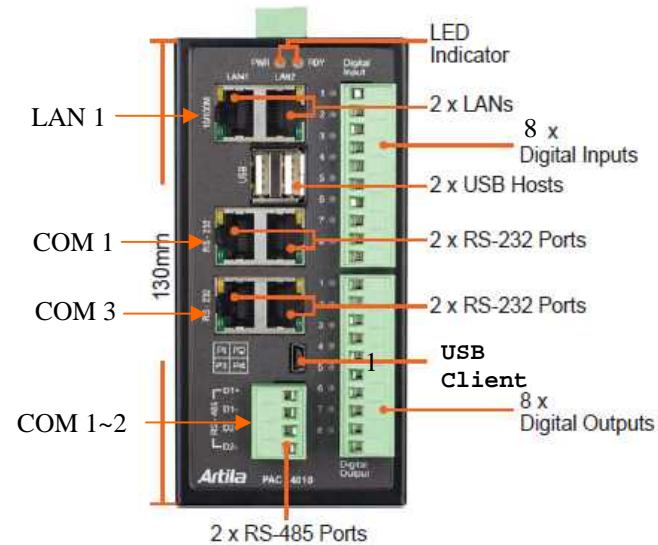


**Introduction:**

PAC-4010 is an ARM9-based Linux ready industrial controller. The key features are as follow:

1. ARM926EJ-S ARM Thumb Processor 400MHz w/MMU
2. 32-KByte Data Cache and 32-KByte Instruction Cache
3. 64MB SDRAM, 128MB NAND Flash on board
4. Two 10/100 Mbps Ethernet
5. Two USB 2.0 full speed (12 Mbps) Host Ports, one USB device port
6. Multimedia Card Interface for Micro SD memory card
7. Four serial ports: RS-232 x2 and RS-232 x2 or Isolated RS-485 x2
8. Eight channels 2500Vrms isolated photo coupler digital input (Bipolar)
9. Eight channels 2500Vrms isolated Darlington digital output
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

**PAC-4010 Layout**



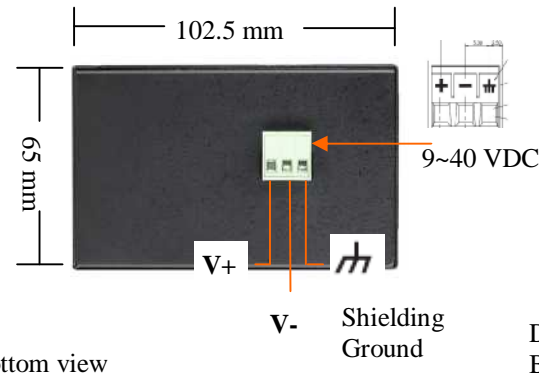
Top view

**Packing List**

1. PAC-4010 Programmable Automation Controller
2. DIN Rail bracket
3. Artila CD

**Optional Accessory:**

1. CB-RJ45F9-150: RJ45 to DB9 Female Cable
2. CB-BHDB9-020: M-502 console cable
3. PWR-12V-1A



Bottom view

Back view



DIN Rail Bracket



## 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 PAC-4010 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 PAC-4010 again. If Ready LED is still off, please contact the manufacture for technical support.

### Link and Act LED

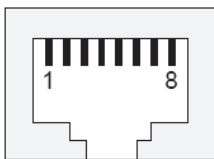
When Ethernet port are connected to the network, Link LED will show solid green. If there is traffic is the Ethernet line, the yellow Act LED will flash.

### Serial Port LED

When RXD line is high then Yellow light is ON and when TXD line is high, Green light is ON.

### Ethernet Port

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



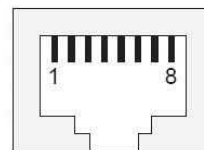
### Serial Ports:

Port 1~2: Software selectable RS-232 or isolated RS-485. If RS-485 is chosen, please use terminal block connector for RS-485.

Port 3~4: RS-232 port with hardware flow control

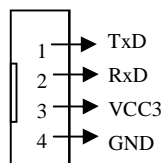
Note: Only Port 2 support RS-232 full modem control DSR,DCD and DTR.

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



### Serial Console Port:

Serial console port is located inside the box at JP4 of M-502. You need a special console cable (CB-BHDB9-020) to access it



TxD: RS-232 transmit  
 RxD: RS-232 receive  
 VCC3: 3.3 VCC Output  
 GND: Signal ground

Use any terminal software such as hyper terminal and configure the setting as follow:

*Baud Rate: 115200*

*Data bits: 8*

*Parity: N*

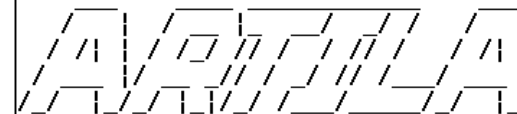
*Stop bit: 1*

*Terminal type: VT100*

**Note :** We provide a utility software, **setconsole** to redirect the console port to any one of the serial port. Therefore user do not need to open the case to access the physical console port. Please refer to **setconsole** command in the Artila utility section.

```
Finished to configure packages.
INIT: Entering runlevel: 5
Starting system message bus: dbus.
Starting ssh server: done.
Starting amgrd: done
Starting syslogd/klogd: done
Starting Telnet Server: done
Starting FTP Server: vsftpd... done.
Starting Lighttpd Web Server: lighttpd.
Starting Ready LED: done
```

```
PAC-4000 login: guest
Password:
```



```
http://www.artila.com
```

```
guest@PAC-4000:~$
```

**Power Input Connector**

PAC-4010 uses +9VDC to 40VDC power and input from three ports plug-in screw terminal connector. Auto-polarity and surge protection are included in power input circuitry of PAC-4010 to provide power protection. Shielding ground provides better EMI protection. Please wire the shielding ground to an appropriate grounded metal surface



**Digital Input Connector**

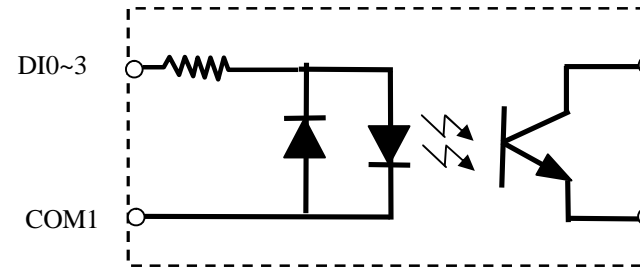
The 8 channel isolated input are equipped with 2500 Vrms photo coupler . Four of the channels form a group and share the same common ground. The specification of the isolated input channels are:

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

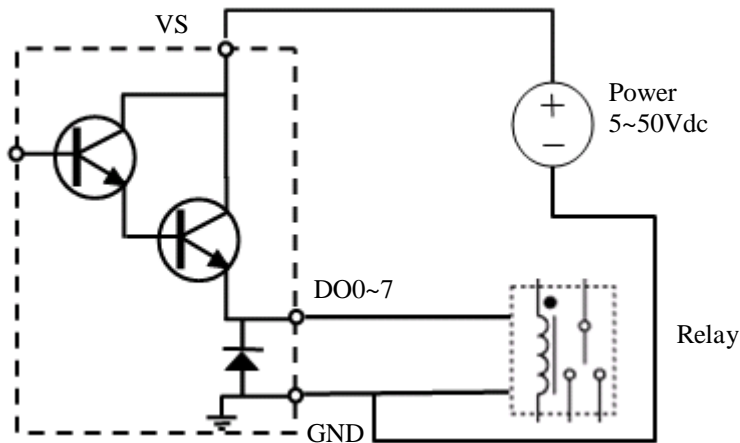
DI Ports		DO Ports	
1	DI0	1	DO0
2	DI1	2	DO1
3	DI2	3	DO2
4	DI3	4	DO3
5	COM1	5	DO4
6	DI4	6	DO5
7	DI5	7	DO6
8	DI6	8	DO7
9	DI7	9	GND
10	COM2	10	VS

**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 50 Vdc and the maximum driving current is 500 mA. 2500 Vrms isolation is provided in all 8 DO ports.



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





## 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. sda to sdb: USB flash disk
4. ttyUSB0 to ttyUSB1: USB RS-232 adaptor (fdt\_i2c.ko)
5. rtc: Real Time Clock
6. gpio: Digital I/O
7. ttyACM0 and ttyACM1: USB Modem (CDC compliant)
8. mmc : SD driver

## Utility Software:

PAC-4010 includes busybox utility collection and Artila utility software and there are placed at :

/sbin

/bin

/usr/bin

/use/sbin

Please refer to Appendix for the utility collection list

```

Telnet 192.168.2.127
root@Matrix504:~# ls
arp          init          lsof         setconsole
depmod       init.sysvinit makedevs     shutdown
depmod.26   insmod        mkdosfs      shutdown.sysvinit
fdisk        iwconfig      mkfs.minix   start-stop-daemon
fsck         iwgetid       mkfs.vfat    sulogin
fsck.minix  iwlist        mkswap       swapoff
getty        iwpriv        modprobe     swapon
halt         iwspy         pivot_root   switch_root
halt.sysvinit killall5      poweroff     sysctl
hotplug     klogd         reboot       sysctl.procps
hwclock     ldconfig      reboot.sysvinit syslogd
ifconfig    logread       rmmod        telinit
ifdown      losetup       route        udhcpc
ifup        lsmod         runlevel

root@Matrix504:~# cd /bin
root@Matrix504:/bin# ls
addgroup    dmesg         mktemp       sh
adduser     echo          more         sleep
bash        egrep         mount        stty
bashbug     false        mount.util-linux su
busybox     fgrep        mountpoint   sync
cat         grep         mv           tar
chattr      gunzip       netstat     touch
chgrp       gzip         pidof        true
chmod       hostname     pidof.sysvinit umount
chown       ip           ping         umount.util-linux
cp          kill         ps           uname
cpio        kill.procps  ps.procps    usleep
date        ln           pwd          vi
dd          login        rm           zcat
delgroup   ls           rmdir        zcat
deluser    ls           run-parts
df          mkmod        sed

```

## Mounting External Storage Memory

To find out the device name of the external memory device which plug into PAC-4010, you can use the command

```
dmesg | grep sd
```

```
dmesg | grep mmc
```

To find out the device type (sda , sdb or mmc)

And use

```
mount /dev/sda1
```

```
mount/dev/mmc
```

to mount the USB disk or SD card and folder is local at `media/sda1` or `/mnt/sda1`

```

Telnet 192.168.2.127
root@Matrix504:~# cat /etc/fstab
# stock fstab - you probably want to override this with a machine specific one

rootfs      /          auto      defaults      1 1
proc        /proc      proc      defaults      0 0
devpts      /dev/pts   devpts    mode=0620,gid=5 0 0
usbfs       /proc/bus/usb usbfs     defaults      0 0
tmpfs       /var/volatile tmpfs     defaults,size=6M 0 0

# mount dev
/dev/sda1   /media/sda1 auto      defaults,sync,noauto 0 0
/dev/sda    /media/sda1 auto      defaults,sync,noauto 0 0
/dev/sdb1   /media/sdb1 auto      defaults,sync,noauto 0 0
/dev/sdb    /media/sdb1 auto      defaults,sync,noauto 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 /usr/www and the /etc/lighttpd.conf contains the lighttpd 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-4010 supports SSH. If you use Linux computer, you can use SSH command to login PAC-4010. The configuration of SSH and key are located at

/etc/ssh

The key generation program is available at /usr/bin



## Putty Console Software

For Windows user, you can download the putty software at <http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html> to use SSH to login PAC-4010

## ipkg package software management

ipkg is a light software package utility. It can be used to install, upgrade and remove the software package for PAC-4010. Currently user can use ipkg to install the software package from Artila FTP. You can find the configuration at `ipkg.conf`

When PAC-4010 is connected to network and issue command

```
ipkg update
```

To update the package list and use

```
ipkg install
```

to install software package and

```
ipkg remove
```

to remove software

```
ipkg list
```

to list available software

```
ipkg list_installed
```

to list software installed

Please refer to Appendix for more about ipkg





## Loader Menu

Loader menu helps user to select the run level of system boot up. User need to use serial console to enter loader menu. Please configure the serial port of terminal as follow:

Baud Rate: 115200  
Data bits: 8  
Parity: N  
Stop bit: 1  
Flow Control: None  
Terminal type: VT100

Once power up PAC-4010, please repeatedly keying “@” and you will see the loader menu appear as follow:

Starting M502.....

```
*****  
          Artila Loader Version 2.0.9  
          DRAM:64M NAND:128M  
*****  
G: Loader TFTP      L: Loader Serial  
K: Kernel TFTP     S: Kernel Serial  
F: Filesys TFTP    T: Filesys Serial  
E: Env. Upgrade    M: Ethernet Setting  
A: Dataflash Booting U: Runlevel  
C: Switch Console  R: Reset  
*****
```

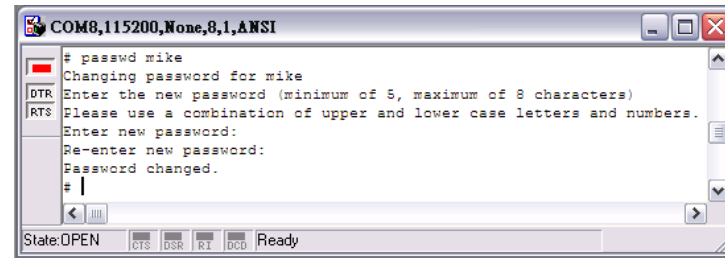
If you miss the timing, please power on again the PAC-4010 and do it again. Select U will prompt the run level selection message. Run level 0 is halt, run level 1 is single user ( disable login and service ). Run level 2~5 are multiple users and run level 6 is reboot. To view the run level configuration, please check

*/etc/inittab*

## Frequently Asked Question

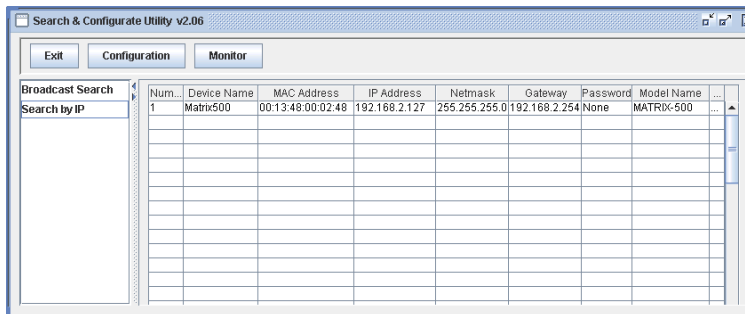
### 1. *Forgot password:*

If you forgot the password for login, please use serial console and use run level 1 to boot system. Use passwd to change the password setting.



### 2. *Forgot the IP address*

If you forgot the PAC-4010 IP address, you can use the Java Manager available in Artila CD to search the IP address of PAC-4010 Or use serial console port to find out the IP address by *#ifconfig*

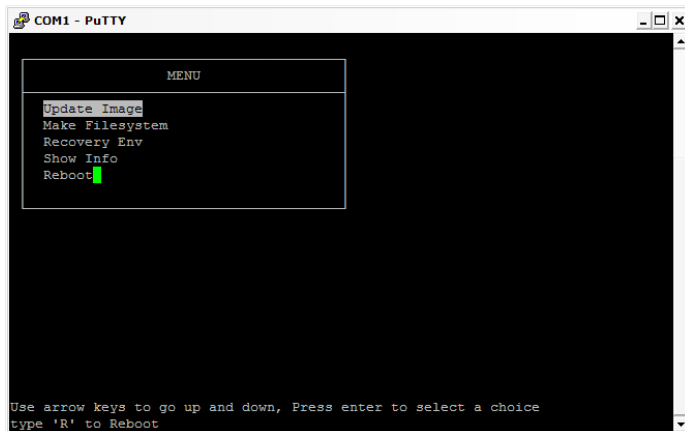


### 3. *System fail to boot*

If you mess up the root file system and make the system fail to boot, PAC-4010 will automatically switch to boot from Dataflash file system and a console menu will show up at console port to help user perform system recovery. *System Recovery Section* will tell you how to recover the system.

## System Recovery

If NAND Flash file system does fail, DataFlash file system will automatically boot up and a Console Menu at console port will appear as follow:



```
COM1 - PuTTY
MENU
Update Image
Make Filesystem
Recovery Env
Show Info
Reboot
Use arrow keys to go up and down, Press enter to select a choice
type 'R' to Reboot
```

1. Update Image: this option can recover the loader, kernel and file system by using an USB disk. The USB disk contains the images files with the path as follow:

Loader: *pac4000/pac4000.alf*  
Kernel: *pac4000/pac4000K*  
File system: *pac4000/pac4000R*

The files are available in Artila CD. Please prepare an USB disk and copy the image files to it before choosing this option.

### Make user's filesystem

2. Make Filesystem: this option is used to create customized file system. Before using this function, you need to copy the folder of *mkimage504* in the Artila CD to an USB disk. This function will create a new file system image for users and they can use it to duplicate the customized file system to other PAC-4010.

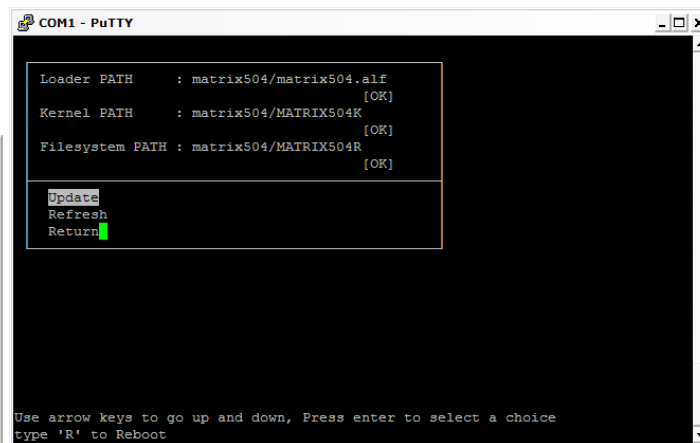
### Recover Environment File

3. Recovery Env.: The option will recover the environment files as default setting. Use this function only when the NAND file system crash.

4. Show Info: Show the version information of PAC-4010

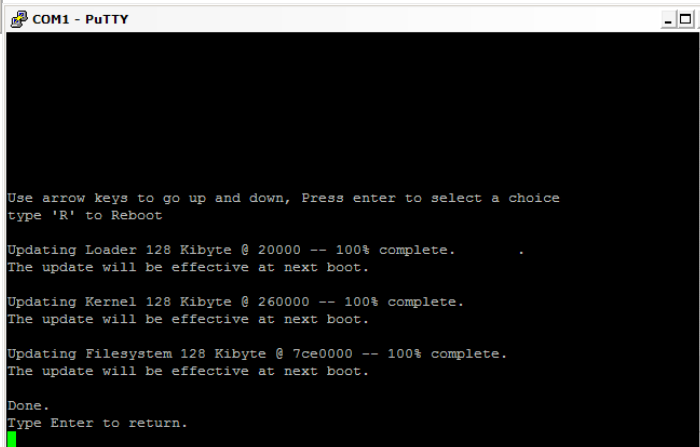
5. Reboot: Reboot the NAND flash file system.

## Update Image Starts



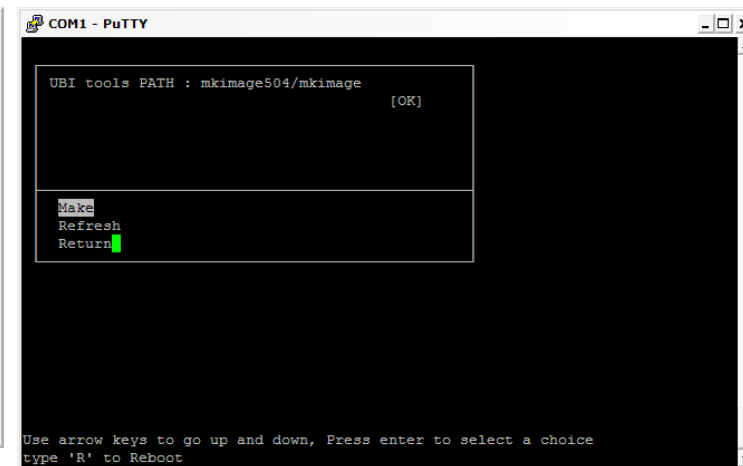
```
COM1 - PuTTY
Loader PATH : matrix504/matrix504.alf [OK]
Kernel PATH : matrix504/MATRIX504K [OK]
Filesystem PATH : matrix504/MATRIX504R [OK]
Update
Refresh
Return
Use arrow keys to go up and down, Press enter to select a choice
type 'R' to Reboot
```

## Update Image Completes



```
COM1 - PuTTY
Use arrow keys to go up and down, Press enter to select a choice
type 'R' to Reboot
Updating Loader 128 Kibyte @ 20000 -- 100% complete.
The update will be effective at next boot.
Updating Kernel 128 Kibyte @ 260000 -- 100% complete.
The update will be effective at next boot.
Updating Filesystem 128 Kibyte @ 7ce0000 -- 100% complete.
The update will be effective at next boot.
Done.
Type Enter to return.
```

## Make Files System Starts



```
COM1 - PuTTY
UBI tools PATH : mkimage504/mkimage [OK]
Make
Refresh
Return
Use arrow keys to go up and down, Press enter to select a choice
type 'R' to Reboot
```

### Note:

1. Use Arrow keys up and down to selection the functions
2. Use Arrow keys left and right to go to higher or lower levels of menu screen

### Force DataFlash boot

1. To force system go into DataFlash booting, repeatedly keying “!” (Shift +1 ) right after PAC-4010 power on.



# Appendix

## Utility Collection

1. busybox v1.14.2-tiny utility collection
2. sysvinit v2.86 -standard Linux initialization
3. util-linux-mount/umount v2.12r-support long file name
4. ssh v4.6p1- support sftp server
5. usbutils v0.7- USB id program
6. lighttpd v 1.7-web server
7. wget v1.9.1- used in ipkg software
8. iptables v1.3.8- IP routing
9. ipkg v.0.99.163- software package management
10. procps v3.2.7- support webmin process management
11. vsftpd v2.0.5- ftp server
12. bash v3.2-GNU shell
13. wireless\_tools v29- wireless LAN utility
14. ppp v2.4.3-ppp dial up utility
15. psmics v22.2- procps supplement
16. artila utility v.1.1- handy utility added by Artila

You can find more utility at Artila Matrix-504 CD and use ipkg to install the utility.

## ipkg software package management

PAC-4010 uses *ipkg* to manage the software installation, upgrade and removal. Artila will continuously add the kernel module and utility at our ftp server, user can install these software from Artila's ftp server. In addition user can also setup your ftp server to update the software you want. To install the utility from Artila ftp, please use *vi* to edit the */etc/ipkg.conf*  
*src/gz arm ftp://ftp:ftp@ftp.artila.com/AT9G20/Artila-CD/Linux/Utility*  
*src/gz kernel ftp://ftp:ftp@ftp.artila.com/AT9G20/Artila-CD/Linux/modules*

You can also copy the Utility and module folder from Artila CD to a USB disk, then use USB disk to install the software by changing the *ipkg.conf*  
*src/gz usb\_arm ftp://root:root@127.0.0.1/media/sda1/Utility*  
*src/gz usb\_kernel ftp://root:root@127.0.0.1/media/sda1/modules*

Make sure the USB disk is correctly mounted, now use command *ipkg update* to update the package list and use *ipkg install webmin*

To install webmin. Webmin is a web-based interface to system administration. To start webmin, go to */etc/webmin* and type *start webmin*

Then you can use browser to visit PAC-4010 port 10000

The webmin for PAC-4010 provides following modules:

1. Webmin: webmin configuration
2. System: system boot, process and log management
3. Server: Apache and SSH server configuration
4. Network: network configuration
5. Hardware: RTC setting
6. Others: File manager, upload and download

Remember to use command

*depmod -a /lib/modules/2.6.29.4/modules.dep*

To update the dependency list if new kernel module were added.

