

Matrix 505 Quick Installation Guide

Version 1.0

Overview

Matrix-505 is a Linux ready, ARM9-based embedded computer. Its lower power and robust design concept makes it an ideal industrial computer platform for harsh environment. The Linux OS and file system are pre-installed in the on-board Flash memory and the GNU tool chain CD coming with Matrix-505 is ready for your application development.

Features

1. Atmel AT91SAM9G45 ARM Processor 400MHz
2. 32-KByte Data Cache and 32-KByte Instruction Cache
3. 128MB DDR RAM, 128MB NAND Flash on board
4. Two independent 10/100 Mbps Ethernet ports
5. Two USB 2.0 high speed (480 Mbps) Host ports
6. One software configurable RS-232/422/485 port and three RS-232/485 ports
7. One USB client port
8. One microSD socket
9. 9 to 48VDC power input
10. Pre-installed Linux 2.6.38 kernel and file system
11. GNU tool chain available in Artila CD
12. Optional DIN RAIL mounting adaptor

Packing List

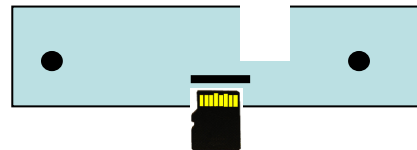
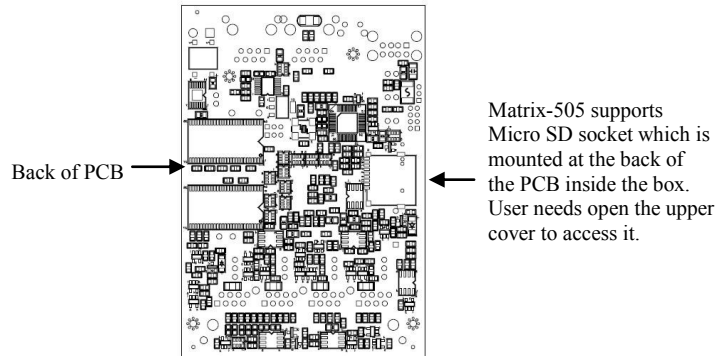
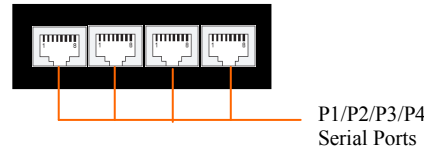
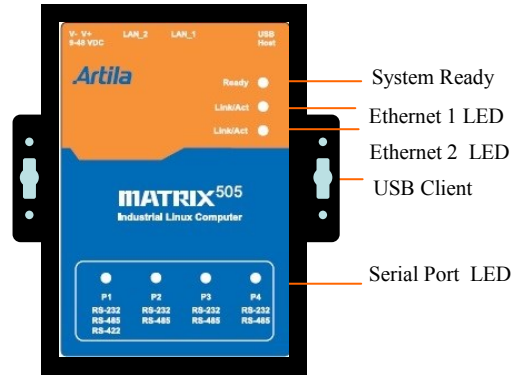
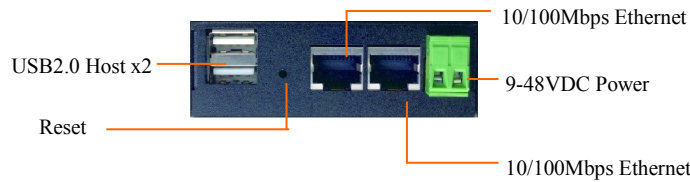
Matrix-505 is shipped with following items

1. Matrix-505
2. Artila CD includes Tool Chain, Installation guide and Utility software and device driver and example programs

Optional Accessory

1. CB-RJ45F9-150: RJ45 to DB9 Female Cable
2. 91-PHDF9-050: Wafer box to DB9 Female Cable
3. DK-35A: DIN RAIL Mounting Kit
4. PWR-12V-1A: 110~240VAC to 12VDC 1A Power Adaptor

Matrix-505 Layout



USB Port

The USB port is an USB2.0 high speed host port. It can be used to expand the hardware function of Matrix-505 and exchange file and data between PC and Matrix-505 using an USB flash disk. Currently the hardware support by Matrix-505 USB is shown as follow:

1. USB Storage Device
2. USB to Wireless LAN Adaptor
3. USB to Serial Adaptor
4. USB to Modem (CDC compliant)
5. USB Camera

The USB client port is reserved for production purpose only. Contact Artila if you find your USB device is not shown on the list.

Reset Button

Press the "Reset" button to activate the hardware reset. Please always use "reboot" command to reset Matrix-505. You should only use this function if the software reboot does not function properly.

Ready LED

After Power ON, Matrix-505 starts booting. Once system is boot up, the Ready LED will show solid green. The Ready LED will be turned off after Matrix-505 received “halt” command.

Link/Act LED

When Ethernet port are connected to the network, Link/Act will show solid green and if there is traffic in the Ethernet, this LED will flash

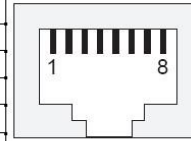
Serial Port LED

These four dual color LEDs indicate the data traffic at the serial ports. When RXD line is high then Green light is ON and when TXD line is high, Yellow light is ON.

Serial Port

The four serial ports can be configured as RS-232, RS-422 or RS-485 by software. They use RJ45 connector and the pin assignment are shown as following table.

Pin	RS-232	RS-422	RS-485
1	DSR	---	---
2	RTS	TXD+	Data+
3	GND	GND	GND
4	TXD	TXD-	Data-
5	RXD	RXD+	---
6	DCD	RXD-	---
7	CTS	---	---
8	DTR	---	---



Port 1: RS-232/422/485

RS-232: RXD, TXD, RTS, CTS, DSR, DTR, DCD, GND

RS-422: TXD+, TXD-, RXD+, RXD-, GND

RS-485: DATA+, DATA-, GND

Port 2/3/4:

RS-232: RXD, TXD, RTS, CTS, GND

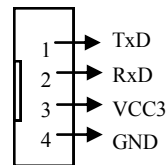
RS-485: DATA+, DATA-, GND

Serial Console Port: (JP1)

Serial console port is used for locally accessing Matrix-505 system using RS-232 port. The console port is located inside the box and close to battery. It is a four-pin wafer box header. User can order wafer console cable to access the serial console port.

Port 0: RS-232:RXD, TXD, GND

Serial Console

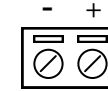


Therefore you need to open the upper metal case and prepare or purchase a serial console cable to use the serial console port .

Another way to use serial console port is to assign any one of the four external serial ports (ttyS1 to ttyS4) to be console port by command *setconsole*

Power Connector

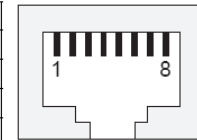
Connect the 9 to 48VDC power line to Matrix-505. If the power is properly supply.



Ethernet Port

The Ethernet Port use RJ45 connector

Pin	Signal
1	ETx+
2	ETx-
3	ERx+
6	ERx-



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 (fdt_sio.ko)
5. rtc: Real Time Clock
6. gpio: General Purpose digital I/O
7. ttyACM0 and ttyACM1: USB Modem (CDC compliant)
8. mmc : SD driver

Utility Software:

Matrix-505 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

```
ex Telnet 192.168.2.127
root@Matrix504:/sbin# ls
arp                init               lsusb              setconsole
depmod             init.sysvinit     mkdevs            shutdown
depmod.26         insmod            mkdosfs           shutdown.sysvinit
fdisk              luconfig          mkfs.minix        start-stop-daemon
fsck               lugetid           mkfs.vfat         sulogin
fsck.minix         iwlist            mkswap            swapoff
getty              iwpriv            nodprobe          swapon
halt               iwspy            pivot_root        switch_root
halt.sysvinit     killall15         poweroff          sysctl
hotplug           klogd             reboot            sysctl.procps
hwclock           ldconfig          reboot.sysvinit   syslogd
ifconfig          logread           rmdir             telinit
ifdown            losetup           route             udhcp
ifup              lsmod             runlevel

root@Matrix504:/sbin# cd /bin
root@Matrix504:/bin# ls
addgroup           dmesg             mktemp            sh
adduser            echo              more              sleep
bash              egrep             mount             stty
bashbug           false             mount.util-linux su
busybox           fgrep             mountpoint        sync
cat               grep              mv                 tar
chattr            gunzip            netstat           touch
chgrp             gzip             pidof             true
chmod             hostname          pidof.sysvinit   umount
chown             ip                ping              unmount.util-linux
cp                kill              ps                 uname
cpio              kill.procps       ps.procps         usleep
date              ln                pud                vi
dd                login             rm                 zcat
delgroup          ls                rmdir
deluser           mkdir             run-parts
df                mknod            sed
```

Mounting External Storage Memory

To find out the device name of the external memory device which plug into Matrix-505, you can use the command

dmesg | grep sd

To find out the device type (sda or sdb)

And use

mount /dev/sda1

to mount the USB disk and folder is local at

```
ex Telnet 192.168.2.127
root@Matrix504:~# cat /etc/fstab
# stock fstab - you probably want to override this with a machine specific one

rootfs                /                    auto                defaults            1 1
proc                  /proc                proc                defaults            0 0
devpts                 /dev/pts             devpts             mode=0620,gid=5    0 0
usbfs                 /proc/bus/usb        usbfs              defaults            0 0
tmpfs                 /var/volatile        tmpfs              defaults,size=6M    0 0

# mount dev
/dev/sda1              /media/sda1          auto                defaults,sync,noauto 0 0
/dev/sda               /media/sda1          auto                defaults,sync,noauto 0 0
/dev/sdb1              /media/sdb1          auto                defaults,sync,noauto 0 0
/dev/sdb               /media/sdb1          auto                defaults,sync,noauto 0 0
root@Matrix504:~#
```

Welcome Message

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

Web Page Directory

The web pages are placed at /usr/www and 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

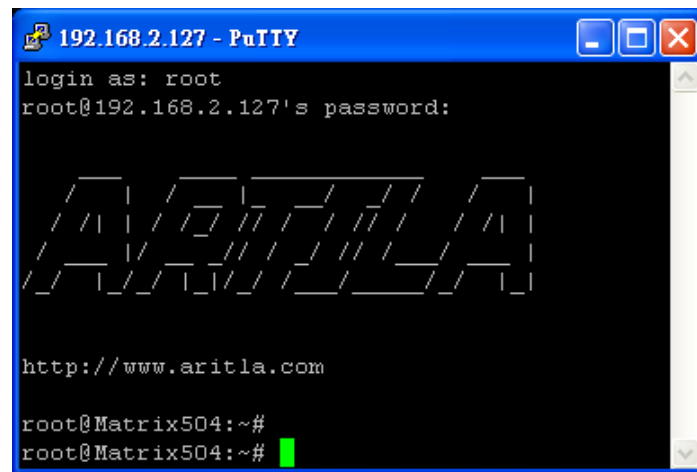
User can also use NTP client utility in Artila CD to adjust the RTC time.

ntpcient [time server ip]

SSH Console

Matrix-505 supports SSH. If you use Linux computer, you can use SSH command to login Matrix-505. The configuration of SSH and key are located at

/etc/ssh



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 Matrix-505

ipkg package software management

ipkg is a light software package utility. It can be used to install, upgrade and remove the software package for Matrix-505.

Currently user can use ipkg to install the software package from Artila FTP. You can find the configuration at *ipkg.conf*

When Matrix-505 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

Please refer to Appendix for more about *ipkg*

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-gnueabi-4.3.3.tar.bz2 to root directory of PC. Under root directory, type following command to install the Matrix-505 Tool Chain

```
#tar -xvff arm-linux-gnueabi-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 Matrix-505 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

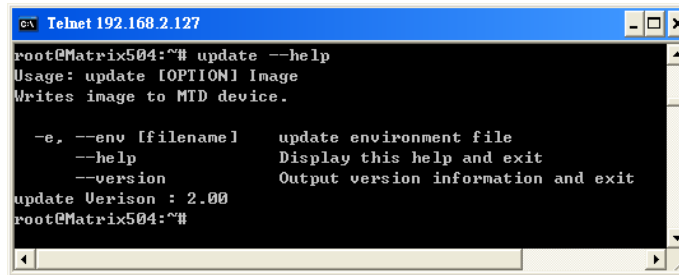
Hello will be executed after system boot up. **rc.local** has the similar function as **/etc/rc** in Matrix-500

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

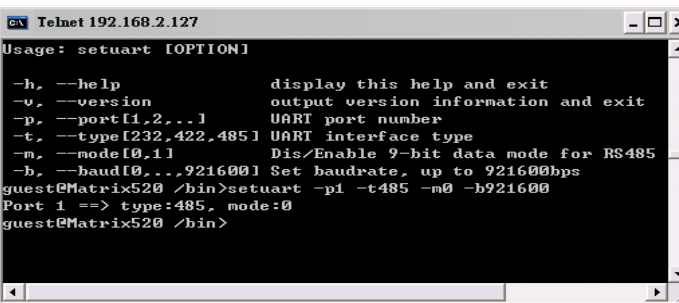


```
Telnet 192.168.2.127
root@Matrix504:~# update --help
Usage: update [OPTION] Image
Writes image to MTD device.

-e, --env [filename]  update environment file
--help               Display this help and exit
--version            Output version information and exit
update Verison : 2.00
root@Matrix504:~#
```

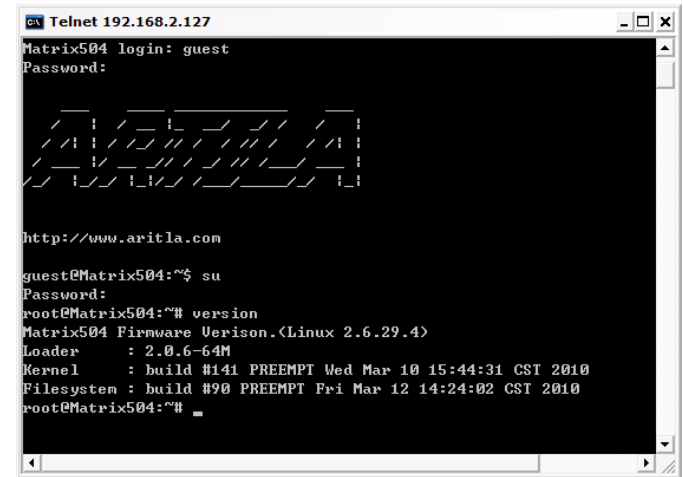
Update can only operated under supervisor mode (password : root). Please use command **su** and login as root

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



```
Telnet 192.168.2.127
Usage: setuart [OPTION]
-h, --help          display this help and exit
-v, --version       output version information and exit
-p, --port [1,2,..] UART port number
-t, --type [232,422,485] UART interface type
-m, --mode [0,1]    Dis/Enable 9-bit data mode for RS485
-b, --baud [0,..,921600] Set baudrate, up to 921600bps
guest@Matrix520 /bin>setuart -p1 -t485 -m0 -b921600
Port 1 ==> type:485, mode:0
guest@Matrix520 /bin>
```

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



```
Telnet 192.168.2.127
Matrix504 login: guest
Password:

Matrix504 Firmware Verison.(Linux 2.6.29.4)
Loader : 2.0.6-64M
Kernel : build #141 PREEMPT Wed Mar 10 15:44:31 CST 2010
Filesystem : build #90 PREEMPT Fri Mar 12 14:24:02 CST 2010
root@Matrix504:~#
```

4. **setconsole**: The console port is located at JP1 of Matrix-505. User can use **setconsole** command to redirect the serial console port to any one of the four serial port. Therefore user can avoid opening the metal case to access the serial console.



```
root@M502:~# setconsole --help
Usage: setconsole [OPTION]
Switch console.

-0, --debug          Set console to debug port
-1, --ttyS1         Set console to ttyS1 port
-2, --ttyS2         Set console to ttyS2 port
-3, --ttyS3         Set console to ttyS3 port
-4, --ttyS4         Set console to ttyS4 port
-c, --close         Close console port
-h, --help          Display this help and exit
-v, --version       Output version information and exit
setconsole Verison : 1.00
```

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 Matrix-505, please repeatedly keying “@” and you will see the loader menu appear as follow:

```
Starting Matrix504.....
*****
      Artila Loader Version 2.0.0
*****
G: Loader TFTP      L: Loader Serial
K: Kernel TFTP     S: Kernel Serial
F: Filesys TFTP    T: Filesys Serial
E: Env. Upgrade    M: Ethernet Setting
A: Dataflash Booting U: Runlevel
R: Reset
*****
```

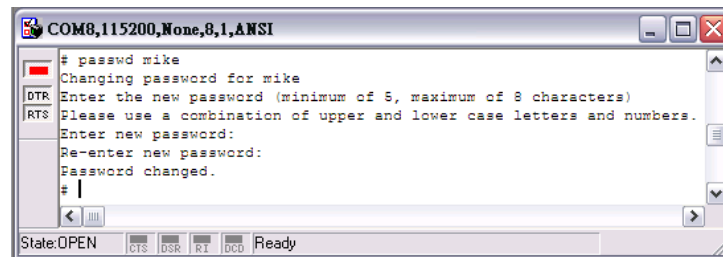
If you miss the timing, please power on again the Matrix-505 and do it again. Select U will prompt the run level selection message. Run level 0 is halt, run level 1 is single user (disable login and service). Run level 2~5 are multiple users and run level 6 is reboot. To view the run level configuration, please check

/etc/inittab

Frequently Asked Question

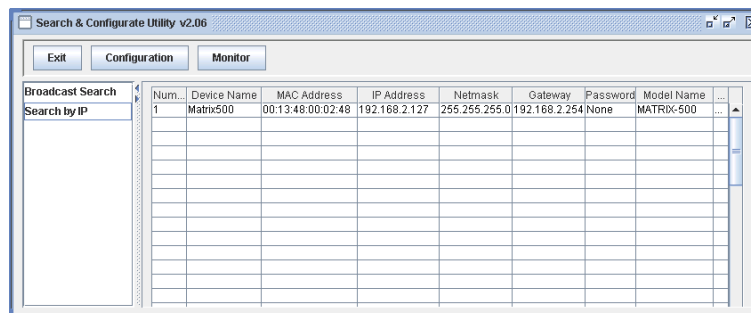
1. Forgot password:

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 Matrix-505 IP address, you can use the Java Manager available in Artila CD to search the IP address of Matrix-505 Or use serial console port to find out the IP address by *#ifconfig*

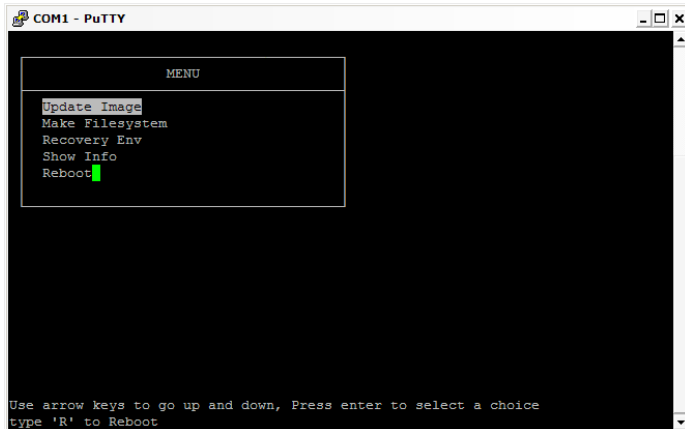


3. System fail to boot

If you mess up the root file system and make the system fail to boot, Matrix-505 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:



```
COM1 - PuTTY
MENU
Update Image
Make Filesystem
Recovery Env
Show Info
Reboot
Use arrow keys to go up and down, Press enter to select a choice
type 'R' to Reboot
```

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: *matrix505/matrix505.alf*
Kernel: *matrix505/matrix505K*
File system: *matrix505/matrix505R*

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

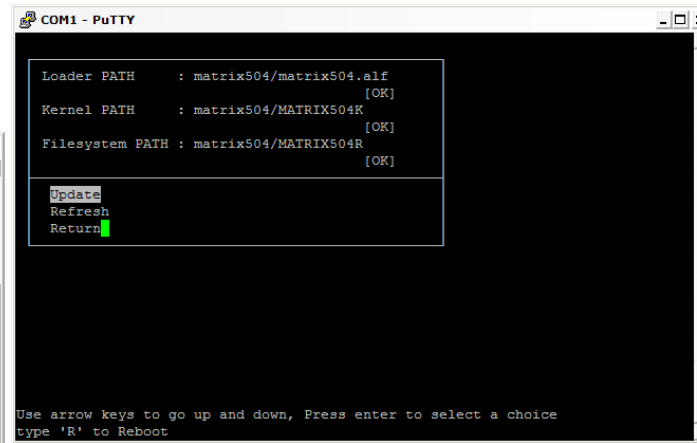
2. Make Filesystem: this option is used to create customized file system. Before using this function, you need to copy the folder of *mkimage505* in the Artila CD to an USB disk. This function will create a new file system image for users and they can use it to duplicate the customized file system to other Matrix-505.

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 Matrix-505

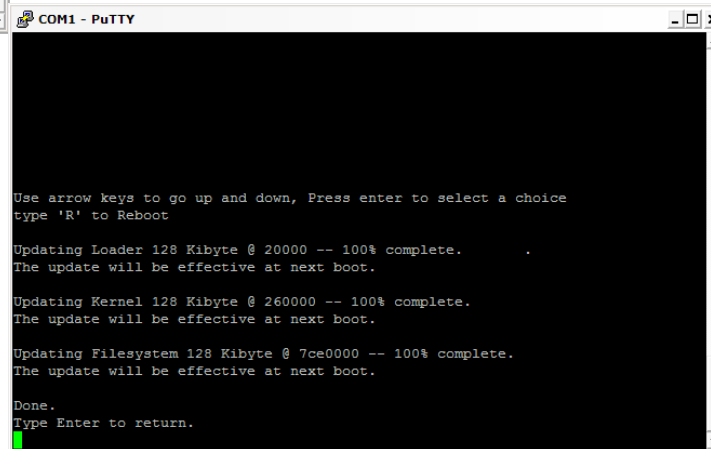
5. Reboot: Reboot the NAND flash file system.

Update Image Starts



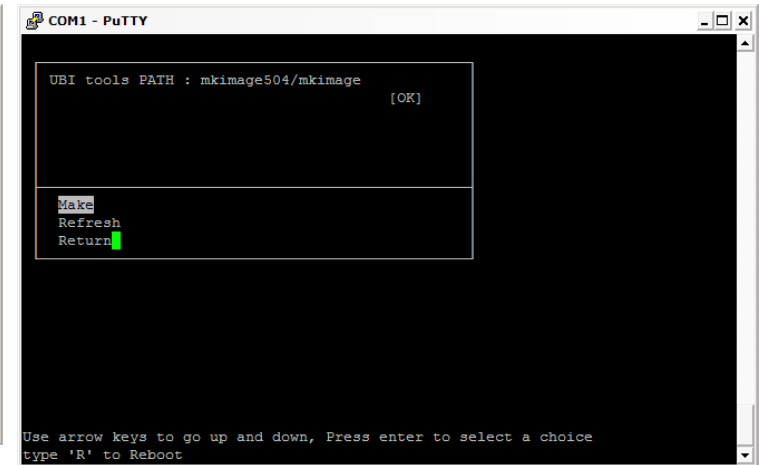
```
COM1 - PuTTY
Loader PATH : matrix504/matrix504.alf [OK]
Kernel PATH : matrix504/MATRIX504K [OK]
Filesystem PATH : matrix504/MATRIX504R [OK]
Update
Refresh
Return
Use arrow keys to go up and down, Press enter to select a choice
type 'R' to Reboot
```

Update Image Completes



```
COM1 - PuTTY
Use arrow keys to go up and down, Press enter to select a choice
type 'R' to Reboot
Updating Loader 128 Kibyte @ 20000 -- 100% complete.
The update will be effective at next boot.
Updating Kernel 128 Kibyte @ 260000 -- 100% complete.
The update will be effective at next boot.
Updating Filesystem 128 Kibyte @ 7ce0000 -- 100% complete.
The update will be effective at next boot.
Done.
Type Enter to return.
```

Make Files System Starts



```
COM1 - PuTTY
UBI tools PATH : mkimage504/mkimage [OK]
Make
Refresh
Return
Use arrow keys to go up and down, Press enter to select a choice
type 'R' to Reboot
```

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 key-ing “!” (Shift +1) right after Matrix-505 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 CD and use ipkg to install the utility.

ipkg software package management

Matrix-505 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 FTP 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 Matrix-505 port 10000
http://192.168.2.127:10000

The webmin for Matrix-505 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/2.6.29.4/modules.dep

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

