Introduction:

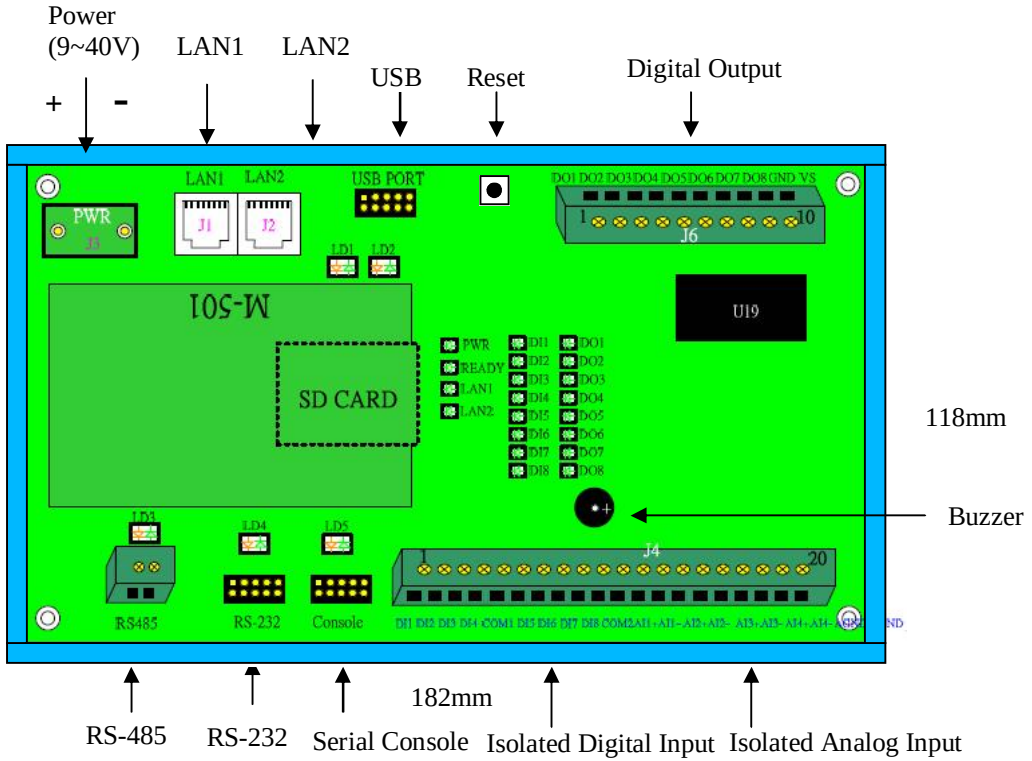
PAC-5070 is ARM9-based Linux ready industrial Programmable Automation Controller. The key features are as follow:

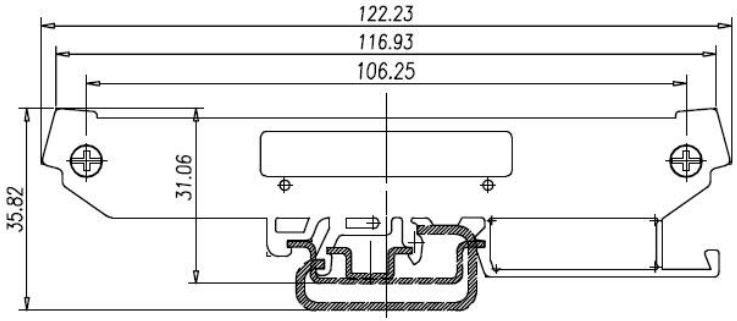
1. ARM920T ARM Thumb Processor with 200MIPS at 180MHz, Memory Management Unit
2. 16-KByte Data Cache and 16-KByte Instruction Cache
3. 64MB SDRAM, 16MB Flash on board
4. Two 10/100 Mbps Ethernet
5. Two USB 2.0 full speed (12 Mbps) Host Ports
6. Multimedia Card Interface for SD memory card
7. One RS-485, One RS-232 and One serial console port
8. 4 isolated analog inputs
9. Input type: mV, V, mA
10. Input range: +/- 150mV, +/- 500mV, +/- 1V, +/- 5V, +/- 10V, 0~150mV, 0~500mV, 0~1V, 0~5V, 0~10V, 0~20mA
11. 1500 Vdc isolation
12. 8 opto-isolated digital inputs
13. 8 Darlington-pair digital outputs
14. 9 to 40VDC power input
15. Pre-installed Standard Linux 2.6 OS
16. GNU tool chain available in Artila CD
17. DIN RAIL mounting

Packing List

1. PAC-5070
2. CBL-F10M9-20: 10-pin header to DB9 male cable for RS-232 x1
3. Artila CD

PAC-5070 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
The Power LED will show solid green if power is properly applied

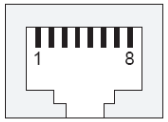
Ready LED
The Ready LED will show solid green if iPAC-5010 complete system boot up. If Ready LED is off during system boot up, please check if power input is correct. Turn off the power and restart iPAC-5010 again. If Ready LED is still off, please contact the manufacture for technical support.

LAN1/LAN2 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 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.

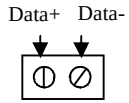
Ethernet Port (LAN1/LAN2)

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

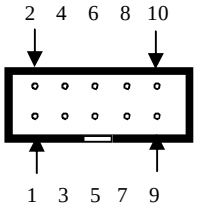


Serial Ports:
COM1: RS-485 (Data+, Data-)
COM2: RS-232 with full modem control
COM3: RS-232 with RxD TxD (Console)

COM1: RS-485



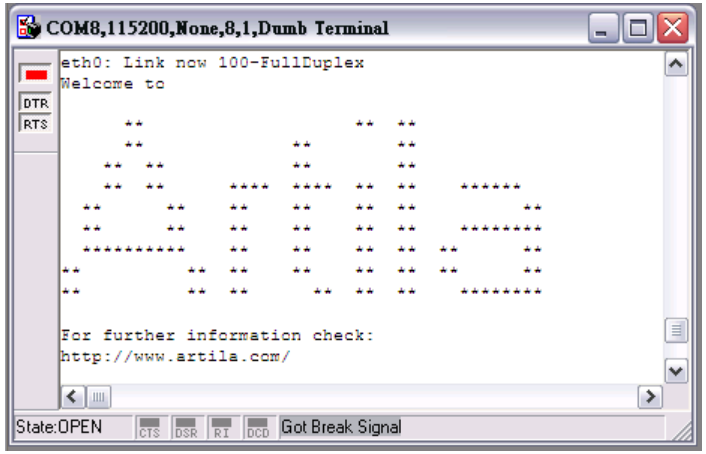
COM2: RS232
COM3: Console



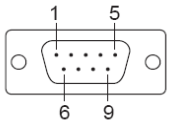
Data+ is pull up to 3.3VDC with 10K Ohm resistor
Data– is pull low to ground
Termination resistor is not included. User can add a 120 Ohm resistor shunt with D+ to D– if necessary

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 PAC-5070, you will see the console message appears.

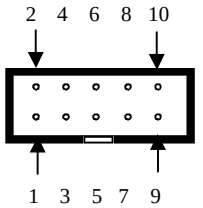


RS-232 DB9 Male Connector



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

USB Port:

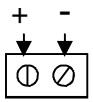


Vcc1,Vcc2: +5Vdc
GND: Ground

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

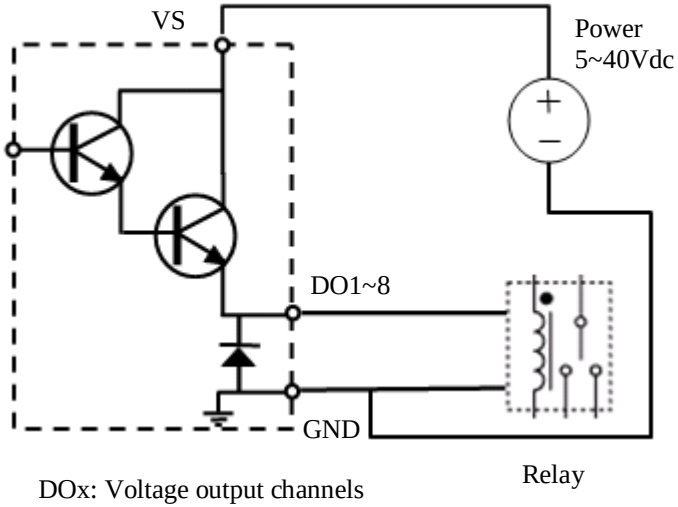
Power Input Connector (J3)

PAC-5070 uses +9VDC to 40VDC power and input from J3 connector. Auto-polarity and surge protection are included in power input circuitry of PAC-5070 to provide power protection to PAC-5070.



Digital Output Connector

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 40 Vdc and the maximum driving current is 500 mA.

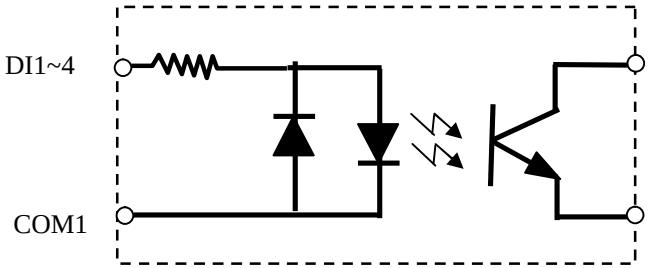


DOx: Voltage output channels
GND: Ground
VS: Voltage source input

Digital Input Connector

The 8 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



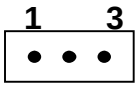
DIx: Isolated digital input channels
COMx: common ground of four DIx

Analog Input Connector

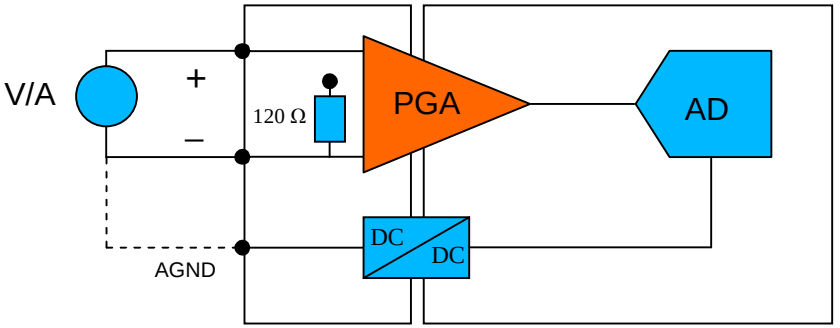
Each of the 4 channels isolated analog input can be configured as various input range and the common features are show as follow:
Effective Resolution: 16-bit
Channels: four differential input channels
Input Type: mV, V, mA
Input Range:
Uni-polar:0~150mV, 0~500mV, 0~1V, 0~5V, 0~10V
Bi-polar: +/- 150mV, +/- 500mV, +/- 1V, +/- 5V, +/- 10V
Current: 0~20mA
Sampling rate: 10~100 samples /sec
Input Impedance: 20 M Ohm
Accuracy: +/- 0.1%
CMR: 50/60 Hz 100dB
Isolation: 1500Vrms (Three-way)

Each of the analog input channel provides (+) (-) and AGND input. To measure floating source such as battery (+,-) and single-ended output which provides positive (+) and ground signal, please connect the negative or ground of the signal to AGND pin in order to provide a virtual ground reference.
To measure current input, please set the jumper (JP1~JP4) to current setting as show below:

Input Type Selection Jumper JP1~JP3



Voltage Input: 1-2 (default)
Current Input: 2-3

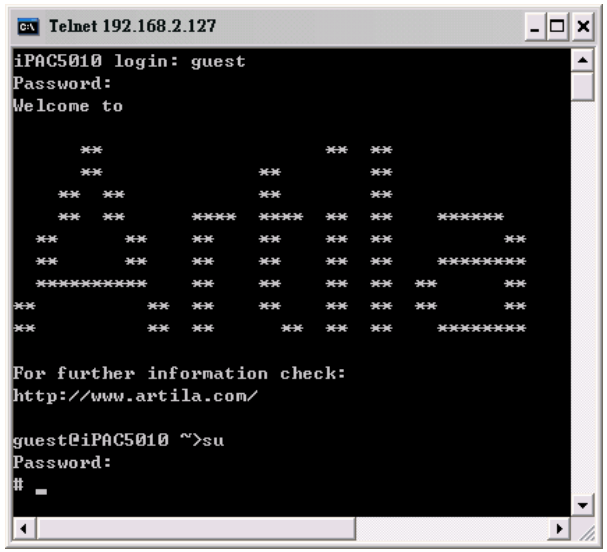


Factory Default Settings

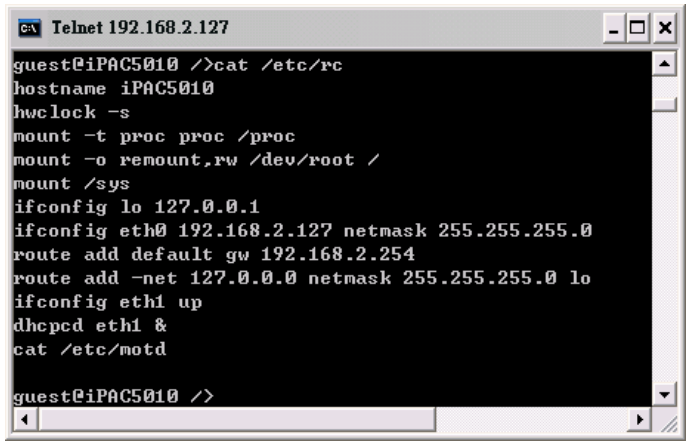
LAN 1 IP Address: 192.168.2.127
LAN 2 IP Address: DHCP
Login: guest
Password: guest
Supervisor: root (ssh only)
Password: root

Login

After power on, wait about 30 seconds for system boot up. Using Telnet and guest or ssh and root to login in PAC-5070.



Network Settings



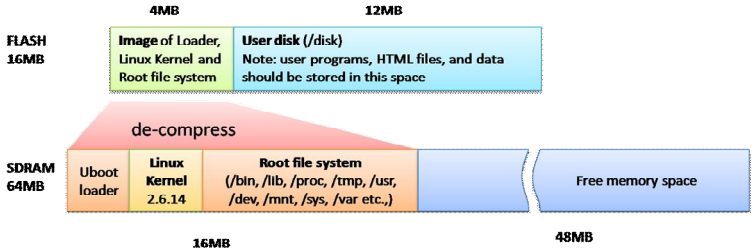
To configure the IP address, Netmask and Gateway setting, please modify */disk/etc/rc* as following:
ifconfig eth0 192.168.2.127 netmask 255.255.255.0
For DHCP setting:
dhcpcd eth1 &

Wireless LAN Configuration

PAC-5070 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 *adhoc*.
To configure the IP address use command
dhcpcd wlan0 & or *ifconfig wlan0 192.168.2.127 netmask 255.255.255.0*

File System

PAC-5070 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 !!!



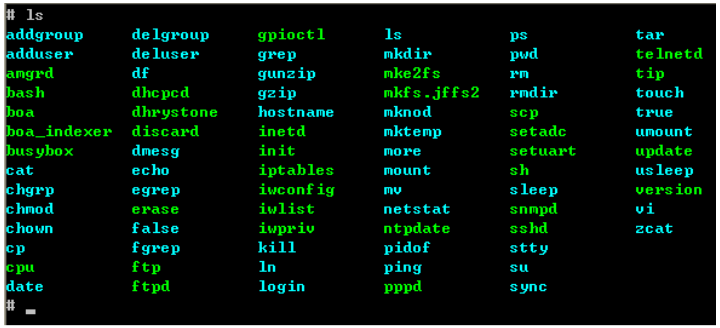
Devices list

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 (fdti_sio.ko)
7. rtc: Real Time Clock
8. gpio: digital I/O
9. adc0~3: analog input channels
10. ttyACM0 and ttyACM1: USB Modem (CDC compliant)

Utility Software:

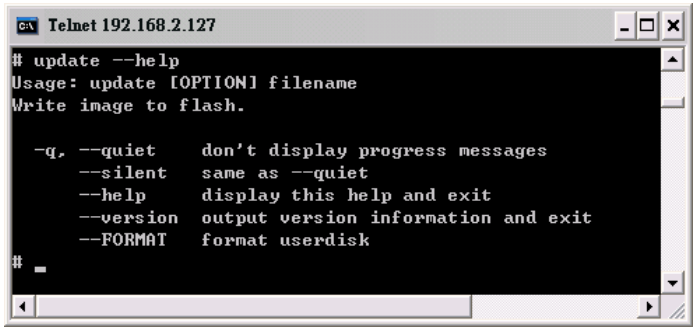
PAC-5070 includes busybox utility collection and Artila utility software as follow:



Artila Utility Software:

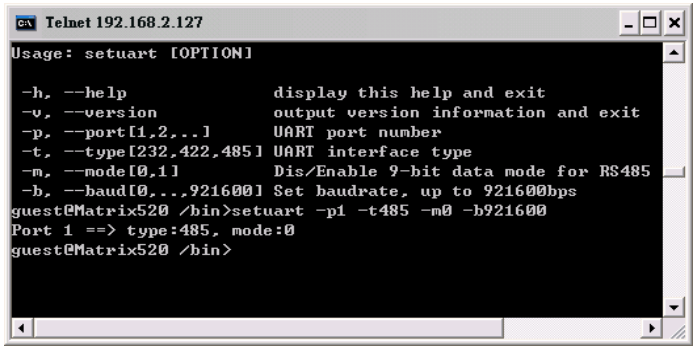
The introduction of Artila utility software as follow:

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)

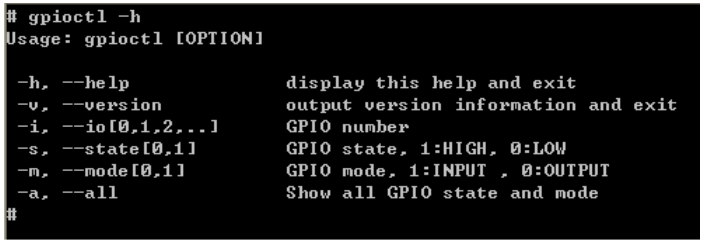
2. *setuart:* configure serial port setting. An example show as followed to configure port 1 as RS-485 interface with baud rate 921600. Please note only port 1 support 9-bit data at RS-485



3. *gpioctl*: gpioctl can use to control the digital input and output of PAC-5070. Use

>gpioctl --help

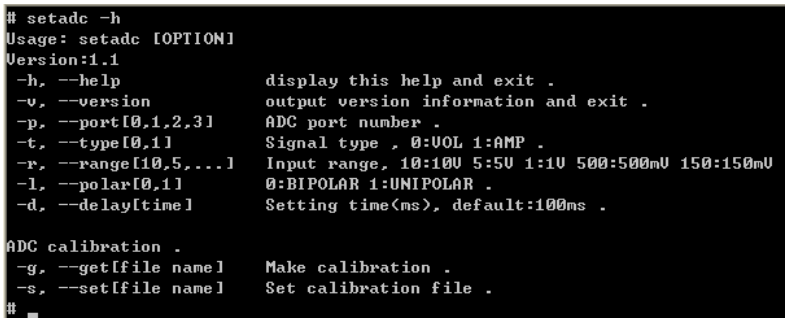
To find out the usage of this command.



4. *setadc*: setadc is used to configure the analog input channels.

>setadc –h

To find out the usage of this command.



To configure channel one (AI1) with +/- 5V with 10 samples / sec sampling rate simply type

>setadc –p0 –t0 –r5 –l0 –d100

How to read Analog Input data

To read the analog data of the input channel, please follow the steps below:

1. Set the configuration of the analog channels [adc0~adc3]
2. Repeatedly read data from the device [adc0~adc3]

Note: Please set the delay time to be 100ms or longer if you want to perform multiple channels scan. The ADC device driver will delay 100 ms for Multiplexer and Programmable Gain Amplifier to be stable before taking the data from ADC.

How to make more utility software

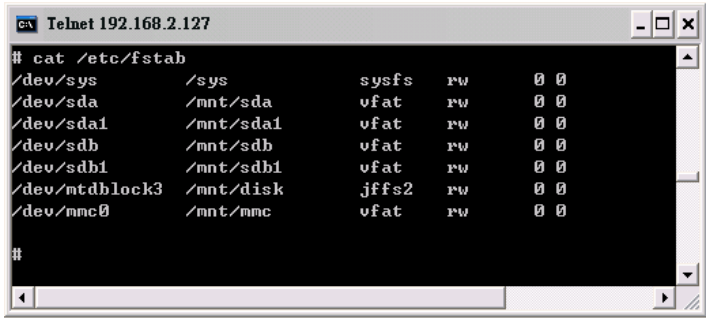
You might also find utility software available on Artila CD under /Matrix 5XX/utility such as *ntpclient, ssh, scp, bluez* and *ssh -keygen*. If you want, you can ftp or copy the utility software to PAC-5070 user disk (/disk). Also you can use find the source code and use the GNU Tool Chain to make the 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 PAC-5070 to factory default setting.

Mounting External Storage Memory

To find out the device name of the external memory device which plug into PAC-5070, 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



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

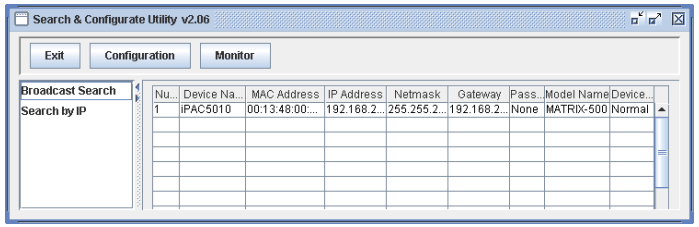
To adjust the RTC time, you can follow the command
/date MMDDhhmmYYYY
where
MM=Month (01~12)
DD=Date (01~31)
hh=Hour
mm=minutes
YYYY= Year
/hwclock –w
To write the date information to RTC
User can also use NTP client utility in Artila CD to adjust the RTC time.
/ntpclient [time server ip]

SSH Console

PAC-5070 support SSH. If you use Linux computer, you can use SSH command to login PAC-5070. The configuration of SSH and key are located at
/etc/config/ssh
The key generation program is available at Artila CD
/matrix 5XX/utility/ssh_keygen
User can copy this program to PAC-5070 to generate the key

Manager Utility Software

The Manager Utility software, **manager.jar** is a java program and is used to discovered the PAC-5070 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 PAC-5070 is found, you can click the Telnet Console to configure the PAC -5070



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 with 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 520 user disk (/disk) and use
chmod +x file.o
Change it to execution mode and
./file.o
to run the file