# PUYA

# UM1503 User Manual

PY32 ISP (In System Program) Application Software

# Preface

This document is used to describe the installation and use of the PY32IspTool software. This software enables ISP download of PY32 MCUs by using USB-TTL, emulator PY-LINK and other serial tools with the bootstrap program embedded in the PY32 MCU System Memory. It supports erase, download, verify, and read functions.

This software can also be nested in Keil MDK software for easy development and debugging.

Туре	Product Line
	PY32F002A, PY32F002B
Micro controller series	py32f003, py32f030, py32f031,
	py32f072, py32f071,
	PY32F403

Table 1: Applicable products

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# **1 Bootstrap procedure**

1.1 Device related bootstrap program parameters

Table 1-1. Device	e related	bootstrap	program	parameters
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MCU	USART	RCC(MHz)	PID	BL ID	SRAM	System Memory
PY32F002A PY32F003 PY32F030	USART1(TX/RX): PA2/PA3 USART1(TX/RX): PA9/PA10 USART1(TX/RX): PA14/PA15	HSI_24	0x0440	0x10	0x20000000 - 0x200001FF	0x1FFF0000 - 0x1FFF0D7F
PY32F071 PY32F072	USART1(TX/RX): PA9/PA10 USART2(TX/RX): PA14/PA15	PLL_48 (HSI_24 x 2)	0x0448	0xA0	0x20000000 - 0x200007FF	0x1FFF0000 - 0x1FFF2F00
PY32F403	USART1(TX/RX): PA9/PA10 USART3(TX/RX): PB10/PB11 USART4(TX/RX): PC10/PC11 USART2(TX/RX): PD5/PD6	PLL_48 (HSI_8 x 6)	0x0413	0xA0	0x20000000 - 0x200007FF	0x1FFF0000 - 0x1FFF4F00

## 1.2 Cautions

(1) For PY32F030/PY32F003/PY32F002A series MCUs, the RX pin of the peripheral not used in this bootstrap program must remain at a known level (low or high) and must not be left open during the detection phase, as described below:

If the application software uses USART1(TX:PA2, RX:PA3) to connect to the bootstrap program, the USART1\_RX (PA10, PA15) pins must be held high or low during the detection phase and must not be left open.

If the application software uses USART1(TX:PA9, RX:PA10) to connect to the bootstrap program, the USART1\_RX (PA3, PA15) pins must be held high or low during the detection phase and must not be left open.

If the application software uses USART1(TX:PA14, RX:PA15) to connect to the bootstrap program, the USART1 RX (PA3, PA10) pins must be held high or low during the detection phase and must not be left open.

(2) The PY32F002B requires the user to download the IAP (In Application Program) program in advance.

# 2 Software Installation

This software is green and free to install, unzip it and double click PY32lspTool\_x64.exe or PY32lspTool\_x86.exe to use it.

			open
Download Function Erase Full Chip Erase Sectors Do not Erase	<ul> <li>✓ Program</li> <li>✓ Verify</li> <li>Option Bytes</li> <li>Run to App</li> </ul>	App Function Run to Uploa Downlo	App d ad
The following are	supported MCUs and p	ins:	^
The following are (1)PY32F030/PY32F0 TX/RX: PA2/PA3 PA9, (2)PY32F072/PY32F0 TX/RX: PA9/PA10 PA: (3)PY32F403: TX/RX: PA9/PA10 PB:	supported MCUs and p 03/PY32F002A: /PA10 PA14/PA15 71: 14/PA15 10/PB11 PC10/PC11 PD	ins: 5/PD6	^

Figure 2-1. PY32IspTool main interface

# **3 Hardware Connection**

Before hardware connection, please make sure the MCU's BOOT0 pin is connected high, nBOOT1 is 1, and select System memory as boot area.

Boot mode configuration		Mode	
nBOOT1 bit	BOOT0 pin	Μοαε	
X	0	Select Main flash as the boot area	
1	1	Select System memory as boot area	
0	1	Select SRAM as boot area	

# Table 3-1. Boot Configuration

The boot loader program is stored in System memory and is used to download the Flash program through the USART interface.

# 3.1 Using USB-TTL

# Table 3.1-1. USB-TTL connection Schematic table

USB-TTL	MCU	<b>Required/Optional</b>
5V/3.3V	VCC	Optional
GND	VSS	Required
TXD	USARTx_RX	Required
RXD	USARTx_TX	Required
DTR	BOOT0/ RST	Optional
RTS	BOOT0/ RST	Optional

## 3.2 Using PY-LINK

# Table 3.2-1. PY-LINK Connection Schematic Table

PY-LINK	MCU
5V/3.3V	VCC
GND	VSS
USART1_TXD	USARTx_RX
USART1_RXD	USARTx_TX

# 4 Software Use

# 4.1 Serial port settings

# Selecting a serial device

When the PY32 series MCU is connected to a PC computer via USB-TTL or PY-LINK, the software will automatically detect and add the serial port number to the software's serial port number selection list, and the user selects the correct serial port number.

# Figure 4.1-1. Selecting a serial device



# Select Baud Rate

The USART of PY32 MCU supports adaptive serial port baud rate detection function, and the application software can select the baud rate range 1200bit/s-1Mbit/s.

Figure 4.1-2. Selecting Baud Rate

				·
Device	USB-SERIAL CH340 (COM5)	~	115200 🗸	connect

# Select DTR/RTS

Referring to the "<u>USB-TTL wiring diagram</u>", the software controls the BOOT0/RST pins by controlling DTR/RTS for boot region selection and reset operation of the MCU. The following configurations are available:

No DTR and RTS

Low level (<-3V) reset of DTR without RTS

DTR low level (<-3V) reset, RTS low level into Bootloader

DTR low level (<-3V) reset, RTS high level into Bootloader

High level of DTR (>+3V) reset without RTS

DTR high level (>+3V) reset, RTS low level into Bootloader

DTR high level (>+3V) reset, RTS high level into Bootloader

Low level (<-3V) reset of RTS without DTR

RTS low level (<-3V) reset, DTR low level into Bootloader

RTS low level (<-3V) reset, DTR high level into Bootloader

High level of RTS (>+3V) reset without DTR

RTS high (>+3V) reset, DTR low into Bootloader

RTS high (>+3V) reset, DTR high into Bootloader

## Figure 4.1-3. Selecting DTR/RTS

RTS high level(> +3V) reset, DTR low level Bootloader

 $\sim$ 

# 4.2 Connecting Devices

After the serial port is set up, click the "connect" button in the software to connect to the PY32 MCU. The status bar shows the word "Connect FAIL" with red background.

Device USB-SERIAL CH340 (COM5) $$	t
APP File	
open	
Download Function App Function	
○Erase Full Chip Program Run to App	
Erase Sectors     Option Bytes	
O Do not Erase Run to App Download	
(2)PY32F072/PY32F071: TX/RX: PA9/PA10 PA14/PA15	^
(3)PY32F403: TX/RX: PA9/PA10 PB10/PB11 PC10/PC11 PD5/PD6	
RTS high level(> +3V) reset, DTR low level Bootloader Getting option bytes successfully! AA BE 55 41 FF 00 00 FF FF FF FF FF FF FF 00 00 Getting flash and sram size successfully! Flash size 64KB, Sram size 8KB. Getting UID successfully! 31 30 53 41 18 39 33 39 1C CA E4 00	
	~
Connect PASS	
RTS high level(> +3V) reset, DTR low level Bootloader	~

Figure 4.2-1. Connect PASS

Figure 4.2-2. Connect FAIL



#### 4.3 Open file

The software supports opening files in both \*.hex/\*.bin formats.

If the software opens a file in hex format, the software automatically sets the programming start address and the program run address.

If the software opens a bin format file, the software sets the programming start address and the program run address to 0x08000000.

FIGURE 4.5-1. Open like	Figu	re 4.	3-1.	Open	file
-------------------------	------	-------	------	------	------

D:\GPI0_Toggle.hex	open
--------------------	------

# 4.4 Download Settings

#### Figure 4.4-1. Download settings

Download Function	
O Erase Full Chip	Program
	✓ Verify
Erase Sectors	Option Bytes
○Do not Erase	Run to App

# Erase Full Chip

"Erase Full Chip" means mass erase, which corresponds to the whole address area of Main Flash. If you check this box, clicking the "Download" button will perform the Erase Full Chip operation.

# Erase Sectors

The software automatically adjusts the sectors to be erased according to the loaded program code. If you check this box, clicking the "Download" button will perform the Erase Sectors operation.

# Do not Erase

"Do not Erase" applies to both of the following:

> The area of the chip to be programmed has been erased

# SRAM Programming

If you check this box, the Erase operation will not be executed when you click the "Download" button.

# • Program

If you check this box, clicking the "Download" button will execute the Program operation.

## • Verify

If you check this box, clicking the "Download" button will perform the Verify operation.

## Option Bytes

By default, the software only performs erase, write, and read operations on the Main Flash area. If you check this box, clicking the "Download" button will perform the write Option Bytes operation.

Nam F E E I V V N r S S S	ne Dption byte for RDP BOR_EN BOR_LEV WDG_SW WWDG_SW NRST_MODE nBOOT1	Function Flash User option 0xAA: level 0, read protection inactive 0: BOR Disable 111 : rise threshold is 3.2V, descent threshold is 1: software watchdog 1: software watchdog 0: RST 1: boot from SYSTEM when BOOTD=1	s 3.1V	^	
	Option byte for RDP BOR_EN BOR_LEV WDG_SW WWDG_SW NRST_MODE nBOOT1	Hash User option 0xAA: level 0, read protection inactive 0: BOR Disable 111 : rise threshold is 3.2V, descent threshold is 1: software watchdog 1: software watchdog 0: RST 1: hoot from SYSTEM when BOOTD=1	s 3.1V		
F E I V V V V V S S S	RDP BOR_EN BOR_LEV WDG_SW WWDG_SW NRST_MODE nBOOT1	0xAA: level 0, read protection inactive 0: BOR Disable 111 : rise threshold is 3.2V, descent threshold is 1: software watchdog 1: software watchdog 0: RST 1: boot from SYSTEM when BOOTD=1	s 3.1V		
E E I V N r S S S	BOR_EN BOR_LEV WDG_SW WWDG_SW NRST_MODE nBOOT1	0: BOR Disable 111 : rise threshold is 3.2V, descent threshold is 1: software watchdog 1: software watchdog 0: RST 1: boot from SYSTEM when BOOTD=1	s 3.1V		
E IV V IN S S S	BOR_LEV WDG_SW WWDG_SW NRST_MODE nBOOT1	111 : rise threshold is 3.2V, descent threshold is 1: software watchdog 1: software watchdog 0: RST 1: boot from SYSTEM when BOOTD=1	s 3.1V		
II V N C S S	WDG_SW WWDG_SW NRST_MODE nBOOT1	1: software watchdog 1: software watchdog 0: RST 1: boot from SYSTEM when BOOT0=1			
V n S S	WWDG_SW NRST_MODE nBOOT1	1: software watchdog 0: RST 1: boot from SYSTEM when BOOT0=1			
M n 0 2 2 2	NRST_MODE nBOOT1	0: RST 1: boot from SYSTEM when BOOT0=1			
r C S S	nBOOT1	1: boot from SYSTEM when BOOT0=1			
- ( S					
S S	Option byte for	Flash SDK area address			
S E (	SDK_STRT	0x0000F800			
Ξ (	SDK_END	0x000007FF			
	Option byte for	Flash WRP address			
V	WRP[0]	1: No Write Protection			
۷	WRP[1]	1: No Write Protection			
V	WRP[2]	1: No Write Protection			
V	WRP[3]	1: No Write Protection			
۷	WRP[4]	1: No Write Protection			
۷	WRP[5]	1: No Write Protection		~	
	OK		ancel		

#### Figure 4.4-2. Setting Option Bytes

## • Run to App

If this is checked, clicking the "Download" button will cause the MCU to jump from the bootstrap program area to the user program area.

# 4.5 Software Operation

#### Run to App

If this button is clicked, it will cause the MCU to jump from the bootstrap program area to run in the user program area.

#### • Upload

Retrieve data to the local disk at the specified address and size.



	Set addr and s	ize:			×
0	Addr: Øx	0800000	Size: Øx	00010000	
		ОК		Cancel	

Download

According to the settings in the "Download Settings" section, the software executes "Erase

Full Chip/Erase Sectors/Do no Erase", "Program ", "Verify", "Option Bytes", and "Run to App".

# 5 Embed into MDK for use

Open MDK, go to Option for Target 'XXXXXX' settings, switch to Utilities tab and Select Use External Tool for Flash Programming.

Select the installation location of PY32lspTool in Command, such as D:\Program Files\PY32lspTool\_x64.exe. Type #H in Arguments

Click OK, the settings are finished. Then click "LOAD" on the toolbar to download.

Using this method requires MDK software to generate a hex format file.

Figure 5-1. MDK software calls PY	32lspTool software to download Flash
-----------------------------------	--------------------------------------

evice   Target   Output   Listing   User   C/C++	Asm Linker Debug Utilities
Configure Flash Menu Command	
C Use Target Driver for Flash Programming	🗖 Use Debug Driver
ULINK2/ME Cortex Debugger	Settings 🔲 Update Target before Debugging
Init File:	Edit
Command: D:\Program Files\PY32lspTool_x64.exe Arguments: #H Run Independent	
Configure Image File Processing (FCARM): Output File:	Add Output File to Group:
	USER 💌
Image Files Root Folder:	Generate Listing

Figure 5-2. MDK software Create HEX File

Create Executable: .\Obje	cts\Pro	Create Batch Fil
Create HEX File	1	
Browse Information	-	
C Create Library: .\Objects\	Pro.lib	

# 6 Version History

Versions	Date	Update Record
V1.0	2023.4.2	First Edition



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