Introduction:

Matrix 512 is an ARM9-based Linux ready industrial computer. The key features are as follow:

- 1. ARM920T ARM Thumb Processor with 200MIPS at 180MHz, Memory Management Unit
- 2. 16-KByte Data Cache and 16-KByte Instruction Cache
- 3. 64MB SDRAM, 16MB Flash on board
- 4. Two 10/100 Mbps Ethernet
- 5. Two USB 2.0 full speed (12 Mbps) Host Ports
- 6. Multimedia Card Interface for SD memory card
- 7. Four 3-in-1 RS-232/422/485 ports
- 8. RS-485 supports auto data direction control
- 9. 21 programmable Digital I/O
- 10. 9 to 40VDC power input
- 11. Pre-installed Standard Linux 2.6 OS
- 12. GNU tool chain available in Artila CD
- 13. Optional DIN RAIL mounting adaptor

Packing List

- 1. Matrix 512 Box Computer
- 2. Wall mount bracket
- 3. Artila CD

Optional Accessory:

- 1. DK-35A: DIN RAIL Mounting Kit
- 2. Console cable CB-DB9MDB9M-100



Matrix 512 Layout



<u>Reset Button</u>

Press the "Reset" button to activate the hardware reset. 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

<u>Ready LED</u>

The Ready LED will show solid green if Matrix 512 complete system boot up. If Ready LED is off during system boot up, please check if power input is correct. Turn off the power and restart Matrix 520 again. If Ready LED is still off, please contact the manufacture for technical support.

Link/Act

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.

<u>Ethernet Port</u>



Serial Ports:

The four serial ports are 3-in-one RS-232/422/485 ports and the interface is configured in by software. Please refer to example program to configure the serial or use *"setuart"* utility to configure serial port setting. RS-485 hardware supports data direction control. Therefore it is software compatible with a RS-232 interface.

<u>Serial Console Port: (P3)</u>

Serial console port shares the connector with Serial port 3 but the pin definition as shown as follow:





Baud Rate: 115200 Data bits: 8 Parity: N Stop bit: 1 Terminal type: ANSI

The console cable can be ordered and its part number is CB-DB9FDB9F-100. Its configuration can be found at document Matrix 512 console cable

Enable/Disable Serial Console Port

The serial console port is disabled as factory default setting. To enable the serial console, you need to purchase or prepare a serial console cable and connect it to port 3. Right after powering on the system, keep typing \$ continuously until you see the message as shown in the figure followed. Console (ttyS0) stands for console port ttyS0 is enabled. Repeat this procedure will disable the serial console and Screen will show "Console (null)"

👪 c	COM8,115200,None,8,1,¥T100	
DTR RTS	 Starting Matrix512Saving Environment to Flash Erasing Flash . done	~
	Erased 1 sectors Writing to Flash done Console (ttySO)	
State:	OPEN CTS DSR RI DCD Got Break Signal	>

<u>Serial Port (</u>DB9 Male)

Po	RS-485	RS-422	RS-232	Pin No.
10	_	TXD-	DCD*	1
	_	TXD+	RXD	2
0 \	DATA+	RXD+	TXD	3
	DATA-	RXD-	DTR*	4
Note	GND	GND	GND	5
	_		DSR*	6
	_	_	RTS	7
	_		CTS	8
	_			9



Note: * Port 2 only

Digital I/O Port (DB25 Female)



Pin No.	Function	Pin No.	Function
1	DIO0	14	DIO13
2	DIO1	15	DIO14
3	DIO2	16	DIO15
4	DIO3	17	DIO16
5	DIO4	18	DIO17
6	DIO5	19	DIO18
7	DIO6	20	DIO19
8	DIO7	21	DIO20
9	DIO8	22	GND
10	DIO9	23	GND
11	DIO10	24	VCC3
12	DIO11	25	VCC5
13	DIO12		

Note:

- 1. VCC3: 3.3 VDC output
- 2. VCC5: 5 VDC output
- 3. GND: Digital Ground

Factory Default Settings

LAN 1 IP Address: 192.168.2.127 LAN 2 IP Address: DHCP Login: guest Password: guest Supervisor: root (ssh supported) Password: root

<u>Network Settings</u>



To configure the IP address, Netmask and Gateway setting, please modify /disk/etc/rc as following: *ifconfig eth0 192.168.2.127 netmask 255.255.255.0* For DHCP setting:

dhcpcd eth1 &

Wireless LAN Configuration

Matrix 512 supports wireless LAN by using USB WLAN adaptor which uses Ralink RT2571 (rt73) controller. Please refer to the website <u>http://ralink.rapla.net</u> for the supporting list of the USB WLAN adaptor.

To configure the wireless LAN setting, please use command: *ifconfig wlan0 up*

iwconfig wlan0 essid XXXX key YYYYYYY mode MMMM For infrastructure mode XXXX is the access point name and YYYYYYYY is the encryption key and MMMM should be *man*-

aged

For Ad-Hoc mode mode XXXX is Matrix512, the device name and YYYYYYY is the encryption key and MMMM should be *ad-hoc*.

To configure the IP address use command *dhcpcd wlan0* &

- or
- ifconfig wlan0 192.168.2.127 netmask 255.255.255.0

<u>File System</u>

📧 Telnet	192.168.2	.127							
	÷			ж×	ж×				
) ()	÷		××		ж×				
**	××		**		××				
**	××	****	****	××	××	**	KXXX		
**	**	**	**	××	××		**		
**	**	××	××	××	××	**	*****		
*****	****	××	**	××	××	××	**		
××	××	××	××	××	××	××	××		
**	**	××	**	××	××	××	*****		
guestUMa /dev/ran /dev/mtc /proc or /dev/sys guestQMa	atrix520 n0 on / lblock4 n /proc s on /sy atrix520	~>mou type e on ∕mn type p s type ~>df	nt xt2 (r t/disk roc (r sysfs	w,no typ w,no (rw	grpi e jf: dira	d) fs2 (1 time)	w,noatime)	>	
Filesyst	tem		1k-blo	cks		Used	Available	Use%	Mounted on
/dev/ran	nØ		8	059		6777	873	89%	
/dev/mtd	lblock4		11	648		532	11116	5%	/mnt/disk
guestCMa	atrix520	~>_							
4									

Matrix 512 configures the root file system as RAMDISK and the user disk (/disk) which includes /home and /etc directory are configured as Flash Disk. To find out the file system information, please use command /mount as show as above. In addition, use command /df to find out the disk space of the disk. The RAM-DISK uses 8MB memory space to store the root file system and the user disk is about 11MB for user's program storage. Therefore, user's program and utility software must be saved in the user disk space (/disk). Files saved to other directory will be loss after power off !!!



Telnet 192.168.2.127					- 🗆 🗙
guest@Mati bin default dev guest@Mati	<pre>wix520 />ls disk etc home wix520 />_</pre>	lib lost+found mnt	proc sbin sys	tmp usr var	
•					• //

<u>Devices list</u>

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. mmc to mmc2: SD memory card
- 4. sda to sde: USB flash disk
- 5. ttyUSB0 to ttyUSB1: USB RS-232 adaptor (fdti_sio.ko)
- 6. rtc: Real Time Clock
- 7. gpio: General Purpose digital I/O
- 8. ttyACM0 and ttyACM1: USB Modem (CDC compliant)

Telnet 19	2.168.2.127				- 🗆	×
guest@Matr	∙ix520 /dev>	ls				
console	mem	mtdblock4	ptyp8	sde	ttyACM0	
cuaØ	midi00	mtdr0	pt yp9	sequencer	ttyACM1	
cua1	mixer	mtdr1	ramØ	sndstat	ttyS0	
dsp	mmc	mtdr2	ram1	spiØ	ttyS1	
flash	mmc Ø	mtdr3	ram2	spi1	ttyS2	
gpio	mmc1	mtdr4	ram3	tty	tty\$3	
hda	mmc2	null	random	tty0	ttyS4	
hda1	mtd0	ррр	rtc	tty1	tty85	
hda2	mtd1	pt yp0	sda	tty2	ttyS6	
hda3	mtd2	ptyp1	sda1	tty3	tty87	
hda4	mtd3	ptyp2	sda2	tty4	ttyS8	
ipsec	mtd4	ptyp3	sda3	tty5	ttyUSB0	
kmem	mtdblock0	ptyp4	sda4	tty6	ttyUSB1	
lcd	mtdblock1	ptyp5	sdb	tty?	ttyp0	
ledman	mtdblock2	pt yp6	sdc	tty8	ttyp1	
log	mtdblock3	ptyp7	sdd	tty9	ttyp2	
guest@Matr	•ix520 ∕dev>					
						-
•					<u> </u>	//.

Utility Software:

Matrix 512 includes busybox utility collection and Artila utility software as follow:

quest@Matrix520	∕bin>ls			4
addgroup	echo	ln	setuart	
adduser	egrep	login	sh	
amgrd	false	ls	sleep	
bash	fgrep	mkdir	sshd	
boa	ftpd	mke2fs	stty	
busybox	gpioctl	mkfs.jffs2	su	
cat	grep	mknod	sync	
chat	gunzip	mktemp	tar	
chgrp	gzip	more	telnetd	
chmod	hostname	mount	tip	
chown	inetd	mp3play	tone	
cp	init	mv	touch	
շրա	iptables	netstat	true	
late	iptables-restore	pidof	umount	
de Igroup	iptables-save	ping	update	
deluser	iwconfig	pppd	usleep	
đ£	iwlist	ps	version	
dheped	iwpriv	pwd	vi	
discard	kill	rm	vplay	
dmesg	lcdctl	rmdir	zcat	
guest@Matrix520	/bin>			

Artila Utility Software:

The introduction of Artila utility software as follow: 1. *update* : update loader, kernel or root file system image. Also use *update* —*FORMAT* to format user disk. Type *update*—*help* to find the command usage



Update can only operated under supervisor mode (password : root)

2. *setuart:* configure serial port setting. An example show as followed to configure port 1 as RS-485 interface with baud rate 921600. Please note only port 1 support 9-bit data at RS-485

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

3. *gpioctl*: gpioctl is used to control the programmable digital I/ O port located on the DB25 connector. Following example is to configure DIO1 as digital input and DIO2 as digital output with low output state.

Telnet 192.168.2.127		- 🗆 🗙
guest@Matrix520 /bin>gpic Usage: gpioctl [OPTION]	<pre>imet 192.168.2.127 CeMatrix520 /bin>gpioct1 -h : gpioct1 [OPTION] help display this help and exitversion output version information and exitio[0,1,2,] GPIO numberstate[0,1] GPIO state, 1:HIGH, 0:LOWmode[0,1] GPIO mode, 1:INPUT, 0:OUTPUTall Show all GPIO state and mode teMatrix520 /bin>gpioct1 -i1 -m1 L -> State:High, Mode:Input teMatrix520 /bin>gpioct1 -i2 -m0 -s0 2 -> State:Low, Mode:Output teMatrix520 /bin></pre>	
<pre>-h,help -v,version -i,io[0,1,2,] -s,state[0,1] -m,mode[0,1] -a,all guest@Matrix520 /bin>gpic GPI01 -> State:High, Mode guest@Matrix520 /bin>gpic</pre>	display this help and exit output version information and GPIO number GPIO state, 1:HIGH, 0:LOW GPIO mode, 1:INPUT, 0:OUTPUT Show all GPIO state and mode octl -i1 -m1 ::Input octl -i2 -m0 -s0	exit
GPIO2 -> State:Low, Mode: guest@Matrix520 /bin>	Output	-
•		▶ //

How to make more utility software

You might also find utility software available on Artila CD under /Matrix & iPAC/utility such as *ntpclient, ssh, scp, bluez* and *ssh-keygen*. If you want, you can ftp or copy the utility software to Matrix 512 user disk (/disk). Also you can use find the source code and use the GNU Tool Chain to make the utility by yourself.

Mounting External Storage Memory

To find out the device name of the external memory device which plug into Matrix 512, you can use the command /*dmesg | grep sd*

or

/dmesg | grep mmc

Туре

mount /dev/sda1 to mount the USB disk and mount /dev/mmc0 to mount SD card

Telnet 192.168.2.127 cat /etc/fstab dev/sys /sys dev/sda /mnt/sda1 dev/sda1 /mnt/sdb1 dev/sdb1 /mnt/sdb1					- 🗆 🗙
# cat /etc/fsta	ւհ				
/dev/sys	/sys	sysfs	rw	00	
/dev/sda	/mnt/sda	vfat	rw	00	
/dev/sda1	/mnt/sda1	vfat	rw	00	
/dev/sdb	/mnt/sdb	vfat	rw	00	
/dev/sdb1	/mnt/sdb1	vfat	rw	00	
/dev/mtdblock3	/mnt/disk	jffs2	rw	00	
/dev/mmc0	/mnt/mmc	vfat	rw	00	
#					-
•					► //.

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 /home/httpd and the boa.conf contains the boa 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 512 support SSH. If you use Linux computer, you can use SSH command to login Matrix 512. The configuration of SSH and key are located at /etc/config/ssh The key generation program is available at Artila CD /matrix and ipac/utility/ssh_keygen User can copy this program to Matrix 512 to generate the key

Are you	i sure yo	ou want	to co	ntin	ue c	onnect	ing (yes/no)? yes
Warning]: Permar 32 168 2	iently 127's	added	'192 rd:	.168	.2.127	'' (RSA) to the list of known host
Welcome	e to	127 3	pu3340	Tu.			
*	< *			**	**		
*	сж 		**		**		
**	**		**		**		
**	**	****	****	**	**	***	***
**	**	**	**	**	**		**
**	**	** **	~~ ~~		÷.		·***
**	**	**	**	**	**	**	**
	4.4	**	**	**	**	***	*****

Install GNU Tool Chain

Find a PC with Linux 2.6.X Kernel installed and login as a root user then copy the arm-linux-3.3.2.tar.gz to root directory of PC. Under root directory, type following command to install the Matrix 512 Tool Chain #tar zxvf arm-linux-3.3.2.tar.gz

Getting started the Hello program

There are many example programs in Artila CD. To compile the sample you can use the Make file to and type *make*

To compile and link the library. Once done, use ftp command *ftp* 192.168.2.127

And bin command to set transfer mode to binary

ftp>bin

to transfer the execution file to Matrix 512 user disk (/disk) and use

chmod + x file.o

ftp>

Change it to execution mode and ./file.o to run the file

[root@localhost ~]# ftp 192.168.2.127 Connected to 192.168.2.127. 220 Matrix520 FTP server (GNU inetutils 1.4.1) ready. 500 'AUTH GSSAPI': command not understood. 500 'AUTH KERBEROS V4': command not understood. KERBEROS V4 rejected as an authentication type Name (192.168.2.127:root): root 331 Password required for root. Password: 230- Welcome to 230-230-230-230-230-230-** 230-**** ** 230-230- ** ** 230- ** 230-230- For further information check: 230- http://www.artila.com/ 230-230 User root logged in. Remote system type is UNIX. Using binary mode to transfer files. ftp> bi 200 Type set to I.

Frequently Asked Question

1. Forgot password:

If you forgot the password for login, please use serial console to modify the password

2. Reset Matrix 512 to factory default setting

The factory default setting is available at /default directory. User can copy the default setting to /etc and /home directories manually or format the user disk to set Matrix 512 to factory default setting. Performing disk format will erase all the files in user disk. Therefore please backup the files you need in USBDISK first before format the disk. Use command: /update —FORMAT To format disk.

To format disk.

3. Forgot the IP address

If you forgot the Matrix 512 IP address, you can use the Java Manager available in Artila CD to search the IP address of Matrix 512 Or use serial console port to find out the IP address by

Groadcast Search ∮ Search by IP	Num 1	Device Name Matrix500	MAC Address								
Search by IP	1	Matrix500		IP Address	Netmask	Gateway	Password	Model Name		٦	
			00:13:48:00:02:48	192.168.2.127	255.255.255.0	192.168.2.254	None	MATRIX-500	•	•	
									\square		
									H,	=	
										-	
									H		
	-								н		
	-								Н		
	_			·							
00100 115000	347	0.1.4.90									
COM8,115200	,None	,8,1,ANSI								Z	
# ifconfig										1	
eth0 1	link	encap:Eth	ernet HWad	dr 00:13:	48:00:02:	48				-	
TR	net	addr:192.	168.2.127	Bcast:192	.168.2.25	5 Mask:	255.25	5.255.0			
TS	JP BR	CADCAST R	UNNING MULT	ICAST MT	U:1500 M	etric:1					
	RX pa	ckets:100	errors:0 d	ropped:0	overruns:	0 frame:	D				
1	TX packets:0 errors:0 dropped:0 overruns:0 carrier:0										
	collisions:0 txqueuelen:1000										
	Interrupt:24 Base address:0xc000										
10 1	ink	encap:Loc	al Loopback								
	net	addr:127.	0.0.1 Mask	:255.0.0.	0						
τ 1	JP LO	OPBACK RU	NNING MTU:	16436 Me	tric:1						
1	X pa	ckets:0 e	rrors:0 dro	pped:0 ov	erruns:0	frame:0					
	IX pa	ckets:0 e	rrors:0 dro	pped:0 ov	erruns:0	carrier:	0				
	olli	sions:0 t	xqueuelen:0							G	
			-								