

## UM0004

**User Manual** 

AT-Link connector user manual

# Introduction

This user manual is written to give a complete account of AT-Link connector that is designed to make it easier and more convenient for users to perform MCU programming and configuratons.

Applicable products:

Туре	ARTERY MCU family
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# 1 Overview

# 1.1 Introduction

Artery AT-Link is an online/offline downloader (referred to as "AT-Link" in this document) that is stable, reliable, portable and easy-to-use. Its main features are shown in Table 1.

	ible 1. AT-Link s	specifications	1	
Main features	AT-Link	AT-Link EZ	AT-Link Pro	AT-Link-ISO
IDE compiling and debugging such as Keil/IAR	Support	Support	Support	Support
USB to USART interface	Support	Support	Support	Support
Simultaneously programming multi-section codes of discontinuous address area	Support	Support	Support	Support
Multiple offline projects storage	Support	Not support	Support	Support
User system area programming	Support	Support	Support	Support
SWD online/offline download	Support	Online only	Support	Support
ISP-USART offline download	Support	Not support	Support	Support
Machine programming control	Support	Not support	Support	Support
Serial number programming	Support	Support	Support	Support
Button free mode	Support	Online only	Support	Support
Programming times limit	Support	Not support	Support	Support
Remote file/project encryption	Support	Support	Support	Support
Limit the number of times of using remote project	Support	Not support	Support	Support
Remote project is bound to the only AT-Link	Support	Not support	Support	Support
Remote file is bound to the only AT-Link	Support	Not support	Support	Support
Online auto/manual firmware upgrade	Support	Support	Support	Support
sLib	Support	Support	Support	Support
Download/verify in ciphertext mode	Support	Not support	Support	Support
Buzzer on	Support	Not support	Support	Support
LED indicators	Support	Support	Support	Support
Output voltage regulation	Not support	Not support	Support	Support
LCD screen prompt	Not support	Not support	Support	Support
Offline parameter settings	Not support	Not support	Support	Support
Anti-interference	Common	Common	Common	Enhanced

Table 1.	AT-Link	specifications
		speemeutions



# 1.2 Glossary

#### AT-Link

ARTERY AT-Link connector.

• ICP

This is an in-circuit programmer software that can be used for various functions by AT-Link.

#### • ISP

This is an in-system programmer that supports write or erase operation to the chip.

• IDE

Third-party development programming software, such as Keil, IAR and other compiling and debugging tools.

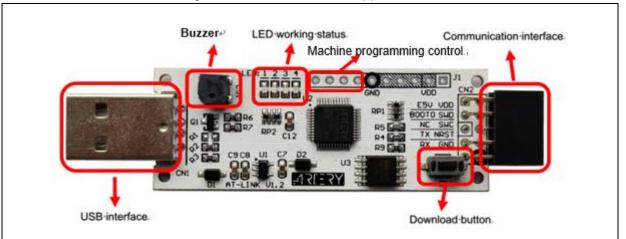


# 2 Hardware specifications

# 2.1 AT-Link

AT-Link is a basic debugger and programmer that supports IDE online debugging, online/offline programming, USB to serial interface and other functions.

It can be connected to PC USB interface, LED, buzzer, buttons, machine programming control interface. It can also be connected to various communication interfaces (such as SWD, SWO, serial port, NRST and BOOT0) and power interface (3V3 and E5V). Figure 1 shows the appearance of an AT-Link.





# 2.1.1 USB interface

It is used to communicate with PC during online debugging and download or ICP parameter configuration. It can also be used as AT-Link power supply interface in offline mode.

# 2.1.2 Communication interfaces

- **SWD:** A serial wire debug interface (including SWCLK and SWDIO) can be used for IDE online debugging or ICP online and offline configuration programming.
- **SWO:** It supports SWO\_UART feature and can be used for print information output in debug mode (For AT-Link with hardware V1.3 and above).
- **USB-to-serial port:** Includes TX and RX, can be connected to the serial interface of the target board for ISP offline download or used as a common serial interface.
- **NRST:** It can be connected to the NRST reset pin of the target board to provide a hardware reset signal, and cooperates with BOOT0 pin for boot mode switch during ISP offline download.
- **BOOT0:** It can be connected to the B00T0 pin of the target board, and cooperates with NRST pin for boot mode switch during ISP offline download.



# 2.1.3 Power supply interface

- **3V3:** used as 3.3 V power output port, output 3.3 V.
- **E5V**: used as 5 V power output or input port. As output: when the USB interface is powered, it outputs about 4.7 V; as input: the outside can input 4.5V~5.5V through this interface to supply for AT-Link.
- **GND:** connected to the GND of the target board.

### 2.1.4 LED and buzzer

LED1-LED4 are "connected" (red), "run" (green), "USB\_status" (blue), and power (orange) respectively.

- LED1: indicating connection state during offline/online operation.
- **LED2:** indicating running state during offline/online operation.
- LED3: indicates the connection status between AT-Link and PC USB. LED is always on after successful connection.
- LED4: After power-on, LED light is always on, indicating that AT-Link is working normally.
- **Buzzer:** It is used to indicate download status, and the switch on/off can be configured through ICP.

This table below shows the status of LED1 and LED2 during IDE, ICP online and offline operations:

Working status	LED1-Connected(red)	LED2-Run (green)	Buzzer status
Power-on initialization	All LEDs blir	ik once	Short beep
Idle state	OFF	OFF	Mute
IDE operation settings	ON	OFF	Mute
IDE debugging stops	ON	OFF	Mute
IDE debugging in progress	ON	ON	Mute
ICP configuration in progress	ON	OFF	Mute
Online/offline download on-going	Blink alternately	Blink alternately	Mute
End of online/offline download: PASS	OFF	Blink slowly	Short beep
End of online/offline download: FAIL	Quick blink	OFF	Ring quickly for 3S
End of continuous download: Remove target	OFF	OFF	Mute
Long press the key 3s to switch to offline download mode: button free download	Blink quickly for 3S	Blink quickly for 3S	Keep ringing for 3s
Long press the key 3s to switch to offline download mode: single download	OFF	Blink fast for 3S	Ring for 3s intermittently

Table 2. AT-Link LED and buzzer status



# 2.1.5 Machine programming control interface

Machine programming control contains START, BUSY, PASS, and FAIL interfaces. The parameters include machine programming control signal enable, active level polarity, START active level pulse width and BUSY delay setup time, which can be programmed in ICP and saved after power-off. Refer to *Section 3.4* for more information on the pin definitions and timing of machine programming control.

- START: Input interface. Download starts when the received active level pulse width is greater than the programmed value.
- BUSY: Output interface, it remains in the active level state during download.
- PASS: Output interface, it will remain active until the next operation after a successful download.
- FAIL: Output interface. If the download fails, the interface remains active until the next operation.

### 2.1.6 Button

Button is mainly used for offline download, and download mode switch.

- Short press 3s and release: For a single offline download.
- Press and hold 3s without release: Switch button free download or single download, with LED and buzzer indicating the switched mode

Note: Button operation can take effect only when AT-Link is in idle state. If offline download is ongoing or the target board is being operated, it will not respond.

# 2.2 AT-Link-EZ

AT-Link EZ is a simplified debugger and programmer, which can be used in conjunction with AT-START get-started board, or work with other circuit boards after being disassembled. It supports IDE online debugging, online programming, USG to serial interface and other functions.

Its hardware specification includes:

It can be connected to PC micro USB interface, LED, various communication interfaces (such as SWD, SWO, serial port, NRST and BOOT0) and power interface (3V3 and E5V). Figure 2 shows the appearance of an AT-Link-EZ.

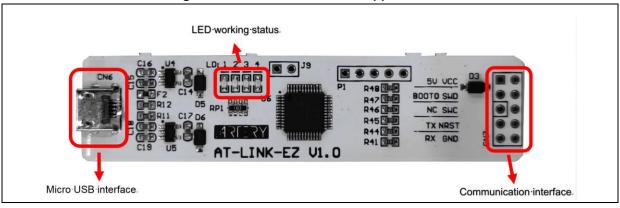


Figure 2. AT-Link-EZ hardware appearance



# 2.2.1 Micro USB interface

It is used to communicate with PC during online download and debugging or parameter configuration. It must be connected to the USB port on PC to supply for AT-Link EZ.

## 2.2.2 Communication interfaces

- **SWD:** A serial wire debug interface (including SWCLK and SWDIO) can be used for IDE online debugging or ICP online programming.
- **SWO:** It supports SWO\_UART feature and can be used for print information output in debug mode (For AT-Link-EZ with hardware V1.1 and above).
- **USB-to-serial port:** Includes TX and RX, can be connected to the serial interface of the target board as a common serial interface.
- **NRST:** It can be connected to the NRST reset pin of the target board to provide a hardware reset signal.
- BOOT0: Reserved.

### 2.2.3 Power supply interface

- **3V3:** used as 3.3 V power output port, output 3.3 V.
- **5V**: used as 5 V power output port, output 4.7 V.
- **GND:** connected to the GND of the target board.

### 2.2.4 LED

LED1-LED4 are "connected" (red), "run" (green), "USB\_status" (blue), and power (orange) respectively.

- **LED1:** indicating connection state during offline/online operation.
- LED2: indicating running state during offline/online operation.
- LED3: indicates the connection status between AT-Link-EZ and PC USB. LED is always on after successful connection.
- LED4: After power-on, LED light is always on, indicating that AT-Link-EZ is working normally.

This table below shows the status of LED1 and LED2 during IDE, ICP online operations:

Working status	LED1-Connected (red)	LED2-Run (green)
Power-on initialization	All LEDs I	olink once
Idle state	OFF	OFF
IDE operation settings	ON	OFF
IDE debugging stops	ON	OFF
IDE debugging in progress	ON	ON

#### Table 3. AT-Link-EZ LED status



Working status	LED1-Connected (red)	LED2-Run (green)
ICP configuration in progress	ON	OFF
Online download in progress	Blink alternately	Blink alternately
End of online download: PASS	OFF	Blink slowly
End of online download: FAIL	Blink quickly	OFF

# 2.3 AT-Link-Pro

AT-Link Pro is a professional debugger and programmer that supports IDE online debugging, online/offline programming, VDD output voltage range control, offline parameter settings, USB to serial interface and other functions.

It can be connected to PC micro USB interface, LCD display, LED, buzzer, buttons, machine programming control interface, various communication interfaces (such as SWD, SWO, serial port, NRST and BOOT0) and power interface (VDD and E5V). Figure 3 shows the appearance of an AT-Link-Pro.



#### Figure 3. AT-Link-Pro hardware appearance

# 2.3.1 Micro USB interface

It is used to communicate with PC during online download and debugging or parameter configuration. It can also act as a power supply interface for AT-Link-Pro in offline mode.

# 2.3.2 LCD touch screen display

LCD screen is used to display information and for touch operations. Regular settings can be done through the touch screen.

The screen is a resistive touch screen. It is recommended to use touch pen or other hard objects for more sensitive operation.





# 2.3.3 Communication interfaces

- **SWD:** A serial wire debug interface (including SWCLK and SWDIO) can be used for IDE online debugging or ICP online/offline programming.
- **SWO:** It supports SWO\_UART feature and can be used for print information output in debug mode (For AT-Link-Pro with hardware V1.2 and above).
- **USB-to-serial port:** Includes TX and RX, can be connected to the serial interface of the target board for ISP offline download, or used as a common serial interface.
- **NRST:** It can be connected to the NRST reset pin of the target board to provide a hardware reset signal, and cooperates with BOOT0 pin for boot mode switch during ISP offline download.
- **BOOT0:** It can be connected to the B00T0 pin of the target board, and cooperates with NRST pin for boot mode switch during ISP offline download.

The voltage status of these pins depends on the VDD input voltage or output setting range.

### 2.3.4 Power supply interfaces

- VDD: Used as power output or input port.
  - As output: Output 3.0 V, 3.3 V or from 1.62 V to 5.0 V (customized), depending on the voltage output range configured by ICP host or LCD touch
  - As input: The voltage between 1.62 V and 5.5 V can be used for the working power of AT-Link Pro. In this case, VDD output is invalid.
- **E5V:** Used as 5V power input or output port.
  - As output: When the USB interface is powered, the output voltage is close to 4.7 V;
  - As input: The external source inputs 4.5 V~5.5 V via this interface to supply power for AT-Link Pro.
- **GND:** Connected to the GND of the target board.

### 2.3.5 LED and buzzer

LED1-LED2 are "connected" (red) and "run" (green), respectively.

- **LED1:** indicating connection state during offline/online operation.
- **LED2:** indicating running state during offline/online operation.
- **Buzzer:** It is used to indicate download status, and the switch on/off can be configured through ICP.

This table below shows the status of LED1 and LED2 during IDE, ICP online and offline operations:



	4. AT-LINK-PTO LED and Duzzer Status		
Working status	LED1	LED2-	Buzzer status
	Connected (red)	Run (green)	
Power-on initialization	All LEDs	blink once	Short beep
Idle	OFF	OFF	Mute
IDE operation settings	ON	OFF	Mute
IDE debugging stops	ON	OFF	Mute
IDE debugging in progress	ON	ON	Mute
ICP configuration in progress	ON	OFF	Mute
Online/offline download	Blink alternately	Blink alternately	Mute
on-going			
End of online/offline download:	OFF	Blink slowly	Short beep
PASS			
End of online/offline download:	Blink fast	OFF	Ring quickly for 3S
FAIL			
End of button free download	OFF	OFF	Mute
Remove target			

#### Table 4. AT-Link-Pro LED and buzzer status

# 2.3.6 Machine programming control interface

Machine programming control contains START, BUSY, PASS, and FAIL interfaces. The parameters include machine programming control signal enable, active level polarity, START active level pulse width and BUSY delay setup time, which can be programmed in ICP and saved after power-off. Refer to *Section 3.4* for more information on the pin definitions and timing of machine programming control.

- START: Input interface. Download starts when the received active level pulse width is greater than the programmed value.
- BUSY: Output interface, it remains in the active level state during download.
- PASS: Output interface, it will remain active until the next operation after a successful download.
- FAIL: Output interface. If the download fails, the interface remains active until the next operation.



# 2.3.7 Button

Button is mainly used for offline download, and download mode switch.

- Short press 3s and release: For a single offline download.
  - When the LCD is in the offline programming page, it serves as a download key for a single offline download.
  - When the LCD is on other pages, it serves as a return key to return to the home page; if the LCD is in sleep mode, it can be used to wakeup the screen.
- Long press and hold 3s without release: When AT-Link Pro is in the online debug mode, it acts as an exit key to exit this mode.

*Note:* Button operation can take effect only when AT-Link is in idle state. If offline download is ongoing or the target board is being operated, it will not respond.

# 2.4 AT-Link-ISO

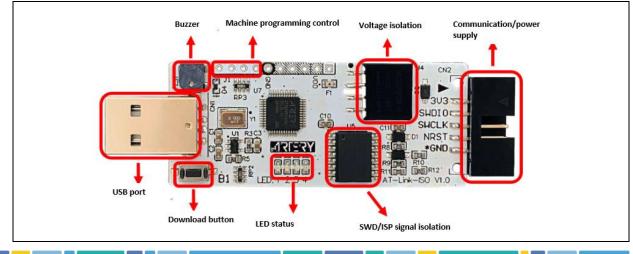
AT-Link-ISO literally refers to the AT-Link with isolation protection feature. Thus it has the exact same function as that of AT-Link, and shows almost no difference when used in regular scenarios compared to AT-Link.

AT-Link-ISO comes with enhanced isolation protection to ensure it is capable of isolating 3000V power supply and signals. Such design also makes it the best choice for the application development under strong interference environment such as motors, high-power supplies and high voltage. It is recommended for the users to select AT-Link-ISO if they meet the above mentiond scenarios so as to get a stable development environment.

Slight differences between AT\_Link\_ISO and AT\_Link are as follows:

- E5V pin cannot be used as a power input. AT-Link-ISO is always powered through USB port.
- The maximum total power output on the isolation side is around 200 mA, slightly weaker than AT-Link. It is not recommended to exceed this limit.

In addition, in consideration of cost and practicality, the machine programming control interface is not included in the isolation protection part of AT-Link-ISO, so it is necessary to ensure that the good connection state should be maintained between AT-Link-ISO and the programming machine during mass production.







# **3** Functional overview

# 3.1 PC connection and driver installation

AT-Link is a USB composite device that integrates HID and CDC device types, and is connected to PC through a USB cable. Except for USB to USART feature, other related functions do not need a driver, which are recognized as a HID device in the device manager. Some operating systems require to install a driver manually, which are recognized as HID and CDC devices (AT Link-USART) in the device manager after installation.

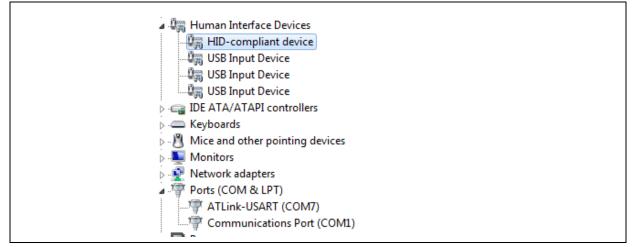
# 3.1.1 How to install a driver

Double click on "Artery\_ATLink-USART\_DriverInstall.exe" and follow the prompts to install:

Artery_ATLink-USART_DriverInstall_V1.0.00	
Device Name: ATLink-USART VID: 2E3C PID: F000 UID: CA4EF&0&000	Install driver

Figure 5. Driver installation illustration





# 3.2 IDE operation

AT-Link can be used for debugging and download on the third-party development tools such as Keil and IAR. It supports up to 6 hardware breakpoints.

# 3.2.1 Keil IDE environment

Take Keil V5.18.0.0 as an example in this document.

#### Initialization:

Select "CMSIS-DAP Debugger "in "Options-Debug", as shown Figure 7:



Device   Target	Output   Listing   User   C/C++	Asm Linker	Debug   Vtilities	
C Use <u>S</u> imulato		Use: CMSIS     Altera     Stellari	Blaster Cortex Debugger	Settings
Load Applica	ation at Startup 🔽 Run to main()	✓ Load Signun J-LINK Initializatiq ULINK	s ICDI 1 Systems JTAGjet / J-TRACE Cortex Pro Cortex Debugger < Debugger	o main()
I Breakpoi I Watch V	g Session Settings nts I Toolbox /indows & Performance Analyzer Display I System Viewer Parameter:	Restore CMSIE R Fast M PEMic Warch W Memory D Driver DLL:	odels Debugger ro Debugger naows	* swer
SARMCM3.DLL	-REMAP	SARMCM3.DLL		
Dialog DLL:	Parameter:	Dialog DLL:	Parameter:	
DCM.DLL	-pCM4	TCM.DLL	-pCM4	

Figure 7. Select CMSIS-DAP Debugger in KeiL

Go to Debug Settings, tick "*SWJ*", select "*SW* "from Port drop-down list, and select "*1 MHz*" or above in *"Max Clock*" to get the best AT-Link performance, as shown in figure 8:

#### Note: The target board MCU must be connected normally to display AT-Link information correctly. The target board RDP enable, SWJ disable and other conditions will result in incorrect display.

Debug   Trace   Flash Download   CMSIS-DAP - JTAG/SW Adapter SW Do	
AT-Link-CMSIS-DAP  Serial No: C3D275220040B5 Firmware Version: 1.2.0	IDCODE         Device Name         Move                • 0x2BA01477             ARM CoreSight SW-DP          Up            Down
SWJ Port: SW -	utomatic Detection ID CODE:
Debug         Connect & Reset Options         Connect:       Normal         ✓       Reset:         Autode         ✓       Reset after Connect         ✓       Stop after f	Cache Memory Download to Flash

Figure 8. Debug settings in Keil

#### Debugging:

Click on "*Debug*" button on the software to enter the debugging mode, and follow Keil window for various operations.

Figure 9. Keil debugging

	bug Peripherals Jools SVCS Window Help		
/	Disassembly     Ox08000A52 0000 MOVS r0,r0		
ister Value Core	110: system_clock_config();		
80 0±20000098 81 0±20000298	111: COXOSOOOA54 FOOOFS9E BL.W system clock conf	- (Augenagenes)	
R2 0x20000298	112: at32_board_init();	( (0K06000B34)	
		AuxAAAAAAA	
85 0x20000034 85 0x00000000			
B7 0x00000000	startup_at32f403a_407.s main.c		
B8 0x0000000 B9 0x00000000	101 }		
- 810 0x08000060 - 811 0x00000000	102 103 日/**		
812 0x20000074 813 (SP) 0x20000898	104 * @brief main function.		
814 (LR) 0x08000213	105 * Cparam none		
115 (PC) 0x080000x54 € xP5R 0x21000000	106 * @retval none 107 */		
Banked System	107 min main (void)		
Internal Bode Thread	109 🕀 {		
-Privilege Privileged	110 system_clock_config():		
States 1250	111 112 at32 board init();		
Sec 0.00012500	113		
	114 button_exint_init();		
	115 116 while(1)		
	117 白 {		
	118 at32_led_toggle(LED2);		
	119 delay_ms(g_speed * DELAY); 120 at32_led_toggle(LED3);		
	120 at 32_led_toggle(LEDS); 121 delay_ms(g_speed * DELAY);		
	122 at 32 led toggle(LED4):		
	123 delay_ms(g_speed * DELAY);		
	124 - }		
	126		
	127 日/**		
	128 * 0} 129 */		
Project Registers	129 */		
nand	1.0	4 Gill Stack + Locals	
	1F403A 407 Firmware Library V2.x.x\\project\\at start f40		
\\template\/src/main.c	119	///templates/\mdk_v5//objects//ter > Name Location/V Type	
1, `sysclk_source		· · · · · · · · · · · · · · · · · · ·	
		*	
		· · ·	

# 3.2.2 IAR IDE environment

-AT-Link is applicable to IAR V7.10 and above only. Take IAR V7.40 as an example here.

#### • Initialization:

Select "CMSIS DAP" in "Options-Debugger-Setup-Driver," as shown in figure 10:

Figure 10. Select CMSIS DAP in IAR

Category: General Options						Factory Settings	
Static Analysis Runtime Checking C/C++ Compiler	Setup	Download	Images	Extra Options	Multicore	Plugins	
Assembler Output Converter	Driver	-		🔽 Run to			
Custom Build	CMSIS	80	•	main			
Build Actions	Simul						
Linker Debugger	Angel CMSIS	DAP					
Simulator	GDB S	erver OM-monitor					
Angel	I-jet	/JTAGjet k/J-Trace					
CMSIS DAP	TI St	ellaris					
GDB Server IAR ROM-monitor	Macra PE mi			e			
I-jet/JTAGjet	RDI ST-LI	NK				ALC 102-112-1	
J-Link/J-Trace	Third	-Party Driv	ver	\debugger\Arter	Tek\AT32F41	.3xC	
TI Stellaris Macraigor	TI XD	2					
PE micro	L						
RDI							
ST-LINK							
ST-LINK Third-Party Driver TI XDS				_	ок	Cancel	



Then, select "SWD" Interface in "Options-Debugger-CMSIS DAP", as shown in Figure 10:

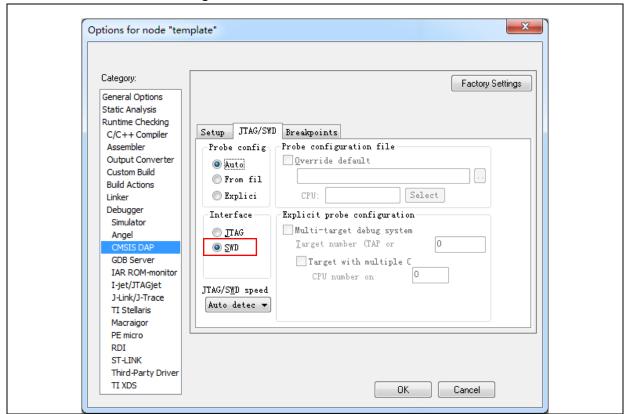


Figure 11. Select SWD interface in IAR

Debugging

Click on "debug" to enter the debug mode, and follow IAR window for various operations.

pace ×			<ul> <li>X Disassembly</li> </ul>
	menc  * Øbrief exint0 interrupt handler		Go to
s fr Q	<pre></pre>		Dissembly     Dissembly
	at32_led_toggle(LED4); delay_ms(g_speed * DELAY);		0x8000ac0: 0x8000ac2:
olate	<[		> - < <u>m</u>
Messages Building configuration: tem Updating build tree	<	Fie	• • • • •

Figure 12. IAR debugging





# 3.3 ICP tool operation

ICP tool can be used to perform online operations such as Flash memory download/read and parameter configurations on Artery MCU chips, and also configure AT-Link encryption files, online/offline operation and monitoring, firmware upgrade and so on.

### 3.3.1 How to use encryption files

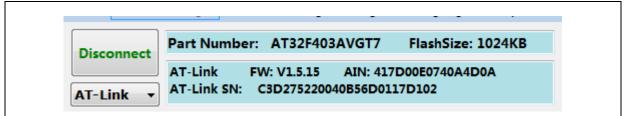
- To protect files against leakage and copying during remote transfers, the contents of firmware can be encrypted into the corresponding benc/henc/senc files for encryption download;
- The encryption key must be the same as that of the target AT-Link;
- Each AT-Link has its unique serial number, which is the initial factory default encryption key.

#### The steps for using encryption files are as follows:

1) Obtain the encryption key of the target AT-Link

The factory default encryption key is AT-Link serial number, which is available on the ICP homepage by connecting to the target AT-link. Users can also customize the encryption key according to their needs, modify and save it in the AT-Link setting-parameter setting of ICP.

#### Figure 13. Encryption key location



#### Figure 14. Customize the encryption key

Encryption key:	*****D102	Save
Encryption key:	0102	Save

1) In ICP, click on *"file-make encryption file"*, enter the encryption key, then the firmware contents in the format of bin/hex/srec/s19 generated by tools such as Keil and IAR are changed into encrypted files in the format of benc/henc/senc.

Figure 15. Make encryption file

ſ	Make encryption file	
	Encryption key (6-24 bytes) C3D275220040B56D0117D102	
	Original file	
	Encryption file	
	Begi	n Cancel



- 2) Encrypted files are transferred remotely to the corresponding AT-Link for online/offline download.
  - Online download: Add encrypted files to the download file box and click on "*Begin*". If "Verify" box is ticked, you need to input an encryption key.

Verify	Custom encryption key for verify:
	C3D275220040B56D0117D102

- Figure 16. Verify after online download
- Offline download: Add encrypted files to the offline project configuration, and save them to the corresponding AT-Link for offline download.

### 3.3.2 Paramete settings

This section describes how to configure AT-Link parameters.

Number of data storage area: This indicates the number of codes stored offline, which can be configured as 1/2/4/8/16, with their individual maximum capacity 16/8/4/2/1 MB respectively. Offline download also supports downloading several code files (up to 5) at one time, which occupy multiple storage areas.

Note: Modifying this option will clear all offline stored data.

- Machine programming control:
  - Machine programming control enable: Tick it and click on "Save "to enable machine programming control.
  - - Polarity of active level: Select low level or high level.
  - - START pin active level pulse width: 20-1000 ms
  - - Busy pin delay setup time of: 20-1000 ms
- SWD speed: Configure the SWD transfer speed for online/offline operation during non-IDE operation. It is recommended to click on "*Auto detect* "to let AT-Link automatically obtain the best SWD speed according to the actual circuit. Users can also select SWD speed from the drop-down list. Depending on the line length between AT-Link and target board, it is advisable to reduce the SWD speed if the line distance is long. To take into account the programming quality, it is recommended to connect AT-Link and target board using a flat cable thicker than AWG28. Measuring at AWG28 cable, the line length is around 10 meters for 1MHz SWD, 5 meters for 2 MHz SWD, and 3 meters for 5 MHz SWD.
- **Reset mode:** It contains software system reset and hardware NRST pin reset, which is used to select the reset mode after the target board connection and download completed.
- **Buzzer:** Buzzer enable/disable. When this function is disabled, all other operations are mute except for power-on initialization.
- Encryption key: Supports the combined configuration of 6-24 bytes of letters or numbers, which is customized by AT-Link users. Its initial default value is a 24-byte AT-Link serial number.



#### Note: Modifying this option will clear all existing offline stored data.

• **Restore factory parameters:** Clear all AT-Link parameters and stored data, and return to factory default values.

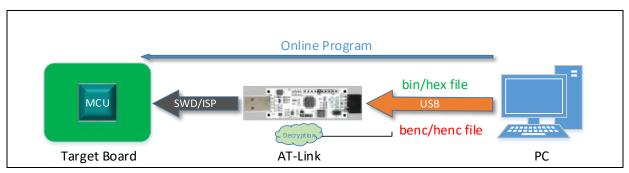
Data stora		k offline confi	g settings	AT-LINK ON	ine downioa	u status		
	r of area: 1	.6 🔻	Save	(1MB Ea	ch storage a	area)	🔵 : Idle	
Status o	of area:				2		😑 : Data	
A1 🔴	A2 🔴	A3 🔴	A4 🔴	A5 🔴	A6 🔴	A7 🔴	A8 🔴	
A9 🔴	A10 🔴	A11 🔴	A12 🔴	A13 🔴	A14 🔴	A15 🔴	A16 🔴	
Output vol	tage settings	5						
Output	voltage		- VE	DD actual vol	tage:			
3.3V	◯ 3.0V	Custom		V(1.62~5.				
	· _ · · · ·		-					
Start pin				f active level:	<ul> <li>Low</li> </ul>	evel 🔘 Hiç	80	e ms ms
Start pin	e machine pr active level p delay setup t	ogramming bulse width: time:			e low	evel 🔘 Hig	80	ms
✓ Enable Start pin Busy pin	e machine pr active level p delay setup t d: 500 KH	ogramming bulse width: time:	Polarity o		O Low I L	evel 🔘 Hiş	80	ms
✓ Enable Start pin Busy pin SWD spee Reset mod	e machine pr active level p delay setup t d: 500 KH	rogramming bulse width: time: Hz ▼	Polarity of Auto determined set	ect Buzzer:		evel 🔘 Hig	80	ms
✓ Enable Start pin Busy pin	e machine pr active level p delay setup t d: 500 KH	rogramming bulse width: time: Hz v are system re	Polarity of Auto determined set	ect Buzzer:	Enable	evel 🔘 Hig	80	ms
✓ Enable Start pin Busy pin SWD spee Reset mod	e machine pr active level p delay setup t d: 500 KH	rogramming bulse width: time: Hz v are system re	Polarity of Auto determined set	ect Buzzer:	Enable	evel 🔘 Hig	80	ms
Enable     Start pin     Busy pin     SWD spee Reset mod Encryption	e machine pr active level p delay setup t d: 500 KH	rogramming bulse width: time: Hz • are system ree	Polarity of Auto determined set	ect Buzzer:	Enable	evel 🔘 Hig	50	ms
Enable     Start pin     Busy pin     SWD spee Reset mod Encryption	e machine pr active level p delay setup t d: 500 KH le: Softwa key: *******	rogramming bulse width: time: Hz • are system ree	Polarity of Auto determined set	ect Buzzer:	Enable	evel 🔘 Hig	80	ms

#### Figure 17. Parameters settings



## 3.3.3 Online operations

AT-Link supports online programming. The data transfer can be the original bin/hex/srec/s19 data or encrypted benc/henc/senc data. For encrypted benc/henc/senc data, the encryption key to generate data must be the same as that of AT-Link during programming.



#### Figure 18. Online programming process

#### Online download

Select AT-Link and connect. If the connection is successful, the information such as model, serial number and firmware version will be displayed, and each AT-Link has its unique serial number. If the target board is connected successfully, its MCU part number and Flash size will be shown, and will halt the target board MCU. If failed, related online operations cannot be performed.

- Supports downloading multi-section files (up to five) at one time, in the format of original bin, hex, srec, s19 or encrypted benc, henc, senc.
- A few chips have SPIM feature. If the download file address goes beyond SPIM address (0x08400000), users need to tick "SPIM", and select the correct external Flash part number, Remap, FLASH\_DA 0x and other parameters according to the needs.
- Download Form allows users to set various options, where the user system files only support bin or hex format.

# *Note:* If the downloaded files are encrypted, you need to enter the encryption key to enable verify after download.

SPIM       FLASH_DA 0x       0       @ Remap0 (Use PAI1/PAI2 pins)         Type       Select       Remap1 (Use PBI0/PBI1 pins)         Memory read settings       Address 0x       0000000       Read size       0         Address 0x       0000000       Read size       0       Data bits       Read         File info        0       Disable slib       Disable slib       Disable slib         No.       File name       File size       Address range(0x)       Addd         1       test, 64k.bin       65536       08000000-0800FFFF       Delete         File info         No.       File name       File size       Address range(0x)       Addd         1       test, 64k.bin       65536       08000000-0800FFFF       Delete         File info         Write address ox (B00000)         Bash info       File cRC verify         DownLoad         Write address ox (B000000)         Bash info       File cRC verify         OwnLoad         Write user system data         User system data         User system data file path	File J-Link settin	ngs AT-Li	nk settings	Target	Languag	e Help	D				sLib status						
AT-Link FW: V15.13 AIN: 41700000740AJD0A XT-Link、 AT-Link SR: C3D27522004085500117D12 アサー  SPIM FLASH_DA 0x 0 ● Remap0 (Use PA11/PA12 pins) Type Select ● Remap1 (Use PB10/PB11 pins) Memory read settings Address 0x 08000000 Read size 0x 100 Data bits 8 bits ● Read Flie info No. File name File size Address range(0x) Add 1 test_64k.bin 65536 08000000-0800FFFF Delete Flash info Filetest_64k.bin Address range(0x08000000-0800FFFF Delete Flash info Filetest_64k.bin Address 0 1 2 3 4 5 6 7 8 9 A 8 C D E F AI Posse00000 C0000FFFF Checksum: 0x0067CC79 Address 0 0 1 2 3 4 5 6 7 8 9 A 8 C D E F AI Posse00000 C00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Pai	rt Number:	AT32F403/	VGT7	FlashSiz	: 1024k	(B	40		עכ	sLib status	s: Disable		Remaining	g usage t	times: 251	
TT-Link       TT-Link SN: C3D27522004085600117D102       推 持力         SPIM       FLASH_DA Dx       0       @ Remap0 (Use PA11/PA12 pins)         Type       Select       @ Remap0 (Use PA11/PA12 pins)         Memory read settings       Address 0x 08000000       Read size 0x 100       Data bits 8 bits       Read         File info       Image: Size (State Sectors of file size       Image: Size (State Sectors of file size       Disable slib before download         I test_64Lbin       65536       08000000-0800FFF       Delete       Disable file size       Disable file size         Address name:       File cRC       File CRC verify       DownLoad       Use roystem data       Button free mode         Current SN       0x       0x       0x       0x       0x       0x       0x         Address name:       0x       2 3 4 5 6 7 8 9 A 8 C D E F Al       Disable file path       Image: Size (State Sector Se		Link El	M• V1 5 15	ATN: 417	000E0740A			27 I Y	<u> </u>	X I	Enable pa	ssword 0x		sLib posit	ion:	Main Flash	
SPIM       FLASH_DA Ox       0								雅	特	カ	Disable pa	assword 0x		Start sect	or	Sector20x080	001000 •
End sector       Disable sLib before download         No.       File info		CDINA	FLACU DA	0		P				//		[	Disable sLib	DATA star	rt sector	Sector20x080	001000 -
Memory read settings           Address 0x 0800000         Read size 0x 100         Data bits 8 bits •         Read           File info         Itest_64k.bin         Disable sLib before download           No. File name         File size         Address range(0x)         Add           1         test_64k.bin         65536         08000000-0800FFFF         Delete           Flash info         File cscc verify         DownLoad         Uvite software serial number(SN)         Button free mode           Current SN         0         00000001         Button free mode         Current SN         0         00000001           Address nage (0x08000000 0x0800FFFF)         Chies F AI         0         00000001         Button free mode           Current SN         0         00000001         Increase step 0         000000001         Button free mode           Current SN         0         00000001         User system data         User system data         User system data           Vest 54k.bin File download 00 00 00 00 00 00 00 00 00 00 00 00 00			FLASH_DA											End secto	r	Sector20x080	001000 -
Addess 0x 0800000       Read size 0x 100       Data bits       8 bits       Read         File info       I test_64k.bin       65536       08000000-0800FFFF       Delete         I test_64k.bin       65536       08000000-0800FFFF       Delete         File info       I test_64k.bin       65536       08000000-0800FFFF       Delete         File file size       I test_64k.bin       65536       08000000-0800FFFF       Delete         File file size       I test_64k.bin       Button free mode       Write address 0x       8010000         Current SN       0       00000001       Increase step 0x       00000001       Button free mode         Address range(0x0800000 0x0800FFFF)       Checksum: 0x087CC79       Increase step 0x       00000001       Button free mode         Address 0       1       2       3       4       5       7       8       9       A       0				Se	ect	Kemapı	Use PB		L pins)								
File info         No. File name       File size       Address range(0x)       Add         1       test_64k.bin       65536       08000000-0800FFF       Disable FAP before download         Jump to the user program       Enable SLD       Disable FAP after download         Jump to the user program       Enable SLD         Flash info       File CRC verify       DownLoad         Hash info       File crc verify       DownLoad         Kottess range(0x0800000 0x0800FFFF)       chcc verify       DownLoad         User system data       User system data         User system data file path          0x08000000       0x0 0x	·					_				_	· ·						
File info         No.       File name       File size       Address range(0x)       Add         1       test_64k.bin       65536       08000000-0800FFF       Delete         File shinto       65536       08000000-0800FFF       Delete         File shinto       File cRC verify       DownLoad         Hash info       File cRC verify       DownLoad         File shinto       File cRC verify       DownLoad         Address range(0x0800000 0x0800FFFF)       checksum: 0x067CC79         Address range(0x0800000 0x0800FFFF)       checksum: 0x067CC79         Address range(0x080000000000000000000000000000000000	Address 0x 0800	00000	Read size Ox	100	Data	a bits 8	bits 💌		Rea	d	Erase the	e sectors of	file size	•	📃 Dis	able sLib befor	e download
No.         File name         File size         Address range(0x)         Add           1         test_64k.bin         65336         08000000-0800FFF         Delete         Jump to the user program         Enable FAP after download           Itest_64k.bin           Flash CRC         File CRC verify         DownLoad           Write software serial number(SN)           Write address 0x         08010000           Current SN 0x         000000001           Address of 0         1         2         3         4         5         7         8         9         A         E         D         E         F         Africence           Oxide         0         1         2         3         4         5         6         7         8         9         A         C         D         E         A         C         D         E         A         C         D         E         A         C         D         E         A         C         D         E         A         C         D         E         A         C         D         C         C         C         C         C         C         C	File info										Verify	Cust	om encryption l	key for verify:	📃 Ena	able sLib	
1       test_64k.bin       65536       08000000-0800FFFF       elete         I       test_64k.bin       65536       08000000-0800FFFF       elete         I       file       file       file       08000000-0800FFFF       elete         I       file       file       file       file       file       file         Address       0       1       2       3       4       5       6       7       8       9       A       8       C       0       File	No. File name				File size	Addre	ss range	(0x)	A	dd					📃 Dis	able FAP before	e download
Flash CRC         Flie CRC verify         DownLoad           Flash info         Flie         Flie         CC verify         DownLoad           Address         0         1         2         3         4         5         6         7         8         9         A         8         C         D         F         Address         0         00000001         Increase step         0x         0x <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>(E) 5</td><td>LL 540 - 6 - 1</td><td></td></t<>															(E) 5	LL 540 - 6 - 1	
Flash rds         File         File         DownLoad           Flash infs         File         File         CCC verify         DownLoad         Write address 0x         08010000         Button free mode           Address         nage (bx88000000 bx880/FFFF)         checksum: 6x06/7C79         Increase step 0x         000000001         Increase step 0x         000000001           Address         0         1         2         4         5         6         7         8         9         A         C         D         E         F         A1           0x08000000         008800FFFF         checks000000         0         00         0	1 test 64k.b	bin			05530	08000	000-0800	DFFFF	De	lata	📃 📃 Jump	to the user	program			able FAP after d	lownload
Flash CRC         File CRC verify         DownLoad           Increase step 0x         00000001           Mddress range (bx0800000 bx800FFFF) checksum: 0x0067CC79           Address range (bx0800000 bx800FFFF) checksum: 0x0067CC79           Write user system data           User system data           User system data           0x8000010           0x8000010           0x800010           0x800010 <t< td=""><td>1 test_64k.t</td><td>bin</td><td></td><td></td><td>65536</td><td>08000</td><td>000-0800</td><td>OFFFF</td><td>De</td><td>elete</td><td></td><td></td><td></td><td>1</td><td></td><td>able FAP aπer d</td><td>lownload</td></t<>	1 test_64k.t	bin			65536	08000	000-0800	OFFFF	De	elete				1		able FAP aπer d	lownload
Flash CRC         File CRC verify         DownLoad           Flash info         Filetext_64k.bin         Increase step 0x         00000001           Address range (0x08000 FFFF)         checksum: 0x0067CC79         Increase step 0x         00000001           Address of 0         1         2         3         4         5         6         7         8         9         A         0	1 test_64k.k	bin			65536	08000	000-0800	OFFFF	De	elete	🗖 Write	software se	rial number(SN)				lownload
Address         0         1         2         3         4         6         7         8         9         A         8         C         D         F         Address           Address         0         1         2         3         4         5         6         7         8         9         A         8         C         D         E         F         Address           000000000         90         77         0         20         0         08         7         A         B         C         D         E         F         Address         Address         C         0         E         F         Address         Address         C         0         E         F         Address         Address         C         C         D         E         F         Address         C	1 test_64k.k	bin			65536	08000	000-0800	OFFFF	De	elete	Write	<b>software se</b> te address (	rial number(SN)				lownload
Address range (0x080000 0x0800FFFF) checksum: 0x087CC7C         Address       0       1       2       3       4       5       6       7       8       9       A       B       C       D       F       Ad         Modesson00       90       F0       0	1 test_64k.t	bin									Write	<b>software se</b> te address (	rial number(SN)				lownload
Address         0         1         2         3         4         5         6         7         8         9         A         B         C         D         E         F         Ai           0x08500000         90         F7         00         20         C1         02         00         08         F9         A0         00         08         4         User system data file path         User system data file path            0x0800010         C0         02         00         08         10         00         00         02             0x0800010         C0         00         00         00         00         00         00         00         00            0x0800010         C0         00         00         00         00         00         00         00            0x0800010         00         00         00         00         00         00         00         00         00            0x0800010         00         00         00         00         00         00         00         00         00         00         00         00				F							Write Wri Cur	software se te address ( rent SN (	rial number(SN) 08010000 00000001				lownload
Oxf800000         90         F7         00         20         CL         02         00         68         F9         A0         00         68         f6           Oxf800001         CD         02         00         68         Co         02         00         68         F9         A0         00         68         f6           Oxf8000010         CD         02         00         68         10         02         00         68         60         00         02         03         04         04         05         68         60         05         02         03         03         04         05         68         60         05         03         04         05         04         05         04         05<	Flash info File:test	st_64k.bin	)FFFF1_checks		lash CRC						Write Wri Cur Incr	software se te address ( rent SN ( rease step (	rial number(SN)           0x         08010000           0x         00000001           0x         00000001				lownload
Construction         CD         Q2         Q0         Ref         Q2         Q0         Ref         Q2         Q0         Q2         Q2         Q2         Q3         Q2         Q3         Q3         Q2         Q3         Q3         Q3         Q3         Q3         Q3         Q3         Q3         Q3         Q4	Flash info File:tes Address range:[0x04	st_64k.bin 18000000 0x080		sum: 0x006	lash CRC	File	CRC veri	fy	DownL	oad	Write Wri Cur Incr	software se te address ( rent SN ( rease step ( user system	rial number(SN) >> 08010000 >> 00000001 >> 00000001 >> 00000001				lownload
00000000 00 00 00 00 00 00 00 00 00 00	Flash info Address range:(0x0) Address	st_64k.bin 88000000 0x080 0 1 2	3 4 5	sum: 0x006	ilash CRC 7CC79	File	CRC veri	fy I	DownL	oad	Write Wri Cur Incr	software se te address ( rent SN ( rease step ( user system	rial number(SN) >> 08010000 >> 00000001 >> 00000001 >> 00000001			iton free mode	
	Flash info Address range:(0x0k Address (0x0k Address (0x0k) 0x0800000 9	st_64k.bin 18000000 0x080 0 1 2 30 F7 00	3 4 5 20 C1 02	sum: 0x006 6 7 2 00 0	ilash CRC 7CC79 7 8 9 8 C9 02	File A 00 0	CRC veri B C 08 F9	fy I D E A0 0	DownL4	oad A: _	Write Wri Cur Incr	software se te address ( rent SN ( rease step ( user system	rial number(SN) >> 08010000 >> 00000001 >> 00000001 >> 00000001			iton free mode	
	Flash info Address range:(0x0) Address (0 0x08000000 9 0x08000010 C	st_64k.bin 18000000 0x080 0 1 2 90 F7 00 CD 02 00	3 4 5 20 C1 02 08 CF 02	sum: 0x006 6 7 2 00 0 2 00 0	lash CRC 7CC79 8 C9 02 8 D1 02	A 00 0	CRC veri <b>B</b> C 08 F9 08 00	fy     D   E A0 0 00 0	<b>DownL</b> <b>F</b> 0 08 0 00	oad A: _	Write Writ Incr	software se te address ( rent SN ( rease step ( user system system data	irial number(SN)           0x         08010000           0x         00000001           0x         00000001           0x         00000001           data         file path			iton free mode	

#### Figure 19. Online download window



#### **Online configurations**

This page describes online MCU configurations such as erase, user system data, RDP, sLib, bootloader AP mode.

Figure 20 Online energian

Artery ICP Pro	ogrammer_V2.5.01		The supervised states	
File J-Link	settings AT-Link setting	s Ta	irget Language Help	_
Disconnect	Part Number: AT32F4	03/	Mass erase Erase main flash	
AT-Link •	AT-Link FW: V1.5.15 AT-Link SN: C3D27522		Erase SPIM	雅特力
	SPIM FLASH	DA	Erase sectors User system data	11/PA12 pins)
Memory read			Access protection	-10/PB11 pins)
Address 0x		0x	sLib status	Read
File info			DownLoad	
		_	Flash CRC	+(0x) Add
	iame 54k.benc		Debug	0x) Add DFFFF Delete

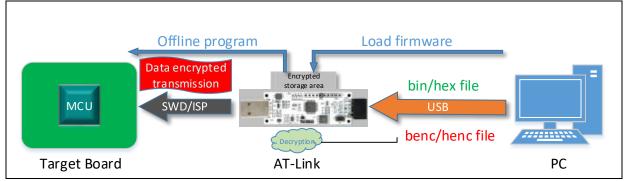
### 3.3.4 Offline operations

AT-Link supports offline download, and works with the Hex Encryption function of Artery MCU to implement encrypted data transfer during offline programming.

- Data transfer can be original bin/hex/srec/s19 format or encrypted benc/henc/senc format;
- For encrypted benc/henc/senc data, the encryption key to generate data must be the same as that of AT-Link used during programming.
- For AT-Link that has saved offline projects, offline programming mode is supported.

#### Note: All AT-Link parameters can be saved after power-off.





#### Offline project configurations

This page describes the configurations of offline download, including information, user system data and code. All the configuration contents are collectively referred to as an offline project.

- **Offline project:** Indicates the saved offline projects, and select a project from the drop-down list to view its configuration parameters;
- Delete/Create: Delete the selected project or create a new one in the drop-down list;
- **Project name:** When creating a project, the project name can be customized, supporting up to 16 bytes.



- **Device:** When creating a new project, users can select "Only download a specific MCU" or "All MCUs under certain series". For example, if users select AT32F413 Universal-1Kbytes/sector, it means that all 1KB MCUs/sector under F413 series can be downloaded;
- Add/Delete: When creating a new project, add/delete the code file to be downloaded. The format can be original bin/hex/ srec/s19 or encrypted benc/henc/senc. Multiple code files can be configured, but their storage addresses cannot be on the same Flash page. The maximum length of a file name is 32 bytes;
- Erase option: Configure as required. Perform various erase operations before downloading.
- Download interface: Select SWD or ISP interface when creating a new project;
- **Download times:** If this option is ticked, it means that the total number of downloads is limited ranging from 1 to 4000000. Both successes and failures are included in the total number. If the total number is exceeded, no more downloads are allowed.
- **Reset and run:** Reset and run after the completion of download. This option and *Enable RDP* after download cannot be enabled at the same time
- **Encryption transmit:** The download process works with the Hex Encryption feature of Artery MCU to implement encrypted transfer so as to ensure data security;
- Verify: Verify whether the data is correct after download, and a hardware check method will be used during transfer encryption to ensure data security.
- Enable RDP after download: RDP is enabled when the download is complete. This option and *Reset and Run* cannot be enabled at the same time.
- **Bootloader AP mode:** For some MCUs, their bootloader memory can be configured as an extended user code area to store user code. To avoid misuse, users need to enter the encryption key 0xA35F6D24 to make it effective.

#### Note: This mode setting is irreversible and can only be modified once.

- Write user system data: Users can choose to download user system data at the same time. The format can only be either bin or hex;
- **Software serial number:** 32-bit data. The programming address can be customized. This address and code address cannot be on the same flash page. Serial number value = initial serial number + number of successful downloads x each incremented value. If overflow occurs, the high bits will be cleared and the low 32 bits reserved;
- **SPIM:** When there are files with their address range in SPIM (including code or serial number), users need to select the corresponding external Flash model, Remap and FLASH\_DA and other information;
- **sLib settings:** Configure sLib-related parameters, including disabling sLib before download or enabling sLib when download, the sLib password and sLib range must be programmed;
- Save project file: After the completion of all configurations, they can be packaged to generate an encrypted \* .atcp project file for remote transfer or local storage. When saving, it is up to the user to tick the option "This project is only used at the specified AT-Link" (AT-Link SN is required) or "This project is only used once" (AT-Link AIN is required)
- **Open project:** Open an existing atcp format project file and load its content into software for viewing.



• Save project to AT-Link: Save the configured project or open project file into the AT-Link through a dynamic encryption algorithm for the purpose of offline download.

1-Link	settings AI-Lin	k offline config se	attings AT-L	ink offline download sta	atus	
Offlin	e project f42	5 ISP		▼ Delete		Creat
Proje	t name project	:	De	vice AT32F403A 👻	AT32F403ARGT7	
No.	File name		File size	Address range(0x)	Storage loca	. Add
1	LED.bin		1928	0800000-08000787		Delete
•			III		)	
Eras	e option Erase	the sectors of file	e size	•		
Do	wnload times			Download interface	SWD	•
🔳 En	cryption transmi	t 🔽	Verify	Reset and run		
	rite user system able FAP after de					
Soft	able FAP after de	ownload <b>ber(SN)</b> SPIM s serial number	settings   sLi	b settings		
Soft	able FAP after de ware serial num Write software s ite address in fla tial SN:	ownload tber(SN) SPIM s serial number ash: 0x 080100 0x 000000	settings   sLi	b settings	ers Save pa	rameters

#### Figure 22. Offline project configuration window

#### Offline download status monitoring

This page gives a description of AT-Link offline download status monitoring and configurations.

- Select offline download item: Because AT-Link can store multiple offline projects, users need to select one project to activate. The activated project will be selected for downloading. If the activated project is deleted, users need to select it again.
- **Download interface:** It only indicates the interfaces for the current project and cannot be changed. If it is an ISP interface, the baud rate and boot mode can be modified according to the target board circuit.
- Total downloads: It only indicates the total number of downloads of the activated project.
- **Download times:** It indicates the number of download of the active project, including the successes and failures. When the total downloads is reached, the project file can no longer be downloaded so as to prevent download times control function from being maliciously cracked.
- Successful downloads: It indicates the number of successful downloads of the active project.
- **Start download:** Start a single offline download, and the corresponding prompt message will be displayed according to the download progress. If it fails, error message will be displayed.



• Start/Cancel button free download: Once started, there is no need to operate ICP interface, only need to replace the target board MCU according to the prompts to complete automatic continuous download. The switching of *Start/Cancel* can be allowed only when AT-Link is in idle state.

*Note:* Other operations are not allowed in button free download mode. Users must cancel button free download mode before operation.

AT-Link settings AT-Link offline c	onfig settings AT-Link o	ffline download status	
AT LINK Settings AT LINK ON THE C	oning sectings		
Select offline download item :		Download interface:	SWD
437 hex+usd ▼	Save and activate	ISP uart baud rate:	115200 -
		ISP boot mode:	Manual -
Activated project: 437 he	ex+usd		
Total downloads: Unlimited			
Downloaded times: 3	Successful	downloads: 3	
	Saccessia		
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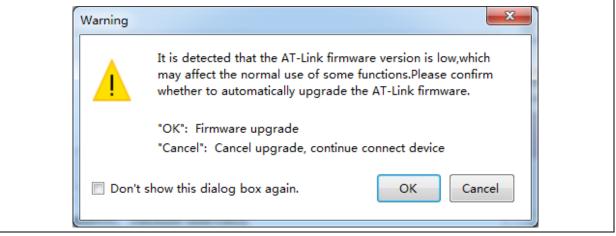
Figure 23. Offline download window

### 3.3.5 Firmware upgrade

AT-Link, AT-Link EZ and AT-Link Pro support auto network and manual upgrade, which is shown in the "*Help*" menu. This is used to upgrade various functions and support more MCU models.

• **Auto upgrade:** When connecting, the ICP software will detect the current connected AT-Link version. If it is lower than the latest version on the internet or the firmware version embedded in ICP, users are prompted to perform auto upgrade.

Figure 24. Auto firmware upgrade



 Manual upgrade: Users can download the latest firmware in benc format on Artery official website, and select a firmware and upgrade it.

Figure 25. Firmware manual upgrade

AT-Link firmware file path :	🐼 Select AT-Link firmware file path	
	AT-Link firmware file path :	
OK Cancel		OK Cancel

# 3.4 Machine programming control

After offline project configurations are stored, select a project for offline download through a machine programming control interface, withoug the need of ICP software.

The auto programming machine sends a sufficient active level pulse width to the START pin and calculates the debounce time so that the AT-Link starts programming to the target board. In this case, the BUSY pin will output active level and toggle at the end of programming. Then the auto programming machine can read PASS/FAIL pin to judge whether the programming is OK or ERR.

The parameters of machine programming control can be customized in AT-Link parameter settings according to the needs.



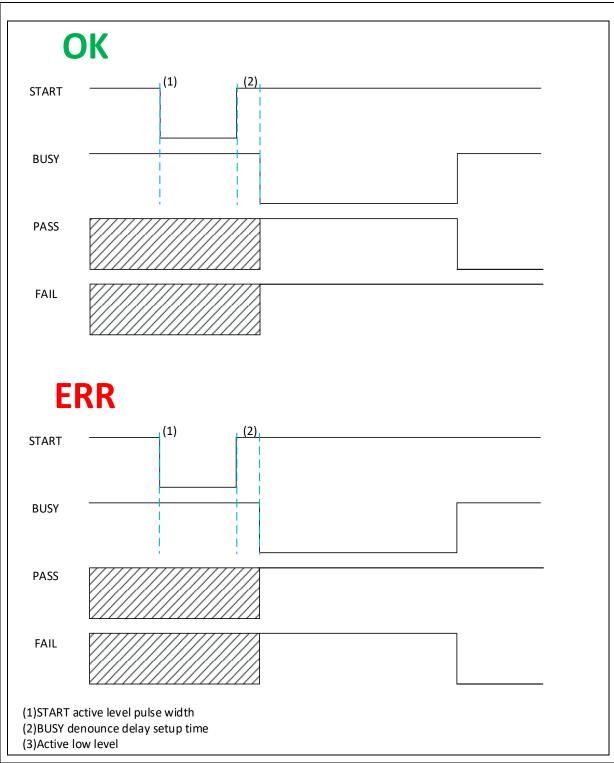


Figure 26. Typical timing diagram of machine programming control

# 3.5 Button operations

After the offline project configurations are stored, select a project for offline download through buttons, without the need of ICP software.

When AT-Link is in idle state, press and hold the key for 3s to switch between button free download mode and single download mode.

• **Single download:** In a single download mode, short press the key once to download an offline project, and the download result can be incidated through LCD, LED or buzzer.



• **Button free download:** In button free mode, when the download is completed, the target board is directly replaced for continuous download. The download result can be indicated through LCD, LED or buzzer.

# 3.6 LCD touch operations

To facilitate mass programming, users can directly configure some AT-Link parameters offline on the LCD screen, such as output voltage, machine programming, SWD speed, offline project file operation, switching single/button free download mode, etc. All configurations, similar to ICP Tool operations, can be saved after power-off.

It is possible to perform special operations through LCD display:

- Online debugging: Once it is enabled, the LCD screen operation and offline download is disabled temporarily, and the AT-Link-Pro is used as an online debugger.
- Low-power consumption mode: To address the problem of insufficient USB power supply in some circumstances, after this mode is enabled, when the LCD is in idle state for more than 30s, the screen will be OFF to reduce power consumption. The screen can be waken up temporarily through touching.

# 3.7 Offline programming procedure

For mass programming, offline programming mode can be used to significantly shorten the programming time and save cost. This section describes how to create and use offline project files.

#### 1. Create offline project

Go to offline project configuration window, tick "*Create offline project*", select a MCU part number to be programmed, enter offline project name, add the corresponding code, and set other parameters according to your needs (user system data, sLib setting, download times.etc.)

#### 2. Save offline project (two methods)

- a) Save the configured offline project to PC (it is up to the user to tick the option "This project is only used at the specified AT-Link" or "This project is only used once"), and send to the programming factory, who will open the project and save it to the connected AT-Link.
- b) Directly save the configured offline project to the currently connected AT-Link.

#### 3. Activate offline project

AT-Link can save up to 16 offline projects. Access to offline download page of ICP software, select an offline project to be programmed, save and activated it (For AT-Link-Pro, the user can select the offline project through touch operation on offline programming window)



# 4 Notes

# 4.1 ISP interface offline download

- Bootloader code mode must be selected and used to enable ISP download;
- When FAP is enabled, after the debugger interface (SWD) is connected to the device, the bootloader fails to run, in this case, power-on reset must be performed. Therefore, if ICP is used to connect to the FAP-enabled device, it is impossible to perform ISP offline download.
- If FAP-enabled device needs ISP offline download, it is the simplest solution to not connect to the SWD interface of AT-Link.



# 5 Revision history

Table 5. Document	revision	history
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Date	Revision	Changes
2021.9.2	2.0.0	Initial release



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