M-508

Linux ARM9 System on Module

User Guide

Version 1.0

Table of Contents

1. Introduction

M-508 is a Linux ready Single Board Computer featuring four serial ports, 10/100Mbps Ethernet, USB port and SD socket for flash disk expansion. The pre-install Linux OS and GNU tool chain make M-508 ready for your application development.

1.1 Features

- ARM920T ARM Thumb Processor with 200MIPS at 180MHz, Memory Management Unit
- 16-KByte Data Cache and 16-KByte Instruction Cache
- 64MB SDRAM, 32MB Flash on board
- 512KB non-volatile FRAM (M-508T only)
- One 10/100Mbps Ethernet
- Two USB 2.0 full speed (12Mbps) Host Ports
- Multimedia Card Interface for SD memory card
- Four RS-232/485 ports software selectable
- Port 4 also supports RS-422
- 32 General Purpose DIO
- +5VDC power input
- Pre-installed Standard Linux 2.6.14 OS

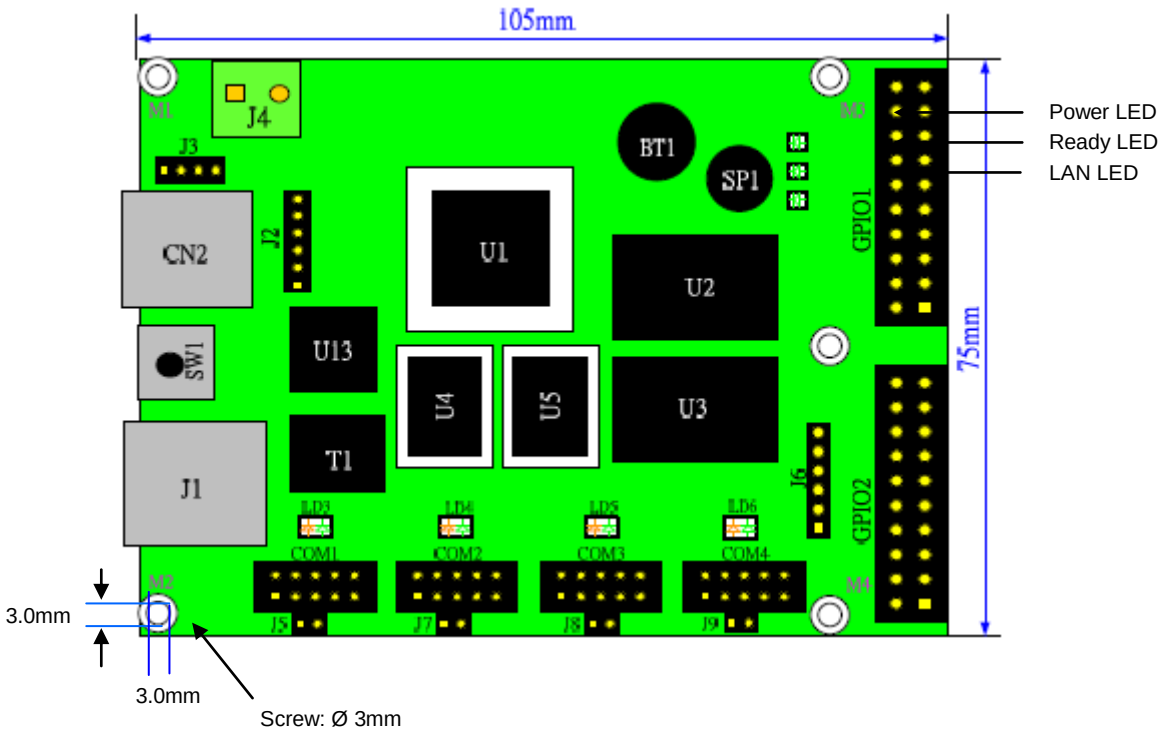
1.2 Packing List

- M-508
- 91-0P9M9-001 10-pin header to DB9 male cable x4

1.3 Optional Accessory

- CB-F9F9-150: DB9 Female serial console Cable

2. Layout


105mm
75mm
Power LED
Ready LED
LAN LED
M1
M2
M3
M4
J4
J3
J2
CN2
SW1
J1
BT1
SP1
U1
U2
U3
U4
U5
U13
T1
J6
GPIO1
GPIO2
LD3
LD4
LD5
LD6
COM1
COM2
COM3
COM4
J5
J7
J8
J9
3.0mm
3.0mm
Screw: Ø 3mm

3. Pin Assignment and Definition

3.1 Power LED (PWR)

Power LED will keep solid green when power is applied.

3.2 Ready LED (RDY)

After Power ON, M-508 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 M-508 received "halt" command.

3.3 LAN1 / Act (LAN)

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.

3.4 Serial Port LED (LD3 ~ LD6)

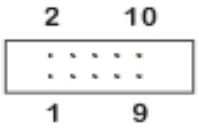
These four dual color LEDs indicate the data traffic at the serial ports. When RXD line is high then Orange light is ON and when TXD line is high, Green light is ON.

3.5 Debug LED (LD1 ~ 2)

The debug LEDs are located near LAN LED and are used for system boot debug. If system are correctly boot, they are switch off.

Serial Ports (COM1/COM2/COM3/COM4)

Pin No.	RS-232	RS-485	RS-422**
1	DCD*	-	Tx-
2	DSR*	-	-
3	Rx	-	Tx+
4	RTS	-	-
5	Tx	Data+	Rx+
6	CTS	-	-
7	DTR*	Data-	Rx-
8	-	-	-
9	GND	GND	GND
10	-	-	-



Note: * Port 2 only
** Port 4 only

3.6 Serial Port Pin Definition (DB9 Male)

The serial port pin assignment is shown as follow:

- **Port 1, 3: RS-232 / 485 (software selection)**

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

  RS-485: Data+, Data-, GND

- **Port 2: RS-232 / 485 (software selection)**

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

  RS-485: Data+, Data-, GND

- **Port 4: RS-232 / 422 / 485 (software selection)**

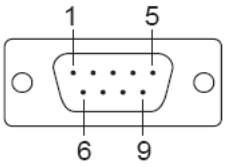
  RS-232: RXD, TXD, RTS, CTS, GND

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

  RS-485: Data+, Data-, GND

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

Port 1~4



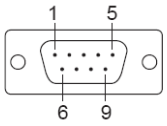
Note: * Port 2 only

3.7 Serial Console Port

Serial console port is used to access M-508 using RS-232. At factory, serial console port is disabled because serial console port shares the COM3 serial port connector with the pin definition as shown:

Pin No.	RS-232
1	-
2	-
3	-
4	-
5	GND
6	-
7	TXD
8	RXD
9	-

Port 3



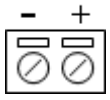
Baud Rate: 115200
Data bits: 8
Parity: N
Stop bit: 1
Terminal type: ANSI

User need to prepare or order a serial console cable (CB-F9F9-100) and enable the serial console port

as described in Enable Serial Console port section.

3.8 Power Connector

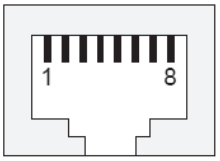
Connect the +5VDC power line to M-508. If the power is properly supply, the power LED will show a solid green color.



> ☞ **Note**
>
> Please check the power voltage and polarity before connecting it.

3.9 Ethernet Port

Pin No.	Signal
1	ETx+
2	ETx-
3	ERx+
6	ERx-



The Ethernet Port uses RJ45 connector.

3.10 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.

3.11 USB Port

The USB port is a USB2.0 high speed host port. It can be used to expand the hardware function of M-508 and exchange file and data between PC. Currently the hardware support by M-508 USB is shown as follow:

- USB Storage Device
- USB to Wireless LAN Adaptor (Ralink RT2571)
- USB to Modem (CDC compliant)
- USB Camera

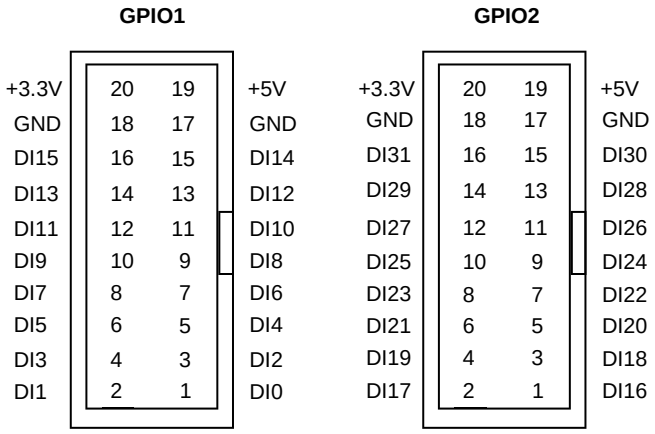
Contact Artila if you find your hardware is not shown on the list.

3.12 Reset Button

Press the “Reset” button to activate the hardware reset. Please always use “reboot” command to reset M-508. You should only use this function if the software reboot does not function properly.

3.13 General Purpose IO (GPIO)

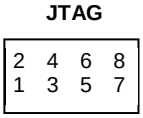
GPIO signals are housed in a 20-pin box connector, GPIO1 and GPIO2. Each of the connector includes 16 channels of GPIO. The pin definition is as shown following:



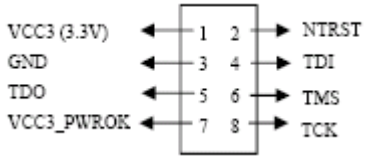
The signal level of GPIO is CMOS level and pitch of the pin header is 2.54mm. Each of the DIO pin can be programmed as digital input or digital output.

3.14 CN1 JTAG Header

JTAG header is located near power connector and it is a 2x4 2.0mm pin header and the pin definition is shown as follow:

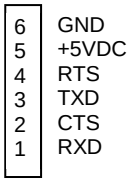


Definition



3.15 COM2 TTL Header

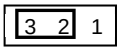
COM2 TTL is a CMOS/TTL signal pin connector and it is connected to UART of port 2 and its definition is as shown below:



This connector allows user to design an internal Modem to work with M-508.

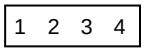
3.16 JP2 Boot Manager Selection

JP2 is boot selection jumper near CN1. Set to position 2-3 always. Change the setting will cause incorrectly boot up.



3.17 USB Client Connector (J3)

USB client port is reserved for future enhancement. This function is disabled by software.

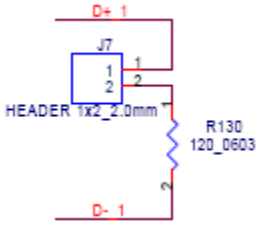


Pin definition is as follow:

1. Data +
2. Data -
3. Host_detect
4. GND

3.18 RS-485 Terminator Jumper (J5, J7, J8, J9)

Short the jumper will enable the 120ohm terminator as shown below:



3.19 USB Host Connector (J2)

USB host connector is designed for internal USB device connection. The connector is a six pins wafer box with lock 1.0mm wire to board connector and its pin definition is as shown below:

wafer box with lock 1.0 mm

1	+5VDC
2	HDMA
3	HDPA
4	GND
5	N/C
6	GND

3.20 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

3.21 Network Settings

```
# cat rc
hostname M508
hwclock -s
mount -t proc proc /proc
mount -o remount,rw /dev/root /
mount /sys
mount -t jffs2 /dev/mtdblock5 /mnt/disk-1
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
sram
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 &

3.22 Wireless LAN Configuration

M-508 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 M-508 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

3.23 File System

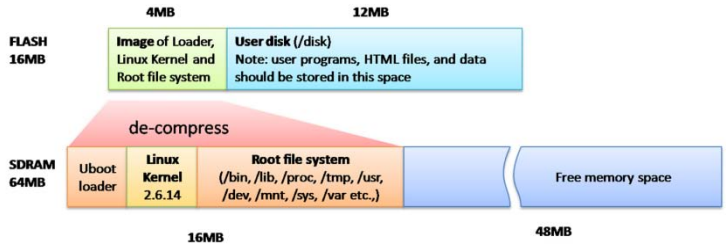
```
# ls
bin         disk        lib         proc        tmp
default     etc         lost+found  sbin        usr
dev         home        mnt         sys         var
#
```

M-508 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 RAMDISK 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 loss after power off.**

```
# mount
/dev/ram0 on / type ext2 (rw,nogrpid)
/dev/mtdblock4 on /mnt/disk type jffs2 (rw,noatime)
/proc on /proc type proc (rw,nodiratime)
/dev/sys on /sys type sysfs (rw)
/dev/mtdblock5 on /mnt/disk-1 type jffs2 (rw,noatime)
/dev/mtdblock6 on /mnt/sram type ext2 (rw,nogrpid)
# df
Filesystem           1k-blocks      Used Available Use% Mounted on
/dev/ram0                 8059      6257      1393  82% /
/dev/mtdblock4           11648       636     11012   5% /mnt/disk
/dev/mtdblock5           16384       644     15740   4% /mnt/disk-1
/dev/mtdblock6             499        13       461   3% /mnt/sram
#
```

The second flash memory is configured as disk-1 and its available space is 15MB. In addition, M-508T is equipped with 512KB FRAM and it is configured as *sram.*



3.24 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)

3.25 Utility Software

M-508 includes busybox utility collection and Artila utility software as follow:

4. Artila Utility Software

The introduction of Artila utility software as follow:

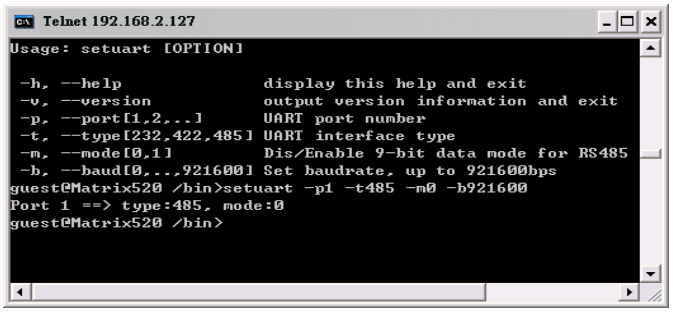
4.1 update

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 be operated under supervisor mode (password: root).

4.2 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.



4.3 gpioctl

Configure gpio port setting. Use ***gpioctl — help*** to see how to configure gpio ports.

For example:

 # gpioctl –i0 –m1 –s1

Will configure GPIO channel 0 (Pin DI0) to be input with internal pull high resistor.

 # gpioctl –i1 –m0 –s1

Will set GPIO channel 1 (pin DI1) to be output and with high state.

4.4 How to Make More Utility Software

You might also find utility software available on Artila FTP under /Matrix and iPAC/utility such as *ntpclient, ssh, scp, bluez* and *ssh-keygen*. If you want, you can ftp or copy the utility software to M-508 user disk (/disk). Also you can use find the source code and use the GNU Toolchain to make the utility by yourself.

4.5 Mounting External Storage Memory

To find out the device name of the external memory device which plug into M-508, you can use the command

/dmesg | grep sd

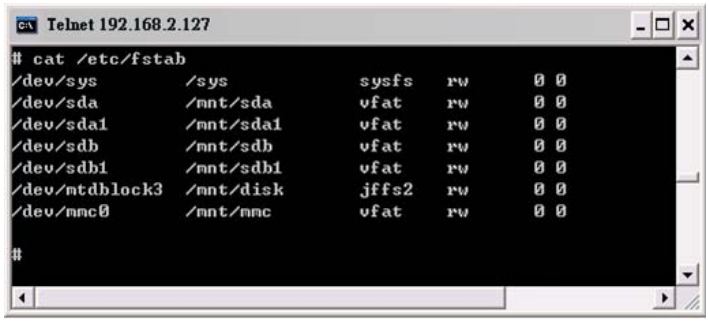
or

/dmesg | grep mmc

Type

mount /dev/sda1 to mount the USB disk and

mount /dev/mmc0 to mount SD card



4.6 Welcome Message

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

4.7 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***.

4.8 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 on Artila FTP to adjust the RTC time.

/ntpclient [time server ip]

4.9 SSH Console

M-508 support SSH. If you use Linux computer, you can use SSH command to login M-508. The configuration of SSH and key are located at /etc/config/ssh

The key generation program is available on Artila FTP: /matrix and ipac /utility/ssh_keygen

User can copy this program to M-508 to generate the key.

4.10 Install GNU Toolchain

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 M-508 *Gnu Toolchain.*

#tar zxvf arm-linux-3.3.2.tar.gz

4.11 Getting Started with the Hello Program

There are many example programs on Artila FTP. 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

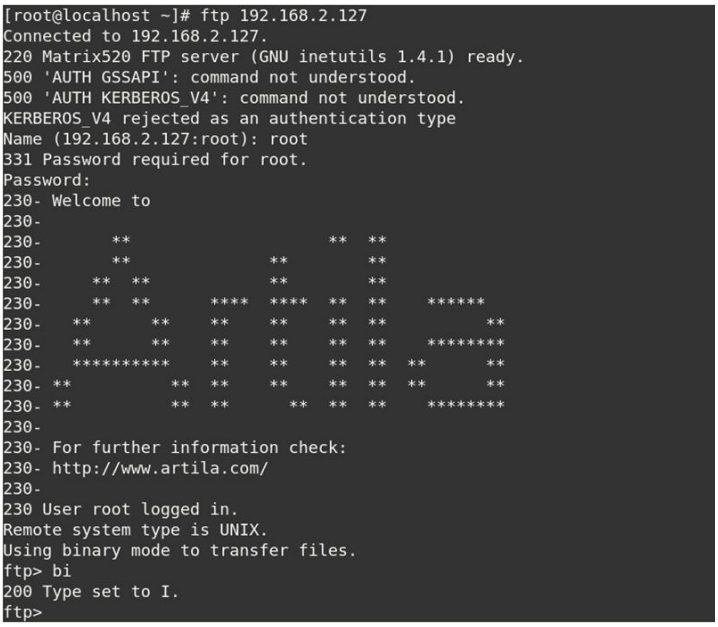
To transfer the execution file to M-508 user disk (/disk) and use

chmod +x file.o

To change it to execution mode and

./file.o

to run the file.



4.12 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 (91-RJCON-100) and connect it to port 3. Use any terminal software such as hyper terminal and setting as follow:

Baud Rate: 115200

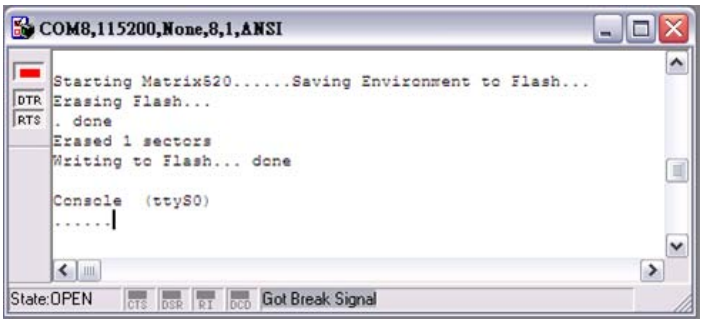
Data bits: 8

Parity: N

Stop bit: 1

Terminal type: ANSI

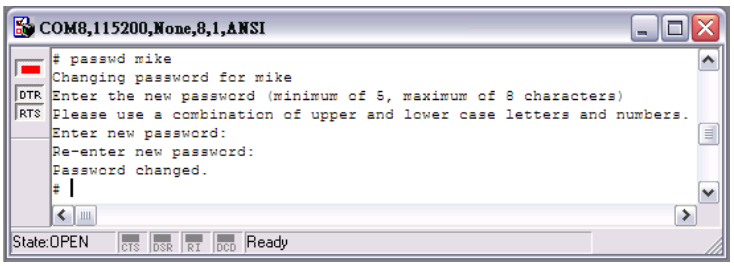
Right after powering on the system, keep typing $ continuously until you see the message as shown in the figure followed. Console (ttyS0) stands for console port ttyS0 is enabled. Repeat this procedure will disable the serial console and screen will show “Console (null)”.



5. Frequently Asked Question

5.1 Forgot Password

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



5.2 Reset M-508 to Factory Default Setting

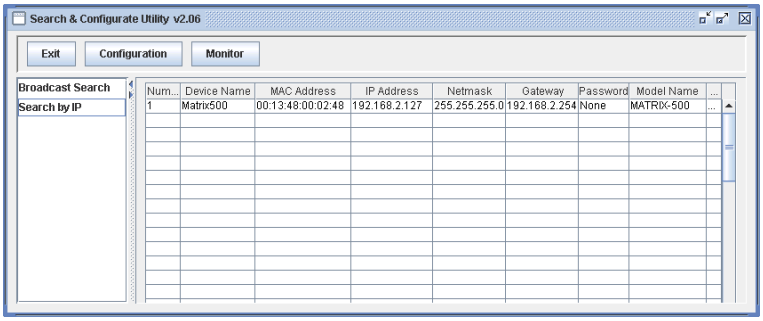
The factory default setting is available at */default* directory. User can copy the default setting to */etc* and */home* directories manually or format the user disk to set M-508 to factory default setting. Performing disk format will erase all the files in user disk. Therefore please backup the files you need in USBDISK first before format the disk. Use command:

#update —FORMAT

To format disk.

5.3 Forgot the IP Address

If you forgot the M-508 IP address, you can use the Java Manager available on Artila FTP to search the IP address of M-508.



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