

Cortex-M Offline Programmer II

user

manual

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declaration Ming Dynasty (1368-1644)

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1 summary

1.1 skim through

CM PGM (Cortex-M Programmer) is an offline programmer for XHSC Cortex-M series MCUs, which supports all Cortex-M series MCU products of XHSC. The purpose is to provide users with a small, portable, safe, reliable and easy-to-operate offline programming tool and design solution for small batches, and currently provides two versions, the standard version and the version with screen, for users to choose.

The CM PGM offline programming system is shown in Figure 1-1. The offline programmer consists of the configuration software ConfigTool.exe and the PGM main board.

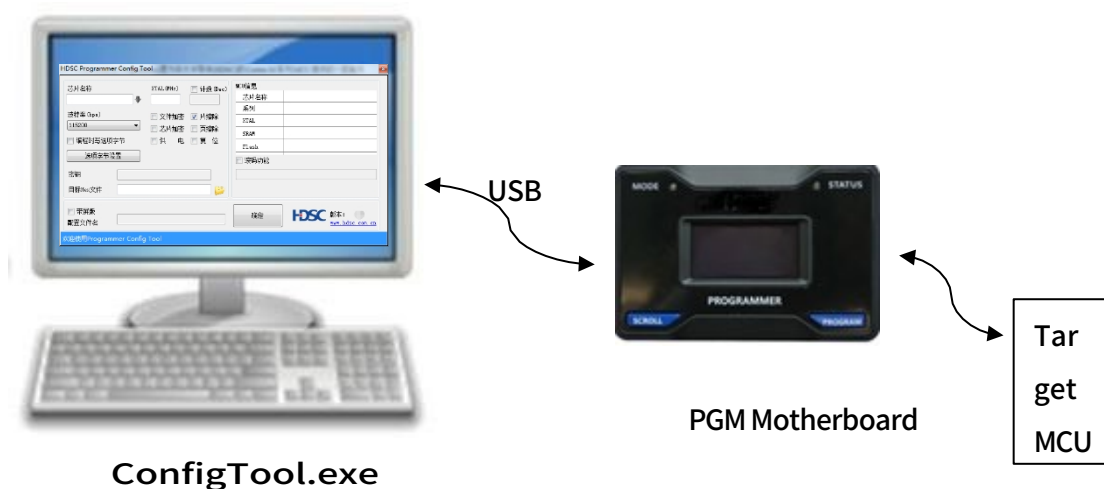


Figure 1-1 Offline Programming System

Configuration software (ConfigTool.exe) generates configuration files, PGM motherboard code files. The USB interface supplies power to the PGM motherboard, and the user can copy the necessary files for programming to the PGM via USB.

After the file copying is completed, the user can switch the programming mode and start the programming function through the keys on the PGM main board. The functions supported by the offline programmer are as follows:

- Programming mode (UART/ SWD) selectable
- LEDs and OLED screen (only supported in version with screen) indicate programming mode and programming status.
- The configuration tool contains the following configurable features:
 - Target chip external crystal and internal clock configurable (supported by some series)

- counting function
- Target chip power supply selectable function
- File encryption function
- Target chip encryption function

- Reset function (supported by some series)
- Rolling Code Function
- Chip Erase/Page Erase Configuration
- Flash Write Protect (supported by some series)
- USART full-duplex/half-duplex mode configuration (supported by some series)
- Buzzer function
- Speed Selection
- Multi-file selection and programming status display (supported by screened versions only)
- self-escalation
 - Automatic detection of firmware version upgrades
 - Motherboard Firmware Forced Upgrade at the Touch of a Button

1.2 Appearance and Interface

1.2.1 Offline Programmer

The appearance and functional components of the Offline Programmer are shown in Figure 1-2:

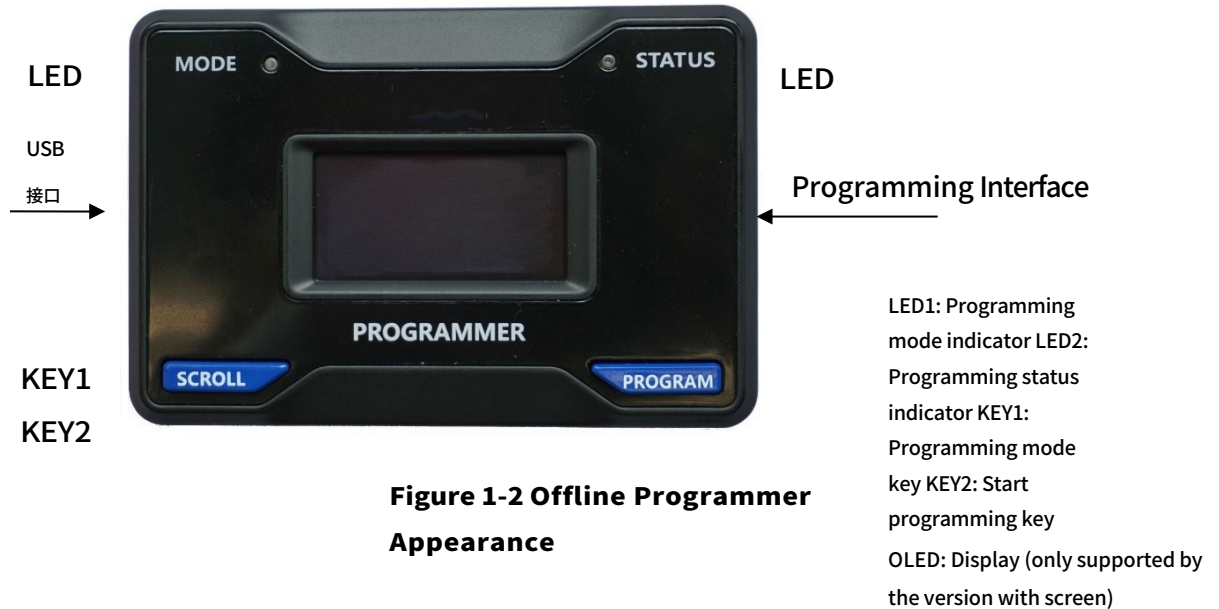


Figure 1-2 Offline Programmer Appearance

The USB connector is a standard Type B connector.

The programming interface is connected to the target MCU and the interface is assigned as shown below:

V21.

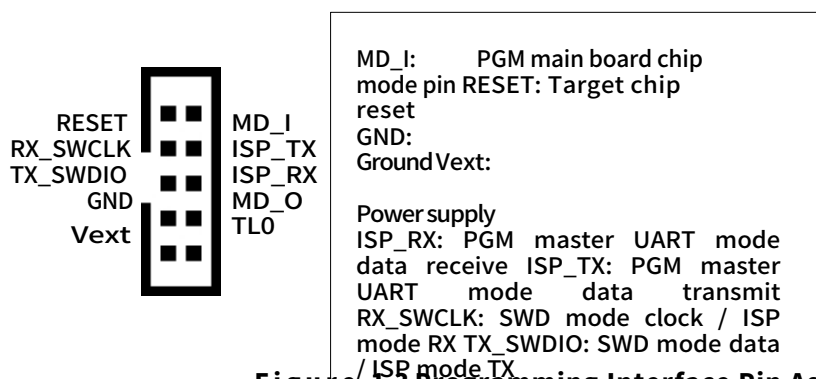


Figure 1-3 Programming Interface Pin Assignment

1.3 Offline Programmer Features

1.3.1 Programming Mode

The offline programmer supports two programming modes: UART programming mode and SWD programming mode. LED1 color indicates the current programming mode, green light for SWD mode and orange light for UART mode. The offline programmer with screen version also shows the current programming mode on the display, please refer to the icon description of the version with screen for details.

1.3.2 keystrokes

The two versions of the Offline Programmer have different key definitions.

1. Standard Edition:

KEY1 is the Programming Mode button, a short press (approx. 0.5 sec.) of KEY1 causes the PGM main board to switch between UART mode and SWD mode. KEY2 is the Start Programming button, a short press (approx. 0.5 sec.) of KEY2 starts the programming function once.

Attention:

- The keys are invalid when the remaining count is 0 and when the programmer is programming.

2. With screen version:

The function of KEY1 and KEY2 on each page is indicated by the corresponding position on the display.

1.3.3 LED indicator

LED1 is the Programming Mode Indicator and the display status is shown in Table 1-1:

Table 1-1 LED1 Status

LED1 Color	current state
greener	SWD Programming Mode
orange (color)	UART programming modes (including single and dual wire)

LED2 is the programming status indicator, various colors indicate the status as shown in Table 1-2:

Table 1-2 LED2 Status

greener	red (color)	orange (color)	Offline Programmer Status
Flash Mob ①	go out (of a fire etc)	go out (of a fire etc)	Programming in progress

resounding	go out (of a fire etc)	go out (of a fire etc)	Programming Success/Idle
Slow flash ②	go out (of a fire etc)	go out (of a fire etc)	Idle, but the number of remaining sub-programs is less than 50.
go out (of a fire etc)	flash	go out (of a fire etc)	The number of programmed cycles remaining is 0
go out (of a fire etc)	go out (of a fire etc)	resounding	Programming Failure
go out (of a fire etc)	resounding	slow flash	Programming failure with less than 50 programs remaining

Note ①: Fast flash, frequency about 16Hz

Note ②: Slow flash, frequency 1Hz

1.3.4 XTAL Support

HC32F14 and HC32M14 series target boards can be programmed with different external crystal or internal RC. The programmer with screen version displays the current configured clock frequency on the programming page, please refer to the version with screen [Icon Description] for details.

1.3.5 electricity supply

The target MCU system can either be externally powered or powered using the PGM motherboard.

1. Configure the power supply function, i.e., the PGM motherboard supplies power to the target chip.

The PGM motherboard can provide 3.3V, 100mA maximum power to the target board.

The programmer with screen version displays the current power supply configuration on the programming page, please refer to the version with screen [Icon Description] for details.

2. If power supply is not configured, external power supply is required for the target system-on-chip.

Complete the hardware connection according to the programming mode in the [Programming Mode] section, and then supply power to the target chip.

Attention:

- The Vext pin must be connected to the target board whether powered or unpowered mode is selected.

1.3.6 reckoning

Limit Programming Count Configurable Function. You can configure whether to use the counting function or not, and the maximum configurable number of times is 4294967294. When the programmer counting function is enabled, and the number of times is not enough and the number of times is 0, LED2 will show the corresponding prompt message as shown in Table 3. The programmer with screen version shows the current count information in the display, please refer to the version with screen [Icon Description] for details.

1.3.7 surety

Provides functions such as file encryption and chip encryption, as detailed below:

1. File encryption function (supported by all series)

When enabled, the offline programming system configuration software ConfigTool.exe performs AES (128-bit, ECB mode) encryption of the target binary file.

2. Chip encryption function has different settings for different chips. For details, please refer to the related documents of the chip.

3. The programmer with screen version displays the current file encryption and chip encryption configurations on the programming page, please refer to the version with screen [Icon Description] for details.

1.3.8 reset (a dislocated joint, an electronic device etc)

You can configure whether to reset the target MCU after successful programming. The programmer with screen version displays the current reset configuration in the programming page, please refer to the version with screen [Icon Description] for details.

Attention:

- The reset function in UART mode is invalid.

1.3.9 Rolling Code Function

Provides roll code function. You can set the roll code address, initial roll code value, and roll code step. The programmer with screen version displays the current roll code value in the programming interface, please refer to the version with screen [Icon Description] for details.

1.3.10 Chip Erase/Page Erase Configuration

You can select the way to erase before programming in the interface. When slice erase is selected, full slice erase is used; when page erase is selected, the programmer erases the corresponding area according to the size of the programmed file.

Attention:

- If both the roll code function and the page erase function are enabled, and the roll code address is outside the code file address range, the page where the roll code is located is also at risk of being erased.

1.3.11 Flash Write Protect

Some chips support flash write-protect function setting. After setting and programming successfully, the protected area cannot be erased or written when the next code is run.

The above 1.3.4 to 1.3.11 are the configurable functions of the offline programmer, and the detailed configuration methods are shown in the detailed configuration steps in the [Operation Procedures] section.

1.3.12 Firmware self-upgrade

Provides CM PGM

motherboard firmware upgrade

function. Two firmware upgrade

methods are currently available:

1. Firmware self-upgrade

After importing the file into the tool, re-power it up. The system will automatically determine the consistency between the existing firmware and the firmware image in the file. If not, the tool firmware will be automatically upgraded to the firmware image in the file.

2. mandatory upgrade

By entering the upgrade mode by keystroke, the firmware in the tool will be forced to upgrade to the firmware image in the file.

Attention:

- A mandatory upgrade is required after changing the configuration of Rolling Code, Count, Encryption Key, etc.

1.4 version with screen

1.4.1 Interface switching

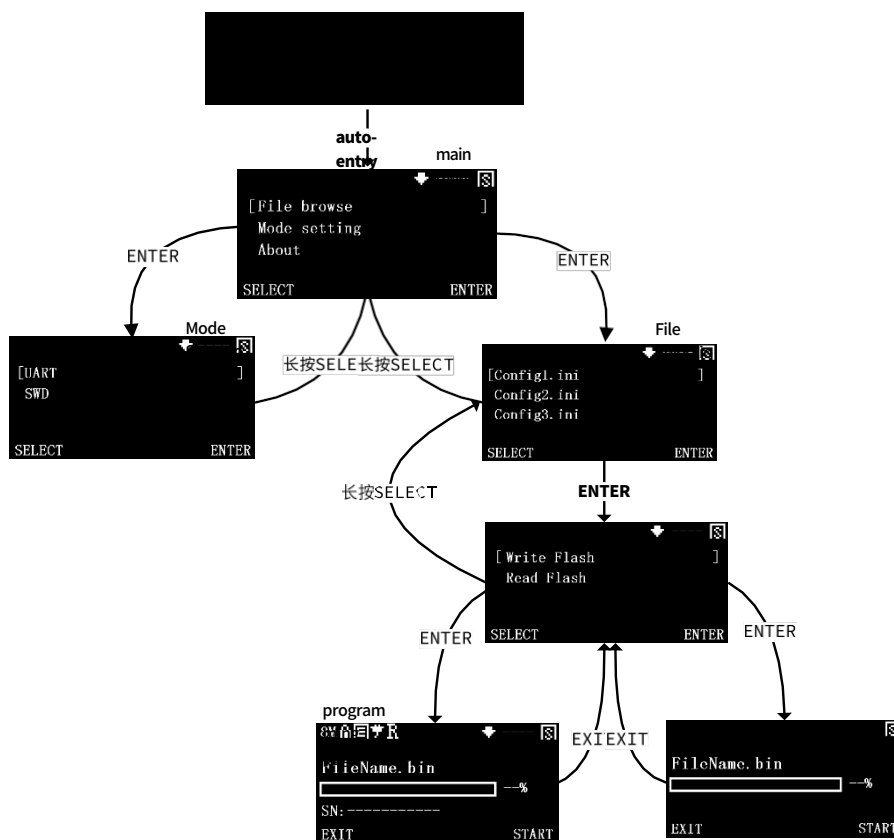






Figure 1-4 Switching Programs

1.4.2 Icon Description






In addition to the power-up page, the icon in the upper right corner of the screen indicates the programmer status as shown in Table 1-3.

Table 1-3 Status Icons for Screen Version

 	"-----" indicates that the download limit function is not enabled; The number indicates the number of downloads remaining for this programmer.
	"S" indicates that the SWD programming mode is currently selected; "U" indicates that UART programming mode is currently selected.
	"-----" indicates that the code rolling function is not enabled; The number indicates the current roll code value.

The icon in the upper left corner of the programming page screen indicates the configuration information for the currently selected profile as shown in Table 1-4.

Table 1-4 Configuration Information Icons for Screened Version

 et al. (and other authors)	Indicates that the clock frequency is selected.
	Indicates that the chip encryption function is enabled.
	Indicates that the target binary is AES encrypted.
	Indicates that the target board power supply function is enabled.
	Indicates that the target board reset function is enabled.

2 Offline Programming System Configuration Software

2.1 Driver Installation

Microsoft.NET Framework v4.0 is required to run this software.

Check whether Framework 4.0 exists in

"C:\Windows\Microsoft.NET\Framework64" as shown below:

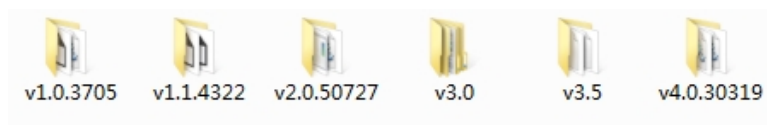


Figure 2-1 Framework 4.0

If the operating system is not installed, please go to the Microsoft official website to download and select the appropriate version to download.

2.2 Configuration Software Introduction

The root directory of this software is (EXE)XHSC Programmer Config Tool_VX.X, the contents of the folder are shown in Figure 2-2. The ConfigTool.exe is an executable file, the Config folder contains the configuration files of the software, the PGMFile folder contains the CM PGM firmware, the RamCode folder stores the RamCode of the target chip, and the User Data stores the programming files generated by the configuration software.

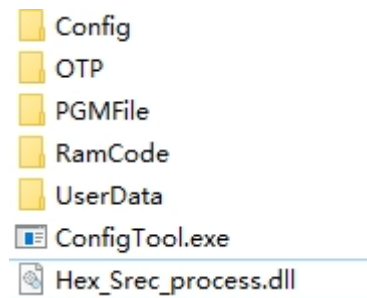


Figure 2-2 Configuration Software Directory Structure

After the user runs ConfigTool.exe, the files in the folder User Data may be generated as shown in Table 2-1.

Table 2-1 Generating Files

filename	descriptive
PGMKEY.bin	Converted PGM code file. This file can be deleted after the tool is upgraded
***. config	Configuration file containing programming configuration information and user program binaries

Double-click "ConfigTool.exe" to open the software, the software interface as shown in Figure 2-3:



Figure 2-3 Software Interface

Chip Name: Set the target MCU model.

XTAL: Configure the external crystal frequency or internal high-speed clock of target MCU. **Baud Rate:** Configure the baud rate of UART communication between PGM board and target board. **Count:** Set the function of programming times.

File Encryption: Configure the encryption function of the target file, if you enable the encryption function, you need to set the key.

Key: Enter the key for file encryption.

Chip Encryption: Configure the target chip encryption function.

Power Supply: Select whether or not to allow the PGM board to supply power to the target board. **Slice Erase/Page Erase:** Configure the Flash erase mode when programming. **Reset:** Select whether to reset the target MCU after successful programming.

Target Hex File: Select the file that needs to be programmed for the target board. **MCU**

Information: Display the currently selected MCU information.

Rolling code function: Configure the target chip rolling code function.

Option Byte Setting/Write Option Byte during Programming: Special Byte Write Function, there are certain series of Flash Write Protect function at present.

With Screen Version and Configuration File Name: Optional feature when using the Offline Programmer with Screen Version and needing to generate a configuration file with a specified file name. **Low Speed Mode:** SWD uses low speed mode.

Buzzer Tip Enable: enables the buzzer.

Attachment: A bin file can be attached to burn.

2.3 procedure

The following is the procedure for configuring the software using the MCU models HC32L136X8/ HC32L130X8 as an example, where 2.3.1 to 2.3.5 are shown, 2.3.15 is a required step and 2.3.6 to 2.3.14 are optional configuration steps.

2.3.1 Double-click to open ConfigTool.exe software

2.3.2 Configuration Target MCU Model

If you select MCU model HC32L136X8/ HC32L130X8, the selected MCU information appears in the right MCU information column as shown in Figure 2-4.

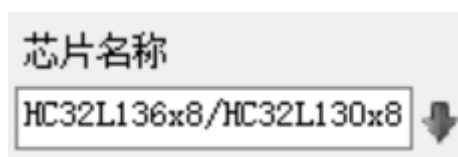


Figure 2-4 Selecting the Chip Model

2.3.3 Configuring the hardware environmen t

HC32L136X8/ HC32L130X8 series set XTAL to 0M, independent of the hardware environment. (Except HC32F14X series, this item is defaulted to 0.)

Sets whether the target board will use the PGM main board to power the target board or use the target board's self-power supply. In this example, the PGM motherboard is selected to supply power.

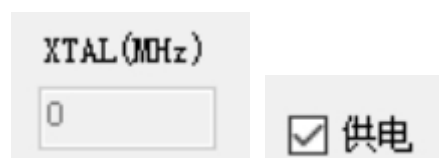
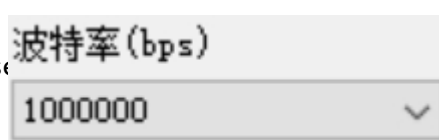


Figure 2-5 Configuring the Hardware Environment

2.3.4 Setting the baud rate

Set the communication baud rate, in this example it is set to 1000000, in case of good communication, it is recommended to choose the highest baud rate to get the best performance.



2.3.5 Setting the target file

Select the file that needs to be programmed for the target MCU, the supported formats for the target file are .srec, hex, bin. bin file format default programming address is Flash base address.



Figure 2-7 Setting the Target Hex File

2.3.6 Setting the

Erase

Method

By default, the software selects the Slice Erase method. If you only need to erase the area where the code is located when programming, then select the page erase method.

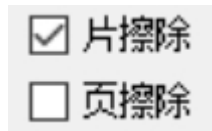


Figure 2-8 Erase Method Setting

2.3.7 Setting

the

reset

Select the Reset checkbox if you need to reset the target board after successful programming.



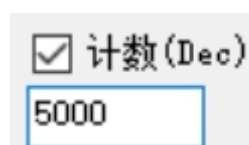
Figure 2-9 Reset Function Setting

2.3.8 Setting the

counting

function

For the count limit function, check the Count (Dec) checkbox and set a count less than or equal to 4294967294.



settings

2.3.9 encrypti

on

Chip encryption restricts access to the contents of the customer chip's Flash. Different series of chips have different encryption settings.

The PGM tool also provides file encryption to prevent file transfers from being stolen. You can set your own key and bind it to the specified programmer hardware. When the "File Encryption" function is selected, "Chip Encryption" is automatically enabled.

Attention:

- For chips other than the HC32F4XX series, after encryption, if you need to program again, you must use the UART mode.
- The number of encryption times for HC32X7X and HC32X9X series chips is limited to 64. After 64 times, decryption is not possible.
- The key supports ASCII strings in the range of 2 to 16.

- Chip encryption settings vary greatly from one series of chips to another, so we recommend that you consult our FAE or other technical interface for details.

Figure 2-11 Encryption Settings

Figure 2-11 Encryption Settings

2.3.10 Configuration file name settings

If you are using a screened version of the Offline Programmer, select the "Screened Version" checkbox and enter the name of the configuration file to be generated in the "Configuration File Name" text box.

Attention:

- Do not select this item for the screenless version of the programmer.

Figure 2-12 Configuration File Name Settings

Figure 2-12 Configuration File Name Settings

2.3.11 Setting the Rolling Code Function

If you need to set the roll code function, check the "Roll Code Function" check box and set the roll code parameters. Rolling code parameters include rolling code address, rolling code step length and rolling code initial value, separated by semicolon. The roll code address is 0x1000, the roll code step is 1, and the initial value is 0.

Figure 2-13 Rolling Code Function Settings

Attent

ion:

- Use of the roll code feature is limited to one profile.

- The address in the roll code parameter should be hexadecimal, the step size can be positive or negative, the initial value of the roll code is an unsigned number, and the range is (0~4294967295)

2.3.12 data encryption

If you select HC32F460 series chip, you can configure data encryption disorder function. Select "Data Encryption" and click the button "Data Encryption Setting" to set the area to be encrypted.

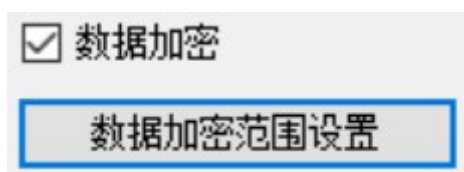


Figure 2-14 Data Encryption

2.3.13 Setting the USART Half-Duplex or Full-Duplex Mode

For some series of chips, USART half-duplex/full-duplex communication mode can be configured. Check "USART Half Duplex" if you want to use USART Half Duplex or "USART Full Duplex" if you want to use USART Full Duplex.

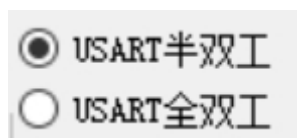


Figure 2-15 USART Half or Full Duplex Mode Setting

Attention:

ion:

- This is the selection of the USART communication only, the mode selection for SWD and USART is irrelevant here and is done by the tool.

2.3.14 Setting Buzzer Enable

Activates and deactivates the buzzer.

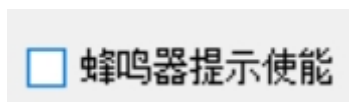


Figure 2-16 B u z z e r Setting

2.3.15 Setting the low speed mode

Check the low speed mode to reduce the SWD communication speed.

- This is only selected if the communication environment is severely disturbed or if the hardware design has an impact on the communication speed.
- This option only affects the SWD communication speed, not the Uart.

☐ 低速模式

Figure 2-17 Low Speed Mode Setting

2.3.16 Adding additional files

Adding an additional bin file can be burned along with the burn file.

- This file can be left blank to not affect the burn operation.

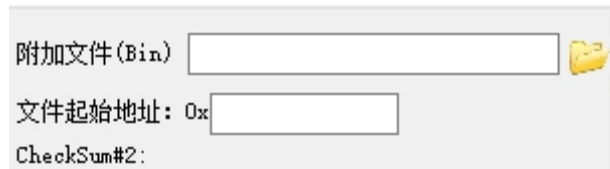


Figure 2-18 Additional Files

2.3.17 reconize

Configure the functions as desired and click the "OK" button.

When finished, the following user files are created in the User Data folder in the installation directory.

1. Configuration file name not set

Generate two files: PGMKEY.bin
pgm.config

2. Configuration file name set

Generate two files: PGMKEY.bin
xxxx.config

3 Offline Programmer Software and Documentation Update

After generating a user file following the steps in the [Procedure] section, copy the generated configuration file and PGM motherboard code file to the offline programmer, and then update the PGM firmware.

3.1 file copy

Connect the PGM to the computer via USB, after the computer recognizes the USB flash drive device, copy the files as follows:

1. Formatting the USB flash drive.
2. Copy PGMKEY.bin and ***.config to USB flash disk, the standard version programmer copy files as shown in Figure 3-1. The standard version of programmer copies the files as shown in Figure 3-1. The version with screen can copy multiple configuration files to USB flash disk as shown in Figure 3-2.

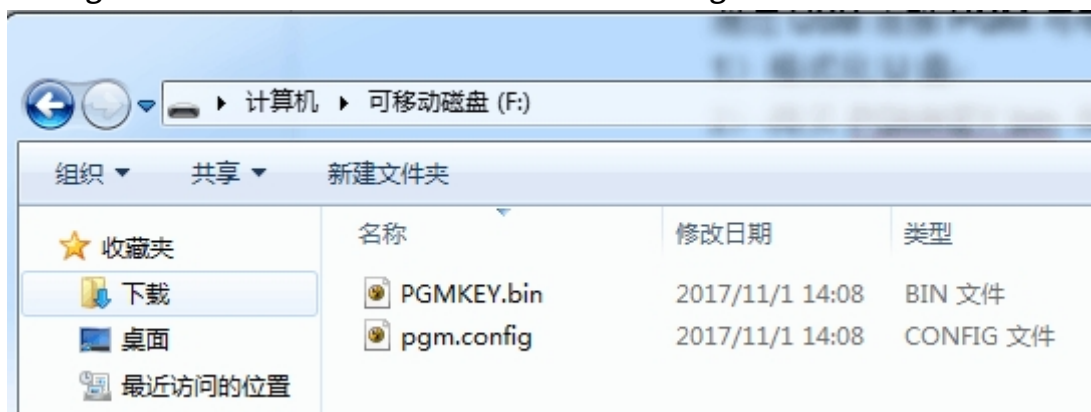


Figure 3-1 Copying Files in the Standard Version

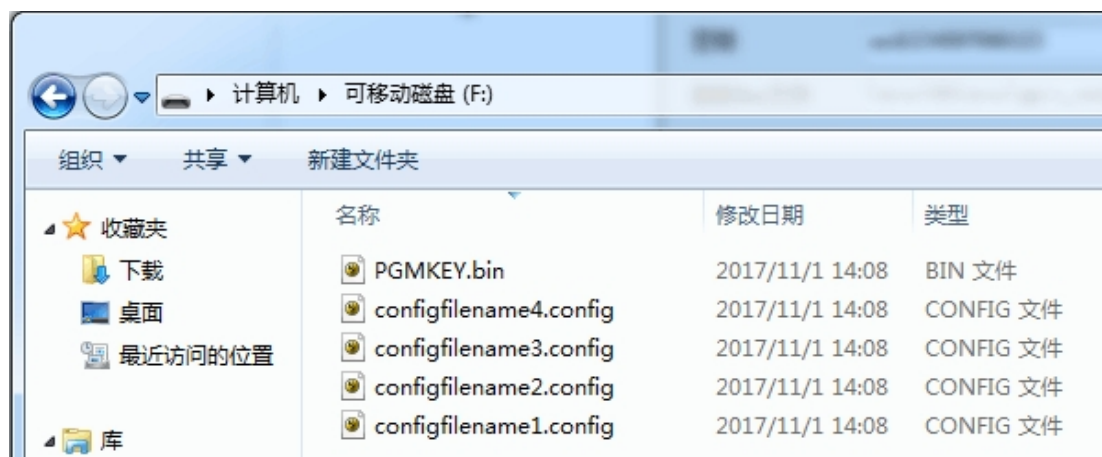


Figure 3-2 Copy File with Screen Version

Attent

ion:

-When copying multiple profiles to the screened version of

version of the offline programmer, the multiple profiles will only work properly if there is no need to upgrade the PGM firmware.

3.2 Offline Programmer Motherboard Firmware Upgrade

The CM PGM must be firmware upgraded if any of the operations corresponding to the following functions are performed:

Table 3-1 Firmware Upgrade Operations That Must Be Performed on the CM PGM

functionality	manipulate
file encryption	opens
	Modify the key
reckoning	opens
	cloture
	Number of revisions
rolling stock (e.g. gambling chip)	change address
	Modify step size
	Modify the starting value
Read protection 1	opens
	Modify the key
data encryption	opens
	Modify the data encryption range

The PGM motherboard firmware upgrade procedure is as follows:

Method 1 (automatic upgrade)

Re-power up, if the firmware in the tool is not the same as the copied firmware, the upgrade process will start automatically.

Method 2 (Manual forced upgrade)

- 1) Press the KEY1 and KEY2 buttons simultaneously;
- 2) When the PGM is powered on, LED1 and LED2 of the standard programmer are green, and the screen display of the programmer with screen is as shown in the following figure
3-3 shown:



Figure 3-3 Offline Programmer Upgrade Screen 1

- 3) Press KEY1 and KEY2 buttons at the same time, the offline programmer will start to upgrade the firmware of the motherboard, at this time, the LED1 light is always on in green, the LED2 light is flashing in green, and the screen display of the offline programmer with screen version is shown in Figure 3-4:

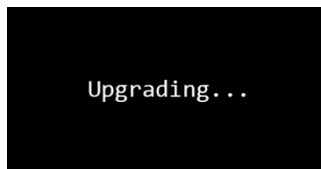


Figure 3-4 Offline Programmer Upgrade Screen 2

Attention:

- Before upgrading, make sure that PGMKEY.bin and the corresponding ***.config file have been copied in the offline programmer, and repeat the upgrading procedure if there is an abnormal situation.
 - If file encryption is used, after upgrading, the PGMKEY.bin file needs to be deleted to ensure that the secret key will not be disclosed.
 - The manual forced upgrade method is only required if you change the rollover settings or if the firmware in the tool is corrupted.
- 4) Run the PGM code directly after successful upgrade. The screen of the offline programmer with screen version jumps to the boot screen.

During the upgrade process, the LED1 and LED2 lamp color status is shown in Table 3-2:

Table 3-2 LED Indicator Status

LED1	LED2	current state
greener	greener	UDISK, enter upgrade mode
greener	go out (of a fire etc)	Switching from UDISK state to Upgrading state
greener	Green Flash	Upgrading, start upgrading
greener	Red Flash	Upgrade failed, or no PGMKEY.bin file is available
Green/orange	greener	Power on interface, upgrade successful (LED1 color shows current programming mode, details as shown in Table 1-1)

4 workflow

Taking the programming/flash reading of the HC32L13XXX chip as an example, the general flow of the CM PGM offline programming system is as follows:

1. Software Configuration

Open the configuration software **ConfigTool.exe** and follow the detailed steps in the [Procedure] section to configure the programming environment to generate the files. **PGMKEY.bin** and *****.config** files are generated in the **User Data** folder.

2. file copy

Connect to the computer through the USB port of the CM PGM. If the USB flash drive is not recognized by the computer, please refer to the steps in the chapter of "Upgrading the Firmware of Offline Programmer Motherboard" to make the computer recognize the USB flash drive. Copy the file to the tool and re-power on the tool to upgrade. Delete the PGMKEY.bin file (not necessary, recommended). If you use the file encryption function, you need to delete this file after upgrading)

3. Preparing Hardware Connections

Refer to the [Programming Mode] section to connect the target MCU, or connect an external power supply if one is required.

4. Switching Programming Mode

View the current programming mode and select it based on the contents of Table 1-1 or the information on the screened version of the display.

5. Startup Programming or Flash Read

Short press the programming key to start programming in the standard version, and check the programming status and programming result according to the contents of Table 1-2.

The version with screen selects the programmed file or reads Flash through the menu and starts up through the menu prompts to check the programmed status and programmed results according to the contents of Table 1-2 or the on-screen display.

The data read by Flash is saved as read.bin file, which needs to be retrieved from PC after reconnecting the programmer.

5 Common Error Handling

If the offline programmer malfunctions, please refer to Table 5-1 to handle the problem. If the problem still cannot be solved, please contact your agent or the manufacturer.

Table 5-1 Common Error Handling

serial number	Type of error	rationale	cure
1	Offline programmer LED1 does not light up after power up	hardware damage	Recommended to return to factory
2	USB flash disk does not display after power on, LED1 green Color, LED2 not lit	Offline Programmer bootloader code corruption	Recommended to return to factory
3	USB flash disk does not display after power on, LED1 green Color, LED2 flashes red	PGM No Firmware Code	Follow the steps in the chapter "Upgrading the Firmware of the Offline Programmer Motherboard" to upgrade. Firmware Code
4	Press KEY1, KEY2 at the same time, power on The USB flash drive is not recognized after	Corrupted bootloader code	Recommended to return to factory
5	Screenless version, KEY1 can switch programming mode Eq. KEY2 no reaction	No pgm.config file	Copy the pgm.config file to a USB flash drive
6	upgrade failure	No PGMKEY.bin file or PGMKEY.bin file is corrupted	Checking the PGMKEY.bin file for correctness
7	Programming Failure	<ul style="list-style-type: none"> hardware connection error Configuration information error Target chip damaged 	<ul style="list-style-type: none"> Check that the wiring method matches the programming mode Check if the target chip matches the configuration information Check if the crystal is matched Check that the programmed count is 0 Upgrade the firmware code corresponding to the current config file (PGMKEY.bin) Both the code roll function and page erase function are enabled, and the code

			roll address is outside the code file address range.
8	With screen version, the screen does not display or display incomplete	Hardware issues	Recommended to return to factory

Version Revision Record

version number	revision date	revision
2020/02/19	Rev1.0	First Edition Release.
2020/12/10	Rev1.1	<ol style="list-style-type: none"> 1. Added buzzer, new feature description for low speed mode; 2. File encryption operations add caveats; 3. Add support series; 4. Other details fixed.
2021/12/31	Rev1.2	Increase the model number.
2022/08/01	Rev1.3	<ol style="list-style-type: none"> 1. Modify the company logo; 2. Added 008, 015 series encryption count description; 3. Changes in the way function modules are described; 4. Add a few notes and modify some of the presentation.
2023/07/05	Rev2.0	<p>Optimize the strong coupling structure between the original chip and the programmer, remove the description of the chip and replace it with the chip part.</p> <p>Sub-independent file description.</p>