

How to Create a Firmware Image for the UC-8100 Series

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Contents

1	Introduction.....	2
2	Requirements.....	2
3	Set Up the Work Environment.....	2
4	Build a Custom Kernel Image with Your Configuration Settings.....	3
5	Change the Root File System.....	4
6	Upgrade the Firmware on the Target Computer	5
6.1	UC-8100 Metal Model.....	5
6.2	UC-8100 Plastic Model	9

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1 Introduction

This document is a step-by-step guide to building a custom kernel and OS image for the UC-8100 Series of computers. Instructions for the plastic and metal models are specified in separate sections.

2 Requirements

1. A computer or a virtual machine (VM) running Debian 9 or Ubuntu16 (64 bit) as the Primary OS.
2. Sufficient disk space on your HDD
For example, I set 40 GB on my VM. You can set aside disk space based on the number of kernels you want to build. The minimum disk space required for a kernel source (and its compiled code) is about 2 GB.
3. Basic Linux knowledge (using the terminal and running basic commands)

3 Set Up the Work Environment

To compile kernel sources, modules, and programs for the UC-8100 Series, you must first download the corresponding toolchain from the Moxa support and download center at:

<https://www.moxa.com/support/DownloadFile.aspx?type=support&id=13751>

To set up the work environment, do the following:

1. Install the toolchain on Debian 9/Ubuntu 16 and above.
After extracting the contents of the toolchain package to a folder, run the install script from the folder using the following command.
2. When the installation is completed, export these environment variables before using toolchain:

```
sudo sh arm-linux-gnueabihf_4.X_Build_XXXX.sh
```

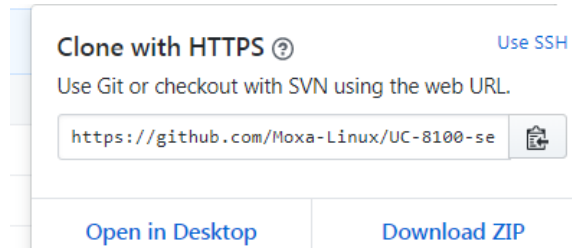
```
export PATH=$PATH:/usr/local/arm-linux-gnueabihf-4.9/usr/bin
export ARCH=arm
export CROSS_COMPILE=arm-linux-gnueabihf-
```

3. Install libraries and tools required for compiling kernel source and generating images

```
sudo apt-get install libncurses5-dev
sudo apt-get install liblz4-tool
sudo apt-get install u-boot-tools
sudo apt-get install git
```

4. Download the kernel source from github.

Use the git clone: https://github.com/Moxa-Linux/UC-8100-series_V2.0.git
or click on the file to download it directly.



4 Build a Custom Kernel Image with Your Configuration Settings

To create a custom kernel image, you must first change some kernel options.

Use following commands to configure and build a kernel image.

Note: The UC-8100 plastic and metal models use different command options.

- To specify the configuration settings, use:

```
make uc8100_defconfig
```

Or

```
make uc8100me_defconfig
```

- To modify the configuration of the kernel, use

```
make meunconfig
```

- To build kernel image, use:

```
make uImage
```

- To build device tree, use:

```
make moxa-uc8100.dtb
```

Or

```
make moxa-uc8100-me.dtb
```

- To build modules, use:

```
make modules
```

- To output stripped kernel modules, use:

```
mkdir out
```

```
make INSTALL_MOD_STRIP=1 modules_install INSTALL_MOD_PATH=./out
```

- To remove symbolic link of kernel source, use

```
cd out
rm out/lib/modules/4.1.0-ltsi-rt-uc8100+/kernel/source
rm out/lib/modules/4.1.0-ltsi-rt-uc8100+/kernel/build
Or
rm out/lib/modules/4.1.0-ltsi-rt-uc8100-me+/kernel/source
rm out/lib/modules/4.1.0-ltsi-rt-uc8100-me+/kernel/build
```

5 Change the Root File System

To create a firmware image with your configuration settings for the UC8100 Series, you need to modify the custom kernel (created in the previous section) as well as the drivers, programs, and configuration.

To modify your own kernel/drivers/programs/configuration in the root file system, do the following:

1. Download the standard image for an UC-8100 Series as per your requirement.

- a. For the UC-8100 plastic model, go to:

https://www.moxa.com/support/sarch_result.aspx?type=soft&prod_id=1992&type_id=4

- b. For the UC-8100 metal version, visit:

https://www.moxa.com/support/sarch_result.aspx?type=soft&prod_id=5155&type_id=4

2. Mount the UC-8100 Series standard image as a folder on a PC.

Use mount-img utility:

```
mount-img <image name> <folder>
```

For example: `./mount-img mount FB_UC8100_V2.1_Build_XXX.img rfs`

You will see 3 folders: p1, p2, and p3, under the folder you mounted:

- p1 : Kernel image and device tree
- p2 : Main partition that Linux exist
- p3 : Backup partition

3. Add/modify your kernel/drivers/programs/configurations as per your requirements:
 - if you want to update the kernel or device tree => put uImage or dtb into p1
 - if you want to put your files, such as programs => put files into p2
 - if you want to update modules => copy modules into p2/lib/modules
4. Unmount the folder after the modification is completed.

For example: `./mount-img umount FB_UC8100_V2.1_Build_XXXXX.img rfs`

You now have a custom UC-8100 OS image that you can use to upgrade the firmware on other UC-8100 Series computers.

6 Upgrade the Firmware on the Target Computer

6.1 UC-8100 Metal Model

6.1.1 Prepare an SD card

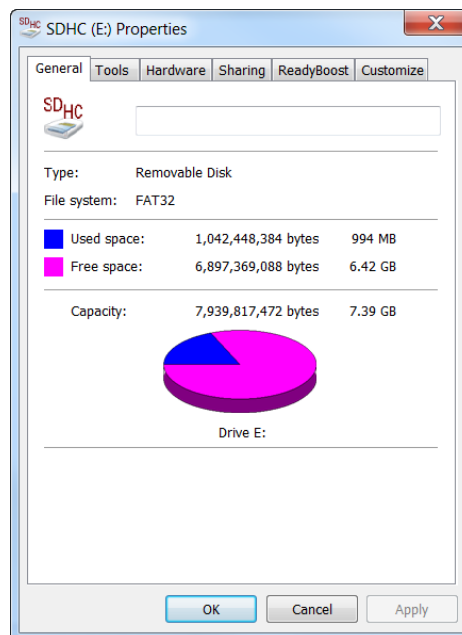
If you are using Windows, take the following steps.

1. Unlock the SD card's write protection switch is unlocked.



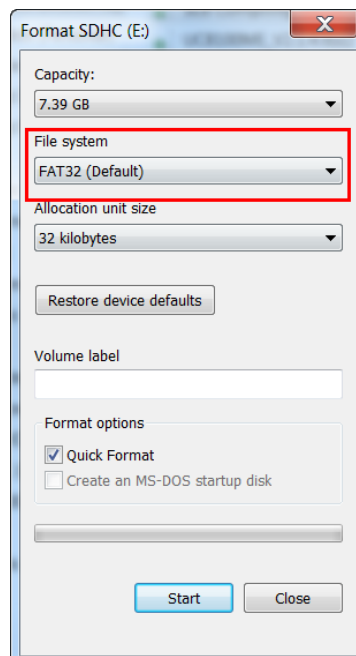
2. Insert the SD card into the SD card slot.

3. Make sure the SD card's file system is FAT32



If the SD card's file system is not FAT32, format it to FAT32 file system on the primary partition.

Note: Formatting a SD card to FAT32 will delete all the files in the SD card when you format it)



4. Copy the image file into the SD card and then follow the steps to update firmware.

6.1.2 Upgrade the Firmware on the Target Computer

- 1 Use the serial console to log in into the UC-8100 computer.
See the *UC-8100 Hardware Manual* for instructions on how to connect to the serial console.
- 2 After powering on the UC-8112-ME computer, press key to enter the BIOS configuration settings.
If you couldn't enter the BIOS menu by press , please replace putty by Tera Term terminal console tool available for download at:
<https://ttssh2.osdn.jp/index.html.en>

```
-----  
Model: UC-8100-ME  
  
Boot Loader Version 1.2.0S00      CPU TYPE: 1GHz  
  
Build date: Jun  1 2017 - 19:40:51  Serial Number: IMOXAI234567  
  
LAN1 MAC: 00:90:e8:xx:xx:xx      LAN2 MAC: 00:90:e8:xx:xx:xx  
  
-----  
(0) Extend USB Port Control      (1) Firmware Update by SD Card  
(2) Firmware Update by Tftp      (3) Select Boot Device  
(4) Go To OS                     (5) Auto update ThingsPro from SD card  
  
-----Command>>
```

- 3 Enter 1 to choose update image file by SD Card.

```
Command>>1  
  
Firmware File Name (firmware.img):
```

- 4 Enter the image filename.

```
Firmware File Name (firmware.img): FWR_UC-8112-ME-T-LX_V2.0.0_Build_16032911.img
```

- 5 After update firmware, enter 3 to go to OS.

```
Firmware File Name (firmware.img): FWR_UC-8112-ME-T-LX_V2.0.0_Build_16032911.img
mmc2(part 0) is current device
MMC write: dev # 2, block # 0, count 393216 ... 393216 blocks write: OK
mmc2(part 0) is current device
MMC write: dev # 2, block # 393216, count 393216 ... 393216 blocks write: OK
mmc2(part 0) is current device
MMC write: dev # 2, block # 786432, count 237568 ... 237568 blocks write: OK

-----

Model: UC-8100-ME
Boot Loader Version 1.2.0S00      CPU TYPE: 1GHz
Build date: Jun  1 2017 - 19:40:51  Serial Number: IMOX A1234567
LAN1 MAC: 00:90:e8:xx:xx:xx      LAN2 MAC: 00:90:e8:xx:xx:xx

-----

(0) Extend USB Port Control      (1) Firmware Update by SD Card
(2) Firmware Update by Tftp      (3) Select Boot Device
(4) Go To OS                    (5) Auto update ThingsPro from SD card

-----Command>> 3
```

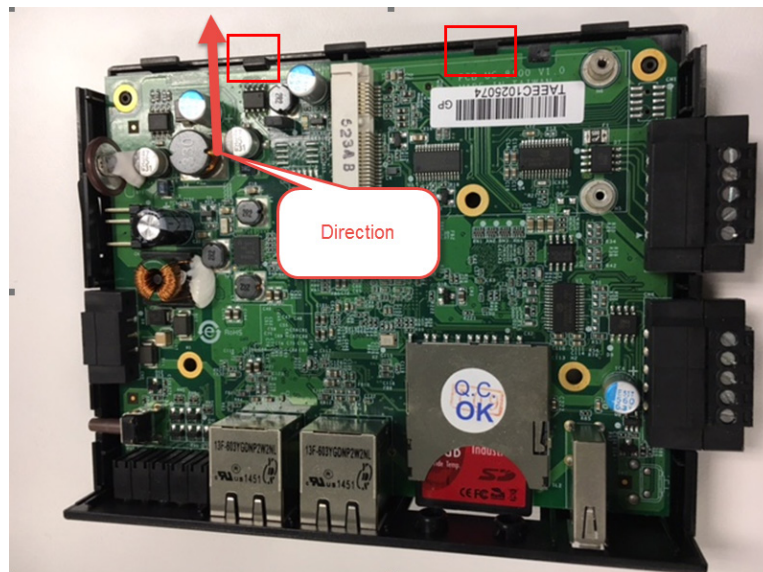

6.2 UC-8100 Plastic Model

6.2.1 Remove the microSD card

1. Remove the front cover.

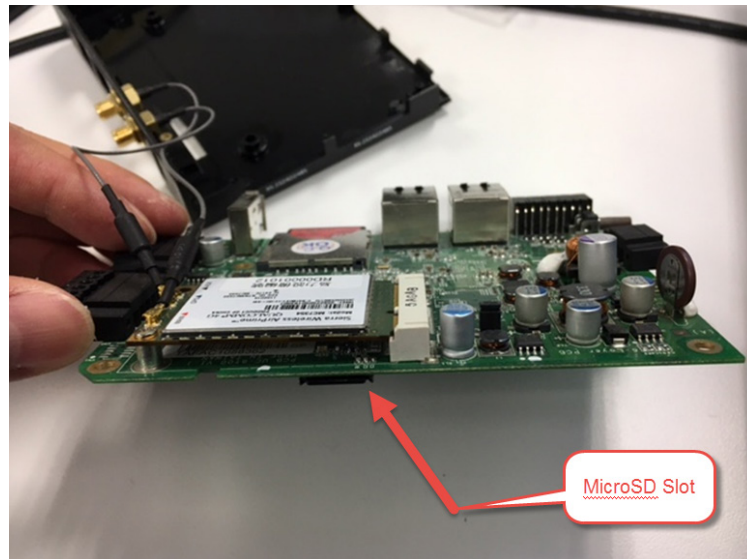


2. Release the board from the two clips attaching it to the cover.

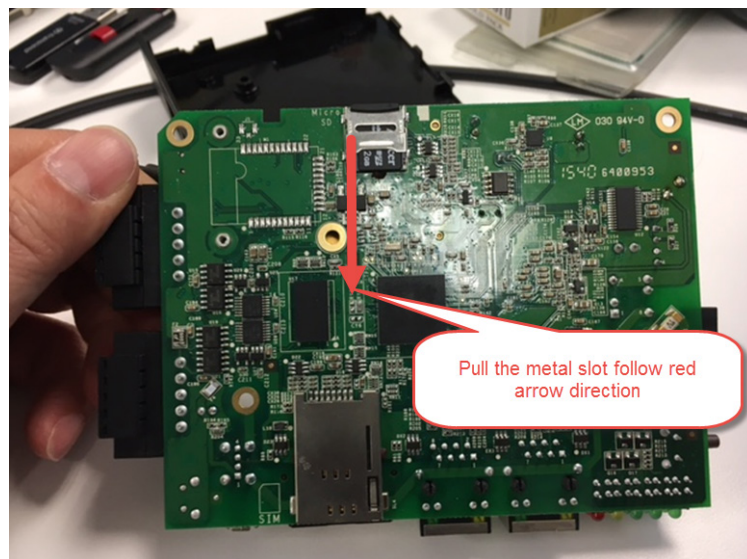


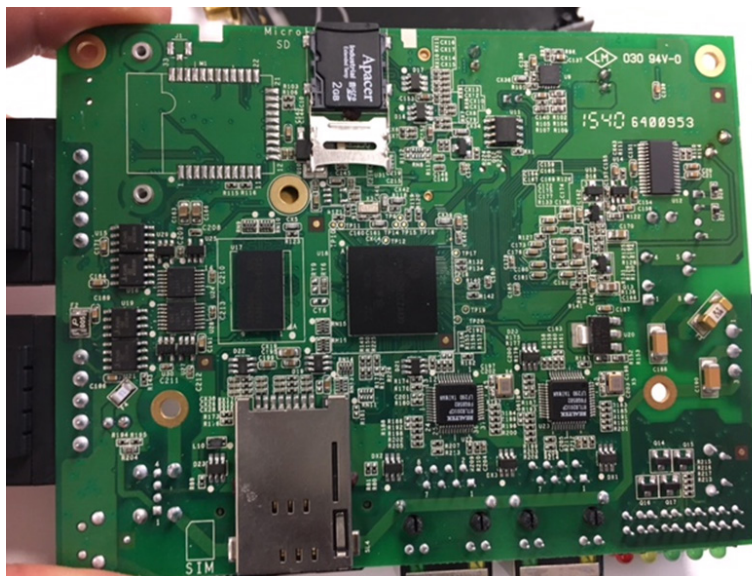
How to Create a Firmware Image for the UC-8100 Series

3. Flip the board to access the microSD slot as shown below:



4. Remove the microSD card from the slot.



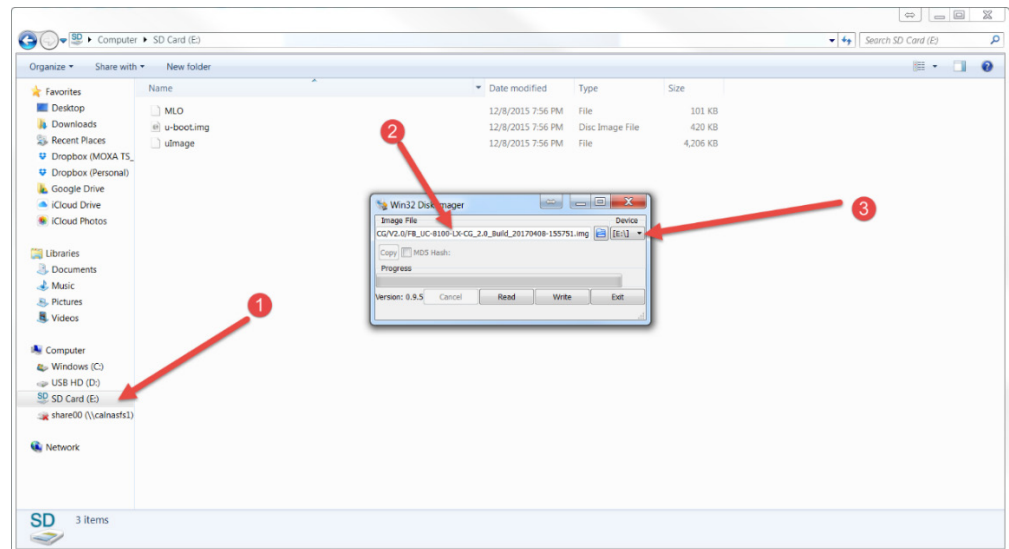


5. Insert the microSD into an SD converter.



How to Create a Firmware Image for the UC-8100 Series

6. Install the SD card in a Windows PC and run the **Win32 DisImager** utility.



7. Make sure the driver (1) is same as driver shown on (3).
8. Choose the image file (3).
9. Remove the microSD card socket from the Windows PC and install it on the UC-8100 computer board.