

Matrix 504 Quick Installation Guide

Overview

Matrix 504 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 504 is ready for your application development.

Features

1. ARM926EJ-S ARM Thumb Processor 400MHz w/MMU
2. 32-KByte Data Cache and 32-KByte Instruction Cache
3. 64MB SDRAM, 128MB NAND Flash on board
4. One 10/100 Mbps Ethernet
5. Two USB 2.0 full speed (12 Mbps) Host Ports
6. One software configurable RS-232/422/485 port and three RS-232/485 ports
7. One serial console port
8. 5 programmable GPIO
9. 9 to 48VDC power input
10. Pre-installed Linux 2.6.29 kernel and file system
11. GNU tool chain available in Artilla CD
12. Optional DIN RAIL mounting adaptor

Packing List

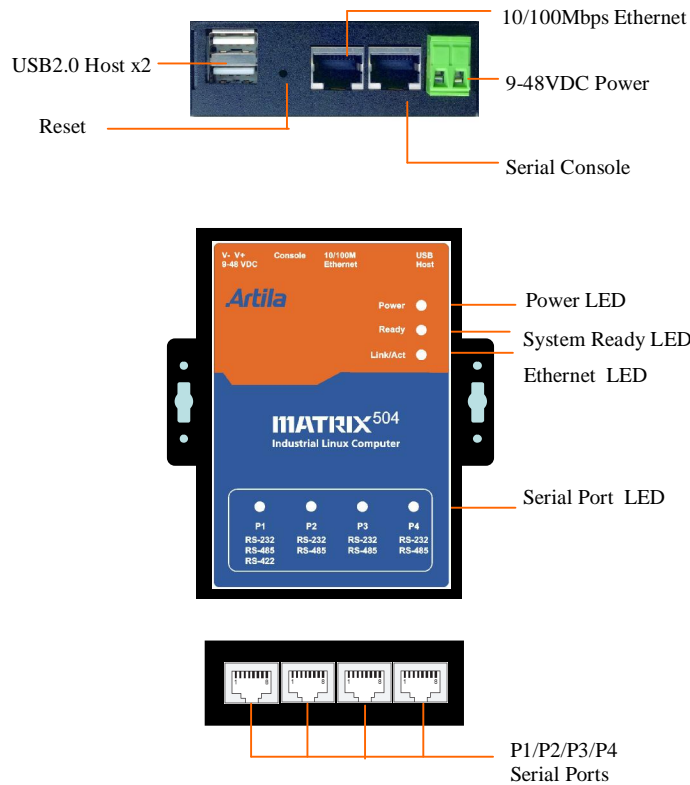
Matrix 504 is shipped with following items

1. Matrix 504
2. Artilla 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. CB-RJ2CON-100: Serial Console Cable
3. DK-35A: DIN RAIL Mounting Kit
4. PWR-12V-1A: 110~240VAC to 12VDC 1A Power Adaptor

Matrix 504 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 504 and exchange file and data between PC and Matrix 504 using an USB flash disk. Currently the hardware support by Matrix 504 USB is shown as follow:

1. USB Storage Device
2. USB to Wireless LAN Adaptor (Ralink RT73)
3. USB to Serial Adaptor (fdt usb to UART)
4. USB to Modem (CDC compliant)
5. USB Camera

The USB client port is reserved for production purpose only. Contact Artilla if you find your hardware 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 504. You should only use this function if the software reboot does not function properly.

Power LED

The Power LED will show solid green if power is properly applied

Ready LED

After Power ON, Matrix 504 starts booting. Once system is boot up, the Ready LED will show solid green. The Ready LED will be turned off after Matrix 504 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

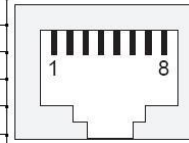
Serial Port LED

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

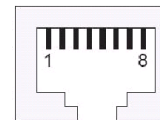
Serial Console Port:

Serial console port is used for locally accessing Matrix 504 system using RS-232 port. The console port uses RJ45 connector and is next to Ethernet port. Therefore please be careful to plug in the right connector

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

| Pin | Definition |
|-----|------------|
| 1 | PIO0 |
| 2 | TXD |
| 3 | GND |
| 4 | PIO1 |
| 5 | PIO2 |
| 6 | PIO3 |
| 7 | RXD |
| 8 | PIO4 |

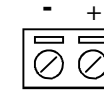
Console



Therefore you need to prepare or purchase the serial console cable (CB-RJ2CON-100) in order to use the serial console port . In addition to the serial console signal, the console RJ45 port also provides GPIO (programmable I/O signal) function. The GPIO port is CMOS I/O and can be programmed as digital input or output. Power up setting is digital input mode with 75K ohm pull up resistor.

Power Connector

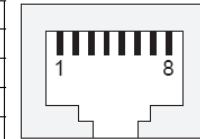
Connect the 9 to 48VDC power line to Matrix 504. If the power is properly supply, the power LED will show a solid green color.



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

Utility Software:

Matrix 504 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               lssub             setconsole
depmod             init.sysvinit     makedevs         shutdown
depmod.26         insmod            mkdosfs          shutdown.sysvinit
fdisk              iwconfig          mkfs.minix       start-stop-daemon
fsck              iwgetid           mkfs.vfat        sulogin
fsck.minix        iwlist            mkswap           swapoff
getty             iwpriv           nodprobe         swapon
halt              iwspy            pivot_root       switch_root
halt.sysvinit     killall5          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            amount.util-linux
cp              kill             ps              uname
cpio            kill.procps      ps.procps        usleep
date            ln               pwd              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 504, 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

media/sda1 or **/mnt/sda1**

```
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/sda       auto            defaults,sync,noauto 0 0
/dev/sdb1             /media/sdb1      auto            defaults,sync,noauto 0 0
/dev/sdb              /media/sdb       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/share/apache2 and the /etc/apache2/httpd.conf contains the apache 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

Matrix 504 supports SSH. If you use Linux computer, you can use SSH command to login Matrix 504. The configuration of SSH and key are located at

/etc/ssh

The key generation program is available at /usr/bin

```
192.168.2.127 - PuTTY
login as: root
root@192.168.2.127's password:

http://www.aritla.com

root@Matrix504:~#
root@Matrix504:~#
```

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-504

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-504. Currently user can use ipkg to install the software package from Artila FTP. You can find the configuration at **ipkg.conf**

When Matrix-504 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**

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-504, 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
*****
```

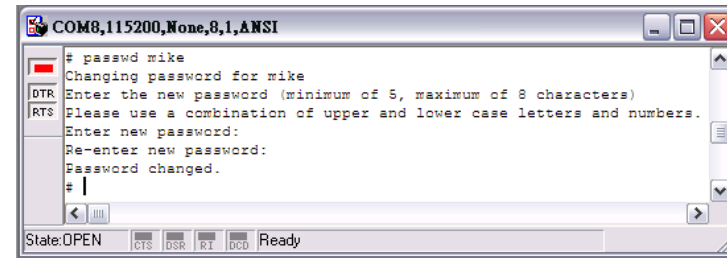
If you miss the timing, please power on again the Matrix-504 and do it again. Select U will prompt the run level selection message. Run level 0 is halt, run level 1 is single user (disable login and service). Run level 2~5 are multiple users and run level 6 is reboot. To view the run level configuration, 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.

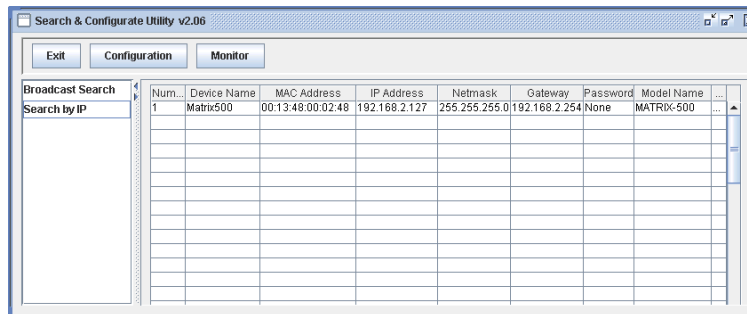


2. Forgot the IP address

If you forgot the Matrix 504 IP address, you can use the Java Manager available in Artila CD to search the IP address of Matrix 504

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

#ifconfig

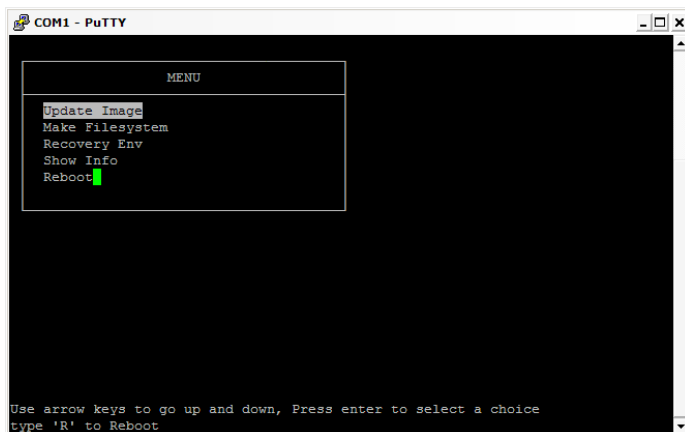


3. System fail to boot

If you mess up the root file system and make the system fail to boot, Matrix-504 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: *matrix504/matrix504.alf*
Kernel: *matrix504/matrix504K*
File system: *matrix504/matrix504R*

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

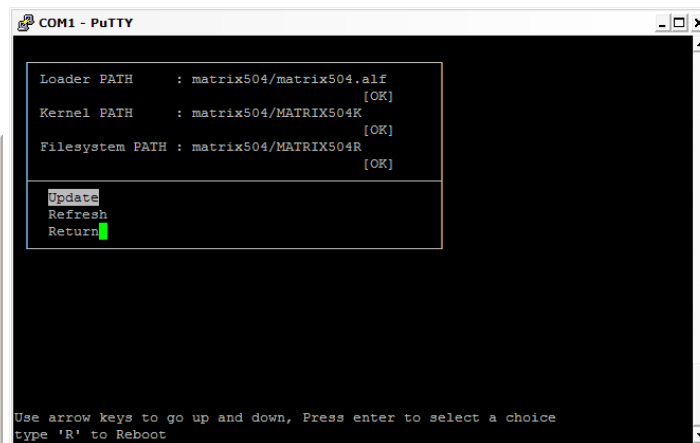
2. Make Filesystem: this option is used to create customized file system. Before using this function, you need to copy the folder of *mkimage504* in the Artila CD to an USB disk. This function will create a new file system image for users and they can use it to duplicate the customized file system to other Matrix-504.

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-504

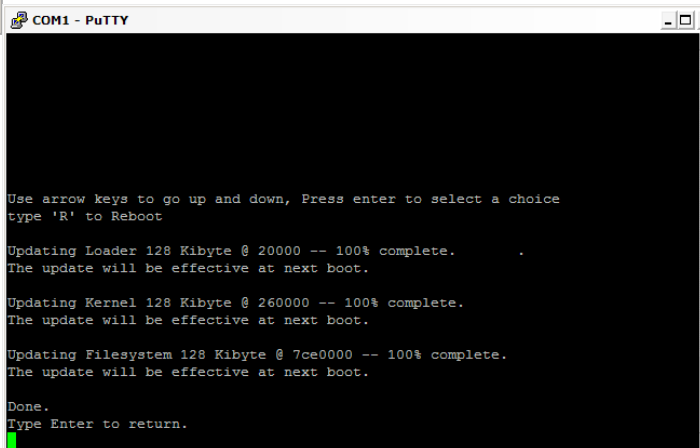
5. Reboot: Reboot the NAND flash file system.

Update Image Starts



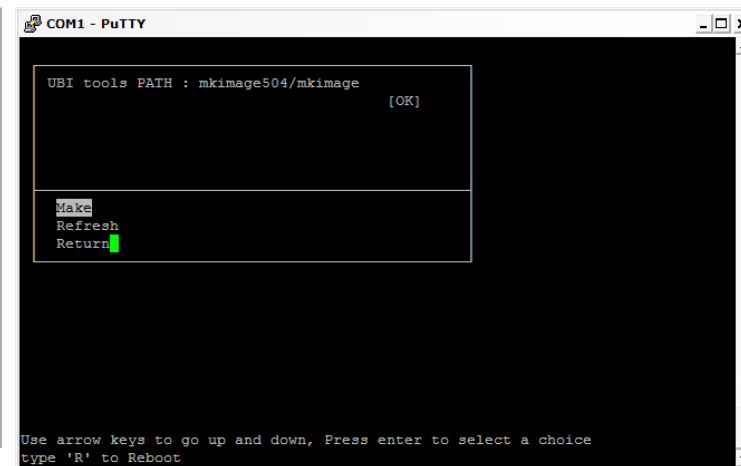
```
COM1 - PuTTY
Loader PATH : matrix504/matrix504.alf [OK]
Kernel PATH : matrix504/MATRIX504K [OK]
Filesystem PATH : matrix504/MATRIX504R [OK]
Update
Refresh
Return
Use arrow keys to go up and down, Press enter to select a choice
type 'R' to Reboot
```

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 keying “!” (Shift +1) right after Matrix-504 power on.

Appendix

Utility Collection

1. busybox v1.14.2-tiny utility collection
2. sysvinit v2.86 -standard Linux initialization
3. util-linux-mount/umount v2.12r-support long file name
4. ssh v4.6p1- support sftp server
5. usbutils v0.7- USB id program
6. Apache2 v2.23-web server
7. wget v1.9.1- used in ipkg software
8. iptables v1.3.8- IP routing
9. ipkg v.0.99.163- software package management
10. procps v3.2.7- support webmin process management
11. vsftpd v2.0.5- ftp server
12. bash v3.2-GNU shell
13. wireless_tools v29- wireless LAN utility
14. ppp v2.4.3-ppp dial up utility
15. psmics v22.2- procps supplement
16. artila utility v.1.1- handy utility added by Artila

You can find more utility at Artila Matrix-504 CD and use ipkg to install the utility.

ipkg software package management

Matrix-504 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/Matrix504/Linux/Utility
src/gz kernel ftp://ftp:ftp@ftp.artila.com/Matrix504/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 Matrix-504 port 10000
http://192.168.2.127:10000

The webmin for Matrix-504 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.

