

GProgrammer User Manual

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Preface

Purpose

This document introduces how to install GProgrammer and operate its functional modules, enabling users to quickly get started with GProgrammer.

Audience

This document is intended for:

- GR5xx user
- GR5xx developer
- GR5xx tester

Release Notes

This document is the fourteenth release of *GProgrammer User Manual*, corresponding to GProgrammer V1.2.36.

Revision History

Version	Date	Description
1.5	2020-05-30	Initial release
1.6	2020-06-30	 Updated sector-related description in "Chip Configuration". Added "GR551x_console.exe", introducing a command-line program to erase and download commands; added "GR551x_encrypt_signature.exe" and "User-defined Windows Scripts". Introduced the public key hashes to verify signatures, updated the file name extension for encrypted and signed files, and introduced the firmware signing function in "Encrypt & Sign".
1.7	2020-08-30	 Introduced the GR5515I0ND System-on-Chip (SoC) for GR551x SoCs in "SoC/MCU Selection". Changed icons for Delete and Startup in "Firmware".
1.8	2020-09-30	Added description on firmware download failure in "Download Firmware".
1.9	2020-11-26	Updated UI screenshots for software version.
2.0	2021-01-05	Updated software UI screenshots for SoC/MCU selection and firmware operations.
2.1	2021-03-02	 Added file modification description to "eFuse Settings". Added file export description to "Import and Export". Updated descriptions concerning operations prior to viewing device logs in "Device Log". Added description of IO_LDO_SEL field to "eFuse Layout". Deleted the parameter of nvds in erase and download commands in "GR551x_console.exe".
2.2	2021-05-13	Deleted functionalities for GMF03x series.
2.3	2021-07-16	Updated software UI figures for SoC selection.



Version	Date	Description
2.4	2021-09-06	Updated software UI figures for SoC selection.
2.5	2022-02-20	 Added GR5526 to descriptions specific to SoC models supported by GProgrammer. Updated the "Firmware" and "Encrypt & Sign" sections where adding HEX firmware files via GProgrammer is supported. Updated the "Firmware" section where Export is added to the Firmware interface and exporting BIN firmware files by GProgrammer is supported. Modified the "External Flash" section where QSP12 is added to SPI Type and relevant configuration items are modified.
2.6	2023-01-19	Updated commands supported by GR5xxx_console.exe and GR5xxx_encrypt_signature.exe. Deleted the GR5515IOND SoC.
2.7	2023-02-03	 Updated description in "GR5xxx_console.exe" and added commands supported by GR5xxx_console.exe, including "device" and "load". Added description on the parameter "rand_number" to GR5xxx_console.exe commands. Added description on the software package GProgrammer- Version.tar.bz2 (running on Linux). Added a tip in "Flash Configuration" in "External Flash". Added description on viewing/reselecting the chip model in use. Added description on refreshing and choosing the serial number of target boards in SWD connection mode. Added more data file formats (except BIN files) support during downloading data to Flash memories. Added the function button Parse Para for parsing data in the NVDS area.
2.8	2023-03-30	 Added Detect USB for UART connection of GR5526. Optimized the data download to the Boot info space of GR5526. Added the functionality to configure the ID of an NVDS parameter. Updated commands supported by GR5xxx_console.exe and added the "dump" command. Replaced the email for feedback with the Developer Community website.



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1 Introduction

GProgrammer is a firmware programming tool that applies to Bluetooth Low Energy (Bluetooth LE) GR5xx System-on-Chips (SoCs). It provides the following features:

- Connection via SWD and UART
- Firmware download
- Flash programming & erasing
- Inputting product information (ID, name, description, and value)
- Downloading files to eFuse
- Viewing eFuse contents
- · Firmware encryption and signing
- Configuring Non-Volatile Data Storage (NVDS) parameters
- Displaying device logs
- Programming on GR5xxx_console

Figure 1-1 shows the Graphical User Interface (GUI) of GProgrammer.

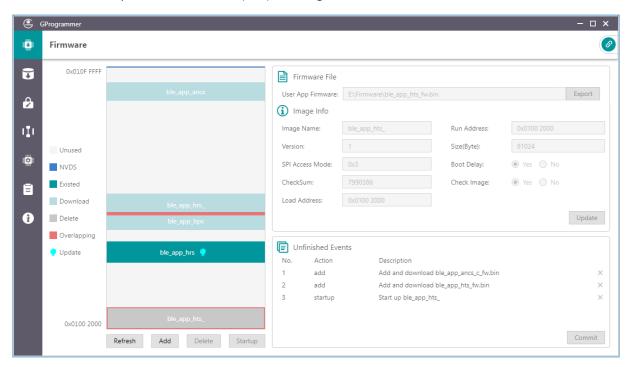


Figure 1-1 GProgrammer GUI



2 Installation Instructions

This chapter describes the environment requirements as well as installation steps for installing GProgrammer.

2.1 Installation Requirements

• Hardware environment

Table 2-1 Hardware environment

Name	Description
СРИ	1.6 GHz and faster
RAM	1 GB and larger

Operating system

Table 2-2 Operating system

Name	Description	
Windows	Windows 7/Windows 10 (32-bit/64-bit)	
Linux	Ubuntu 20.04 (64-bit)	

2.2 Installation Steps

GProgrammer runs on Windows with an executable installation package: *GProgrammer Setup Version.exe*. Users can follow the steps below when installing GProgrammer:



To run GProgrammer on Linux (64-bit), you only need to unzip the software package *GProgrammer-Version.tar.bz2* and double-click the portable .exe program to launch GProgrammer.

1. Double-click *GProgrammer Setup Version.exe*, and follow the steps in the **GProgrammer Setup** wizard (see Figure 2-1).





Figure 2-1 GProgrammer Setup installation wizard

Version indicates the GProgrammer software version number.

2. After installing GProgrammer, you are prompted to install J-Link on demand. See Figure 2-2.

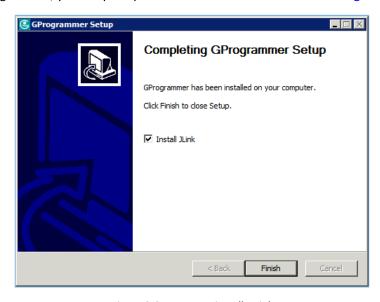


Figure 2-2 Prompt to install J-Link

Tip:

For users who have installed J-Link on their PCs before installing GProgrammer, clear **Install J-Link** in the installation wizard.

3. After installing J-Link, you can start the GProgrammer by clicking the GProgrammer shortcut on desktop or **Start** menu.



3 GProgrammer Use Instructions

This chapter elaborates on how to use functional modules of GProgrammer.

3.1 Hardware Connection

Before starting GProgrammer, make sure the host (PC) is correctly connected to the target board. You can establish the connection in either SWD mode or UART mode.

SWD mode

In SWD mode, users need a J-Link emulator with one end connecting to the host through a Micro USB cable and the other end connecting to SoC pins of the target board through Dupont wire cables.

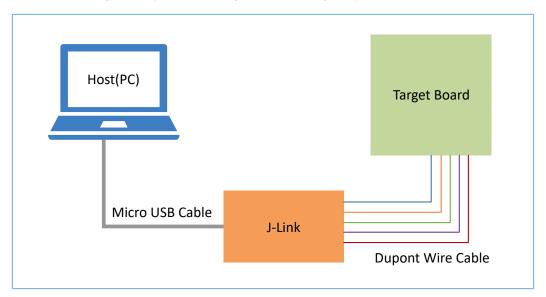


Figure 3-1 Host-target-board connection in SWD mode

The table below lists the mapping relations between J-Link emulator pins and SoC pins.

Table 3-1 Mapping relations between J-Link emulator pins and SoC pins

J-Link Emulator Pin	SoC Pin
vcc	VCC
GND	GND
SWDIO	GPIO_1
SWCLK	GPIO_0



- For target boards that have been integrated with J-Link emulator chips, you can connect the host to the target board directly through a Micro USB cable.
- For Goodix Starter Kit (SK) Boards, you cannot connect an SK Board to a PC directly via the on-board J-Link port
 for firmware programming because the integrated ROM upgrade program in the SoC shall be implemented based
 on a baud rate of 921600, a value which the integrated J-Link emulator chips on the SK Board fails to support.

UART mode

In UART mode, users need a USB-to-serial converter with one end connecting to the host through a Micro USB cable and the other end connecting to SoC pins of the target board through Dupont wire cables.

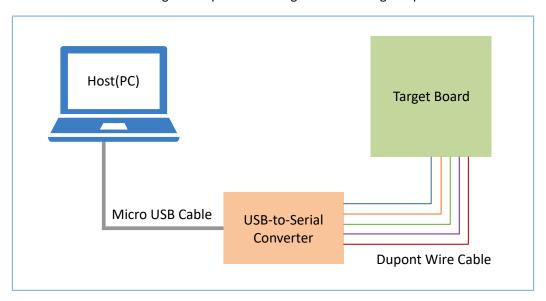


Figure 3-2 Host-target-board connection in UART mode

The table below lists the mapping relations between USB-to-serial converter pins and SoC pins.

Table 3-2 Mapping relations between USB-to-serial converter pins and SoC pins

USB-to-Serial Converter Pin	SoC Pin
vcc	vcc
GND	GND
тх	GPIO_1
RX	GPIO_0
RTS	CHIP_EN



₽Tip:

- For target boards that have been integrated with USB-to-serial converter chips, you can connect the host to the target board directly through a Micro USB cable.
- When the SWD interface is closed, firmware information in the Flash is to be erased after the Host and the target board is connected through UART.

3.2 SoC Selection

Start GProgrammer. Prior to other operations, you are required to choose the SoC model on your target board and click **OK**.



By default, GProgrammer opens the SoC selection interface when being started.

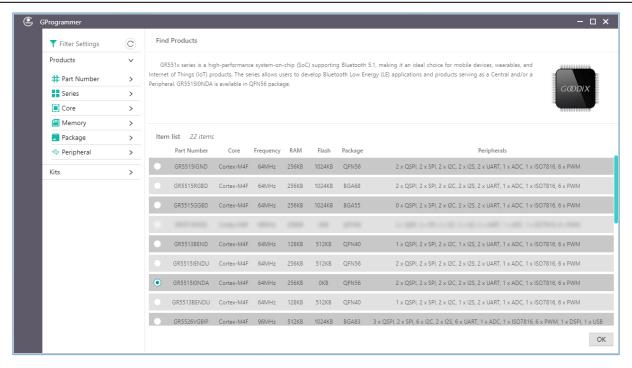


Figure 3-3 SoC selection interface

On the SoC selection interface, the left pane lists **Products** and **Kits** options, and the right pane shows the available choices. You can select an SoC by defining its **Part Number**, **Series**, **Core**, **Memory**, **Package**, or **Peripheral**.



Peripherals listed on the SoC selection interface are only part of the peripherals of an SoC. For details of all peripherals, see the datasheet corresponding to SoC series.

3.3 GProgrammer GUI



After you choose an SoC, the main operational interface opens, as shown in the figure below.

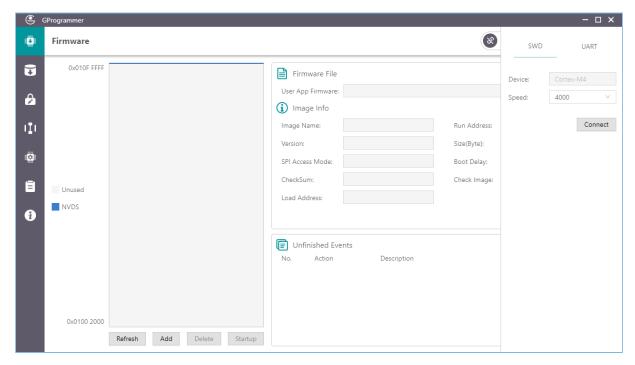


Figure 3-4 GProgrammer GUI

The GUI comprises a functional navigation bar on the left (see Table 3-3) and a function operational zone on the right.

Table 3-3 Options on the functional navigation bar

Icon	Function Name	Description
©	-	 View/Reselect the chip model in use. You can view the selected chip model by moving the cursor onto this icon. You can select another chip model by clicking this icon to return to the SoC selection interface. The current device is to be disconnected after clicking OK in the lower-right corner.
o	Firmware	Display firmware-related operations.
ច	Flash	Display operations related to Flash memory.
ê	Encrypt & Sign	Display operations related to firmware encryption and signing.
(1)	eFuse Layout	Display eFuse layout.
o	Chip Configuration	Display operations related to chip configurations.
B	Device Log	Display device logs.
Ð	Help	Display help information.

3.4 Connection Management

GProgrammer helps users manage and control the connection between your host and target board.



Click on the upper-right corner of the interface to open or hide the connection management window of GProgrammer.

GProgrammer supports two connection modes: SWD and UART.

• SWD

Users need to configure parameters below and click Connect to connect the target board to the host.

Table 3-4 Parameter description

Parameter	Description	
Device	CPU of the on-board chip. It is "Cortex-M4" by default and cannot be modified.	
Speed	Data transfer rate. The default value is 4000 .	
SN.	Serial number of the target board. The default value is 0 . • When the PC is connected with only one target board, you can keep the default value "0" or obtain the corresponding serial number by clicking Refresh .	
SN	 When the PC is connected with multiple target boards, you should obtain the corresponding serial numbers by clicking Refresh, and then choose the target one. In this case, if you keep the default value "0" and start device connection, a window will pop up to inform you of choosing the target board S/N when GProgrammer runs on Windows. 	

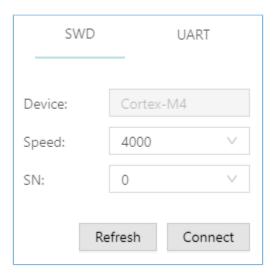


Figure 3-5 GProgrammer SWD connection

UART

Users need to configure **Port** (click **Refresh** and select a correct **Port** value) and **Baudrate** on demand. The default configurations of other parameters (**Parity**, **DataBits**, **StopBits**, and **FlowControl**) cannot be modified.

After setting these parameters, click **Connect** to connect the target board to the host.



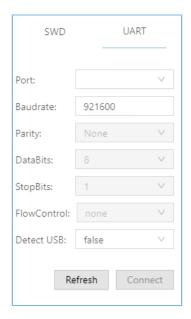


Figure 3-6 GProgrammer UART connection

The parameter **Detect USB** is applicable to USB connection for GR5526 only. Setting **Detect USB** to **true** will enable USB device detection. After clicking **Refresh**, you will be prompted to reset devices, and GProgrammer will search USB devices (a USB device will be enumerated as a serial device) and add the available devices to the **Port** list. Setting **Detect USB** to **false** will disable USB device detection. After you click **Refresh**, GProgrammer will add all serial devices to the **Port** list.

After the connection is successfully established, the connection management window automatically hides with the latent turning into latent, which indicates successful connection establishment.

To disconnect the host from the board, click open the connection management window, and click **Disconnect**.

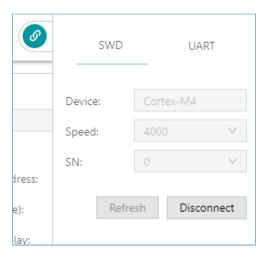


Figure 3-7 Clicking **Disconnect** on GProgrammer



3.5 Firmware

Click on the left side of the main interface of GProgrammer to open the **Firmware** interface.

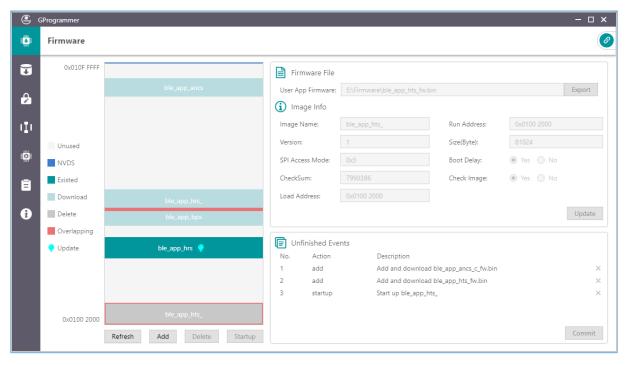


Figure 3-8 GProgrammer Firmware interface

You can download your application firmware to the contiguous space of Flash memories, ranging from 0x01002000 to 0x010FFFFF.

Note:

The start and end addresses of Flash memories to which firmware can be downloaded vary depending on the Flash size of the specific SoC.

3.5.1 Downloading Firmware

GProgrammer graphically displays the Flash memory space layout occupied by firmware (see Figure 3-9), which helps you easily learn the Flash occupation status.



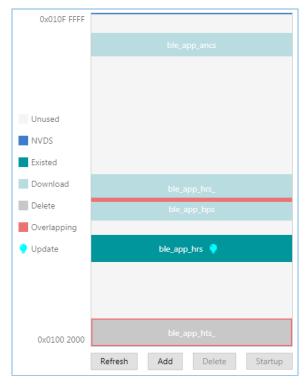


Figure 3-9 Flash firmware layout

- represents Flash space to which data can be downloaded.
- represents default NVDS area to which firmware cannot be downloaded.
- Indicates space for storing to-be-deleted firmware. Example: ble app hts .
- indicates space for storing to-be-downloaded firmware. Example: ble_app_ancs.
- indicates space for storing downloaded firmware in Flash memories. Example: ble_app_hrs.
- Indicates space overlapped by two pieces of firmware. Examples: ble app hrs and ble app bps.

Follow the steps below to download firmware to a Flash memory by using GProgrammer:

- 1. Click **Add** to add a local firmware file (HEX/BIN) to GProgrammer. GProgrammer presents details of the added firmware such as firmware directory (**User App Firmware**) and **Image Info**.
 - In the **Firmware File** area, click **Export** to convert the imported firmware file to an unencrypted BIN file that can be used by the SoC.
- 2. Click **Commit** to download the firmware to Flash memories.

After downloading, the color of the firmware turns from to , indicating the firmware has been successfully downloaded.



- 1. GProgrammer automatically reads firmware existing in the Flash memories after being connected a target board.
- If J-Link cannot be connected when you download firmware, connection/firmware download to the SK Board
 fails. At this moment, the SoC may be in sleep mode (the firmware keeps running in sleep mode). You can press
 RESET on the SK Board, wait for around one second, and re-download the firmware. If this approach does not
 work, erase the Flash and re-download the firmware.

3.5.2 Action Order

You can execute multiple actions at a time. For example, download multiple pieces of firmware to Flash memories and set one piece of firmware as **Startup**. The user-defined actions are executed by clicking **Commit**. The action orders are displayed in **Unfinished Events**, as shown in Figure 3-10.

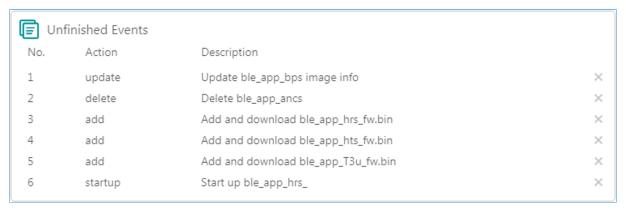


Figure 3-10 Action order

Executable actions for users are listed in the table below.

Table 3-5 Executable actions for users on GProgrammer

Name	Button/Icon	Description
		Click Add to add a local firmware file to GProgrammer.
		Alternatively, you can add a local firmware file to GProgrammer by directly dragging the file to
Add firmware	Add	GProgrammer from Windows/File Explorer.
		Note:
		Do not click Open after dragging the file to GProgrammer.
		Click Refresh to obtain the information of firmware downloaded in the Flash memories of a
		target board.
Refresh firmware	Refresh	Unexecuted actions of Flash firmware on the living target board in the Unfinished Events pane,
		such as those labeled as startup or update are withdrawn with modified parameters being reset
		to values before refresh.



Name	Button/Icon	Description
Delete firmware	Delete	Click the Delete button to delete existing firmware in Flash memories. Select firmware to be deleted in the Flash firmware layout, and click Delete . The firmware color turns to An action labelled as delete is added to the Unfinished Events . Note: Delete operations result in deleting only image info of the selected firmware. The firmware information stored in the area will not be deleted.
Start execution	Startup	Set firmware as startup to run the firmware immediately. Select firmware in the Flash firmware layout, and click the Startup button. displays on the right of the firmware. An action labelled as startup is added to the Unfinished Events . The host automatically disconnects from the target board after running the firmware.
Update firmware information	Update	Click the Update button to update the information of existing firmware in Flash memories on a target board. Select firmware to be updated in the Flash firmware layout, and modify the firmware information (the color of modified parameters turns to). Click Update , and the cion displays on the right side of the firmware. An action labelled as update is added to the Unfinished Events . Execute update actions, and all parameters involved are locked. No editing is allowed. If modification is required, withdraw the previous update action.

- In the action order list, you can withdraw an action by clicking on the right side of the action.
- For two associated actions, withdrawal of the associated action may lead to automatic withdrawal of the previous action. For example, add a firmware file to Flash memories, and set it as **startup**. Withdrawal of **Add** leads to withdrawal of **Startup**.

In addition, if there is overlapped space for firmware, **Commit** will not be available until the conflict is resolved.

Note:

For two pieces of firmware totally overlapping with each other, you can click the overlapping space to select one piece of firmware and double-click the space to select the other.

3.6 Flash

Click on the left side of the main interface of GProgrammer to open the **Flash** interface.



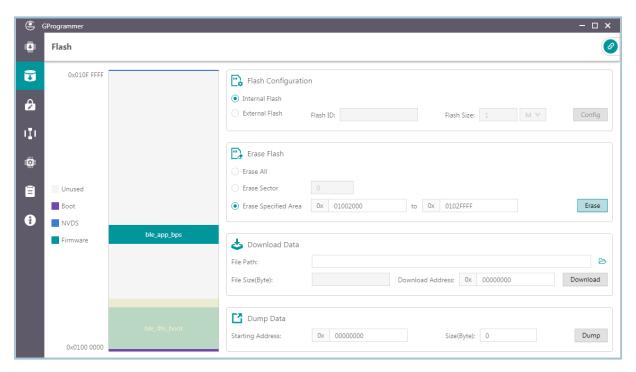


Figure 3-11 GProgrammer Flash interface

GProgrammer allows users to program internal and external Flash memories of SoCs. Detailed programming actions include **Erase Flash**, **Download Data**, and **Dump Data**.

Similar to the firmware layout, the Flash module presents the Flash space occupation in a graphic manner.

- unused Flash space
- space for NVDS
- Boot info space (0x01000000 to 0x01002000, specific to SoC model). The Boot info space is automatically loaded and displayed when users choose internal Flash memories.
- space for storing downloaded firmware in Flash memories. Example: ble app bps
- space to be operated, such as Flash space to be erased

3.6.1 Internal Flash

3.6.1.1 Flash Configuration

Select Internal Flash in the Flash Configuration list to program internal Flash memories.

The Flash layout on the left side of the **Flash** interface automatically synchronizes with updated firmware layout information to obtain the firmware, NVDS, and Boot info space.



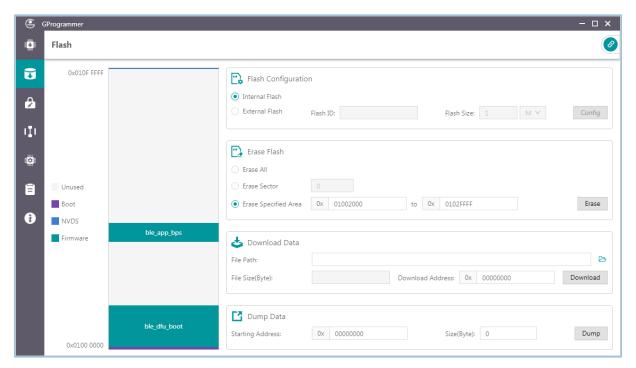


Figure 3-12 Selecting Internal Flash

3.6.1.2 Erase Flash

GProgrammer provides three Flash erasing mechanisms: Erase All, Erase Sector, and Erase Specified Area.

Erase All

The mechanism helps erase all Flash spaces.

The Boot info and NVDS space is cleared with all firmware deleted.



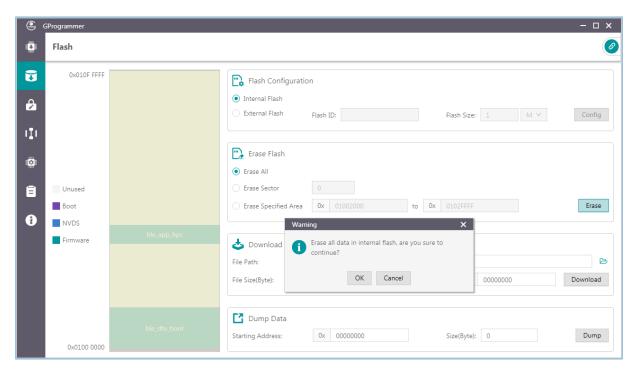


Figure 3-13 Erase All on GProgrammer

• Erase Sector

The mechanism helps erase a specified Flash sector (size: 4 KB).

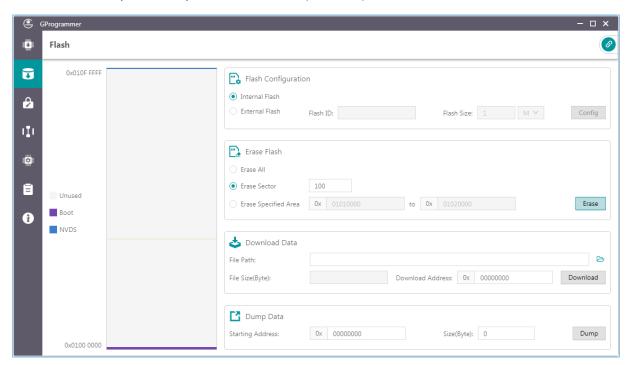


Figure 3-14 Erase Sector on GProgrammer

Erase Specified Area

The mechanism helps erase an area within a specified address range, by sector.



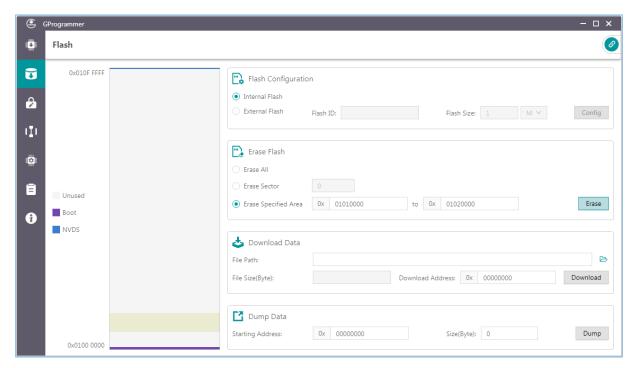


Figure 3-15 Erase Specified Area on GProgrammer

3.6.1.3 Download Data

When downloading data to Flash memories on GProgrammer, users only need to view and add the data file, as well as set a start address for downloading in **Download Address**.



The download address shall be 4 KB-aligned.



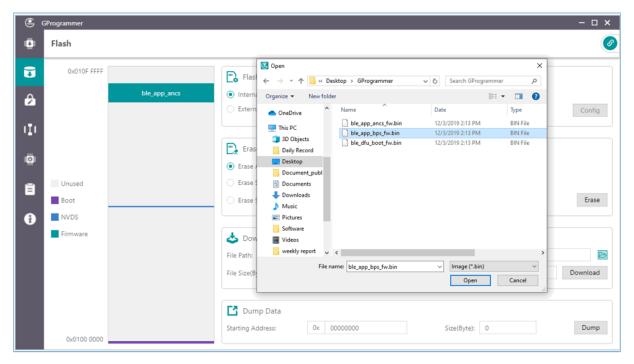


Figure 3-16 Viewing and selecting a data file to be downloaded

A Flash overflow error occurs when the downloaded file size is excessively large or the start address is out of range.

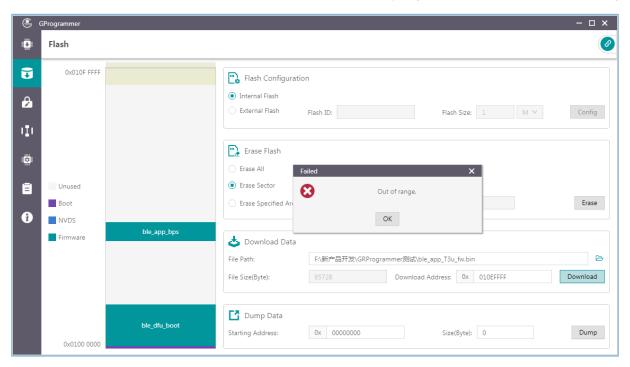


Figure 3-17 Flash overflow error



♣Tip:

Users are allowed to forcibly download data to the Boot info space in SWD connection mode only; in UART mode, force download to the Boot info space is prohibited.

3.6.1.4 Dump Data

Users can dump any data in Flash memories to a local file by specifying a starting dump address and the data size.

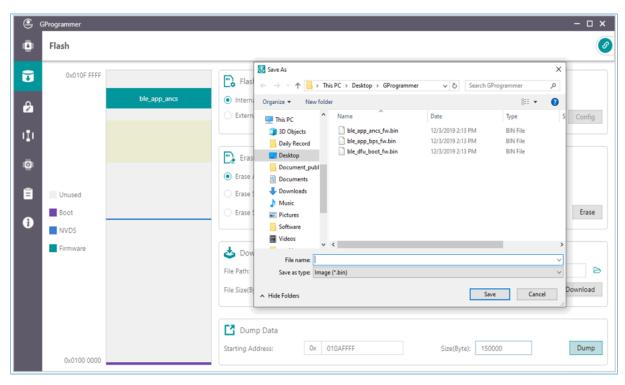


Figure 3-18 Dump Data on GProgrammer

3.6.2 External Flash

3.6.2.1 Flash Configuration

Select **External Flash** in the **Flash Configuration** list to program external Flash memories. Click **Config** to configure the SPI Type and pins based on actual demands.

Click Apply to complete the configuration.

Д́Тір:

- Before clicking Apply, make sure external Flash memories are correctly connected to the target board in accordance with pin configurations. Incorrect connections lead to failures in communications between external Flash and the board.
- GPIO_0 and GPIO_1 are for device connection, and if they are configured as external Flash pins, GProgrammer will disconnect from the target board.



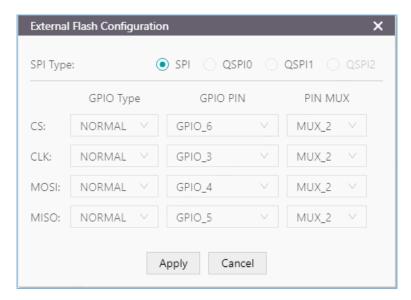


Figure 3-19 SPI configurations

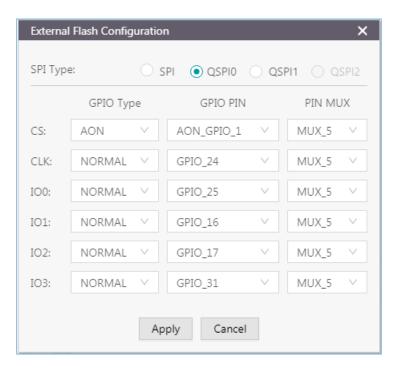


Figure 3-20 QSPI0 configurations

• Configure Flash Size

After users apply the pin configurations, GProgrammer reads and displays the external **Flash ID** based on which the **Flash Size** is automatically set.

Users need to manually set the **Flash Size** when GProgrammer fails to get the Flash size based on the accessed Flash ID.



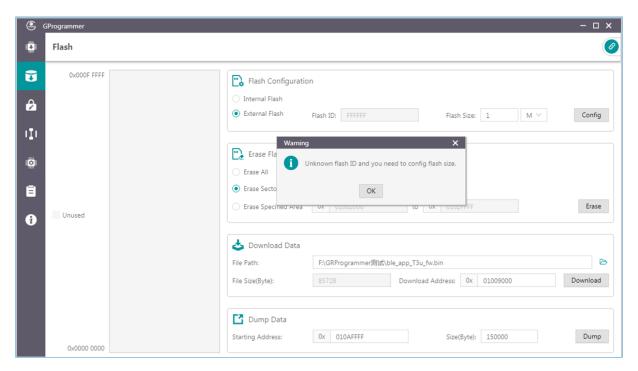


Figure 3-21 Unknown Flash ID

3.6.2.2 External Flash Programming

GProgrammer allows users to program Flash memories (erase Flash, download data to Flash, and dump data to a local file) within a valid address range.

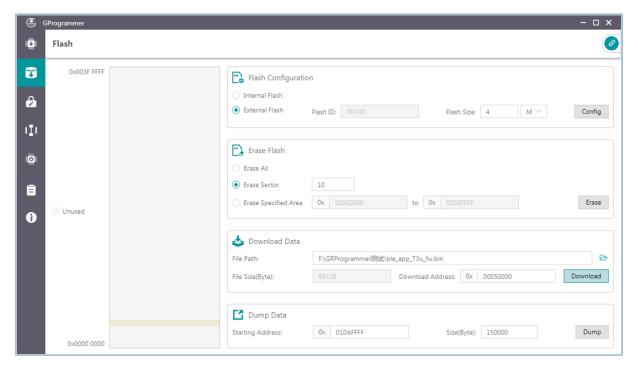


Figure 3-22 **Download Data** to external Flash on GProgrammer





No operation on external Flash is allowed before completing pin configurations.

3.7 Encrypt & Sign

Click on the left side of the main interface of GProgrammer to open the Encrypt & Sign interface.

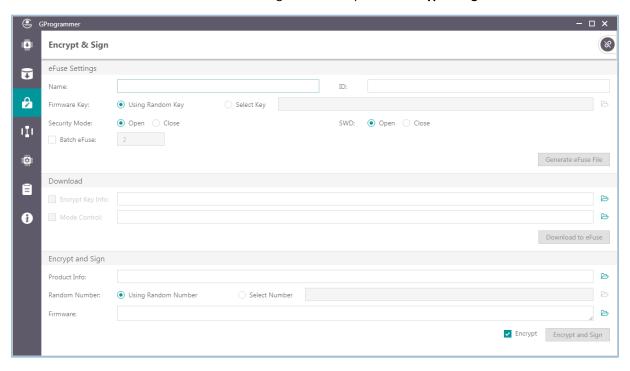


Figure 3-23 GProgrammer Encrypt & Sign interface

The selected SoCs support Security Mode and Non-security Mode. The mode is determined by the security mode of the product written in eFuse. When Security Mode is enabled, only firmware that has been encrypted and signed can be downloaded to Flash memories.

3.7.1 eFuse Settings

eFuse is a one-time programmable (OTP) memory with random access interfaces on SoCs. The eFuse stores product configurations, security mode control information, and keys for encryption and signing.

When using GProgrammer, users can generate eFuse files by specifying product names, IDs, and firmware keys, and by configuring security mode and SWD interfaces.

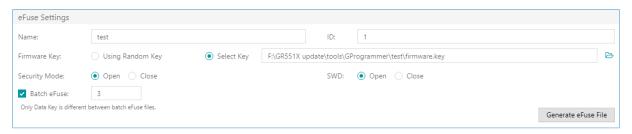


Figure 3-24 Setting eFuse parameters



- Firmware keys can be random keys generated by GProgrammer. Users can also add key files on demand.
- Selecting **Open** for **Security Mode** will enable the security mode, which cannot be disabled after being enabled.
- Selecting **Close** for **SWD** will disable SWD. In this case, developers can upgrade the firmware through DFU.

GProgrammer allows users to generate multiple *Encrypt_key_info.bin* files in batches by checking **Batch eFuse**. The generated files are unique, meeting requirements of scenarios demanding one key for one device. For example, when users input "3" in the **Batch eFuse** box, GProgrammer generates three *Encrypt_key_info.bin* files: *Encrypt_key_info.bin*, 2_*Encrypt_key_info.bin*, and 3_*Encrypt_key_info.bin*.

Generated files are listed in the figure below:

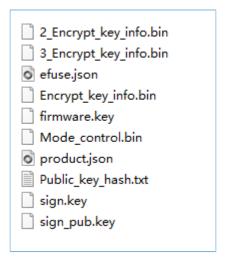


Figure 3-25 Generated files

- *efuse.json*: a temporary file
- Encrypt_key_info.bin, 2_Encrypt_key_info.bin, and 3_Encrypt_key_info.bin: files to be downloaded to eFuse, covering information on products, encryption, and signing. These files shall be downloaded to and stored in eFuse.
- *firmware.key*: a private key for encrypting firmware
- *Mode_control.bin*: an eFuse file covering information on security mode and SWD. This file shall be downloaded to and stored in eFuse.
- *product.json*: a product information file. This file shall be imported to a GProgrammer when encrypting or signing firmware.
- *sign.key*: a private key to generate signatures
- sign_pub.key: a public key to verify signatures
- Public_key_hash.txt: a public key hash file to verify signatures



Please keep the above files properly. These files are required for subsequent **Download to eFuse** and **Encrypt and Sign** operations.

To make files download to eFuse or firmware encryption and signing user-friendly, GProgrammer automatically loads the paths of the *Encrypt_key_info.bin* file and the *Mode_control.bin* file to the **Download** area, and the path of the *product.json* file to the **Product Info** pane in the **Encrypt and Sign** area, as shown in the figure below.

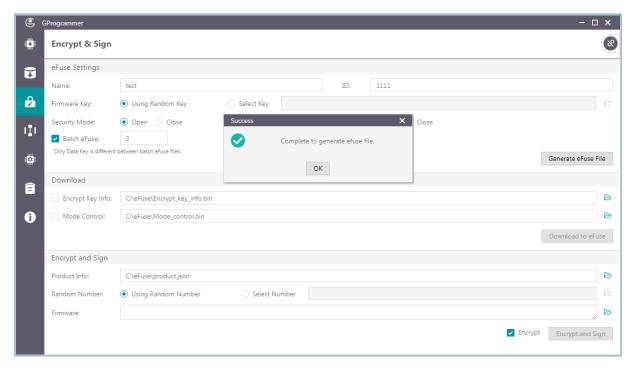


Figure 3-26 Paths for automatically loaded files

Note:

No modification of eFuse-generated files is allowed because any modification may lead to firmware encryption and signing failures.

3.7.2 Download

For users who have clicked **Generate eFuse File** to generate *Encrypt_key_info.bin* and *Mode_control.bin* files in the **eFuse Settings** pane, select **Encrypt Key Info** and **Mode Control** in the **Download** pane, and click **Download to eFuse** to download the files to eFuse.

Otherwise, users need to manually add *Encrypt_key_info.bin* and *Mode_control.bin* files before downloading the files to eFuse.



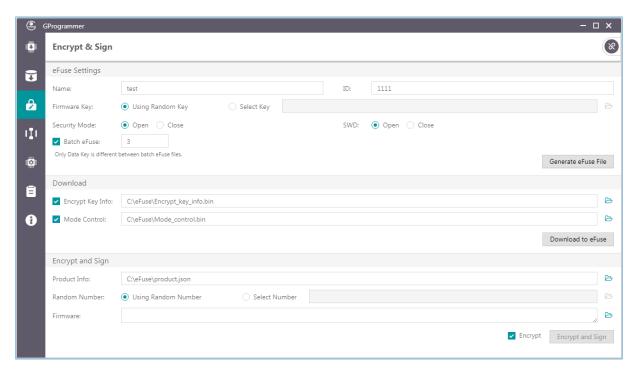


Figure 3-27 Downloading files to eFuse

eFuse information cannot be repeatedly downloaded to firmware.

3.7.3 Encrypt & Sign

GProgrammer allows users to encrypt and sign, or to sign multiple firmware files (HEX/BIN) by using one set of product information (**Product Info**) and one random number (**Random Number**).

- Random Number: If Using Random Number is selected, random numbers automatically generated by software
 will be used for signing. You can also click Select Number to import a .bin file which contains customized
 numbers for signing.
- Firmware: Import unencrypted firmware files in this field. GProgrammer supports importing unencrypted firmware in both .hex and .bin formats and outputting (encrypted and) signed firmware in .bin format. When multiple firmware files are imported, add ";" between file paths, as shown below.



Figure 3-28 Adding more than one firmware file

- Encrypt: To encrypt and sign the firmware, check the Encrypt box, and the button changes from Sign to Encrypt and Sign; to sign the firmware only, clear the Encrypt box, and the button changes back to Sign.
 - Files after being encrypted and signed are generated in BIN formats with details listed below:

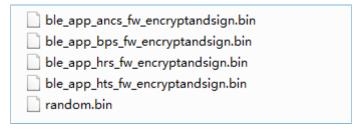


Figure 3-29 GProgrammer-generated files after encryption and signing

Files after being signed are listed below:

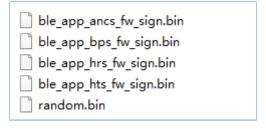


Figure 3-30 GProgrammer-generated files after signing

Note:

The random number generated by GProgrammer is for encryption algorithms. After users perform encryption and signing of firmware files, the *random.bin* file is stored in the same directory as encrypted and signed firmware files. Users can view and add the *random.bin* file to GProgrammer next time they use the random number for firmware encryption and signing.

3.8 eFuse Layout

Click III on the left side of the main interface of GProgrammer to open the **eFuse Layout** interface.



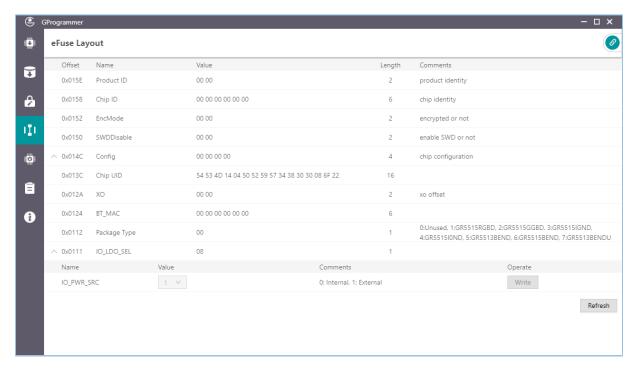


Figure 3-31 eFuse Layout interface

GProgrammer presents users with eFuse layout information: **Offset**, **Value**, **Length**, and **Comments** of fields including but not limited to **Product ID**, **Chip ID**, **EncMode**, **SWDDisable**, **Config**, and **IO_LDO_SEL**. Among them, the **Config** and **IO_LDO_SEL** fields contain multiple bit fields.

Click Refresh to obtain the values of all fields or bit fields.

Click before **Offset** of **Config** or **IO_LDO_SEL** to expand the detailed bits, as shown in the figure below. Click or double-click **Config** or **IO_LDO_SEL** to collapse the detailed bits.

You can change the IO_PWR_SRC value in the IO_LDO_SEL field to set the power source of peripherals.

Note:

You can only change the IO_PWR_SRC value from "0" to "1". The contrary direction is not allowed.



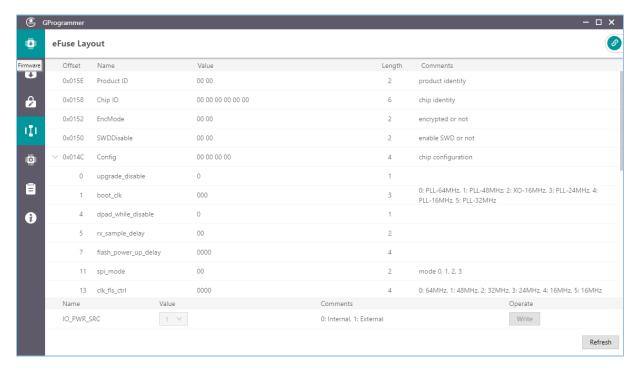


Figure 3-32 Expanded Offset

The fields and bit fields listed in the interface are stored in the *efuse_config.json* file in the config folder. Information stored in eFuse is more than just the listed fields and bit fields.

3.9 Chip Configuration

Click on the left side of the main interface of GProgrammer to open the **Chip Configuration** interface.

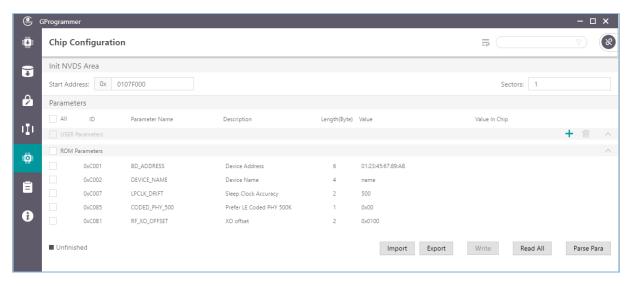


Figure 3-33 GProgrammer Chip Configuration interface



GProgrammer allows users to set the parameters (including **USER Parameters** and **ROM Parameters**) stored in the NVDS area.

- USER Parameters: user-defined parameters that can be added, deleted, and modified
- ROM Parameters: ROM parameters stored on SoCs, which can be modified only by users. Neither parameter
 addition nor deletion is allowed.

Note:

- The default ROM parameters listed in the interface are stored in the *nvds_config.json* file in the config folder. The parameters are not results accessed in real time from the NVDS area. For more information about ROM parameters, see Table 3-6.
- Click = in the upper-right corner of the **Chip Configuration** interface to enable display of complete value contents of a parameter.
- Look up parameters quickly by using the <u>screening</u> sox in the upper-right corner of the interface.

ID **Parameter Name** Description 0xC001 **BD ADDRESS** This parameter sets the Bluetooth device address. 0xC002 DEVICE NAME This parameter sets the device name. 0xC007 LPCLK DRIFT This parameter sets the Sleep Clock Accuracy (SCA); range: 10 ppm to 500 ppm 0xC085 CODED_PHY_500 This parameter sets the default Coded PHY value; Value 0: 125 kbps; Value 1: 500 kbps 0xC0B1 RF_XO_OFFSET This parameter sets the clock calibration byte; range: 0x000 to 0x1FF

Table 3-6 NVDS ROM parameters

3.9.1 Init NVDS Area

Prior to configuring NVDS parameters, users need to specify a start address (4 KB aligned) and the number of occupied sectors in the NVDS area.

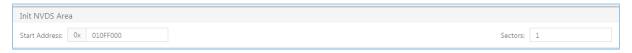


Figure 3-34 Setting the start address and sector quantity in the NVDS area

NVDS initialization fails when the configured NVDS area overlaps with the existing firmware area.



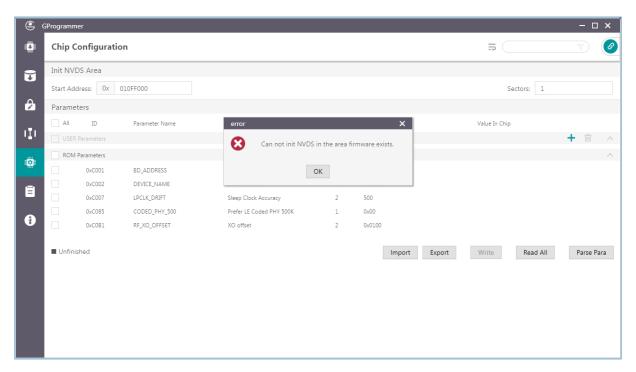


Figure 3-35 NVDS initialization failure

3.9.2 Read All

GProgrammer can read all parameters in the current NVDS area and display them in the Parameters pane.

To prevent operation failures in user applications due to parameter overlapping in the NVDS area, users are recommended to click **Read All** after connecting the target board to the host.

GProgrammer provides three parameter states: **Unfinished**, **Same**, and **Different**, which help you quickly identify the parameter state in the current NVDS. Details are listed below:

- **Unfinished**: Parameters in unfinished state are presented in black. These parameters are either new ones different from the default listed parameters after users click **Read All** (example: 0x4000 in Figure 3-36) or ones that have been listed in the NVDS area but with a different parameter length (example: 0x4001 in Figure 3-36).
- Same: Parameters in same state are presented in green, indicating the parameters already exist in the NVDS area and have the same length and value as those in the default list (example: 0x4002 in Figure 3-36)
- **Different**: Parameters in different state are presented in orange, indicating the parameters already exist in the NVDS area and have the same length as but a different value from default listed parameters (example: 0x4003 in Figure 3-36)



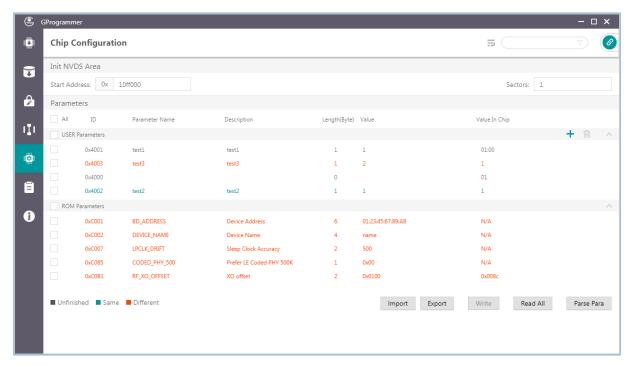


Figure 3-36 Read All interface

3.9.3 Write

Select parameters to be written to NVDS, and click Write.

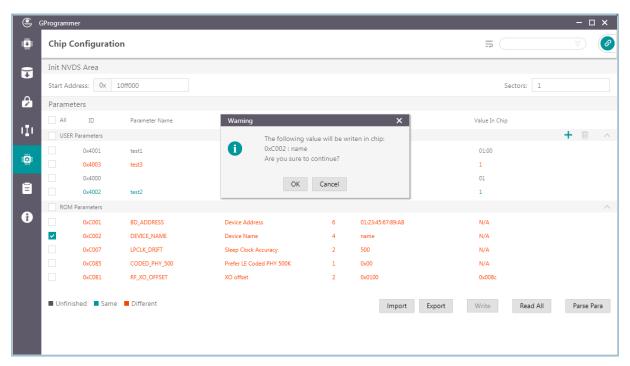


Figure 3-37 Write parameters to NVDS



△Tip:

- Parameters in unfinished state cannot be written to NVDS directly.
- You can select more than one parameter to implement a batch write.
- When an unfinished parameter is selected, **Write** is unavailable.

3.9.4 Add a User Parameter

Follow the steps below to add a user parameter to NVDS.

- 1. Click + to open the Add USER Parameter window.
- 2. Specify the **ID**, **Parameter Name**, **Description**, **Type**, **Length(Byte)**, **Value**, and data presentation format (**dec** or **hex**).

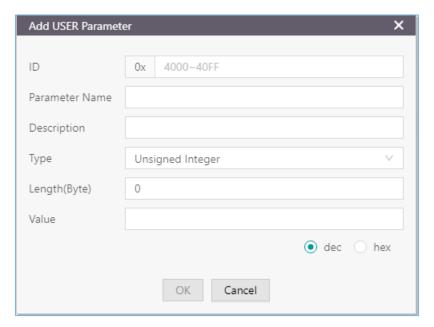


Figure 3-38 Adding a user parameter to NVDS

3. Click **OK** to complete the adding.



- You cannot input a parameter ID that is identical with those listed in the **Parameters** pane. Otherwise, a warning dialog box pops up, as shown in Figure 3-39.
- If the added ID is different from those existing in the NVDS, the added parameter is directly written to NVDS.
- If the ID of a to-be-added parameter already exists in NVDS and the two parameters with the same ID are of the same length, the to-be-added parameter is written to NVDS.
- If the ID of a to-be-added parameter already exists in NVDS but the two parameters with the same ID are of different lengths, the to-be-added parameter is not written to NVDS. Users need to modify the parameter length before writing it to NVDS.

The default range of the ID is 0x4000–0x40FF. You can modify the valid range to 0x4000–0x7FFF in *nvds_common_config.json*. Note that if the range is too large, the parameter read duration will be affected.

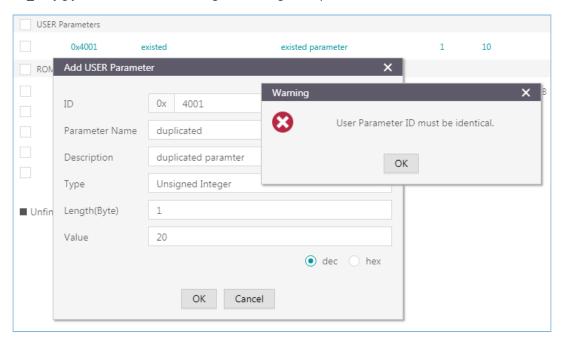


Figure 3-39 Failure to add a user parameter due to an identical parameter ID

3.9.5 Modify NVDS Parameters

Users can modify both the **USER Parameters** and **ROM Parameters**.

ROM Parameters: You can modify the **Parameter Name**, **Description**, and **Value** of a ROM parameter. The modification on a parameter value does not lead to changes in the parameter length (except varying-length character strings).

USER Parameters: For user parameters in same and different states, the **Parameter Name**, **Description**, and **Value** can be modified. For user parameters in unfinished state, the **Type** and **Length(Byte)** can be modified.

Double-click a parameter to be modified, and edit the parameter information in the pop-up window. Click **OK** to write the modifications into NVDS.



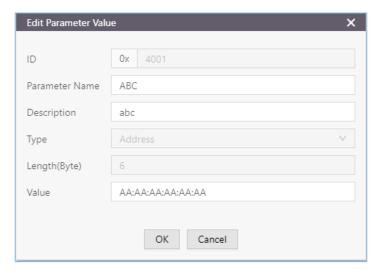


Figure 3-40 Edit Parameter Value window

Parameters in unfinished state with a modified length that is different from that in the NVDS remain unfinished. Such parameters cannot be automatically written into the NVDS.

3.9.6 Remove a User Parameter

Users can remove user parameters only.

Select a parameter to be removed, and click Delete to remove the parameter from the NVDS.

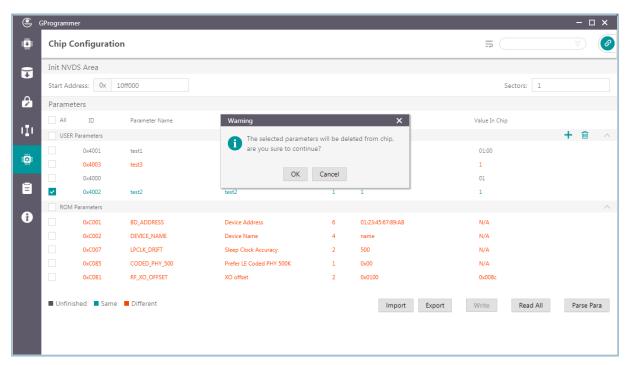


Figure 3-41 Removing a parameter



Tip:

- You can select more than one parameter and click Delete to implement a batch removal.
- When a ROM parameter is selected, **Remove** is unavailable (Delete is in grey).

3.9.7 Import and Export

GProgrammer allows users to export the selected parameter data (**Parameter Name**, **Description**, **Length**, and **Value**) to a local JSON configuration file and import local JSON configuration files to GProgrammer.

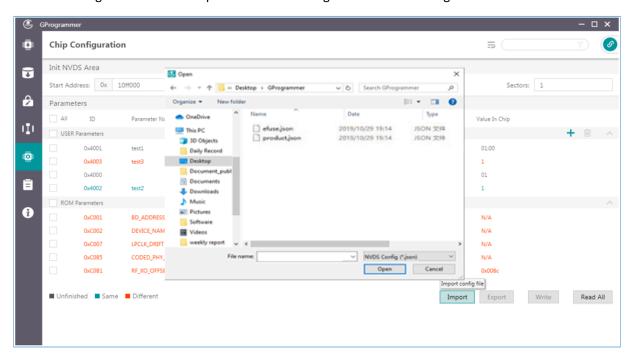


Figure 3-42 Importing local JSON configuration files to GProgrammer

Tip:

- Parameters in the imported JSON files replace all those listed in the **Parameters** pane.
- Export modified parameter data to a local JSON file to prevent repeated modification.
- **Export** is unavailable when parameters in unfinished state exist.

3.9.8 Parse Data in the NVDS Area

GProgrammer provides users with data parsing functionality **Parse Para**. It supports parsing data read from the NVDS area or loaded from a local data file.



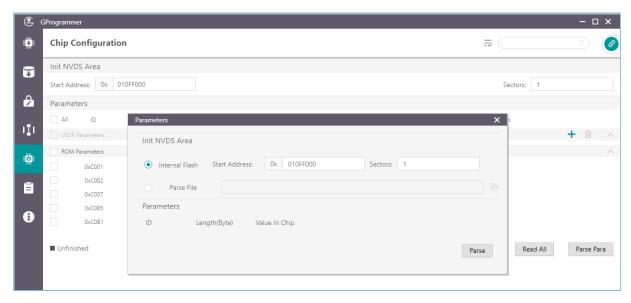


Figure 3-43 Configuring to-be-parsed data

- To parse data read from the NVDS area, choose **Internal Flash**, and then set the start address of the NVDS area (4 KB aligned) as well as the number of occupied sector(s).
 - The area shall be in the range configured for NVDS parameters, with start address and the number of occupied sector(s) as detailed in "Section 3.9.1 Init NVDS Area". Otherwise, data parsing fails.
- To parse data loaded from a local data file, choose **Parse File**, and then select an exported NVDS data file locally.

- This functionality is applicable to non-encrypted data only.
- When parsing starts by clicking **Parse**, the sequence of data parsing and result display is identical with that of Flash memory data. **Value in Chip** is in little-endian mode.

3.10 Device Log

Click on the left side of the main interface of GProgrammer to open the **Device Log** interface.



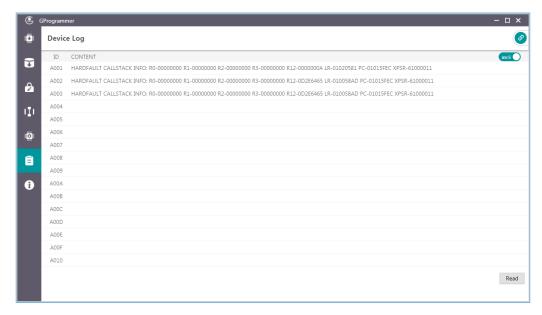


Figure 3-44 Device Log interface

Users can view device logs, mainly error information during SoC running, on GProgrammer. Click **Read** to retrieve the device logs.

Note:

Prior to viewing device logs, make sure you have performed the following:

- Write device error code into the NVDS by using the application firmware (NVDS ID: A001–A010).
- Initialize the NVDS area correctly on GProgrammer, and the initialization result is identical with the value defined in the application firmware.

In the interface, click or in the upper-right corner to switch the mode in displaying device logs between ASCII and stream.

- Career in the device logs are displayed by ASCII character as shown in Figure 3-45.
- The device logs are displayed by byte stream as shown in Figure 3-46.

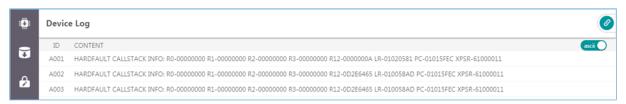


Figure 3-45 Device logs in ASCII characters



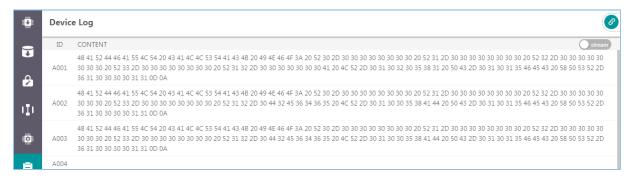


Figure 3-46 Device logs in byte streams

3.11 Command-line Programs

Goodix provides two command-line programs in the GProgrammer installation directory: *GR5xxx_console.exe* and *GR5xxx_encrypt_signature.exe*.

Note:

GR5xxx represents the name of SoC series.

- GR5xxx_console.exe supports firmware download and Flash programming in SoCs in a command-line interface.
- GR5xxx_encrypt_signature.exe supports firmware encryption and (or) signing in a command-line interface.

3.11.1 GR5xxx_console.exe

Follow the steps below to run GR5xxx_console.exe:

- 1. Open the **Command Prompt** window from the **Start** menu or by entering **cmd** in the **Run** window.
- 2. Navigate to the GProgrammer installation directory by using cd command.
- 3. Type the GR5xxx_console.exe command to complete corresponding operations. The details about the command are shown in Table 3-7.

Table 3-7 GR5xxx_console supported commands

Command	Functional Description	Command Format and Parameter Description	Remarks
program	Programs firmware files to internal SoC Flash memories.	program <firmware file="" path=""> <run immediately:y="" n="" =""> <flash address(hex)="" start=""> <flash size=""> <product type=""> <s n(optional)=""> Parameter description: • <firmware file="" path="">: It sets the path of the to-bedownloaded firmware file. • <run immediately:y="" n="" ="">: It decides on whether to run the firmware immediately after downloading.</run></firmware></s></product></flash></flash></run></firmware>	The following parameters apply to all commands: • <flash address(hex)="" start="">: It sets the start address in the Flash memories to which firmware files are downloaded. Value:</flash>



Command	Functional Description	Command Format and Parameter Description	Remarks
erase	Erases Flash memory data within an SoC based on a specified address range.	erase <start address<hex="">> <end address<hex="">><force bootinfo:y="" conflict="" erase="" firmware="" n="" when="" with="" =""> <flash address(hex)="" start=""> <flash size=""> <product type=""> <s n(optional)=""> Parameter description: • <start address<(hex)="">>: It represents the start address of the storage area to be erased (in hexadecimal). • <end address<(hex)="">>: It represents the end address of the storage area to be erased (in hexadecimal). • <force bootinfo:y="" conflict="" erase="" firmware="" n="" when="" with="" ="">: This parameter decides whether to forcibly erase the flash memory data when its address</force></end></start></s></product></flash></flash></force></end></start>	 GR5526 <flash size="">: It indicates the Flash size (unit: KB) of the selected SoC. For value details, see the Flash column in Figure 3-3. Note: For SoCs with 0 KB Flash, the external Flash size applies.</flash> <pre> <pre> <pre> <pre> <pre> <pre></pre></pre></pre></pre></pre></pre>
eraseall	Erases all Flash memory data within an SoC.	conflicts with that of firmware, Boot info, or NVDS. eraseall <pre>croduct type> <s n(optional)=""></s></pre>	
download	Downloads data files to internal SoC Flash memories.	download <data file="" path=""> <start address<(hex)="">> <force bootinfo:y="" conflict="" download="" firmware="" n="" when="" with="" =""> <flash address(hex)="" start=""> <flash size=""> <product type=""> <s n(optional)=""> Parameter description:</s></product></flash></flash></force></start></data>	
writeefuse	Writes Encrypt Key Info and Mode Control files to eFuse.	writeefuse <encrypt file="" info="" key="" path=""> <mode control="" file="" path=""> <product type=""> <s n(optional)=""> Parameter description: • <encrypt file="" info="" key="" path="">: It sets the path of Encrypt Key Info file. • <mode control="" file="" path="">: It sets the path of Mode Control file. reset <product type=""> <s n(optional)=""></s></product></mode></encrypt></s></product></mode></encrypt>	PC is connected with multiple DUTs.



Command	Functional Description	Command Format and Parameter Description	Remarks
generate	Converts firmware files into BIN files that can be used by the SoC	generate <input file="" firmware="" path=""/> <output file="" firmware="" path=""> <flash address(hex)="" start=""> <flash size=""> <product type=""> Parameter description: • <input file="" firmware="" path=""/>: It indicates the path of an imported file (HEX/BIN file generated via integrated development environment tools). • <output file="" firmware="" path="">: It indicates the output file of an exported file.</output></product></flash></flash></output>	
device	Obtains J-Link device information, such as device name and serial number.	 device <display count(optional)=""></display> Parameter description: <display count(optional)="">: It sets the number of device information parameters to be displayed.</display> 	
load	Loads firmware, such as Flash and RAM firmware.	load <firmware file="" path=""> <erase type=""> <run immediately:y="" n="" =""> <s n(optional)=""> Parameter description: • <firmware file="" path="">: It sets the path of the to-be- downloaded firmware file. • <erase type="">: It sets the type to erase Flash, with the following options: • sector: Erases Flash space occupied by boot info and firmware. • chip: Erases all Flash spaces. • none: Erases the firmware space only. • <run immediately:y="" n="" ="">: It decides on whether to run the firmware immediately after downloading.</run></erase></firmware></s></run></erase></firmware>	
dump	Dumps data from internal Flash.	<pre>dump <start address(hex)=""> <size(hex)> <file path=""> <s n(optional)=""></s></file></size(hex)></start></pre>	
help	Displays all help information.	help	

Take GR551x SoC as an example. The code below shows how to use the program command to download a firmware file to SoC Flash memories and run the firmware immediately after downloading. Command line:

```
GR5xxx_console.exe program "D:/test/test_fw.bin" y "0x01000000" 1024 0
```

The parameter descriptions are listed below:

• "D:/test/test_fw.bin": It indicates the path for the to-be-downloaded firmware BIN file



• "0x01000000" 1024 0: It represents the start address in Flash to which the firmware is downloaded (0x01000000), the Flash size (1024 KB), and SoC model (GR551x) respectively.

The downloading progress is displayed in real time during executing the program command.



You cannot operate GR5xxx_console.exe while GProgrammer is running.

3.11.2 GR5xxx_encrypt_signature.exe

Follow the steps below to run *GR5xxx_encrypt_signature.exe*:

- 1. Open the **Command Prompt** window from the **Start** menu or by entering **cmd** in the **Run** window.
- 2. Navigate to the GProgrammer installation directory by using cd command.
- 3. Type GR5xxx_encrypt_signature.exe --parameter to complete corresponding operations.

 For most frequently used parameters, see Table 3-8. To view all parameters, enter GR5xxx_encrypt_signat ure.exe --help.

Table 3-8 Frequently used parameters for GR5xxx_encrypt_signature.exe

Parameter	Description	Remarks
operation	Indicates the operation type. Options:encryptandsign: Encrypt and sign firmware.sign: Sign firmware only	
firmware_key	Shows the directory of <i>firmware.key</i> , which is used for firmware encryption and signing, or signing only.	
signature_key	Shows the directory of <i>sign.key</i> , which is used for firmware encryption and signing, or signing only.	The directories correspond to the paths you have set when you click Generate eFuse File in "Section 3.7.1 eFuse Settings".
signature_pub_key	Shows the directory of <i>sign_pub.key</i> , which is used for firmware encryption and signing, or signing only.	
product_json_path	Shows the directory of <i>product.json</i> , which is used for firmware encryption and signing, or signing only.	
rand_number	Shows the directory of <i>random.bin</i> , which is used for firmware encryption and signing, or signing only.	
ori_firmware	Shows the directory that saves the firmware before encryption and signing, or signing only.	
output	Shows the directory that saves the firmware after encryption and signing, or signing only.	
random_output	Shows the directory that saves the random numbers used for firmware encryption and signing, or signing only.	



Parameter	Description	Remarks
	Sets the start address in the Flash memories to which firmware files are	
haan addu	downloaded. Value:	
base_addr	0x01000000: for GR551x	
	0x00200000: for GR5526	
	Indicates the Flash size (unit: KB) of the selected SoC. For value details,	
flash_size	see the Flash column in Figure 3-3.	
110311_3126	Note:	
	For SoCs with 0 KB Flash, the external Flash size applies.	
	Indicates the SoC series. Valid value and description:	
product_type	• 0: GR551x	
	• 1: GR5526	
help	Displays help information.	

Take GR551x SoC as an example. The code below shows how to encrypt and sign firmware by using GR5xxx encrypt signature.exe:

```
GR5xxx_encrypt_signature.exe --operation="encryptandsign" --firmware_key="D:/test/eFuse/firmware.key" --signature_key="D:/test/eFuse/sign.key" --signature_pub_key="D:/test/eFuse/sign_pub.key" --product_json_path="D:/test/eFuse/product.json" --rand_number="D:/test/eFuse/random.bin" --ori_firmware="D:/test/firmware/test_fw.bin" --output="D:/test/firmware_encryptAndSign/test_fw_encryptAndSign.bin" --random_output="D:/test/firmware_encryptAndSign/random.bin" --base_addr="0x01000000" --flash_size="1024" --product_type="0"
```

In the code snippet above, the **D:/test/eFuse/** directories show the user-defined folders where files are saved after users click **Generate eFuse File**, as described in "Section 3.7.1 eFuse Settings". For descriptions of other parameter, see Table 3-8.

- --ori_firmware="D:/test/firmware/test_fw.bin": the directory of the firmware before any operation
- --output="D:/test/firmware_encryptAndSign/test_fw_encryptAndSign.bin": the directory of the encrypted and signed firmware
- --base_addr="0x01000000" --flash_size="1024" --product_type="0": the start address in Flash to which the firmware is downloaded (0x01000000), the Flash size (1024 KB), and SoC model (GR551x) respectively
- --rand_number: Refer to "Section 3.7.3 Encrypt & Sign" for specific descriptions on "Random Number".

Run the command to encrypt and sign the firmware.

3.11.3 User-defined Windows Scripts

Users can also write custom scripts on Windows to call command-line programs. Two sample script files are provided in the GR5xxx_script file in the GProgrammer installation directory.



GR5xxx represents the name of SoC series.

encryptAndSignatureFirmware.bat can encrypt and sign firmware with firmware_origin.bin in the same directory and the files saved in the eFuse directory. The encrypted and signed firmware is available in firmware_encryptAndSign.bin.

program_Firmware_EncryptAndSign.bat can erase all internal Flash memories, and download the firmware firmware_encryptAndSign\firmware_encryptAndSign.bin and save the firmware file in the internal Flash memories.

3.12 Help

Click on the left side of the main interface of GProgrammer to open the **Help** interface. GProgrammer offers help and support to users.

About GProgrammer

This section provides version information and features of GProgrammer.

Feedback

If you have any questions or suggestions, please log in to <u>Developer Community</u> for feedback.

About Goodix

For more information, please visit Goodix official website: www.goodix.com.