

Matrix 500 Quick Installation Guide

Overview

Matrix 500 features four serial ports, 10/100 Mbps Ethernet, USB port and SD socket for flash disk expansion. The pre-install Linux OS and GNU tool chain make Matrix 500 ready for your application development.

Features

1. ARM920T ARM Thumb Processor with 200MIPS at 180MHz, Memory Management Unit
2. 16-KByte Data Cache and 16-KByte Instruction Cache
3. 32MB SDRAM, 16MB Flash on board
4. One 10/100 Mbps Ethernet
5. Two USB 2.0 full speed (12 Mbps) Host Ports
6. Multimedia Card Interface for SD memory card
7. One 3-in-1 RS-232/422/485 ports and three RS-232 ports
8. 16 General Purpose DIO inside box
9. 9 to 48VDC power input
10. Pre-installed Standard Linux 2.6.14 OS
11. GNU tool chain available in Artila CD
12. Optional DIN RAIL mounting adaptor

Packing List

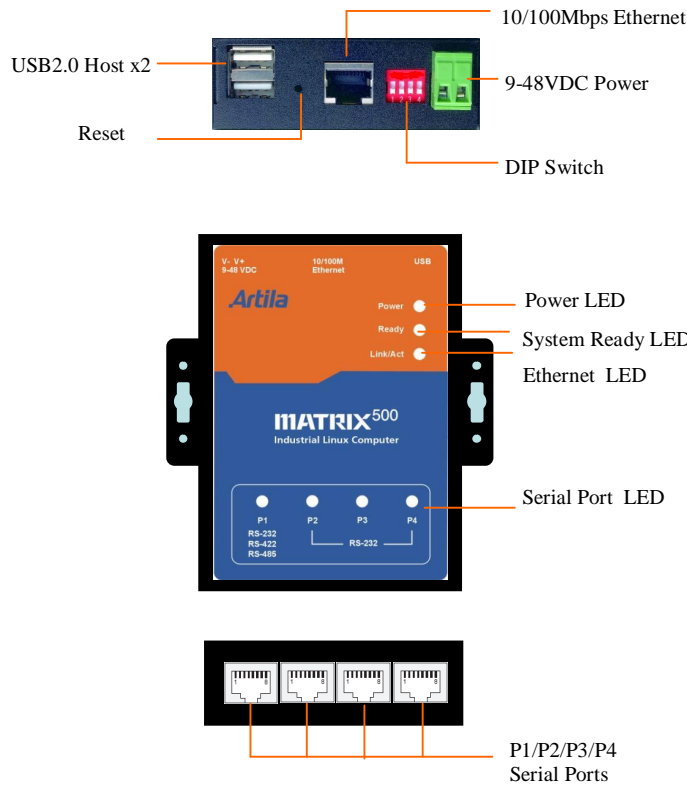
Matrix 500 is shipped with following items

1. Matrix 500
2. Artila CD includes Tool Chain, Installation guide and example programs

Optional Accessory

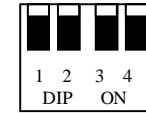
1. CB-RJ45F9-150: RJ45 to DB9 Female Cable
2. CB-RJ2CON-100: Serial Console Cable
3. DK-35A: DIN RAIL Mounting Kit
4. PWR-12V-1A: 110~240VAC to 12VDC 1A Power Adaptor

Matrix 500 Layout



DIP Switch

The four keys DIP switch is used to configure serial port interface and user application. Key 1 and 2 are used to configure the RS-232/422/485 mode of serial port P1 and Key3 and Key 4 are connected to GPIO and they are reserved for user's application.



	1	2	3	4
RS-232	ON	ON	--	--
RS-422	OFF	ON	--	--
RS-485	OFF	OFF	--	--

USB Port

The USB port is a USB2.0 high speed host port. It can be used to expand the hardware function of Matrix 500 and exchange file and data between PC and Matrix 500 using a USB flash disk. Currently the hardware support by Matrix 500 USB is shown as follow:

1. USB Storage Device
2. USB to Wireless LAN Adaptor (Ralink RT2571)
3. USB to Serial Adaptor (fdti usb to UART)
4. USB to Modem (CDC compliant)
5. USB Camera

Contact Artila 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 500. 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 500 will decompress the kernel and root file system to RAMDISK. Once system is boot up, the Ready LED will show solid green. The Ready LED will be turned off after Matrix 500 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

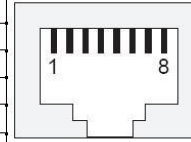
Serial Port LED

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 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 (switch selection)
 RS-232: RXD, TXD, RTS, CTS, GND
 RS-422: TXD+, TXD-, RXD+, RXD-, GND
 RS-485: DATA+, DATA-, GND

Port 2: RS-232: RXD, TXD, RTS, CTS, DSR, DTR, DCD, GND

Port 3: RS-232: RXD, TXD, RTS, CTS, GND

Port 4: RS-232: RXD, TXD, RTS, CTS, GND

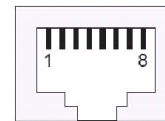
Serial Console Port:

Serial console port is used for local access Matrix 500 system using RS-232 port. At factory, serial console port is disabled because serial console port shares the P3 connector with Serial port 3 and the pin definition as shown as follow:

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

Pin	RS-232
1	
2	TXD
3	GND
4	
5	
6	
7	RXD
8	

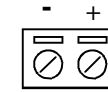
P3



Therefore you need to prepare or purchase the serial console cable (CB-RJ2CON-100) in order to use the serial console port . See Enable serial console port for information to use serial console.

Power Connector

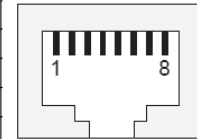
Connect the 9 to 48VDC power line to Matrix 500. If the power is properly supply, the power LED will show a solid green color.



Ethernet Port

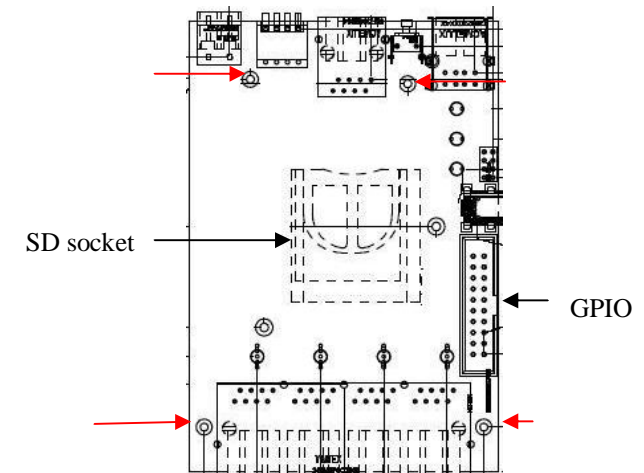
The Ethernet Port use RJ45 connector

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



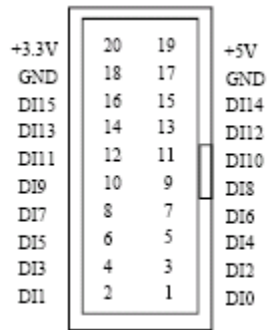
SD Socket

The SD socket is compatible with SD memory card specification version 1.0. The SD Socket is located in the back panel of the PCB. To install the SD memory card, please use the screw driver to open the metal case of Matrix 500 and unscrew Screw 1 to 4 as following



General Purpose IO (GPIO)

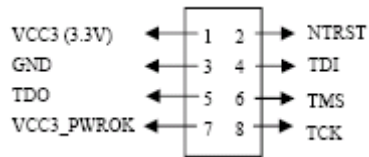
CN7 is a 20-pin box connector which is used for 16 channels GPIO. The pin definition is as shown following:



The signal level of GPIO is CMOS/TTL compatible and pitch of the pin header is 2.54 mm. Each of the DIO pin can be programmed as digital input or digital output.

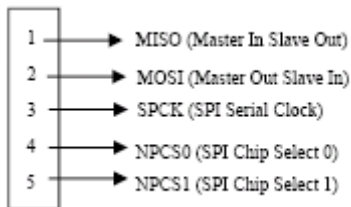
JTAG Header

CN1 is a JTAG header and the pin definition is shown as follow:



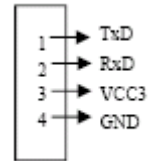
SPI Header

CN6 is a SPI header and its pin definition is shown as follow:



Serial debug Header

JP2 is a pin header for serial console port. Please notice all the signal are CMOS/TTL level.



Boot manager selection

JP1 is boot selection jumper. Set to position 2-3 always. Change the setting will cause incorrectly boot up.

Factory Default Settings

LAN 1 IP Address: 192.168.2.127
 Login: guest
 Password: guest
 Supervisor: root (use ssh to login)
 Password: root
 Serial Console: Disabled

Network Settings

```

c:\ Telnet 192.168.2.127
# cat rc
hostname Matrix500
hwclock -s
mount -t proc proc /proc
mount -o remount,rw /dev/root /
mount /sys
ifconfig lo 127.0.0.1
ifconfig eth0 192.168.2.127 netmask 255.255.255.0
route add default gw 192.168.2.254
route add -net 127.0.0.0 netmask 255.255.255.0 lo
cat /etc/motd
#
  
```

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

To configure the wireless LAN setting, please use command:
modprobe rt73
ifconfig wlan0 up

iwconfig wlan0 essid XXXX key YYYYYYYY mode MMMM

For infrastructure mode XXXX is the access point name and YYYYYYYY is the encryption key and MMMM should be *managed*

For Ad-Hoc mode mode XXXX is the Matrix 500 host name and YYYYYYYY is the encryption key 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*

File System

```

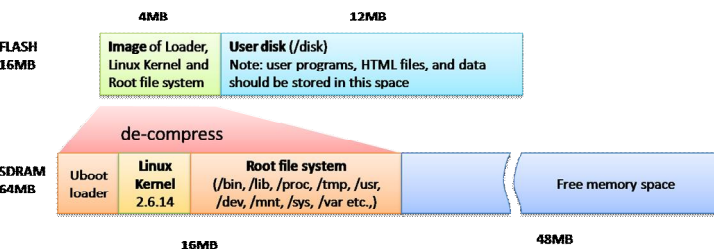
c:\ Telnet 192.168.2.127
# ls
bin          disk          lib           proc          tmp
default     etc           lost+found   sbin          usr
dev          home          mnt          sys           var
#
  
```

Matrix 500 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 shown as below. In addition, use command /df to find out the disk space of the disk. The RAM-DISK uses 8MB SDRAM space to store the root file system and 8MB for uboot loader and Linux Kernel Therefore it is about 16MB free SDRAM for user application software. The image of Linux kernel and root file system is stored in the flash memory and it uses about 4MB flash memory space and the rest of 12MB flash memory is designed for user flash disk to store user's program.

Therefore, user's program and utility software must be saved in the user disk space (/disk). Files saved to other directory will be lost after power off !!!

```

c:\ Telnet 192.168.2.127
# mount
/dev/ram0 on / type ext2 (rw,nogrpuid)
/dev/mtdblock3 on /mnt/disk type jffs2 (rw,noatime)
/proc on /proc type proc (rw,nodiratime)
/dev/sys on /sys type sysfs (rw)
# df
Filesystem      1k-blocks    Used Available Use% Mounted on
/dev/ram0        8059         6172    1478    81% /
/dev/mtdblock3  12288         532    11756     4% /mnt/disk
#
  
```



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. 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)

```

c:\ Telnet 192.168.2.127
# cd /dev
# ls
console  men          mtblock4  pty8       sde         ttyACM0    tty3
cua0     midi00      mtdr0     pty9       sequencer  ttyACM1    tty4
cua1     mixer       mtdr1     ram0       sndstat    ttyS0      tty5
dsp      mmc         mtdr2     ram1       spi0       ttyS1      tty6
flash    mmc0        mtdr3     ram2       spi1       ttyS2      tty7
gpio     mmc1        mtdr4     ram3       tty        ttyS3      tty8
hda      mmc2        null      random     tty0       ttyS4      tty9
hda1     nt00        ppp       rtc         tty1       ttyS5      urandom
hda2     nt01        pty0      sda         tty2       ttyS6      video0
hda3     nt02        pty1      sda1        tty3       ttyS7      video1
hda4     nt03        pty2      sda2        tty4       ttyS8      watchdog
ipsec    nt04        pty3      sda3        tty5       ttyUSB0    zero
kmen     mtblock0    pty4      sda4        tty6       ttyUSB1
lcd      mtblock1    pty5      sdb         tty7       tty0
ledman   mtblock2    pty6      sdc         tty8       tty1
log      mtblock3    pty7      sdd         tty9       tty2
#
  
```

Utility Software:

Matrix 500 includes busybox utility collection and Artila utility software as follow:

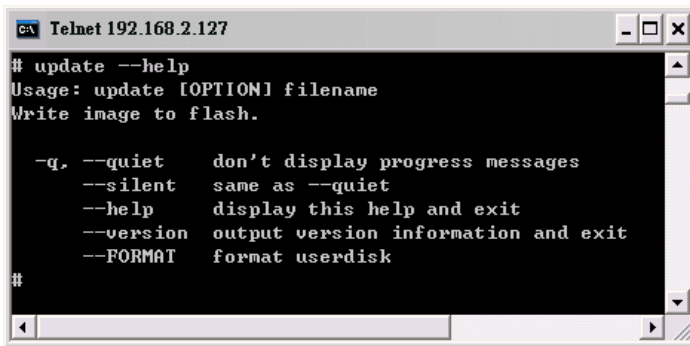
```

c:\ Telnet 192.168.2.127
# ls /bin
addgroup  delgroup  ftpd      kill      pidof     su
adduser  deluser   gpioc1l  ln        ping      sync
angrd    df         grep      login     pppd      tar
bash     dhcpcd    gunzip    ls        ps         telnetd
boa      dhrystone gzip       mkdir     pwd        tip
busybox  discard   hostname mke2fs    rm         touch
cat      dmesg     inetd     mkfs_jffs2 rmdir      true
chgrp    echo      init      mknod    setuart   umount
chmod    egrep     iptables mktemp    sh         update
chown    erase     iptables more       sleep     usleep
cp       false    iwconfig mount      snmpd     version
cpu      fgrep    iwlist   mv         sshd      vi
date     ftp       iwpriv   mv         stty      zcat
# ls /sbin
adjtimex  ifdown    nakedevs  start-stop-daemon
getty     ifup      modprobe  sulogin
halt      insmod    reboot    syslogd
hwclock   klogd    rmmod
ifconfig  lsmod    route
#
  
```

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

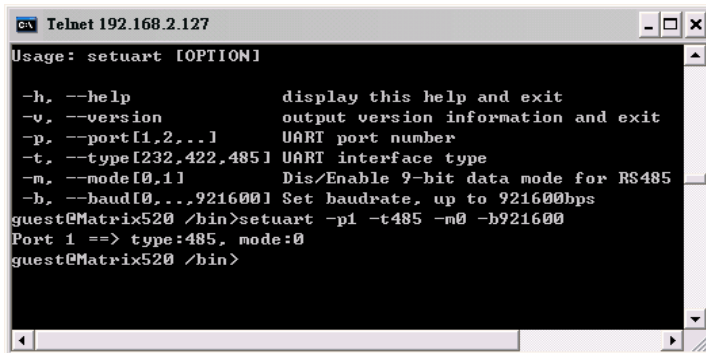


```
cx Telnet 192.168.2.127
# update --help
Usage: update [OPTION] filename
Write image to flash.

  -q, --quiet      don't display progress messages
  --silent        same as --quiet
  --help          display this help and exit
  --version       output version information and exit
  --FORMAT        format userdisk
#
```

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



```
cx 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>
```

How to make more utility software

You might also find utility software available on Artila CD under /Matrix 520/utility such as *ntpclient*, *ssh*, *scp*, *bluez* and *ssh-keygen*. If you want, you can ftp or copy the utility software to Matrix 520 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 500, you can use the command
`/dmesg | grep sd`
or
`/dmesg | grep mmc`
Type
`mount /dev/sda1` to mount the USB disk and
`mount /dev/mmc0` to mount SD card

```
ca Telnet 192.168.2.127
# cat /etc/fstab
/dev/sys      /sys          sysfs        rw      0 0
/dev/sda      /mnt/sda      vfat         rw      0 0
/dev/sda1     /mnt/sda1    vfat         rw      0 0
/dev/sdb      /mnt/sdb      vfat         rw      0 0
/dev/sdb1     /mnt/sdb1    vfat         rw      0 0
/dev/mtdblock3 /mnt/disk    jffs2        rw      0 0
/dev/mmc0     /mnt/mmc     vfat         rw      0 0
#
```

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 Artilla CD to adjust the RTC time.

`/ntpclient [time server ip]`

SSH Console

Matrix 500 support SSH. If you use Linux computer, you can use SSH command to login Matrix 500. The configuration of SSH and key are located at
`/etc/config/ssh`

The key generation program is available at Artilla CD

`/matrix 5XX/utility/ssh_keygen`

User can copy this program to Matrix 500 to generate the key

```
root@localhost:~/artila/linux-2.6.x
[root@localhost ~]# ssh 192.168.2.127
The authenticity of host '192.168.2.127 (192.168.2.127)' can't be established.
RSA key fingerprint is ba:4b:2d:ae:04:07:bd:c6:5c:4f:8a:43:4b:24:ee:9f.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.2.127' (RSA) to the list of known hosts.
root@192.168.2.127's password:
Welcome to

**          ** **
**          ** **
** **      ** **
** **      **** ** ** *****
** **      ** ** ** ** ** ** ** **
** **      ** ** ** ** ** ** ** ** *****
***** ** ** ** ** ** ** ** ** **
** **      ** ** ** ** ** ** ** ** **
**          ** **      ** ** *****

For further information check:
http://www.artila.com/

root@Matrix520 />
```

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 500 Tool Chain
`#tar zxvf arm-linux-3.3.2.tar.gz`

Getting started with the Hello program

There are many example programs in Artilla 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 500 user disk (`/disk`) and use

`chmod +x file.o`

Change it to execution mode and

`./file.o`

to run the file

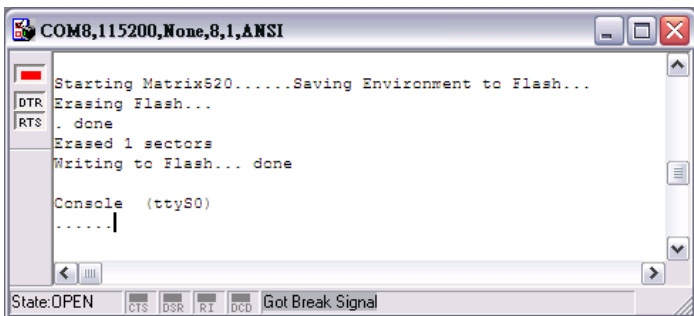
```
[root@localhost ~]# ftp 192.168.2.127
Connected to 192.168.2.127.
220 Matrix520 FTP server (GNU inetutils 1.4.1) ready.
500 'AUTH GSSAPI': command not understood.
500 'AUTH KERBEROS_V4': command not understood.
KERBEROS_V4 rejected as an authentication type
Name (192.168.2.127:root): root
331 Password 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.
ftp>
```

Enable Serial Console Port

The serial console port is disabled as factory default setting. To enable the serial console, you need to use the serial console cable (CB-RJ2CON-100) and connect it to port 3. Use any terminal software such as hyper terminal and setting as follow:

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

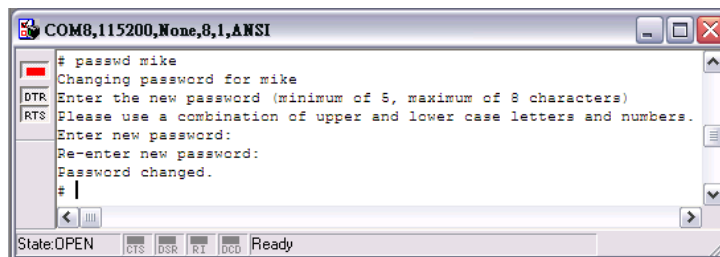
The serial console port is disabled as factory default setting. To enable the serial console, you need to purchase or prepare a serial console cable and connect it to port 3. Right after powering on the system, keep typing \$ continuously until you see the message as shown in the figure followed. Console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



Frequently Asked Question

1. **Forgot password:**

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

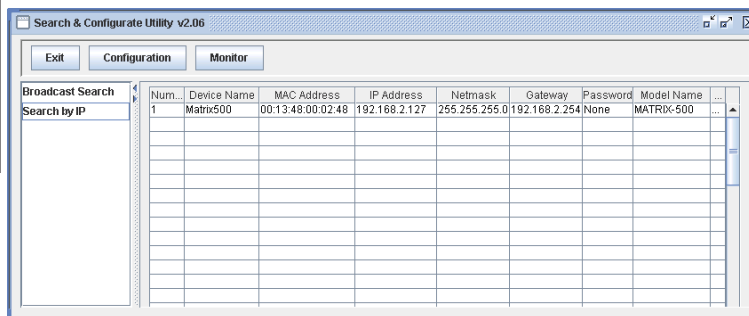


2. **Reset Matrix 500 to factory default setting**

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 500 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.

3. **Forgot the IP address**

If you forgot the Matrix 500 IP address, you can use the Java Manager available in Artilla CD to search the IP address of Matrix 500 Or use serial console port to find out the IP address by



#ifconfig

