M-9G45A Evaluation Kit User Guide

Overview

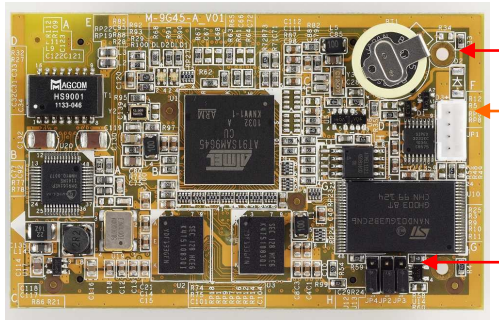
M-9G45A is an ARM9-based Linux ready System on Module. The M-9G45A is equipped with an ATMEL AT9SAM9G45 SoC and many peripherals include:

1. Atmel AT91SAM9G45 400MHz
2. 128MB DDR2 RAM, 128MB NAND Flash, 2MB DataFlash
3. One 10/100 Mbps Ethernet with MAC/PHY and transformer
4. 24-bit CMOS LCD interface up to 1280x860
5. Four wire touch screen
6. One USB 2.0 high speed (480 Mbps) Host Ports, One USB client port
7. Multimedia Card Interface for SD memory card
8. Four UARTs with RS-485 data direct control
9. On board Real Time Clock and watchdog timer with Lithium battery
10. I2S bus for audio I/O
11. I2C bus for GPIO expansion
12. 15 Programmable Digital I/O Port
13. Serial console (Debug) port (RS-232)
10. Serial Peripheral Interface (SPI) Ports
11. Linux 2.6.38 OS

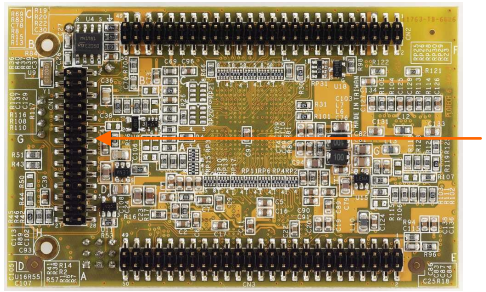
Linux 2.6.38 OS is pre-installed in the flash disk of M-9G45A and many powerful utility programs are also included. GNU C/C++ tool chain are shipped with M-9G45A CD. Therefore, M-9G45A is ready to drop in your design to save your time in software porting and hardware debug.

M-9G45A Layout

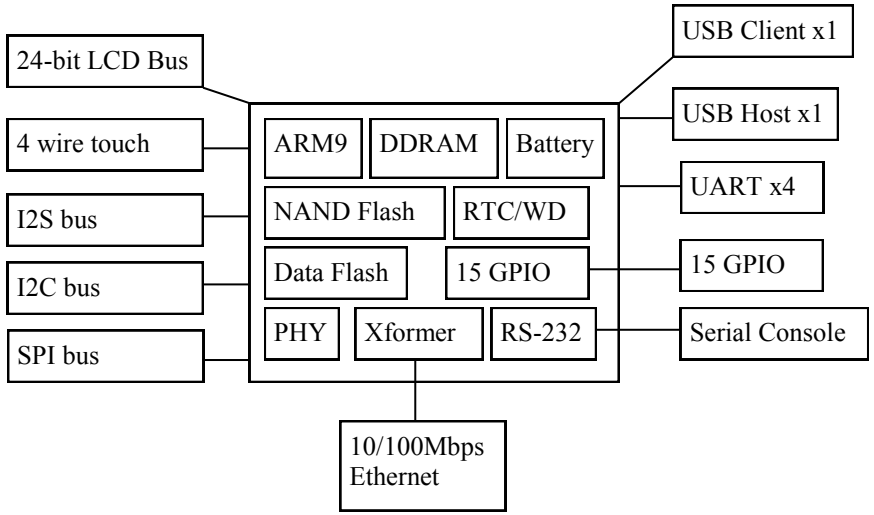
Front View



Rear View



Function Block Diagram



M-9G45A Hardware Specifications

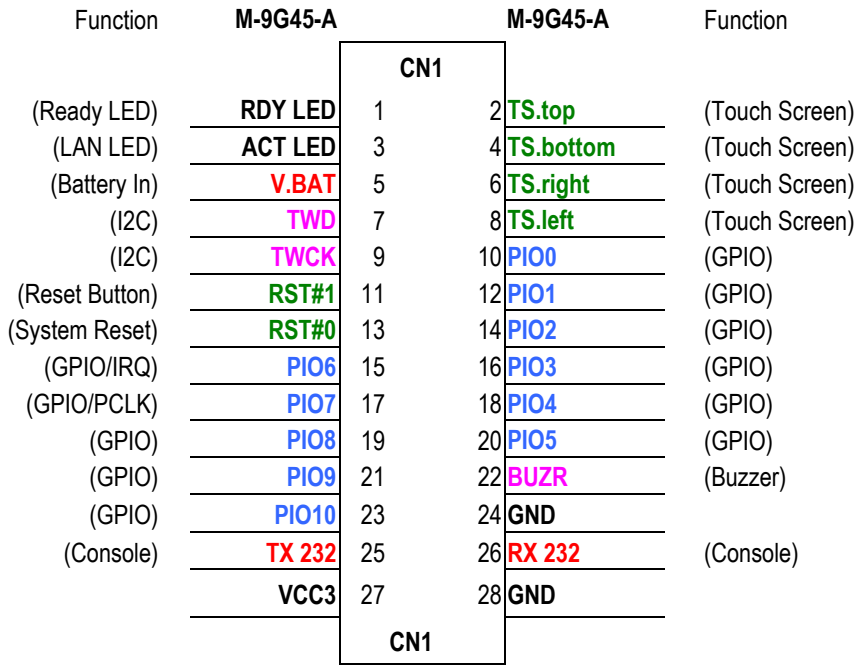
SoC: ATMEL AT91SAM9G45
CPU: ARM926EJ-S ARM Thumb Processor with Memory Management Unit (MMU)
Clock: 400MHz
SDRAM: 128MB
Flash: 128MB NAND Flash and 2MB Data Flash
Ethernet: 10/100 Mbps with MAC/PHY and Transformer
PHY: DAVCOM DM9161
Transformer: 1.5 KV isolation
Signal: ***ETX0+, ETX0-, ERX0+, ERX0-***
USB Host: USB 2.0 full speed (12Mbps) Host x2
Signal: ***USB A+, USB A-***
USB Device: ***Uddata+, Uddata-, Udio***
UART: Four Universal Asynchronous Receiver and Transmitter
Data Bits: 5 to 9 bits
Parity: None, Even, Odd, Mark, Space
Stop: 1, 1.5, 2 bits
Baud Rate: Up to 921.6 Kbps
Flow Control: RTS/CTS, XON/XOFF, None
RS485 Driver Control Signal (RTS1~RTS4)
Signal Level: CMOS/3.3V compatible
COM1: ***TXD1, RXD1***, ***RTS1***, ***CTS1, DCD1, DTR1,DSR1***
(Software configurable RS-232/485 mode)
COM2: ***TXD2***, ***RXD2***, ***RTS2***, ***CTS2***
(Software configurable RS-232/485 mode)
COM3: ***TXD3***, ***RXD3***, ***RTS3***, ***CTS3***
(Software configurable RS-232/485 mode)
COM4: ***TXD4***, ***RXD4***, ***RTS4***, ***CTS4***
(Software configurable RS-232/485 mode)
Inter-IC Bus: (I2C Bus)
Compatible with standard two-wire serial memory interface
Supported Devices: (built-in)
Real Time Clock: ST M41T81 (option:Ricoh RS5C372A)
Watchdog Timer: ST M41T81
Backup battery: Lithium Battery (BR 1225 3V 48mAh)
GPIO controller: NXP PCA9539 (32 GPIO)
Signal: ***TWD, TWDK***
I2S (internal IC Sound):
Transmitter: ***TSCK, TWS, TSD***
Receiver: ***RSCK, RWS, RSD***
Audio clock: ***Audio Clk***
Supported Device: Audio codec TI TLV320AIC23
Serial Peripheral Interface: (SPI)
Two chip Selects with external decoder
Three wires signals: MISO, MOSI and SPCK clock
Signal: ***MISO, MOSI, SPCK, NPCS1, NPCS2***
Supported Device: ATMEL Dataflash

Multimedia Card Interface
Compatible with SD memory card Specification 1.0
Signal: ***MCCDA, MCCK, MCDA0, MCDA1, MCDA2, MCDA3, CD, WP***
Programmable DIO
15 General Purpose I/O can be programmable as digital input or output
Signal Level: CMOS/TTL Compatible
Input: Low level: -0.3V min
+0.8V max
High level: +2.0V min
+3.6V max
Output: Low level: +0.4V @0.3 mA
High level: +3.3V @0.3 mA
Signal: ***I/O_0 to I/O_14***

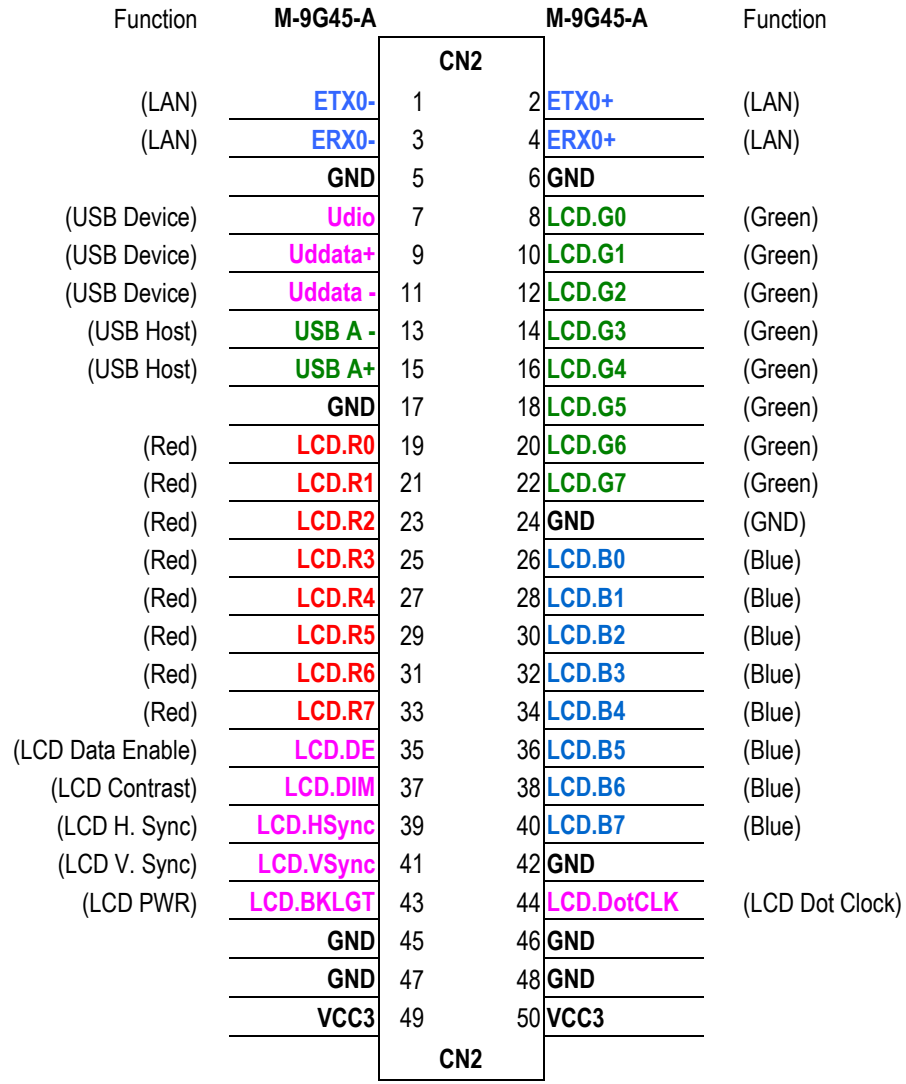
LCD bus:
Signal:
LCD.R0~LCD.R7: Red color bus
LCD.G0~LCD.G7: Green color bus
LCD.B0~LCD.B7: Blue color bus
LCD.DE: LCD data enable
LCD.DIM: LCD brightness (PWM)
LCD.HSync: LCD H. Sync
LCD.VSync: LCD V. Sync
LCD.BKLGT: LCD backlight on/off
LCD.DotCLK: LCD dot clock

Touch Screen:
Signal:
TS.top: Touch top input
TS.bottom: Touch bottom input
TS.right: Touch right input
TS.left: Touch left input
Predefine Pins:
Reset Button (CN1, pin#11, ***RST#1***) input
Buzzer (CN1, pin#22, ***BUZR***) output
System reset (CN1, pin#13) CMOS output
System ready LED (CN1, pin#1, ***RDY_LED***) output
LAN activity LED (CN1, pin#3, ***ACT_LED***) output
External battery input (CN1, pin#5, ***V.BAT***) input
Debug Port: JP4
Serial Console: RS-232 TX/RX
Signal: ***DTXD_232, DRXD_232***
Power:
Input: 3.0 to 3.6VDC (3.3V nominal)
Consumption: 240mA (max) 170 mA (nominal)

Pin Assignment and Definition



Pin Assignment and Definition



Function	M-9G45-A			M-9G45-A	Function
		CN2			
(LAN)	ETX0-	1	2	ETX0+	(LAN)
(LAN)	ERX0-	3	4	ERX0+	(LAN)
	GND	5	6	GND	
(USB Device)	Udio	7	8	LCD.G0	(Green)
(USB Device)	Uddata+	9	10	LCD.G1	(Green)
(USB Device)	Uddata -	11	12	LCD.G2	(Green)
(USB Host)	USB A -	13	14	LCD.G3	(Green)
(USB Host)	USB A+	15	16	LCD.G4	(Green)
	GND	17	18	LCD.G5	(Green)
(Red)	LCD.R0	19	20	LCD.G6	(Green)
(Red)	LCD.R1	21	22	LCD.G7	(Green)
(Red)	LCD.R2	23	24	GND	(GND)
(Red)	LCD.R3	25	26	LCD.B0	(Blue)
(Red)	LCD.R4	27	28	LCD.B1	(Blue)
(Red)	LCD.R5	29	30	LCD.B2	(Blue)
(Red)	LCD.R6	31	32	LCD.B3	(Blue)
(Red)	LCD.R7	33	34	LCD.B4	(Blue)
(LCD Data Enable)	LCD.DE	35	36	LCD.B5	(Blue)
(LCD Contrast)	LCD.DIM	37	38	LCD.B6	(Blue)
(LCD H. Sync)	LCD.HSync	39	40	LCD.B7	(Blue)
(LCD V. Sync)	LCD.VSync	41	42	GND	
(LCD PWR)	LCD.BKLGT	43	44	LCD.DotCLK	(LCD Dot Clock)
	GND	45	46	GND	
	GND	47	48	GND	
	VCC3	49	50	VCC3	
		CN2			

Pin Assignment and Definition

Function	M-9G45-A	CN3		M-9G45-A	Function
	VCC3	1	2	VCC3	
	GND	3	4	GND	
	GND	5	6	GND	
(COM2)	TXD2	7	8	CTS1	(COM1)
(COM2)	RXD2	9	10	RTS1	(COM1)
(COM2)	RTS2	11	12	RXD1	(COM1)
(COM2)	CTS2	13	14	TXD1	(COM1)
(COM3)	TXD3	15	16	DTR1	(COM1)
(COM3)	RXD3	17	18	DSR1	(COM1)
(COM3)	RTS3	19	20	DCD1	(COM1)
(COM3)	CTS3	21	22	GND	
(COM4)	TXD4	23	24	MCDA0	(SD)
(COM4)	RXD4	25	26	MCDA1	(SD)
(COM4)	RTS4	27	28	MCDA2	(SD)
(COM4)	CTS4	29	30	MCDA3	(SD)
(GPIO)	PIO11	31	32	MCCK	(SD)
(GPIO)	PIO12	33	34	MCCDA	(SD)
(GPIO)	PIO13	35	36	CD	(SD)
(GPIO)	PIO14	37	38	WP	(SD write protect)
(I2S)	TSCK	39	40	MISO	(SPI)
(I2S)	TWS	41	42	MOSI	(SPI)
(I2S)	TSD	43	44	SPCK	(SPI)
(I2S)	RSCK	45	46	NPCS1	(SPI)
(I2S)	RWS	47	48	NPCS2	(SPI)
(I2S)	RSD	49	50	Audio Clk	(Audio Clock)
		CN3			

Factory Default Settings

LAN 1 IP Address: 192.168.2.127
Login: root or guest (telnet guest only)
Password: root or guest (telnet guest only)
Serial Console Port:
Baud rate: 115200
Data format: 8 Bits, No Parity, 1 Stop bit (N,8,1)
Flow Control: None
Terminal type: VT100

Power on and System boot up

Once M-9G45A is correctly power on, it will start boot Linux kernel and mount file system. You can use Ethernet and telnet and login M-9G45A. Once kernel loaded, it will find */sbin/init* and execute it. The initialization configuration is at */etc/inittab*. Once boot up, you can use telnet to login M-9G45A.

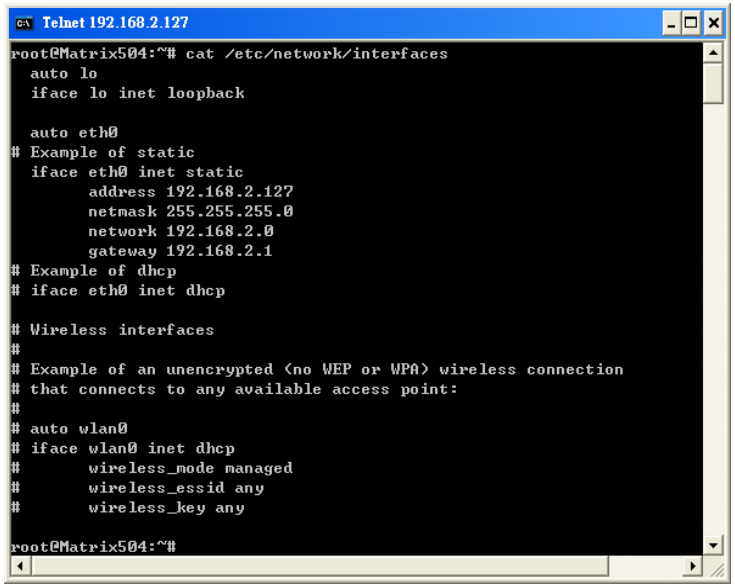
Inittab and Run levels:

Inittab contains information of system initialization. The system initialization script */etc/rcS.d* runs first then the run level 5 */etc/rc5.d* M-9G45A uses run level for system setup and the default run level is number 5. Please refer to introduction to linux (http://tille.garrels.be/training/tldp/) for information about run level. Following is the run levels setting:
Run level 0: halt
Run level 1 is single user (login and service are disabled)
Run level 2~5 are multiple users
Run level 6 is reboot.
Please refer to loader menu section for selection of run level

Default started service

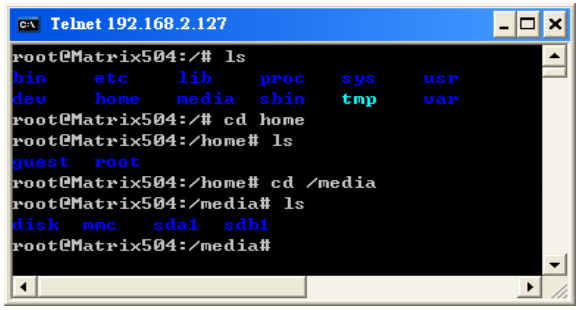
1. amgrd (Artila broadcast search daemon)
2. ssh (secured shell) with sftp
3. syslog/klogd (system and kernel log)
4. telnet server (disable root with */etc/securetty*)
5. ftp server (vsftp)
6. web server (lighttpd)
7. Ready LED (debug LED for internal use)
8. Auto start GTK+ demo
9. Xserver GUI

Network Settings

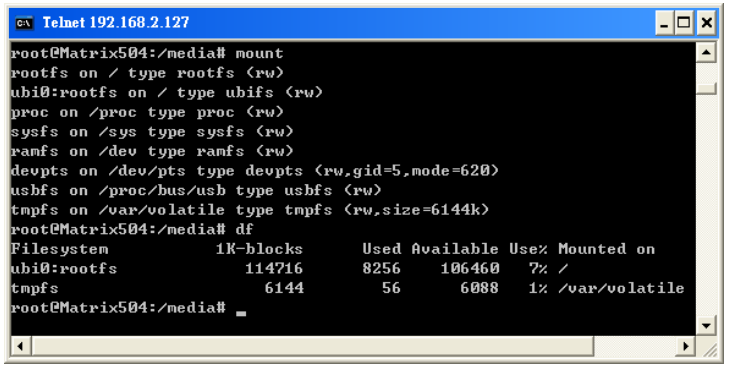


Use ***vi*** editing tool to edit the */etc/network/interfaces* for network setting. The default setting is static IP 192.168.2.127. M-9G45A also supports Wireless LAN. Use
wireless_essid XXX
wireless_key YYY
To add SSID and WEP key if necessary. XXX is SSID and YYY is WEP Key
M-9G45A supports USB WLAN adaptor (Ralink RT2571). You can enable the driver module (rt73usb) by adding *rt73usb* in */etc/modules*

File System



The 128MB NAND Flash memory of M-9G45A contains Boot loader (uBoot), Linux Kernel, Root File System and user disk (\home). The file system and disk space are shown as follow



Devices list

The supported devices are shown at /dev directory. Following list are most popular ones:

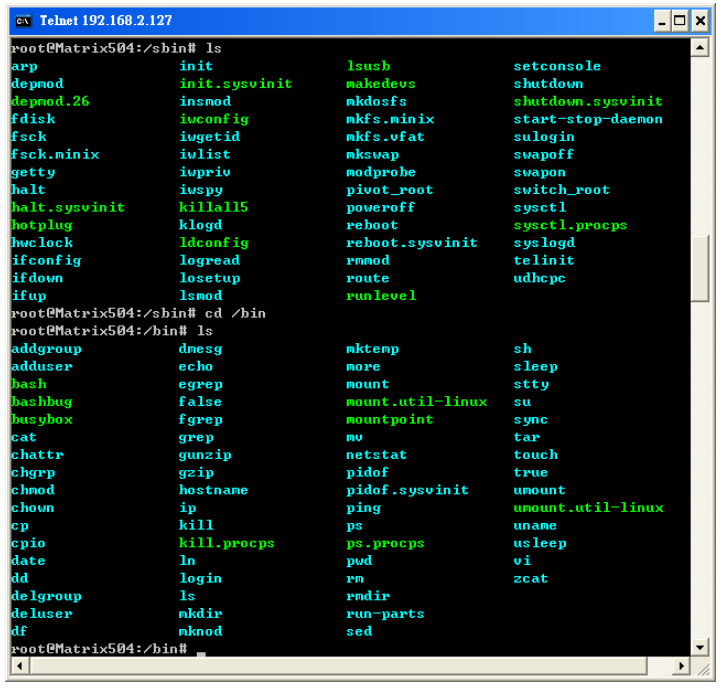
1. ttyS0: serial console port
2. ttyS1 to ttyS4: serial port 1 to port 4
3. sda to sdb: USB flash disk
4. ttyUSB0 to ttyUSB1: USB RS-232 adaptor (usbserial.ko)
5. gpio: General Purpose digital I/O
6. ttyACM0 and ttyACM1: USB Modem (CDC compliant)
7. spi0, spi1: SPI bus controller
8. mmc : SD driver
9. rtc0: m41t81 real time clock device (default)
10. rtc1: rs5c372a real time clock device (M-501 compatible)

Utility Software:

M-9G45A includes busybox utility collection and Artila utility software and there are placed at :

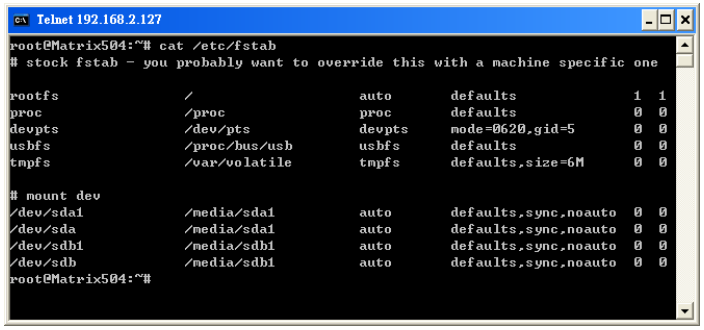
/sbin
/bin
/usr/bin
/use/sbin

Please refer to Appendix for the utility collection list



Mounting USB device by udev

M-9G45A supports udev which can automatically load the device driver when plugging your USB device.



Web Page Directory

The web pages are placed at ***/usr/www*** and the ***/etc/lighttpd.conf*** contains the lighttpd web server settings. The home page name should be ***index.html***

Adjust the system time

To adjust the RTC time, you can follow the command

date MMDDhhmmYYYY

where

MM=Month (01~12)
DD=Date (01~31)
hh=Hour
mm=minutes
YYYY= Year

hwclock –w

To write the date information to RTC

User can also use NTP client utility in Artila CD to adjust the RTC time.

ntpclient [time server ip]

SSH Console

M-9G45A supports SSH. If you use Linux computer, you can use SSH command to login M-9G45A. The configuration of SSH and key are located at

/etc/ssh

The key generation program is available at */usr/bin*

Welcome Message

To modify the welcome message, user can use text edit to modify the /etc/motd.

Putty Console Software

For Windows user, you can download the putty software at http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html to use SSH to login M-9G45A

ipkg package software management

ipkg is a light software package utility. It can be used to install, upgrade and remove the software package for M-9G45A. Currently user can use ipkg to install the software packge from Artila FTP. You can find the configuration at *ipkg.conf*

When M-9G45A is connected to network and issue command

ipkg update

To update the package list and use

ipkg install

to install software package and

ipkg remove

to remove software

ipkg list

to list available software

ipkg list_installed

to list software installed

Install GNU Tool Chain

Find a PC with Linux OS installed as followed:
Fedore 7, ubuntu 7.04, OpenSUSE 10.2, Mandriva 2008, Debian 5.0, Centos (RedHat) 5 and above.
Login as a root user then copy the arm-linux-4.3.2.tar.gz to root directory of PC. Under root directory, type following command to install the M-9G45A Tool Chain
#tar -xvfj arm-linux-4.3.3.tar.bz2
The tool chain file name are
arm-linux-gnueabi-gcc
arm-linux-gnueabi-g++
arm-linux-gnueabi-strip
Version: gcc 4.3.3, glibc 2.9, binutils 2.18

For Windows user, please download the toolchain from CodeSourcery at
http://www.codesourcery.com/sgpp/lite/arm/portal/package4547/public/arm-none-linux-gnueabi/arm-2009q1-203-arm-none-linux-gnueabi.exe
The tool chain file name are
arm-none-linux-gnueabi-gcc
arm-none-linux-gnueabi-g++
arm-none-linux-gnueabi-strip
Version: gcc 4.3.3, glibc 2.8, binutils 2.19

Getting started with the Hello program

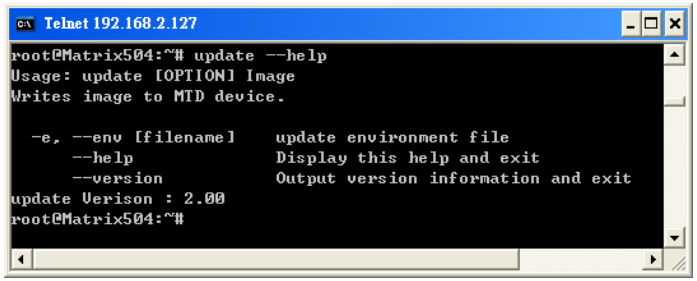
There are many example programs in Artila CD. To compile the sample you can use the Make file and type
make
To compile and link the library. Once done, use ftp command
ftp 192.168.2.127
Then login with password. Use bin command to set transfer mode to binary
ftp>bin
to transfer the execution file to M-9G45A user disk (/home/guest) and use
chmod +x file.o
To change it to execution mode and
./file.o
to run the program

Auto start program on boot:

To start a program on boot, you can use ***/etc/rc.local***
For example to use ***vi*** to edit ***rc.local***
hello &
exit 0
Hello will be executed after system boot up. ***rc.local*** has the similar function as ***/etc/rc*** in M-9G45A

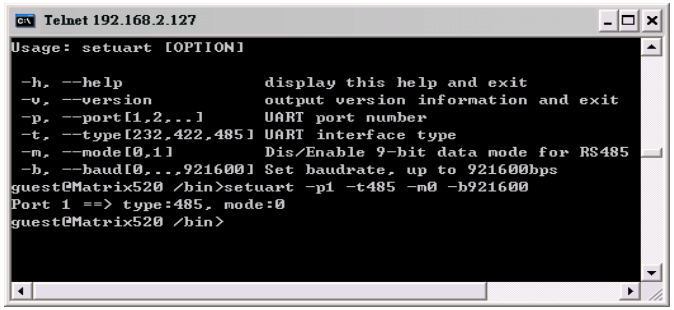
Artila Utility Software:

The introduction of Artila utility software as follow:
1. ***update*** : update loader, environment file and kernel image. Type *update—help* to find the command usage

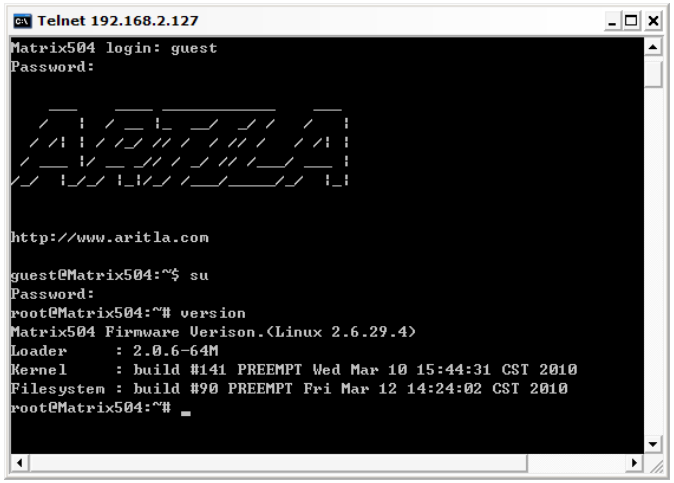


Update can only operated under supervisor mode (password : root). Please use command ***su*** and login as root

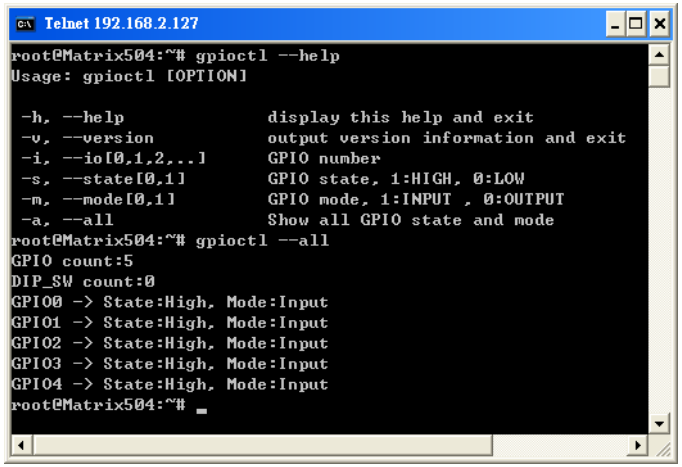
2. ***setuart***: configure serial port setting. An example show as followed to configure port 1 as RS-485 interface with baud rate 921600.



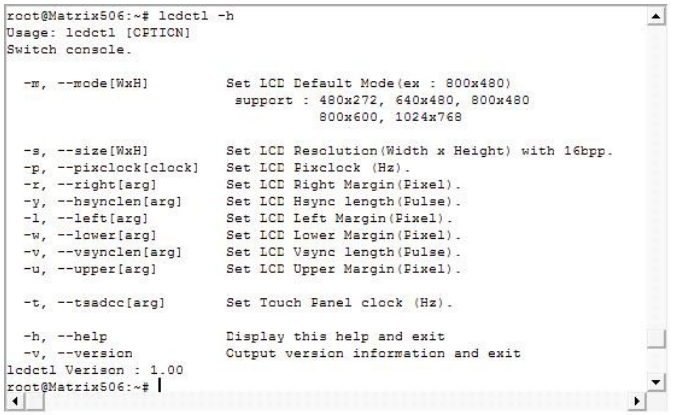
3. ***version***: find out the version of OS.



4. ***gpioctl***: The gpio can be configured by ***gpioctl*** and the usage is as shown followed.



4. ***lcdctl***: The lcdctl is used to configure LCD setting and the usage is as shown followed.

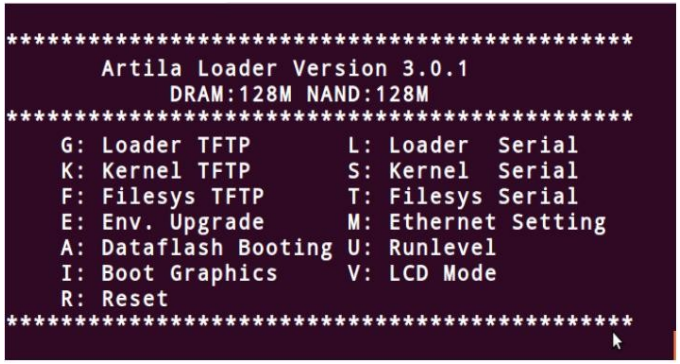


Loader Menu

Loader menu helps user to select the run level of system boot up. User need to use serial console to enter loader menu. Please configure the serial port of terminal as follow:

Baud Rate: 115200
Data bits: 8
Parity: N
Stop bit: 1
Flow Control: None
Terminal type: VT100

Once power up M-9G45A, please repeatedly keying "@" and you will see the loader menu appear as follow:



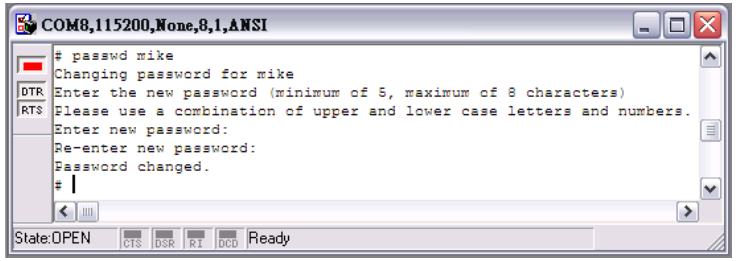
If you miss the timing, please power on again the M-9G45A and do it again. Select U will prompt the run level selection message. Run level 0 is halt, run level 1 is single user (disable login and service). Run level 2~5 are multiple users and run level 6 is reboot. To view the run level configuration, please check

/etc/inittab

Frequently Asked Question

1. *Forgot password*:

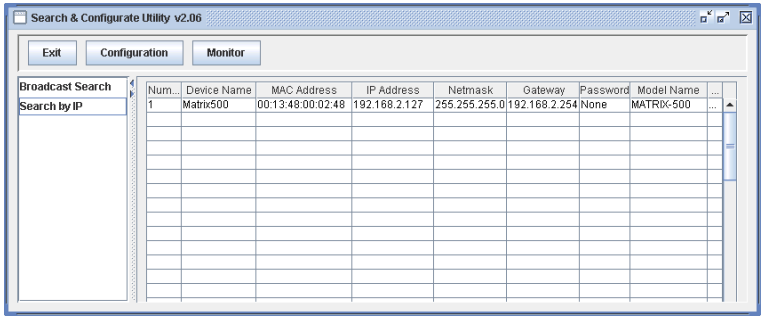
If you forgot the password for login, please use serial console and use run level 1 to boot system. Use passwd to change the password setting.



2. *Forgot the IP address*

If you forgot the M-9G45A IP address, you can use the Java Manager available in Artila CD to search the IP address of M-9G45A

Or use serial console port to find out the IP address by *#ifconfig*

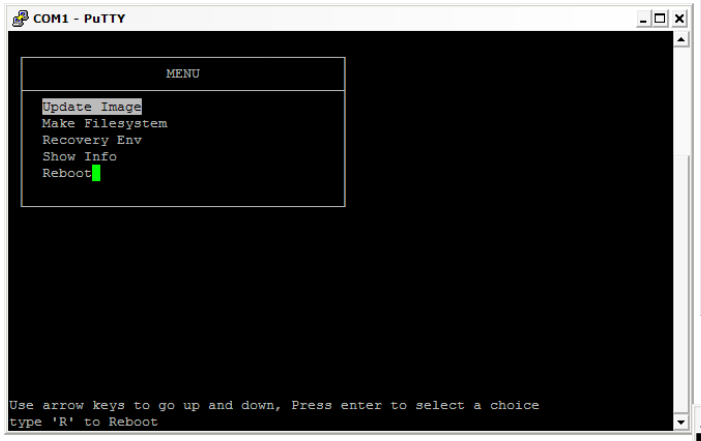


3. *System fail to boot*

If you mess up the root file system and make the system fail to boot, M-9G45A will automatically switch to boot from Dataflash file system and a console menu will show up at console port to help user perform system recovery. ***System Recovery Section*** will tell you how to recover the system.

System Recovery

If NAND Flash file system does fail, DataFlash file system will automatically boot up and a Console Menu at console port will appear as follow:



1. Update Image: this option can recover the loader, kernel and file system by using an USB disk. The USB disk contains the images files with the path as follow:

    Loader: ***M9G45A/m9g45a.alf***
    Kernel: ***M9G45A/M9G45-K***
    File system: ***M9G45A/M9G45-R***

The files are available in Artila CD. Please prepare an USB disk with vFAT file system and copy the image files to it before choosing this option.

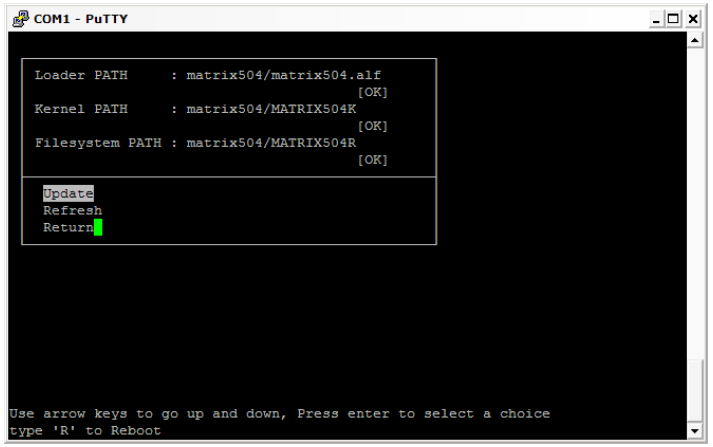
2. Make Filesystem: this option is used to create customized file system. Before using this function, you need to copy the folder of ***mkimage*** in the Artila CD to an USB disk. This function will create a new file system image for users and they can use it to duplicate the customized file system to other M-9G45A.

3. Recovery Env.: The option will recover the environment files as default setting. Use this function only when the NAND file system crash.

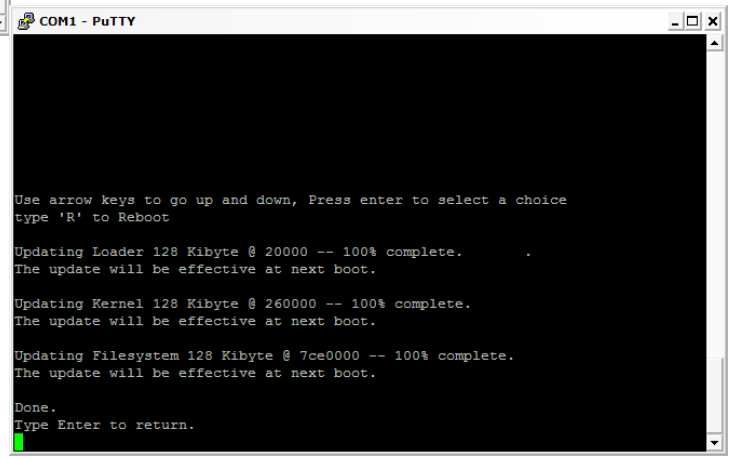
4. Show Info: Show the version information of M-9G45A

5. Reboot: Reboot the NAND flash file system.

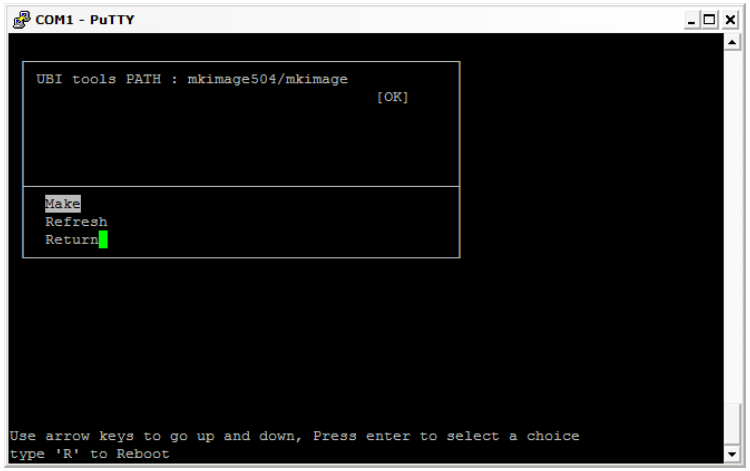
Update Image Starts



Update Image Completes



Make Files System Starts



Note:

1. Use Arrow keys up and down to selection the functions
2. Use Arrow keys left and right to go to higher or lower levels of menu screen
3. To force system go into DataFlash booting, repeatedly keying “!” (Shift +1) right after M-9G45A power on.

Appendix

Utility Collection

1. Busybox:-tiny utility collection
2. Sysvinit: -standard Linux initialization
3. util-linux-mount/umount :-support long file name
4. ssh :– support sftp server
5. Usbutils:– USB id program
6. Lighttpd:-web server
7. Wget:– used in ipkg software
8. Iptables:– IP routing
9. Ipkg:– software package management
10. Procps:– support webmin process management
11. Vsftpd:– ftp server
12. Bash:-GNU shell
13. wireless_tools :– wireless LAN utility
14. Ppp:-ppp dial up utility
15. Psmics:– procps supplement
16. artila utility:– handy utility added by Artila

You can find more utility at Artila M-9G45A CD and use ipkg to install the utility.

ipkg software package management

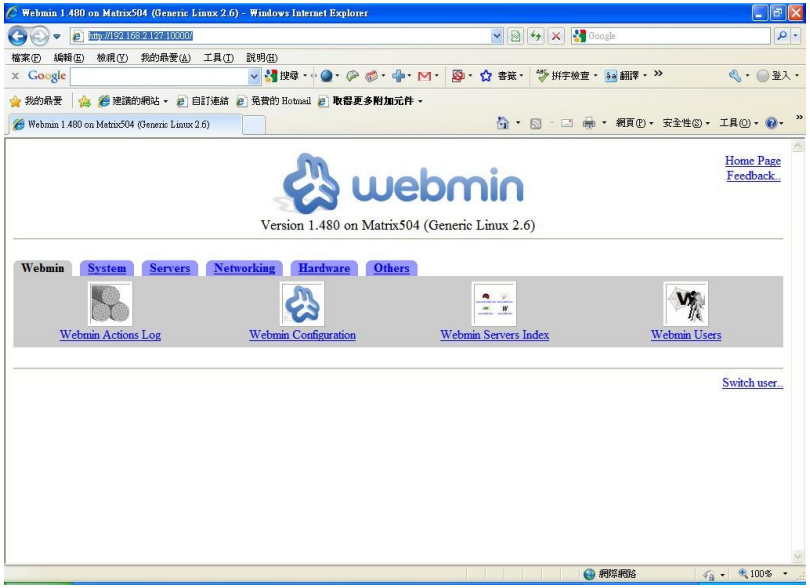
M-9G45A uses ***ipkg*** to manage the software installation, upgrade and removal. Artila will continuously add the kernel module and utility at our ftp server, user can install these software from Artila's ftp server. In addition user can also setup your ftp server to update the software you want. To install the utility from Artila ftp, please use ***vi*** to edit the ***/etc/ipkg.conf***

src/gz arm ftp://ftp:ftp@ftp.artila.com/AT9G45/Artila-CD/Linux/Utility
src/gz kernel ftp://ftp:ftp@ftp.artila.com/AT9G45/Artila-CD/Linux/modules

You can also copy the Utility and module folder from Artila CD to a USB disk, then use USB disk to install the software by changing the ***ipkg.conf***

src/gz usb_arm ftp://root:root@127.0.0.1/media/sda1/Utility
src/gz usb_kernel ftp://root:root@127.0.0.1/media/sda1/modules

Make sure the USB disk is correctly mounted, now use command
ipkg update
to update the package list and use
ipkg install webmin
To install webmin. Webmin is a web-based interface to system administration. To start webmin, go to ***/etc/webmin*** and type
start webmin
Then you can use browser to visit M-9G45A port 10000



The webmin for M-9G45A provides following modules:

1. Webmin: webmin configuration
2. System: system boot, process and log management
3. Server: Apache and SSH server configuration
4. Network: network configuration
5. Hardware: RTC setting
6. Others: File manager, upload and download

Remember to use command

depmod –a /lib/modules/2.6.38.7/modules.dep

To update the dependency list if new kernel module were added.

M-9G45A Evaluation Board Layout