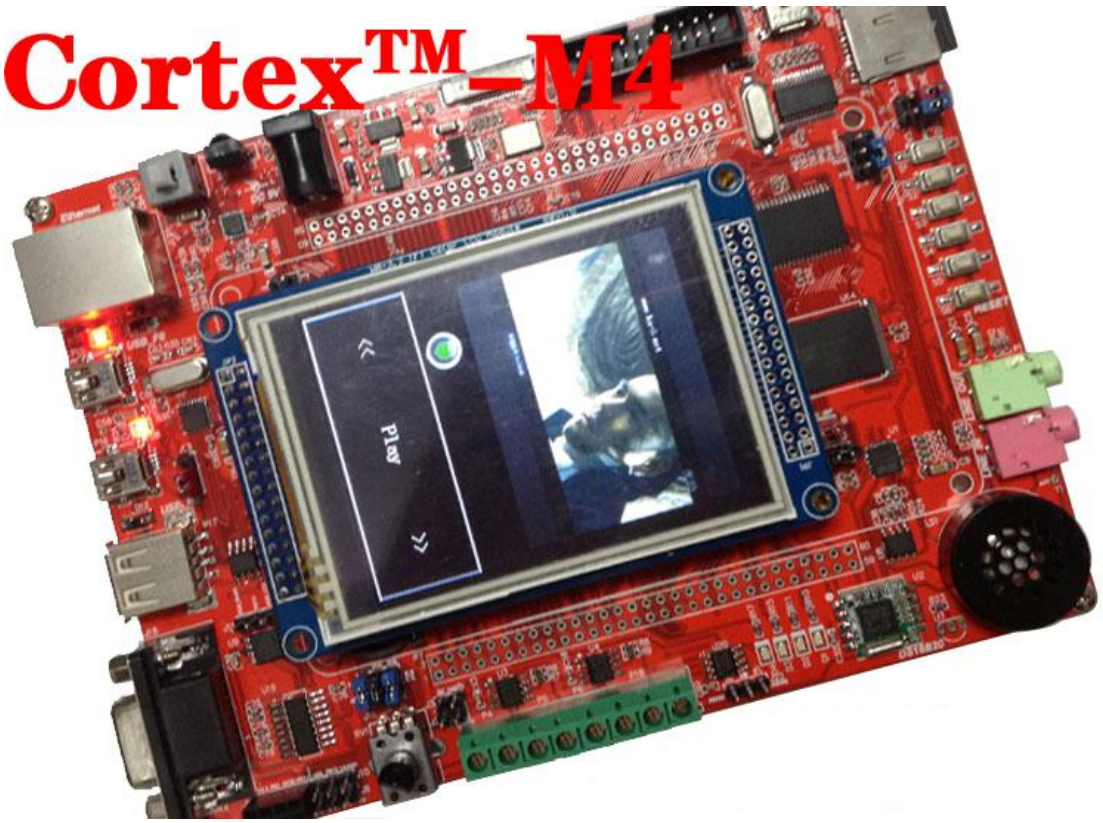
# Cortex-M4 407 Development Board

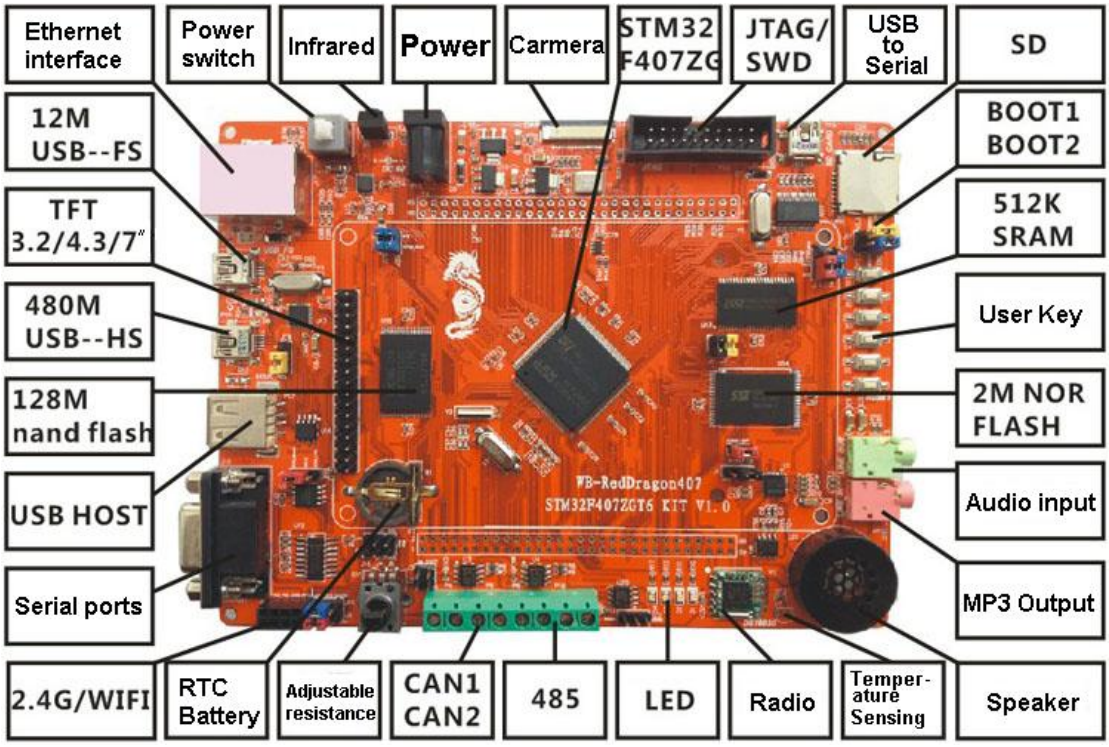
# User's Manual



# Directory

# **Chapter 1** Hardware Resources Overview

## § 1.1 Preview of hardware resources




Red Dragon 407 development board is a learning board of the basic ST STM32F407ZGT6 (LQFP144) processor, the processor uses the ARM Cortex ™-M4 Kernel that core. ARM Cortex ™-M4 is a 32-bit MCU with FPU unit, 210 DMIPS, up to the 1MB FLASH/192 +4 KB RAM, USB OTG HS / FS, Ethernet, 17 timers, 3 ADCs, 15 communication interfaces and a camera port. Frequency up to168MHz. The processor is the latest embedded processor by ARM specifically developed to meet the need for effective and easy to use control and signal processing functions

hybrid digital signal control markets. Efficient signal processing functions with the Cortex-M processor series low-power, low-cost and easy-to-use combination of advantages designed to meet specifically for motor control, automotive, power management , embedded audio and industrial automation markets emerging category flexible solutions.

§ 1.2 Chip-chip resources introduced

ARM Cortex ™-M4 processor, running at up to 68 MHz of frequency with FPU unit;

In-system programming (ISP) and In-Application Programming (IAP)

1M on-chip Flash program memory;

Clock, reset and supply management

2.0 to 3.6 V power supply and I / O pins, power on / off reset (POR / PDR), programmable voltage detector (PVD), inline 4 to16 MHz high speed crystal oscillator, factory-trimmed 8MHz RC oscillator, the internal 40kHz RC oscillator, PLL supply the CPU clock, with 32kHz **RTC** oscillator calibration ;

Low power consumption;

Sleep, Stop and Standby modes VBAT supply for RTC and backup registers ;

Debug mode;

Serial Wire Debug (SWD) and JTAG debug interface;

LCD parallel interface, 8080/6800;

3 × 12-bit, 2.4 MSPS A / D converter, 24 the conversion channel;

2 × 12-bit D / A converter;

General-purpose DMA: 16-channel DMA controller with FIFOs and burst support;

17 timer; 12, 16, and two 32-bit timers that the number of frequencies up to 168 MHz, each group contains four input capture / output compare / PWM or pulse counter channels;

15 communication interfaces;

2 I2C interfaces (SMBus / PMBus);

4 USARTS / 2 UARTs (10 Mbit / s) interface, support for ISO7816, LIN, IrDA interface and modem control;

3 SPI (37.5 Mbit / s) and two hybrid full-duplex I2S to achieve audio class accuracy via internal audio PLL or external clock, reset and clock supply management;

2 CAN (2.0B active), an SDIO interface;

Advanced Connection;

USB 2.0 full-speed device / host / OTG;

USB 2.0 high-speed/full-speed device / host / OTG controller dedicated ;

DMA, on-chip full-speed PHY and ULPI;

10/100 Ethernet MAC with dedicated DMA: supports the IEEE1588v2 hardware MII / RMII;

8 - 14-bit parallel camera interface (54 Mbytes / s);

Unique 96-bit ID.

§ 1.3 Development board board resources introduced

20-pin JTAG interface, the user can download and debug the J-Link (ulink) emulator.

RS232 to TTL serial converter module for the development board and PC communication.

DS18B20 temperature acquisition module,

The NRF24l01 wireless communication module, multi-block development board can transmit data wirelessly

USB to serial module;

SDIO operation SD card;

Infrared receiver module;

Onboard SPI FLASH W25Q16;

Independent user keys

4 LED lights;

Camera interface leads (board with the OV7670 routine);

Ethernet interface

2-way CAN transceiver

USB full speed / high-speed interface;

WM8978 Audio decoding chip;

Adjustable resistance, for AD acquisition

TEA5767 radio modules

TFT LCD module

RS485 transceiver;

NAND NOR SRAM rich resources;

External function pin all leads to facilitate the secondary development.

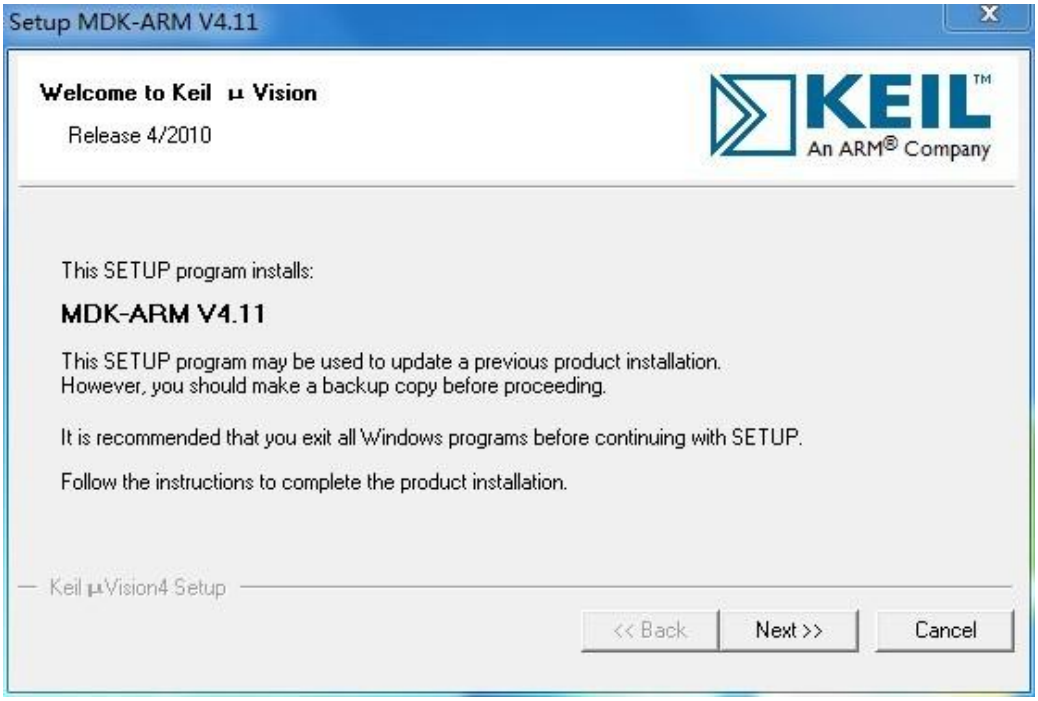
# **Chapter 2** Development Environment

## § 2.1 Up the development environment

The RealView MDK Development Kit from Keil, Germany, is the ARM's latest software development tools for a variety of embedded processors. The RealView MDK integrated the most advanced technology in the industry, including μVision3 integrated development environment with RealView compiler. Supports ARM7, ARM9 and the latest Cortex-M3 core processor, auto-configuration startup code, compared to the integrated Flash programmer module, powerful Simulation device simulation, performance analysis, and ARM before Kit ADS RealView compiler The latest version of the performance improvement of over20%. So we choose MDK as our development environment. It is stored in the CD-ROM \ install software directory, the name ismdk411.rar.

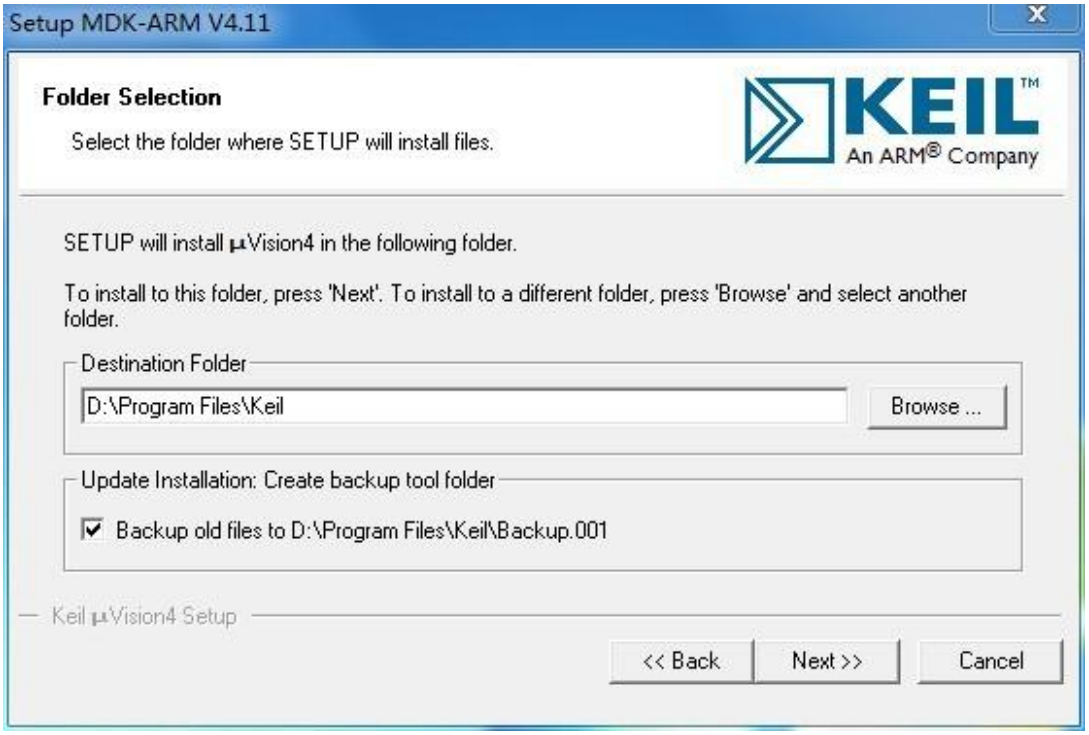
The MDK installation method and other Windows programs, the process is as follows:

1. To decompression mdk411.rar, double click to run, the following dialogue appears, click Next




2. Check to agree to the license terms check box, click Next


3. Select the installation path, click Next, and wait for the installation can be completed.


Setup MDK-ARM V4.11
Folder Selection
Select the folder where SETUP will install files.
KEIL
An ARM® Company
SETUP will install µVision4 in the following folder.
To install to this folder, press 'Next'. To install to a different folder, press 'Browse' and select another folder.
Destination Folder
D:\Program Files\Keil
Browse ...
Update Installation: Create backup tool folder
Backup old files to D:\Program Files\Keil\Backup.001
Keil µVision4 Setup
<< Back
Next >>
Cancel

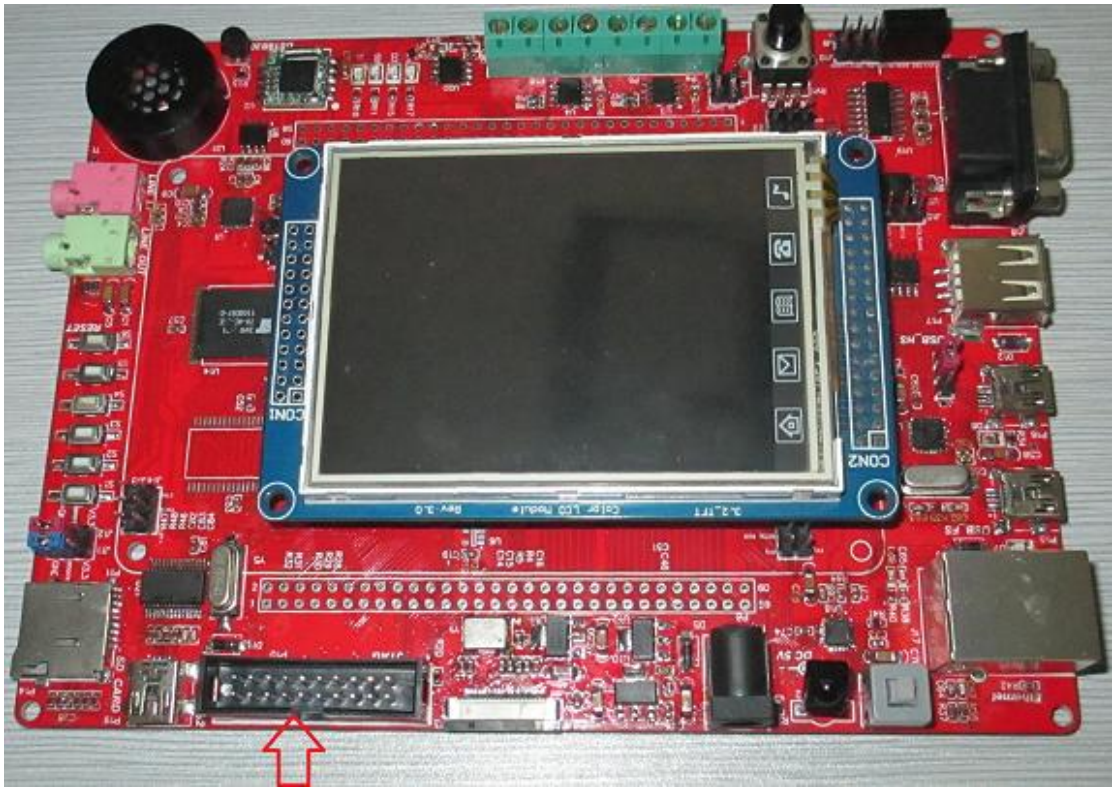
**Chapter 3** Program code programming

Red Dragon 407 development board supports two program download, J-Link download (ULINK), serial ISP download.

§ 3.1 J-link downloads (Here you can watch Red Dragon 103 first video tutorial)

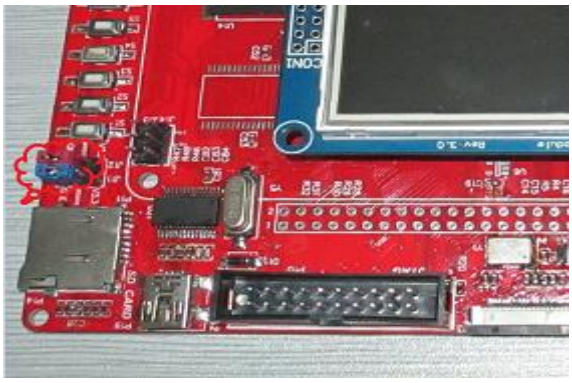
1. You must install the J-Link driver, driver stored in the \ install Software \ Setup_JLinkARM_V414c.zip,

2. J-Link emulator connected to a corresponding interface on the board.

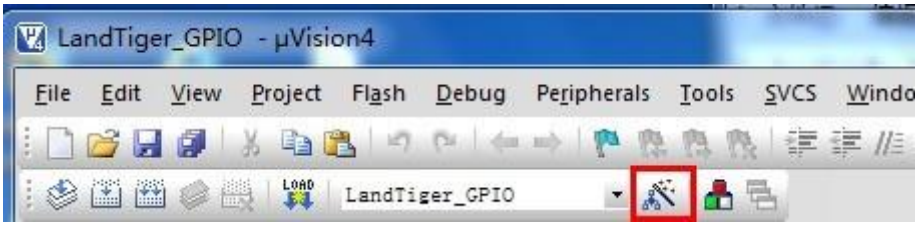


3. Settings on the jumper cap BOOT: (BOOT0 BOOT1 are connected to

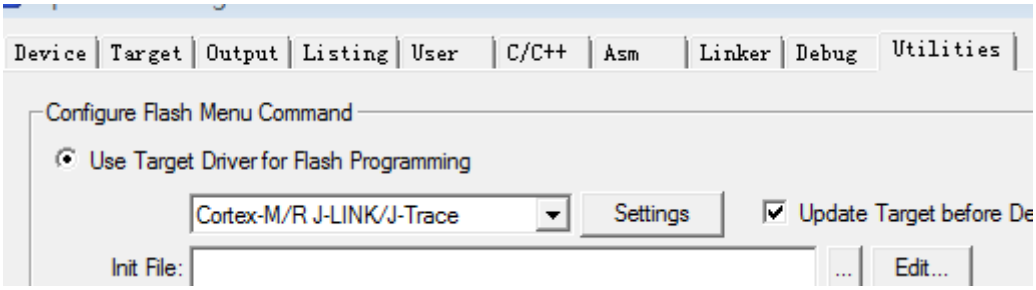
GND)



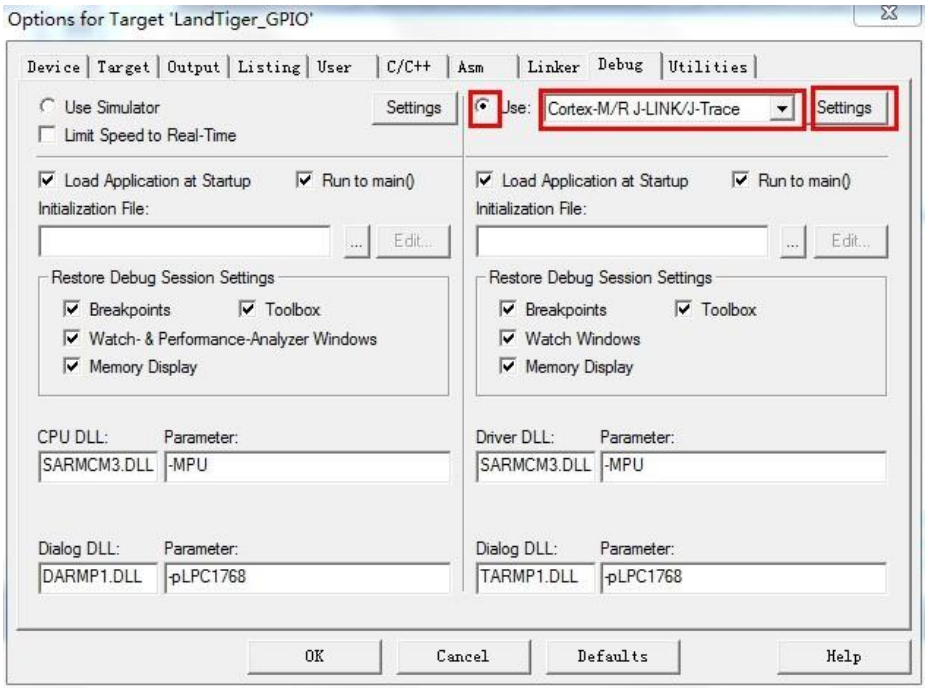
4. Open MDK software, click on the project configuration button, as shown below:



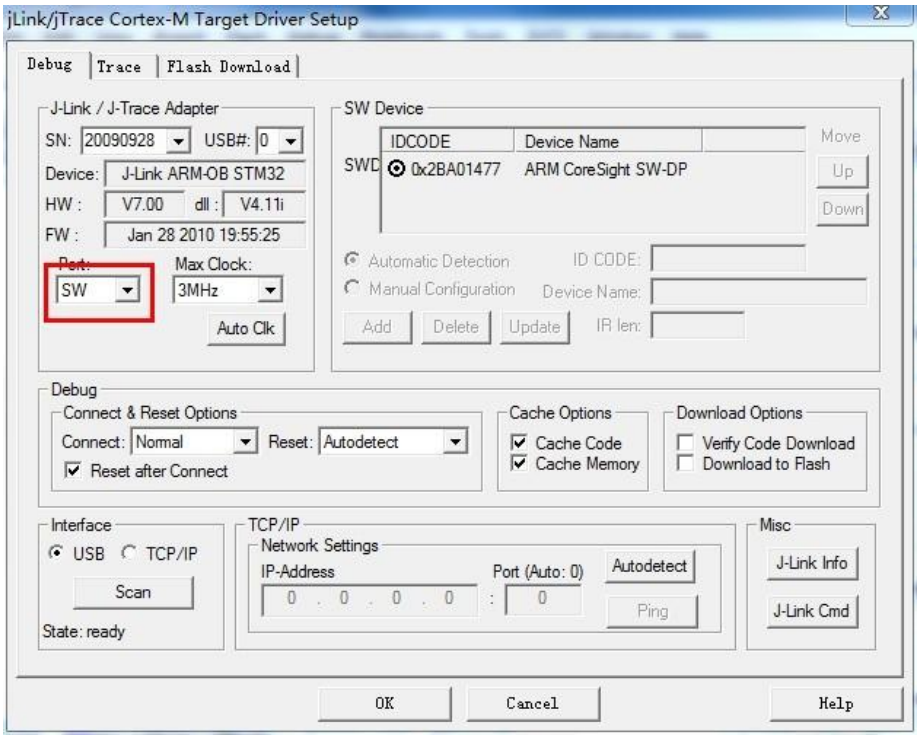

5. Use option is checked in the Debug tab, choose to use J-Link, and click the "Settings" button to set as follows:



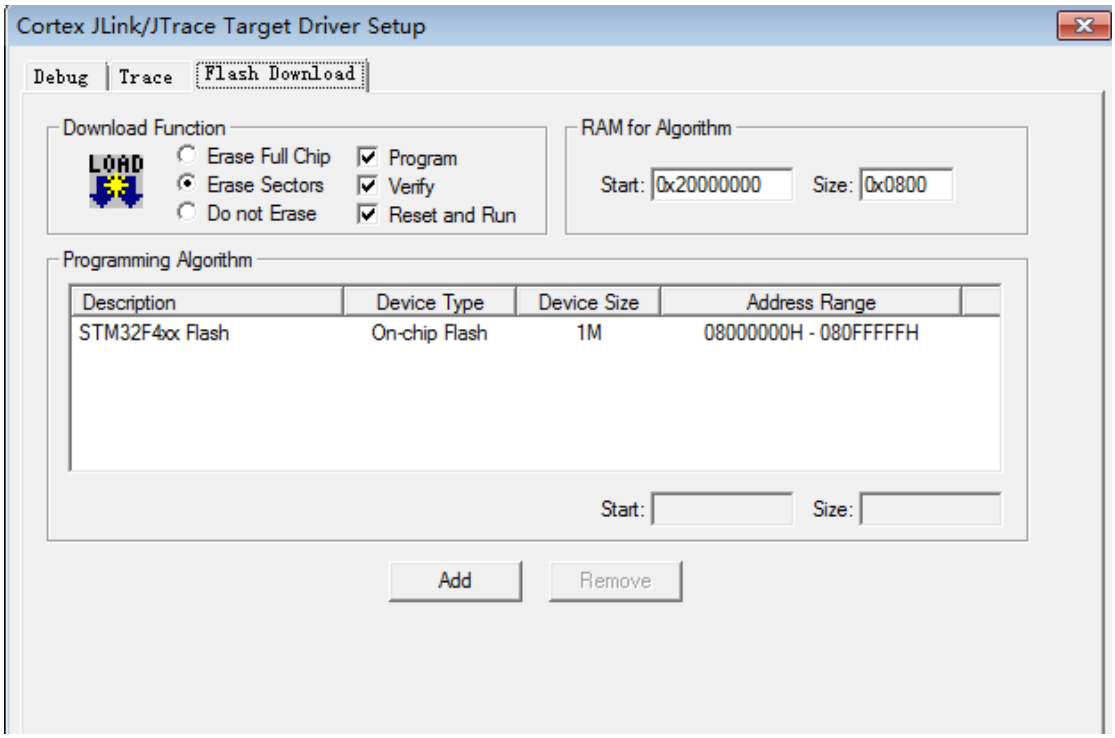

6. In the Debug tab, check the Use option, choose to use the J-Link and click on the "Settings" button, as shown below:




7. If the connection to the emulator, the interface will display relevant information, if you want to use the SWD, SW; Port option to select if you want to use the JTAG Port option to select the JTAG, as shown:




8. Choosing flash




9. To this set up, close the window above, until the project compiled by click on the "download" button or debugging "button to download the program. As shown below:


§ 3.2 Serial ISP download

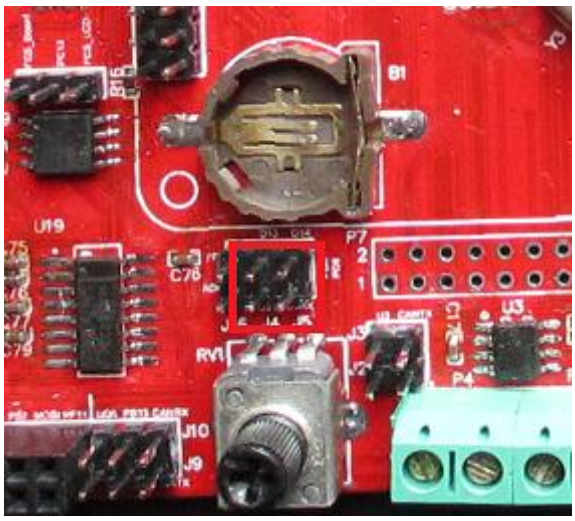
Here please reference "Wang Bao development board user manual download method"

**Chapter 4** The routine demonstration and jumper line settings

This chapter demonstrates part of the routine use of these routines related to the jumper connection hardware, the other routines directly download and run to see the demonstration effect. In addition, the routine documentation will further instructions (Note: each routine contain the ReadMe.txt instructions document and test methods, the routine will be updated, indicating the use of routine document accordingly with the new ). The following are examples of several routines:

§ 4.1 serial communication

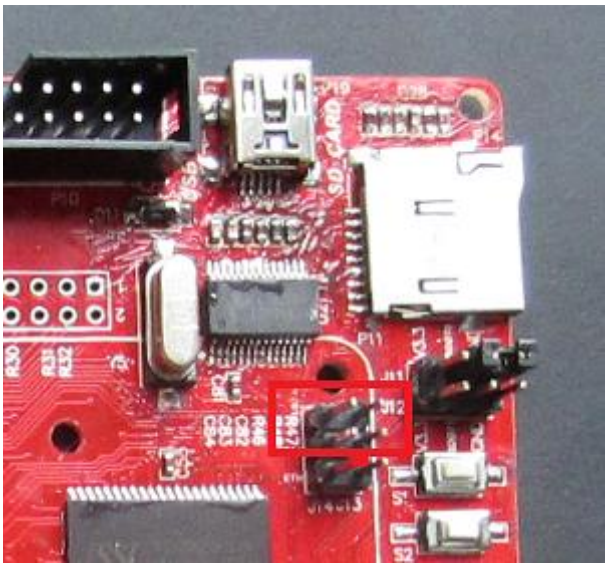
1. The serial cable USART port of the PC and the development board, and JP the JP5 jumper cap into (see below)




2. Compile and download the corresponding routines, debugging assistant open the serial port on the PC side, baud rate to 115200, you can see the serial output in serial debugging assistant. As shown below:

§ 4.2 USB turn serial

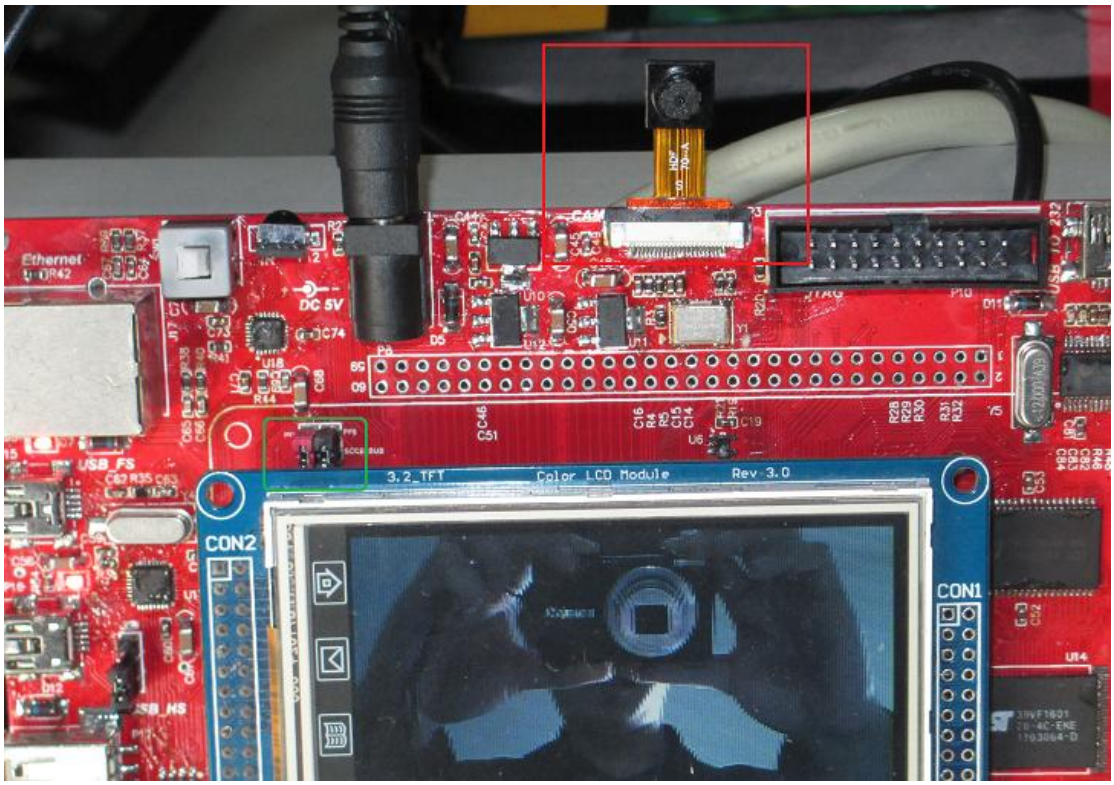
1. Loading USB-to-serial driver, software information to find PL2303_Prolific_DriverInstaller_v1210.exe and loading;
2. Insert MINI USB cable, connected to the computer, a USB TO 232 to the USB of computer drive completion of the loading, virtual serial port.
3. Development board of the jumper cap, J13, J14 inserted near the USB to serial port at the two pins.



4. Compile and download the corresponding routines, debugging assistant open the serial port on the PC side, set the baud rate to 115200,you can see the output in serial debugging assistant. As shown below:

§ 4.3 Camera

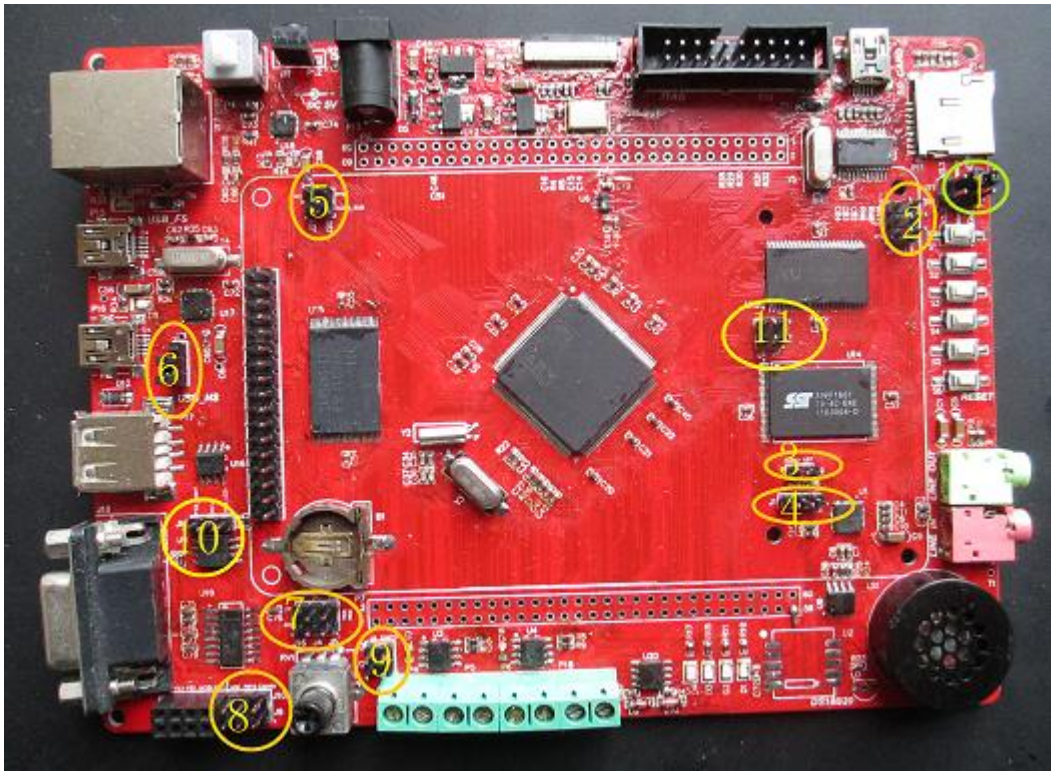
1. Plug the camera into the CAM camera socket, plug the jumper cap J20, J21, and display, as shown.




2. Download and run the program, you can see on the LCD screen footage.

**Chapter 5** Jumper Line Description

§ 5.1 Other jumper line use




1:BOOT0 and BOOT1

Development board BOOTO, the BOOT1 jumper to select the start-up mode of the CPU :

| BOOT0 | BOOT1 | Startup mode |
|---|---|---|
| 0 | Unrelated | User flash memory starts |
| 1 | 0 | Start from the system memory |
| 1 | 1 | Start from the embedded SRAM |

2:

| | | | |
|---|---|---|---|
| U6TX | Serial port to send | U6RX | Serial port to receive |
| PG14 | Common terminal | PG9 | Common terminal |
| ETH | Network | NE2 | NOR f lash chip select |

3:

4:

5: J20, J21 camera control lines

6 the: USB_HS jumper cap

7:

| | | | |
|---|---|---|---|
| J16 | PF6 | ADC | AD test jumper cap |
| J4 | D13 | U3TX | Serial transmission line |
| J5 | D14 | U3RX | Serial receive line |

8:

| | | |
|---|---|---|
| CAN RX | CAN TX | CAN1 transceiver |
| P B13 | PB12 | Common terminal |
| UCS | UDS | Serial transceiver line |

9: J2, J3 CAN2 transceiver

10: J15 FLASH chip select

| | |
|---|---|
| FCS_Band | Board FLASH CS selection terminal |
| PC13 | Common terminal |
| FCS_LCD | Screen Flash CS choice side |

11:

| | |
|---|---|
| J7 | I2C control lines for radio control |
| J8 | |

# **Chapter 6** Other Considerations

1. USB power supply problems

   When using the USB-powered, USB power supply current is limited, will cause the LCD display darker.

2. Connected onboard emulator and external J-Link

   When the on-board the emulators and external J-Link is connected to the computer, MDK software loaded drivers may be one of the two, and this may be that you do not use. So try not to use both emulator.

3. Impact of camera

   When using the camera, the camera I / O and SD card, the USB I / O utilities, the operation will be conflicts.