



SP325/SP328/SP328P Programmer User Manual

Revision A2



深圳硕飞科技有限公司
SHENZHEN SFLY TECHNOLOGY CO., LTD.

CONTENTS

Chapter 1 Introduction

1.1 Performance Characteristics	3
1.2 SP32 series programmer parameter table	4

Chapter 2 Programmer Hardware

2.1 Product Overview	5
2.2 Product Add-ons	5

Chapter 3 Quick To Use

3.1 Preparation	6
3.2 Create a Project / Select a Chip Model	7
3.3 Load Data	7
3.4 Project Settings	8
3.5 Run the Project (Programming Operation)	8

Chapter 4 Standalone Programming

4.1 Downloading Standalone Project Data	9
Method 1: Download from a PC	9
Method 2: Load from a USB Flash Drive	10
4.2 Standalone Operation (Programming)	11
Manual Mode.....	11
Automatic Control Mode (ATE Interface Control)	12

Appendix

Appendix 1 System Settings	13
Appendix 2 Initial Value Setting for Automatic Serial Number	14
Appendix 3 UID Security Encryption	15
Appendix 4 SP328 Programmer ATE Control Interface	18
Appendix 5 FAQ	21
Appendix 6 Disclaimer	22
Appendix 7 Document Revision History	23

Chapter 1 Introduction

The SP32 series (SP325/SP328/SP328P) programmer is a high-speed production programmer dedicated to SPI FLASH, developed by SFLY Technology. It fully supports high-speed programming of SPI NOR FLASH, SPI NAND FLASH, I2C EEPROM, and MicroWire EEPROM from domestic and international manufacturers.

1.1 Performance Characteristics

Hardware features

- USB 2.0 High-Speed communication (480 Mbps);
- High-speed MCU + FPGA architecture with built-in hardware programming engine and dynamic I/O allocation technology for maximum speed and stability;
- Supports QUAD SPI and DUAL SPI transfer modes, providing 4× and 2× the transfer rate of standard SPI respectively;
- Adjustable chip read/write clock frequency for optimized speed and reliability;
- Support USB and standalone mode high-speed mass production programming;
- Built-in large-capacity memory for standalone project storage with multiple CRC verifications to ensure data integrity;
- USB flash drive interface for loading standalone projects either from a PC or directly from a USB drive;
- 2.4-inch TFT color LCD with navigation keypad for intuitive operation;
- Three independent LEDs indicating BUSY, FAIL, and OK status;
- Multiple programming startup methods: button startup (dedicated start button rated for up to 10 million operations), chip placement (intelligent detection chip placement and removal, automatic startup programming), ATE control (independent ATE control interface, providing accurate and reliable programming machine control signals such as BUSY, OK, NG, START, extensively support automatic programming equipment of various manufacturers);
- Short-circuit and over-current protection to prevent damage caused by incorrect chip insertion;
- Main unit dimensions: 164 × 113 × 36 mm.

Software Features

- Supports Windows XP (SP2), Vista, Windows 7/8/10/11 (32-bit and 64-bit);
- Supports software upgrades for new device support;
- Supports project file management (project files store all programming parameters, including chip type, data files, programming settings, etc.);
- Supports project file locking and read-only attributes to prevent operators from accidentally modifying programming parameters;
- Supports reading Unique ID (UID) on supported chips;
- Supports data encryption based on the Unique ID (UID) of selected chips, providing anti-copying and anti-counterfeiting protection for products/ chips;
- Supports reading and writing of chip auxiliary memory areas (OTP regions) and configuration areas (status registers, etc.);
- Supports reading SFDP data from selected SPI Flash;
- Automatic serial number generation (for generating unique product serial numbers, MAC addresses, Bluetooth IDs, etc., with auto-increment and file-based modes), including offline serial number programming;
- Intelligent Flash erase technology (skips blank areas; only memory areas containing data are erased, significantly reducing erase time).

Note

The above functions vary by product model. For details, please refer to the SP32 series programmer parameter table in Section 1.2

1.2 SP32 series programmer parameter table

Product parameter		SP328P	SP328	SP325
Using USB mode (Programming via USB connection to a PC)		Y	Y	Y
Standalone mode (Programming without a computer connection)		Y	Y	N
Standalone Storage Memory		2Gb	2Gb	N
Maximum memory of supported chips (Note 1)	Using USB mode	4Gb	4Gb	4Gb
	Standalone mode	2Gb	2Gb	N
Supported chip voltage range		1.7-3.6V	1.7-3.6V	1.7-3.6V
Support chip series (interface type) ① I2C EEPROM ② Microwire EEPROM ③ SPI Flash ④ SPI NAND Flash		①②③④	①②③④	① ②③④
SPI-specific protocol support (Note 2) ① Standard SPI ② Dual SPI ③ Quad SPI		①②③	① ②③	② ②③
ATE Control Interface (Automatic Programming Machine Control Interface)		Y	Y	N
Automatic Mass Production Start Methods ① Button control ② ATE interface control ③ Automatic chip insertion detection and programming start		①②③	① ②③	①③
Automatic Serial Number (Rolling code programming)	Using USB mode	Y	Y	Y
	in stand-alone mode	Y	N	N
UID Security Encryption (Adds anti-copying protection to chips; supported on certain chips)		Y	N	N
LCD Display		2.4" TFT	2.4" TFT	N
USB Drive Interface (Used for loading standalone programming project files)		Y	Y	N
Operation Keypad		Y	Y	N
Programming speed (Programming + verification) (Note 3)	W25Q64FV(64Mb)	16.9S	16.9S	16.9S
	GD25Q128B(128Mb)	51.2S	51.2S	51.2S
	W25N01GV(1Gb)	75S	75S	75S

"Y" means it has or supports the function, while "N" means not.

Note1 Future free software upgrades will support higher-capacity devices. The maximum capacity in standalone mode depends on the standalone storage memory. (2 Gb = 256 MB)

Note2 DUAL: Dual-channel mode, using two I/O lines for data transmission simultaneously. The data transfer rate is twice that of standard SPI.

QUAD: Quad-channel mode, using four I/O lines for data transmission simultaneously. The data transfer rate is four times that of standard SPI.

Note3 Test performed using random data across full device capacity. Time unit: seconds.

Chapter 2 Programmer Hardware

2.1 Product Overview



Item	Name	Illustrate
①	2.4-inch Color LCD Screen	Displays operation information in standalone mode (not available on SP325)
②	Operation Keypad	Used for standalone mode operation (not available on SP325)
③	Adapter Module Interface	Used to install SP32-series dedicated adapter modules (hereinafter referred to as programming sockets; sockets are optional accessories)
④	Programming Start Button	
⑤	Indicator LEDs	BUSY: Busy – Yellow OK: Success – Green FAIL: Failure – Red
⑥	Power Interface	Connects to a 5V/1A DC power adapter (Note: 1. Do not use a power supply with output voltage higher than 5V. 2. When operating in USB mode, USB power is sufficient; no external power adapter is required.)
⑦	USB Interface	Connects to a computer via USB
⑧	USB Drive Interface	In standalone mode, used to load programming project files from a USB flash drive (not available on SP325)
⑨	ATE Control Interface	Provides control signals for automatic programming machines (BUSY, OK, NG, START) (not available on SP325)

2.2 Product Add-ons



USB cable



5V/1A power adapter

Note

- The color/appearance of accessories of different batches may be different, please refer to the actual product;
- SP325 is supplied without a power adapter as standard and can be powered directly via USB;
- The standard configuration of the programmer does not include a programming socket. please choose according to your needs;

Chapter 3 Quick To Use

This chapter takes a piece of SOIC8 (208mil) packaged SPI FLASH chip W25Q64FVSIQ as an example to introduce the SP328P programmer's method of programming the chip in USB mode. The conventional programming includes the following 5 steps:

Hardware and Software Preparation ➡ Create Project / Select Chip Model ➡ Load Programming File
➡ Project Settings ➡ Run Project (Programming)

3.1 Preparation

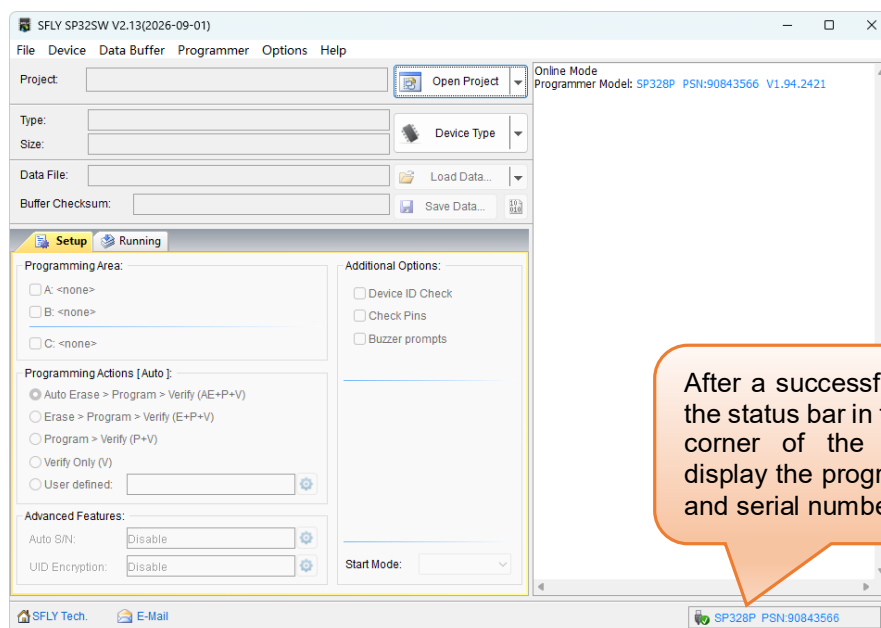
- Install the SP32SW software for SP32 series programmers (the USB driver is included and will be installed automatically during software installation). Supported operating systems: Windows XP (SP2), Windows 7 to Windows 11 (32-bit / 64-bit). Software download website: <http://www.sflytech.com>

- Connect the programmer to the USB port of the computer with a USB cable (Note: No external power adapter is required in USB mode.)



Connect to the computer
USB port

- Launch the SP32SW software. If the connection is successful, the status bar in the lower-right corner of the software will display the programmer model and serial number. If the connection fails: Verify that the USB cable is properly connected. Check whether the USB driver has been installed correctly in Windows Device Manager. (If the USB driver is not installed properly, manually update the driver by locating the USB_DRIVER folder in the SP32SW installation directory and installing the driver from there.)

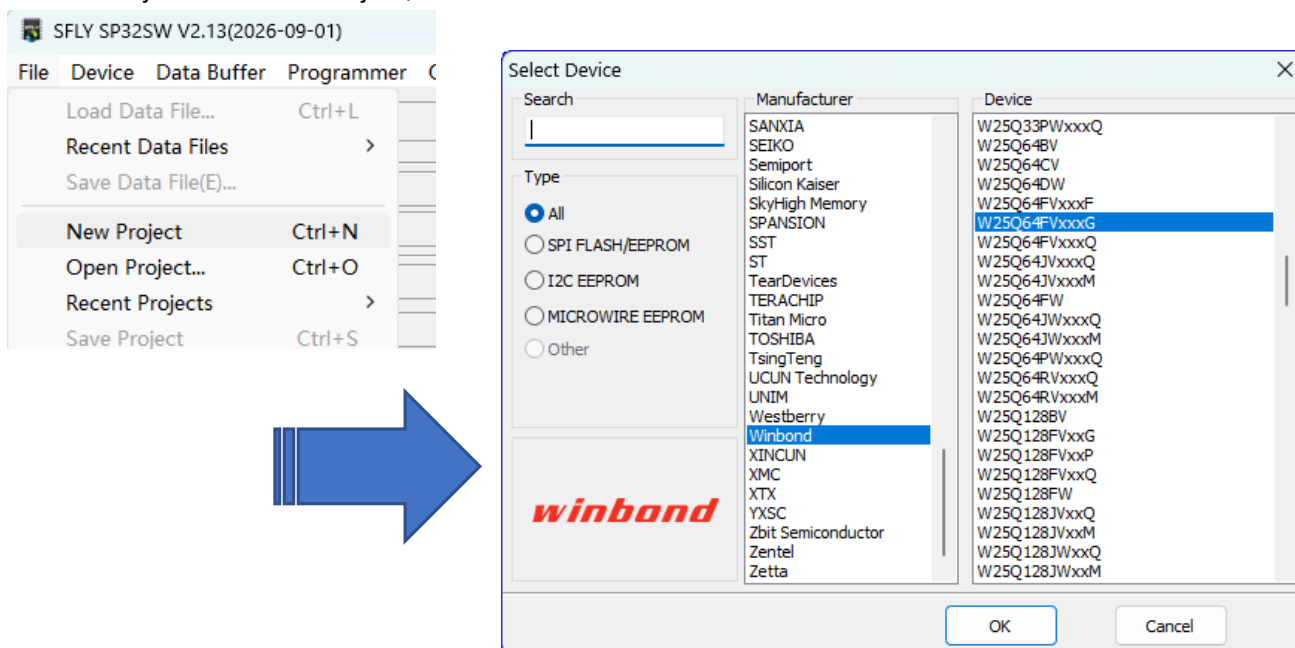


- Install the programming socket: For chips in SOIC8 (208 mil) package, use the programming socket model: AM-SOP8-200A



3.2 Create a Project / Select a Chip Model

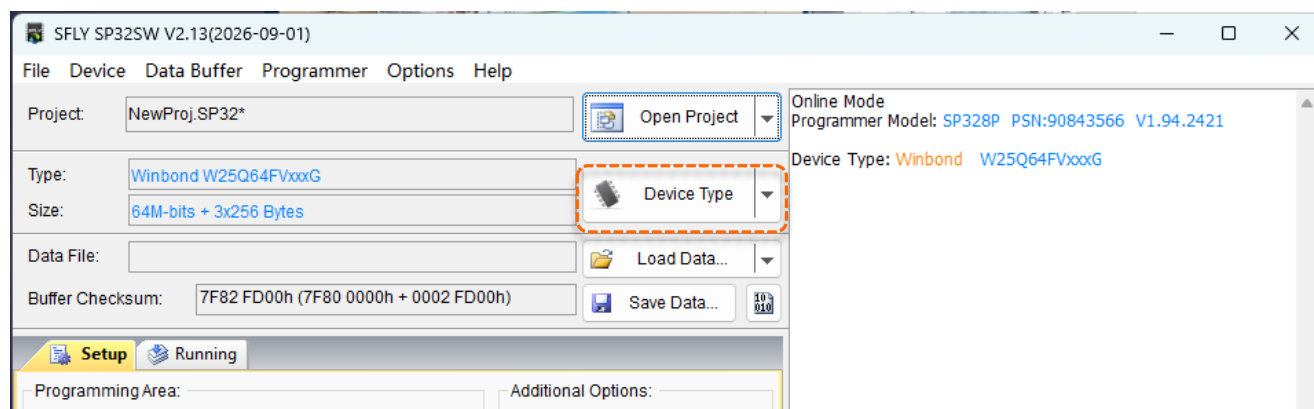
- Click Project/File - New Project;



- In the "Select Chip Model " dialog box, select the Chip manufacturer "Winbond" and then choose the chip model "W25Q64FVxxxG". (Note: Enter a chip model keyword such as "W25Q64" in the search box to quickly locate the target chip model.)

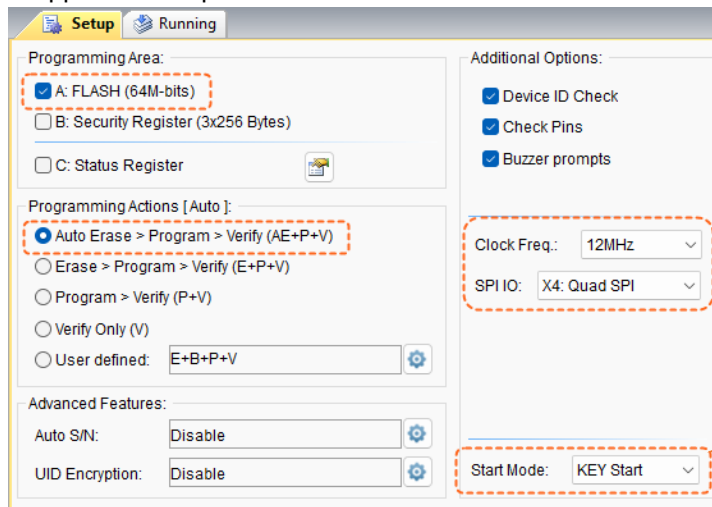
3.3 Load Data

- Click the "Load Data..." button to load the programming data file. Multiple file formats are supported, including BIN and HEX.



3.4 Project Settings

■ Configure the programming options and parameters on the Project Settings interface according to the target chip and application requirements.



The programming speed is determined by the Clock Frequency and SPI I/O Mode. Maximum programming speed: 24MHz + X4: Quad SPI

Select the programming start mode.

■ After completing the configuration, click **Project/File** → **Save Project**. The saved project file can be reopened later for the same programming task without repeating the configuration process.

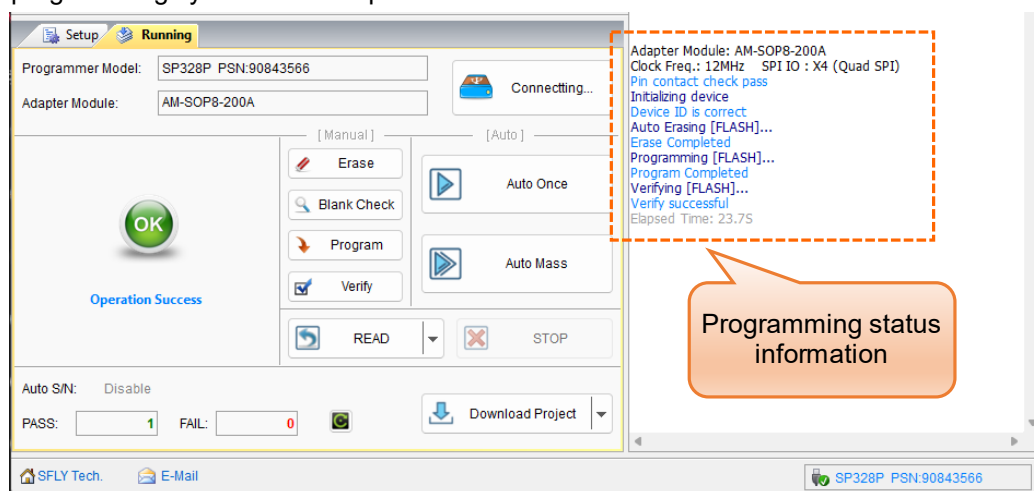
3 Programming Start Modes:

- Chip Detection Start: The programmer automatically detects chip insertion and removal and completes the entire programming process automatically, without any mouse or keypad operation.
- Push-button Start: Each press of the programmer's red START button initiates one programming cycle.
- ATE Control: The programming process is initiated by an external automated programming system through the programmer's ATE interface, making it suitable for high-volume automated production.

3.5 Run the Project (Programming Operation)

■ Insert the target chip into the programming socket. Ensure that Pin 1 of the chip is aligned with the white triangle (Pin 1) mark on the socket PCB.

■ Click "Auto Single". The programmer automatically executes the sequence "Auto Erase → Program → Verify", completing the programming cycle for one chip.



Programming status information

Note

- For volume production programming, click the "Auto Batch" button. The programmer will program one chip each time a start signal is detected. (Please configure the desired start mode in the Project Settings interface first.)
- Click the "Download Project to Programmer" button to enable standalone programming mode. For detailed instructions, refer to Chapter 4 – Standalone Programming.

Chapter 4 Standalone Programming

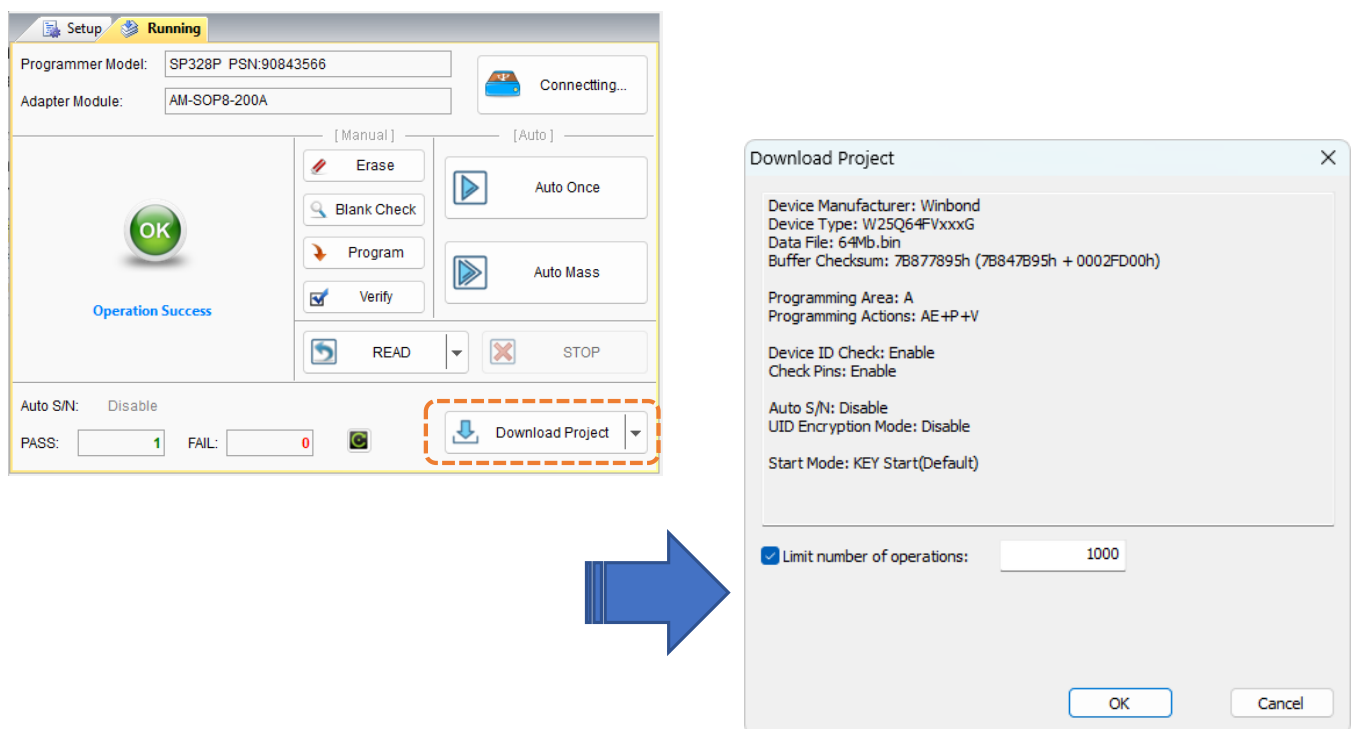
SP328 and SP328P support standalone programming (programming without a PC).
The basic operation flow is as follows:

Download Standalone Project Data ➡ Disconnect the USB Cable and Power the Programmer with a 5V Adapter
➡ Perform Standalone Programming (Manual or Automatic Mode)

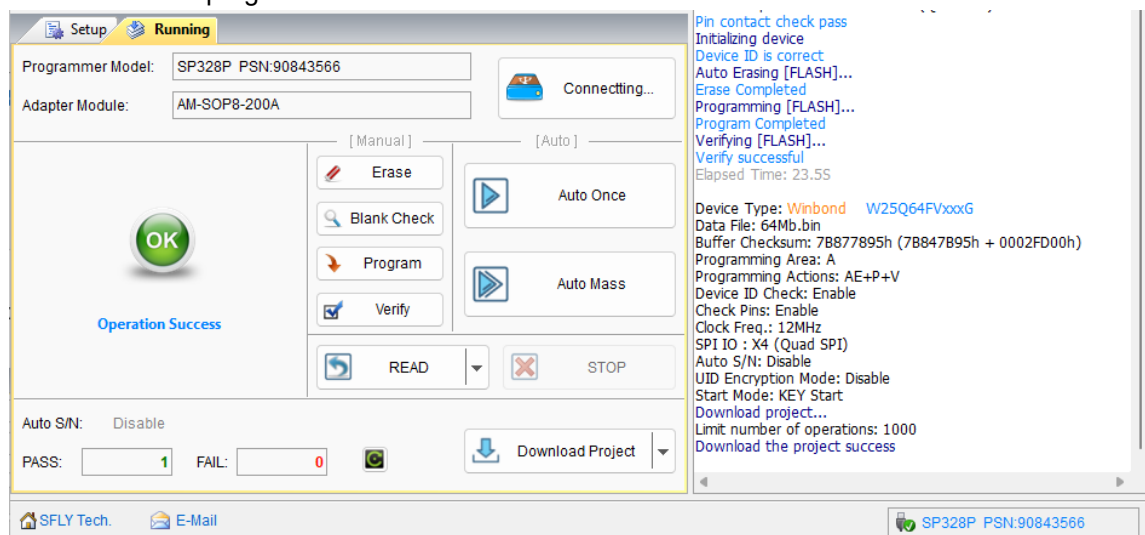
4.1 Downloading Standalone Project Data

Method 1: Download from a PC

- 1) Connect the programmer to the computer using a USB cable and launch the SP32SW software.
- 2) Create and save a programming project according to the procedure described in Chapter 3 Quick To Use, or load an existing project file.
- 3) On the Project Run interface, click the "Download Project to Programmer" button. The Download Project dialog box will appear, allowing you to specify the programming quantity. Verify the settings and click OK.



- 4) When the software indicates that the operation has completed successfully, the standalone project data has been downloaded to the programmer.



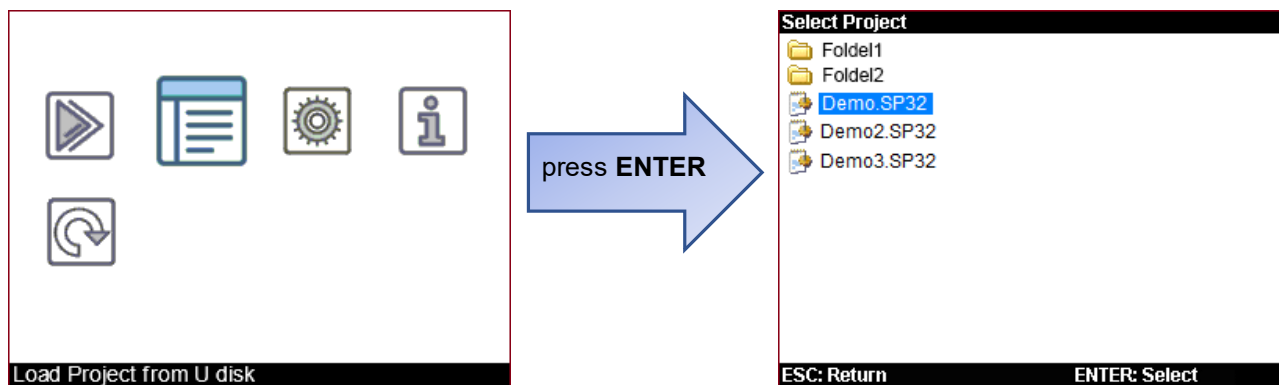
Method 2: Load from a USB Flash Drive

The SP328/SP328P is equipped with a USB flash drive interface and can load programming project files directly from a USB flash drive. Multiple project files can be stored on a USB flash drive for convenient field programming.

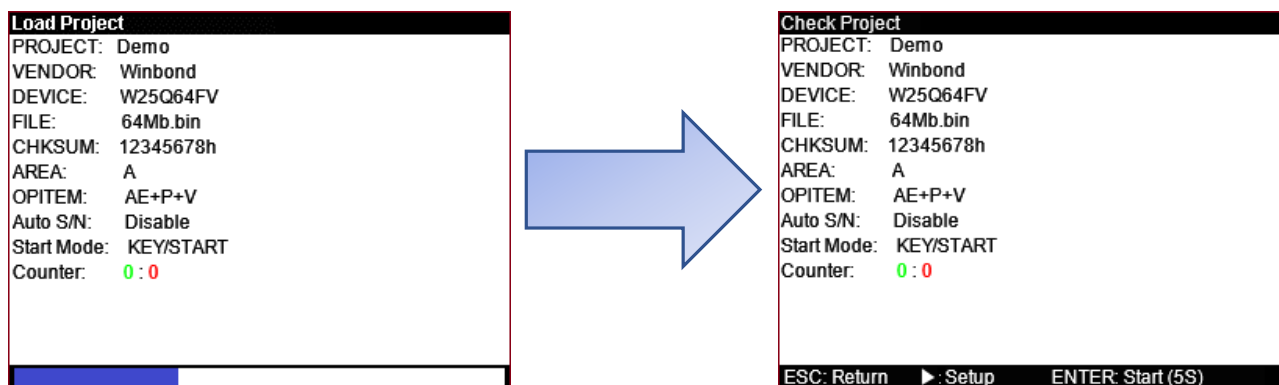
- 1) Prepare a USB flash drive (maximum capacity: 128 GB) and format it with a FAT file system (FAT16, FAT32, or exFAT).
- 2) Create a project file using the SP32SW software and save/copy it to the USB flash drive. (If the current project uses the Automatic S/N File Mode, copy the S/N file to the USB flash drive as well. The S/N file must be stored in the root directory of the USB flash drive.)
- 3) Power the programmer with a standard 5V power adapter. The programmer will automatically enter standalone mode.
- 4) Insert the USB flash drive containing the project file into the programmer's USB port.



- 5) From the main software interface, switch to the "Load Project from USB Drive" interface. Use the programmer keypad to select the desired project file, then press ENTER to load it. Refer to the picture below:



- 6) After the project has been loaded, the programmer automatically verifies the project data to ensure programming accuracy.



If the Automatic Serial Number function is enabled, the initial serial number value can be configured by pressing the key on the Project Verification interface. For details, refer to Appendix 2.

Note

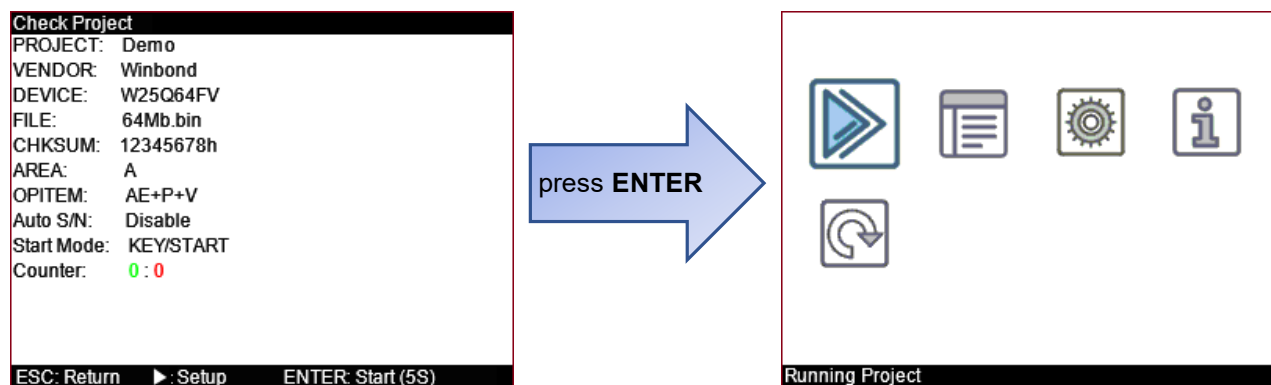
- Either of the above methods can be used to download the standalone project data. Once the standalone project data has been downloaded, the programmer is ready for standalone batch programming.
- If the Automatic Serial Number function is enabled, the initial serial number value can be configured by pressing the corresponding key on the Check Project interface. For details, refer to Appendix 2.

4.2 Standalone Operation (Programming)

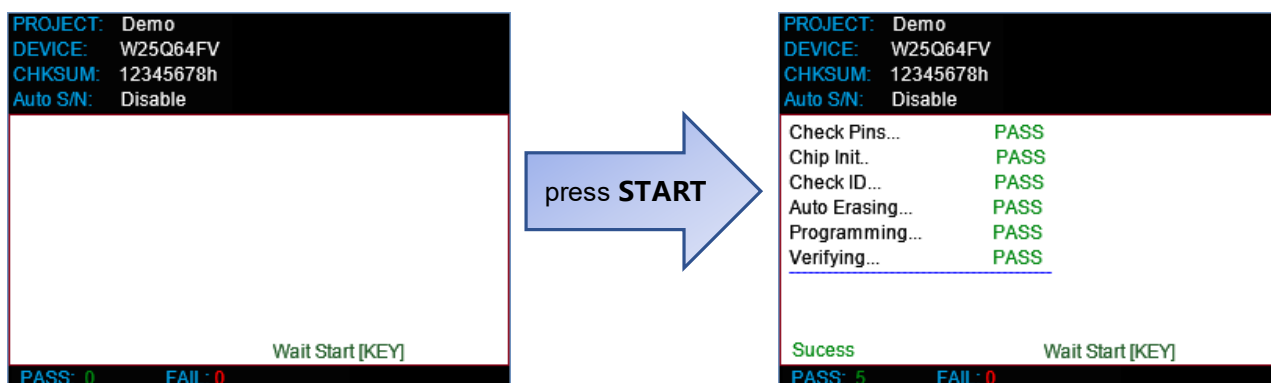
Manual Mode

In manual mode, chips are inserted and removed manually. The operating procedure in standalone mode is as follows:

- 1) Install the appropriate programming socket for the target chip.
- 2) Power the programmer using the supplied 5V power adapter. (Note: Do not connect the USB cable.)
- 3) On the Project Run interface, press ENTER. The programmer will verify the downloaded standalone project data to ensure programming accuracy.



- 4) Press ENTER or wait for the 5-second countdown to complete. The programmer will enter the Project Run (Programming) mode.
- 5) Insert the target chip into the programming socket and press the red START button to begin programming. (Note: The programming start mode can be configured as Chip Detection Start, Push-button Start, or other available modes. The start mode can be configured either in the project settings before downloading the standalone project data, or through the System Settings menu using the programmer keypad while operating in standalone mode.)

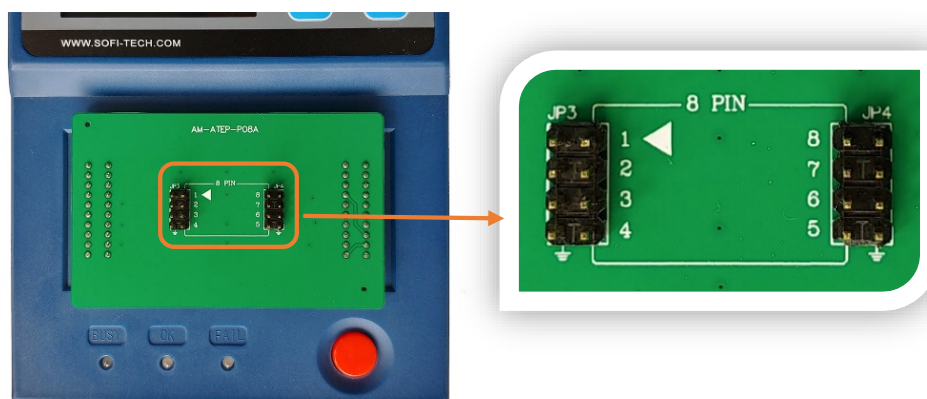


Automatic Control Mode (ATE Interface Control)

The SP328/SP328P is equipped with an ATE control interface and can be integrated with automated programming equipment to achieve fully automatic programming operations, including automatic chip handling and programming. The procedure is as follows:

- 1) Download the standalone project data and select ATE Control as the programming start mode. In this mode, the programmer's ATE interface provides START, OK, NG, and BUSY status signals.
- 2) Install the ATE interface board onto the programmer and connect the chip signal lines to the corresponding pins on the interface board.

Note: For 8-pin chips, use the AM-ATEP-P08A interface board. For 16-pin chips, use the AM-ATEP-P16A interface board. The figure below shows the most commonly used 8-pin interface board. Pin numbers 1–8 correspond to chip pins 1–8 respectively. All pins marked with the ground symbol on both sides are connected to GND.



- 3) Connect the machine control cable to the programmer's ATE interface.



3--BUSY	5--OK	9--NG
7--START	2--VCC	4/6/8/10--GND

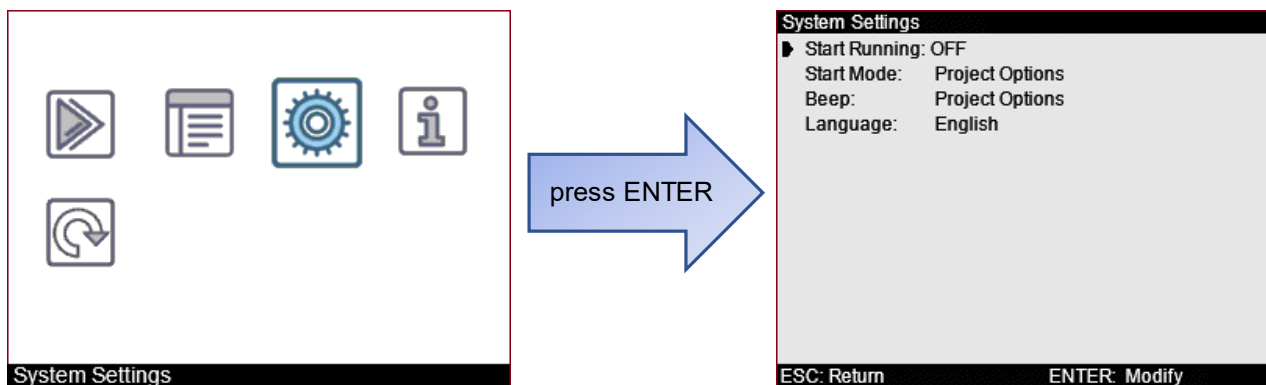
- 4) Start programming.

Note

When operating in standalone mode, always use the supplied 5V power adapter. Do not use any other power supply. Using an incorrect power supply may damage the programmer hardware.

Appendix 1 System Settings

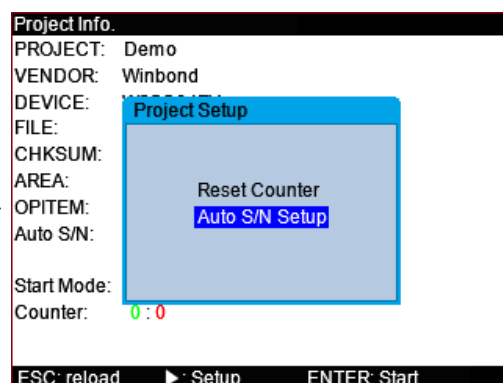
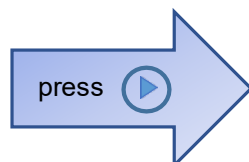
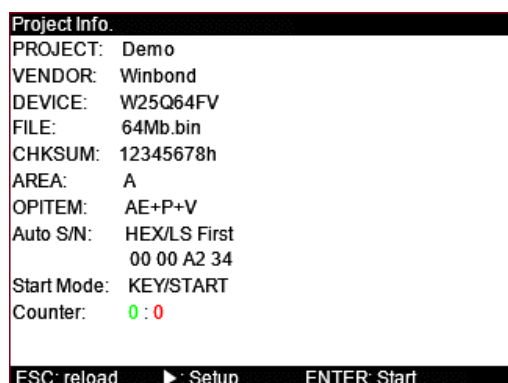
- On the main interface, select the icon  to enter the system settings menu.



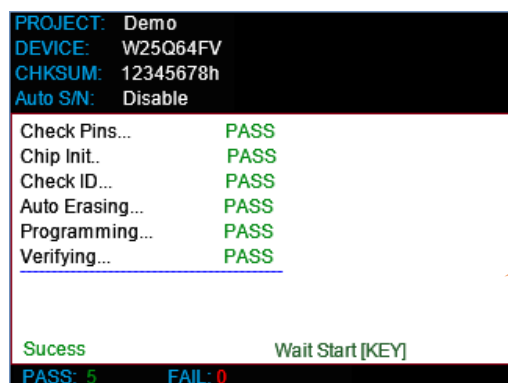
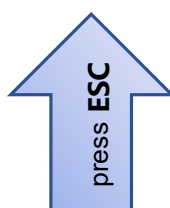
Setting	Option	Illustrate
Auto Run	Enable	Automatically runs the last loaded project stored in memory when the programmer is powered on
	Disable	Enters the main interface when the programmer is powered on
Start Mode	Project Setting	The start mode is determined by the project settings Available start modes configured in the programmer software: Push-button Start, Chip Detection Start, ATE Control, or Push-button + ATE Control
	Push-button Start	Always starts in Push-button Start mode, regardless of the project setting
	Chip Detection Start	Always starts in Chip Detection Start mode, regardless of the project setting
	ATE Control	Always starts in ATE Control mode, regardless of the project setting
	Push-button or ATE Control	Always starts in Push-button + ATE Control mode, regardless of the project setting
Buzzer	Project Setting	Determined by the project settings
	Enable	Buzzer enabled. Success: one short beep; Failure: two short beeps
	Disable	Buzzer disabled
Language	Chinese	
	English	

Appendix 2 Initial Value Setting for Automatic Serial Number

- On the Project Information interface, press the Programmer Key  to configure the initial serial number value.

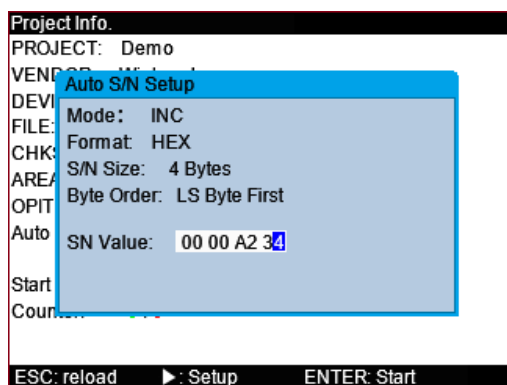


Select "Auto S/N Setting" and press ENTER to enter the settings

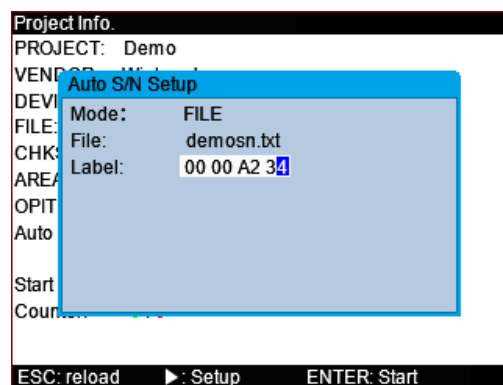


If the Operation screen is displayed, press ESC to return to the Project Information screen.

- The Automatic S/N Setting interface is shown below.



Increment Mode



File Mode

- Increment Mode: Set the S/N value (initial serial number for programming) manually using the keypad.
- File Mode: Set the starting Label number from a file.

Appendix 3 UID Security Encryption

Overview

Many memory chips contain a unique ID (UID) stored internally. The UID is unique to each chip, meaning every chip contains different UID data. This UID is permanently programmed into the chip before leaving the factory and is stored as read-only data. It cannot be modified or copied to another chip. The UID can be used to implement product security and prevent unauthorized duplication (piracy).

Basic Principle

The chip's UID is used as the source data for an encryption algorithm, generating a unique encrypted value, which is then stored in the memory area of the chip.

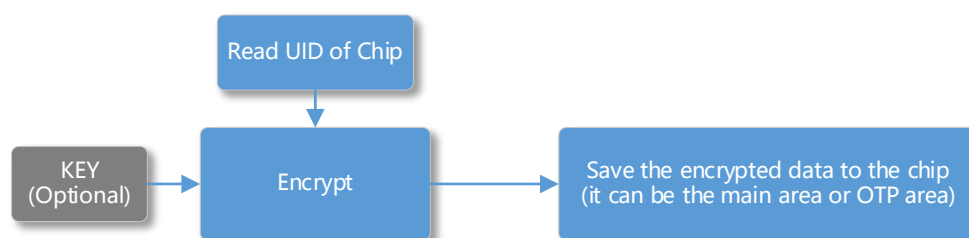
Since the UID data of each chip is different, the generated encrypted data is also different. As a result, the contents stored in each chip within a production batch are different. So the contents of any chip (the encrypted data portion) can only match the UID of that chip. If the contents of a chip are copied to another chip, the encrypted data will no longer match the UID.

Therefore, the product can verify its legitimacy during operation by checking whether the UID matches the stored encrypted data.

Implementation

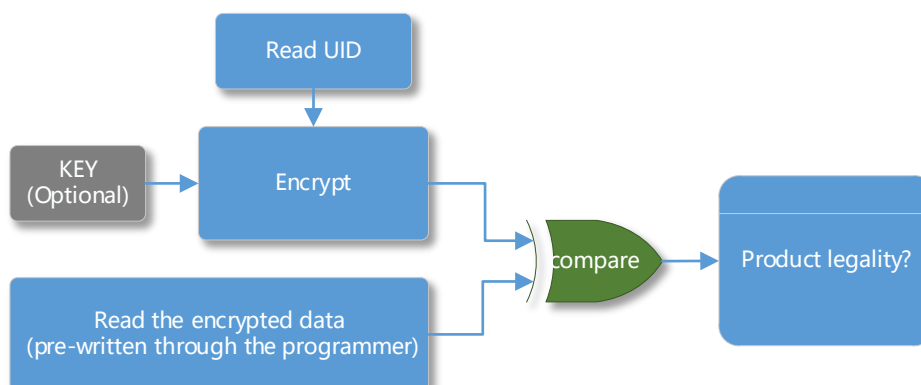
To implement UID encryption, two parts are required:

- 1) Store UID-Based Encrypted Data in the Chip. The encrypted data can be generated and programmed into the memory chip during the programming process. The workflow is shown below:



The above programming operation can be completed using the SFLY SP328P Programmer.

- 2) When the product is running, it checks whether the UID matches the encrypted data to determine whether the product is genuine. The workflow is shown below:



Note: The UID encryption algorithm used by the product must match that used by the programmer.

UID Encryption Data Processing in the SFLY SP328P Programmer

The SFLY SP328P Programmer provides a UID encryption feature.

During programming, the programmer can automatically generate encrypted data based on the UID of the target chip and write it into the chip.

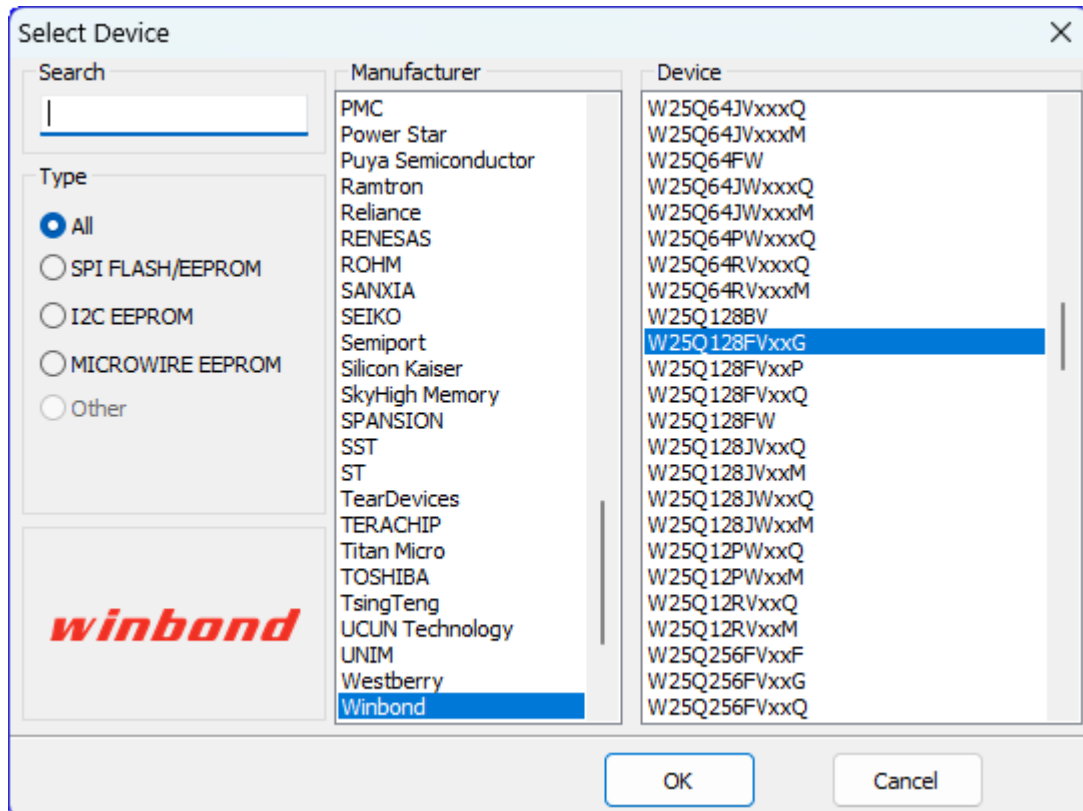
The programmer supports both SHA256 and MD5 algorithms, and an optional additional key can be included in the encryption process.

The generated encrypted data can be stored at any location in the chip's main memory specified by the user. If the chip supports an OTP (One-Time Programmable) area, the encrypted data can also be stored there.

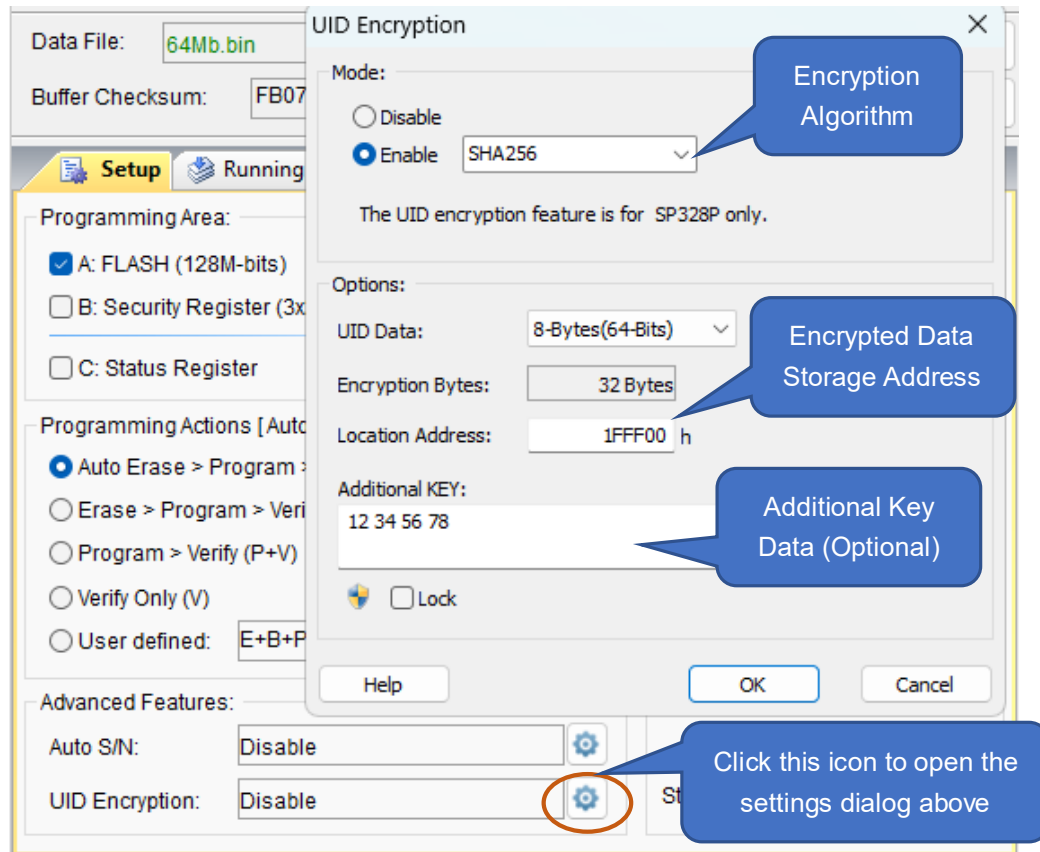
If other encryption algorithms are required, customized software is available from SFLY.

SP328P Software Configuration Procedure

1) Select a chip with UID Support (Example: W25Q128FV)



2) Enable and Configure the UID Security Encryption Function



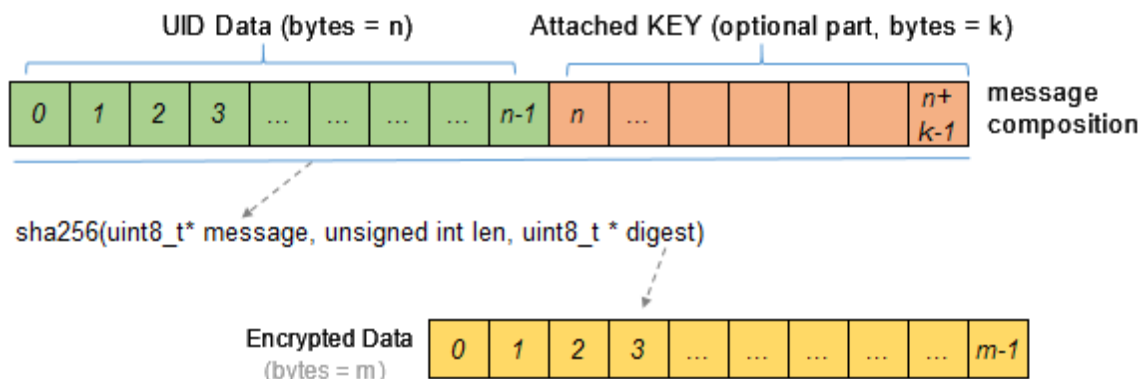
Note: The storage address shown above is a buffer-mapped address. If the encrypted data needs to be stored in the chip's OTP area, open the Chip Information window in the software to check the OTP region's mapped address in the buffer.

- After the above configuration is completed, the programmer automatically reads the chip UID during programming, performs the encryption calculation, and stores the resulting encrypted data starting at address 0x1FFF00.

About the Additional KEY

The software provides an optional Additional KEY parameter that can participate in the encryption process. If the Additional KEY field is left blank, encryption is performed using only the UID.

When an Additional KEY is specified, the programmer appends the KEY data to the UID before performing the encryption operation. The following diagram illustrates the SHA256 encryption process:

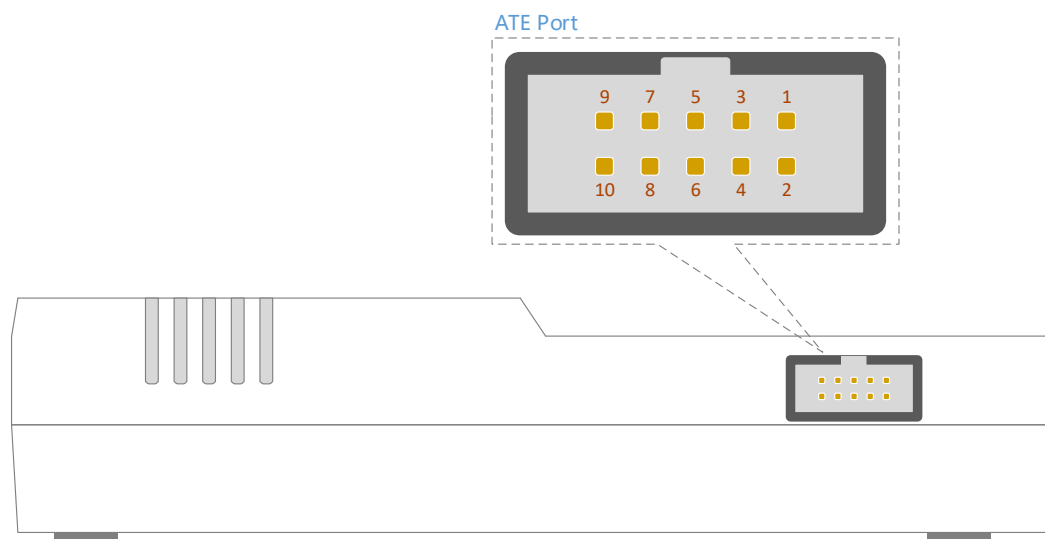


Note:

- n = Number of UID bytes in the chip
- k = Number of bytes in the user-defined Additional KEY
- m = Number of bytes in the generated encrypted data, determined by the selected algorithm (SHA256: 32 bytes, MD5: 16 bytes)

Appendix 4 SP328 Programmer ATE Control Interface

Programmer ATE Interface



Pin Description

Pin No.	Name	Direction	Description
7	START	Input	Receives the start signal
3	BUSY	Output	Programmer status indication. High = Busy, Low = Idle
5	OK	Output	Result indication. High = Success
9	NG	Output	Result indication. High = Failure
2	VCC	Output	3.3 V power output, providing up to 250 mA to external circuits
4, 6, 8, 10	GND		

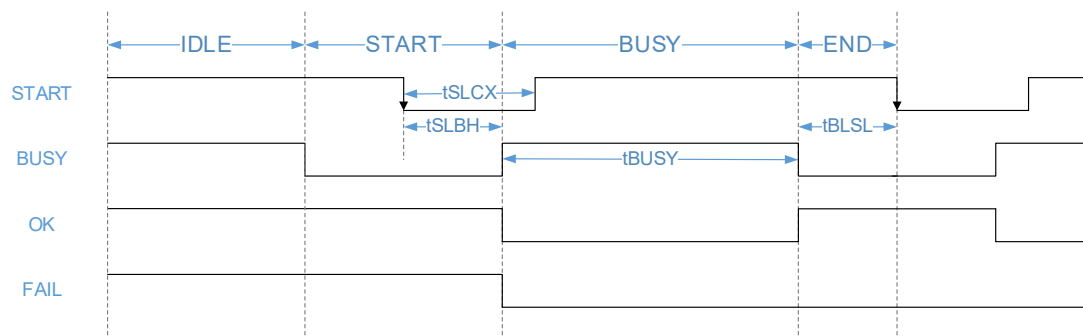
Output Signal Status

BUSY	OK	NG	Description
H	H	H	USB Mode: Programmer not in automatic mass-production mode, or programmer startup mode not set to ATE Control. Standalone Mode: Programmer not on the programming interface.
L	H	H	USB Mode: Initial state after entering mass-production mode for the first time. Standalone Mode: Initial state after entering programming interface.
H	L	L	Busy
L	H	L	Programming completed successfully
L	L	H	Programming failed

Note:

- USB Mode: ATE signals are output only when the programmer is operating in automatic batch programming mode and the startup mode is set to ATE Control.
- Standalone Mode: ATE signals are output only when the programmer is on the programming interface and the startup mode is set to ATE Control.

Interface Timing Diagram



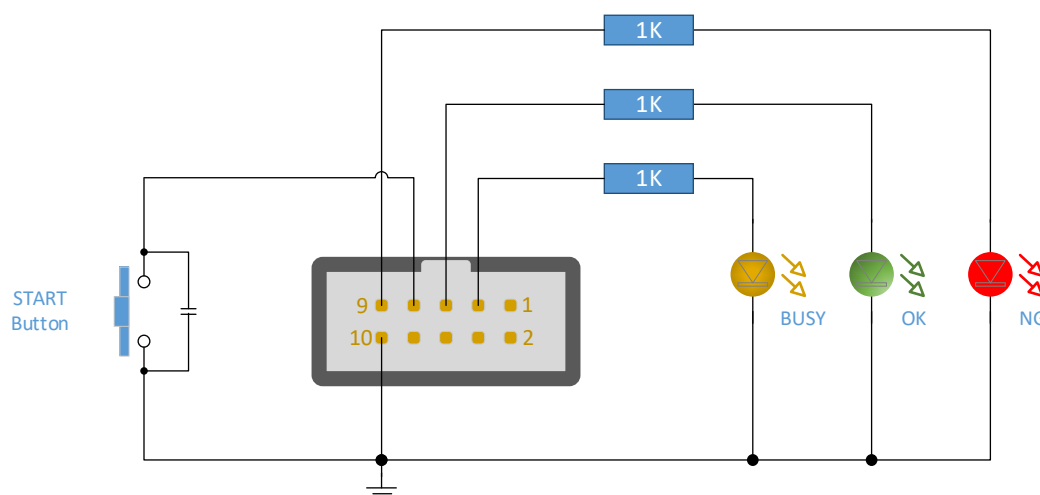
Timing Parameters

Symbol	Description	Min.	Typical	Max.
tSLCX	Start pulse width (low-level duration)	12ms	30ms	50ms
tSLBH	Time from start pulse falling edge to operation start	12ms		50ms
tBUSY	Programming operation period	100ms		
tBLSL	Interval between operation completion and next start pulse	100ms		

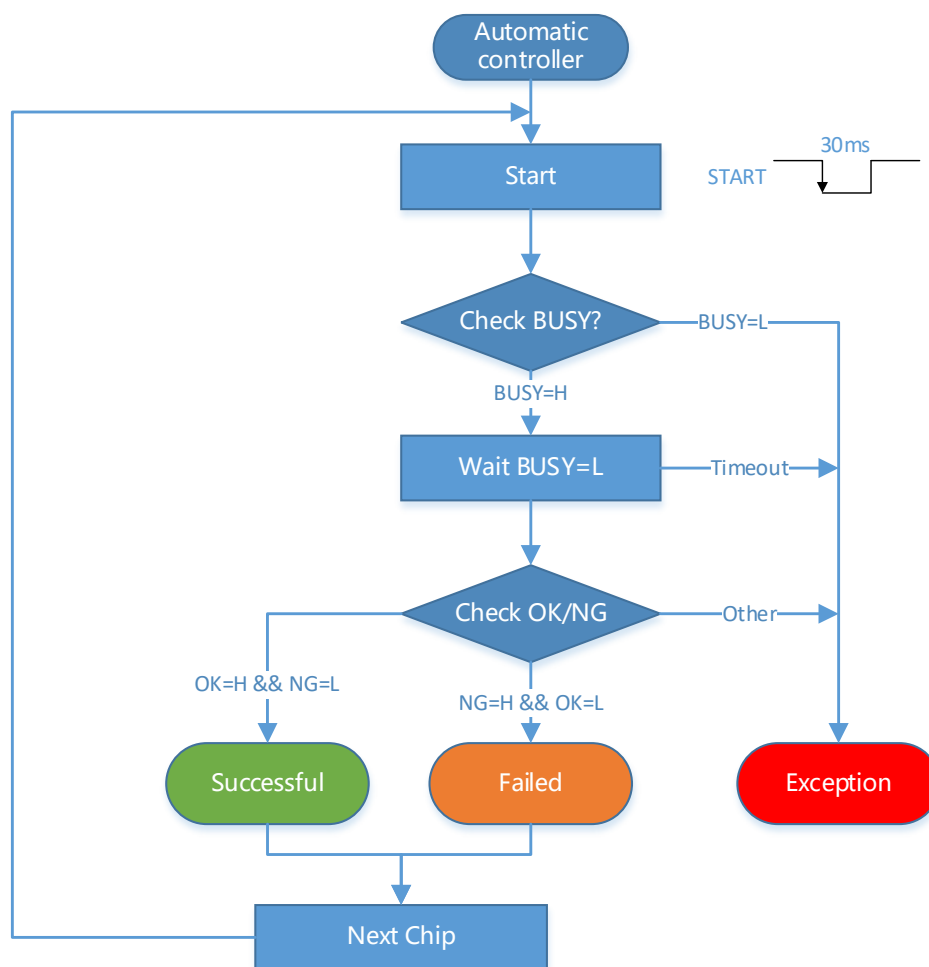
Start Signal

While waiting for a start command, the programmer continuously monitors the START signal. The START signal must satisfy the following conditions: A falling edge transition from High to Low and the signal remains Low for at least 12 ms. The programmer then enters the Busy state and begins operation.

Simple Test Circuit



Reference Flow for External Controller



Appendix 5 FAQ



Why can't a duplicated SPI NAND FLASH run properly?

- Due to the inherent bit-flip characteristics of NAND Flash, the data read from a master chip cannot be guaranteed to be identical to the original file.
- The partition table information cannot be read from the master chip.
- The bit error tolerance parameters cannot be read from the master chip.

For the reasons above, we strongly recommend programming the Flash chip using the original data file rather than a copied chip.



Can the programmer support img files?

- The programmer software supports binary and hexadecimal file encoding formats. The conventional suffix of binary files is *.bin, and the conventional suffix of hexadecimal files is *.hex;
- img is just a file suffix, and does not represent the file encoding format. Normally (above 90%) such files are binary encoded. Just load it directly in the software, the software will automatically recognize whether the file is binary code, and load it in the recognized format;
- To ensure the accuracy of file loading, we recommend that users check the buffer checksum and file checksum with engineer (or file code providers/customers) after loading such files. (These information will be displayed at the bottom of the main window of the writer software.)



What are the common reasons for programming failure (including erasing failure/programming failure/verification failure/ID error, etc.)?

- The chip manufacturer/model selected in the software does not match the actual chip;
- The chip is placed in the wrong direction, or the programming socket is inserted in the wrong position. Please check the correct placement method through the "Chip Information" window of the software;
- Poor contact between the chip pins and the programming socket;
- Connect chips that have been soldered on other circuit boards by wires or IC programming clips, which may cause programming failure due to circuit interference. Please put the chips back into the programming socket for programming;
- The chip may be damaged, replace with a new chip for testing.



Why does the 24 series chip have no erase function?

- The chip is based on EEPROM technology, the chip data can be directly rewritten without pre-erasing, so there is no erasing operation available;
- If you need to clear the chip data, please write FFH data directly to the chip.



How can I configure the programming speed?

For SP32 series programmers (SP325/SP328/SP328P), the programming speed can be adjusted through the Clock Frequency and SPI I/O settings on the Project Settings interface. The maximum programming speed is: 24 MHz + X4 (Quad SPI). For detailed instructions, please refer to Section 2.4 of Chapter 2.



Is there documentation for software features such as UID encryption and SPI NAND Flash programming settings?

Detailed instructions for all programmer software features are available in the software Help file.

To access the Help file: Menu → Help → View Help. After opening the Help file, you can either browse the table of contents or search for specific topics using keywords in the index.

Appendix 6 Disclaimer

Shenzhen Sfly Technology Co., Ltd. does its utmost to ensure the correctness of the product and its related software and materials. For possible product (including software and related materials) defects and errors, the company will do its best to solve the problem with its commercial and technical capabilities. The company is not responsible for all kinds of incidental, inevitable, direct, indirect, special, extended or punitive damages arising from the use or sale of this product, including but not limited to the loss of profit, goodwill, availability, Business interruption, data loss, etc., shall not be liable for any direct, indirect, incidental, special, derivative, punitive damages and third-party claims.

Appendix 7 Document Revision History

Release date	Version	Revised by	Illustrate
2026-07-01	A2	LYX	First edition