Armadillo-800 EVA Product Manual

A8000-D00Z

Version 1.1.0
2012/02/28

Atmark Techno, Inc.

Armadillo Site

Armadillo-800 EVA Product Manual

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Table of Contents

List of Figures

List of Tables

Chapter 1. Preface

Thank you for purchasing the Armadillo-800 EVA.

1.1. This Document and Related Files

For all manuals including this document and also all other related files such as source files and image files, we recommend using the newest versions available. Before continuing with this document, please check the Armadillo Site for information on the latest versions.

Also, the following user only content is available to those who have registered their purchased Armadillo-800 EVA at the Atmark Techno User Site.

- Purchaser only software
- Armadillo-800 EVA circuit diagrams

In order to carry out product registration, please access the "User Only Content" menu on the user site.

A legitimate authentication file extracted from the purchased product must be uploaded during product registration. The procedure to extract the authentication file is linked to from the "Armadillo-800 EVA Product Registration" page.

1.2. Document Structure

This document comprises of Chapters 1 to 19 and an appendix.

Chapters 1 to 4 introduce Armadillo-800 EVA.

Chapters 5 to 10 explain how to use Armadillo-800 EVA. This includes explanations on the installed software and the recovery procedure used to return the software to its factory default state.

Chapters 11 to 17 cover the information required for software development. This includes preparation of the development environment and how to build the various software.

Chapters 18 to 19 explain the hardware specifications.

Finally, the appendix explains the functionality of the bootloader.

1.3. Typographical Conventions

1.3.1. Fonts

Fonts are used in the following ways in this document.

Table 1.1. Fonts

Font Example	Explanation
Plain text font	Used for standard text
`[PC ~]$` **`ls`**	Shell prompt and user input text
text	Text that is either displayed, is to be edited, or is a comment

1.3.2. Command Entry Examples

The command entry examples in this document all have an assumed execution environment which is reflected in the displayed prompt. The directory part "`/`" will differ depending on the current directory. The home directory of each user is represented by "~".

Table 1.2. Relationship Between Prompt and Execution Environment

Prompt	Command Execution Environment
`[PC /]#`	To be executed by a privileged user on the work PC
`[PC /]$`	To be executed by a general user on the work PC
`[armadillo /]#`	To be executed by a privileged user on Armadillo
`[armadillo /]$`	To be executed by a general user on Armadillo
`hermit>`	To be executed on Armadillo in maintenance mode

Commands that may change or vary depending on the relevant environment are written as shown below. Please adjust the commands as necessary.

Table 1.3. Abbreviations Used in Command Entry Examples

Notation	Explanation
[version]	File version number

1.3.3. Icons

Icons are used in the following way in this document.

⚠ This is used for precautions.

💡 This is used for helpful information.

1.4. Acknowledgements

The software used on Armadillo is composed from Free Software / Open Source Software. This Free Software / Open Source Software is the result of efforts from developers from all over the world. We would like to take this opportunity to express our gratitude.

Chapter 2. Precautions

2.1. Product Opening Precautions

Please check the following items before opening the product.

- In order to use this product, the "Software License Agreement" (included in the "Please Read First" documentation included with this product) must be agreed to. Please open the product only after having checked and agreed to the "Software License Agreement".

2.2. Evaluation Board Precautions

Products sold as a "development set" or an "evaluation set" (hereafter, referred to as an "evaluation board") are for evaluation use during technical development or demonstration. Please use the product with an understanding of the following points.

- Evaluation boards are assumed to be handled in accordance with good technical and practical standards by engineers with knowledge and practical experience of electronics.
- Evaluation boards are unfinished products in terms of the design, sale and production protective measures normally required of final products used by general consumers.
- Only a one year replacement warranty from time of purchase is provided for evaluation boards as laid out in our product warranty policy.
- Aside from the above replacement warranty, no explicit or implied guarantee, including the guarantee that the evaluation board is fit for a particular purpose, and any other form of guarantee, is offered by us to the purchaser.
- Even if a malfunction occurs in the evaluation board or in the parts it consists of, we will not analyze the cause of the malfunction.

2.3. Safety Precautions

In order to use this product safely, please take special note of the following precautions.

- Be sure to read all product manuals and related documentation before using this product. Please use this product correctly and safely making sure to follow all usage precautions.

- When operating or extending this product in a way not described in the product manuals, please do so safely and on your own responsibility after having fully understood the materials on our web site and any other technical information.
- Please do not install this product in a place with a lot of water, moisture, dust or soot. This could cause a fire, product failure or electric shock.
- Some parts of this product generate heat and can reach high temperatures. Depending on the surrounding temperature and on how this product is handled, this may cause burns. Please do not touch the electronic components or the surrounding area while the product is powered on or before it has cooled down after being powered off.
- When using this product in the development of devices or systems to original specifications, please carry out the design and development after having thoroughly read and fully understood the product manuals and related materials, the technical information offered on our web site and related device data sheets. Also, please carry out full tests beforehand in order to provide and maintain reliability and safety.
- This product is not intended for uses that require extremely high reliability and safety in terms of functionality and accuracy (such as medical equipment, traffic control systems, combustion control systems, safety equipment and so on). If this product is used in these kinds of equipment, devices or systems, this company will not be held responsible in any way for any accident resulting in injury or death, fire or damage and so on.
- This product uses semiconductor components designed for generic electronics equipment such as office automation equipment, communications equipment, measurement equipment and machine tools. It is possible that a foreign noise or surge may cause this product to malfunction or fail. To ensure there will be no risk to life, the body or property in the event of malfunction or failure, be sure to take all possible measures in regard to device safety design, such as using protection circuits like limit switches or fuse breakers, or system redundancy, and to only use the device after taking measures to ensure sufficient reliability and safety.
- Please do not use products with Wireless LAN functionality in places near medical devices such as heart pacemakers and hearing aids, automatic control equipment such as fire alarms and automatic doors, microwave ovens, advanced electronic equipment or televisions and radios, or near "Premises Radio Stations" for "Mobile Body Identification" or "Specified Low Power Radio Stations". The radio waves emitted by this product may cause these types of devices to malfunction.

2.4. Usage Precautions for Products with Wireless LAN Functionality

This product uses 2.4GHz band radio waves. As it uses radio waves when operating, it may cause electromagnetic interference and radio frequency interference.

- Please do not use this product in places near medical devices such as heart pacemakers and hearing aids, automatic control equipment such as fire alarms and automatic doors, microwave ovens, advanced electronic equipment or televisions and radios.
- Please do not use this product near "Premises Radio Stations" for "Mobile Body Identification" or "Specified Low Power Radio Stations".
- If radio frequency interference between this product and similar wireless stations or other devices does occur, please promptly change the place of use or stop operating the product (stop using the radio waves).

2.5. Warranty

As laid out in the "Product Warranty Policy" which is provided with this product or available on our web site, the main board of this product is covered by a one year replacement warranty from time of purchase. Please note that the other included goods and software are not covered by the warranty.

Product Warranty Policy http://www.atmark-techno.com/support/warranty-policy

2.6. Exporting

This product has as a general rule been developed and manufactured with the assumption that it will be used within Japan. When exporting this product, it is the responsibility of the exporter to follow all export related law and carry out all required procedures. No guarantee is made in regards to whether or not this product conforms to any overseas laws or regulations. This product and related technology may not be used for the purpose of development of weapons of mass destruction, for the purpose of military use or other military related uses, or in devices which have had their production, use, sale or procurement prohibited by national or overseas law or regulations.

2.7. Trademarks

- Armadillo is a registered trademark of Atmark Techno, Inc. All other company names, product names and related trademarks are the property of their respective owners. TM and (c) marks are omitted.
- The SD, SDHC, microSD, microSDHC and SDIO logos are trademarks of SD-3C, LLC.

Chapter 3. Overview

3.1. Board Overview

Armadillo-800 EVA is an evaluation board that includes the Renesas Electronics "R-Mobile A1" processor (ARM Cortex-A9, 800MHz max CPU clock), 512MB of DRAM (DDR3-800) and 8GB of flash memory (eMMC). It has numerous multimedia functions including a 5 inch LCD (WVGA) capacitive touchscreen panel, digital HD output support and a 3.1M pixel CMOS camera module. It also has the IEEE802.11b/g/n compliant "Armadillo-WLAN (AWL13)" wireless LAN module for industrial embedded devices included as standard. With a whole assortment of modules that can be difficult to obtain included, it is possible to evaluate a large number of functions.

The main specifications of Armadillo-800 EVA are as shown below.

Table 3.1. Armadillo-800 EVA Specifications

Processor	Renesas Electronics R-Mobile A1 (R8A77404DBA)	
CPU Core	ARM Cortex-A9 single core Instruction / data cache: 32kByte / 32kByte L2 cache: 256kByte Media processing engine (NEON) included Floating-point coprocessor (VFPv3) included	
System Clocks	CPU core clock: 792MHz (800MHz max[a]) DDR clock: 396MHz (400MHz max[a]) Internal bus clock: 198MHz (200MHz max[a]) Expansion bus clock: 99MHz (100MHz max[a]) Oscillation source clock: 24MHz	
RAM	DDR3 SDRAM: 512MByte (32bit width) (DDR3-800)	
Flash Memory	eMMC NAND flash memory: 8GByte	
LAN (Ethernet)	10BASE-T/100BASE-TX with AUTO-MDIX support	
Wireless LAN	SDHI1[b]	Armadillo-WLAN module (AWL13) IEEE 802.11b/g/n support (72.2Mbps max[c])
Serial (UART)	7 channels max	
	SCIFA0[d]	+3.3V CMOS levels with flow control pins (CTS, RTS) Expansion I/O Connector
	SCIFA1	RS-232C levels with no flow control pins D-Sub 9-pin connector
	SCIFA2[e]	+3.3V CMOS levels with flow control pins (CTS, RTS) and synchronous clock pin (SCK) Expansion I/O Connector
	SCIFA4[f]	+3.3V CMOS levels with no flow control pins Expansion I/O Connector
	SCIFA6[d]	+3.3V CMOS levels with no flow control pins but with synchronous clock pin (SCK) Expansion I/O Connector
	SCIFA7[g]	+3.3V CMOS levels with no flow control pins LCD Expansion I/F Connector
	SCIFB[h]	+3.3V CMOS levels with no flow control pins but with synchronous clock pin (SCK) Expansion I/O Connector or LCD Expansion I/F Connector
USB	2 channels	
	USB0[i]	USB HOST (High Speed support) Type A connector USB DEVICE (High Speed support) Type B connector
	USB1	USB HOST (High Speed support) Type A connector

SD/MMC	2 channels max[j]	
	SDHI0	SD slot
	SDHI1[k]	SD slot
Video	LCDC0[l]	RGB/YCrCb interface 1440x900 max / 24bit color LCD panel[m] - AMPIRE AM-800480L1TMQW-T00H - 5 inch WVGA (800x480 dots / 24bit color) - LED backlight - Capacitive multitouch panel LCD Expansion I/F connector[m]
	LCDC1	Digital HD output[n] HDMI Type-A connector[o] Composite video output[n] RCA pin jack
	VOU[l]	Digital video output, LCD Expansion I/F connector
Terrestrial Digital Tuner I/F	SSP[d]	8bit parallel bus or 1bit serial bus Expansion I/O Connector
Smart Card I/F	SIM	Expansion I/O Connector
Camera	2 channels max[p]	
	CEU0	16bit data bus max[q] Camera module - CRESYN DCB-NSB55QFMRB - 3.1M pixel QXGA: 15fps max, VGA: 30fps max 8bit data bus Expansion I/O Connector
	CEU1	8bit data bus Expansion I/O Connector
Audio	FSIA	Stereo headphone out mini-jack Stereo line out RCA pin jack Mono mic in mini-jack
	FSIB	Digital output HDMI Type-A connector[o]
I2C	3 channels	
	I2C0	Used for internal board devices LCD Expansion I/F Connector
	I2C1	For external expansion only Expansion I/O Connector
	I2C2 (GPIO)	For RTC only
SPI I2S Microwire	2 channels max	
	MSIOF1[r]	Expansion Bus connector
	MSIOF2[s]	LCD Expansion I/F Connector
GPIO	13bit (188bit max[t])	
Expansion Bus	Address bus: 25bit Data bus: 16bit max[u] Chip select: 4bit max[u]	
Calendar Clock	Real-time clock	
RTC Backup Power	Coin battery support[v]	
Switch	Tact switch x 4	
LED	LED (yellow, surface mounted) x 4	
JTAG	ARM standard 20 pin connector[w] H-UDI 14 pin connector (connector not mounted)[x]	
Power Supply Voltage	5V+-5%	
Operating Temperature	10 - 40 celcius (with no condensation)	
Board Size	183 x 135mm (excluding protrusions)	

[a]R-Mobile A1 max clock frequency

[b]Cannot be used when the SD slot is also used

[c]Theoretical value of standard

[d]Cannot be used when some specific CEU1 signals are also used

[e]Cannot be used when some specific SSP and SIM signals are also used

[f]Cannot be used when some specific SSP signals are also used

[g]Cannot be used when some specific LCDC0 signals are also used

[h]Cannot be used when some specific SSP and LCDC0 signals are also used

[i]USB HOST and USB DEVICE cannot be used at the same time

[j]The number of channels when SDHI1 is selected for the SD slot

[k]Cannot be used when wireless LAN is also used

[l]LCDC0 and VOU cannot be used at the same time

[m]The LCD panel and LCD Expansion I/F connector cannot be used at the same time

[n]Digital HD output and composite video cannot be used at the same time

[o]The video and audio HDMI Type-A connectors are the same single connector

[p]The number of channels when CEU0 is used with 8bit data bus

[q]The maximum number of bits when CEU1 is not used

[r]Cannot be used when some specific expansion bus signals are also used

[s]Cannot be used when some specific LCDC0 signals are also used

[t]Total number of pins usable as GPIO with the pin multiplexing function on the R-Mobile A1

[u]Maximum number of bits when eMMC is not used

[v]Battery not included

[w]The ARM connector and H-UDI connector cannot be used at the same time as they share the same signal lines

[x]Connector not mounted

3.2. Block Diagram

The block diagram of Armadillo-800 EVA is as shown below.

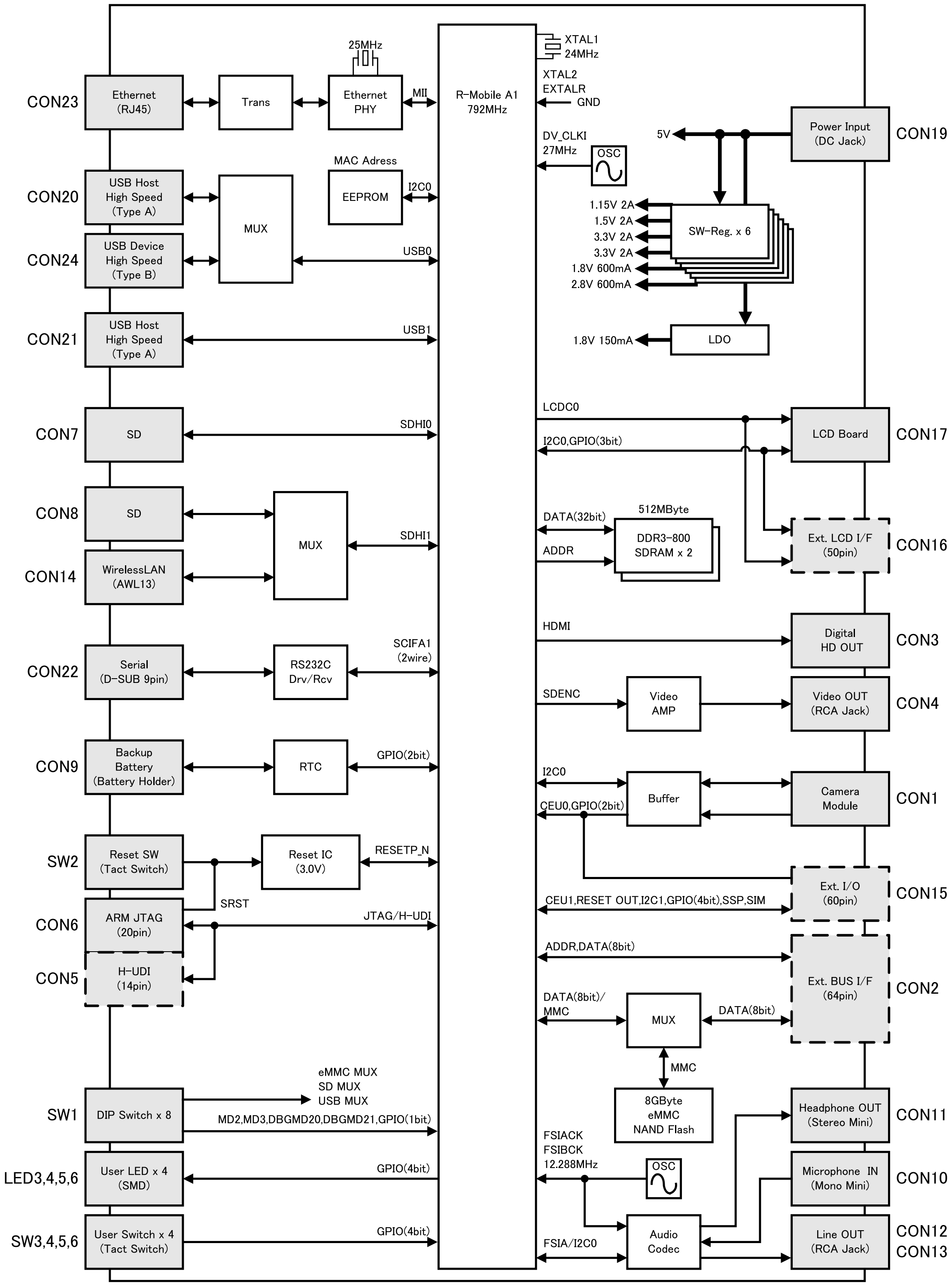


Figure 3.1. Armadillo-800 EVA Block Diagram

Chapter 4. Interface Layout

The following describes the interface layout of Armadillo-800 EVA. Please check the location of each interface.

4.1. Armadillo-800 EVA Interface Layout

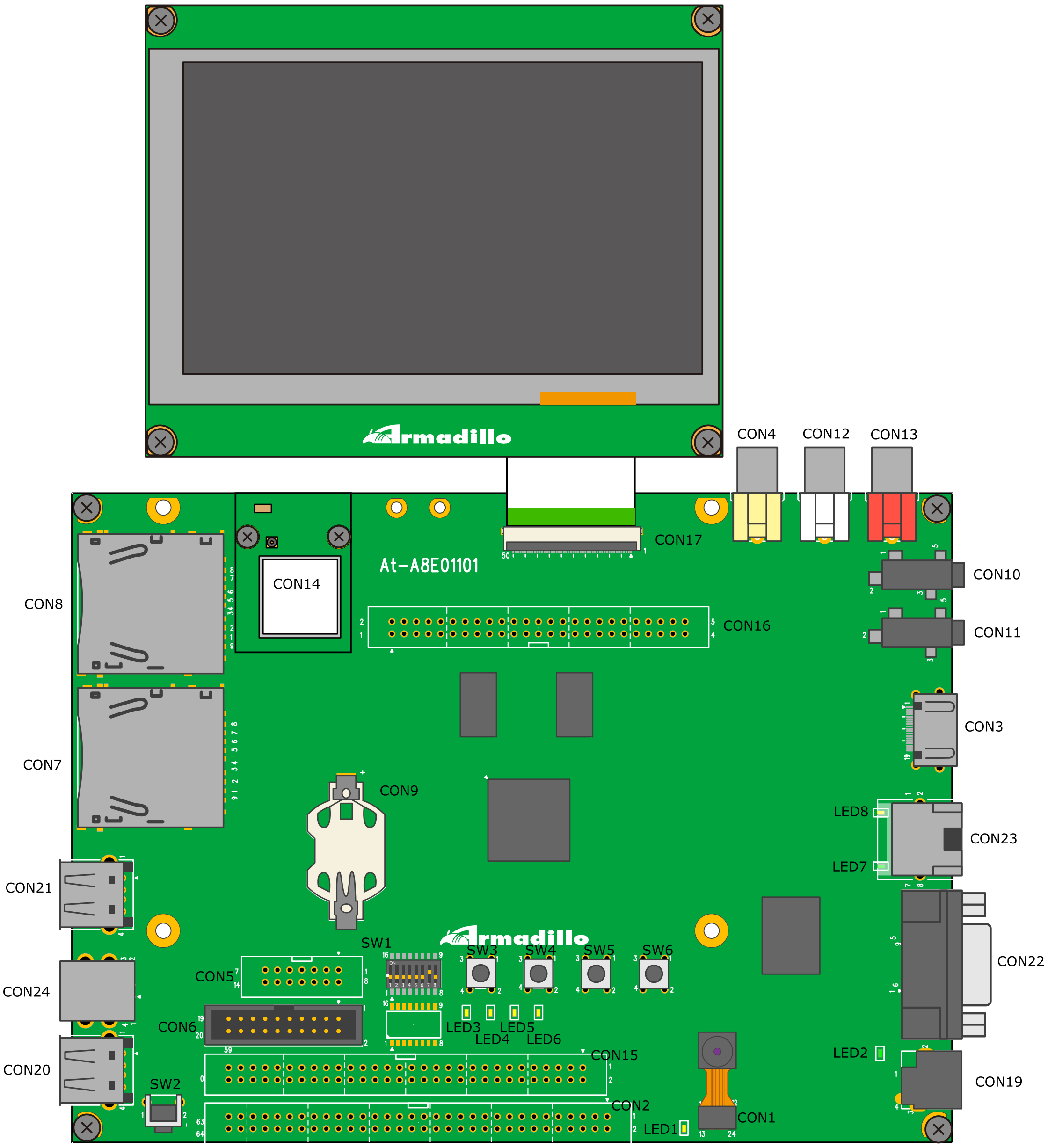


Figure 4.1. Armadillo-800 EVA Interface Layout Diagram

Table 4.1. Armadillo-800 EVA Interfaces

Part Number	Interface	Form	Notes
CON1	Camera module	FPC connector (24P) (0.4mm pitch)	Insertion life: 50 times
CON2	Expansion Bus	Pin headers (64P) (2.54mm pitch)	Connector not mounted
CON3	Digital HD output	HDMI Type A connector	
CON4	Composite video output	RCA jack yellow	
CON5	H-UDI JTAG	Pin headers (14P) (2.54mm pitch)	Connector not mounted
CON6	ARM JTAG	Pin headers (20P) (2.54mm pitch)	
CON7	SD1	SD slot	
CON8	SD2	SD slot	
CON9	RTC external backup	Battery box	Compatible battery: CR2032
CON10	Mono mic input	Mini-jack (dia. 3.5mm)	
CON11	Stereo headphone output	Mini-jack (dia. 3.5mm)	
CON12	Stereo line output (L)	RCA jack white	
CON13	Stereo line output (R)	RCA jack red	
CON14	AWL13 module	Narrow-pitch connector (34P) (0.5mm pitch)	Insertion life: 50 times
CON15	Expansion	Pin headers (60P) (2.54mm pitch)	Connector not mounted
CON16	LCD1	Pin headers (50P) (2.54 pitch)	Connector not mounted
CON17	LCD2	FFC Connector (50P) (0.5mm pitch)	Insertion life: 20 times
CON19	Power input	DC jack	Compatible plug: EIAJ #2
CON20	USB1	USB Type A connector	
CON21	USB2	USB Type A connector	
CON22	Serial	D-Sub 9-pin (male)	
CON23	LAN	RJ-45 connector	
CON24	USB3	USB Type B connector	
LED1	Camera LED (yellow)	LED (surface mounted)	
LED2	Power LED (green)	LED (surface mounted)	
LED3 - LED6	User LED (yellow)	LED (surface mounted)	
LED7	LAN link LED (green)	LED (surface mounted)	
LED8	LAN activity LED (yellow)	LED (surface mounted)	
SW1	Function selection switch	DIP switch (8 switches)	
SW2	Reset switch	Tact switch (l=3.85mm) Right angle	
SW3 - SW6	User Switch	Tact switch (h=5mm) Straight	

4.2. DIP Switch

The DIP switch (SW1) must be configured before the Armadillo-800 EVA is powered on. The factory default configuration of the DIP switch is shown in Table 4.2, “DIP Switch Configuration (Factory Default)”.

Table 4.2. DIP Switch Configuration (Factory Default)

SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6	SW1.7	SW1.8
OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF

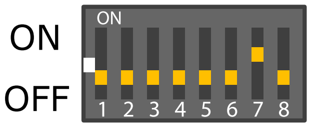


Figure 4.2. DIP Switch (SW1) Configuration (Factory Default)

The function of each switch is as shown below.

Table 4.3. DIP Switch (SW1) Switch Functions

Function	Switch		Operation
Boot mode configuration	SW1.1		
	OFF		OS auto-boot mode
	ON		Maintenance mode
Boot device configuration	SW1.2	SW1.3	
	OFF	OFF	eMMC
	ON	OFF	SDHI0 (CON7)
	OFF	ON	(Unconfigured)
	ON	ON	Expansion Bus (CS0)
Expansion Bus Configuration	SW1.4		
	OFF		Data bus upper 8bits (D8 - D15) disabled / eMMC enabled
	ON		Data bus upper 8bits (D8 - D15) enabled / eMMC disabled
SDHI1 Configuration	SW1.5		
	OFF		SD Interface 2 (CON8) disabled / AWL13 module interface (CON14) enabled
	ON		SD Interface 2 (CON8) enabled / AWL13 module interface (CON14) disabled
USB0 Configuration	SW1.6		
	OFF		USB Interface 1 (CON20) enabled / USB Interface 3 (CON24) disabled
	ON		USB Interface 1 (CON20) disabled / USB Interface 3 (CON24) enabled
JTAG Configuration	SW1.7	SW1.8	
	OFF	OFF	SH-X2
	ON	OFF	ARM
	OFF	ON	(Unconfigured)
	ON	ON	Boundary scan

Chapter 5. Before Power-on

5.1. Preparation

The following equipment is required in order to carry out evaluation of the Armadillo-800 EVA.

Work PC

A PC that runs either Debian GNU/Linux or Windows and has at least one serial port.

Serial Cross Cable

A D-Sub 9 pin (female-to-female) cross connection cable to connect the Armadillo-800 EVA and the work PC.

Serial Communication Software

This is a serial communication program such as "minicom" on Linux or "Tera Term Pro" on Windows and is used to control the Armadillo. Please install the serial communication program on the work PC.

The following equipment is also required in some cases. Please prepare it when necessary.

SD Card

Please prepare a card with a capacity of at least 1GByte. This is used, for example, to return the Armadillo-800 EVA to its factory default state.

USB Memory

This is used for data transfer between the Armadillo-800 EVA and the work PC.

LAN Cable

This is required when communicating with the Armadillo-800 EVA via LAN.

HDMI Cable

This is required when displaying video from CON3.

RCA Cables

These are required when using CON12, CON13 or CON4 for audio or video output.

Speaker or Headphones

These are required when using CON11 for audio output. When using speakers, a separate stereo mini-plug cable may be required.

Microphone

This is required for audio input to CON10.

Display

A display with a HDMI terminal or RCA input terminals. This is required for video or audio output.

5.2. Connections

The following is an example of connections to the Armadillo-800 EVA.

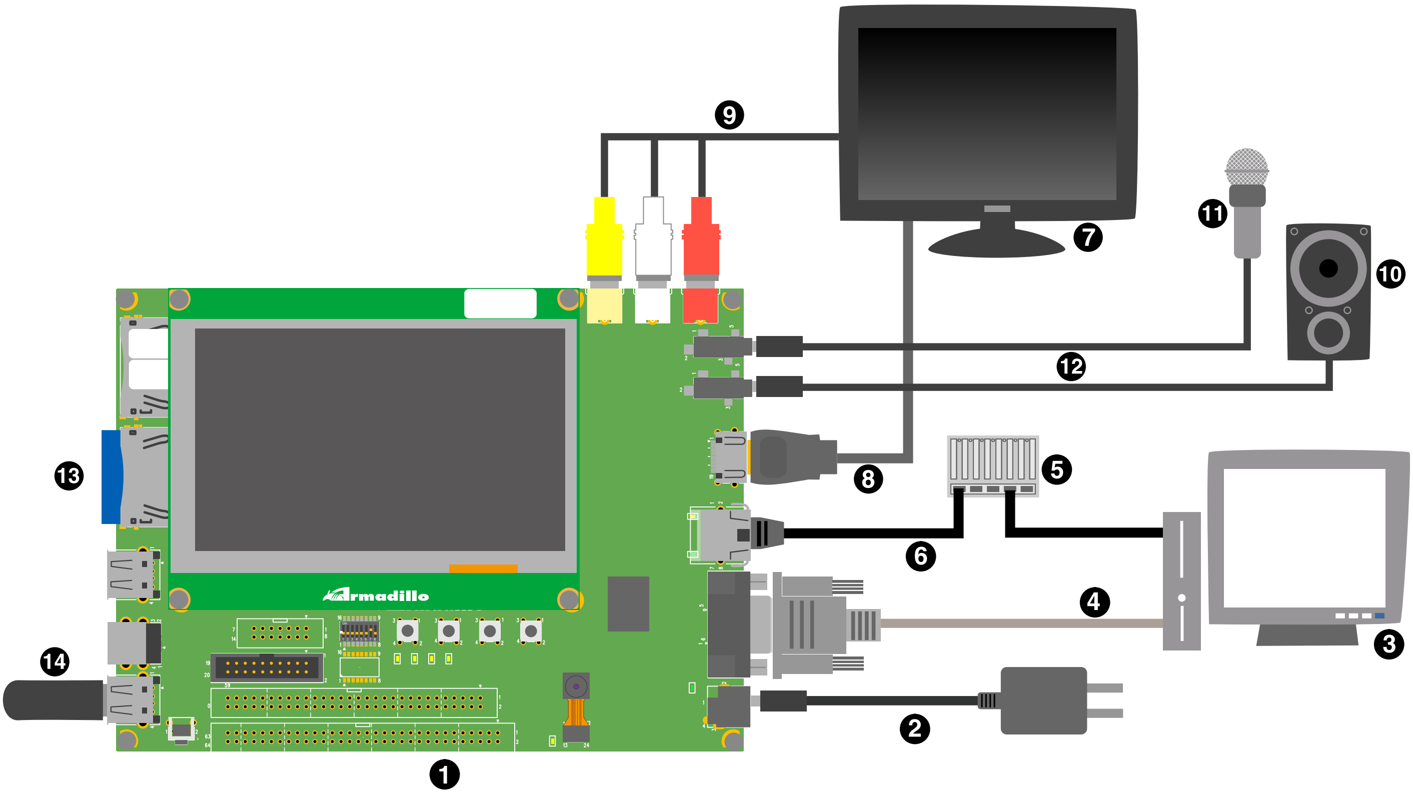


Figure 5.1. Armadillo-800 EVA Connections Example

❶ Armadillo-800 EVA

❷ AC adapter (included)

❸ Work PC

❹ Serial cross cable (included)

❺ LAN hub

❻ LAN cable

❼ Display

❽ HDMI cable

❾ RCA cable

❿ Speakers

⓫ Microphone

⓬ Stereo mini-plug cable

⓭ SD Card

⓮ USB Memory

> When connecting the AC adapter, please ensure that any display connected with a HDMI cable is powered off. If the AC adapter is connected while the display is

powered on, the LCD included with the Armadillo-800 EVA may not display normally.

For details on this phenomenon, please refer to "A800-EVA-ERRATUM #1" in "Armadillo-800 EVA Revision Information v1.1.0".

A protective film is attached to the included LCD module and camera module when shipped. Please remove the film before using them.

5.3. DIP Switch Configuration

Please set SW1 as shown in Table 5.1, “DIP Switch Configuration”. Please refer to Table 4.3, “DIP Switch (SW1) Switch Functions” for details on the SW1 functions.

Table 5.1. DIP Switch Configuration

1	2	3	4	5	6	7	8
OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF

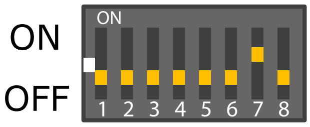


Figure 5.2. DIP Switch Configuration

5.4. Serial Communication Software Configuration

Please start the serial communication software and set the serial communication configuration to that shown in Table 5.2, “Serial Communication Configuration”.

Table 5.2. Serial Communication Configuration

Item	Configuration
Transmission Rate	115,200bps
Data Length	8bit
Stop Bit	1bit
Parity	None
Flow Control	None

Please keep the width of the serial communication software to more than 80 characters. The display may become disordered when entering commands if the width is less than 80 characters.

5.5. Installed Software

The operating systems installed in the internal storage in the factory default state are as follows.

Table 5.3. Installed Operating Systems

OS	Version
Debian GNU/Linux	6.0
Android	2.3.7

Armadillo-800 EVA in its default factory state is configured so that Android boots when it is powered on. The operating system booted at power-on is determined by the bootloader configuration (operating system boot configuration). Please refer to the following to change which operating system is booted.

- Chapter 6, Booting Android
- Chapter 7, Booting Debian GNU/Linux

Chapter 6. Booting Android

6.1. Preparation

The following explains the changes made to the operating system boot configuration in order to boot Android.

The operating system booted can be changed by starting the bootloader in maintenance mode and altering the operating system boot configuration. The bootloader will start in maintenance mode when the DIP switch boot mode configuration switch (SW1.1) is first set to ON and the Armadillo-800 EVA then powered on.

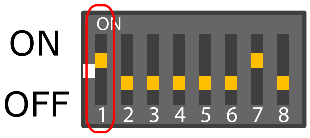


Figure 6.1. DIP Switch Boot Mode Configuration

The bootloader command prompt is displayed when the bootloader is started in maintenance mode.

```
Hermit-At v3.0.0 (Armadillo-800 EVA) compiled at 22:22:10, Dec 21 2011
hermit>
```

To boot Android, change the operating system boot configuration as shown in Figure 6.2, “Operating System Boot Configuration Change Procedure (Android)”.

```
hermit>setbootdevice mmcblk0p4  ❶
hermit>setenv console=ttySC1,115200 noinitrd rootwait root=/dev/mmcblk0p4 init=/
init ❷
```

❶ Set the boot device in which the Linux kernel for Android is stored

❷ Set the Linux kernel parameters

Figure 6.2. Operating System Boot Configuration Change Procedure (Android)

The changes to the operating system boot configuration are now complete. Android can now be booted with the boot command.

```
hermit>boot
```

Android will boot automatically after powering off the Armadillo-800 EVA, setting the DIP switch boot mode configuration switch (SW1.1) to OFF and powering the Armadillo-800 EVA back on.

6.2. Booting

The boot log shown below will be displayed in the serial communication software when Android boots.

```
mmcsd: SD card at address 0x00000001
mmcsd: M8G2FA 1048576KiB
gendisk: /dev/mmcblk0p4: start=0x000f4280, size=0x001dcdc0
gendisk: Image.bin is found. (4390496 Bytes)
Copying        kernel...done.
Doing console=ttySC1,115200
Doing noinitrd
Doing rootwait
Doing root=/dev/mmcblk0p4
Doing init=/init
Linux version 2.6.35.7 (atmark@atde4) (gcc version 4.4.5 (Debian 4.4.5-8) ) #1 P
REEMPT Wed Dec 21 22:37:47 JST 2011
CPU: ARMv7 Processor [412fc093] revision 3 (ARMv7), cr=10c53c7f
CPU: VIPT nonaliasing data cache, VIPT nonaliasing instruction cache
Machine: Armadillo-800EVA
    :
    :
    :
VFS: Mounted root (ext3 filesystem) on device 179:4.
Freeing init memory: 124K
init: cannot open '/initlogo.rle'
init: cannot find '/system/etc/install-recovery.sh', disabling 'flash_recovery'
sh: can't access tty; job control turned off
$ net eth0: attached phy 0 to driver Generic PHY
WM8978 0-001a: Imprecise sampling rate: 48000Hz, consider using PLL
PHY: 0:00 - Link is Up - 100/Full
warning: `zygote' uses 32-bit capabilities (legacy support in use)
request_suspend_state: wakeup (3->0) at 11694431586 (2000-01-01 00:12:25.6519288
34 UTC)
```

Figure 6.3. Boot Log (Android)

6.3. Shutdown

Follow the steps shown in Procedure 6.1, “Android Shutdown Procedure” to perform a safe shutdown.

This procedure is not supported by linux-2.6.35-a800eva-at1. To shutdown please just cut the power supply. If power is cut while data is being written to a removable disk, the file system or the data may be damaged.

Procedure 6.1. Android Shutdown Procedure

1. Press SW3 (power button) for an extended time.

2. Press "Power off" (red frame in diagram) in the "Phone options" screen.

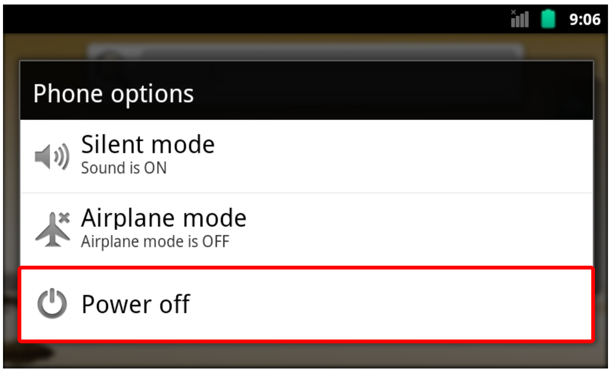
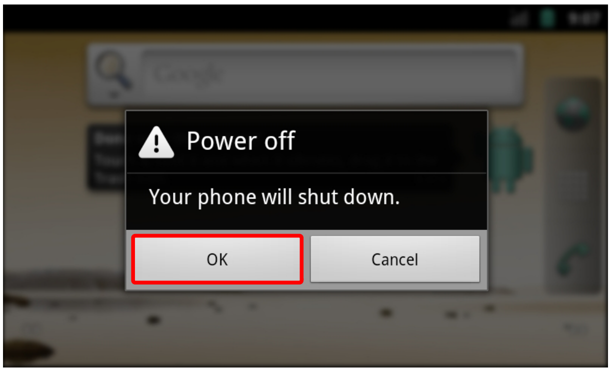


Figure 6.4. Phone Options Screen: Power off

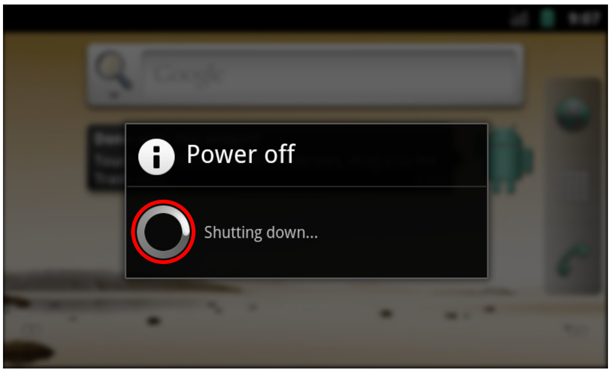
3. Press the "OK" button (red frame in diagram) in the "Power off" dialog screen.



Your phone will shut down.

Figure 6.5. Power Off Screen: OK Button

4. Wait for the "Shutting down" spinner (red frame in diagram) to stop in the "Power Off Progress" screen.



Shutting down...

Figure 6.6. Power Off Progress Screen: Shutting Down Spinner

5. Turn the power off.

6.4. Basic Operations

The following explains the basic operation of Android.

Most operations on Android are performed with the touchscreen and user switches. For the names and main functions of the user switches, please refer to Table 6.1, “User Switch Names and Functions”.

Table 6.1. User Switch Names and Functions

User Switch	Name	Main Function
SW3	Power Button	Move to lock screen / shut down safely
SW4	Back Button	Return to the previous screen
SW5	Menu Button	Open the menu
SW6	Home Button	Move to the home screen

SW3 was assigned as the select button in linux-2.6.35-a800eva-at1. This was changed to the power button from linux-2.6.35-a800eva-at2. The select button is used to activate the currently focused key.

6.4.1. Lock Screen

When the "Power Button" is pressed immediately after booting Android or while in any screen apart from the lock screen, Figure 6.7, “Lock Screen” will be displayed.

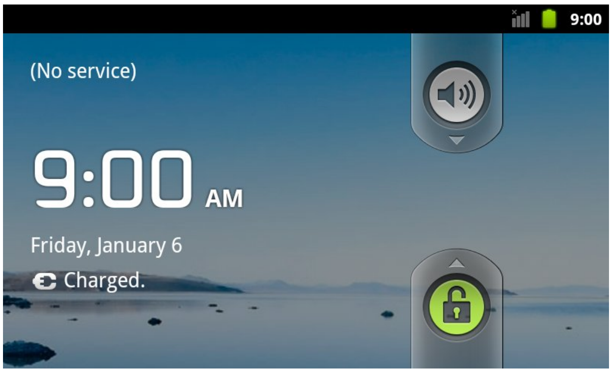


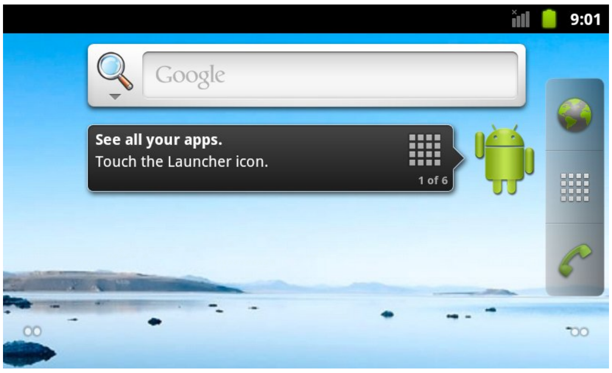
Figure 6.7. Lock Screen

The lock can be released by pressing the "Menu Button" twice. When this is done immediately after booting Android, the home screen shown in Section 6.4.2, “Home Screen” will be displayed.

The lock screen will be displayed if no operation is made for a fixed period of time while any other screen is being displayed.

6.4.2. Home Screen

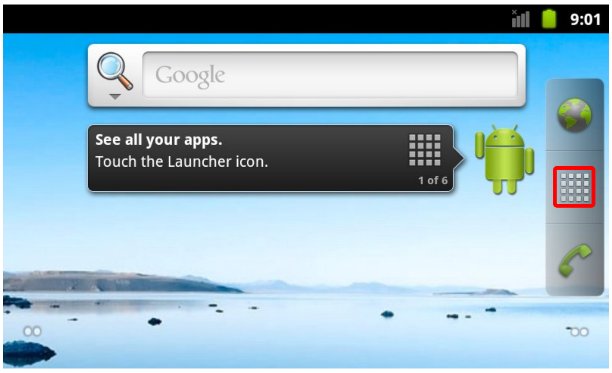
When the "Home Button" is pressed in any screen apart from the lock screen, Figure 6.8, “Home Screen” will be displayed.



See all your apps.
Touch the Launcher icon.

Figure 6.8. Home Screen

When the "Application List Button" (red framed icon) in Figure 6.9, “Home Screen: Application List Button” is pressed, the screen shown in Figure 6.10, “Application List Screen” will be displayed.



See all your apps.
Touch the Launcher icon.

Figure 6.9. Home Screen: Application List Button

6.4.3. Application List

When the "Application List Button" is pressed in the home screen, Figure 6.10, “Application List Screen” will be displayed. A list of all installed applications are displayed in this screen.

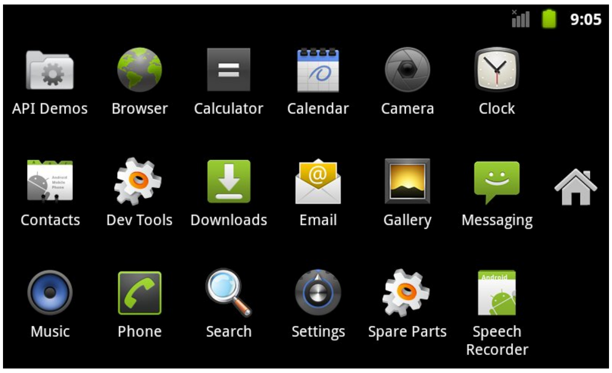


Figure 6.10. Application List Screen

Each application can be started by pressing its icon. Screen drawing and music playing demos can be accessed by pressing the "API Demos" icon.

⚠ The following devices are not supported on the factory default Android.

- Camera
- Wireless LAN
- SD Card

The Android source code[1] can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com).

[1] Software with usage restrictions is not included.

Chapter 7. Booting Debian GNU/Linux

7.1. Preparation

The following explains the changes made to the operating system boot configuration in order to boot Debian GNU/Linux (hereafter to referred to as Debian).

The operating system booted can be changed by starting the bootloader in maintenance mode and altering the operating system boot configuration. The bootloader will start in maintenance mode when the DIP switch boot mode configuration switch (SW1.1) is first set to ON and the Armadillo-800 EVA then powered on.

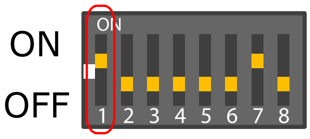


Figure 7.1. DIP Switch Boot Mode Configuration

The bootloader command prompt is displayed when the bootloader is started in maintenance mode.

```
Hermit-At v3.0.0 (Armadillo-800 EVA) compiled at 22:22:10, Dec 21 2011
hermit>
```

To boot Debian, change the operating system boot configuration as shown in Figure 7.2, “Boot Configuration Change Procedure (Debian)”.

```
hermit>setbootdevice mmcblk0p2  ❶
hermit>setenv console=ttySC1,115200 noinitrd rootwait root=/dev/mmcblk0p2 ❷
```

❶ Set the boot device in which the Linux kernel for Debian is stored

❷ Set the Linux kernel parameters

Figure 7.2. Boot Configuration Change Procedure (Debian)

The changes to the boot configuration are now complete. Debian can now be booted with the boot command.

```
hermit>boot
```

Debian will boot automatically after powering off the Armadillo-800 EVA, setting the DIP switch boot mode configuration switch (SW1.1) to OFF and powering the Armadillo-800 EVA back on.

7.2. Booting

The boot log shown below will be displayed in the serial communication software when Debian boots.

```
mmcsd: SD card at address 0x00000001
mmcsd: M8G2FA 1048576KiB
gendisk: /dev/mmcblk0p2: start=0x004ade00, size=0x009ba200
gendisk: Image.bin is found. (4390496 Bytes)
Copying        kernel...done.
Doing console=ttySC1,115200
Doing noinitrd
Doing rootwait
Doing root=/dev/mmcblk0p2
Linux version 2.6.35.7 (atmark@atde4) (gcc version 4.4.5 (Debian 4.4.5-8) ) #1 P
REEMPT Wed Dec 21 22:37:47 JST 2011
CPU: ARMv7 Processor [412fc093] revision 3 (ARMv7), cr=10c53c7f
CPU: VIPT nonaliasing data cache, VIPT nonaliasing instruction cache
Machine: Armadillo-800EVA
    :
    :
    :
VFS: Mounted root (ext3 filesystem) on device 179:2.
Freeing init memory: 124K
INIT: version 2.88 booting
Using makefile-style concurrent boot in runlevel S.
Starting the hotplug events dispatcher: udevd.
Synthesizing the initial hotplug events...done.
Waiting for /dev to be fully populated...done.
Activating swap...done.
Checking root file system...fsck from util-linux-ng 2.17.2
/dev/mmcblk0p2: Backing up journal inode block information.

/dev/mmcblk0p2: clean, 11589/637728 files, 88453/1274944 blocks
done.
EXT3-fs (mmcblk0p2): using internal journal
Cleaning up ifupdown....
Setting up networking....
Loading kernel modules...done.
Activating lvm and md swap...done.
Checking file systems...fsck from util-linux-ng 2.17.2
done.
Mounting local filesystems...done.
Activating swapfile swap...done.
Cleaning up temporary files....
Configuring network interfaces...done.
Cleaning up temporary files....
Setting kernel variables ...done.
INIT: Entering runlevel: 2
Using makefile-style concurrent boot in runlevel 2.
Starting enhanced syslogd: rsyslogd.
Starting periodic command scheduler: cron.

Debian GNU/Linux 6.0 debian ttySC1
```

```
debian login:
```

Figure 7.3. Boot Log (Linux)

7.3. Login

The login prompt will be displayed once the boot has completed. The users shown in Table 7.1, “Serial Console Login Username and Password” can be used to login.

Table 7.1. Serial Console Login Username and Password

Username	Password	Permissions
root	root	root user

7.4. Shutdown

To perform a safe shutdown, execute the halt command as shown below, wait until the "System halted." message is displayed and then disconnect the power supply.

```
[armadillo ~]# halt

Broadcast message from root@debian (ttySC1) (Sat Jan  1 04:25:31 2000):

The system is going down for system halt NOW!
INIT: Switching to runlevel: 0
INIT: Sending processes the TERM signal
Using makefile-style concurrent boot in runlevel 0.
Asking all remaining processes to terminate...done.
All processes ended within 1 seconds....done.
Stopping enhanced syslogd: rsyslogd.
Deconfiguring network interfaces...done.
Cleaning up ifupdown....
Saving the system clock.
Deactivating swap...done.
Will now halt.
System halted.
```

Figure 7.4. Shutdown

Chapter 8. Function Use with Debian GNU/Linux

This chapter covers how to use each Armadillo-800 EVA function on Debian. In order to execute the steps described in this chapter, booting and login must first be completed referring to Chapter 7, Booting Debian GNU/Linux.

8.1. Wired LAN

The following describes how to use wired LAN.

Wired LAN is disabled on Debian in the factory default state. The steps to enable wired LAN with the **ifup** command are shown in Figure 8.1, “Enabling Wired LAN with the ifup Command”.

```
[armadillo ~]#ifup eth0 ❶
Internet Systems Consortium DHCP Client 4.1.1-P1
Copyright 2004-2010 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/

net eth0: attached phy 0 to driver Generic PHY
Listening on LPF/eth0/00:11:0c:00:04:d7
Sending on   LPF/eth0/00:11:0c:00:04:d7
Sending on   Socket/fallback
DHCPDISCOVER on eth0 to 255.255.255.255 port 67 interval 3
PHY: 0:00 - Link is Up - 100/Full
DHCPDISCOVER on eth0 to 255.255.255.255 port 67 interval 7
DHCPOFFER from 172.16.0.1
DHCPREQUEST on eth0 to 255.255.255.255 port 67
DHCPACK from 172.16.0.1
bound to 172.16.2.237 -- renewal in 33138 seconds.
[armadillo ~]#ifconfig eth0 ❷
eth0      Link encap:Ethernet  HWaddr 00:11:0c:00:04:d7
          inet addr:172.16.2.237  Bcast:172.16.255.255  Mask:255.255.0.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:876 errors:0 dropped:0 overruns:0 frame:0
          TX packets:109 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:316114 (308.7 KiB)  TX bytes:13236 (12.9 KiB)
          Interrupt:142 DMA chan:ff
```

❶ Enable the wired LAN interface. DHCP is used for network configuration on Debian in the factory default state.

❷ Display the wired LAN interface state.

Figure 8.1. Enabling Wired LAN with the ifup Command

The **ifdown** command is used to deactivate wired LAN previously enabled with the **ifup** command. The steps are shown in Figure 8.2, “Deactivating Wired LAN with the ifdown Command”.

```
[armadillo ~]#ifdown eth0  ❶
Internet Systems Consortium DHCP Client 4.1.1-P1
Copyright 2004-2010 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/

Listening on LPF/eth0/00:11:0c:00:04:d7
Sending on   LPF/eth0/00:11:0c:00:04:d7
Sending on   Socket/fallback
DHCPRELEASE on eth0 to 172.16.0.1 port 67
[armadillo ~]#ifconfig eth0  ❷
eth0      Link encap:Ethernet  HWaddr 00:11:0c:00:04:d7
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:963 errors:0 dropped:0 overruns:0 frame:0
          TX packets:111 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:332666 (324.8 KiB)  TX bytes:13638 (13.3 KiB)
          Interrupt:142 DMA chan:ff
```

❶ Deactivate the wired LAN interface.

❷ Display the wired LAN state.

Figure 8.2. Deactivating Wired LAN with the ifdown Command

The **ifup** and **ifdown** commands perform the actions described in /etc/network/interfaces. It is configured so that an IP address is obtained from a DHCP server in the factory default state. By altering the interfaces file it is possible to set a static IP address or have the interface enabled automatically at boot time. Please see the interfaces man page for details.

```
[armadillo ~]# man 5 interfaces
```

8.2. Wireless LAN

The following describes how to use the Armadillo-WLAN (AWL13) wireless LAN module on Armadillo-800 EVA.

While the following steps are required in order to use wireless communication, it is possible to have steps one and two performed automatically with udev on Debian as installed on Armadillo-800 EVA.

1. Load the kernel module
2. Load the firmware
3. Perform the wireless configuration

8.2.1. Preparation

8.2.1.1. Automatic Kernel Module / Firmware Loading

Execute the **depmod** command so that udev can load the kernel module automatically when it detects the AWL13.

```
[armadillo ~]#ls /lib/modules/$(uname -r)
awl13
[armadillo ~]#depmod
[armadillo ~]#ls /lib/modules/$(uname -r)
awl13              modules.dep      modules.softdep
modules.alias      modules.dep.bin  modules.symbols
modules.alias.bin  modules.devname  modules.symbols.bin
```

The kernel module will be loaded automatically after rebooting. Execute the **reboot** command to perform a reboot.

```
[armadillo ~]#reboot
```

Once the kernel module is loaded, udev will automatically load the firmware. The following will appear in the boot log once the kernel module and firmware have been successfully loaded.

```
awl13: Version 3.0.0 Load.
awl13: MAC is 00:1d:12:cf:29:65
```

After executing the **depmod** command, to have the AWL13 detected by udev without rebooting Armadillo-800 EVA execute the following command.

```
[armadillo ~]# udevadm trigger
```

If the kernel module does not load, please check the configuration of SW1 (DIP switch) referring to Section 5.3, “DIP Switch Configuration”. Only either one of CON14 (AWL13 Module Interface) and CON8 (SD2 Interface) can be used at any one time. To use AWL13, please set the SDHI1 configuration (SW1.5) on the DIP switch to off.

8.2.2. Wireless Configuration

The following covers infrastructure mode and ad-hoc mode wireless configuration. For more detailed information, please refer to the "Armadillo-WLAN (AWL13) Software Manual".

When connected to a network using the wired LAN interface, the AWL13 may not be used for network transmission. In order to ensure that wireless transmission is used, please deactivate the wired LAN interface by referring to Figure 8.2, “Deactivating Wired LAN with the ifdown Command”.

Wireless LAN transmission may become unstable due to the operating environment. In these environments, the problem can sometimes be resolved by attaching an external antenna. For information on external antennas please refer to the "Armadillo-WLAN (AWL13) Hardware Manual".

8.2.2.1. Wireless Configuration Parameters

The following covers the basic configuration parameters used for wireless communication. The **`iwconfig`** / **`iwpriv`** commands included in Wireless Tools[1] are used for configuration.

SSID

The access point identifier.

ID Length	1 - 32 characters (default: "wifi")
Configuration Example	iwconfig awlan0 essid wifi
Confirmation Example	iwconfig awlan0

[1] Installed by default.

Encryption Method

The configuration and confirmation of the encryption method, such as WPA and WPA2.

Value

Configuration Value	Encryption Method
"none"	Encryption disabled
"WEP64"	WEP (key length: 64bits)
"WEP128"	WEP (key length: 128bits)
"WPA-TKIP"	WPA-PSK(TKIP)
"WPA-CCMP"	WPA-PSK (AES)
"WPA-AES"	WPA-PSK (AES)
"WPA2-TKIP"	WPA2-PSK (TKIP)
"WPA2-CCMP"	WPA2-PSK (AES)
"WPA2-AES"	WPA2-PSK (AES)
"WPA-MIX"	WPA-PSK (TKIP, AES)
"WPA2-MIX"	WPA-PSK (AES)
"WPA/2-TKIP"	WPA-PSK(TKIP) WPA2-PSK (TKIP)
"WPA/2-CCMP"	WPA-PSK (AES) WPA2-PSK (AES)
"WPA/2-AES"	WPA-PSK (AES) WPA2-PSK (AES)
"WPA/2-MIX"	WPA-PSK (TKIP, AES) WPA2-PSK (TKIP, AES)

Configuration Example iwpriv awlan0 set_cryptmode WPA2-AES

Confirmation Example iwpriv awlan0 get_cryptmode

Notes WPA / WPA2 are not supported in ad-hoc mode.

As a key is generated when specifying TKIP or AES, the command will take some time to complete due to the computation performed.

The key is recreated and the command takes time to complete even when setting the SSID or pre-shared key. In order to have the key generated only once, it is recommended to set the encryption method after having set the SSID and passphrase.

Pre-Shared Key (PSK)

A WPA/WPA2 PSK or network passphrase.

Key Length	For PSKs	64 character hexadecimal string
	For Passphrases	8 - 63 character string

Configuration Example iwpriv awlan0 set_psk PreSharedKey (for passphrases)

Communication Mode

The communication form classification.

Mode	"Managed"	Infrastructure
	"Ad-Hoc"	Ad-hoc
	"Auto"	Wireless LAN functionality off (default)
Configuration Example	iwconfig awlan0 mode Managed	
Confirmation Example	iwconfig awlan0	
Notes	After loading the firmware, as the communication mode is set to Auto the wireless functionality will be in the off state. Please be sure to set either "Managed" or "Ad-Hoc" before starting wireless communication.	

WEP Key

The secret key used for packet encryption.

Key Length	10 characters for WEP-64bit and 26 hexadecimal characters for WEP-128bit.
Configuration Example	iwconfig awlan0 enc 1234567890
Confirmation Example	iwconfig awlan0
Notes	WEP key index numbers 1 to 3 are not supported. When a WEP key is set, **Encryption Method** is also set appropriately according to the key length.

Channel

The frequency band to use.

Channel	1 - 13 (default: 11)
Configuration Example	iwconfig awlan0 channel 11

8.2.2.2. Infrastructure Mode Configuration Example

The following is an example of configuring AWL13 in infrastructure mode and connecting to an access point. When the encryption method of the access point is WPA-PSK or WPA2-PSK please refer to Section 8.2.2.2.1, “Infrastructure Mode: WPA-PSK / WPA2-PSK”, and when it is WEP please refer to Section 8.2.2.2.2, “Infrastructure Mode: WEP”.

8.2.2.2.1. Infrastructure Mode: WPA-PSK / WPA2-PSK

For this example of connecting to an access point set to WPA-PSK / WPA2-PSK, configuration parameters are shown in Table 8.1, “Infrastructure Mode: WPA-PSK / WPA2-PSK Parameters Example” and the configuration steps are shown in Figure 8.3, “ Infrastructure Mode: WPA2-PSK (AES) Configuration Procedure”.

Table 8.1. Infrastructure Mode: WPA-PSK / WPA2-PSK Parameters Example

Item	Configuration Value
ESSID	myessid
Passphrase	mypassphrase
Encryption Method	WPA2-PSK (AES)
IP Address	192.168.0.1

```
[armadillo ~]#iwconfig awlan0 essid myessid ❶
[armadillo ~]#iwconfig awlan0 mode Managed ❷
[armadillo ~]#iwpriv awlan0 set_psk mypassphrase ❸
[armadillo ~]#iwpriv awlan0 set_cryptmode WPA2-AES ❹
[armadillo ~]#ifconfig awlan0 192.168.0.1 up ❺
```

❶ Set myessid for the SSID.

❷ Set the communication mode to infrastructure mode.

❸ Set mypassphrase for the passphrase.

❹ Set WPA2-PSK (AES) for the encryption method.

❺ Enable the wireless LAN interface. Set the IP address to 192.168.0.1.

Figure 8.3. Infrastructure Mode: WPA2-PSK (AES) Configuration Procedure

The steps for checking the configuration are shown in Figure 8.4, “Infrastructure Mode: WPA2-PSK (AES) Configuration Confirmation Procedure”. If the BSSID (the access point MAC address) is shown for **Access Point:** in the **`iwconfig`** command output, then the connection to the access point has completed.

```
[armadillo ~]#iwconfig awlan0 ❶
awlan0    IEEE 802.11bgn  ESSID:"myessid"
          Mode:Managed  Frequency:2.412 GHz  Access Point: XX:XX:XX:XX:XX:XX
          Bit Rate=65 Mb/s
          Encryption key:off
          Power Management:off
          Link Signal level=-37 dBm
          Rx invalid nwid:0  Rx invalid crypt:0  Rx invalid frag:0
          Tx excessive retries:0  Invalid misc:0   Missed beacon:0
[armadillo ~]#ifconfig awlan0 ❷
awlan0    Link encap:Ethernet  HWaddr 00:1d:12:cf:29:65
          inet addr:192.168.0.1  Bcast:192.168.0.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:47 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:6760 (6.6 KiB)  TX bytes:1196 (1.1 KiB)
```

❶ Show the wireless LAN state.

❷ Show the wireless LAN interface state.

Figure 8.4. Infrastructure Mode: WPA2-PSK (AES) Configuration Confirmation Procedure

8.2.2.2.2. Infrastructure Mode: WEP

For this example of connecting to an access point set to WEP, configuration parameters are shown in Table 8.2, “ Infrastructure Mode: WEP Parameters Example” and the configuration steps are shown in Figure 8.5, “Infrastructure Mode: WEP Configuration Procedure”.

Table 8.2. Infrastructure Mode: WEP Parameters Example

Item	Configuration Value
ESSID	myessid
WEP Key (WEP-64bit)	1234567890
IP Address	192.168.0.1

```
[armadillo ~]#iwconfig awlan0 essid myessid ❶
[armadillo ~]#iwconfig awlan0 mode Managed ❷
[armadillo ~]#iwconfig awlan0 enc 1234567890 ❸
[armadillo ~]#ifconfig awlan0 192.168.0.1 up ❹
```

❶ Set myessid for the SSID.

❷ Set the communication mode to infrastructure mode.

❸ Set the WEP key to 1234567890. The encryption method will be set appropriately from the key length.

❹ Enable the wireless LAN interface. Set the IP address to 192.168.0.1.

Figure 8.5. Infrastructure Mode: WEP Configuration Procedure

The steps for checking the configuration are shown in Figure 8.6, “Infrastructure Mode: WEP Configuration Confirmation Procedure”. If the BSSID (the access point MAC address) is shown for **Access Point:** in the **`iwconfig`** command output, then the connection to the access point has completed.

```
[armadillo ~]#iwconfig awlan0  ❶
awlan0    IEEE 802.11bgn  ESSID:"myessid"
          Mode:Managed  Frequency:2.412 GHz  Access Point: XX:XX:XX:XX:XX:XX
          Bit Rate=65 Mb/s
          Encryption key:1234-5678-90
          Power Management:off
          Link Signal level=-37 dBm
          Rx invalid nwid:0  Rx invalid crypt:0  Rx invalid frag:0
          Tx excessive retries:0  Invalid misc:0   Missed beacon:0
[armadillo ~]#ifconfig awlan0  ❷
awlan0    Link encap:Ethernet  HWaddr 00:1d:12:cf:29:65
          inet addr:192.168.0.1  Bcast:192.168.0.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:47 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:6760 (6.6 KiB)  TX bytes:1196 (1.1 KiB)
```

❶ Show the wireless LAN state.

❷ Show the wireless LAN interface state.

Figure 8.6. Infrastructure Mode: WEP Configuration Confirmation Procedure

8.2.2.3. Ad-Hoc Mode Configuration Example

The following is an example of configuring AWL13 in ad-hoc mode and connecting to an ad-hoc terminal.

WPA / WPA2 are not supported in ad-hoc mode.

8.2.2.3.1. Ad-Hoc Mode: WEP-128bit

For this example of connecting to an ad-hoc terminal set to WEP, configuration parameters are shown in Table 8.3, “Ad-Hoc Mode: WEP Parameters Example” and the configuration steps are shown in Figure 8.7, “Ad-Hoc Mode: WEP Configuration Procedure”.

Table 8.3. Ad-Hoc Mode: WEP Parameters Example

Item	Configuration Value
ESSID	myessid
WEP Key (WEP-128bit)	12345678901234567890123456
Channel	1
IP Address	192.168.0.1

```
[armadillo ~]#iwconfig awlan0 essid myessid ❶
[armadillo ~]#iwconfig awlan0 mode Ad-Hoc ❷
[armadillo ~]#iwconfig awlan0 enc 12345678901234567890123456 ❸
[armadillo ~]#iwconfig awlan0 channel 1 ❹
[armadillo ~]#ifconfig awlan0 192.168.0.1 up ❺
```

❶ Set myessid for the SSID.

❷ Set the communication mode to ad-hoc mode.

❸ Set the WEP key to 12345678901234567890123456. The encryption method will be set appropriately from the key length.

❹ Set the channel to 1.

❺ Enable the wireless LAN interface. Set the IP address to 192.168.0.1.

Figure 8.7. Ad-Hoc Mode: WEP Configuration Procedure

The steps for checking the configuration are shown in Figure 8.8, “Ad-Hoc Mode: WEP Configuration Confirmation Procedure”.

```
[armadillo ~]#iwconfig awlan0 ❶
awlan0    IEEE 802.11bgn  ESSID:"myessid"
          Mode:Ad-Hoc  Frequency:2.412 GHz  Cell: 8E:1F:40:6D:7A:3F
          Bit Rate=0 kb/s
          Encryption key:1234-5678-9012-3456-7890-1234-56
          Power Management:off
          Link Signal level=-37 dBm
          Rx invalid nwid:0  Rx invalid crypt:0  Rx invalid frag:0
          Tx excessive retries:0  Invalid misc:0   Missed beacon:0
[armadillo ~]#ifconfig awlan0 ❷
awlan0    Link encap:Ethernet  HWaddr 00:1d:12:cf:29:65
          inet addr:192.168.0.1  Bcast:192.168.0.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:47 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:6760 (6.6 KiB)  TX bytes:1196 (1.1 KiB)
```

❶ Show the wireless LAN state.

❷ Show the wireless LAN interface state.

Figure 8.8. Ad-Hoc Mode: WEP Configuration Confirmation Procedure

8.3. Time Configuration

The following describes time configuration. There are two types of time: the system clock managed by the Linux kernel and the hardware clock managed by the real-time clock. It is possible to maintain the time for a certain period even after power is cut by setting the time in the hardware clock.

In order to set the time to the hardware clock, first set the system clock. The hardware clock is then set to match the system clock.

```
[armadillo ~]#date 010609002012  ❶
[armadillo ~]#date  ❷
Fri Jan  6 09:00:05 UTC 2012
```

❶ Set the system clock to 9:00 on January 6, 2012[2].

❷ Check the system clock.

Figure 8.9. System Clock Configuration

```
[armadillo ~]#hwclock -wu  ❶
[armadillo ~]#hwclock  ❷
Fri Jan  6 09:00:14 2012  -0.319894 seconds
```

❶ Set the hardware clock from the system clock.

❷ Check the hardware clock.

Figure 8.10. Hardware Clock Configuration

Once the real-time clock is set, as the system clock is set from the real-time clock value when Debian is booted after powering off and on there is no need to set the system clock again. When powering off for an extended period of time, a battery must be connected to the RTC external backup interface (CON9).

8.4. Package Management

The following describes how to manage packages with the APT (Advanced Packaging Tool) package management system. While only the bare minimum of packages required for Debian to operate are installed in the factory default state, it is possible to easily add packages using APT.

In the factory default state, APT obtains indexes of usable packages from Debian sites (HTTP servers) on the internet[3]. Therefore in order to use APT, networking must be enabled and the internet accessible.

For information on enabling networking, please refer to Section 8.1, “Wired LAN” and Section 8.2, “Wireless LAN”.

When the system clock is incorrect by a large margin, warning messages may appear when using APT. Please correct the system clock beforehand by referring to Section 8.3, “Time Configuration”.

[2] The format is MMDDhhmm[[CC]YY][.ss]. For details, please refer to the **`date`** man page.

[3] This is configured in `/etc/apt/sources.list`. For configuration details, please refer to the sources.list man page.

apt-get update

Update the package index files to the latest versions.

Arguments None

Usage Example

```
[armadillo ~]#apt-get update
```

apt-get upgrade

Upgrade all currently installed packages to the latest versions.

Arguments None

Usage Example

```
[armadillo ~]#apt-get upgrade
```

apt-get install [package name]

Install the package specified in the argument. The package will be upgraded if it is already installed.

Arguments Package name (multiple possible)

Usage Example

```
[armadillo ~]#apt-get install gcc
```

apt-get remove [package name]

Uninstall the package specified in the argument. Nothing will occur if the package is not currently installed.

Arguments Package name (multiple possible)

Usage Example

```
[armadillo ~]#apt-get remove apache2
```

apt-cache search [keyword]

Search for packages which include the specified keyword in their package name or description.

Arguments Keyword (regular expressions supported)

Usage Example

```
[armadillo ~]#apt-cache search "Bourne Again SHell"
bash-doc - Documentation and examples for the The GNU
Bourne Again SHell
bash-static - The GNU Bourne Again SHell (static version)
bash - The GNU Bourne Again SHell
```

8.5. GStreamer

The following describes how to install and use GStreamer.

GStreamer is an open source multimedia framework. It provides base functionality for multimedia applications that use audio and video.

The **`gst-launch`** command is available with GStreamer to perform validation. With **`gst-launch`** it is possible to use GStreamer functionality without creating a program.

`gst-launch` can be used to try the following functionality.

- Section 8.7, “Video”
- Section 8.8, “Camera”
- Section 8.9, “Audio”

8.5.1. Installing GStreamer

Use APT to install GStreamer. For information on using APT, please refer to Section 8.4, “Package Management”.

Execute the following command to install GStreamer with APT.

```
[armadillo ~]#apt-get install gstreamer0.10 gstreamer-tools
```

Figure 8.11. Installing GStreamer

8.5.2. Using GStreamer

In this section the **`gst-launch`** command is used to operate GStreamer.

With GStreamer, elements with specific functionality are linked to create the desired functionality. With **`gst-launch`**, elements are linked using exclamation marks.

Elements have pads which can either input or output multimedia data. Elements are clasified into three types depending on the pads they have.

Table 8.4. Element Types

Element	Explanation
Source Elements	Elements with only output pads.
Filter Elements	Elements with at least one input and one output pad.
Sink Elements	Elements with only input pads.

Below shows an example using **`gst-launch`** with only a source element and a sink element.

```
[armadillo ~]#gst-launch audiotestsrc ! alsasink
```

Figure 8.12. Playing Test Audio

audiotestsrc is a source element that generates test audio (with a 440Hz sine wave). alsasink is a sink element that outputs audio to an ALSA device. By linking these two elements test audio is output to an ALSA device.

Armadillo-800 EVA does not support the test audio format that is generated from audiotestsrc by default. An example where audiotestsrc properties are specified to output test audio from headphones connected to the stereo headphone output (CON11) on Armadillo-800 EVA is shown below.

```
[armadillo ~]#gst-launch -v audiotestsrc ! 'audio/x-raw-int,channels=2,width=16' !
alsasink
```

Figure 8.13. Playing Test Audio on Armadillo-800 EVA

For more detailed information on GStreamer, please refer to the official GStreamer site (http://gstreamer.freedesktop.org/).

8.6. X Server

The following describes how to install and start X Server.

X Server can be used to try the following functionality.

- Section 8.7, “Video”
- Section 8.8, “Camera”

8.6.1. Installing X Server

Use APT to install the X server. For information on using APT, please refer to Section 8.4, “Package Management”.

Execute the following command to install the X server with APT.

```
[armadillo ~]#apt-get install xserver-xorg-core
```

Figure 8.14. Installing X Server

8.6.2. Starting X Server

The following describes how to start the X server specifying which video output the X server should use. The video outputs supported on Armadillo-800 EVA are as shown below.

Video Outputs	Frame Buffer Device	Notes
LCD	/dev/fb0	The LCD panel included with Armadillo-800 EVA and connected to CON17.
Display	/dev/fb1	A display connected to CON3 or CON4.

While the X server uses `/dev/fb0` by default, the frame buffer device to be used can be specified with the $FRAMEBUFFER environment variable.

To use the LCD for the X server video output, execute the command shown in Figure 8.15, “Starting X Server (LCD)”, and to use the display, execute the command shown in Figure 8.16, “Starting X Server (Display)”.

```
[armadillo ~]#X &
```

Figure 8.15. Starting X Server (LCD)

```
[armadillo ~]#FRAMEBUFFER=/dev/fb1 X :1 &
```

Figure 8.16. Starting X Server (Display)

Once the X server has started the boot screen shown in Figure 8.17, “X Server Boot Screen” will be displayed.

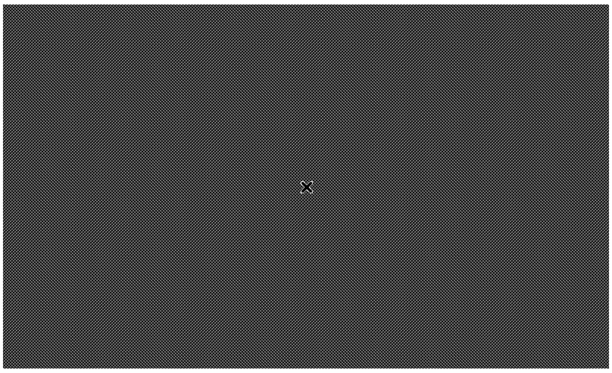


Figure 8.17. X Server Boot Screen

8.7. Video

The following describes how to use video. The video outputs supported in the factory default state are as shown below.

Video Outputs	Frame Buffer Device	Resolution (Default)	Notes
LCD	/dev/fb0	800 x 480	The LCD panel included with Armadillo-800 EVA and connected to CON17.
Display	/dev/fb1	1920 x 1080	A display connected to CON3 or CON4.

8.7.1. Displaying Images

The following describes how to display images. GStreamer is used to display the images. If it is not installed, please install it by referring to Figure 8.11, “Installing GStreamer”.

As GStreamer cannot draw directly to video, the X server is also used. Please start the X server beforehand by referring to Section 8.6, “X Server”.

The steps to display a JPEG image on the LCD are shown in Figure 8.18, “JPEG Image Display (LCD)”, and the steps to display an image on the display are shown in Figure 8.19, “JPEG Image Display (Display)”.

```
[armadillo ~]#DISPLAY=:0 gst-launch filesrc location=sample.jpg ! jpegdec !
freeze ! ffmpegcolorspace ! autovideosink
```

Figure 8.18. JPEG Image Display (LCD)

```
[armadillo ~]#DISPLAY=:1 gst-launch filesrc location=sample.jpg ! jpegdec !
freeze ! ffmpegcolorspace ! autovideosink
```

Figure 8.19. JPEG Image Display (Display)

The files included in the gnome-backgrounds package can be used as the JPEG file samples. A command example showing how to prepare the JPEG files for display on the LCD is shown below.

```
[armadillo ~]#apt-get install gnome-backgrounds imagemagick
[armadillo ~]#cp /usr/share/pixmaps/backgrounds/gnome/
nature/YellowFlower.jpg .
[armadillo ~]#convert -geometry 800x480! YellowFlower.jpg
sample.jpg
[armadillo ~]#X &
[armadillo ~]#DISPLAY=:0 gst-launch filesrc
location=sample.jpg ! jpegdec ! freeze ! ffmpegcolorspace !
autovideosink
```

Figure 8.20. Using Image Files in gnome-backgrounds Package

8.7.2. Display Video Mode Configuration

The following describes how to set the video modes.

Video mode configuration is not supported in linux-2.6.35-a800eva-at1. If the following steps are executed the settings will not be applied correctly.

The video modes that can be selected can be displayed as shown below.

```
[armadillo ~]#cat /sys/class/graphics/fb1/modes
U:720x480p-60
U:1280x720p-60
U:1920x1080p-24
U:1920x1080p-60
U:1920x1080i-60
```

Figure 8.21. Displaying Configurable Video Modes (Display)

U:1920x1080p-60 is not supported. Only set the **U:1920x1080p-60** video mode under your own responsibility.

The video modes supported by Armadillo-800 EVA are shown below.

Video Mode	Resolution	Scanning Mode	Frame Rate	Interfaces for output
U:720x480i-60	720 x 480	Interlace	60	Composite video output (CON4)
U:720x480p-60	720 x 480	Progressive	60	Digital HD Out (CON3)
U:1280x720p-60	1280 x 720	Progressive	60	Digital HD Out (CON3)
U:1920x1080p-24	1920 x 1080	Progressive	24	Digital HD Out (CON3)
U:1920x1080i-60	1920 x 1080	Interlace	60	Digital HD Out (CON3)

An example of setting the video mode of the display to **U:1280x720p-60** is shown in Figure 8.22, “Video Mode Configuration (Display)”.

```
[armadillo ~]#echo U:1280x720p-60 > /sys/class/graphics/fb1/mode
```

Figure 8.22. Video Mode Configuration (Display)

8.8. Camera

The following describes how to display video taken by the camera mounted to the camera module interface (CON1) on the LCD. GStreamer is used to capture and display the video. If it is not installed, please install it by referring to Figure 8.11, “Installing GStreamer”.

As GStreamer cannot draw directly to video, the X server is also used. Please start the X server beforehand by referring to Section 8.6, “X Server”.

Execute the following command to display video taken by the camera on the LCD. Press Ctrl+c to stop the application.

```
[armadillo ~]#DISPLAY=:0 gst-launch v4l2src ! "video/x-raw-
yuv,width=800,height=480,format=(fourcc)NV12" ! ffmpegcolorspace ! autovideosink
```

Figure 8.23. Displaying Video from Camera on LCD

If video from the camera is not displayed on the LCD, please reboot Armadillo-800 EVA and execute Figure 8.23, “Displaying Video from Camera on LCD” again.

8.9. Audio

The following describes how to record and play audio. The audio functionality on Armadillo-800 EVA is implemented as ALSA devices. The interfaces and corresponding ALSA devices are shown in Table 8.5, “Interfaces and ALSA Devices”.

Table 8.5. Interfaces and ALSA Devices

ALSA Device	Interface	Function	Sampling Frequency	Format
hw:0	Mono mic in (CON10)	Record	48k, 32k, 16k, 8k Hz	Signed 16/24 bit, Little-endian
	Stereo headphone out (CON11)	Playback		
	Stereo line out (CON12,13)			
hw:1	Digital Out (CON3)	Playback	48k Hz	Signed 16 bit, Little-endian

GStreamer is used to record and play audio. If it is not installed, please install it by referring to Figure 8.11, “Installing GStreamer”.

To operate audio, please connect the equipment shown in Table 8.6, “Equipment to Connect to Audio Interfaces” to each interface.

Table 8.6. Equipment to Connect to Audio Interfaces

Interface	Equipment
Mono mic in (CON10)	Microphone
Stereo headphone out (CON11)	Speakers or headphones
Stereo line out (CON12,13)	Display (connected by RCA cables)
Digital Out (CON3)	Display (connected by an HDMI cable)

The steps to record audio are shown in Figure 8.24, “Audio Recording”. This creates a stereo WAV file (`sample.wav`) with a 48kHz sampling rate.

```
[armadillo ~]#gst-launch alsasrc ! 'audio/x-raw-
int,channels=2,rate=48000,width=16' ! audioresample ! wavenc ! filesink
location=sample.wav
[armadillo ~]#file sample.wav
sample.wav: RIFF (little-endian) data, WAVE audio, Microsoft PCM, 16 bit, stereo
48000 Hz
```

Figure 8.24. Audio Recording

The steps to play an audio file are shown in Figure 8.25, “Audio File Playback (hw:0)” and Figure 8.26, “Audio File Playback (hw:1)”. The audio file is assumed to be in the current directory. The audio file used here is assumed to be a stereo WAV file (`sample.wav`) with a 48kHz sampling rate.

```
[armadillo ~]#file sample.wav
sample.wav: RIFF (little-endian) data, WAVE audio, Microsoft PCM, 16 bit, stereo
48000 Hz
[armadillo ~]#gst-launch filesrc location=sample.wav ! decodebin ! audioconvert !
audioresample ! alsasink
```

Figure 8.25. Audio File Playback (hw:0)

```
[armadillo ~]#file sample.wav
sample.wav: RIFF (little-endian) data, WAVE audio, Microsoft PCM, 16 bit, stereo
48000 Hz
[armadillo ~]#gst-launch filesrc location=sample.wav ! decodebin ! audioconvert !
audioresample ! alsasink device=hw:1
```

Figure 8.26. Audio File Playback (hw:1)

The steps to output mic audio as is to hw:0 are shown in Figure 8.27, “Outputting Mic Input to hw:0”.

```
[armadillo ~]#gst-launch alsasrc ! 'audio/x-raw-
int,channels=2,rate=48000,width=16' ! audioresample ! alsasink
```

Figure 8.27. Outputting Mic Input to hw:0

The files included in the gnome-audio package can be used as the sample audio files. As the audio (WAV) files included in the package have a 44.1kHz sampling rate, they must be resampled to 48kHz.

```
[armadillo ~]#apt-get install gnome-audio resample
[armadillo ~]#cp /usr/share/sounds/login.wav .
[armadillo ~]#resample -to 48000 login.wav sample.wav
[armadillo ~]#gst-launch filesrc location=sample.wav !
decodebin ! audioconvert ! audioresample ! alsasink
```

Figure 8.28. Using Audio Files in gnome-audio Package

8.10. Storage

The following describes how to use storage. On Armadillo-800 EVA, along with the internal storage (eMMC) it is possible to use external storage such as SD cards and USB memory. External storage can be used to easily transfer data to and from the work PC.

The devices which can be used as storage are shown in Table 8.7, “Storage Devices”.

Table 8.7. Storage Devices

Device	Disk Device	First Partition	Notes
eMMC	/dev/mmcblk0	/dev/mmcblk0p1	Internal storage. 8GB capacity.
SD/MMC Card	/dev/mmcblk*[a]	/dev/mmcblk*p1	External storage. Connected to SD1 (CON7) or SD2 (CON8).
USB Memory	/dev/sd*[b]	/dev/sd*1	External storage. Connected to USB1 (CON20) or USB2 (CON21).

[a] mmcblk1 then mmcblk2 in the order the storage is detected.

[b] sda, then sdb and sdc in the order the storage is detected.

In the factory default state the eMMC is divided into a number of partitions, with software such as an operating system or a bootloader stored in them. When using eMMC as storage, please be careful not to write to partitions storing any software in use.

Only either one of SD2 (CON8) and the AWL13 module (CON14) can be used at any one time. To use a SD/MMC card connected to SD2, please set the SDHI1 configuration (SW1.5) on the DIP switch to on.

Only either one of USB1 (CON20) and USB3 (CON24) can be used at any one time. To use USB memory connected to USB1, please set the USB0 configuration (SW1.6) on the DIP switch to off.

8.10.1. Using Storage

The following uses USB memory as an example to explain how to use storage.

In order to make storage usable, the storage file system must be mounted to the root file system. The **`mount`** command is used for mounting. To mount a FAT32 file system in the first partition of USB memory to the `/mnt/` directory in the root file system, execute the following command.

```
[armadillo ~]#mount -t vfat /dev/sda1 /mnt
```

Figure 8.29. Mounting Storage

For mounting storage with other types of file systems and so on, please refer to the **`mount`** man page for details.

```
[armadillo ~]# man 8 mount
```

The file systems supported by the Linux kernel can be displayed as shown below.

```
[armadillo ~]# cat /proc/filesystems
nodev   sysfs
nodev   rootfs
     :
     : (abbreviated)
     :
```

To safely remove mounted storage it must be unmounted first. The **`umount`** command is used for unmounting. To unmount storage mounted to the `/mnt/` directory, execute the following command.

```
[armadillo ~]#umount /mnt
```

Figure 8.30. Unmounting Storage

8.10.2. Changing and Formatting Storage Partitions

The following uses an SD card as an example to explain how to change and format storage partitions.

The **fdisk** command is used to alter the partition structure. An example of using the fdisk command to alter a SD card that has one partition so that it is split into two partitions is shown in Figure 8.31, “Altering Storage Partitions”. The existing partition is first deleted and then two new primary partitions are created. The first partition is assigned 100MByte, and the second partition is assigned the remaining space.

```
[armadillo ~]#fdisk /dev/mmcblk1  ❶
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
         switch off the mode (command 'c') and change display units to
         sectors (command 'u').

Command (m for help): d  ❷
Selected partition 1

Command (m for help): n  ❸
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-7182, default 1):   ❹
Using default value 1
Last cylinder, +cylinders or +size{K,M,G} (1-7182, default 7182): +100M  ❺

Command (m for help): n  ❻
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 2
First cylinder (373-7182, default 373):   ❼
Using default value 373
Last cylinder, +cylinders or +size{K,M,G} (373-7182, default 7182):   ❽
Using default value 7182

Command (m for help): w  ❾
The partition table has been altered!

Calling ioctl() to re-read partition tab mmcblk1:le.
 p1 p2
Syncing disks.
```

❶ Start operations on the partition table of the SD card. If multiple SD cards are connected, the device file of the SD card may be for example mmcblk2 and different to that in this example.

❷ Delete the existing partition.

❸ Newly create primary partition 1.

❹ Use the default value (staring cylinder) for the first cylinder by just entering return.

❺ Specify 100MByte worth for the last cylinder.

❻ Newly create primary partition 2.

❼ Use the default value (the cylinder following primary partition 1) for the first cylinder by just entering return.

❽ Use the default value (remaining cylinders) for the last cylinder by just entering return.

❾ Write the changes to the SD card.

Figure 8.31. Altering Storage Partitions

To format the first partition on the SD card as an EXT3 file system, execute the following command.

```
[armadillo ~]#mkfs.ext3 /dev/mmcblk1p1
```

Figure 8.32. Formatting Storage

> The **`mkfs.ext2`** command is used to format EXT2 file systems, while the **`mkfs.vfat`** command included in the dosfstools package is used to format FAT32 file systems. For usage information, please refer to each of their man pages.

8.11. LED Backlight

The following describes how to change the brightness of the LED backlight. The LED backlight functionality on Armadillo-800 EVA is implemented as a backlight class. The files shown in Table 8.8, “Files Used for Brightness Configuration” under the `/sys/class/backlight/pwm-backlight.0/` directory are used to change the LED backlight brightness.

Table 8.8. Files Used for Brightness Configuration

File	Explanation
brightness	Write a value between 0 (off) and max_brightness (maximum brightness) to change the brightness.
max_brightness	The maximum value (maximum brightness) that can be written to brightness can be read from this file.

The steps to change the LED backlight brightness are shown in Figure 8.33, “Altering LED Backlight Brightness”.

```
[armadillo ~]#cd /sys/class/backlight/pwm-backlight.0/
[armadillo ~]#cat max_brightness  ❶
255  ❷
[armadillo ~]#echo 0 > brightness ❸
[armadillo ~]#cat max_brightness > brightness ❹
```

❶ Display the maximum brightness value.

❷ Confirm that the value range that can be specified for brightness is 0 to 255.

❸ Turn it off.

❹ Turn it on at maximum brightness.

Figure 8.33. Altering LED Backlight Brightness

For information on using the other files under /sys/class/backlight/pwm-backlight.0/, please refer to Documentation/ABI/stable/sysfs-class-backlight in the Linux kernel source.

8.12. LED

The following describes how to control the LEDs. LEDs on Armadillo-800 EVA are implemented with the LED class. Files under the LED class directory are used for LED control. Controllable LEDs and their corresponding LED class directories are shown in Table 8.9, “LEDs and Corresponding LED Class Directories”.

Table 8.9. LEDs and Corresponding LED Class Directories

LED	LED Class Directory
LED3	/sys/class/leds/LED3/
LED4	/sys/class/leds/LED4/
LED5	/sys/class/leds/LED5/
LED6	/sys/class/leds/LED6/

8.12.1. Turning LEDs Off and On

The following describes how to turn LEDs off and on. An LED is turned off or on by writing a numerical value to brightness under the LED class directory.

Writing 0 to brightness will turn the LED off, and writing 1[4] will turn it on.

Using LED3 as an example, the steps below show how to turn an LED on and off and also how to obtain the current state.

```
[armadillo ~]#echo 1 > /sys/class/leds/LED3/brightness
```

Figure 8.34. Turning LED3 On

```
[armadillo ~]#echo 0 > /sys/class/leds/LED3/brightness
```

Figure 8.35. Turning LED3 Off

```
[armadillo ~]#cat /sys/class/leds/LED3/brightness
0
```

Figure 8.36. Obtain the Current State of LED3

8.12.2. Using LED Triggers

The following describes how to use LED triggers. LEDs turn on and off in accordance with the trigger set to the trigger file under the LED class directory. The triggers that can be set with the trigger file are shown below.

[4] As the LEDs on Armadillo-800 EVA do not have brightness control functionality, writing any value of 1 or higher will just turn the LED on.

Table 8.10. Triggers Configurable with the trigger File

Trigger	Explanation
none	No trigger set (default).
battery-charging-or-full	This is a dummy trigger. It is always off.
battery-charging	This is a dummy trigger. It is always off.
battery-full	This is a dummy trigger. It is always off.
usb-online	This is a dummy trigger. It is always off.
ac-online	This is a dummy trigger. It is always off.
mmc0	Acts as eMMC access lamp.
mmc1	Acts as SD1 access lamp.
mmc2	Acts as SD2 or AWL13 module access lamp.
timer	Turns on and off at specified timing. When this is selected the `delay_on` and `delay_off` files appear under the LED class directory. The on time in milliseconds is specified to the former and off time to the later.

Using LED3 as an example, the steps below show how to configure a trigger and to also obtain the current configuration.

```
[armadillo ~]#echo timer > /sys/class/leds/LED3/trigger
[armadillo ~]#echo 1000 > /sys/class/leds/LED3/delay_on
[armadillo ~]#echo 500 > /sys/class/leds/LED3/delay_off
```

Figure 8.37. Setting LED3 Trigger to timer

```
[armadillo ~]#cat /sys/class/leds/LED3/trigger
none battery-charging-or-full battery-charging battery-full usb-online ac-online
mmc0 mmc1 mmc2 [timer]
```

Figure 8.38. Displaying LED3 Trigger

8.13. User Switch

The following describes how to obtain events from user switches. User switches on Armadillo-800 EVA are implemented as input devices. The switches that can be used as user switches, and their corresponding input device files are shown in Table 8.11, “Switches and Corresponding Input Device Files”.

Table 8.11. Switches and Corresponding Input Device Files

User Switch	Input Device File	Event Code
SW3	/dev/input/event0	116 (Power)
SW4		158 (Back)
SW5		139 (Menu)
SW6		102 (Home)

SW3 was assigned as 28 (Enter) on linux-2.6.35-a800eva-at1. This was changed to 116 (Power) on linux-2.6.35-a800eva-at2 and later.

SW2 is a reset switch. It cannot be used as a user switch. Please take care as the Armadillo-800 EVA will be reset when it is pressed.

The event device file numbers are determined by the order the input devices are detected. Therefore, if another input device such as a USB keyboard is detected at boot time, the event device numbers may change.

The **evtest** command is used to obtain the events. Use APT to install **evtest**. For information on using APT, please refer to Section 8.4, “Package Management”.

Execute the following command to install **evtest** with APT.

```
[armadillo ~]#apt-get install evtest
```

Figure 8.39. Installing evtest

Execute the following command to capture the user switch events. Press Ctrl+c to stop the application.

```
[armadillo ~]#evtest /dev/input/event0
Input driver version is 1.0.0
Input device ID: bus 0x19 vendor 0x1 product 0x1 version 0x100
Input device name: "gpio-keys"
Supported events:
  Event type 0 (Sync)
  Event type 1 (Key)
    Event code 28 (Enter)
    Event code 102 (Home)
    Event code 139 (Menu)
    Event code 158 (Back)
Testing ... (interrupt to exit)
    :
    : (event display)
    :
^C
[armadillo ~]#
```

Figure 8.40. Capturing User Switch Events

8.14. Touchscreen

The following describes how to capture events from the touchscreen. The touchscreen on Armadillo-800 EVA is implemented as an input device. The input device file corresponding to the touchscreen is `/dev/input/event1`.

The event device file numbers are determined by the order the input devices are detected. Therefore, if another input device such as a USB keyboard is detected at boot time, the event device numbers may change.

The **evtest** command is used to capture the events. If it is not installed, please install it by referring to Figure 8.39, “Installing evtest”.

Execute the following command to capture the touchscreen events. Press Ctrl+c to stop the application.

```
[armadillo ~]#evtest /dev/input/event1
Input driver version is 1.0.0
Input device ID: bus 0x18 vendor 0x0 product 0x0 version 0x0
Input device name: "st1232-touchscreen"
Supported events:
  Event type 0 (Sync)
  Event type 1 (Key)
  Event type 3 (Absolute)
    Event code 48 (?)
      Value      0
      Min        0
      Max      255
    Event code 53 (?)
      Value      0
      Min        0
      Max      799
    Event code 54 (?)
      Value      0
      Min        0
      Max      479
Testing ... (interrupt to exit)
    :
    : (event display)
    :
^C
[armadillo ~]#
```

Figure 8.41. Capturing Touchscreen Events

Chapter 9. Utilizing SD Booting

This chapter covers the steps to boot directly from an SD card (hereafter referred to as "SD booting"). By utilizing SD booting, it is possible to change the system images by just swapping the SD card. An SD card with a capacity of at least 1GByte is required to carry out the steps shown in this chapter. While the steps for booting Debian GNU/Linux 6.0 (codename squeeze) are shown as an example below, other operating systems can also be used with SD booting.

9.1. Boot Disk Creation

The SD card to be used for SD booting is prepared on the work PC. This SD card is called the boot disk. For information on the structure of the boot disk created in this section, please refer to Table 9.1, “Boot Disk Structure”.

Table 9.1. Boot Disk Structure

Partition Number	File System	Stored Files
1	VFAT	Bootloader image file
2	ext3	The root file system and kernel image file

The following restrictions apply when storing the bootloader image file in the boot disk.

- It must be stored in partition 1 on the boot disk
- It must be stored directly in the root directory
- The filename must be "sdboot.bin"
- The partition ID must be 0xb (Win95 FAT32)
- The file system must be FAT32 or FAT16 (32MByte or more)

While there will be no problems if the steps shown in this chapter are followed, please be aware of these restrictions when creating an original boot disk.

Only CON7 (SD Interface 1) is supported for SD booting. CON8 cannot be used for SD booting.

The commands shown for boot disk creation are examples for when they are executed on ATDE. While it is also possible to create the boot disk with similar steps on Armadillo-800 EVA, as there will be differences in the device file names etc, please change the commands as necessary.

9.1.1. Obtaining Files Required for Boot Disk Creation

Obtain the files that are required to create the boot disk as shown in Table 9.2, “Files Required for Boot Disk Creation”. These files can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com) or the included DVD-ROM.

Table 9.2. Files Required for Boot Disk Creation

File	Explanation
loader-armadillo8x0-v[version].bin	Bootloader image file
debian-squeeze_a800eva_[version].tar.gz	Debian GNU/Linux 6.0 Root File System Archive
linux-a800eva-[version].bin	Kernel Image File

9.1.2. Partition Creation

Create two primary partitions on the SD card.

Connect the SD card to the work PC and create the partitions as shown in Figure 9.1, “Partition Creation Procedure”.

```
[PC ~]# fdisk /dev/sdb ❶
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
         switch off the mode (command 'c') and change display units to
         sectors (command 'u').

Command (m for help): o ❷
Building a new DOS disklabel with disk identifier 0x65314ac5.
Changes will remain in memory only, until you decide to write them.
After that, of course, the previous content won't be recoverable.

Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(rite)

WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
         switch off the mode (command 'c') and change display units to
         sectors (command 'u').

Command (m for help): n ❸
Command action
e   extended
p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-1790, default 1):    ❹
Using default value 1
Last cylinder, +cylinders or +size{K,M,G} (1-1790, default 1790): +128M ❺

Command (m for help): n ❻
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 2
First cylinder (62-1790, default 62):    ❼
Using default value 62
Last cylinder, +cylinders or +size{K,M,G} (62-1790, default 1790):    ❽
Using default value 1790

Command (m for help): t ❾
Partition number (1-4): 1
Hex code (type L to list codes): b
Changed system type of partition 1 to b (W95 FAT32)
```

```
Command (m for help): w  ❿
The partition table has been altered!

Calling ioctl() to re-read partition table.
 sdb: p1 p2
Syncing disks.
[PC ~]#
```

❶ Start operations on the partition table of the SD card. If USB memory and so on is connected, the device file of the SD card may be for example sdc or sdd and different to that in this example.

❷ Newly create the DOS partition table.

❸ Newly create primary partition 1.

❹ Use the default value (staring cylinder) for the first cylinder by just entering return.

❺ Specify 128MByte worth for the last cylinder.

❻ Newly create primary partition 2.

❼ Use the default value (the cylinder following primary partition 1) for the first cylinder by just entering return.

❽ Use the default value (remaining cylinders) for the last cylinder by just entering return.

❾ Change the partition type of primary partition 1 to Win95 FAT32 (0x0b).

❿ Write the changes to the SD card.

Figure 9.1. Partition Creation Procedure

Check that the partitions have been created. Two partitions should have been created as shown in Figure 9.2, “Partition Confirmation Procedure”.

```
[PC ~]# fdisk -l /dev/sdb
Disk /dev/mmcblk1: 3983 MB, 3983540224 bytes
106 heads, 41 sectors/track, 1790 cylinders
Units = cylinders of 4346 * 512 = 2225152 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x61e03ae6

        Device Boot      Start         End      Blocks   Id  System
/dev/sdb1                    1          61      132532+   b  W95 FAT32
/dev/sdb2                   62        1790     3757117   83  Linux
```

Figure 9.2. Partition Confirmation Procedure

9.1.3. File System Creation

Create file systems in each of the partitions created in Section 9.1.2, “Partition Creation”.

With the SD card still connected to the work PC, create the file systems as shown in Figure 9.3, “File System Creation Procedure”.

The mkfs.vfat command (dosfstools package) is used for the file system creation. If it is not installed on the work PC, please install it as shown below.

```
[PC ~]# apt-get update
[PC ~]# apt-get install dosfstools
```

```
[PC ~]# mkfs.vfat /dev/sdb1  ❶
mkfs.vfat 3.0.9 (31 Jan 2010)
[PC ~]# mkfs.ext3 /dev/sdb2  ❷
mke2fs 1.41.12 (17-May-2010)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
235248 inodes, 939279 blocks
46963 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=964689920
29 block groups
32768 blocks per group, 32768 fragments per group
8112 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736

Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 21 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
[PC ~]#
```

❶ Create a VFAT file system in primary partition 1.

❷ Create an ext3 file system in primary partition 2.

Figure 9.3. File System Creation Procedure

9.1.4. System Image Extraction

Extract the files obtained in Section 9.1.1, “Obtaining Files Required for Boot Disk Creation” to the SD card with the file systems created in Section 9.1.3, “File System Creation”.

With the SD card still connected to the work PC, extract the files as shown in Figure 9.4, “System Image Extraction Procedure”. In the command examples below, it is assumed that the files obtained in Section 9.1.1, “Obtaining Files Required for Boot Disk Creation” are in the current directory.

```
[PC ~]# ls
debian-squeeze_a800eva_[version].tar.gz  loader-armadillo8x0-v[version].bin
```

```
linux-a800eva-[version].bin
[PC ~]# mount -t vfat /dev/sdb1 /mnt
[PC ~]# cp ~/loader-armadillo8x0-v[version].bin /mnt/sdboot.bin  ❶
[PC ~]# umount /mnt
[PC ~]# mount -t ext3 /dev/sdb2 /mnt
[PC ~]# tar zxf ~/debian-squeeze_a800eva_[version].tar.gz -C /mnt  ❷
[PC ~]# cp ~/linux-a800eva-[version].bin /mnt/boot/Image.bin  ❸
[PC ~]# umount /mnt
[PC ~]#
```

❶ Copy the bootloader image to partition 1 on the boot disk. The filename must be renamed to "sdboot.bin".

❷ Extract the Debian GNU/Linux 6.0 root file system archive to partition 2 on the boot disk.

❸ Copy the kernel image file to the "/boot/" directory on partition 2 of the boot disk. The filename must be renamed to "Image.bin" or "linux.bin".

Figure 9.4. System Image Extraction Procedure

9.1.5. Editing Configuration Files

The Debian GNU/Linux 6.0 root file system extracted in Section 9.1.4, “System Image Extraction” is configured for use with partition 2 on the eMMC as the root file system. Change "/dev/mmcblk0p2" to "/dev/mmcblk1p2" as shown in Figure 9.4, “System Image Extraction Procedure”.

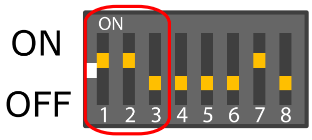
```
[PC ~]# mount -t ext3 /dev/sdb2 /mnt
[PC ~]# vi /mnt/etc/fstab
# <file system> <mount> <type>  <options>                       <dump>  <pass>
proc            /proc   proc    defaults                        0       0
/dev/mmcblk1p2  /       ext3    defaults,errors=remount-ro      0       1
[PC ~]# umount /mnt
[PC ~]#
```

Figure 9.5. Editing fstab

9.2. Booting from Boot Disk

Boot from the boot disk created in Section 9.1, “Boot Disk Creation”. Carry out the following preparation before powering on the Armadillo-800 EVA.

- Connect the boot disk to SD Slot 1 (CON7).
- Set the DIP switch boot device configuration to SDHI0 (SW1.2 on, SW1.3 off) in order to boot from the bootloader in the boot disk.
- Set the DIP switch boot mode configuration (SW1.1) to on in order to start the bootloader in maintenance mode.



After the preparation is complete, turn the power on and the board will start in maintenance mode. Referring to Figure 9.6, “Booting from Boot Disk”, configure to use the kernel and root file system in the boot disk and then boot using the boot command.

```
hermit> setbootdevice mmcblk1p2
hermit> setenv console=ttySC1,115200 noinitrd rootwait root=/dev/mmcblk1p2
hermit> boot
```

Figure 9.6. Booting from Boot Disk

Chapter 10. Recovery Procedure

This chapter shows how to return the contents of the internal storage (eMMC) on Armadillo-800 EVA to the factory default state. An SD card with a capacity of at least 1GByte is required to carry out the steps shown in this chapter.

10.1. Partition Structure

The following shows the partition structure of the internal storage on Armadillo-800 EVA. The internal storage on Armadillo-800 EVA is divided into a number of partitions in a similar way to a PC. It is because of this that multiple operating systems can be installed.

The factory default state partition structure of the internal storage is shown in Table 10.1, “Internal Storage Partition Structure”.

Table 10.1. Internal Storage Partition Structure

Device File Name	Size	Partition Type
/dev/mmcblk0p1	512MByte	0b (Win95 FAT32)
/dev/mmcblk0p2	5GByte approx.	83 (Linux)
/dev/mmcblk0p3	1GByte	83 (Linux)
/dev/mmcblk0p4	1GByte	83 (Linux)

Under the current MMC 4.3 standard, an eMMC device can have at maximum two boot partitions. The eMMC on Armadillo-800 EVA has two boot partitions.

Table 10.2. eMMC Boot Partitions

Device File Name	Size
/dev/mmcblk0boot0	512kByte approx.
/dev/mmcblk0boot1	512kByte approx.

As shown in Table 10.1, “Internal Storage Partition Structure” and Table 10.2, “eMMC Boot Partitions”, internal storage is divided into six regions. The use of each region in the factory default state is shown in Table 10.3, “Internal Storage Region Use”.

Table 10.3. Internal Storage Region Use

Partition	Use
Partition 1 (/dev/mmcblk0p1)	Used mainly for the Android SD card region. Formatted as VFAT.
Partition 2 (/dev/mmcblk0p2)	Has Debian GNU/Linux installed. A kernel image is also stored under the /boot/ directory. Formatted as ext3.
Partition 3 (/dev/mmcblk0p3)	This is a reserved region[a]. Formatted as ext3.
Partition 4 (/dev/mmcblk0p4)	Has Android installed. A kernel image is also stored under the /boot/ directory. Formatted as ext3.
Boot Partition 1 (/dev/mmcblk0boot0)	The bootloader image is stored here.
Boot Partition 2 (/dev/mmcblk0boot1)	Parameters used by the bootloader are saved here.

[a] A system image for this partition is planned to be released in a future update.

10.2. Total eMMC Recovery

The following shows how to recover the whole eMMC.

10.2.1. Recovery Disk Creation

The SD card to be used for recovery is prepared on the work PC. This SD card is called the recovery disk.

The commands shown for recovery disk creation are examples for when they are executed on ATDE. While it is also possible to create the recovery disk with similar steps on Armadillo-800 EVA, as there will be differences in the device file names etc, please change the commands as necessary.

10.2.1.1. Obtaining Files Required for Recovery Disk Creation

Obtain the files that are required to create the recovery disk as shown in Table 10.4, “Files Required for Recovery Disk Creation”. These files can be obtained from the Atmark Techno Users Site (https://users.atmark-techno.com) or the included DVD-ROM.

In order to obtain the files from the Atmark Techno Users Site, it is necessary to first carry out "Purchased Product Registration" at the "Atmark Techno Users Site" after having purchased the product.

Table 10.4. Files Required for Recovery Disk Creation

File	Explanation
recovery-image_a800eva_[version].tar.gz	This contains the image files and so on to be written to eMMC
recovery-system_a800eva_[version].tar.gz	This contains the program to carry out the recovery and so on

10.2.1.2. Partition Creation

Create two primary partitions on the SD card.

Connect the SD card to the work PC and create the partitions as shown in Figure 10.1, “Partition Creation Procedure”.

```
[PC ~]# fdisk /dev/sdb  ❶
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
         switch off the mode (command 'c') and change display units to
         sectors (command 'u').

Command (m for help): o  ❷
Building a new DOS disklabel with disk identifier 0x65314ac5.
Changes will remain in memory only, until you decide to write them.
After that, of course, the previous content won't be recoverable.

Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(rite)

WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
```

```
         switch off the mode (command 'c') and change display units to
         sectors (command 'u').

Command (m for help): n  ❸
Command action
e   extended
p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-1790, default 1):     ❹
Using default value 1
Last cylinder, +cylinders or +size{K,M,G} (1-1790, default 1790): +512M  ❺

Command (m for help): n  ❻
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 2
First cylinder (243-1790, default 243):    ❼
Using default value 243
Last cylinder, +cylinders or +size{K,M,G} (243-1790, default 1790):    ❽
Using default value 1790

Command (m for help): t  ❾
Partition number (1-4): 1
Hex code (type L to list codes): b
Changed system type of partition 1 to b (W95 FAT32)


Command (m for help): w  ❿
The partition table has been altered!

Calling ioctl() to re-read partition table.
 sdb: p1 p2
Syncing disks.
[PC ~]#
```

❶ Start the partitioning of the SD card. If USB memory and so on is connected, the device file of the SD card may be for example sdc or sdd and different to that in this example.

❷ Newly create the DOS partition table.

❸ Newly create primary partition 1.

❹ Use the default value (staring cylinder) for the first cylinder by just entering return.

❺ Specify 512MByte worth for the last cylinder.

❻ Newly create primary partition 2.

❼ Use the default value (the cylinder following primary partition 1) for the first cylinder by just entering return.

❽ Use the default value (remaining cylinders) for the last cylinder by just entering return.

❾ Change the partition type of primary partition 1 to Win95 FAT32 (0x0b).

❿ Write the changes to the SD card.

Figure 10.1. Partition Creation Procedure

Check that the partitions have been created. Two partitions should have been created as shown in Figure 10.2, “Partition Confirmation Procedure”.

```
[PC ~]# fdisk -l /dev/sdb
Disk /dev/sdb: 3983 MB, 3983540224 bytes
106 heads, 41 sectors/track, 1790 cylinders
Units = cylinders of 4346 * 512 = 2225152 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x65314ac5

        Device Boot      Start         End      Blocks   Id  System
/dev/sdb1                    1         242      525845+   b  W95 FAT32
/dev/sdb2                  243        1790     3363804   83  Linux
```

Figure 10.2. Partition Confirmation Procedure

10.2.1.3. File System Creation

Create file systems in each of the partitions created in Section 10.2.1.2, “Partition Creation”.

With the SD card still connected to the work PC, create the file systems as shown in Figure 10.3, “File System Creation Procedure”.

dosfstools is used for the file system creation. If it is not installed on the work PC, please install it as shown below.

```
[PC ~]# apt-get update
[PC ~]# apt-get install dosfstools
```

```
[PC ~]# mkfs.vfat /dev/sdb1  ❶
mkfs.vfat 3.0.9 (31 Jan 2010)
[PC ~]# mkfs.ext3 /dev/sdb2  ❷
mke2fs 1.41.12 (17-May-2010)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
210496 inodes, 840951 blocks
42047 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=864026624
26 block groups
32768 blocks per group, 32768 fragments per group
8096 inodes per group
```

```
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200

Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 27 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
[PC ~]#
```

❶ Create a VFAT file system in primary partition 1.

❷ Create an ext3 file system in primary partition 2.

Figure 10.3. File System Creation Procedure

10.2.1.4. Recovery Image Extraction

Extract the files obtained in Section 10.2.1.1, “Obtaining Files Required for Recovery Disk Creation” to the SD card with the file systems created in Section 10.2.1.3, “File System Creation”.

With the SD card still connected to the work PC, extract the files as shown in Figure 10.4, “File Extraction Procedure”. In the command examples below, it is assumed that the files obtained in Section 10.2.1.1, “Obtaining Files Required for Recovery Disk Creation” are in the current directory.

```
[PC ~]# ls
recovery-image_a800eva_[version].tar.gz  recovery-system_a800eva_[version].tar.gz
[PC ~]# mount -t vfat /dev/sdb1 /mnt
[PC ~]# cd /mnt
[PC /mnt]# tar zxf ~/recovery-image_a800eva_[version].tar.gz
[PC /mnt]# cd
[PC ~]# umount /mnt

[PC ~]# mount -t ext3 /dev/sdb2 /mnt
[PC ~]# cd /mnt
[PC /mnt]# tar zxf ~/recovery-system_a800eva_[version].tar.gz
[PC /mnt]# cd
[PC ~]# umount /mnt
[PC ~]#
```

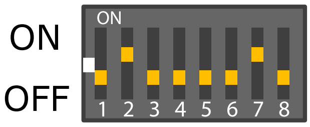
Figure 10.4. File Extraction Procedure

10.2.2. Recovery Execution

When the procedure below is carried out, all of the content in the eMMC on the Armadillo-800 EVA will be returned to the factory default state. To only return a particular partition to the factory default state, please refer to Section 10.3, “Recovery of a Particular eMMC Root File System” or Section 10.4, “eMMC Bootloader Recovery”.

Use the recovery disk created in Section 10.2.1, “Recovery Disk Creation” to perform the recovery. Carry out the preparation below before powering on the Armadillo-800 EVA.

- On the DIP switch turn SW1.2 and SW1.7 on and all others off.



- Connect the recovery disk to SD Slot 1 (CON7).

After the preparation is complete, power on the board while pressing SW3 and the recovery will start. The recovery progress can be seen with the LED patterns.

Table 10.5. Recover Progress and LEDs

LED3	LED4	LED5	LED6	Recovery Progress
Blinking	Off	Off	Off	Formatting eMMC user partitions
Off	Blinking	Off	Off	Formatting eMMC boot partitions
Blinking	On	On	On	Creating system in eMMC partition 1
On	Blinking	On	On	Creating system in eMMC partition 2
On	On	Blinking	On	Creating system in eMMC partition 3
On	On	On	Blinking	Creating system in eMMC partition 4
On	On	On	On	Recovery completed successfully
Blinking	Blinking	Blinking	Blinking	Recovery ended abnormally

The recovery is complete when all the LEDs are on. If all LEDs are blinking an error has occurred. In this case, please check the steps and execute the recovery again. To boot from eMMC after recovery, set the DIP switch boot device configuration to eMMC (SW1.2 off, SW1.3 off), remove the SD card and power on the board.

10.3. Recovery of a Particular eMMC Root File System

The following introduces how to recover just a particular eMMC root file system. The candidates for recovery are as shown in Table 10.6, “Candidate Root File Systems for Recovery”.

Table 10.6. Candidate Root File Systems for Recovery

Root File System	Partition Number	File System
Debian GNU/Linux	2	ext3
Android	4	ext3

The Armadillo-800 EVA must be booted from SD beforehand by referring to Chapter 9, Utilizing SD Booting.

10.3.1. Debian GNU/Linux Recovery

The following shows how to recover Debian GNU/Linux to eMMC partition 2.

10.3.1.1. Obtaining Files Required for Debian GNU/Linux Recovery

Obtain the files that are required in order to recover Debian GNU/Linux as shown in Table 10.7, “Files Required for Debian GNU/Linux Recovery”. These files can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com) or the included DVD-ROM.

Table 10.7. Files Required for Debian GNU/Linux Recovery

File	Explanation
debian-squeeze_a800eva_[version].tar.gz	Debian GNU/Linux 6.0 root file system archive
linux-a800eva-[version].bin	Kernel Image File

10.3.1.2. Debian GNU/Linux Recovery Execution

Carry out the recovery of Debian GNU/Linux as shown in Figure 10.5, “Debian GNU/Linux Recovery Procedure”. It is assumed that the files obtained in Section 10.3.1.1, “Obtaining Files Required for Debian GNU/Linux Recovery” are in the current directory.

```
[armadillo ~]# ls
debian-squeeze_a800eva_[version].tar.gz  linux-a800eva-[version].bin
[armadillo ~]# mkfs.ext3 /dev/mmcblk0p2 ❶
mke2fs 1.41.12 (17-May-2010)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
318864 inodes, 1274944 blocks
63747 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=1308622848
39 block groups
32768 blocks per group, 32768 fragments per group
8176 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736

Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 24 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
[armadillo ~]# mount -t ext3 /dev/mmcblk0p2 /mnt ❷
[armadillo ~]# tar zxf ~/debian-squeeze_a800eva_[version].tar.gz -C /mnt ❸
[armadillo ~]# cp ~/linux-a800eva-[version].bin /mnt/boot/Image.bin ❹
[armadillo ~]# umount /mnt
[armadillo ~]#
```

❶ Create an ext3 file system.

❷ Mount the file system.

❸ Extract the root file system archive.

❹ Copy the kernel image file to the /mnt/boot/ directory. The filename must be renamed to either "Image.bin" or "linux.bin".

Figure 10.5. Debian GNU/Linux Recovery Procedure

10.3.2. Android Recovery

The following shows how to recover Android to eMMC partition 4.

10.3.2.1. Obtaining Files Required for Android Recovery

Obtain the files that are required in order to recover Android as shown in Table 10.8, “Files Required for Android Recovery”. The Android root file system archive can be obtained from the Atmark Techno Users Site (https://users.atmark-techno.com) or the included DVD-ROM. The kernel image file can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com) or the included DVD-ROM.

> In order to obtain the files from the Atmark Techno Users Site, it is necessary to first carry out "Purchased Product Registration" at the "Atmark Techno Users Site" after having purchased the product.

Table 10.8. Files Required for Android Recovery

File	Explanation
android-2.3.7_a800eva_[version].tar.gz	Android 2.3.7 root file system archive
linux-a800eva-[version].bin	Kernel Image File

10.3.2.2. Android Recovery Execution

Carry out the recovery of Android as shown in Figure 10.6, “Android Recovery Procedure”. It is assumed that the files obtained in Section 10.3.2.1, “Obtaining Files Required for Android Recovery” are in the current directory.

```
[armadillo ~]# ls
android-2.3.7_a800eva_[version].tar.gz  linux-a800eva-[version].bin
[armadillo ~]# mkfs.ext3 /dev/mmcblk0p4  ❶
mke2fs 1.41.12 (17-May-2010)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
61056 inodes, 244152 blocks
12207 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=251658240
8 block groups
32768 blocks per group, 32768 fragments per group
7632 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376

Writing inode tables: done
Creating journal (4096 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 23 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
[armadillo ~]# mount -t ext3 /dev/mmcblk0p4 /mnt  ❷
[armadillo ~]# tar zxf ~/android-2.3.7_a800eva_[version].tar.gz -C /mnt  ❸
[armadillo ~]# mkdir /mnt/boot
[armadillo ~]# cp ~/linux-a800eva-[version].bin /mnt/boot/Image.bin  ❹
```

```
[armadillo ~]# umount /mnt
[armadillo ~]#
```

❶ Create an ext3 file system.

❷ Mount the file system.

❸ Extract the root file system archive.

❹ Copy the kernel image file to the /mnt/boot/ directory. The filename must be renamed to either "Image.bin" or "linux.bin".

Figure 10.6. Android Recovery Procedure

10.4. eMMC Bootloader Recovery

The following shows how to recover the bootloader to eMMC boot partition 0. The Armadillo-800 EVA must be booted from SD beforehand by referring to Chapter 9, Utilizing SD Booting.

10.4.1. Obtaining Files Required for Bootloader Recovery

Obtain the files that are required in order to recover the bootloader as shown in Table 10.9, “Files Required for Bootloader Recovery”. These files can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com) or the included DVD-ROM.

Table 10.9. Files Required for Bootloader Recovery

File	Explanation
loader-armadillo8x0-v[version].bin	Bootloader image file

10.4.2. Bootloader Recovery Execution

Carry out the recovery of the bootloader as shown in Figure 10.7, “Bootloader Recovery Procedure”. It is assumed that the files obtained in Section 10.4.1, “Obtaining Files Required for Bootloader Recovery” are in the current directory.

```
[armadillo ~]# ls
loader-armadillo8x0-v[version].bin
[armadillo ~]# echo 0 > /sys/block/mmcblk0boot0/force_ro  ❶
[armadillo ~]# cat ~/loader-armadillo8x0-v[version].bin > /dev/mmcblk0boot0  ❷
[armadillo ~]# sync
[armadillo ~]#
```

❶ Release the boot partition software write protection.

❷ Write the bootloader image to the partition.

Figure 10.7. Bootloader Recovery Procedure

Chapter 11. Development Environment Setup

This chapter explains how to setup a development environment on the work PC in order to carry out software development for Armadillo-800 EVA.

If the work PC is Debian GNU/Linux 6.0 (codename squeeze)[1], then a software development environment for Armadillo-800 EVA can be setup by installing the cross development tools. For information on how to install the cross development tools, please refer to Section 11.2, “Installing Cross Development Tools”.

If the work PC is Windows or a version of Linux other than Debian GNU/Linux 6.0 (codename squeeze), then a software development environment for Armadillo-800 EVA can be setup by using "ATDE (Atmark Techno Development Environment)". For information on how to use ATDE, please refer to Section 11.1, “Using ATDE”.

11.1. Using ATDE

The following covers how to use ATDE on the work PC.

ATDE is a VMware virtual machine data image that provides the Armadillo development environment. ATDE4, which supports software development for Armadillo-800 EVA, is based on Debian GNU/Linux 6.0 (codename squeeze) with cross development tools and other required tools already installed.

For information on obtaining and installing VMware, please refer to VMware's web page (http://www.vmware.com/).

VMware offers a number of products, from free versions for non-commercial use to paid commercial use versions. Separate licenses and end-user license agreements (EULA) exist for each product, so please choose the most appropriate product after having fully checked these.

11.1.1. Obtaining ATDE

The ATDE4 archives shown in Table 11.1, “ATDE4 Types” can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com) or the included DVD-ROM.

Table 11.1. ATDE4 Types

ATDE4 Archive	The Base Debian GNU/Linux
atde4-[version]-amd64.zip	Debian GNU/Linux 6.0 for the 64-bit PC (amd64) architecture
atde4-[version]-i386.zip	Debian GNU/Linux 6.0 for the 32-bit PC (i386) architecture

[1] While it is possible to develop on other versions of Linux, not everything will work in exactly the same way as described in this document. If doing so, please take full responsibility and adjust the work to your environment.

11.1.2. Starting ATDE

The atde4.vmx file in the directory extracted from the ATDE4 archive is the ATDE4 virtual machine configuration file. ATDE4 can be booted by opening this file with VMware. The users shown in Table 11.2, “Usernames and Passwords” can be used to log into ATDE4[2].

Table 11.2. Usernames and Passwords

Username	Password	Permissions
`atmark`	`atmark`	General user
`root`	`root`	Privilege user

ATDE4 has been confirmed to boot on the VMware products below.

- VMware Player 3.1.5
- VMware Workstation 7.1.5
- VMware Workstation 8.0.1

There is a chance that ATDE4 may not function properly depending on the operating environment of the work PC (hardware, VMware, and ATDE4 type). If this is the case, please check the operating environment by referring to the documentation of the VMware product being used at the VMware web site (http://www.vmware.com/).

11.2. Installing Cross Development Tools

The following describes how to install cross development tools for the armel architecture as Debian packages on a work PC running Debian GNU/Linux 6.0 (codename squeeze).

11.2.1. Obtaining Cross Development Tool Debian Packages

The Debian packages of the cross development tools can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com) or the included DVD-ROM.

11.2.2. Installing Cross Development Tool Debian Packages

The Debian packages are installed to the work PC. It is assumed that all cross development tool Debian packages obtained in Section 11.2.1, “Obtaining Cross Development Tool Debian Packages” have been placed under the ~/ directory.

Please refer to Figure 11.1, “Install Command for 64-bit PC Cross Development Tool Debian Packages” if using Debian GNU/Linux 6.0 for the 64-bit PC (amd64) architecture, or Figure 11.2, “Install Command for 32-bit PC Cross Development Tool Debian Packages” if using Debian GNU/Linux 6.0 for the 32-bit PC (i386) architecture.

```
[PC ~]$sudo dpkg --install *_amd64.deb *_all.deb
```

Figure 11.1. Install Command for 64-bit PC Cross Development Tool Debian Packages

[2] It is not possible to log in with the GUI as the privileged user.

```
[PC ~]$sudo dpkg --install *_i386.deb *_all.deb
```

Figure 11.2. Install Command for 32-bit PC Cross Development Tool Debian Packages

If a cross development environment for the same target architecture has already been installed on the work PC, please make sure to first uninstall this existing environment before installing the new cross development environment.

Chapter 12. Building the Kernel

This chapter covers how to cross build the Linux kernel source code on the work PC and create a kernel image file.

The development environment must first be setup on the work PC by referring to Chapter 11, Development Environment Setup.

12.1. Obtaining Source Archive

Obtain the linux-2.6.35-a800eva-[version].tar.gz Linux kernel source archive. The source archive can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com) or the included DVD-ROM.

12.2. Extracting Source Archive

Extract the source archive as shown in Figure 12.1, “Extracting Source Archive”.

```
[PC ~]#ls
linux-2.6.35-a800eva-[version].tar.gz
[PC ~]#tar zxvf linux-2.6.35-a800eva-[version].tar.gz
linux-2.6.35-a800eva-[version]  linux-2.6.35-a800eva-[version].tar.gz
```

Figure 12.1. Extracting Source Archive

12.3. Building

Build the extracted source code and create the kernel image file as shown in Figure 12.2, “Building the Kernel”.

```
❶[PC ~]$cd linux-2.6.35-a800eva-[version]
❷[PC ~/linux-2.6.35-a800eva-[version]]$make ARCH=arm
armadillo800eva_android_defconfig
❸[PC ~/linux-2.6.35-a800eva-[version]]$make ARCH=arm CROSS_COMPILE=arm-linux-
gnueabi-
❹[PC ~/linux-2.6.35-a800eva-[version]]$ls arch/arm/boot/Image
Image
```

❶ Move to the source code directory

❷ Apply the default configuration

❸ Build the source code

❹ Confirm that the kernel image file has been created

Figure 12.2. Building the Kernel

12.4. Installing

Install the kernel image to the internal storage. Debian GNU/Linux must first be booted from an SD card by referring to Chapter 9, Utilizing SD Booting.

It is assumed that the kernel image file created in Section 12.3, “Building” is in the current directory.

Please refer to Figure 12.3, “Installing Kernel Image to Android System” if installing to the Android system or refer to Figure 12.4, “Installing Kernel Image to Debian GNU/Linux System” if installing to the Debian GNU/Linux system.

```
[armadillo ~]$ls
Image
❶[armadillo ~]$mount /dev/mmcblk0p4 /mnt
❷[armadillo ~]$rm -f /mnt/boot/*.bin
❸[armadillo ~]$cp Image /mnt/boot/Image.bin
[armadillo ~]$umount /mnt
```

❶ Mount eMMC partition 4.

❷ Delete kernel image files from under /boot/ on eMMC partition 4.

❸ Copy the kernel image file to /boot/ on eMMC partition 4. The filename must be renamed to either "Image.bin" or "linux.bin".

Figure 12.3. Installing Kernel Image to Android System

```
[armadillo ~]$ls
Image
❶[armadillo ~]$mount /dev/mmcblk0p2 /mnt
❷[armadillo ~]$rm -f /mnt/boot/*.bin
❸[armadillo ~]$cp Image /mnt/boot/Image.bin
[armadillo ~]$umount /mnt
```

❶ Mount eMMC partition 2.

❷ Delete kernel image files from under /boot/ on eMMC partition 2.

❸ Copy the kernel image file to /boot/ on eMMC partition 2. The filename must be renamed to either "Image.bin" or "linux.bin".

Figure 12.4. Installing Kernel Image to Debian GNU/Linux System

Chapter 13. Building the SGX Kernel Modules

This chapter covers how to cross build the PowerVR SGX DDK (Driver Development Kit) source code on the work PC and create the kernel modules.

When using a kernel image with Android that has had changes to configuration such as Kernel features which have a large effect on the kernel structure, in rare cases the SGX kernel modules may stop functioning. When using a customized kernel, SGX kernel modules must be made for that kernel.

The development environment must first be setup on the work PC by referring to Chapter 11, Development Environment Setup.

13.1. Obtaining Source Archive

Obtain the eurasia_km-[version].tar.gz SGX DDK source code archive. The source archive can be obtained from the included DVD-ROM.

13.2. Preparing Kernel

Kernel source code that has been previously built is required in order to build the SGX kernel modules. Build the kernel source code by referring to Chapter 12, Building the Kernel.

13.3. Building

Extract the source archive obtained in Section 13.1, “Obtaining Source Archive” and build it after having configured the parameters to suit the build environment. The commands below assume that the kernel source code built in Section 13.2, “Preparing Kernel” is in the ~/linux-2.6.35-a800eva directory.

dos2unix is used for the SGX kernel modules build. If it is not installed on the work PC, please install it as shown below.

```
[PC ~]# apt-get update
[PC ~]# apt-get install dos2unix
```

```
❶[PC ~]$tar zxvf eurasia_km-[version].tar.gz
❷[PC ~]$cd eurasia_km-[version]/eurasiacon/build/linux2/r8a7740_android
❸[PC ~/eurasia_km-[version]/eurasiacon/build/linux2/r8a7740_android]$make
ARCH=arm KERNEL_CROSS_COMPILE=arm-linux-gnueabi- CROSS_COMPILE=arm-linux-gnueabi-
TARGET_PRODUCT=armadillo-800eva HAL_VARIANT=armadillo-800eva KERNELDIR=~/
linux-2.6.35-a800eva
(abbreviated)
  MODPOST 3 modules
  CC      /home/atmark/eurasia_km-[version]/eurasiacon/
binary2_r8a7740_android_release/target/kbuild/bc_example.mod.o
  LD [M]  /home/atmark/eurasia_km-[version]/eurasiacon/
binary2_r8a7740_android_release/target/kbuild/bc_example.ko
  CC      /home/atmark/eurasia_km-[version]/eurasiacon/
binary2_r8a7740_android_release/target/kbuild/pvrsrvkm.mod.o
  LD [M]  /home/atmark/eurasia_km-[version]/eurasiacon/
binary2_r8a7740_android_release/target/kbuild/pvrsrvkm.ko
  CC      /home/atmark/eurasia_km-[version]/eurasiacon/
binary2_r8a7740_android_release/target/kbuild/shmobilelfb.mod.o
  LD [M]  /home/atmark/eurasia_km-[version]/eurasiacon/
binary2_r8a7740_android_release/target/kbuild/shmobilelfb.ko
❹[PC ~/eurasia_km-[version]/eurasiacon/build/linux2/r8a7740_android]$ls ../../../
binary2_r8a7740_android_release/target/kbuild/*ko
../../../binary2_r8a7740_android_release/target/kbuild/bc_example.ko
../../../binary2_r8a7740_android_release/target/kbuild/pvrsrvkm.ko
../../../binary2_r8a7740_android_release/target/kbuild/shmobilelfb.ko
```

❶ Extract the SGX DDK source code archive

❷ Move to the source code directory

❸ Execute the build

❹ Three kernel modules are created

Figure 13.1. Building the SGX Kernel Modules

13.4. Installing

Install the SGX kernel modules to the Android system in the internal storage. Debian GNU/Linux must first be booted from an SD card by referring to Chapter 9, Utilizing SD Booting.

It is assumed that the SGX kernel modules created in Section 13.3, “Building” are in the current directory.

```
[armadillo ~]$ls
bc_example.ko  pvrsrvkm.ko  shmobilelfb.ko
❶[armadillo ~]$mount /dev/mmcblk0p4 /mnt
❷[armadillo ~]$cp *.ko /mnt/lib/modules/
[armadillo ~]$umount /mnt
```

❶ Mount eMMC partition 4.

❷ Copy the kernel modules to /lib/modules/ on eMMC partition 4.

Figure 13.2. Installing SGX Kernel Modules

Chapter 14. Building the Wireless LAN (AWL13) Linux Device Driver

This chapter covers how to cross build the device driver source code for the Armadillo-WLAN (AWL13) wireless LAN module on the work PC and create the kernel module.

The development environment must first be setup on the work PC by referring to Chapter 11, Development Environment Setup.

14.1. Obtaining Source Archive

Obtain the awl13-[version].tar.gz AWL13 device driver source archive. The source archive can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com) or the included DVD-ROM.

14.2. Preparing Kernel

Kernel source code that has been previously built is required in order to build the AWL13 device driver source code. Build the kernel source code by referring to Chapter 12, Building the Kernel. The following configuration must be enabled.[1]

- CONFIG_MMC
- CONFIG_SYSFS
- CONFIG_WIRELESS_EXT

14.3. Building

Extract the source archive obtained in Section 14.1, “Obtaining Source Archive” and build it after having configured the parameters to suit the build environment. The commands below assume that the kernel source code built in Section 14.2, “Preparing Kernel” is in the ~/linux-2.6.35-a800eva-[version] directory.

[1] Enabled in the default Armadillo-800 EVA configuration.

```
❶[PC ~]$tar zxvf awl13-[version].tar.gz
❷[PC ~]$cd awl13-[version]
❸[PC ~/awl13-[version]]$AWL13_DEVICE=SDIO make ARCH=arm CROSS_COMPILE=arm-linux-
gnueabi- KERNELDIR=~/linux-2.6.35-a800eva-[version]
make -C ../linux-2.6.35-a800eva-[version]/ M=/home/atmark/aerial-awl13 modules
make[1]: Entering directory `/home/atmark/linux-2.6.35-a800eva-[version]'
  CC [M]  /home/atmark/aerial-awl13/src/awl13_log.o
  CC [M]  /home/atmark/aerial-awl13/src/awl13_sdiodrv.o
  CC [M]  /home/atmark/aerial-awl13/src/awl13_ioctl.o
  CC [M]  /home/atmark/aerial-awl13/src/awl13_fw.o
  CC [M]  /home/atmark/aerial-awl13/src/awl13_sysfs.o
  CC [M]  /home/atmark/aerial-awl13/src/awl13_wid.o
  LD [M]  /home/atmark/aerial-awl13/src/awl13_sdio.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /home/atmark/aerial-awl13/src/awl13_sdio.mod.o
  LD [M]  /home/atmark/aerial-awl13/src/awl13_sdio.ko
make[1]: Leaving directory `/home/atmark/linux-2.6.35-a800eva-[version]'
❹[PC ~/awl13-[version]]$ls src/awl13_sdio.ko
  awl13_sdio.ko
```

❶ Extract the AWL13 source code archive

❷ Move to the source code directory

❸ Execute the build

❹ The awl13_sdio.ko kernel module has been created

Figure 14.1. Building the AWL13 Driver

Specify the host interface for AWL13_DEVICE. On Armadillo-800 EVA the AWL13 is configured to operate in SDIO boot mode.

14.4. Installing

Install the AWL13 kernel module to the Debian GNU/Linux system in the internal storage. Debian GNU/Linux must first be booted from an SD card by referring to Chapter 9, Utilizing SD Booting.

It is assumed that the AWL13 kernel module created in Section 14.3, “Building” is in the current directory.

```
[armadillo ~]$ls
awl13_sdio.ko
❶[armadillo ~]$mount /dev/mmcblk0p2 /mnt
❷[armadillo ~]$cp awl13_sdio.ko /lib/modules/$(uname -r)/awl13/
[armadillo ~]$umount /mnt
```

❶ Mount eMMC partition 2.

❷ Copy the kernel module to /lib/modules/$(uname -r)/awl13/ on eMMC partition 2.

Figure 14.2. Installing AWL13 Kernel Module

Chapter 15. Building the Bootloader

This chapter covers how to cross build the bootloader source code on the work PC and create a bootloader image file.

The development environment must first be setup on the work PC by referring to Chapter 11, Development Environment Setup.

15.1. Obtaining Source Archive

Obtain the hermit-at-[version]-source.tar.gz bootloader source archive. The source archive can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com) or the included DVD-ROM.

> Hermit-At v3 series is used for the Armadillo-800 EVA bootloader.

15.2. Extracting Source Archive

Extract the obtained source archive as shown in Figure 15.1, “Extracting Source Archive”.

```
[PC ~]#ls
hermit-at-[version]-source.tar.gz
[PC ~]#tar zxvf hermit-at-[version]-source.tar.gz
hermit-at-[version]  hermit-at-[version]-source.tar.gz
```

Figure 15.1. Extracting Source Archive

15.3. Building

Build the extracted source archive to create the bootloader image file as shown in Figure 15.2, “Building the Bootloader”.

```
❶[PC ~]$cd hermit-at-[version]
❷[PC ~/hermit-at-[version]]$make armadillo800eva_defconfig
❸[PC ~/hermit-at-[version]]$make
❹[PC ~/hermit-at-[version]]$ls src/target/armadillo8x0/loader-armadillo8x0-v[version].bin
src/target/armadillo8x0/loader-armadillo8x0-v[version].bin
```

❶ Move to the source code directory

❷ Apply the default configuration

❸ Build the source code

❹ Confirm that the bootloader image file has been created

Figure 15.2. Building the Bootloader

15.4. Installing

Install the bootloader image to the boot partition on the internal storage. Debian GNU/Linux must first be booted from an SD card by referring to Chapter 9, Utilizing SD Booting.

It is assumed that the bootloader image file created in Section 15.3, “Building” is in the current directory.

```
[armadillo ~]$ls
loader-armadillo8x0-v[version].bin
❶[armadillo ~]$echo 0 > /sys/block/mmcblk0boot0/force_ro
❷[armadillo ~]$cat ~/loader-armadillo8x0-v[version].bin > /dev/mmcblk0boot0
[armadillo ~]$sync
```

❶ Release the boot partition software write protection.

❷ Write the bootloader image to the partition.

Figure 15.3. Installing Bootloader Image

Chapter 16. Using JTAG ICE

This chapter explains how to connect a JTAG ICE in order to carry out ARM debugging.

16.1. Preparation

16.1.1. JTAG Cable Connections

Connect the JTAG ICE cable to the ARM JTAG interface (standard ARM 20-pin connector). For detailed information on the signal layout and so on, please refer to Section 18.6, “CON6 (ARM JTAG Interface)”.

16.1.2. DIP Switch Configuration

Set the DIP switch JTAG configuration to ARM. Please refer to Figure 16.1, “DIP Switch JTAG Configuration (ARM)” and set JTAG Configuration 1 (SW1.7) to on and JTAG Configuration 2 (SW1.8) to off.

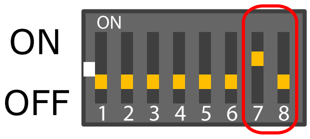


Figure 16.1. DIP Switch JTAG Configuration (ARM)

16.2. Connection Confirmation

Once configured in accordance with Section 16.1, “Preparation”, the CPU will be seen as shown below.

Item	Value
Device ID	0x4BA00477
Command Length	4

16.3. Debugger Support

For information on whether or not your debugger supports Armadillo-800 EVA, please contact the debugger maker.

Chapter 17. Linux Kernel Specifications

This chapter covers the Linux kernel specifications. The linux-2.6.35-a800eva-[version].tar.gz Linux kernel source archive can be obtained from the Armadillo Site (http://armadillo.atmark-techno.com) or the included DVD-ROM.

17.1. Default Configuration

A default configuration is used for the Linux kernel installed in the internal storage in the factory default state. The file that describes this default configuration for Armadillo-800 EVA is `arch/arm/configs/armadillo800eva_android_defconfig` included in the Linux kernel source.

On Armadillo-800 EVA, while the boot device that stores the Linux kernel differs depending on the operating system, the same Linux kernel is used. The default configuration is generalized in such a way that the Linux kernel can operate with all the operating systems installed in the internal storage in the factory default state.

Table 17.1. Operating System and Default Configuration

OS	Boot Device	Configuration
Debian GNU/Linux	mmcblk0p2	armadillo800eva_android_defconfig
Android	mmcblk0p4	

17.2. Android Functionality

On Armadillo-800 EVA, a common Linux kernel (source code and default configuration) is used for both Debian GNU/Linux and Android. Because of this, the behavior of a number of functions differ to that of standard Debian GNU/Linux or Android.

Android functions can be enabled or disabled in the kernel configuration. A list of the main Android functions and their state in the default configuration is shown in Table 17.2, “Main Configuration for Android Functionality”.

Table 17.2. Main Configuration for Android Functionality

Configuration	Default	Function
ANDROID_BINDER_IPC	Enabled	Android inter-process communication
ASHMEM	Enabled	Anonymous shared memory
ANDROID_PMEM	Enabled	Android process memory allocator
UID_STAT	Enabled	`/proc/uid_stat/` support
ANDROID_LOGGER	Enabled	Android logger
WAKELOCK	Enabled	Expanded power management (wake lock)
WAKELOCK_STAT	Enabled	`/proc/wakelocks` support
USER_WAKELOCK	Enabled	User space suspend prevention
EARLYSUSPEND	Enabled	Expanded power management (early suspend)
ANDROID_LOW_MEMORY_KILLER	Enabled	Android OOM (Out Of Memory) handling
RTC_INTF_ALARM	Enabled	Android alarms
ANDROID_TIMED_OUTPUT	Enabled	Android timer output
ANDROID_TIMED_GPIO	Disabled	Android GPIO timer output
ANDROID_PARANOID_NETWORK	Disabled	Android network protection
ANDROID_RAM_CONSOLE	Disabled	Android console RAM buffer

17.3. Linux Driver List

The following shows the Linux drivers used to control Armadillo-800 EVA with their source code paths and controllable devices.

Board Configuration

Source Code	arch/arm/mach-shmobile/board-armadillo800eva.c

Timer Driver

Source Code	arch/arm/mach-shmobile/sh_cmt.c

Interrupt Controller Driver

Source Code	arch/arm/mach-shmobile/intc-sh7740.c

PWM Driver

Source Code	arch/arm/mach-shmobile/tpu-pwm.c

UART Driver

Source Code	drivers/serial/sh-sci.c
Device File	/dev/ttySC1 (CON22)

Ethernet Driver

Source Code	drivers/net/sh_eth.c
Device	eth0 (CON23)

MMC Host Driver

Source Code	drivers/mmc/host/sh_mmcif.c
Device	/dev/mmcblk0

SD Host Driver

Source Code	drivers/mmc/host/sh_mobile_sdhi.c
Device	/dev/mmcblk1 /dev/mmcblk2

USB Host Driver

Source Code	drivers/usb/host/ehci-rmobile.c drivers/usb/host/ohci-rmobile.c

Frame Buffer Driver

Source Code	drivers/video/rmobile_lcdcfb.c
Device	/dev/fb0 (CON17) /dev/fb1 (CON3 or CON14)

Capture Interface Driver

Source Code	drivers/media/video/sh_mobile_ceu_camera.c

Camera Driver

Source Code	drivers/media/video/mt9t112.c
Device	/dev/video0

Real-Time Clock Driver

Source Code	drivers/rtc/rtc-s35390a.c
Device	/dev/rtc0

Touchscreen Driver

Source Code	drivers/input/touchscreen/st1232.c
Device	/dev/input/event1

Button Switch Key Driver

Source Code	drivers/input/keyboard/gpio_keys.c
Device	/dev/input/event0

LCD Backlight Driver

Source Code	drivers/video/backlight/pwm_bl.c
Device	/sys/class/backlight/pwm-backlight.0

LED Driver

Source Code	drivers/leds/leds-gpio.c
Device	/sys/class/leds/LED3 (LED3) /sys/class/leds/LED4 (LED4) /sys/class/leds/LED5 (LED5) /sys/class/leds/LED6 (LED6)

Audio Driver

Source Code	sound/soc/sh/fsi-wm8978.c sound/soc/sh/fsi-hdmi.c sound/soc/sh/fsi.c sound/soc/codecs/wm8978.c
Device	hw:0 (CON10/11/12/13) hw:1 (CON3)

Chapter 18. Interface Specifications

18.1. CON1 (Camera Module Interface)

CON1 is an interface for connecting a camera module.

- Supported camera module: DCB-NSB55QFMRB-S-05-02 (CRESYN)

Table 18.1. CON1 Signals

Pin Number	Signal Name	I/O	Function
1	CAM0_2V8_D6	In	Data bus (bit6), connected to VIO_D6_0 pin on R-Mobile A1
2	CAM0_2V8_D7	In	Data bus (bit7), connected to VIO_D7_0 pin on R-Mobile A1
3	NC	-	Not connected
4	NC	-	Not connected
5	CAM0_2V8_STANDBY	Out	Standby signal, connected to D22 pin on R-Mobile A1
6	VCC_CAM2.8V	Power	Power (VCC_CAM2.8V)
7	VCC_CAM2.8V	Power	Power (VCC_CAM2.8V)
8	DGND	Power	Power (DGND)
9	CAM0_2V8_PCLK	In	Clock signal input, connected to VIO_CLK_0 pin on R-Mobile A1
10	DGND	Power	Power (DGND)
11	CAM0_2V8_MCLK	Out	Clock signal output, connected to VIO_CKO_0 pin on R-Mobile A1
12	CAM0_2V8_SCL	Out	I2C clock, connected to I2C_SCL_0 pin on R-Mobile A1
13	CAM0_2V8_D3	In	Data bus (bit3), connected to VIO_D3_0 pin on R-Mobile A1
14	CAM0_2V8_D2	In	Data bus (bit2), connected to VIO_D2_0 pin on R-Mobile A1
15	CAM0_2V8_D1	In	Data bus (bit1), connected to VIO_D1_0 pin on R-Mobile A1
16	CAM0_2V8_D0	In	Data bus (bit0), connected to VIO_D0_0 pin on R-Mobile A1
17	CAM0_2V8_D4	In	Data bus (bit4), connected to VIO_D4_0 pin on R-Mobile A1
18	CAM0_2V8_D5	In	Data bus (bit5), connected to VIO_D5_0 pin on R-Mobile A1
19	CAM0_2V8_SDA	In/Out	I2C data, connected to I2C_SDA_0 pin on R-Mobile A1
20	GPIO4_FLASH	In/Out	Connected to LED1 (high: on, low: off)
21	VCC_CAM1.8V	Power	Power (VCC_CAM1.8V)
22	CAM0_2V8_RESET#	Out	Reset signal, connected to D23 pin on R-Mobile A1
23	CAM0_2V8_VSYNC	In	VSYNC signal, connected to VIO_VD_0 pin on R-Mobile A1
24	CAM0_2V8_HSYNC	In	HSYNC signal, connected to VIO_HD_0 pin on R-Mobile A1

18.2. CON2 (Expansion Bus Interface)

CON2 is an interface for bus expansion. A connector is not mounted.

- Board side connector example: XG4C-6431 (OMRON)
- Corresponding connector example: XG4M-6431 (OMRON)

Table 18.2. CON2 Signals

Pin Number	Signal Name	I/O	Function
1	VCC_3.3V	Power	Power (VCC_3.3V)
2	DGND	Power	Power (DGND)
3	A1_D0	In/Out	Data bus (bit0), connected to D0 pin on R-Mobile A1
4	A1_D1	In/Out	Data bus (bit1), connected to D1 pin on R-Mobile A1
5	A1_D2	In/Out	Data bus (bit2), connected to D2 pin on R-Mobile A1
6	A1_D3	In/Out	Data bus (bit3), connected to D3 pin on R-Mobile A1

Pin Number	Signal Name	I/O	Function
7	A1_D4	In/Out	Data bus (bit4), connected to D4 pin on R-Mobile A1
8	A1_D5	In/Out	Data bus (bit5), connected to D5 pin on R-Mobile A1
9	A1_D6	In/Out	Data bus (bit6), connected to D6 pin on R-Mobile A1
10	A1_D7	In/Out	Data bus (bit7), connected to D7 pin on R-Mobile A1
11	A1_D8	In/Out	Data bus (bit8), connected to D8 pin on R-Mobile A1
12	A1_D9	In/Out	Data bus (bit9), connected to D9 pin on R-Mobile A1
13	A1_D10	In/Out	Data bus (bit10), connected to D10 pin on R-Mobile A1
14	A1_D11	In/Out	Data bus (bit11), connected to D11 pin on R-Mobile A1
15	A1_D12	In/Out	Data bus (bit12), connected to D12 pin on R-Mobile A1
16	A1_D13	In/Out	Data bus (bit13), connected to D13 pin on R-Mobile A1
17	A1_D14	In/Out	Data bus (bit14), connected to D14 pin on R-Mobile A1
18	A1_D15	In/Out	Data bus (bit15), connected to D15 pin on R-Mobile A1
19	EXT_MMC_RST_B	In/Out	External reset signal, connected to MEMC_NWE pin on R-Mobile A1
20	A1_CS6A_B	In/Out	Chip select 6A, connected to CS6A# pin on R-Mobile A1
21	A1_CS5B_B	In/Out	Chip select 5B, connected to CS5B# pin on R-Mobile A1
22	A1_CS5A_B	In/Out	Chip select 5A, connected to CS5A# pin on R-Mobile A1
23	A1_CS0_B	In/Out	Chip select 0, connected to CS0#pin on R-Mobile A1
24	A1_RESETOUTS_B	In/Out	Reset signal, connected to RESETOUTS# pin on R-Mobile A1
25	A1_RD_B	In/Out	Read signal, connected to RD# pin on R-Mobile A1
26	A1_RDWR	In/Out	Readwrite signal, connected to RDWR pin on R-Mobile A1
27	A1_WE1_B	In/Out	Write enable signal 1, connected to WE1# pin on R-Mobile A1
28	A1_WE0_B	In/Out	Write enable signal 0, connected to WE0# pin on R-Mobile A1
29	A1_DACK0_B	In/Out	DACK signal 0, connected to DACK_0 pin on R-Mobile A1
30	A1_DREQ0_B	In/Out	DREQ signal 0, connected to DREQ_0 pin on R-Mobile A1
31	A1_ICIORD	In/Out	ICIORD signal, connected to WE2# pin on R-Mobile A1
32	A1_ICIOWR	In/Out	ICIOWR signal, connected to WE3# pin on R-Mobile A1
33	A1_IOIS16_B	In/Out	IOIS16 signal, connected to IOIS16# pin on R-Mobile A1
34	A1_BSCMD	In/Out	BSCMD signal, connected to BSCMD pin on R-Mobile A1
35	A1_CKO	In/Out	CKO signal, connected to CKO pin on R-Mobile A1
36	DGND	Power	Power (DGND)
37	A1_A0	In/Out	Address bus (bit0), connected to A0 pin on R-Mobile A1
38	A1_A1	In/Out	Address bus (bit1), connected to A1 pin on R-Mobile A1
39	A1_A2	In/Out	Address bus (bit2), connected to A2 pin on R-Mobile A1
40	A1_A3	In/Out	Address bus (bit3), connected to A3 pin on R-Mobile A1
41	A1_A4	In/Out	Address bus (bit4), connected to A4 pin on R-Mobile A1
42	A1_A5	In/Out	Address bus (bit5), connected to A5 pin on R-Mobile A1
43	A1_A6	In/Out	Address bus (bit6), connected to A6 pin on R-Mobile A1
44	A1_A7	In/Out	Address bus (bit7), connected to A7 pin on R-Mobile A1
45	A1_A8	In/Out	Address bus (bit8), connected to A8 pin on R-Mobile A1
46	A1_A9	In/Out	Address bus (bit9), connected to A9 pin on R-Mobile A1
47	A1_A10	In/Out	Address bus (bit10), connected to A10 pin on R-Mobile A1
48	A1_A11	In/Out	Address bus (bit11), connected to A11 pin on R-Mobile A1
49	A1_A12	In/Out	Address bus (bit12), connected to A12 pin on R-Mobile A1
50	A1_A13	In/Out	Address bus (bit13), connected to A13 pin on R-Mobile A1
51	A1_A14	In/Out	Address bus (bit14), connected to A14 pin on R-Mobile A1
52	A1_A15	In/Out	Address bus (bit15), connected to A15 pin on R-Mobile A1
53	A1_A16	In/Out	Address bus (bit16), connected to A16 pin on R-Mobile A1
54	A1_A17	In/Out	Address bus (bit17), connected to A17 pin on R-Mobile A1
55	A1_A18	In/Out	Address bus (bit18), connected to A18 pin on R-Mobile A1
56	A1_A19	In/Out	Address bus (bit19), connected to A19 pin on R-Mobile A1
57	A1_A20	In/Out	Address bus (bit20), connected to A20 pin on R-Mobile A1
58	A1_A21	In/Out	Address bus (bit21), connected to A21 pin on R-Mobile A1
59	A1_A22	In/Out	Address bus (bit22), connected to A22 pin on R-Mobile A1
60	A1_A23	In/Out	Address bus (bit23), connected to A23 pin on R-Mobile A1

Pin Number	Signal Name	I/O	Function
61	A1_A24	In/Out	Address bus (bit24), connected to A24 pin on R-Mobile A1
62	A1_A25	In/Out	Address bus (bit25), connected to A25 pin on R-Mobile A1
63	VCC_3.3V	Power	Power (VCC_3.3V)
64	DGND	Power	Power (DGND)

18.3. CON3 (Digital HD Output Interface)

CON3 is a digital HD output interface. It has a HDMI Type-A connector mounted.

Table 18.3. CON3 Signals

Pin Number	Signal Name	I/O	Function
1	TX2_P	Out	TMDS data 2 +, connected to TODP2 pin on R-Mobile A1
2	-	-	TMDS data 2 shield, connected to DGND
3	TX2_N	Out	TMDS data 2 -, connected to TODN2 pin on R-Mobile A1
4	TX1_P	Out	TMDS data 1 +, connected to TODP1 pin on R-Mobile A1
5	-	-	TMDS data 1 shield, connected to DGND
6	TX1_N	Out	TMDS data 1 -, connected to TODN1 pin on R-Mobile A1
7	TX0_P	Out	TMDS data 0 +, connected to TODP0 pin on R-Mobile A1
8	-	-	TMDS data 0 shield, connected to DGND
9	TX0_N	Out	TMDS data 0 -, connected to TODN0 pin on R-Mobile A1
10	TMC_P	Out	TMDS clock +, connected to TOCP pin on R-Mobile A1
11	-	-	TMDS clock shield, connected to DGND
12	TXC_N	Out	TMDS clock -, connected to TOCN pin on R-Mobile A1
13	DDC_CEC	In/Out	Not Connected[a]
14	NC	-	Not connected
15	DDC_SCL	In/Out	SCL, connected to HDMI_SCL pin on R-Mobile A1
16	DDC_SDA	In/Out	SDA, connected to HDMI_SDA pin on R-Mobile A1
17	DGND	Power	Power (DGND)
18	DDC_5.0V	Power	Power (DDC_5.0V)
19	DDC_HPD	In	Hot plug detect, connected to HDMI_HPD pin on R-Mobile A1

[a] To address the issue "A800-EVA-ERRATUM #2: A Voltage over the HDMI Standard is Applied to the HDMI CEC Signal Line", CEC is now non-connected. Please refer to the "Armadillo-800 EVA Revision Information" for more details.

18.4. CON4 (Composite Video Output Interface)

CON4 is a composite video output interface. It has a yellow RCA jack mounted.

Table 18.4. CON4 Signals

Pin Number	Signal Name	I/O	Function
1	YCVBSOUT	Out	Composite video output, connected to YCVBSOUT pin on R-Mobile A1
2	DGNC	Power	Power (DGND)

18.5. CON5 (H-UDI JTAG Interface)

CON5 is a H-UDI JTAG interface. A connector is not mounted.

- Board side connector example: XG4C-1431 (OMRON)
- Corresponding connector example: XG4M-1431 (OMRON)

> ⚠ As CON5 and CON6 share the same signal lines, they cannot be used at the same time.

Table 18.5. CON5 Signals

Pin Number	Signal Name	I/O	Function
1	A1_TCK	In	TCK signal, connected to TCK pin on R-Mobile A1
2	A1_TRST_B	In	TRST signal, connected to TRST# pin on R-Mobile A1
3	A1_TDO	Out	TDO signal, connected to TDO pin on R-Mobile A1
4	A1_EDBGREQ/ ASEBRK_B	In	ASEBRK signal, connected to EDBGREQ pin on R-Mobile A1
5	A1_TMS	In	TMS signal, connected to TMS pin on R-Mobile A1
6	A1_TDI	In	TDI signal, connected to TDI pin on R-Mobile A1
7	RESETP_B	In	Reset signal (low: reset, high: reset inactive), connected to RESETP# pin on R-Mobile A1
8	NC	-	Not connected
9	DGND	Power	Power (DGND)
10	DGND	Power	Power (DGND)
11	VCC_3.3V	Power	Power (VCC_3.3V)
12	DGND	Power	Power (DGND)
13	DGND	Power	Power (DGND)
14	DGND	Power	Power (DGND)

18.6. CON6 (ARM JTAG Interface)

CON6 is an ARM JTAG interface. It has a XG4C-2031 (OMRON) connector mounted.

- Corresponding connector example: XG4M-2031 (OMRON)

> ⚠ As CON5 and CON6 share the same signal lines, they cannot be used at the same time.

Table 18.6. CON6 Signals

Pin Number	Signal Name	I/O	Function
1	VCC_3.3V	Power	Power (VCC_3.3V)
2	VCC_3.3V	Power	Power (VCC_3.3V)
3	A1_TRST_B	In	TRST signal, connected to TRST# pin on R-Mobile A1
4	DGND	Power	Power (DGND)
5	A1_TDI	In	TDI signal, connected to TDI pin on R-Mobile A1
6	DGND	Power	Power (DGND)
7	A1_TMS	In	TMS signal, connected to TMS pin on R-Mobile A1
8	DGND	Power	Power (DGND)
9	A1_TCK	In	TCK signal, connected to TCK pin on R-Mobile A1
10	DGND	Power	Power (DGND)
11	A1_RTCK	Out	RTCK signal, connected to RTCK pin on R-Mobile A1
12	DGND	Power	Power (DGND)
13	A1_TDO	Out	TDO signal, connected to TDO pin on R-Mobile A1
14	DGND	Power	Power (DGND)
15	SRST_IN_B_OD	In	Reset signal (low: reset, high: reset inactive), connected to RESETP# pin on R-Mobile A1
16	DGND	Power	Power (DGND)
17	A1_EDBGREQ/ ASEBRK_B	In	DBGRQ signal, connected to EDBGREQ pin on R-Mobile A1
18	DGND	Power	Power (DGND)

Pin Number	Signal Name	I/O	Function
19	NC	-	Connects to pin 17 on CON6 when resistor mounted at R45
20	DGND	Power	Power (DGND)

18.7. CON7 (SD Interface 1)

CON7 is an SD slot.

Table 18.7. CON7 Signals

Pin Number	Signal Name	I/O	Function
1	A1_SDHI0_D3	In/Out	SD data (bit3), connected to SDHID3_0 pin on R-Mobile A1
2	A1_SDHI0_CMD	In/Out	SD command, connected to SDHICMD_0 pin on R-Mobile A1
3	DGND	Power	Power (DGND)
4	VCC_SD0	Power	Power (VCC_SD0)
5	A1_SDHI0_CLK	Out	SD clock, connected to SDHICLK_0 pin on R-Mobile A1
6	DGND	Power	Power (DGND)
7	A1_SDHI0_D0	In/Out	SD data (bit0), connected to SDHID0_0 pin on R-Mobile A1
8	A1_SDHI0_D1	In/Out	SD data (bit1), connected to SDHID1_0 pin on R-Mobile A1
9	A1_SDHI0_D2	In/Out	SD data (bit2), connected to SDHID2_0 pin on R-Mobile A1
10	A1_SDHI0_CD	In	SD card detect (low: card inserted, high: card removed), connected to D20 pin on R-Mobile A1
11	FG	Power	Power (DGND)
12	A1_SDHI0_WP	In	Write protect (low: writable, high: not writable), connected to SDHIWP_0 pin on R-Mobile A1
13	DGND	Power	Power (DGND)
14	DGND	Power	Power (DGND)
15	DGND	Power	Power (DGND)
18	DGND	Power	Power (DGND)

18.8. CON8 (SD Interface 2)

CON8 is an SD slot.

⚠

As CON8 and CON14 share the same signal lines, they cannot be used at the same time.

The selection of which interface the signals used with CON8 and CON14 are connected to is done with the DIP switch (SW1) SDHI1 configuration. For details, please refer to Table 4.3, “DIP Switch (SW1) Switch Functions” or Section 18.25, “SW1 (Function Selection Switch)”.

Table 18.8. CON8 Signals

Pin Number	Signal Name	I/O	Function
1	SDSLOT2_SDHI1_D3	In/Out	SD data (bit3), connected to MEMC_AD11 pin on R-Mobile A1
2	SDSLOT2_SDHI1_CMD	In/Out	SD command, connected to MEMC_CS0 pin on R-Mobile A1
3	DGND	Power	Power (DGND)
4	VCC_SD0	Power	Power (VCC_SD0)
5	SDSLOT2_SDHI1_CLK	In/Out	SD clock, connected to MEMC_INT pin on R-Mobile A1
6	DGND	Power	Power (DGND)
7	SDSLOT2_SDHI1_D0	In/Out	SD data (bit0), connected to MEMC_AD8 pin on R-Mobile A1
8	SDSLOT2_SDHI1_D1	In/Out	SD data (bit1), connected to MEMC_AD9 pin on R-Mobile A1

Pin Number	Signal Name	I/O	Function
9	SDSLOT2_SDHI1_D2	In/Out	SD data (bit2), connected to MEMC_AD10 pin on R-Mobile A1
10	SDSLOT2_SDHI1_CD	In	SD card detect (low: card inserted, high: card removed), connected to MEMC_AD12 pin on R-Mobile A1
11	FG	Power	Power (DGND)
12	SDSLOT2_SDHI1_WP	In	Write protect (low: writable, high: not writable), connected to MEMC_AD13 pin on R-Mobile A1
13	DGND	Power	Power (DGND)
14	DGND	Power	Power (DGND)
15	DGND	Power	Power (DGND)
18	DGND	Power	Power (DGND)

18.9. CON9 (RTC External Backup Interface)

CON9 is an external RTC backup interface.

- Compatible battery: CR2032

Table 18.9. CON9 Signals

Pin Number	Signal Name	I/O	Function
1	BAT	Power	RTC backup power in
2	DGND	Power	Power (DGND)

18.10. CON10 - CON13 (Audio Interfaces)

CON10 - CON13 are audio interfaces. They are connected to the R-Mobile A1 via an audio codec.

18.10.1. CON10 (Mono Mic In Interface)

This is a mono microphone input interface. It has a dia. 3.5mm mini-jack mounted.

Table 18.10. CON10 Signals

Pin Number	Signal Name	I/O	Function
1	MIC_IN	In	Mic in signal
2	AGND_DA	Power	Power (AGND_DA)
3	AGND_DA	Power	Power (AGND_DA)
5	AGND_DA	Power	Power (AGND_DA)

18.10.2. CON11 (Stereo Headphone Out Interface)

CON11 is a stereo headphone output interface. It has a dia. 3.5mm mini-jack mounted.

Table 18.11. CON11 Signals

Pin Number	Signal Name	I/O	Function
1	HP_OUT_L	Out	Headphone out (left channel)
2	GPIO	In	Headphone detect
3	HP_OUT_R	Out	Headphone out (right channel)
5	AGND_DA	Power	Power (AGND_DA)

18.10.3. CON12 (Stereo Line Out (L) Interface)

CON12 is a stereo line output (L) interface. It has a white RCA jack mounted.

Table 18.12. CON12 Signals

Pin Number	Signal Name	I/O	Function
1	LINE_OUT_L	Out	Line out (left channel)
2	AGND_DA	Power	Power (AGND_DA)

18.10.4. CON13 (Stereo Line Out (R) Interface)

CON13 is a stereo line output (R) interface. It has a red RCA jack mounted.

Table 18.13. CON13 Signals

Pin Number	Signal Name	I/O	Function
1	LINE_OUT_R	Out	Line out (right channel)
2	AGND_DA	Power	Power (AGND_DA)

18.11. CON14 (AWL13 Module Interface)

CON14 is an AWL13 module interface. It is connected to the AWL13 control signals and is configured to operate in SDIO boot mode.

> As CON8 and CON14 share the same signal lines, they cannot be used at the same time.
>
> The selection of which interface the signals used with CON8 and CON14 are connected to is done with the DIP switch (SW1) SDHI1 configuration. For details, please refer to Table 4.3, “DIP Switch (SW1) Switch Functions” or Section 18.25, “SW1 (Function Selection Switch)”.

Table 18.14. CON14 Signals

Pin Number	Signal Name	I/O	Function
1	SDDATA1	In/Out	SDIO data (bit1), connected to MEMC_AD9 pin on R-Mobile A1
2	SDDATA0	In/Out	SDIO data (bit0), connected to MEMC_AD8 pin on R-Mobile A1
3	DGND	Power	Power (DGND)
4	DGND	Power	Power (DGND)
5	NC	-	Not connected
6	NC	-	Not connected
7	SDCLK	Out	SDIO clock, connected to MEMC_INT pin on R-Mobile A1
8	VCC_SD1	Power	Power (VCC_SD1)
9	NC	-	Not connected
10	SDCMD	Out	SDIO command, connected to MEMC_CS0 pin on R-Mobile A1
11	SDDATA3	In/Out	SDIO data (bit3), connected to MEMC_AD11 pin on R-Mobile A1
12	SDDATA2	In/Out	SDIO data (bit2), connected to MEMC_AD10 pin on R-Mobile A1
13	NC	-	Not connected
14	NC	-	Not connected
15	BOOT_SEL1	Out	SDIO boot mode selection (BOOT_SEL1: low, BOOT_SEL0: high, HOST_SEL: high)
16	BOOT_SEL0	Out	
17	HOST_SEL	Out	
18	NC	-	Not connected
19	NC	-	Not connected
20	NC	-	Not connected
21	NC	-	Not connected

Pin Number	Signal Name	I/O	Function
22	NC	-	Not connected
23	NC	-	Not connected
24	NC	-	Not connected
25	NC	-	Not connected
26	NC	-	Not connected
27	NC	-	Not connected
28	HRST	In	Connected to VCC_SD1
29	NC	-	Not connected
30	NC	-	Not connected
31	NC	-	Not connected
32	NC	-	Not connected
33	NC	-	Not connected
34	NC	-	Not connected

18.12. CON15 (Expansion Interface)

CON15 is an expansion interface. A connector is not mounted.

- Board side connector example: XG4C-6031 (OMRON)
- Corresponding connector example: XG4M-6031 (OMRON)

Table 18.15. CON15 Signals

Pin Number	Signal Name	I/O	Function
1	VCC_5V	Power	Power (VCC_5V)
2	VCC_5V	Power	Power (VCC_5V)
3	VCC_3.3V	Power	Power (VCC_3.3V)
4	VCC_3.3V	Power	Power (VCC_3.3V)
5	DGND	Power	Power (DGND)
6	DGND	Power	Power (DGND)
7	A1_VIO0_CKO	In/Out	Connected to VIO_CKO_0 pin on R-Mobile A1
8	A1_VIO0_CLK	In/Out	Connected to VIO_CLK_0 pin on R-Mobile A1
9	A1_VIO0_HD	In/Out	Connected to VIO_HD_0 pin on R-Mobile A1
10	A1_VIO0_VD	In/Out	Connected to VIO_VD_0 pin on R-Mobile A1
11	A1_VIO0_FIELD	In/Out	Connected to VIO_FIELD_0 pin on R-Mobile A1
12	A1_VIO0_D0	In/Out	Connected to VIO_D0_0 pin on R-Mobile A1
13	A1_VIO0_D1	In/Out	Connected to VIO_D1_0 pin on R-Mobile A1
14	A1_VIO0_D2	In/Out	Connected to VIO_D2_0 pin on R-Mobile A1
15	A1_VIO0_D3	In/Out	Connected to VIO_D3_0 pin on R-Mobile A1
16	A1_VIO0_D4	In/Out	Connected to VIO_D4_0 pin on R-Mobile A1
17	A1_VIO0_D5	In/Out	Connected to VIO_D5_0 pin on R-Mobile A1
18	A1_VIO0_D6	In/Out	Connected to VIO_D6_0 pin on R-Mobile A1
19	A1_VIO0_D7	In/Out	Connected to VIO_D7_0 pin on R-Mobile A1
20	A1_VIO0_STANDBY	In/Out	Connected to D22 pin on R-Mobile A1
21	A1_VIO0_RST_B	In/Out	Connected to D23 pin on R-Mobile A1
22	DGND	Power	Power (DGND)
23	A1_VIO1_CLK	In/Out	Connected to SCIFA_RXD_0 pin on R-Mobile A1
24	A1_VIO1_HD	In/Out	Connected to D29 pin on R-Mobile A1
25	A1_VIO1_VD	In/Out	Connected to SCIFA_TXD_0 pin on R-Mobile A1
26	A1_VIO1_D0	In/Out	Connected to VIO_D8_0 pin on R-Mobile A1
27	A1_VIO1_D1	In/Out	Connected to VIO_D9_0 pin on R-Mobile A1
28	A1_VIO1_D2	In/Out	Connected to VIO_D10_0 pin on R-Mobile A1
29	A1_VIO1_D3	In/Out	Connected to VIO_D11_0 pin on R-Mobile A1
30	A1_VIO1_D4	In/Out	Connected to VIO_D12_0 pin on R-Mobile A1

Pin Number	Signal Name	I/O	Function
31	A1_VIO1_D5	In/Out	Connected to VIO_D13_0 pin on R-Mobile A1
32	A1_VIO1_D6	In/Out	Connected to VIO_D14_0 pin on R-Mobile A1
33	A1_VIO1_D7	In/Out	Connected to VIO_D15_0 pin on R-Mobile A1
34	A1_VIO1_STANDBY	In/Out	Connected to SCIFA_RTS_0# pin on R-Mobile A1
35	A1_VIO1_RST_B	In/Out	Connected to SCIFA_CTS_0# pin on R-Mobile A1
36	CAM_DISABLE	In	Camera enable / disable switch signal (low: enable, high: disable)
37	VCC_3.3V	Power	Power (VCC_3.3V)
38	DGND	Power	Power (DNGD)
39	A1_STP0_IPCLK	In/Out	Connected to STP_IPCLK_0 pin on R-Mobile A1
40	A1_STP0_IPSYNC	In/Out	Connected to SCIFB_TXD pin on R-Mobile A1
41	A1_STP0_IPEN	In/Out	Connected to SCIFB_RXD pin on R-Mobile A1
42	A1_STP0_IPD0	In/Out	Connected to SCIFB_SCK pin on R-Mobile A1
43	A1_STP0_IPD1	In/Out	Connected to MEMC_AD1 pin on R-Mobile A1
44	A1_STP0_IPD2	In/Out	Connected to SCIFA_RTS_1# pin on R-Mobile A1
45	A1_STP0_IPD3	In/Out	Connected to MEMC_AD2 pin on R-Mobile A1
46	A1_STP0_IPD4	In/Out	Connected to MEMC_AD3 pin on R-Mobile A1
47	A1_STP0_IPD5	In/Out	Connected to SCIFA_CTS_1# pin on R-Mobile A1
48	A1_STP0_IPD6	In/Out	Connected to MEMC_WAIT pin on R-Mobile A1
49	A1_STP0_IPD7	In/Out	Connected to MEMC_NOE pin on R-Mobile A1
50	A1_SIM_D	In/Out	Connected to SCIFA_SCK_2 pin on R-Mobile A1
51	A1_SIM_CLK	In/Out	Connected to MEMC_ADV pin on R-Mobile A1
52	A1_SIM_RST	In/Out	Connected to MEMC_CS1 pin on R-Mobile A1
53	A1_PORT15	In/Out	Connected to FMSOIBT pin on R-Mobile A1
54	A1_PORT14	In/Out	Connected to FMSOILR pin on R-Mobile A1
55	RESETP_B	In/Out	Connected to RESETP# pin on R-Mobile A1
56	NC	-	Not connected
57	VCC_3.3V	Power	Power (VCC_3.3V)
58	DGND	Power	Power (DGND)
59	A1_SCL	In/Out	Connected to I2C_SCL_0 pin on R-Mobile A1
60	A1_SDA	In/Out	Connected to I2C_SDA_0 pin on R-Mobile A1

18.13. CON16 (LCD Interface 1)

CON16 is an LCD interface. A connector is not mounted.

> As CON16 and CON17 share the same signal lines, they cannot be used at the same time.

- Board side connector example: XG4C-5031 (OMRON)
- Corresponding connector example: XG4M-5031 (OMRON)

Table 18.16. CON16 Signals

Pin Number	Signal Name	I/O	Function
1	VCC_5V	Power	Power (VCC_5V)
2	VCC_5V	Power	Power (VCC_5V)
3	VCC_3.3V	Power	Power (VCC_3.3V)
4	VCC_3.3V	Power	Power (VCC_3.3V)
5	DGND	Power	Power (DGND)
6	DGND	Power	Power (DGND)

Pin Number	Signal Name	I/O	Function
7	A1_LCD0_D16	Out	LCD data (bit16), connected to LCDD16_0 pin on R-Mobile A1
8	A1_LCD0_D17	Out	LCD data (bit17), connected to LCDD17_0 pin on R-Mobile A1
9	A1_LCD0_D18	Out	LCD data (bit18), connected to LCDD18_0 pin on R-Mobile A1
10	LCD0_D19	Out	LCD data (bit19), connected to DBGMD20 pin on R-Mobile A1
11	LCD0_D20	Out	LCD data (bit20), connected to DBGMD21 pin on R-Mobile A1
12	LCD0_D21	Out	LCD data (bit21), connected to DBGMDT0 pin on R-Mobile A1
13	LCD0_D22	Out	LCD data (bit22), connected to DBGMDT2 pin on R-Mobile A1
14	LCD0_D23	Out	LCD data (bit23), connected to DBGMDT1 pin on R-Mobile A1
15	A1_LCD0_D8	Out	LCD data (bit8), connected to LCDD8_0 pin on R-Mobile A1
16	A1_LCD0_D9	Out	LCD data (bit9), connected to LCDD9_0 pin on R-Mobile A1
17	A1_LCD0_D10	Out	LCD data (bit10), connected to LCDD10_0 pin on R-Mobile A1
18	A1_LCD0_D11	Out	LCD data (bit11), connected to LCDD11_0 pin on R-Mobile A1
19	A1_LCD0_D12	Out	LCD data (bit12), connected toLCDD12_0 pin on R-Mobile A1
20	A1_LCD0_D13	Out	LCD data (bit13), connected to LCDD13_0 pin on R-Mobile A1
21	A1_LCD0_D14	Out	LCD data (bit14), connected to LCDD14_0 pin on R-Mobile A1
22	A1_LCD0_D15	Out	LCD data (bit15), connected to LCDD15_0 pin on R-Mobile A1
23	A1_LCD0_D0	Out	LCD data (bit0), connected to LCDD0_0 pin on R-Mobile A1
24	A1_LCD0_D1	Out	LCD data (bit1), connected to LCDD1_0 on R-Mobile A1
25	A1_LCD0_D2	Out	LCD data (bit2), connected to LCDD2_0 on R-Mobile A1
26	A1_LCD0_D3	Out	LCD data (bit3), connected to LCDD3_0 on R-Mobile A1
27	A1_LCD0_D4	Out	LCD data (bit4), connected to LCDD4_0 on R-Mobile A1
28	A1_LCD0_D5	Out	LCD data (bit5), connected to LCDD5_0 on R-Mobile A1
29	A1_LCD0_D6	Out	LCD data (bit6), connected to LCDD6_0 on R-Mobile A1
30	A1_LCD0_D7	Out	LCD data (bit7), connected to LCDD7_0 on R-Mobile A1
31	DGND	Power	Power (DGND)
32	A1_LCD0_DCK	Out	DCK signal, connected to LCDDCK_0 pin on R-Mobile A1
33	A1_LCD0_HSYN	Out	HSYNC signal, connected to LCDHSYN_0 pin on R-Mobile A1
34	A1_LCD0_VSYN	Out	VSYNC signal, connected to LCDVSYN_0 pin on R-Mobile A1
35	A1_LCD0_DISP	Out	DISP signal, connected to LCDDISP_0 pin on R-Mobile A1
36	A1_LCD0_DON	Out	DON signal, connected to LCDDON_0 pin on R-Mobile A1
37	A1_LCD0_VEPWC	Out	VEPWC signal, connected to LCDVEPWC_0 pin on R-Mobile A1
38	A1_LCD0_VCPWC	Out	VCPWC signal, connected to LCDVCPWC_0 pin on R-Mobile A1
39	A1_LCD0_LCLK	Out	LCLK signal, connected to D24 pin on R-Mobile A1
40	A1_LCD0_LED_CONT	Out	LED_CONT signal, connected to MEMC_BUSCLK pin on R-Mobile A1
41	NC	-	Not connected
42	NC	-	Not connected
43	NC	-	Not connected
44	NC	-	Not connected
45	A1_SDA0	In/Out	SDA signal, connected to I2C_SDA_0 pin on R-Mobile A1
46	A1_SCL0	In/Out	SCL signal, connected to I2C_SCL_0 pin on R-Mobile A1
47	TP_INT	In	Interrupt signal, connected to FMSICK pin on R-Mobile A1
48	TP_RST_B	Out	Reset signal, connected to D21 pin on R-Mobile A1
49	VCC_3.3V	Power	Power (VCC_3.3V)
50	DGND	Power	Power (DGND)

18.14. CON17 (LCD Interface 2)

CON17 is an LCD interface.

- Supported LCD module: AM-800480L1TMQW-T00H (AMPIRE)

As CON16 and CON17 share the same signal lines, they cannot be used at the same time.

Table 18.17. CON17 Signals

Pin Number	Signal Name	I/O	Function
1	VCC_5V	Power	Power (VCC_5V)
2	VCC_5V	Power	Power (VCC_5V)
3	VCC_5V	Power	Power (VCC_5V)
4	NC	-	Power (VCC_3.3V)
5	VCC_3.3V	Power	Power (VCC_3.3V)
6	VCC_3.3V	Power	Power (VCC_3.3V)
7	NC	-	Not connected
8	DGND	Power	Power (DGND)
9	DGND	Power	Power (DGND)
10	TP_RST_B	Out	Reset signal, connected to D21 pin on R-Mobile A1
11	TP_INT	In	Interrupt signal, connected to FMSICK pin on R-Mobile A1
12	DGND	Power	Power (DGND)
13	A1_SCL0	In/Out	SCL signal, connected to I2C_SCL_0 pin on R-Mobile A1
14	A1_SDA0	In/Out	SDA signal, connected to I2C_SDA_0 pin on R-Mobile A1
15	DGND	Power	Power (DGND)
16	A1_LCD0_LED_CONT	Out	LED_CONT signal, connected to MEMC_BUSCLK pin on R-Mobile A1
17	DGND	Power	Power (DGND)
18	A1_LCD0_DON	Out	DON signal, connected to LCDDON_0 pin on R-Mobile A1
19	A1_LCD0_DISP	Out	DISP signal, connected to LCDDISP_0 pin on R-Mobile A1
20	A1_LCD0_VSYN	Out	VSYNC signal, connected to LCDVSYN_0 pin on R-Mobile A1
21	A1_LCD0_HSYN	Out	HSYNC signal, connected to LCDHSYN_0 pin on R-Mobile A1
22	A1_LCD0_DCK	Out	DCK signal, connected to LCDDCK_0 pin on R-Mobile A1
23	DGND	Power	Power (DGND)
24	A1_LCD0_D7	Out	LCD data (bit7), connected to LCDD7_0 on R-Mobile A1
25	A1_LCD0_D6	Out	LCD data (bit6), connected to LCDD6_0 on R-Mobile A1
26	A1_LCD0_D5	Out	LCD data (bit5), connected to LCDD5_0 pin on R-Mobile A1
27	A1_LCD0_D4	Out	LCD data (bit4), connected to LCDD4_0 on R-Mobile A1
28	A1_LCD0_D3	Out	LCD data (bit3), connected to LCDD3_0 on R-Mobile A1
29	A1_LCD0_D2	Out	LCD data (bit2), connected to LCDD2_0 on R-Mobile A1
30	A1_LCD0_D1	Out	LCD data (bit1), connected to LCDD1_0 on R-Mobile A1
31	A1_LCD0_D0	Out	LCD data (bit0), connected to LCDD0_0 pin on R-Mobile A1
32	DGND	Power	Power (DGND)
33	A1_LCD0_D15	Out	LCD data (bit15), connected to LCDD15_0 pin on R-Mobile A1
34	A1_LCD0_D14	Out	LCD data (bit14), connected to LCDD14_0 pin on R-Mobile A1
35	A1_LCD0_D13	Out	LCD data (bit13), connected to LCDD13_0 pin on R-Mobile A1
36	A1_LCD0_D12	Out	LCD data (bit12), connected toLCDD12_0 pin on R-Mobile A1
37	A1_LCD0_D11	Out	LCD data (bit11), connected to LCDD11_0 pin on R-Mobile A1
38	A1_LCD0_D10	Out	LCD data (bit10), connected to LCDD10_0 pin on R-Mobile A1
39	A1_LCD0_D9	Out	LCD data (bit9), connected to LCDD9_0 pin on R-Mobile A1
40	A1_LCD0_D8	Out	Connected to LCDD8_0 pin on R-Mobile A1
41	DGND	Power	Power (DGND)
42	LCD0_D23	Out	LCD data (bit23), connected to DBGMDT1 pin on R-Mobile A1
43	LCD0_D22	Out	LCD data (bit22), connected to DBGMDT2 pin on R-Mobile A1
44	LCD0_D21	Out	LCD data (bit21), connected to DBGMDT0 pin on R-Mobile A1
45	LCD0_D20	Out	LCD data (bit20), connected to DBGMD21 pin on R-Mobile A1

Pin Number	Signal Name	I/O	Function
46	LCD0_D19	Out	LCD data (bit19), connected to DBGMD20 pin on R-Mobile A1
47	A1_LCD0_D18	Out	LCD data (bit18), connected to LCDD18_0 pin on R-Mobile A1
48	A1_LCD0_D17	Out	LCD data (bit17), connected to LCDD17_0 pin on R-Mobile A1
49	A1_LCD0_D16	Out	LCD data (bit16), connected to LCDD16_0 pin on R-Mobile A1
50	DGND	Power	Power (DGND)

18.15. CON19 (Power In Interface)

CON19 is a DC jack for power supply. The AC adapter jack shape is EIAJ RC-5320A (voltage classification 2) compliant.

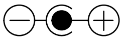


Figure 18.1. AC Adapter Polarity Mark

Table 18.18. CON19 Signals

Pin Number	Signal Name	I/O	Function
1	VCC_5V	Power	Power (VCC_5V)
2	DGND	Power	Power (DGND)
3	DGND	Power	Power (DGND)
4	DGND	Power	Power (DGND)

18.16. CON20 (USB Interface 1)

CON20 is a USB host interface. It has a Type A connector mounted.

> As CON20 and CON24 share the same signal lines, they cannot be used at the same time.
>
> The selection of which interface the signals used with CON20 and CON24 are connected to is done with the DIP switch (SW1) USB0 configuration. For details, please refer to Table 4.3, “DIP Switch (SW1) Switch Functions” or Section 18.25, “SW1 (Function Selection Switch)”.

Table 18.19. CON20 Signals

Pin Number	Signal Name	I/O	Function
1	VCC_5V	Power	Power (VCC_5V)
2	A1_DM0	In/Out	USB minus side signal, connected to DM_0 pin on R-Mobile A1
3	A1_DP0	In/Out	USB plus side signal, connected to DP_0 pin on R-Mobile A1
4	DGND	Power	Power (DGND)
5	DGND	Power	Power (DGND)
6	DGND	Power	Power (DGND)
7	DGND	Power	Power (DGND)

18.17. CON21 (USB Interface 2)

This is a USB host interface. It has a Type A connector mounted.

Table 18.20. CON21 Signals

Pin Number	Signal Name	I/O	Function
1	VCC_5V	Power	Power (VCC_5V)
2	A1_DM1	In/Out	USB minus side signal, connected to DM_1 pin on R-Mobile A1
3	A1_DP1	In/Out	USB plus side signal, connected to DP_1 pin on R-Mobile A1
4	DGND	Power	Power (DGND)
5	DGND	Power	Power (DGND)
6	DGND	Power	Power (DGND)
7	DGND	Power	Power (DGND)

18.18. CON22 (Serial Interface)

This is an asynchronous (start-stop synchronization) serial interface. It has a D-Sub 9-pin mounted. It is connected to the R-Mobile A1 via a RS232C transceiver.

Table 18.21. CON22 Signals

Pin Number	Signal Name	I/O	Function
1	NC	-	Not connected
2	UART_RXD	In	UART received data
3	UART_TXD	Out	UART transmitted data
4	NC	-	Not connected
5	DGND	Power	Power (DGND)
6	RTS	Out	Always high
7	CTS	-	Not connected
8	NC	-	Not connected
9	NC	-	Not connected

18.19. CON23 (LAN Interface)

This is a 10BASE-T/100BASE-TX LAN interface. It has a RJ45 connector mounted. It is connected to the R-Mobile A1 via an Ethernet PHY.

Table 18.22. CON23 Signals

Pin Number	Signal Name	I/O	Function
1	TX+	Out	Differential twisted-pair transmit output (+)
2	TX-	Out	Differential twisted-pair transmit output (-)
3	RX+	In	Differential twisted-pair receive input (+)
4	-	-	75 ohm termination, internal connector connection to CON23 (5 pin)
5	-	-	75 ohm termination, internal connector connection to CON23 (4 pin)
6	RX-	In	Differential twisted-pair receive input (-)
7	-	-	75 ohm termination, internal connector connection to CON23 (8 pin)
8	-	-	75 ohm termination, internal connector connection to CON23 (7 pin)

18.20. CON24 (USB Interface 3)

CON24 is a USB device interface. It has a Type B connector mounted.

> ⚠ As CON20 and CON24 share the same signal lines, they cannot be used at the same time.
>
> The selection of which interface the signals used with CON20 and CON24 are connected to is done with the DIP switch (SW1) USB0 configuration. For details,

please refer to Table 4.3, “DIP Switch (SW1) Switch Functions” or Section 18.25, “SW1 (Function Selection Switch)”.

Table 18.23. CON24 Signals

Pin Number	Signal Name	I/O	Function
1	A1_VBUS	Power	Power (A1_VBUS), connected to VBUS pin on R-Mobile A1
2	A1_DM0	In/Out	USB minus side signal, connected to DM_0 pin on R-Mobile A1
3	A1_DP0	In/Out	USB plus side signal, connected to DP_0 pin on R-Mobile A1
4	DGND	Power	Power (DGND)
5	FG	Power	Power (DGND)
6	FG	Power	Power (DGND)
7	FG	Power	Power (DGND)

18.21. LED1 (Camera LED)

LED1 is a flash LED for the camera module.

Table 18.24. LED1 Behavior

LED	Name (Color)	Explanation
LED1	LED (yellow)	Connected to GPIO4_FLASH on the camera module (low: off, high: on)

18.22. LED2 (Power LED)

LED2 is the power LED. It is active when VCC_3.3V is being supplied.

Table 18.25. LED Behavior

LED	Name (Color)	On	Off
LED2	Power LED (green)	Shows that VCC_3.3V is being supplied.	Shows that VCC_3.3V is not being supplied.

18.23. LED3 - LED6 (User LEDs)

LED3 - LED6 are user LEDs.

Table 18.26. LED3 - LED6 Behavior

LED	Name (Color)	Explanation
LED3	User LED (yellow)	Connected to FRB pin on R-Mobile A1 (low: off, high: on)
LED4	User LED (yellow)	Connected to CS4# pin on R-Mobile A1 (low: off, high: on)
LED5	User LED (yellow)	Connected to CS2# pin on R-Mobile A1 (low: off, high: on)
LED6	User LED (yellow)	Connected to WAIT# pin on R-Mobile A1 (low: off, high: on)

18.24. LED7, LED8 (LAN LEDs)

LED7 and LED8 are the status LEDs of the LAN interface (CON23).

Table 18.27. LED7, LED8 Behavior

LED	Name (Color)	On	Off	Blinking
LED7	LINK/ACT LED (green)	LAN cable connected and link established.	LAN cable connected, link not established.	Sending and receiving data.

LED	Name (Color)	On	Off	Blinking
LED8	SPEED LED (Yellow)	100BASE-TX link established.	10BASE-T link established if LAN cable connected. Otherwise link not established.	-

18.25. SW1 (Function Selection Switch)

SW1 is an eight point DIP switch. Each signal is high when the connected switch is off and low when the switch is on.

Table 18.28. SW1 Signals

Pin Number	Signal Name	Function
1	A1_PORT101_JP2	Connected to FCE0# pin on R-Mobile A1
2	A1_MD2	Connected to MD2 pin on R-Mobile A1
3	A1_MD3	Connected to MD3 pin on R-Mobile A1
4	MMC_DISABLE	eMMC and Expansion Bus Interface (CON2) switch (on: eMMC, off: Expansion Bus Interface)
5	SDSLOT2_ENABLE	SD Interface 2 (CON8) and AWL13 Module (CON14) switch (on: SD Interface 2, off: AWL13 Module)
6	USB_DEVICE_MODE	USB Device Interface (CON24) and USB Host Interface (CON20) switch (on: USB Device Interface, off: USB Host Interface)
7	DBGMD20	Connected to DBGMD20 pin on R-Mobile A1
8	DBGMD21	Connected to DBGMD21 pin on R-Mobile A1

18.26. SW2 (Reset Switch)

SW2 is a reset switch. It has a tact switch mounted. It is connected to the reset IC on the board.

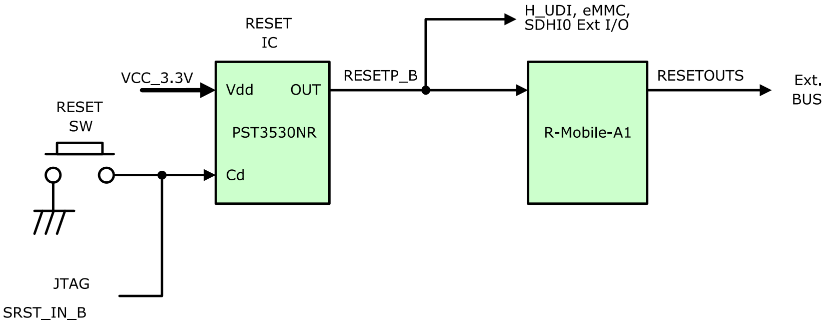


Figure 18.2. Reset Block Diagram

Table 18.29. SW2 Function

SW	Function
SW2	Reset (pushed: reset, released: not reset)

18.27. SW3 - SW6 (User Switches)

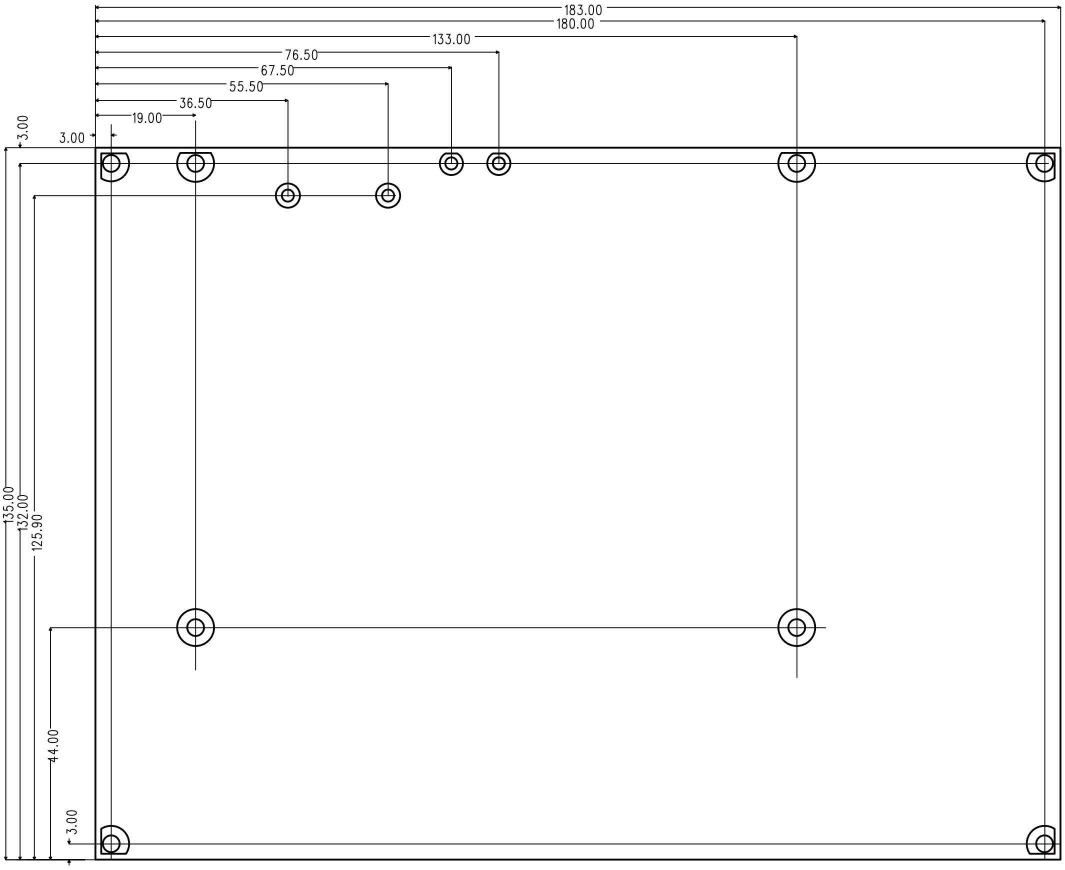
SW3 - SW6 are user switches. They have tact switches mounted. Each pin is low when the connected switch is pushed, and high when the switch is released.

Table 18.30. SW3 - SW6 Functions

SW	Explanation
SW3	Connected to MEMC_AD6 pin on R-Mobile A1
SW4	Connected to MEMC_AD7 pin on R-Mobile A1
SW5	Connected to MEMC_AD4 pin on R-Mobile A1

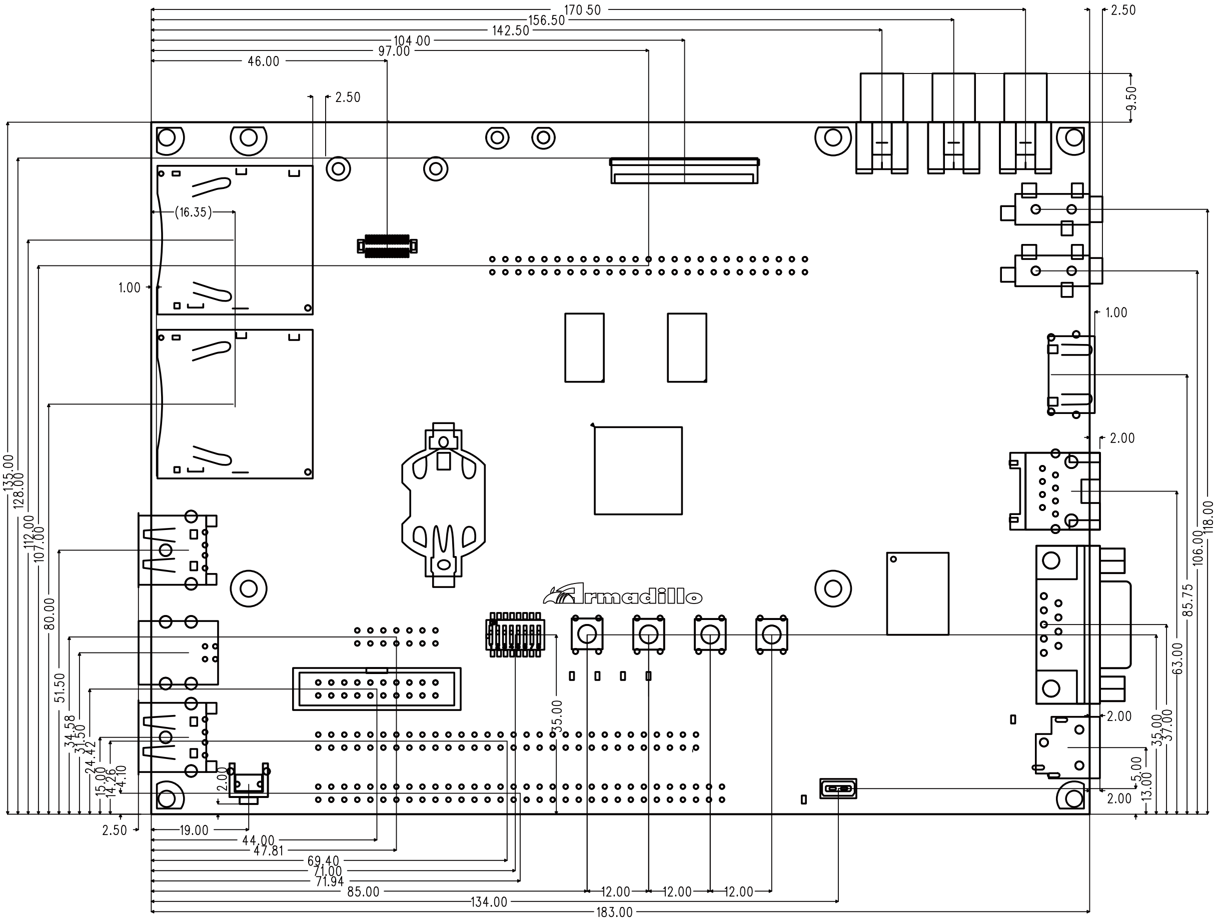
SW	Explanation
SW6	Connected to MEMC_AD5 pin on R-Mobile A1

Chapter 19. Board Outline Diagrams



[Unit : mm]

Figure 19.1. Board Outline and Fixing Hole Measurements



[Unit : mm]

Figure 19.2. Connector Center Measurements

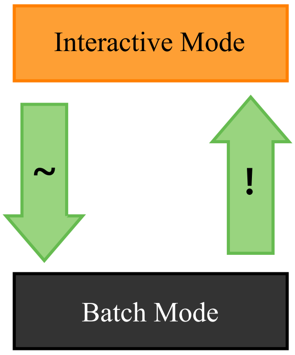
Appendix A. Hermit-At Bootloader

Hermit-At is a functional downloader and bootloader[1] used on Atmark Techno products. The Hermit-At bootloader prompt is displayed when an Armadillo board is booted in maintenance mode. From the prompt it is possible to enter commands for a variety of operations such as updating flash memory and setting Linux kernel parameters. The following gives details on the most well used functions.

Hermit-At Modes

Hermit-AT has two modes: the "interactive mode" which displays the command prompt and operates interactively, and the "batch mode" for communicating with the Hermit-AT downloader. The command prompt and entered characters are not displayed in batch mode, but commands can be executed.

Hermit-AT is always in interactive mode after booting. To move from interactive mode to batch mode enter a tilde "~" and to move from batch mode to interactive mode enter an exclamation mark "!".



Hermit-AT moves to batch mode when communicating with the Hermit-AT downloader. This is because the Hermit-AT downloader sends a tilde in order to establish the communication.

When moving from interactive mode to batch mode and when an entered command succeeds in batch mode the following is displayed.

```
+OK
```

A.1. version

This command displays version information.

[1] Only the Hermit-At bootloader functionality can be used with Armadillo-800 EVA.

```
Syntax: version
```

Figure A.1. version Syntax

A.1.1. version Example

```
hermit> version
Hermit-At v3.0.0 (Armadillo-800 EVA) compiled at 22:22:10, Dec 21 2011
```

Figure A.2. version Example

A.2. info

This command displays board information.

```
Syntax: info
```

Figure A.3. info Syntax

A.2.1. info Example

```
hermit> info
   Board Type: 0x08000000
     Revision: 0x00000003
          Lot: 0x00000001
Serial Number: 0
    Boot Mode: 0x00000038 (eMMC)
       Jumper: ON
      Tact-SW: OFF,OFF,OFF,OFF
 ORIG MAC-1: 00:11:0c:00:00:00
```

Figure A.4. info Example

A.3. mac

This command displays the MAC address.

```
Syntax: mac
```

Figure A.5. mac Syntax

A.3.1. mac Example

```
hermit> mac
00:11:0c:00:00:00
```

Figure A.6. mac Example

A.4. setenv and clearenv

These commands are used to set Linux kernel parameters. The parameters set with setenv are passed to the kernel at boot time. Executing clearenv clears any configuration. The parameters are saved in internal storage and are therefore maintained even after rebooting.

```
Syntax: setenv [kernel parameter]...
Explanation: Sets kernel parameters. Shows current configuration if executed without any options specified.

Syntax: clearenv
Explanation: Clears all set options.
```

Figure A.7. setenv/clearenv Syntax

A.4.1. setenv/clearenv Example

```
hermit> setenv console=ttySC1,115200
hermit> setenv
1: console=ttySC1,115200
hermit> clearenv
hermit> setenv
hermit>
```

Figure A.8. setenv and clearenv Example

A.4.2. Linux Kernel Parameters

Example Linux kernel parameters are shown in Table A.1, “Well Used Linux Kernel Parameters”. For information on other options, please refer to `linux-2.6/Documentation/kernel-parameters.txt`.

Table A.1. Well Used Linux Kernel Parameters

Option	Explanation
console	Specify device to be used for kernel console.
root	Specify root filesystem related settings.
rootdelay	Seconds to wait before attempting to mount root filesystem.
rootwait	Wait until the root filesystem is accessible before attempting to mount it.
noinitrd	Specify what should happen with the initrd data after the kernel has booted.
nfsroot	Specify root filesystem place and NFS options when using NFS.

A.5. setbootdevice

This command is used to specify the boot device holding the Linux kernel. This setting is saved in internal storage and is therefore maintained even after rebooting.

```
Syntax: setbootdevice mmcblk0pN
Explanation: Extract the kernel image stored in the /boot/ directory on partition N of the internal storage to RAM and boot it

Syntax: setbootdevice mmcblk1pN
Explanation: Extract the kernel image stored in the /boot/ directory on partition N of an SD card (CON7) to RAM and boot
it
```

Figure A.9. setbootdevice Syntax

A.5.1. setbootdevice Example

To boot the kernel image stored in the /boot/ directory on partition 4 of the internal storage, execute the command shown in Figure A.10, “Assigning Partition 4 of Internal Storage as Boot Device”.

```
hermit> setbootdevice mmcblk0p4
```

Figure A.10. Assigning Partition 4 of Internal Storage as Boot Device

To boot the kernel image stored on partition 1 of an SD card (CON7), execute the command shown in Figure A.11, “Assigning SD Card as Boot Device”.

```
hermit> setbootdevice mmcblk1p1
```

Figure A.11. Assigning SD Card as Boot Device

A.6. frob

This command is used to enter a mode for reading or altering data at a specified address.

Table A.2. frob Command

frob Command	Explanation
peek [addr]	Read 32bit data from specified address
peek16 [addr]	Read 16bit data from specified address
peek8 [addr]	Read 8bit data from specified address
poke [addr] [value]	Write 32bit data to specified address
poke16 [addr] [value]	Write 16bit data to specified address
poke8 [addr] [value]	Write 8bit data to specified address

A.7. boot

This command boots the Linux kernel image from the boot device specified with the setbootdevice command.

```
Syntax: boot
```

Figure A.12. boot Syntax

A.7.1. boot Example

```
hermit> boot
mmcsd: SD card at address 0x00000001
mmcsd: M8G2FA 1048576KiB
gendisk: /dev/mmcblk0p4: start=0x000f4280, size=0x001dcdc0
gendisk: Image.bin is found. (4390496 Bytes)
Copying        kernel...done.                                              ❶
Doing console=ttySC1,115200
Doing noinitrd
Doing rootwait
Doing root=/dev/mmcblk0p4
Doing init=/init                                                           ❷
Linux version 2.6.35.7 (atmark@atde4) (gcc version 4.4.5 (Debian 4.4.5-8) )
 #1 PREEMPT Wed Dec 21 22:37:47 JST 2011                                   ❸
CPU: ARMv7 Processor [412fc093] revision 3 (ARMv7), cr=10c53c7f
CPU: VIPT nonaliasing data cache, VIPT nonaliasing instruction cache
Machine: Armadillo-800EVA
    :
    :
```

Figure A.13. boot Example

❶ The kernel image is extracted to RAM.

❷ Kernel parameters set with the setenv command are displayed. All messages up to this point are from Hermit-At.

❸ The kernel is booted and kernel boot log displayed.

Revision History

Revision	Data	Description
1.0.0	01/05/2012	• Initial Release
1.1.0	Feb. 02, 2012	• Made updates for linux-2.6.35-a800eva-at2 • Moved all function use descriptions to Chapter 8, Function Use with Debian GNU/Linux • Added use descriptions for devices that connect to CON3/12/13, external storage devices, the LED backlight, LEDs and user switches to Chapter 8, Function Use with Debian GNU/Linux. • Moved all explanations of the Linux kernel to Chapter 17, Linux Kernel Specifications • Added explanations of the default configuration and Android functions to Chapter 17, Linux Kernel Specifications • Updated the explanation in Section 1.2, “Document Structure” • Added a note on connecting the AC adapter • Table 18.3, “CON3 Signals” Changed DDC_CEC signal to Non-connected. • Corrected various errors and inconsistencies

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