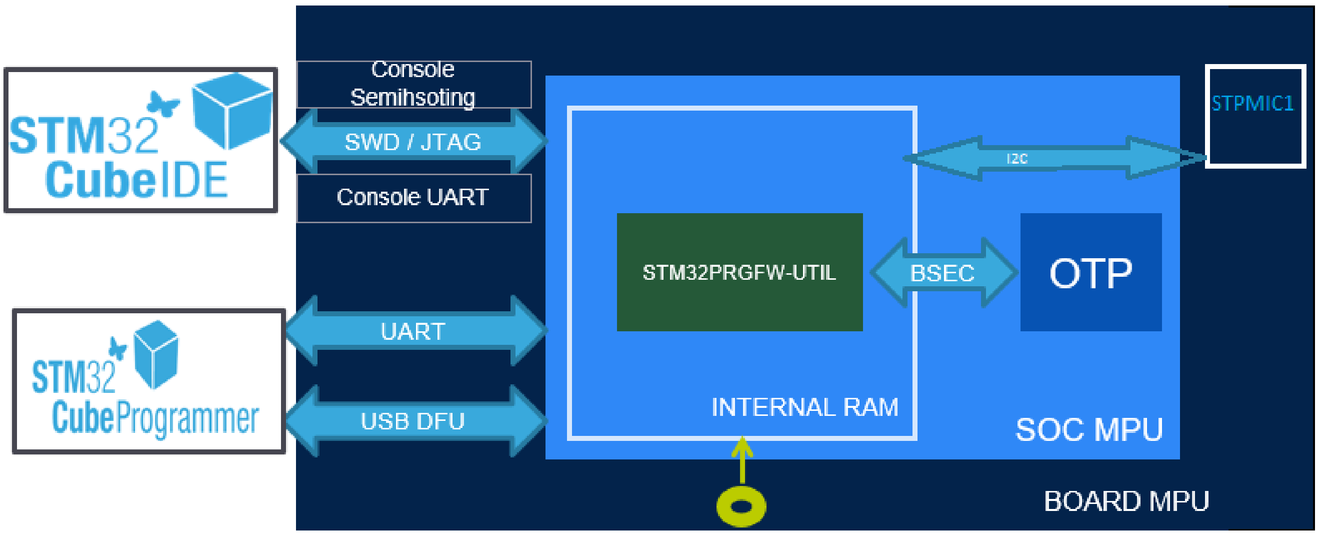
It is **alternative** to the use of **U-Boot embedded SW package** described in article How to fuse OTP↑ but of course U-Boot services are still available.

This Utility could be usefull during bring-up phase to modify OTP when ecosystem Software (U-Boot in particular) is not ready yet. Indeed, this STM32PRGFW-UTIL firmware is **DDR independant** ; thus it is ready to use in most of cases for your own design.
This package includes only source code required to support UART and USB DFU protocol and OTP programming without more complex software, i.e. easy to adapt and improve for your own needs.

This package contains several "Modes" (CP_Serial_Boot, Console_SH..) that you can use with **Windows® or Linux® host PC**.
Please find below the more appropriated mode depending on your setup.
""How to"" for each mode is described below into this document.

Major Use cases / Setup	CP_Serial_boot (Preferred)	Console_SH	Console_UART	CP_Dev_Boot
* Board with USB DFU or UART serial if * STM32CubeProgrammer PC tool installed (v2.15.0 minimum)	X			
* Board with Debug port * STM32CubeIDE PC tool installed (v1.13.0 minimum)		X		
* Board with Debug port and 1 UART interface * Semihosting (Terminal I/O through debug port) NOT available on PC			X Note: need to modify UART instance in source code if different from ST boards	
* Need to debug your own tool based on this package				X

The functional chart of the project describing all applications mentioned above:

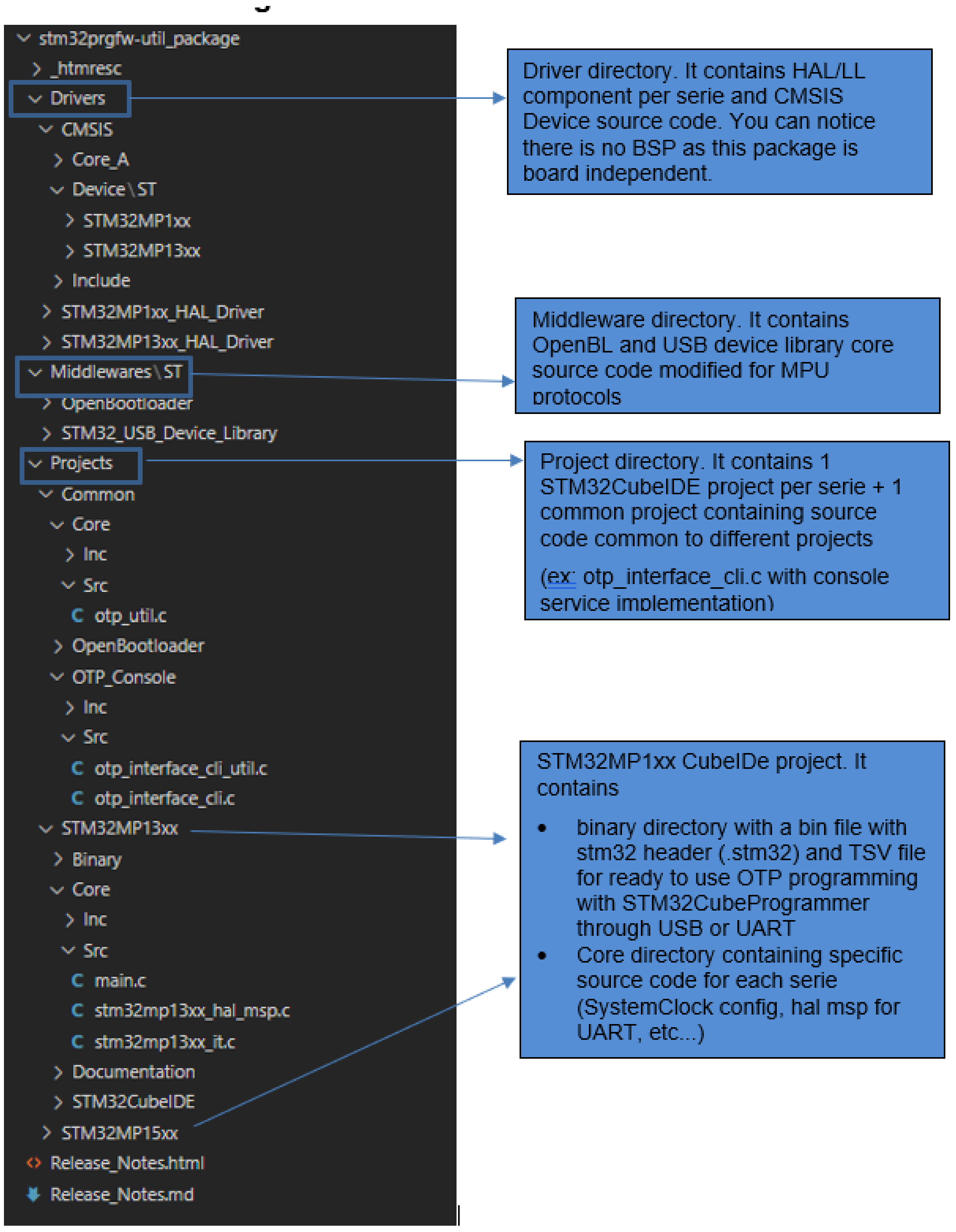


Repository structure

The **STM32PRGFW-UTIL** repository consists of the following repositories:

- **Drivers**: It contains HAL/LL component per serie and CMSIS Device source code. You can notice there is no BSP as this package is board independent.
- **Middlewares**: It contains OpenBL and USB device library core source code modified for MPU protocols.
- **Projects**: Project directory. It contains 1 STM32CubeIDE project per serie and 1 common project containing source code common to the different projects.

The project structure is described as below:



```
stm32prgfw-util_package
  _htmresc
  Drivers
    CMSIS
      Core_A
      Device\ST
        STM32MP1xx
        STM32MP13xx
      Include
    STM32MP1xx_HAL_Driver
    STM32MP13xx_HAL_Driver
  Middlewares\ST
    OpenBootloader
    STM32_USB_Device_Library
  Projects
    Common
      Core
        Inc
        Src
          otp_util.c
      OpenBootloader
      OTP_Console
        Inc
        Src
          otp_interface_cli_util.c
          otp_interface_cli.c
    STM32MP13xx
      Binary
      Core
        Inc
        Src
          main.c
          stm32mp13xx_hal_msp.c
          stm32mp13xx_it.c
      Documentation
      STM32CubeIDE
    STM32MP15xx
  Release_Notes.html
  Release_Notes.md
```

Driver directory. It contains HAL/LL component per serie and CMSIS Device source code. You can notice there is no BSP as this package is board independent.

Middleware directory. It contains OpenBL and USB device library core source code modified for MPU protocols

Project directory. It contains 1 STM32CubeIDE project per serie + 1 common project containing source code common to different projects

(ex: otp_interface_cli.c with console service implementation)

STM32MP1xx CubeIDe project. It contains

- binary directory with a bin file with stm32 header (.stm32) and TSV file for ready to use OTP programming with STM32CubeProgrammer through USB or UART
- Core directory containing specific source code for each serie (SystemClock config, hal msp for UART, etc...)

How to Use CP_Serial_Boot

In this section, you will use "Binary" directory containing a STM32PRGFW-UTIL binary and a tsv file used by STM32CubeProgrammer.

Hardware prerequisites

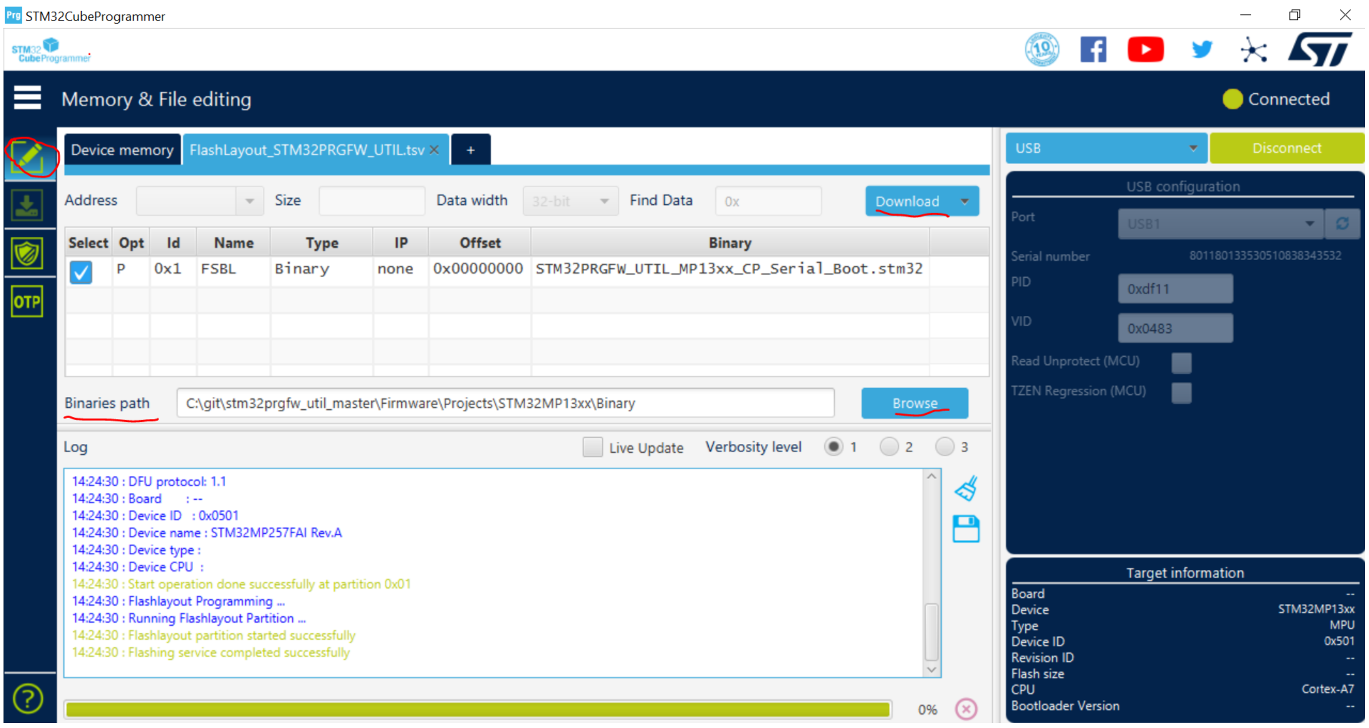
- Set boot boot pins to b000 (BOOT0/1/2 to OFF) position to select **serial boot**

- If you want to use USB DFU interface
  - connect USB cable bewten PC and the board. PC shoud test USB DFU interface
- else if you want to use UART interface
  - connect UART cable between PC and the board
    - Note: could be STLink connector if Virtal COM port is connected on the board like ST DK boards
  - **!!! NOTE: USB cable should not be connected if you want to use UART !!! - ROM CODE will USB DFU if both interface are available!**

STM32CubeProgrammer GUI interface

Please Read STM32CubeProgrammer user manual for further details if needed

- Select Port (USB or UART) depending on the choice you made
- Click on Connect button - STM32CubeProgrammer is now connected to ROM Code
- Select TSV `<Your Directory Path>\`Projects\\`<STM32 device>`\Binary\FlashLayout_STM32PRGFW_UTIL.tsv
- Select Binary Path with Browse Button `<Your Directory Path>\`Projects\\`<STM32 device>`\Binary\
- Click on Download - STM32CubeProgrammer is now connected to STM32PRGFW-UTIL firmware



Select	Opt	Id	Name	Type	IP	Offset	Binary
✓	P	0x1	FSBL	Binary	none	0x00000000	STM32PRGFW_UTIL_MP13xx_CP_Serial_Boot.stm32

Binaries path: C:\git\stm32prgfw_util_master\Firmware\Projects\STM32MP13xx\Binary

Verbosity level [✓ 1] 2 3

```
14:24:30 : DFU protocol: 1.1
14:24:30 : Board       : --
14:24:30 : Device ID   : 0x0501
14:24:30 : Device name : STM32MP257FAI Rev.A
14:24:30 : Device type :
14:24:30 : Device CPU  :
14:24:30 : Start operation done successfully at partition 0x01
14:24:30 : Flashlayout Programming ...
14:24:30 : Running Flashlayout Partition ...
14:24:30 : Flashlayout partition started successfully
14:24:30 : Flashing service completed successfully
```

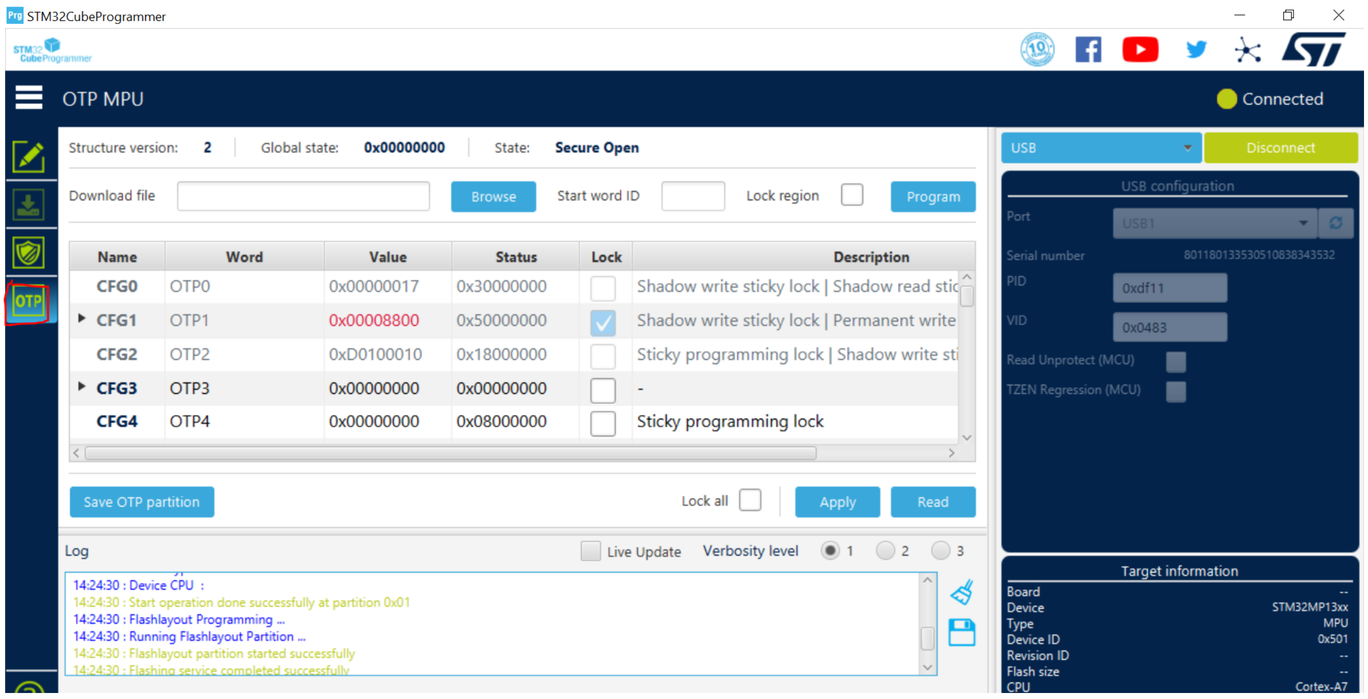
0%

Port	USB1
Serial number	801180133530510838343532
PID	0xdf11
VID	0x0483
Read Unprotect (MCU)	
TZEN Regression (MCU)	

Target information

Board	--
Device	STM32MP13xx
Type	MPU
Device ID	0x501
Revision ID	--
Flash size	--
CPU	Cortex-A7
Bootloader Version	--

- Click on OTP button to get OTP Panel



Structure version: 2 | Global state: 0x00000000 | State: Secure Open

Download file | Start word ID | Lock region

Name	Word	Value	Status	Lock	Description
CFG0	OTP0	0x00000017	0x30000000	☐	Shadow write sticky lock | Shadow read stic
CFG1	OTP1	0x00008800	0x50000000	✓	Shadow write sticky lock | Permanent write
CFG2	OTP2	0xD0100010	0x18000000	☐	Sticky programming lock | Shadow write sti
CFG3	OTP3	0x00000000	0x00000000	☐	-
CFG4	OTP4	0x00000000	0x08000000	☐	Sticky programming lock

Lock all ☐

Log — Live Update ☐ — Verbosity level [✓ 1] 2 3

```
14:24:30 : Device CPU  :
14:24:30 : Start operation done successfully at partition 0x01
14:24:30 : Flashlayout Programming ...
14:24:30 : Running Flashlayout Partition ...
14:24:30 : Flashlayout partition started successfully
14:24:30 : Flashing service completed successfully
```

USB configuration

Port	USB1
Serial number	801180133530510838343532
PID	0xdf11
VID	0x0483
Read Unprotect (MCU)	☐
TZEN Regression (MCU)	☐

Target information

Board	--
Device	STM32MP13xx
Type	MPU
Device ID	0x501
Revision ID	--
Flash size	--
CPU	Cortex-A7

STM32CubeProgrammer CLI interface

Please Read STM32CubeProgrammer user manual for further details if needed

- Go to the STM32CubeProgrammer binary directory (i.e. STM32CubeProgrammer-212\bin)
- Open command prompt inside this bin directory
- Run this command to load the STM32PRGFW-UTIL binary in the embedded ram: $STM32_Programmer_CLI.exe -c port=COM `<num>` -w `<Your Directory Path>\`Projects\`<STM32 device>`\Binary\FlashLayout_STM32PRGFW_UTIL.tsv
- Do not reset the board and execute command - Some command examples where UART interface (COM8) is used:
  $STM32_Programmer_CLI.exe -c port=COM8 -otp displ
  $STM32_Programmer_CLI.exe -c port=COM8 -otp write word=10 value=0x1

  PMIC NVM Programming

- PMIC NVM can be programmed in serial boot mode using USB DFU or UART.
  - Read the entire NVM partition by following command $STM32_Programmer_CLI -c port=usb1 -rp 0xf4 0x0 `<size of partition>` `<Your Directory Path>\`PMIC_NVM_read.bin here NVM data is written to PMIC_NVM_read.bin.
  - To read NVM using UART in serial boot mode replace usb1 with COM port appearing on the HOST. $STM32_Programmer_CLI -c port=COM`<num>` -rp 0xf4 0x0 `<size of partition>` `<Your Directory Path>\`PMIC_NVM_read.bin
  - Backup it by creating a copy PMIC_NVM_write.bin
  - using hex editor modify PMIC_NVM_write.bin.
  - Write the NVM partion using below command for USB DFU. $STM32_Programmer_CLI -c port=usb1 -pmic "`<Your Directory Path>\`PMIC_NVM_write.bin"

- To write NVM using UART in serial boot mode replace usb1 with COM port appearing on the HOST. $STM32_Programmer_CLI -c port=COM`<num>` -pmic "`<Your Directory Path>`\PMIC_NVM_write.bin"

Note: - For STPMIC1 size of partition is 8 Bytes.

How to Use Console_SH

In this mode, you will use STM32CubeIDE and build config Console_SH

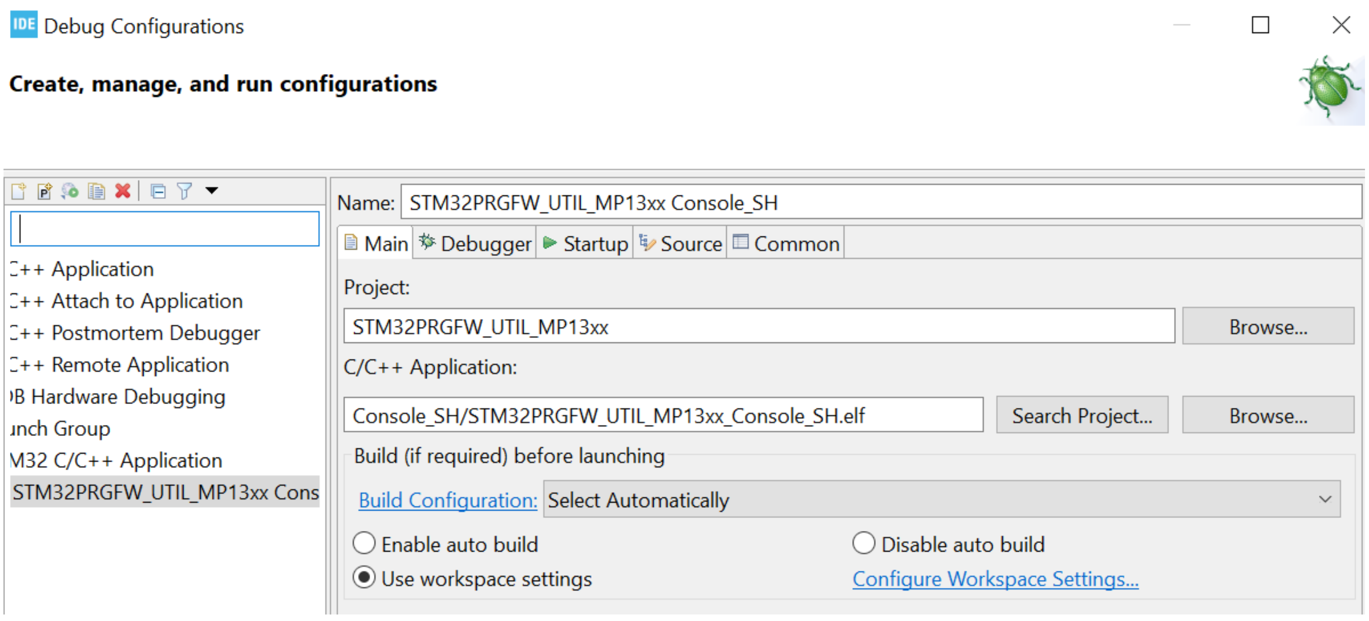
Hardware prerequisites

- Set boot boot pins to b100 (BOOT2 = ON, BOOT0/1=OFF) position to select development boot (or also called Engineering boot)
- Connect cable from Board/STLINK connector to the PC

STM32CubeIDE Step by Step

- Build Project by selecting Console_SH build confiuration
- Setup Debug Configuration as below and in particular (in Startup tab):

```
monitor reset
monitor halt
mon arm semihosting enable
mon arm semihosting_redirect tcp 2323
```



Debug Configurations

Create, manage, and run configurations

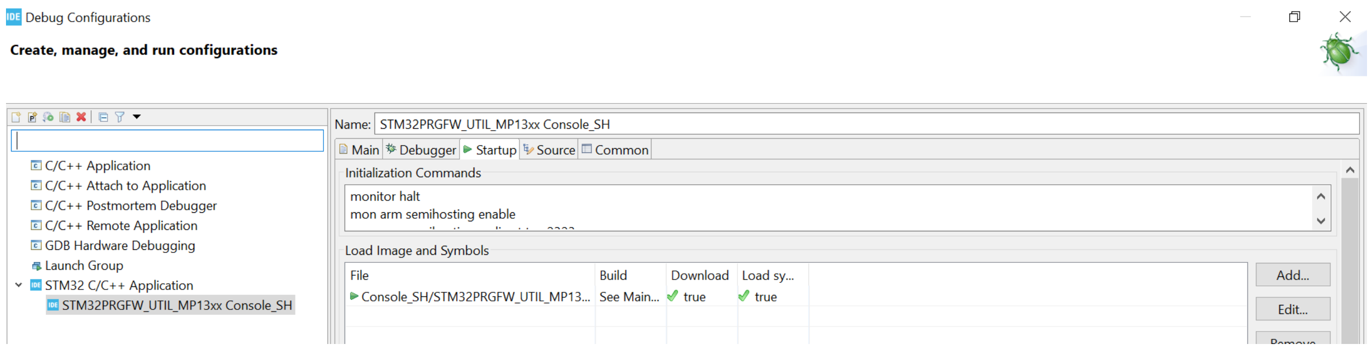
Name: STM32PRGFW_UTIL_MP13xx Console_SH

Main | Debugger | Startup | Source | Common

Project:
STM32PRGFW_UTIL_MP13xx

C/C++ Application:
Console_SH/STM32PRGFW_UTIL_MP13xx_Console_SH.elf

Build (if required) before launching
Build Configuration: Select Automatically
( ) Enable auto build ( ) Disable auto build
(●) Use workspace settings Configure Workspace Settings...


Debug Configurations

Create, manage, and run configurations

- C/C++ Application
- C/C++ Attach to Application
- C/C++ Postmortem Debugger
- C/C++ Remote Application
- GDB Hardware Debugging
- Launch Group
- STM32 C/C++ Application
  - STM32PRGFW_UTIL_MP13xx Console_SH

Name: STM32PRGFW_UTIL_MP13xx Console_SH

Main | Debugger | Startup | Source | Common

Initialization Commands

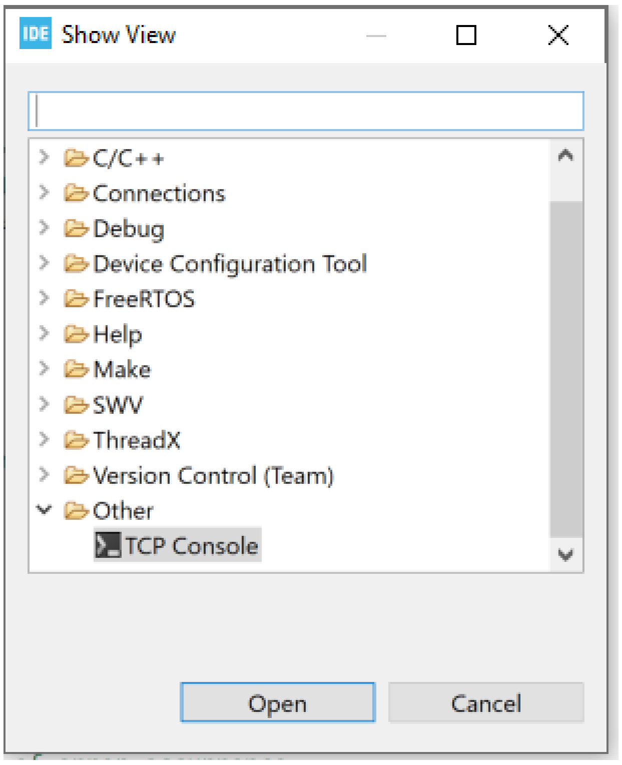
```
monitor halt
mon arm semihosting enable
```

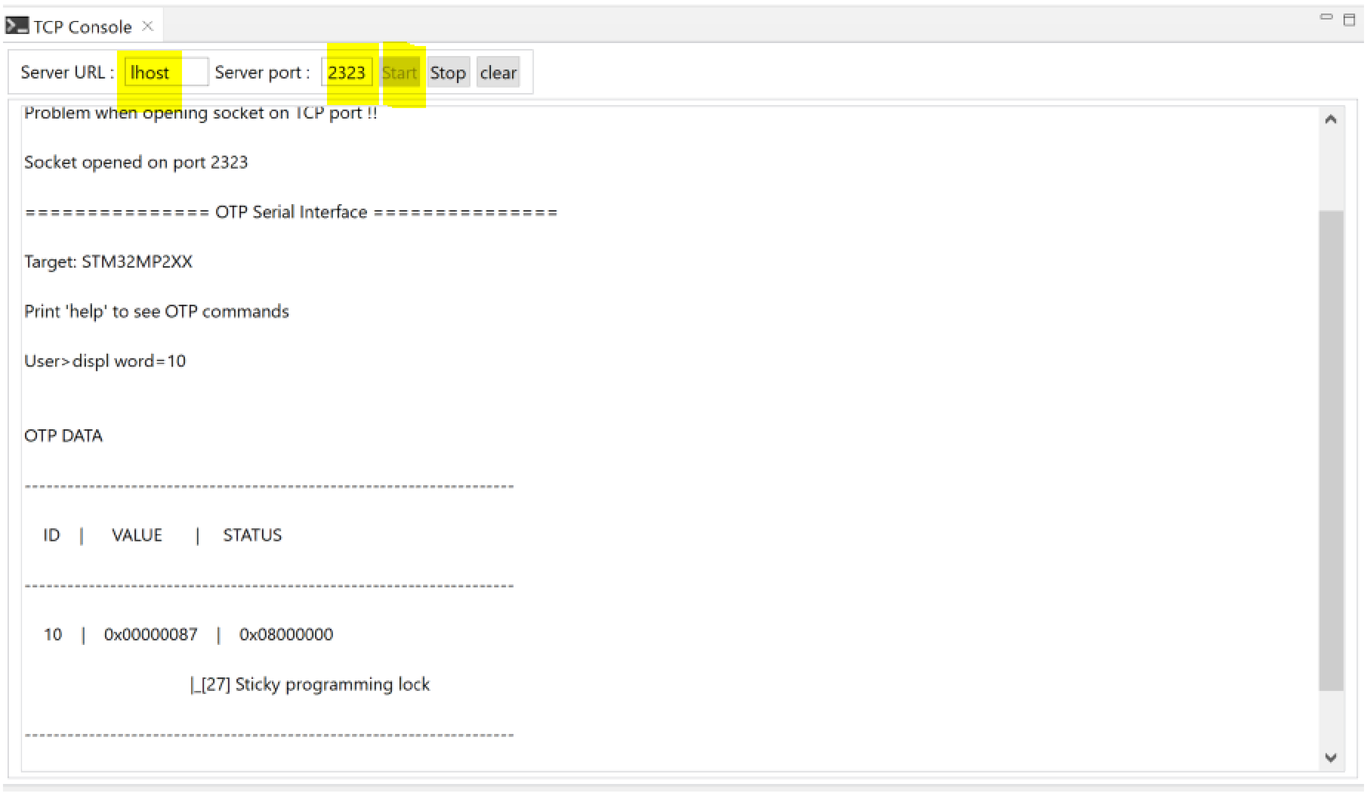
Load Image and Symbols

File	Build	Download	Load sy...
Console_SH/STM32PRGFW_UTIL_MP13...	See Main...	✓ true	✓ true

- Run Debug configuration and Open TCP window with localhost and port number as described below (Window ->Show View-> Other-> TCP Console)
- Some command examples:

```
$help
$displ
$displ word=10
$write word=10 value=1
```





```
Problem when opening socket on TCP port !!

Socket opened on port 2323

=============== OTP Serial Interface ===============

Target: STM32MP2XX

Print 'help' to see OTP commands

User>displ word=10


OTP DATA

--------------------------------------------------------------------

  ID  |     VALUE      |     STATUS

--------------------------------------------------------------------

  10  |  0x00000087  |   0x08000000

                         |_[27] Sticky programming lock

--------------------------------------------------------------------
```

How to Use Console_Uart

In this mode, you will use STM32CubeIDE and build config Console_UART

Hardware prerequisites

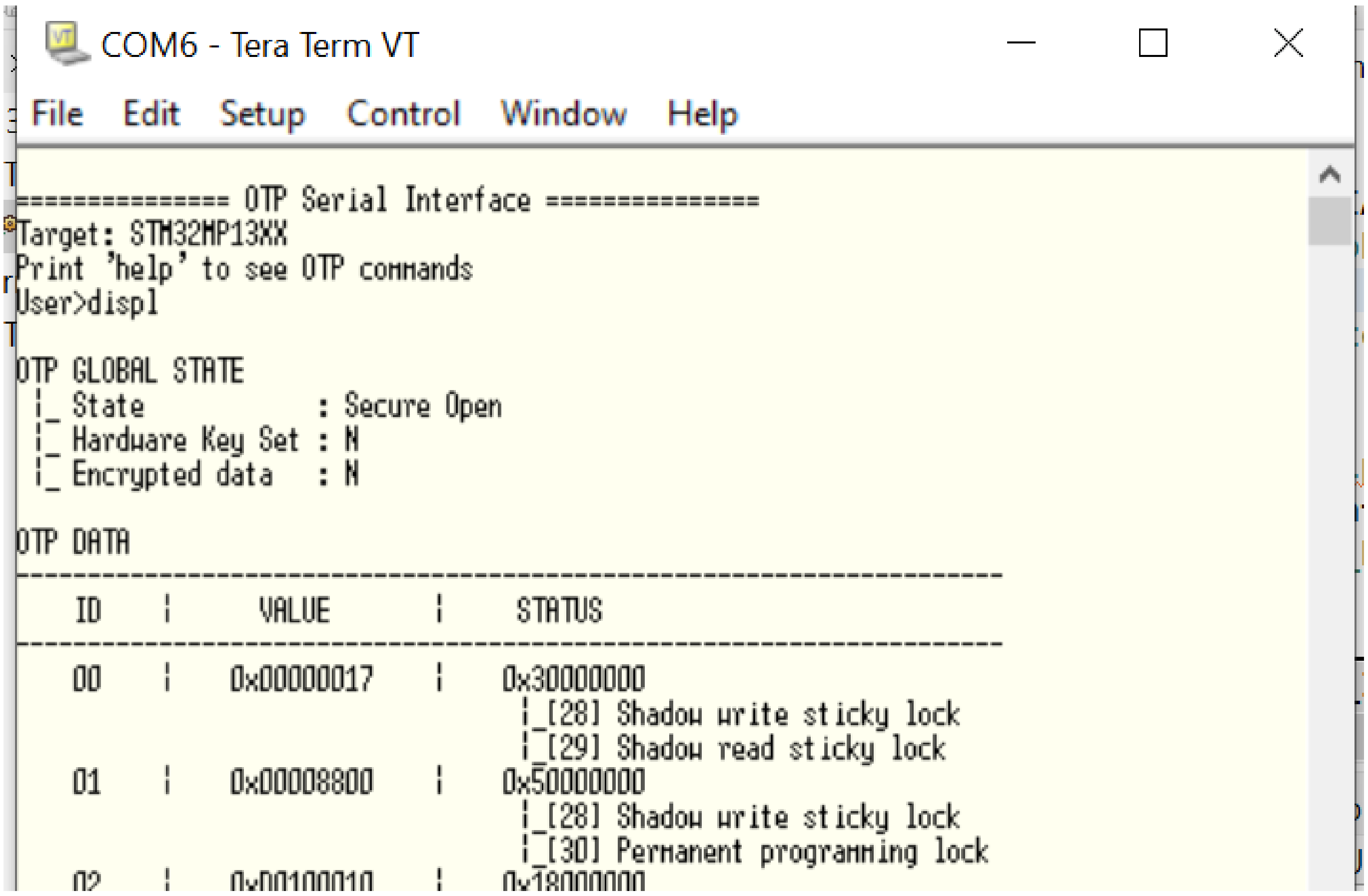
- Set boot boot pins to b100 (BOOT2 = ON, BOOT0/1=OFF) position to select **development boot (or also called Engineering boot)
- Connect cable from Board/STLINK connector to the PC

STM32CubeIDE Step by Step

- Depending your own board, you should change UART instance and GPIO into otp_interface_cli_util.h file
  - By default it is the instance used on ST board (UART4 PD6&PD8 for STM32MP13xx / UART4 PG11/PB2 for STM32MP15xx)
- Build Project by selecting Console_UART build confiuration
- Setup Debug Configuration and in particular (in Startup tab):

```
monitor reset
monitor halt
```

- Run Debug confiiguration
- Connect an hyperterminal and connect to COM port



```
=============== OTP Serial Interface ===============
Target: STM32MP13XX
Print 'help' to see OTP commands
User>displ

OTP GLOBAL STATE
 |_ State             : Secure Open
 |_ Hardware Key Set  : N
 |_ Encrypted data    : N

OTP DATA
--------------------------------------------------------------------
    ID    |        VALUE        |     STATUS
--------------------------------------------------------------------
    00    |     0x00000017      |    0x30000000
                                       |_[28] Shadow write sticky lock
                                       |_[29] Shadow read sticky lock
    01    |     0x00008800      |    0x50000000
                                       |_[28] Shadow write sticky lock
                                       |_[30] Permanent programming lock
    02    |     0x00100010      |    0x18000000
```

Release note

Details about the content of this release are available in the release note **Release_Notes.html**.

Troubleshooting

Caution : The issues are **strictly limited** to submit problems or suggestions related to the software delivered in this repository.

For any other question related to the product, the hardware performance or characteristics, the tools, the environment, you can submit it to the **ST Community** on the STM32 MPUs related page.