

# RED FDM 2020-03-10

# Firmware Download and Debug User Manual

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## 1 Revision History

| Version | Date       | Description                           |
|---------|------------|---------------------------------------|
| 1.0.0   | 2015.03.05 | Initial Release (based on PR9200 APU) |
| 1.0.1   | 2015.06.08 | Modified some image                   |
| 1.0.2   | 2016.05.31 | Modified section in 3.3 IAP-UART      |
| 1.0.3   | 2020.03.10 | Deleted Colink-Ex related content     |

## 2 Firmware Development Process

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Firmware development Process is shown at Figure 1. The suitable tools and devices are required to each development state such as compile, download, debugging system.



Figure 1 firmware development process

#### 2.1 Development Tool (KEIL MDK-ARM)

The MDK-ARM is embedded development tool for Cortex-M microcontroller. MDK-ARM includes ARM C/C++ Compilation Tool chain,  $\mu$ Vision4 IDE, debugger, and simulation environment. PHYCHIPS does not support KEIL MDK-ARM. For more details, please refer to http://www.keil.com

#### 2.2 Firmware Programming

PR9200 support two ways to firmware download. One is method using ULINK2 debug adapter through SWD (Serial Wire Debug). The other is method using IAP (In-Application Programming). IAP can use three type of interface, UART, SPI and I<sup>2</sup>C without any hardware debugger.





#### 2.3 Debugging

Firmware debugging uses ULINK2. Using two debuggers with Keil µVision IDE can debug embedded application of PR9200 and trace firmware.





#### 2.4 Alternative solution

PR9200 supports alternative solution besides ULINK2 + KEIL MDK-ARM.

| IDE          | Debugging Adopter | Port | Note |
|--------------|-------------------|------|------|
| KEIL MDK-ARM | ULINK2            | SWD  |      |



### 3 Flash Download

This section describes four method for flash download, ULINK2, ISP and IAP

#### 3.1 ULINK2

ULINK2 debug adapter connects your PC's USB port to SWD (Serial Wire Debug) of PR9200 and allows you to programming and debug embedded programs on PR9200. In order to download firmware, Keil µVision IDE is required. After connecting ULINK2 to PR9200, follow next step to success to flash download using ULINK2.





#### 3.1.1 Flash Download Configuration on KEIL µVision IDE

1. Select  $\overset{\text{def}}{\longrightarrow}$  or **Flash**  $\rightarrow$  **Configure Flash Tools...** of pull-down menu.

| Fl <u>a</u> sh                |    | <u>D</u> ebug | Pe <u>r</u> ipherals | Ī |  |  |
|-------------------------------|----|---------------|----------------------|---|--|--|
| LOAD                          | D  | ownload       | Ctrl+D               |   |  |  |
|                               | Er | ase           |                      |   |  |  |
| <u>C</u> onfigure Flash Tools |    |               |                      |   |  |  |
| Figure 5                      |    |               |                      |   |  |  |

2. At Utilities tab, select command "Use Target Device for Flash Programming" and choose debugger "ULINK Cortex Debugger". And open Cortex-M Target Driver setup to click "settings"

| Options for Target 'PR9200'  |
|--|
| Device   Target   Output   Listing   User   C/C++   Asm   Linker   Debug Utilities |
| Configure Flash Menu Command   |
| • Use Target Driver for Flash Programming  |
| ULINK Cortex Debugger    Settings  |
| Init File: Edit  |
| C Use External Tool for Flash Programming  |
| Command:   |
| Arguments:   |
| Eun Independent  |
|  |
|  |
|  |
|  |
|  |
| OK Cancel Defaults Help  |

Figure 6

3. Set "Download Function" as follow



| Cortex-M Target Driver Setup  |  |                       |                                     | ×    |
|---|--|-----------------------|-------------------------------------|------|
| Debug   Trace Flash Downlo  | ad   |                       |                                     |      |
| Download Function     Or Erase Full Chip     C Erase Sectors     C Do not Erase     Programming Algorithm | <ul> <li>✓ Program</li> <li>✓ Verify</li> <li>✓ Reset and Run</li> </ul> | RAM for A<br>Start: 0 | Ngorithm<br>x10004000 Size: (0x3000 |      |
| Description   | Device Type  | Device Size           | Address Range                       | -    |
|   |  |                       |                                     |      |
|   |  | Start:                | Size:                               |      |
|   | Add  | Remove                | ]                                   |      |
|   | OK   | Canc                  | cel                                 | Help |

Figure 7

4. Click "Add" button and select "PR9200\_EFLASH\_63KB.FLM".

| Add Flash Programming Algorithm |                   |             |              |  |  |  |
|---------------------------------|-------------------|-------------|--------------|--|--|--|
|                                 | D : T             | D : C       |              |  |  |  |
| Description                     | Device Type       | Device Size | 1 ^          |  |  |  |
| LPC11xx/13xx IAP 32kB Flash     | On-chip Flash     | 32k         |              |  |  |  |
| LPC11xx/13xx IAP 8kB Flash      | On-chip Flash     | 8k          |              |  |  |  |
| LPC17xx IAP 128kB Flash         | On-chip Flash     | 128k        |              |  |  |  |
| LPC17xx IAP 256kB Flash         | On-chip Flash     | 256k        |              |  |  |  |
| LPC17xx IAP 32kB Flash          | On-chip Flash     | 32k         |              |  |  |  |
| LPC17xx IAP 512kB Flash         | On-chip Flash     | 512k        |              |  |  |  |
| LPC17xx IAP 64kB Flash          | On-chip Flash     | 64k         |              |  |  |  |
| PR9200_EFLASH_63KB              | On-chip Flash     | 63k         |              |  |  |  |
| RC28F640J3x Dual Flash          | Ext. Flash 32-bit | 16M         |              |  |  |  |
| S29JL032H_BOT Flash             | Ext. Flash 16-bit | 4M          |              |  |  |  |
| S29JL032H_TOP Flash             | Ext. Flash 16-bit | 4M          |              |  |  |  |
| STM32F10x Med-density Flash     | On-chip Flash     | 128k        |              |  |  |  |
| STM32F10x Low-density Flash     | On-chip Flash     | 16k         | _            |  |  |  |
| STM32F10x High-density Flash    | On-chip Flash     | 512k        |              |  |  |  |
| STM32F10x Connectivity Lin      | On-chip Flash     | 256k        |              |  |  |  |
| STM32F10x M25P64 SPI Fla        | Ext. Flash SPI    | 8M          | $\checkmark$ |  |  |  |
|                                 |                   |             |              |  |  |  |
| Add                             | Cancel            |             |              |  |  |  |

Figure 8

#### [NOTICE]

First of all, copy "PR9200\_EFLASH\_63KB.FLM" to directory KEIL\_INSTALL\ARM\FLASH. Flash algorithm file is included in [DK\_DATA]\Firmware\Flash\_algorithm

5. Make sure that programming algorithm is added.

| ortex-M Target Driver Setup  |               |             |                    |           |  |  |  |  |  |
|--|---------------|-------------|--------------------|-----------|--|--|--|--|--|
| Debug   Trace Flash Download   |               |             |                    |           |  |  |  |  |  |
| Download Function       RAM for Algorithm         Cond       C Erase Full Chip       ✓ Program         C Erase Sectors       ✓ Verify         C Do not Erase       ✓ Reset and Run |               |             |                    |           |  |  |  |  |  |
| Programming Algorithm  | Device Type   | Device Size | Address Range      |           |  |  |  |  |  |
| PR9200_EFLASH_64KB   | On-chip Flash | 64k         | 0000000H - 0000F   | FFFH      |  |  |  |  |  |
| 1  |               | Start: 0    | 0x00000000 Size: 0 | ×00010000 |  |  |  |  |  |
|  | Add           | Remove      |                    |           |  |  |  |  |  |
|  | ОК            | Cano        | cel                | Help      |  |  |  |  |  |

Figure 9

6. At Debug tab, set driver setup as below Figure 10.

| Cortex-M Target Driver Setup  |   | x        |
|---|---|----------|
| (Debug] Trace   Flash Download  |   |          |
| ULINK USB - JTAG/SW Adapter SV<br>Serial No: V0419BJE<br>ULINK Version: ULINK2            | V Device         Move           IDCODE         Device Name         Move           Ø 0x0BB11477         ARM CoreSight SW-DP         Up               | e        |
| Device Family: Cortex-M<br>Firmware Version: V1.42<br>SWJ Port: SW<br>Max Clock: 1MHz     | Automatic Detection     ID CODE:       Manual Configuration     Device Name:       Add     Delete     Update       IR len:     Image: Configuration | <u>n</u> |
| Debug<br>Connect & Reset Options<br>Connect: Normal ▼ Reset: Aut<br>▼ Reset after Connect | todetect ▼ Cache Options Download Options<br>Cache <u>C</u> ode<br>Cache <u>C</u> ode<br>Cache <u>M</u> emory Download to <u>F</u> lash             |          |
|   | OK Cancel Help  |          |

Figure 10

#### 3.1.2 Flash Erase

1. Select *Flash → Erase* at main windows.



Figure 11

2. Check chip erase result at Build output window.

| Build C | utput   |        |              |           |  |  |  |  |  |
|---------|---------|--------|--------------|-----------|--|--|--|--|--|
| Full    | Chip    | Erase  | Done.        |           |  |  |  |  |  |
|         |         |        |              |           |  |  |  |  |  |
|         |         |        |              |           |  |  |  |  |  |
|         |         |        |              |           |  |  |  |  |  |
|         |         |        |              |           |  |  |  |  |  |
| E Bui   | ld Outp | ut 🗔 F | ind in Files | 📸 Browser |  |  |  |  |  |
|         |         |        |              |           |  |  |  |  |  |

Figure 12

#### 3.1.3 Flash Download

1. Select  $\stackrel{\text{LOAD}}{\clubsuit}$  or **Flash**  $\rightarrow$  **Download to Flash** 



Figure 13

2. Check download result from output window.

| Build Output   |                           |
|----------------|---------------------------|
| Load "C:\\     |                           |
| Erase Done.    |                           |
| Programming    | Done.                     |
| Verify OK.     |                           |
|                |                           |
| •              |                           |
| 📰 Build Output | 🙀 Find in Files 🔯 Browser |
|                |                           |

Figure 14

#### 3.2 IAP and Bootloader– UART

PR9200DK support IAP (In-application Programming) using UART. UART IAP help user download flash program without any extra hardware like ULINK2.

UART IAP are similar to ISP but help user download flash program without any extra hardware like ULINK2 and mode transition. User does not need any configuration for IAP.

[notice] PR9200DK's GUI does not support SPI IAP. If you want IAP using SPI, refer to Protocol manual of DK.

#### 3.2.1 UART Download

Connect PC's USB to PR9200DK and execute RED utility. Open "download" window and select firmware binary file (\*.hex) you want. Click "update" button and flash downloading is executed.

| R    |      | Download | - | × |
|------|------|----------|---|---|
| File | Open | Update   |   | 1 |
|      |      |          |   |   |

Figure 15

After download is completed, reset PR9200 or module.

#### [Notice]

If the firmware is abnormally deleted, IAP download do not work properly. In this case, ISP mode can help you download as well as SWD. In order to enter this mode, set PR9200 pin as below table

| ISP_MODEb | P17 | P16 | P15 |
|-----------|-----|-----|-----|
| Low       | Low | Low | Low |

Restart or reset PR9200 after this set is changed. And execute "download" as IAP download After download is completed, change ISP mode to normal mode as set ISP\_MODEb to high. Don't forget resetting PR9200.

When PR9200 operation mode is changed Normal mode to ISP mode, user must reset the chip and vice versa.

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## 4 Debugging

This chapter describes how to debug PR9200 firmware with ULINK2.

#### 4.1 Configuration for ULINK2

1. Select  $\overset{\circ}{N}$  or **Flash**  $\rightarrow$  **Configure Flash Tools...** at Keil µVision IDE main window



2. Select debugger to "ULINK Cortex Debugger" .

| Options for Target 'PR9200'  | X  |
|--|--|
| Device   Target   Output   Listing   User   C/C++   A  | sm Linker Debug Utilities  |
| C Use Simulator Settings   | I Use: ULINK Cortex Debugger ▼ Settings  |
| ✓ Load Application at Startup     ✓ Run to main() Initialization File:     ✓//  //     ✓//  //     ✓//  // / | Image: Wight of the second |
| Restore Debug Session Settings   | Restore Debug Session Settings   |
| CPU DLL: Parameter:           SARMCM3.DLL  | Driver DLL: Parameter:<br>SARMCM3.DLL  |
| Dialog DLL: Parameter:   | Dialog DLL: Parameter:   |
| OK Car   | icel Defaults Help   |

3. Click "Settings" button and setup ULINK USB-JTAG/SW Adapter as shown figure.

|                         | Sw Dev         | vice               |                     |                  |
|-------------------------|----------------|--------------------|---------------------|------------------|
| Serial No: V0419BJE     |                | IDCODE             | Device Name         | Move             |
| ULINK Version: ULINK2   | SWDIO          | ⊙ 0x0BB11477       | ARM CoreSight SW-DP | Up               |
| Device Family: Cortex-M |                |                    |                     | Down             |
| Firmware Version: V1.42 | C Aut          | omatic Detection   | ID CODE:            |                  |
| SWJ Port: SW -          | C Mar          | nual Configuration | Device Name:        |                  |
| Max Clock: 1MHz         | Add            | Delete             | odate IR len:       |                  |
| Debug                   |                |                    | Cache Ontione       | and Options      |
| Connect: Normal Rei     | set: Autodate  |                    | Cache Code          | oad Options      |
| Reset after Connect     | ser. Indiodere |                    | ✓ Cache Memory      | ownload to Flash |
|                         |                |                    |                     | _                |

#### 4.2 Debugging

1. Click Q or **Debug**  $\rightarrow$  **Start/Stop Debug Session** to start debug.

| <u>D</u> eb       | oug         | Pe <u>r</u> ipherals | <u>T</u> ools | <u>s</u> vcs | Window  |  |
|-------------------|-------------|----------------------|---------------|--------------|---------|--|
| ٩                 | Star        | t/Stop <u>D</u> ebug | Session       |              | Ctrl+F5 |  |
| <b>e</b> ∉<br>RST | Res         | et <u>C</u> PU       |               |              |         |  |
|                   | <u>R</u> ur | 1                    |               |              | F5      |  |
| $\otimes$         | <u>S</u> to | р                    |               |              | ;]      |  |
| 214               |             |                      |               |              | b       |  |
| Figure 16         |             |                      |               |              |         |  |

2. When user want to stop debugging, click *Debug* → *Start/Stop Debug Session* again.

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## 5 Address Information

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