

# iPAC-5010 User Guide

## Introduction:

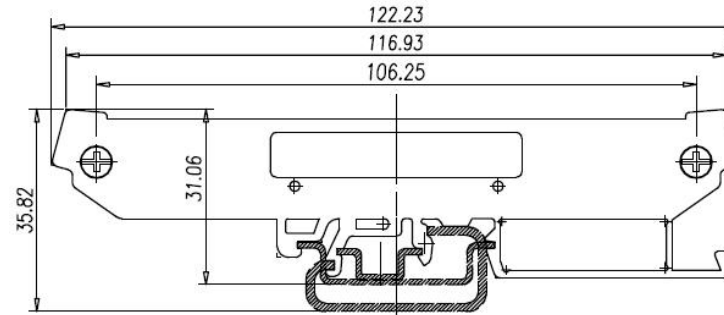
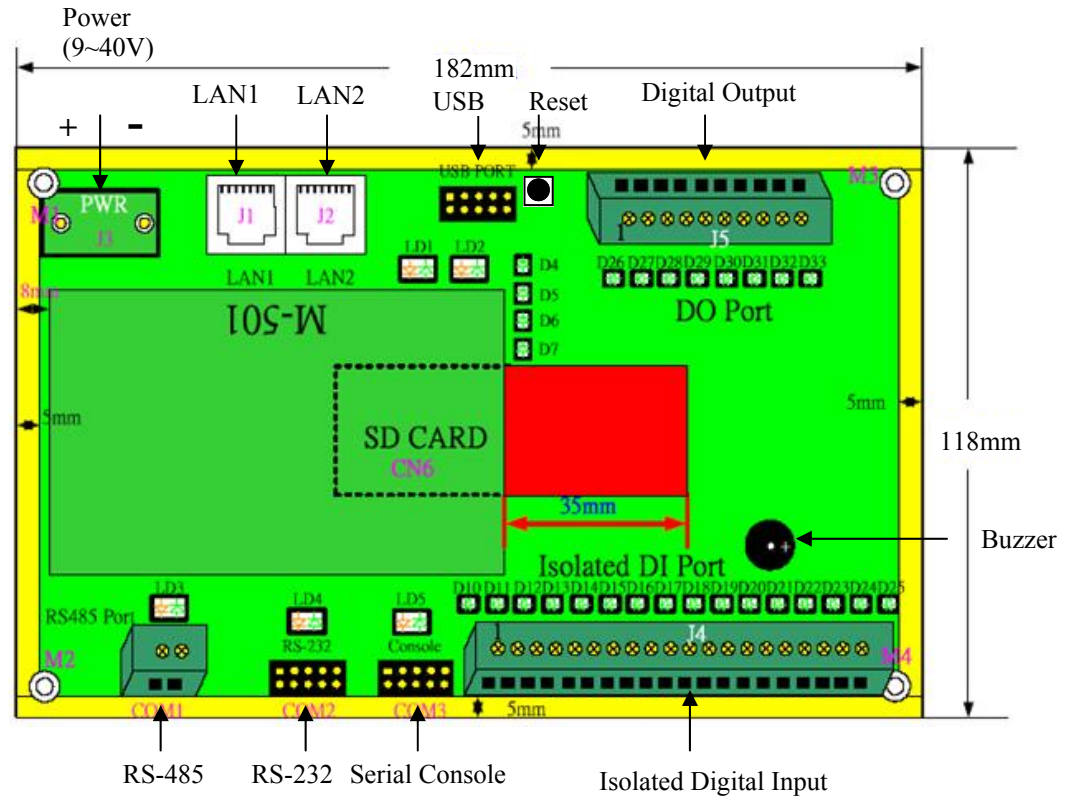
iPAC-5010 is ARM9-based Linux ready industrial Programmable Automation Controller. The key features are as follow:

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. One RS-485, One RS-232 and One serial console port
8. 16 opto-isolated digital inputs
9. 8 Darlington-pair digital outputs
10. 9 to 40VDC power input
11. Pre-installed Standard Linux 2.6 OS
12. GNU tool chain available in Artila CD
13. DIN RAIL mounting

## Packing List

1. iPAC-5010
2. CBL-F10M9-20: 10-pin header to DB9 male cable for RS-232 x1
3. Artila CD

iPAC-5010 Layout



## Pin Assignment and Definition

### Reset Button

Press the “Reset” button to activate the hardware reset. You should only use this function if the software does not function properly.

### Power LED (D4)

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

### Ready LED (D5)

The Ready LED will show solid green if Matrix 520 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.

### LAN1/LAN2 LED (D6/D7)

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 (LD3/LD4/LD5)

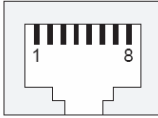
These three dual color LEDs indicate the data traffic at the serial ports. When RXD line is high then RED light is ON and when TXD line is high, GREEN light is ON.

### User LED (LD1/LD2)

LD1 and LD2 are dual color LED for user application. Please refer to example program for the usage.

### Ethernet Port (LAN1/LAN2)

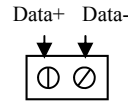
Pin	Signal
1	ETx+
2	ETx-
3	ERx+
6	ERx-



### Serial Ports:

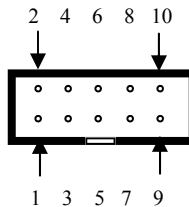
COM1: RS-485 (Data+, Data-)  
COM2: RS-232 with full modem control  
COM3: RS-232 with Rx/D Tx/D (Console)

COM1: RS-485



Data+ is pull up to 3.3VDC with 10K Ohm resistor  
Data- is pull low to ground  
Termination resistor is not included. User can add a 120 Ohm resistor shunt with D+ to D- if necessary

COM2: RS232  
COM3: Console



Pin	COM2	COM3
1	DCD	N/C
2	DSR	N/C
3	RXD	RXD
4	RTS	N/C
5	TXD	TXD
6	CTS	N/C
7	DTR	N/C
8	N/C	N/C
9	GND	GND
10	N/C	N/C

Serial console port (COM3) is very helpful to perform system configuration and debug. When you forgot password or network IP address, serial console provide an easy way to access iPAC-5010. To access serial console port, you can use CBL-F10M9-20 to convert 10-pin header to RS-232 DB9 male connector and use a null modem adaptor for PC RS-232 interface. Use any terminal software such as hyper terminal and setting as follow:

**Baud Rate: 115200**

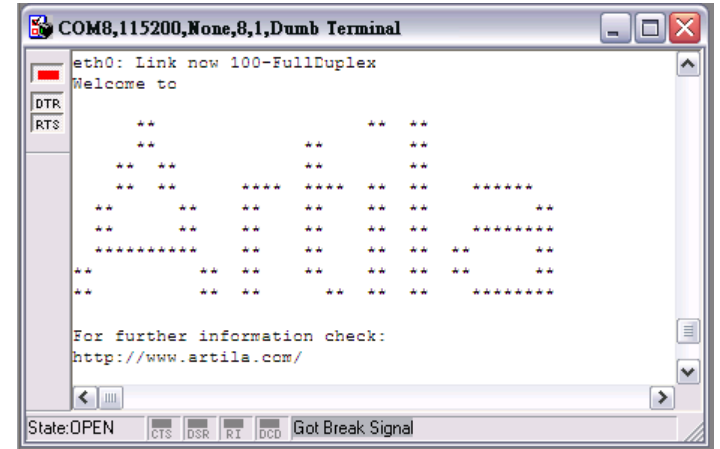
**Data bits: 8**

**Parity: N**

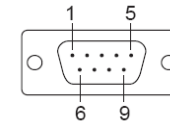
**Stop bit: 1**

**Terminal type: ANSI**

Once you power up iPAC-5010, you will see the console message appears.

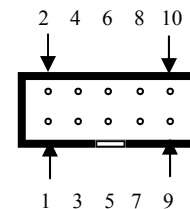


RS-232 DB9 Male Connector



Pin	RS-232
1	DCD
2	RXD
3	TXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	N/C

### USB Port:



Vcc1, Vcc2: +5Vdc  
GND: Ground

Pin	USB
1	Vcc1
2	Vcc2
3	Data1+
4	Data2+
5	Data1-
6	Data2-
7	GND
8	GND
9	N/C
10	N/C

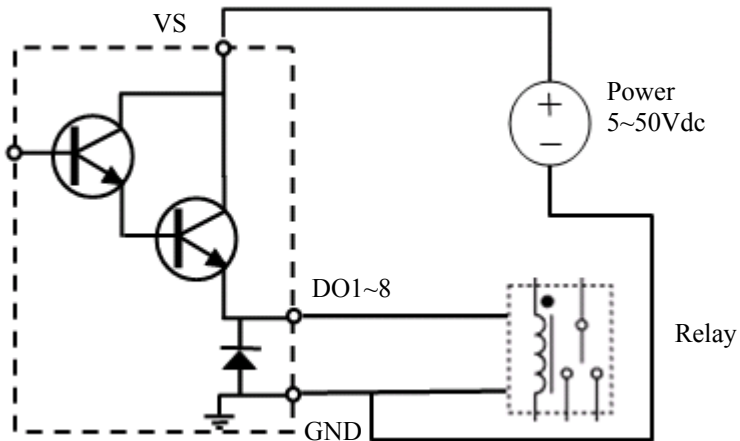
**Power Input Connector (J3)**

iPAC-5010 uses +9VDC to 40VDC power and input from J3 connector. Auto-polarity and surge protection are included in power input circuitry of iPAC-5010 to provide power protection to iPAC-5010.



**Digital Output Connector (J5)**

The digital output are equipped with 8 darlington pair transistors (Allegro UDN2981A) to switch the external relay or solenoid. The internal transient-suppression diodes permit the drive to be used with inductive load. The source voltage of the drive is from 5Vdc to 50 Vdc and the maximum driving current is 500 mA.

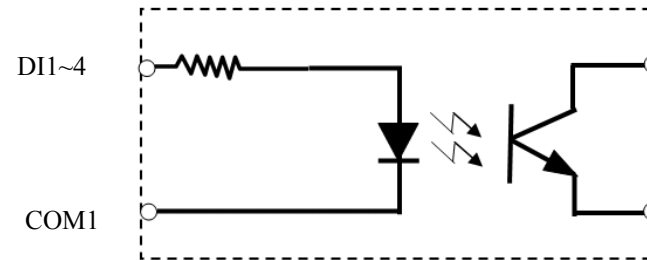


**Digital Input Connector (J4)**

The 16 channel isolated input are equipped with 2500 Vrms photo coupler isolator. Four of the channels form a group and share the same common ground. The specification of the isolated input channels are:

Logical High: 5~24Vdc  
 Logical Low: 0~1.5Vdc  
 Input resistance: 1.2KOhms @0.5W  
 Response time: 20us  
 Isolation: 2500Vrms

J4				J5	
1	DI1	11	DI9	1	DO1
2	DI2	12	DI10	2	DO2
3	DI3	13	DI11	3	DO3
4	DI4	14	DI12	4	DO4
5	COM1	15	COM3	5	DO5
6	DI5	16	DI13	6	DO6
7	DI6	17	DI14	7	DO7
8	DI7	18	DI15	8	DO8
9	DI8	19	DI16	9	GND
10	COM2	20	COM4	10	VS



DIx: Isolated digital input channels  
 COMx: common ground of four DIx  
 DOx: Voltage output channels  
 GND: Ground  
 VS: Voltage source input

## Factory Default Settings

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

## Login

After power on, wait about 30 seconds for system boot up.  
Using Telnet and guest or ssh and root to login in iPAC-5010.

```
Telnet 192.168.2.127
iPAC5010 login: guest
Password:
Welcome to

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

guest@iPAC5010 ~>su
Password:
#
```

## Network Settings

```
Telnet 192.168.2.127
guest@iPAC5010 />cat /etc/rc
hostname iPAC5010
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
ifconfig eth1 up
dhcpcd eth1 &
cat /etc/motd

guest@iPAC5010 />
```

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

iPAC-5010 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:

```
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 iPAC5010 device 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

iPAC-5010 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 RAMDISK 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@iPAC5010 />df
Filesystem      1k-blocks      Used Available Use% Mounted on
/dev/ram0        8059           6055      1595   79% /
/dev/mtdblock4  12160           536     11624    4% /mnt/disk
guest@iPAC5010 />
```

## Devices list

The supported devices are shown at /dev directory. Following list are most popular ones:

1. ttyS0: port 3 serial console port
2. ttyS1 :port 1 RS-485
3. ttyS2: port 2 RS-232
4. mmc to mmc2: SD memory card
5. sda to sde: USB flash disk
6. ttyUSB0 to ttyUSB1: USB RS-232 adaptor (fdt\_sio.ko)
7. rtc: Real Time Clock
8. gpio: digital I/O
9. ttyACM0 and ttyACM1: USB Modem (CDC compliant)

```
Telnet 192.168.2.127
guest@iPAC5010 /dev>ls
console      mem          mtdblock4   pty8        sde          ttyACM0     tty3
cua0         nidi00      mtdr0       pty9        sequencer   ttyACM1     tty4
cua1         mixer       mtdr1       ram0        sndstat     ttyS0       tty5
dsp          mmc         mtdr2       ram1        sp10        ttyS1       tty6
flash        mmc0        mtdr3       ram2        spi1        ttyS2       tty7
gpio         mmc1        mtdr4       ram3        tty         ttyS3       tty8
hda          mmc2        null        random      tty0        ttyS4       tty9
hda1         mtd0        ppp         rtc         tty1        ttyS5       uandom
hda2         mtd1        pty0        sda         tty2        ttyS6       video0
hda3         mtd2        pty1        sda1        tty3        ttyS7       video1
hda4         mtd3        pty2        sda2        tty4        ttyS8       watchdog
ipsec        mtd4        pty3        sda3        tty5        ttyUSB0     zero
kmem         mtdblock0   pty4        sda4        tty6        ttyUSB1
lcd          mtdblock1   pty5        sdb         tty7        tty0
ledman       mtdblock2   pty6        sdc         tty8        tty1
log          mtdblock3   pty7        sdd         tty9        tty2
guest@iPAC5010 /dev>
```

## Utility Software:

iPAC-5010 includes busybox utility collection and Artila utility software as follow:

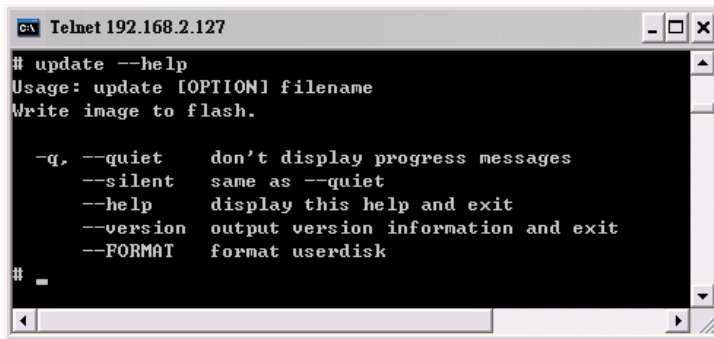
```
Telnet 192.168.2.127
guest@iPAC5010 /bin>ls
addgroup      delgroup     gpiotl      ls           ps           telnetd
adduser       deluser      grep        mkdir        pwd          tip
amrdr         df           gunzip      mkfs         rm           touch
bash          dhcpcd      gzip        mkfs_ext2   rmdir       true
boa           dhrystone   hostname    mkfs_jffs2  scp          umount
boa_indexer   discard     inetd       mknode      setuarta    update
busybox       dnsmasq     init        mktemp      sh           usleep
cat           echo        iptables    mount        sleep        version
chgrp         egrep       iwconfig    more         snmpd       vi
chmod         erase       iwlist      mv           sshd        zcat
chown         false       iwpriv      netstat     stty
cp            fgrep       kill        pidof       su
cpu          ftp         ln          ping        sync
date         ftpd        login       pppd        tar
guest@iPAC5010 /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



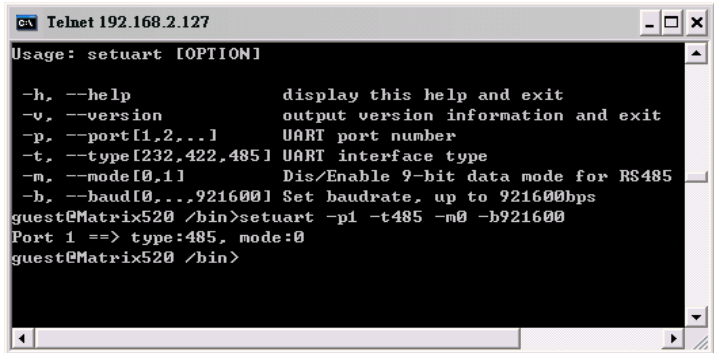
```

c:\ 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



```

c:\ 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,..1] 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. *gpiocpl*: *gpiocpl* can use to control the digital input and output of iPAC-5010. Use

>*gpiocpl* --help

To find out the usage of this command.



```

c:\ Telnet 192.168.2.127
guest@iPAC5010 /bin>gpiocpl -a
GPIO count:24
DIP_SW count:0
GPIO0 -> State:Low, Mode:Output
GPIO1 -> State:Low, Mode:Output
GPIO2 -> State:Low, Mode:Output
GPIO3 -> State:Low, Mode:Output
GPIO4 -> State:Low, Mode:Output
GPIO5 -> State:Low, Mode:Output
GPIO6 -> State:Low, Mode:Output
GPIO7 -> State:Low, Mode:Output
GPIO8 -> State:Low, Mode:Input
GPIO9 -> State:Low, Mode:Input
GPIO10 -> State:Low, Mode:Input
GPIO11 -> State:Low, Mode:Input
GPIO12 -> State:Low, Mode:Input
GPIO13 -> State:Low, Mode:Input
GPIO14 -> State:Low, Mode:Input
GPIO15 -> State:Low, Mode:Input
GPIO16 -> State:Low, Mode:Input
GPIO17 -> State:Low, Mode:Input
GPIO18 -> State:Low, Mode:Input
GPIO19 -> State:Low, Mode:Input
GPIO20 -> State:Low, Mode:Input
GPIO21 -> State:Low, Mode:Input
GPIO22 -> State:Low, Mode:Input
GPIO23 -> State:Low, Mode:Input
guest@iPAC5010 /bin>
```

GPIO0~GPIO7 map to digital output DO1~DO8  
GPIO8~GPIO23 map to digital input DI1 ~DI16

### How to make more utility software

You might also find utility software available on Artila CD under /Matrix 5XX/utility such as *ntpclient*, *ssh*, *scp*, *bluez* and *ssh-keygen*. If you want, you can ftp or copy the utility software to iPAC-5010 user disk (/disk). Also you can use find the source code and use the GNU Tool Chain to make the utility by yourself.

### Restore to default setting

The factory default setting is available at /default directory Copy files in this folder to /disk will restore iPAC-5010 to factory default setting.

## Mounting External Storage Memory

To find out the device name of the external memory device which plug into Matrix 520, 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

iPAC-5010 support SSH. If you use Linux computer, you can use SSH command to login iPAC-5010. 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 iPAC-5010 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

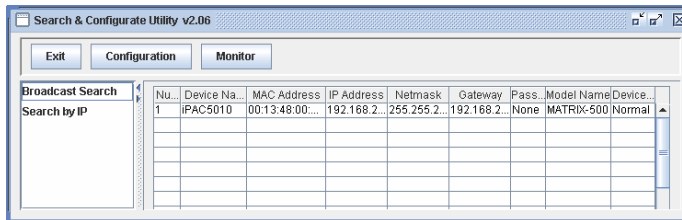
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For further information check:
http://www.artilla.com/

root@Matrix520 />
```

## Manager Utility Software

The Manager Utility software, `manager.jar` is a java program and is used to discovered the iPAC-5010 in the network if the IP address is forgotten. It can be run at any OS where java run time is available. To install the java run time platform at your computer, please visit <http://java.sun.com> and download the Java 2 Standard Edition (J2SE). Once the iPAC-5010 is found, you can click the Telnet Console to configure the iPAC-5010



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

## Getting started 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 520 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-          ** **      ** ** **^~^~^ *****
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230-          **          ** ** **^~^~^ *****
230-
230- For further information check:
230- http://www.artilla.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>
```