RoboPeak Mini USB Display

User Manual

2013-11-28

Rev. 1
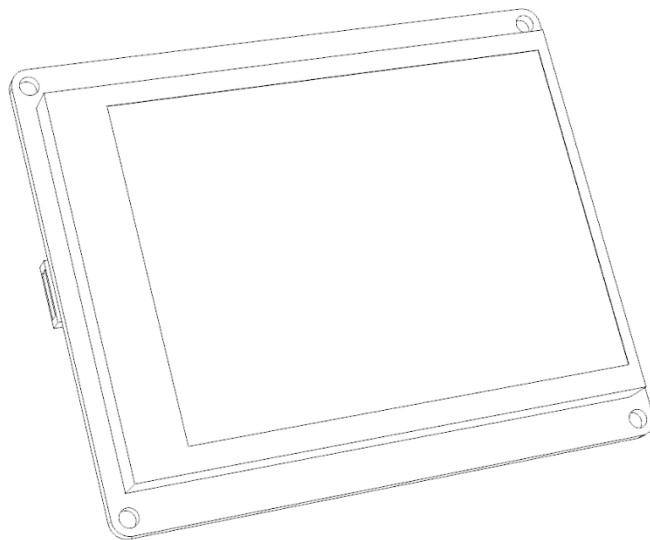
Contents:

1. Introduction

RoboPeak USB Display is a low cost display module with USB connectivity for data transmission and designed by RoboPeak Team. It can be convenient used as a Human Interactive Interface device for various embedded devices and platforms.

Features

RoboPeak USB Display comes with following features :

- Ease to use, easy configuration

- 320x240 resolution with 65536 color

- 2.8-inch resistive touch screen

- Up to 100hz refresh rate

- Powered by USB directly, do not need extra power supply

- USB connectivity, no HDMI or VGA port needed

- Open source Linux device driver

- Can be easily connected with Mini-PCs such as Raspberry-pi, Cubieboard(I/II/III), pcDuino and routers with USB such as WR703

2. Typical Use Case

RoboPeak Mini USB Display can be used in multiple ways. Here we list several typical use cases for your reference.

As Human Interactive Interface for Mini PC

Along with the popularize of ARM chips with the lower cost and higher performance, Mini PC products such as Raspberry Pi becomes very popular. Usually, they use HDMI as an interface to connect with TV and display. By adding USB keyboard and mouse, it looks like a PC so called Mini PC. However, this also limited Mini PC's portability. You needs to bring keyboard and mouse, and can only be used in the place where have TV or display with HDMI interface.

By using RoboPeak Mini USB Display, Mini PC becomes real. You can use it in anywhere as soon as there's power supply.

Figure 1 MK802 Connect RoboPeak Mini USB Display

As an additional screen for PC

A touch screen comes with PC will improve the user experience a lot. Also, you can

think about more innovative ideas with the additional screen. For example, LingRen

series laptop by Razor integrated touch screen used as game skill release panel. It

also can be used as quick entry for common functions of professional software.

Figure 2 Touch Screen integrated in Razor Blade Laptop[1]

Moreover, for devices without display such as Server, NAS device, touch screen can

be a good Human Interface to show devies' status, provide management function.

This will improve device's user experience a lot.

Figure 3 PC connected with RoboPeak Mini USB Display

[1] The picture comes from Razor's website, copyrighted by Razor.

3. Basic Usage

Connect with Mini PC

RoboPeak Mini USB Display is designed for Mini PC at first, so it has considered many use case for connecting with Mini PC. This is also the most convenient way to using RoboPeak Mini USB Display.

You can choose bellow two ways to use RoboPeak Mini USB Display:

- Use prebuilt Mini PC firmware image provided by RoboPeak

- Install prebuilt RoboPeak Mini USB Display device driver by ARM Suite provided by RoboPeak.

Download Prebuilt Mini PC firmware provided by RoboPeak

To facilitate the use of USB display, RoboPeak provides prebuilt Mini PC firmware. All you need to do is simply write prebuilt firmware image to the SD card or NAND flash comes with Mini PC. Then you can use USB display without any additional configuration.

Currently supported Mini PCs (We will provide support for more devices):

- Raspberry PI

- Cubieboard

- Cubieboard Ⅱ

- Pcduino

You can download prebuilt firmware from:

http://www.robopeak.com/docs/doku.php?id=product-rpusbdisp-downloads

Flash RoboPeak firmware to MiniPC

You can follow below steps to flash your MiniPC after downloading the RoboPeak

prebuilt firmware image.

Decompress the firmware

The provided Mini PC firmware is compressed using xz[2]. Before use, you should use

corresponding tool to unzip it.

Decompress the firmware in Windows

The easiest way to decompress xz file in Windows is using 7Zip software. You can

get latest 7Zip from 7Zip's official homepage.

```
http://www.7-zip.org/
```

The usage of 7Zip is out of scope of this document.

Decompress the firmware in Linux or Mac OS X

If you are using Linux system, it has contains xzutils package usually. If you're

using mac OS X, you can install xz tools using Home Brew or Mac Ports.

● Using Home Brew
```
brew install xz
```
● Using Mac Ports
```
ports install xz
```

After installation, you can use xz command to decompress the firmware:
```
xz –kd the-path-to-the-rom.img.xz
```
(Replace the-path-to-the-rom.img.xz to the rom file you have downloaded)

Flash firmware accordingly

The flash approach may different according to SoC solution used by your Mini PC.

---

[2] http://tukaani.org/xz/

Please find appropriated approach in the bellow table to flash your firmware.

Mini PC	SoC Solution	Flash firmware using NAND	Flash firmware using SD card
Pcduino	AllWinner[3] A10	Flash firmware to Mini PC's NAND flash using Phoenix Suit	Flash the firmware to SD card
Cubieboard	AllWinner A10		
Cubieboard Ⅱ	AllWinner A20		
Raspberry PI	Broadcom BCM2835	N/A[4]	

Flash firmware to Mini PC's NAND flash using Phoenix Suit

Phoenix Suit is provided by All Winner and used to update firmware for All Winner

Ax series SoC solution. So it can only be used to flash Pcduino and Cubieboard

series which are using All Winner solution.

You can find the firmware link from RoboPeak's wiki.

http://www.robopeak.com/docs/doku.php?id=product-rpusbdisp-downloads

Step 1 Disconnect all power supply and USB connection from Mini PC

Firstly, you need to disconnect all power supply including power cable, USB OTG

cable to make sure Mini PC has turned off.

Step 2 Using Phoenix Suit

Now, you need to open Phoenix Suit software in your PC.

---

[3] AllWinner is ARM Soc provider in China
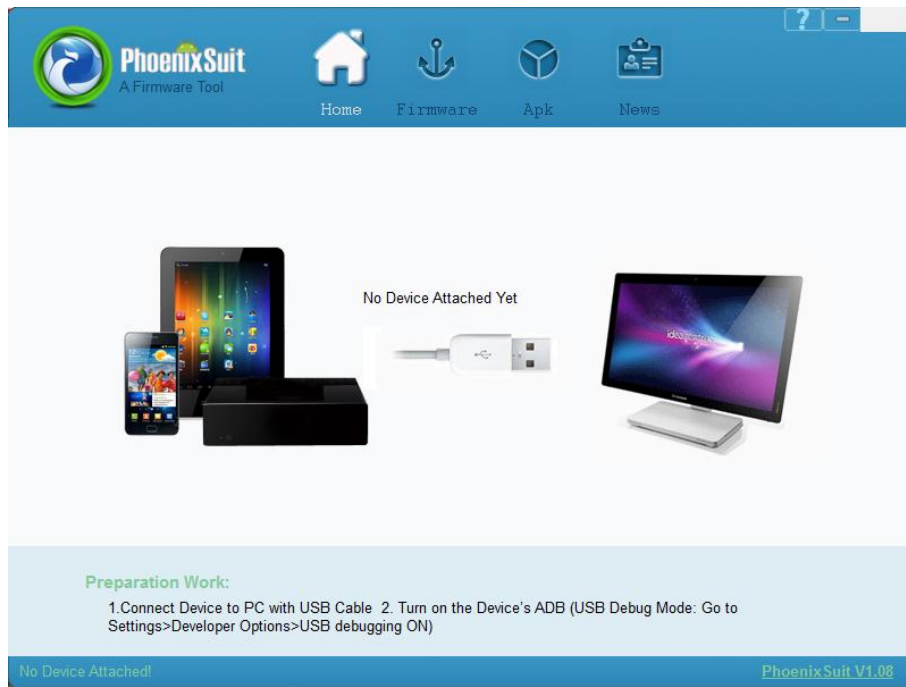
[4] Raspberry PI's firmware is in SD card
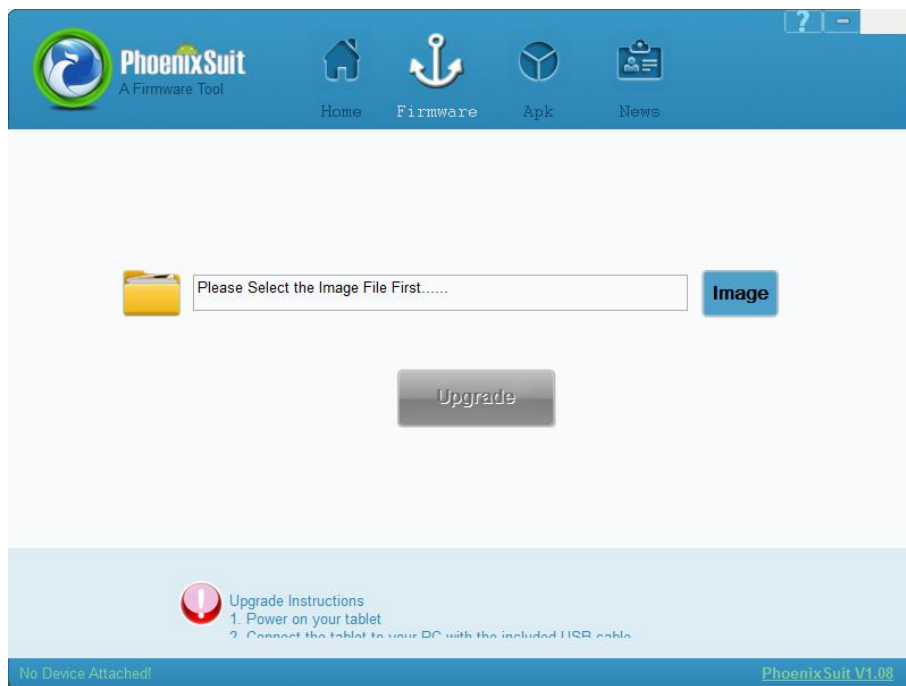
Figure 4 UI of Phoenix Suit

Choose Firmware tab:

Figure 5 Firmware tab of Phoenix Suit

Click "Image" Button to choose decompressed firmware image. (Note, should be
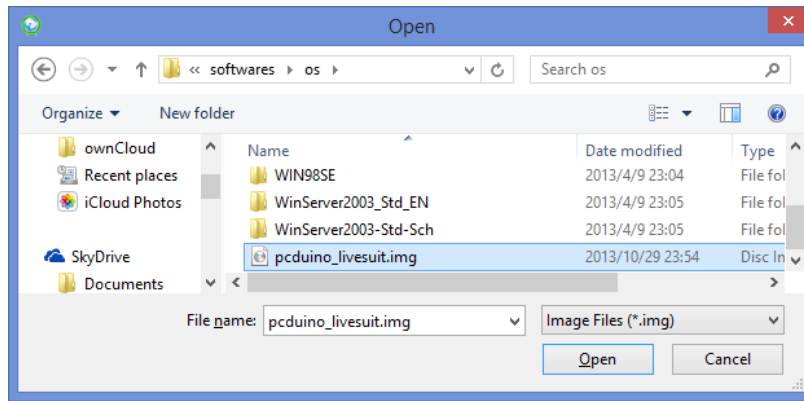
*.img file, not *.xz file)

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Figure 6 Choose image file

Now, Phoenix Suit is ready to flash the firmware to your device.

Step 3 Connect Mini PC

● Pcduino

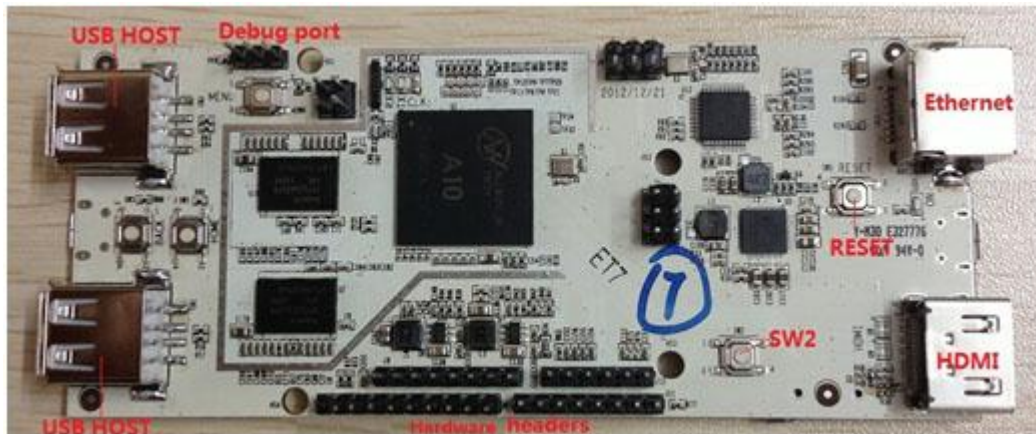Press SW2 key (right corner) in the PCB.

Figure 7 Pcduino layout (Front)[5]

Keep holding SW2 key and connect Mini PC's USB OTG port to PC's USB port.

Then Pcduino will enter DFU mode.

● Cubieboard Series

Connect Mini PC's USB OTG port to PC's USB port using USB cable. Press FEL key

next to USB OTG port and power on Cubieboard, then Cubieboard will enter FEL

mode.

---

[5] The picture is from Pcduino's website, copyrighted by Pcduino

Step 4 Start flash firmware

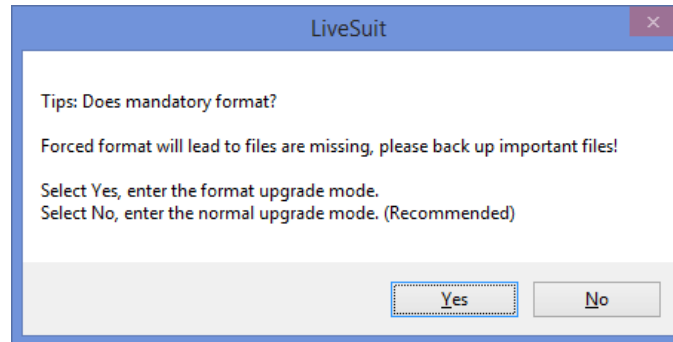When Phoenix Suit detects Mini PC in DFU mode or FEL mode, it will pop up bellow

dialog.

Figure 8 Phoenix Suit format dialog

Press "Yes", Phoenix Suit will prompt again. Press "Yes" again to upgrade with

format the device.

Then, Phoenix Suit will format your Mini PC automatically and load the new

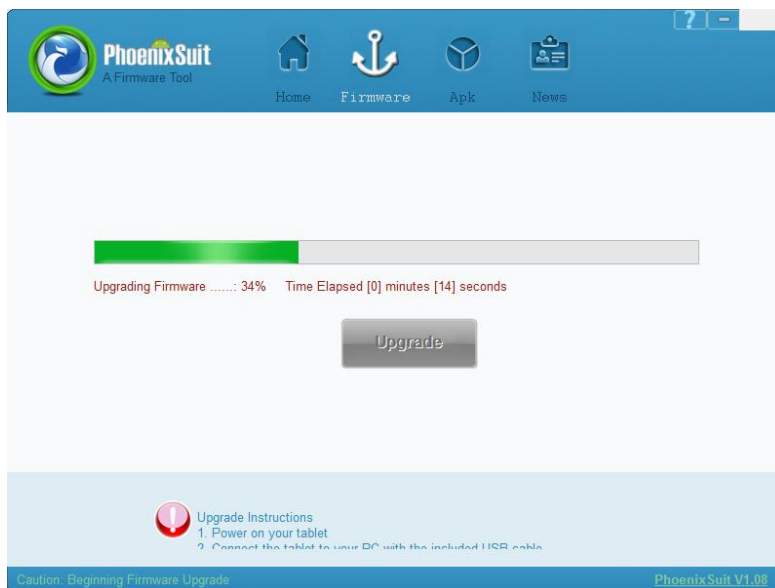firmware. The update progress will show in the Phoenix Suit's UI.

Figure 9 Phoenix Suit upgrading firmware UI

The update process will last 5 ~ 10 minutes. Mini PC will automatically restart after

update finished. Before that, please make sure not to disconnect Mini PC with your

computer.

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Flash firmware to SD card in Windows

Step 1 Download and install Win32 Disk Imager

Win32 Disk Imager is an open source disk image tool in Windows. You can

download the tool from:

http://sourceforge.net/projects/win32diskimager/

Step 2 Open Win32 Disk Imager

Win32 Disk Imager doesn't need to install, it can be used directly after

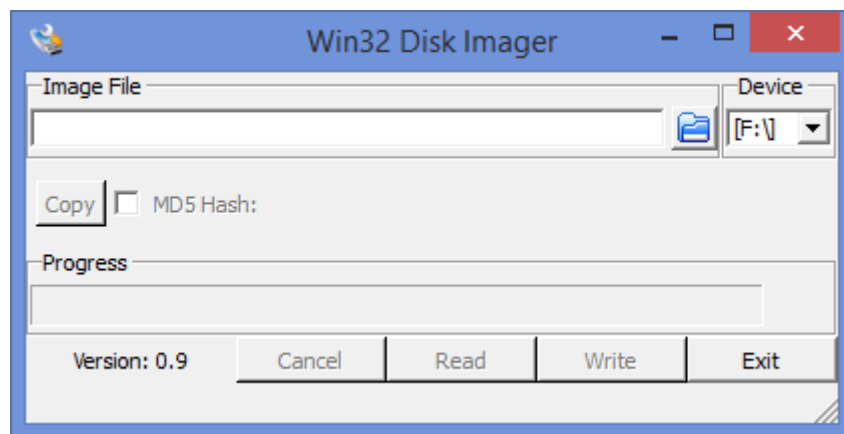decompress. Double click Win32DiskImager.exe to start the application。

Figure 10 UI of Win32 Disk Imager

Use "Open File" button next to Image File Box to choose firmware image. Choose

SD card drive in Device Box. Now, Write button will become available from grey.

Click Write button, Win32 Disk Imager will pop up bellow dialog to ask for
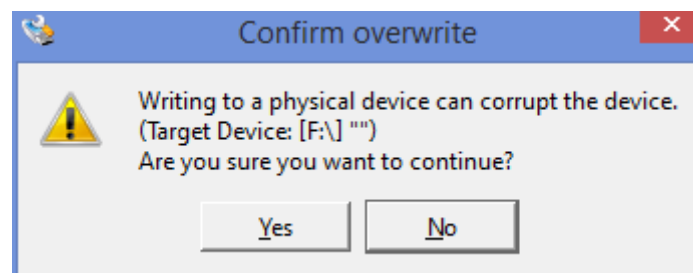
confirmation.

Figure 11 Confirm dialog of Win32 Disk Imager

Press Yes button to start write. Win32 Disk Imager will write the image content to

your SD card. This process may last several minutes according to your SD card's

write speed. Please wait the write process finish to avoid data damage which may

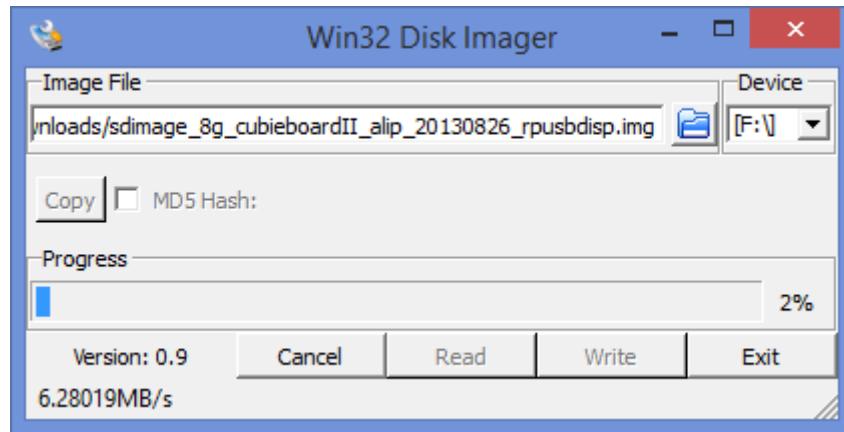lead to boot failure of your Mini PC.

Figure 12 Win32 Disk Imager progress bar

Flash firmware to SD card in Linux

Step 1 Confirm your SD card mount point

It's easy to confirm your SD card mount point in Linux. Take Ubuntu Linux as

example:

First, open terminal and input bellow command:

```
mount
```

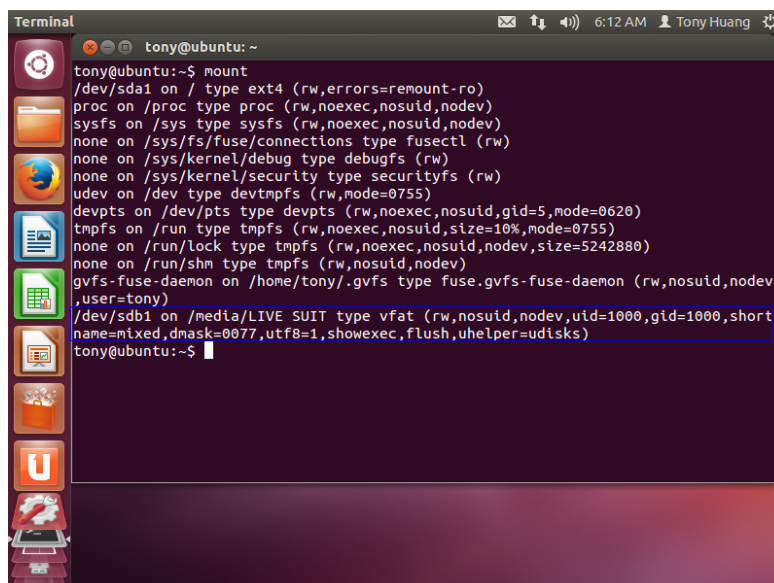Now, you will see all mounted partition information.

Figure 13 The output of mount command

As shown in the blue box, my SD card's label name is LIVE SUIT, it is automatically

mount to /media/LIVE SUIT by Ubuntu. Its device name is /dev/sdb1. Here

/dev/sdb1 contains partition information and its real device name is /dev/sdb.

Step 2 Unmount SD card

Since Ubuntu has already mounted your SD card to /media, the partition will be

locked to prevent write. We need to unmount the SD card first:

```
umount /dev/sdb1
```

When you execute mount command again, you won't see SD card's partition if

unmounts command executed correctly.

Step 3 Write firmware image to SD card

Using dd command to write the firmware image to SD card:

```
sudo dd if=path-to-sdimage.img of=/dev/sdb bs=1M
```

（The path-to-sdimage.img should be the full path to decompressed firmware

image. The SD card device name should use the one you get from step 1.)

WARNING: PLEASE CHECK THE PARAMETER CARFULLY. ANY WRONG

PARAMETER MAY DAMAGE YOUR COMPUTER!

After successfully write, dd command will have bellow output:

```
7600+0 records in
7600+0 records out
```

The output means your write has succeeded. You only need to insert SD card to

your mini PC now.

Flash firmware to SD card in Mac OS X

Step 1 Confirm your SD card mount point

You can use "Disk Utility" tool in Mac OS X. it's under "Other" folder in

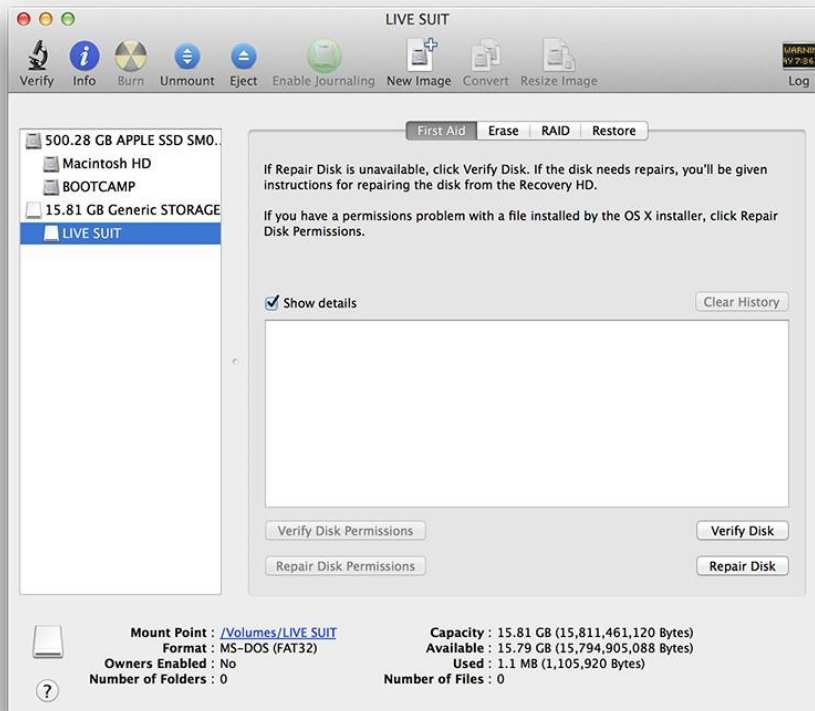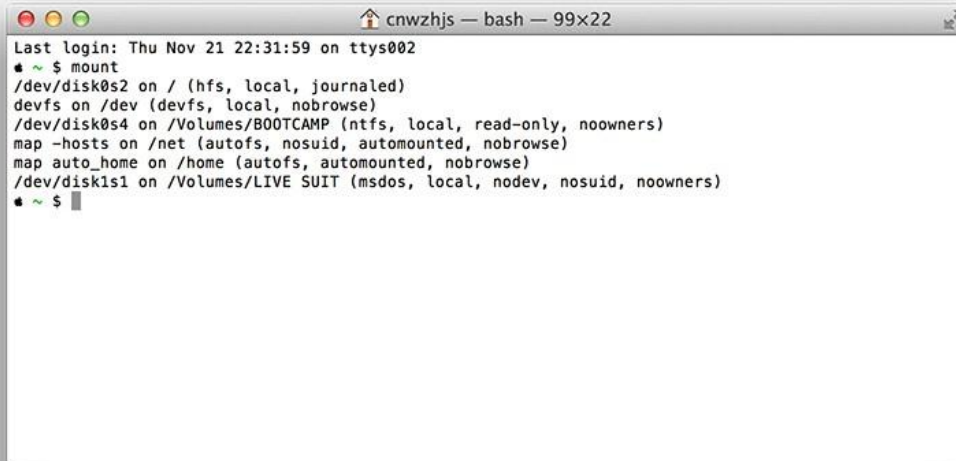Launchpad.

Figure 14 UI of disk utility

Open Disk Utility, you can find your SD card's partition in the left side. In this

example, it's LIVE SUIT. When you select it, the mount point will show in the left

corner: /Volumes/LIVE SUIT.

Then we can get SD card device name by executing bellow command in the

Terminal.

```
mount
```

Now, you should see all mount information in the terminal.

Figure 15 output of mount command

From above figure, we can know /dev/disk1s1 is mounted to /Volumes/LIVE SUIT.

That's it. It's the partition of SD card. Accordingly, the SD card's device name is

/dev/disk1.

Step 2 Unmount SD card

Like Ubuntu[6], Mac OS X will mount SD card's partition automatically. We need to

unmount the SD card to avoid write-prevention.

Execute bellow command in the terminal:

```
sudo diskutil umount /dev/disk1s1
```

(The /dev/disk1s1 in the command should replace with the device name you get

from Step 1)

---

[6] To be accurately, it should be Ubuntu is similar to Mac OS X. Mac OS implemented this feature
earlier than Ubuntu.

Figure 16 Output of diskutil umount

Step 3 Write firmware using dd

The approach of write firmware using dd in Mac OS X is the same as in Linux. Please

refer to the chapter above.

Touch screen calibration

Since RoboPeak Mini USB display is using four-wire resistive touch screen, the zero

and linear relationship may different according to the screen and chips'

characteristics.

All RoboPeak Mini USB display will do touch screen calibration before shipping. The

calibration result will be saved in display's flash. If you found RoboPeak Mini USB

display doesn't behave accurately, you can do calibration again follow below

steps:

Step 1 Disconnect RoboPeak Mini USB display with all connections

The calibration process needs to be done during power on. So please make sure the

display is disconnected with all connections before calibration.

Step 2 Power on and long press screen when RoboPeak logo showed in the screen.

Plug USB cable to power on the display

Figure 17 RoboPeak logo showed in the screen

When RoboPeak logo showed on the screen, long press the screen until the screen

become black and showing bellow text:

```
Touch Screen Calibration
Please press the red flashing dot on the screen..
```
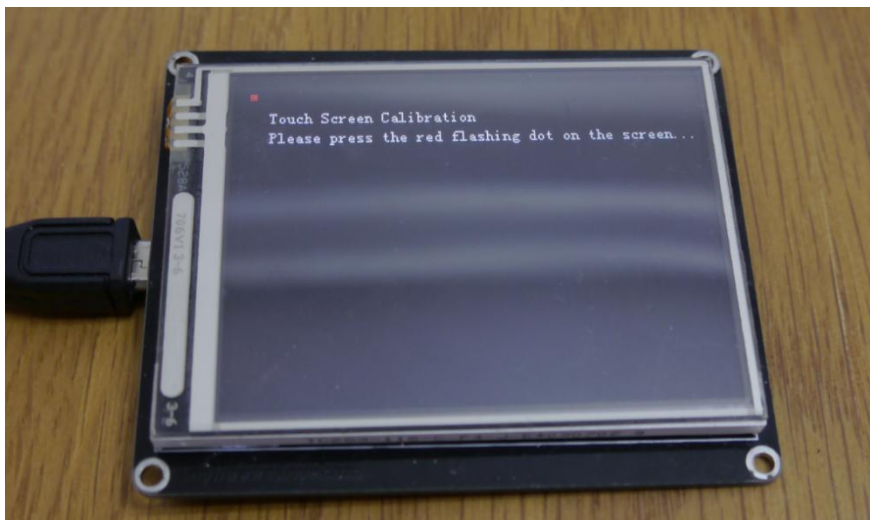

Figure 18 Calibration UI

Step 3 Press specified location according to the hint

You will see there's a red pixel blink in the upper left corner. Please use touch pen

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or your finger to touch that location and hold for about 1 second until promoted

for touching next calibration point.

You will be asked to touch upper left corner, left corner, right corner, upper right

corner during calibration process. After the calibration process done, the data will

be saved to your USB display's flash. You don't need to do calibration each time.

4. Advance Usage

Connect with Linux PC

Step 1 Connect RoboPeak USB Display with computer

Connect RoboPeak USB Display with computer needs:

● RoboPeak USB Display

● Micro USB cable

Please connect Micro USB connector with RoboPeak Mini USB Display and plug USB Type A connector to PC.

Step 2 Download and build device driver software

Since RoboPeak Mini USB Display's driver doesn't include in the Linux kernel by default, we need to build our own device driver. Again, let's take Ubuntu Desktop 12.04.2 LTS as example to introduce how to build RoboPeak Mini USB Display device driver.

Before building driver, please make sure bellow software installed in your system:

● Git

● Linux Headers

● GCC

● Binutils

● Make

You can use bellow commands to update your apt source list and install the needed software packages.

```
sudo apt-get update
```

```
sudo apt-get install git linux-headers-`uname –r` gcc binutils make
```

Step 3 Download the source code of RoboPeak Mini USB Display's Linux device driver

You can use git command to get the latest device driver source code from:

```
git clone https://github.com/robopeak/rpusbdisp.git
```

If the git clone command executed successfully, you will get an rpusbdisp folder in your current path which contains RoboPeak Mini USB Display's device driver source code and related tools.

Step 4 Build device driver

You need to go to rpusbdisp/drviers/linux-driver folder and type make to get the driver built.

```
cd rpusbdisp/drivers/linux-driver
make
```

If build succeed, rp_usbdisplay.ko will be generated under the current folder. You can use bellow command to check the existence of this file.

```
ls *.ko
```

If the file doesn't exist, that means the build is failed. It may be caused by the kernel version mismatch or incorrect kernel configure. Please find more information from Git Hub homepage of RoboPeak Mini USB Display project:

```
https://github.com/robopeak/rpusbdisp
```

Step 5 Install kernel module

After successfully build, you need to install the kernel module to modules folder and update the module dependence relationship. You can execute bellow commands:

```
sudo install rp_usbdisplay.ko "/lib/modules/`uname -r`/kernel/rp_usbdisplay.ko"
sudo depmod -a
```

Step 6 Make sure kernel module has worked correctly

You can use modprobe command to load rp_usbdisplay kernel module:

```
sudo modprobe rp_usbdisplay
```

If modprobe doesn't complain any error, congratulations! The kernel module has

been loaded successfully.

If there's any error, you can use dmesg to diagnosis the issue. Please refer to

GitHub homepage of RoboPeak Mini USB Display project for more information :

```
https://github.com/robopeak/rpusbdisp
```

Step 7 Configure the kernel module to be loaded automatically and reboot

You can configure the RoboPeak Mini USB Display's kernel driver to be loaded

automatically by using bellow command:

```
sudo echo rp_usbdisplay>>/etc/modules
```

If you're using Vmware or Virtual Box VM, rp_usbdisplay kernel module maybe

loaded earlier than VM's video kernel driver. Then the Framebuffer device number

may be different than you see currently. Strong suggest you to **reboot your PC or**

VM immediately now to avoid configure error in next step.

Step 8 Configure X for RoboPeak Mini USB Display

Firstly, you need to check RoboPeak Mini USB Display's Framebuffer device name:

```
cat /proc/fb | grep rpusbdisp-fb
```

The number showed at the beginning is the display's Framebuffer number. Take

my PC as example, the output of above command looks like this:

```
1 rpusbdisp-fb
```

That means my display's Framebuffer number is 1, and corresponding device

name is /dev/fb1.

Then you need to install 10-disp.conf file under xserver_conf folder to your X

configure folder:

```
sudo cp xserver_conf/10-disp.conf /usr/share/X11/xorg.conf.d/
```

You can use vim editor to edit this file:

```
sudo vim /usr/share/X11/xorg.conf.d/10-disp.conf
```

Press "i" to enter edit mode in vim, move cursor to the last character of line 4,

modify /dev/fb0 to the correct framebuffer number you get above. (e.g. /dev/fb1)

Press Esc to exit edit mode and input: bellow command to exit vim and save the

modification.

```
:wq
```

Step 9 Reboot to start using RoboPeak Mini USB Display

```
sudo reboot
```

Uninstall Linux Driver

If you want to disable RoboPeak Mini USB Display, you can follow bellow steps:

Step 1 Restore X Configure file

You only need to remove RoboPeak Mini USB Display's X server configure file and

reboot X Server to disable RoboPeak Mini USB Display. Take Ubuntu Desktop

12.04.2 as example, you can execute bellow commands in terminal:

```
sudo rm -f /usr/share/X11/xorg.conf.d/10-disp.conf
sudo reboot
```

Now, your RoboPeak Mini USB Display has been disabled. If you want to fully

remove it, you still need to do following steps.

Step 2 Stop loading rp_usbdisplay automatically

Using vim to edit /etc/modules file:

```
sudo vim /etc/modules
```

Move cursor to rp_usbdisplay line and input dd to remove the line.

```
dd
```

Type :wq and enter to save and exit.

```
:wq
```

Step 3 Stop and Remove rp_usbdisplay kernel driver

Execute bellow commands in terminal:

```
sudo modprobe -r rp_usbdisplay
sudo rm -f /lib/modules/`uname -r`/kernel/rp_usbdisplay.ko
sudo depmod -a
```

Now, RoboPeak Mini USB Display's driver has been fully removed from your PC.

Using ARM Suite to install and configure RoboPeak Mini USB Display's device driver for Mini PC

Usually, Mini PC has pre-installed Linux firmware when shipping or maybe you have already installed Linux firmware in your Mini PC. Then you can use ARM Suite provided by RoboPeak to install and configure device driver for RoboPeak Mini USB Display.

Step 1 Check whether your device is supported by ARM Suite

Currently, ARM Suite only supports limited devices with specific kernel version combination. (We will add more devices in the future.) So please check your kernel version first using bellow command:

```
uname -r
```

The current support list of ARM Suite:

Device	Kernel Version
Cubieboard	3.4.43+
Cubieboard II	3.4.43+, 3.4.43.sun7i+
Pcduino	3.0.8+, 3.4.29+

Then you need to execute bellow commands in the Terminal to check kernel module dependence:

```
ls /lib/modules/`uname -r`/kernel/drivers/video | grep sys
```

Please check bellow list from output:

- sysfillrect.ko

- syscopyarea.ko

- sysimgblt.ko

- fb_sys_fops.ko

If all these files are existed, then it means you can use ARM Suite to install and

configure driver for RoboPeak Mini USB Display.

Step 2 Download ARM Suite

You can find the latest download address of ARM Suite from our wiki page:

http://www.robopeak.com/docs/doku.php?id=product-rpusbdisp-downloads

Step 3 Upload ARM Suite to your device

Here we assume your device's IP address is 192.168.1.19. If not, you should

change IP address to your device's IP in the bellow command. After executing the

command, ARM Suite will be uploaded to your Mini PC:

```
scp rpusbdisp_arm_suite_1.0_20131117.tar.bz2 scp://192.168.1.19/arm_suite_1.0_20131117.tar.bz2
```

Step 4 Decompress ARM Suite and install

Execute bellow commands in your device's terminal.

```
tar xf rpusbdisp_arm_suite_*.tar.bz2
cd rpusbdisp
sudo ./rpusbdisp_arm_tool.sh install_kernel_module
sudo ./rpusbdisp_arm_tool.sh auto_load
sudo reboot
```

rpusbdisp_arm_tool.sh will choose proper kernel module and install it automatically.

It will also auto configure your lightdm server, install daemon script and add to your

upstart script.

The last reboot command will reboot your device to make driver work.

Using dd to flash firmware to SD card in Windows

If you would like to flash firmware to SD card in windows, you can use the tool "dd

for Windows" to do this.

Step 1 Download "dd for Windows"

dd is an excellent file dump tool in *nix system. "dd for Windows" is a third-party

porting for Windows system. You can download it from:

http://www.chrysocome.net/dd
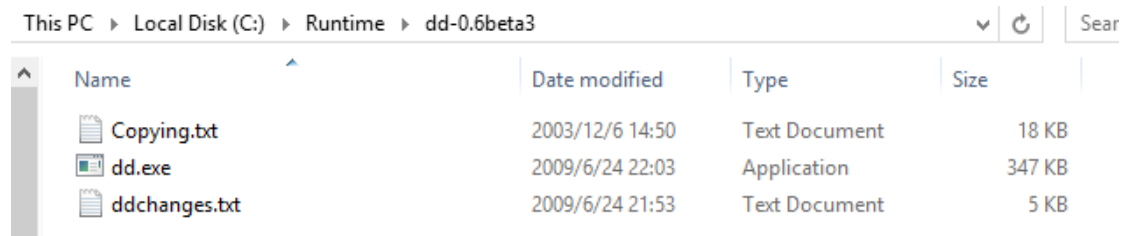
After decompress, the folder looks like this:

Figure 19 dd for Windows

Step 2 Confirm your SD card mount point

You need to use disk management tool in Windows to find your SD card's volume
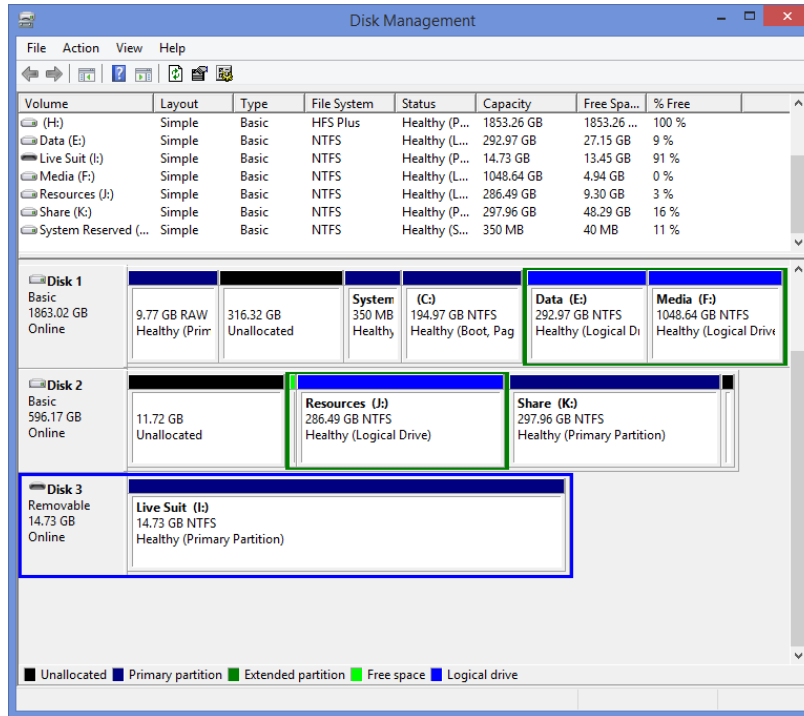
id:

Figure 20 Disk Management Tool

From figure 20, my SD card is disk3, so the device name of my SD card is:

```
\\?\Device\Harddisk3\Partition0
```

If the SD card is mounted (Has assigned driver letter), you need to unmount it first:

Right click the partition, choose "Change Drive Letter and Paths" and choose

"Remove" to remove assigned driver letter. Otherwise, it will cause "Access is

denied" error during dd.

Step 3 Write firmware image to SD card using "dd for Windows"
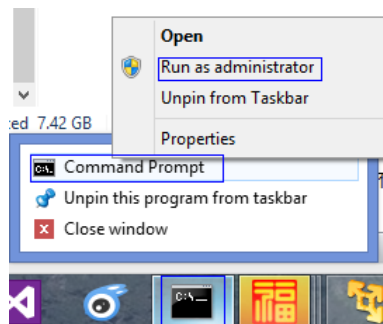
You need to start a cmd.exe run as administrator:

Figure 21 Start a cmd.exe run as administrator

Go to "dd for Windows" folder.

```
C:
cd \Runtime\dd-0.6-beta3
```

（Modify the path according to your environment）

Write image by executing dd :

```
dd if=path-to-sdimage.img of=\\?\Device\Harddisk3\Partition0 bs=1M
```

（The path-to-sdimage.img should be the full path to the download firmware. SD

card device name is the one you find in Step 2）

WARNING: PLEASE CHECK THE PARAMETER CARFULLY. ANY WRONG

PARAMETER MAY DAMAGE YOUR COMPUTER!

After successfully write, dd command will have bellow output:

```
7600+0 records in
7600+0 records out
```

The output means your write has succeeded. You only need to insert SD card to

your mini PC now.

5. Q&A

Why is my RoboPeak Mini USB Display always showing blank screen ?

The RoboPeak Mini USB display may show black screen in bellow situations:

- RoboPeak Mini USB Display doesn't connect with any PC or Mini PC.

  Please check whether the USB cable is correctly connected or try to replace one

  cable.

- You have installed RoboPeak Mini USB driver but doesn't configure X Server

  or any other program to use it

  Please follow Chapter 3 and Chapter 4 to install and configure RoboPeak Mini

  USB Display.

- You RoboPeak Mini USB Display is damaged.

  In this case, please contact with your dealer (In warranty period) or get

  maintenance service (Exceeded warranty period or damaged by yourself)

My touch screen isn't accurate

Please follow Chapter 3 "Calibration touch screen" to re-calibrate. If it still

doesn't work well after calibration, please contact your dealer.

How to stop using RoboPeak Mini USB Display ?

You can follow Chapter 4 "Uninstall Linux Driver" step 1 to stop it.

It can work with both PC Linux driver and Mini PC Linux driver.

How to fully remove RoboPeak Mini USB Display driver ?

You can follow Chapter 4 "Uninstall Linux Driver" to remove it.

It can only work with PC Linux driver.

My Mini PC has already installed Linux, is it possible to use RoboPeak Mini USBDisplay without update firmware ?

You can follow Chapter 4 "Using ARM Suite to install and configure RoboPeak Mini USB Display's device driver for Mini PC" to install and configure the driver manually.

Where can I find the latest information about RoboPeak Mini USB Display ?

You can get the latest information from RoboPeak Mini USB Display's official Wiki page:

http://www.robopeak.com/docs/doku.php?id=product-rpusbdisp

You can also get the latest driver and information from GitHub homepage of RoboPeak Mini USB Display project:

https://github.com/robopeak/rpusbdisp

6. Version History

Date	Description
2013-11-28	Initial version