UM0892
User manual

STM32 ST-LINK utility

Introduction

The STM32 ST-LINK utility software facilitates fast in-system programming of the STM32 microcontroller families in development environments via the ST-LINK tool.

This is the STM32 ST-LINK utility user manual, describing its software functions. When working with the STM32 ST-LINK utility tool, you are encouraged to download the ST-LINK in-circuit debugger/programmer for the STM8 and STM32 which provides more information about the ST-LINK tool.

Contents

1 Getting started

This section describes the requirements and procedures needed to install the STM32 ST-LINK utility software.

1.1 System requirements

The STM32 ST-LINK utility PC configuration requires as a minimum:

- PC with USB port and Intel® Pentium® processor running a 32-bit Microsoft® OS that supports USB:
  - Windows® XP
  - Windows 2000
  - Windows 98SE
  - Windows ME
- 32 MB RAM
- 10 MB hard disk space available

Note: Windows 95, Windows 98 First Edition and NT4.0® do NOT support USB.

1.2 Hardware requirements

The STM32 ST-LINK utility is designed to work with:

- STM32 F-1 , STM32 F-2 and STM32 L-1 series.
- ST-LINK V1.

1.3 Installing the STM32 ST-LINK utility

Follow these steps and the on-screen instructions to install the STM32 ST-LINK utility.

1. Download the compressed STM32 ST-LINK utility software from the ST website.
2. Extract the contents of the **.zip** file into a temporary directory.
3. Double-click the extracted executable, **setup.exe,** to initiate the installation, and follow the on-screen prompts to install the STM32 ST-LINK utility in the development environment. Documentation for the utility is located in the subdirectory **\Docs** where the STM32 ST-LINK utility is installed.

1.4 Uninstalling the STM32 ST-LINK utility

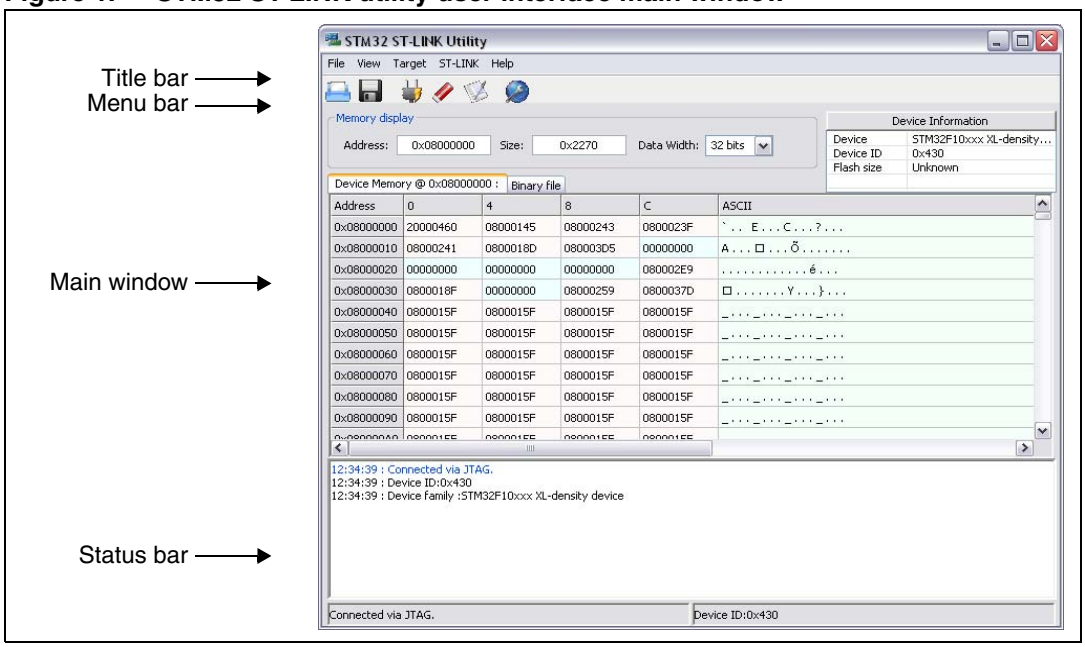
Follow these steps to uninstall the STM32 ST-LINK utility.

1. Select **Start** I **Settings** I **Control Panel**.
2. Double click on **Add or Remove Programs**.
3. Select **STM32 ST-LINK Utility**.
4. Click on the **Remove** button.

2 STM32 ST-LINK utility user interface

2.1 Main window

Figure 1. STM32 ST-LINK utility user interface main window



The main window is composed of three zones and three bars as illustrated in *Figure 1*:

- Memory display zone
- Device information zone
- Memory contents zone
- Title bar: The name of the current menu
- Menu bar: Use the menu bar to access the following STM32 ST-LINK utility functions:
  - **File** menu
  - **View** menu
  - **Target** menu
  - **Help** menu

  (These menus are described in more detail in *Section 2.2*)
- Status window: The status bar displays:
  - Connection status and debug interface
  - Device ID

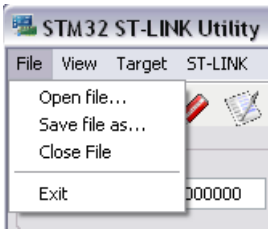
The STM32 ST-LINK utility user interface also provides additional forms and descriptive pop-up error messages.

2.2 Menu bar

The Menu bar allows users to execute the STM32 ST-LINK utility software features.

2.2.1 File menu

Figure 2. File menu



Open file... Opens a binary file.

Save file as… Saves the content of the memory panel into a binary file.

Close File Closes the loaded binary file.

Exit Closes the STM32 ST-LINK utility program.

2.2.2 View menu

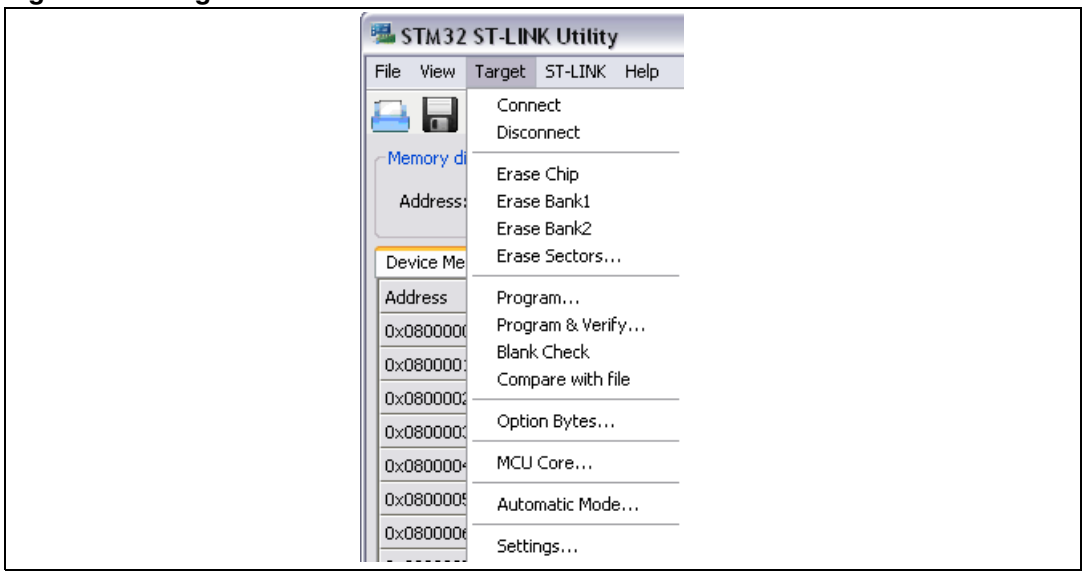
Figure 3. View menu

Binary file Displays the content of the loaded binary file.

Device memory Displays the content of the device memory.

2.2.3 Target menu

Figure 4. Target menu



Connect Connects to the target device and displays the Device Type, Device ID and Flash size in the device information zone.

Disconnect Disconnects from the target device.

Erase Chip Performs a Flash mass erase and then displays the Flash memory content in the memory panel.

Erase Bank1 Erases bank 1 of the Flash memory. This menu is enabled only when connected to a device containing two flash banks.

Erase Bank2 Erases bank 2 of the Flash memory. This menu is enabled only when connected to a device containing two flash banks.

Erase Sectors… Selects sector(s) to erase using the erase sectors dialog window (see *Section 3.3: Flash memory erase* for more details).

Program… Loads a binary file into the device memory (Flash or RAM). To do this, select a binary file, enter the start address (where to put the file in the device) in the program dialog window and then click on program button (see *Section 3.4: Device programming*).

Program & Verify… Loads a binary file into the device memory (Flash or RAM) then performs a verification of the programmed data.

Blank Check Verifies wether the STM32 flash is blank or not. If the flash is not blank, the first address with data is highlighted in a prompt message.

Compare with file Compares the MCU device memory content with hex, binary, srec file.

Option Bytes… Opens the Option Bytes dialog window (See *Section 3.5: Option bytes configuration* for more details).

MCU Core… Opens the MCU Core dialog window (See *Section 3.6: MCU core functions* for more details).

Automatic Mode... Opens the Automatic mode dailog window (See *Section 3.7: Automatic mode functions* for more details).

Settings... Opens the Settings dialog box to select the debug interface (JTAG or SWD).
For the STM32 F-2 series, you must specify the MCU voltage range to be able to correctly program the flash memory.

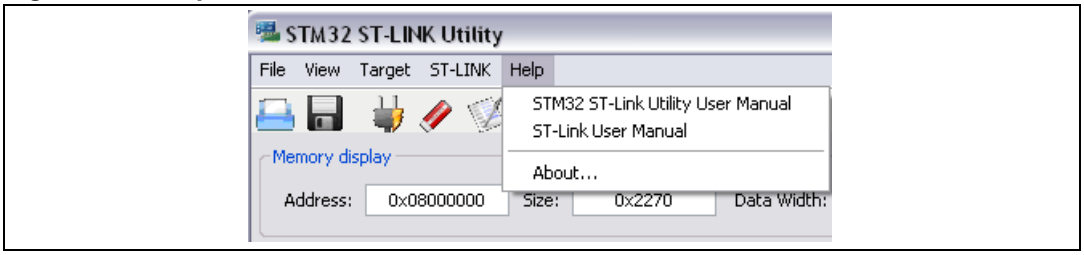
2.2.4 ST-LINK menu

Figure 5. ST-LINK menu

Firmware update Updates the ST-LINK firmware to latest version V1J11S3.

2.2.5 Help menu

Figure 6. Help menu



STM32 ST-LINK Utility User Manual Opens the STM32 ST-LINK utility user manual.

ST-LINK User Manual Opens the ST-LINK user manual.

About... Displays STM32 ST-LINK utility software version and copyright information.

3 STM32 ST-LINK utility features

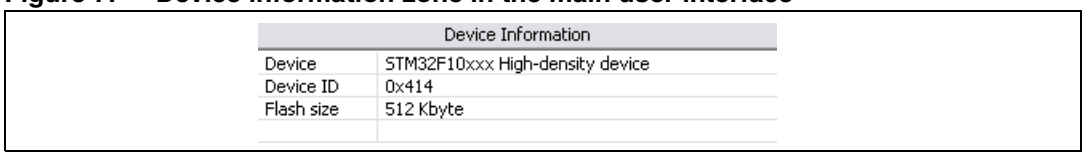
This section provides a detailed description of how to use STM32 ST-LINK utility features:

- *Device information*
- *Memory display and modification*
- *Flash memory erase*
- *Device programming*
- *Option bytes configuration*
- *MCU core functions*
- *Automatic mode functions*

3.1 Device information

The *Device information* zone displays information as shown in *Figure 7*.

Figure 7. Device information zone in the main user interface



Device: Family of the connected STM32 device. Each MCU family includes many devices with different characteristics (Flash size, RAM size, peripherals, ...etc.)

Device ID: MCU device ID code located in the external PPB memory map

Flash size: Size of the on-chip Flash memory(1)

1. This field is not available for STM32F2xx devices.

3.2 Memory display and modification

In addition to the **Device information** zone, the main window contains 2 other zones:

- **Memory display**
- **Memory data**

Memory display: This zone contains three edit boxes:

Address: Memory start address from which you want to read.

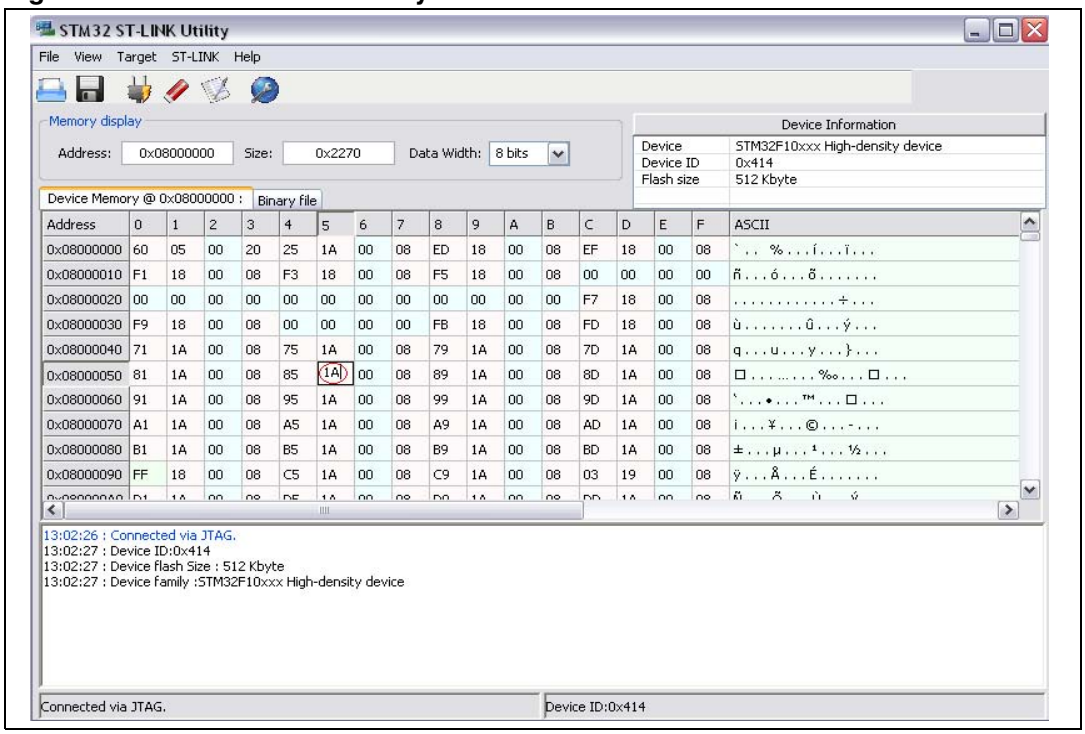
Size: Amount of data to read.

Data width: Width of the displayed data (8-bit, 16-bit or 32-bit).

Memory data: This zone displays the data read from a binary file or the memory content of a connected device. You can modify the content of the file before downloading.

- To use this zone to display the content of binary file, go to **File | Open file...**
- To use this zone to read and display memory content of a connected device, enter the memory start **Address**, data **Size** and the **Data Width** in the **Memory display** zone and then press **Enter**.
- After reading data, you can also modify each value merely by double clicking on the concerned cell as illustrated by *Figure 8*. You can also save the device memory content into a binary file using the menu **File | Save file as...**

Figure 8. STM32 ST-LINK utility user interface



Note: When the Memory data zone displays device memory contents, any modification is automatically applied to the chip. You can modify user Flash memory, RAM memory and peripherals registers.

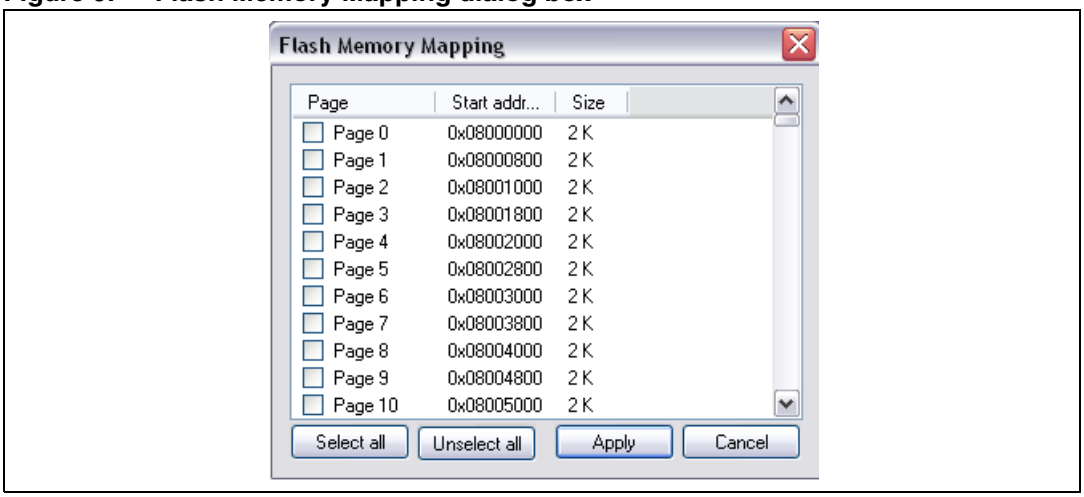
For the STM32 F-2 series, you can modify the OTP area directly from the memory data zone.

3.3 Flash memory erase

There are two type of Flash memory erase:

- **Flash mass erase**: Erase all the memory Flash sectors of the connected device. This is done by clicking on the menu **Target | Erase Chip**.
- **Flash Sector Erase**: Erase the selected sector(s) of the Flash memory. To select sector(s), go to **Target | Erase Sectors...** which then displays the **Flash Memory Mapping** dialog box where you select the sector(s) to erase as shown in *Figure 9*.
  - **Select all** button selects all the Flash pages.
  - **Deselect all** button deselects all sectioned page.
  - **Cancel** button discards the erase operation even if some pages are selected.
  - **Apply** button erases all the selected pages.

Figure 9. Flash Memory Mapping dialog box



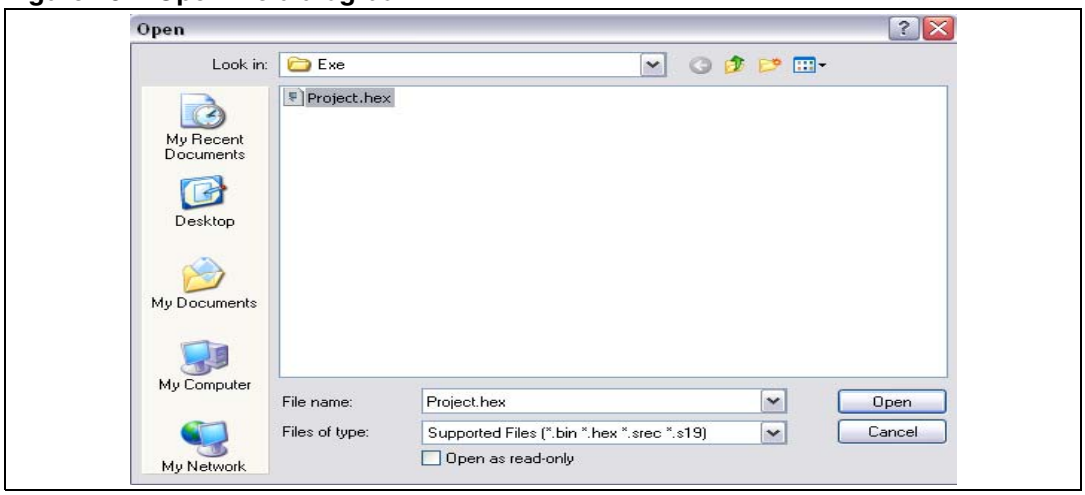
Note: ***Note:*** *To erase the Flash data memory sector of the STM32 L-1 devices, select the data memory box at the end of the list and click* ***Apply****.*

3.4 Device programming

The STM32 ST-LINK utility can download binary, Hex, or srec files into Flash or RAM memory. To do this, follow these steps:

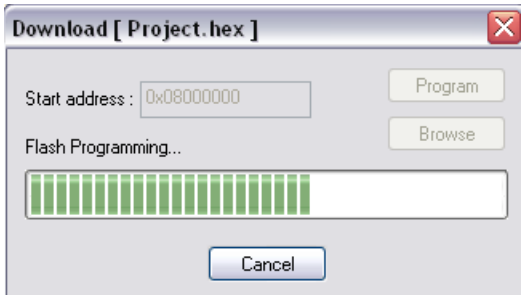
1. Click on **Target** I **Program...** (or **Target** I **Program & Verify...** if you want verify the written data) to open the **Open** file dialog box as shown in *Figure 10*.
   If a binary file is already opened, go to step 3.

Figure 10. Open file dialog box



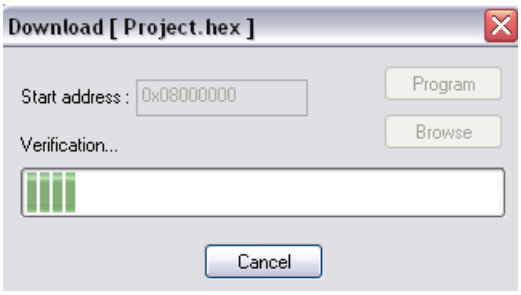
2. Select a binary file and click on the **Open** button.
3. Specify the address from which to start programming as shown in *Figure 11*, it may be a Flash or RAM address.

Figure 11. Device programming dialog box (programming)



4. Finally, click on the **Program** button to start programming. If you selected **Target** I **Program & Verify...** in the first step, a check is done at the end of the programming operation (see *Figure 12*).

Figure 12. Device programming dialog box (verification)



3.5 Option bytes configuration

The STM32 ST-LINK utility can configure all the option bytes via the **Option Bytes** dialog box shown in *Figure 13* which is accessed by **Target I Option Bytes...**.

The **Option Bytes** dialog box contains the following sections:

- **Read Out Protection**: Modifies the read protection state of the Flash memory.
  For STM32 F-2 and STM32 L-1 series, read protection levels are available:
  - Level 0: no read protection
  - Level 1: memory read protection enabled
  - Level 2: memory read protection enabled and all debug features disabled

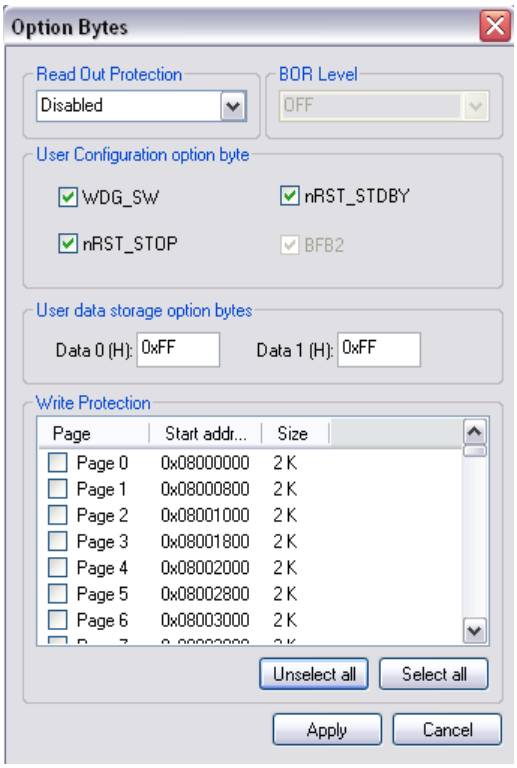
  For the other devices, the read protection can only be enabled or disabled.
- **BOR Level**: Brownout reset level. This list contains the supply level threshold that activates/releases the brownout reset. This option is enabled only when connected to an ultralow an STM32 F-2 or STM32 L-1 device.
  For STM32 L-1 series, 5 programmable VBOR thresholds can be selected:
  - BOR LEVEL 1: Reset threshold level for 1.69 to 1.8 V voltage range
  - BOR LEVEL 2: Reset threshold level for 1.94 to 2.1 V voltage range
  - BOR LEVEL 3: Reset threshold level for 2.3 to 2.49 V voltage range
  - BOR LEVEL 4: Reset threshold level for 2.54 to 2.74 V voltage range
  - BOR LEVEL 5: Reset threshold level for 2.77 to 3.0 V voltage range

  For STM32 F-2 series, 4 programmable VBOR thresholds can be selected:
  - BOR LEVEL 3: Supply voltage rangess from 2.70 to 3.60 V
  - BOR LEVEL 2: Supply voltage ranges from 2.40 to 2.70 V
  - BOR LEVEL 1: Supply voltage ranges from 2.10 to 2.40 V
  - BOR off: Supply voltage ranges from 1.62 to 2.10 V
- **User Configuration option byte:**
  - WDG_SW : If checked, watchdog is enabled by software - otherwise it is automatically enabled at power-on.
  - nRST_STOP: If not checked, reset is generated when entering Standby mode (1.8V domain powered-off). If checked, no reset is generated when entering Standby mode.
  - nRST_STDBY: if not checked, reset is generated when entering Stop mode (all clocks are stopped). If checked, no reset is generated when entering Stop mode.

– BFB2: If not checked, and if the boot pins are set to make the device boot from user Flash at startup, the device boots from Flash memory bank 2, otherwise it boots from Flash memory bank 1. This option is enabled only when connected to a device containing two Flash banks.

- **User data storage option bytes:** Contains two bytes for user storage. These two option bytes are not available in the STM32 F-2 and STM32 L-1 series.
- **Write Protection:** Depending on the device, Flash sectors are grouped by a defined number of sectors. You can modify the write protection of each Flash sector group here.

Figure 13. Option Bytes dialog box



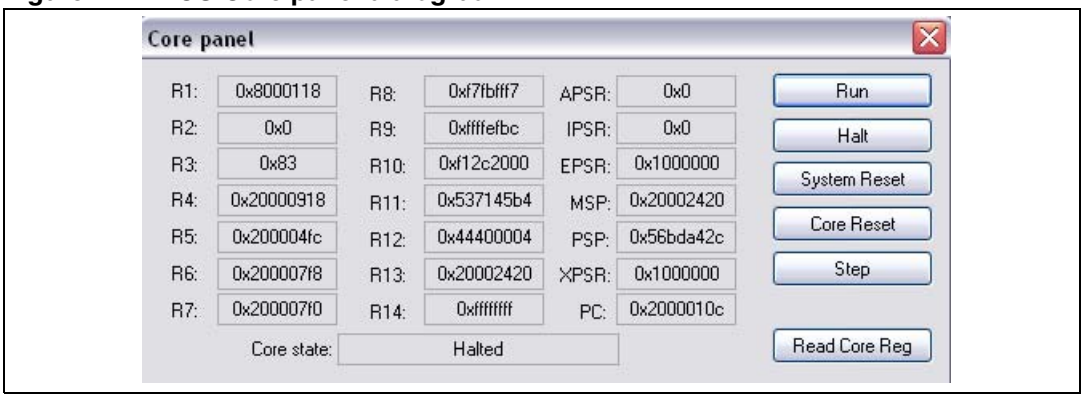
For more details, please refer to the Option Bytes section in the Flash programming manual available from www.st.com.

3.6 MCU core functions

The **Core panel** dialog box shown in *Figure 14*, displays the Cortex™-M3 core register values. It also allows you to carry out the following actions on the MCU, using the buttons on the right:

- **Run**: Run the core.
- **Halt**: Halt the core.
- **System Reset**: Send a system reset request.
- **Core Reset**: Reset the core.
- **Step**: Step one instruction.
- **Read Core Reg**: Update the core registers values.

Figure 14. MCU Core panel dialog box



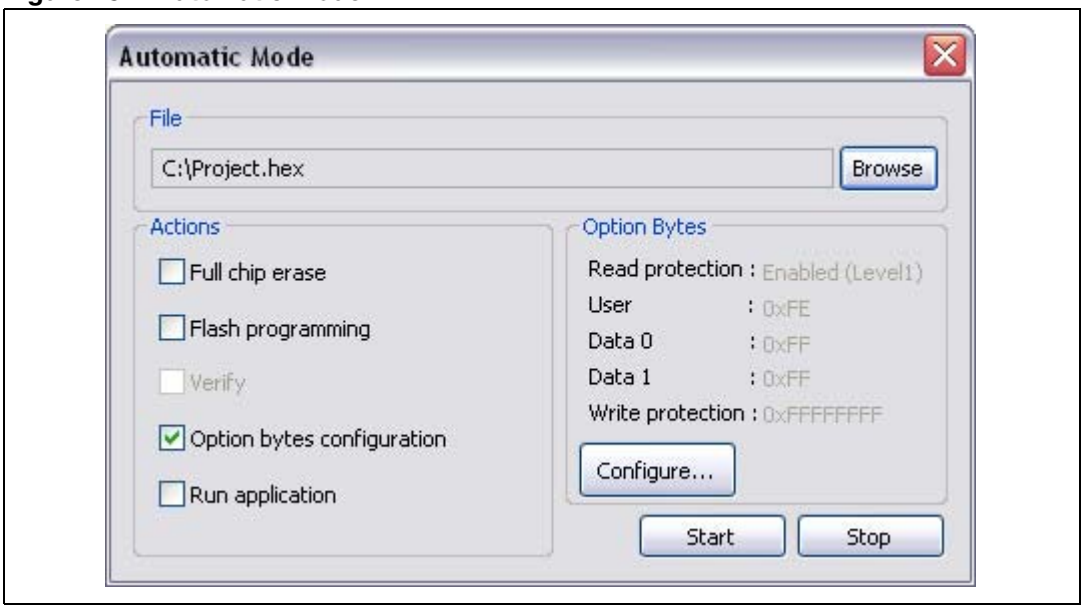
3.7 Automatic mode functions

The **Automatic Mode** dialog box shown in *Figure 15* allows programing and configuring STM32 devices in loop. It allows you to carry out the following actions on the STM32 device:

- **Full chip erase**
- **Flash programming**
- **Verify**
- **Option bytes configuration**
- **Run application**

Clicking on Start button will execute the selected actions on the connected STM32 device and will wait to repeat the same actions after disconnecting the current device and connecting the new device.

Figure 15. Automatic mode



Note: 1 If user deselects Flash programming action while the STM32 Flash memory is readout protected, it will be automatically unprotected.

2 If user deselects Flash programming action while some or all STM32 Flash memory are write protected, they will be automatically unprotected and restored after programming operation.

3 Connection to the device should be established to be able to select the option Bytes configuration using the configure button.

4 The connected devices should be derivatives of the same STM32 family and will be all connected in the same mode (JTAG or SWD).

4 STM32 ST-LINK Utility Command Line Interface (CLI)

4.1 Command Line Usage

The following sections describe how to use the STM32 ST-LINK Utility from the command line.

The ST-LINK Utility Command Line Interface is located at *[Install_Directory]\STM32 ST-LINK Utility\ST-LINK Utility.*

4.1.1 Connection and memory manipulation commands

Command : -c

```
Syntax: -c [JTAG/SWD]

e.g : -c SWD.

Description: Connect to the device using JTAG or SWD
protocols. By default JTAG protocol is used.
```

Command: -w8

```
Syntax: -w8 <Address> <data>

e.g. -w8 0x20000000 0xAA

Description: This writes 8-bit data to the specified mem-
ory address.
```

Command: -w32

```
Syntax: -w32 <Address> <data>

e.g. -w32 0x20000000 0xAABBCCDD

Description: This writes 32-bit data to the specified
memory address.
```

Command: -r8

```
Syntax: -r8 <Address> <NumBytes>

e.g. -r8 0x20000000 0x100

Description: Read <NumBytes> memory.
```

4.1.2 Core commands

Command: -Rst

Syntax: -Rst

Description: System reset.

Command: -Run

Syntax: -Run [<Address>]

e.g. -Run 0x08003000

Description: Set the Program Counter and Stack pointer as defined at user application and perform a run operation. This is usefull if the user application is loaded with offset (e.g. 0x08003000). If address is not specified, 0x08000000 is used.

Command: -Rst

Syntax: -Halt

Description: Halt core.

Command: -Step

Syntax: -Step

Description: Step core.

Command: -SetBP

Syntax: -SetBP [<Address>]

e.g. -SetBP 0x08003000

Description: Set Software or hardware breakpoint at specific address. If address is not specified, 0x08000000 is used.

Command: -ClrBP

Syntax: -ClrBP

Description: Clear all hardware breakpoints if any.

Command:-CoreReg

Syntax: -CoreReg

e.g. -CoreReg

Description: Read Core registers.

Command: -SCore

Syntax: -SCore

Description: Get Core status.

4.1.3 Flash commands

Command: -ME

Syntax: -ME

Description: Full chip erase.

Command: -SE

Syntax: -SE Sector_index

e.g. -SE 4

Description: Perform Sector <Sector_index> erase operation.

Command: -P

Syntax: -P <File_Path> [<Address>]

e.g1. : -P “C:\file.srec”
e.g2. : -P “C:\file.bin” 0x08002000
e.g3. : -P “C:\file.hex”

Description: Perform Load binary, Intel Hex or Motorolla S-record file into device memory. For hex and srec format the address is relevent.

4.1.4 Option bytes commands

Command: -rOB

Syntax: -rOB

Description: Display all option bytes.

Command: -OB

Syntax:
-OB [RDP=<Level>][BOR_LEV=<Level>][IWDG_SW=<Value>]
[nRST_STOP=<Value>][nRST_STDBY=<Value>][BFB2=<Value>]
[Data0=<Value>] [Data1=<Value>][WRP=<Value>]

```
e.g. -OB RDP=0 IWDG_SW=1 nRST_STOP=0 Data0=0xAA
Data1=0xBC.
This command line:
- Disables Read Protection (Level 0),
- Sets the IWDG_SW to 1,
- Sets the nRST_STOP to 0,
- Sets Data0 option byte,
- Sets Data1 option byte.

Description: This cammand configures the option bytes.

Parameters description:
RDP=<Level> : Set the Flash memory read protection
level. Level could be one of the following levels:
0 : Protection disabled.
1 : Protection enabled.
2 : Protection enabled(debug and boot in SRAM features
are DISABLED).
Note: Level 2 is available on available on STM32 F-2 and
STM32 L-1 series only.

BOR_LEV=<Level>: Set the Brownout Reset threshold level.

* For STM32 L-1 series:
0 : BOR OFF,1.45 to 1.55 V voltage range
1 : 1.69 to 1.8 V voltage range
2 : 1.94 to 2.1 V voltage range
3 : 2.3 to 2.49 V voltage range
4 : 2.54 to 2.74V voltage range
5 : 2.77 to 3.0 V voltage range

* For STM32 F-2 series:
0 : BOR OFF, 1.8 to 2.10 V voltage range
1 : 2.10 to 2.40 V voltage range
2 : 2.40 to 2.70 V voltage range
3 : 2.70 to 3.60 V voltage range

IWDG_SW=<Value>: <Value> should be be 0 or 1:
0 : Hardware independent watchdog
1 : Software independent watchdog

nRST_STOP=<Value>: <Value> should be be 0 or 1:
0 : Reset generated when CPU enters the Stop mode
1 : No reset generated.

nRST_STDBY=<Value>: <Value> should be be 0 or 1:
0 : Reset generated when CPU enters the Standby mode
1 : No reset generated.

BFB2=<Value>: <Value> should be be 0 or 1:
0 : Boot from Flash bank 2 when boot pins are set in boot
from user Flash position(default)
1 : Boot from Flash bank 1 when boot pins are set in boot
from user Flash position(default).
```

```
Note: BFB2 is available only on devices containing two
flash banks.

Data0=<Value>: Set Data0 option byte.<Value> should be
in [0..0xFF]
Note: Not available on STM32 F-2 and STM32 L-1 series.

Data1=<Value>: Set Data1 option byte.<Value> should be
in [0..0xFF].
Note: Not available on STM32 F-2 and STM32 L-1 series.

WRP=<Value>: Set the Flash write protection.<Value>
should be in [0..0xFFFFFFFF]
```

Note: 1 All parameters listed above should be in hexadecimal format.

2 For more details, please refer to the Option Bytes section in the Flash programming manual corresponding to your device available at www.st.com

5 Revision history

Table 1. Document revision history

Date	Revision	Changes
22-Jan-2010	1	Initial release.
12-Feb-2010	2	Changed Figs 1,2,3,4,5,6 and 7. Added SWD support.
20-May-2010	3	Added support of XL-density devices in *Section 2.2.3* and *Section 3.5*.
27-Aug-2010	4	Added support of STM32 L-1 series: *3.5: Option bytes configuration* and *4.1.4: Option bytes commands*
28-Feb-2011	5	Hex, srec format support. Command Line Interfact support. Changed name and all figures. Added *Section 3.7: Automatic mode functions*

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