# Phantom 4 Remote Management Module
# User Manual

April 27, 2004
for versions 4.0 to 4.4.3

Rackable Systems
721 Charcot Avenue, San Jose, CA 95131
(408) 321-0290

www.rackable.com

Copyright © Rackable Systems, 2003-2004.  All rights reserved.

Trademarks used in this manual: Rackable Systems, Rackable are registered trademarks of Rackable Systems Corporation. Rackable Systems disclaims any proprietary interest in trademarks and trade names other than its own.

# Table of Contents


| | |
|---|---|
| Chapter 1 - Introduction | 2 |
| Overview | 2 |
| Centralized Management | 2 |
| Organization of this manual | 3 |
| Chapter 2 – Phantom Access | 4 |
| Phantom Functions | 4 |
| Networking the Phantom | 4 |
| Configuring a Linux Serial Console | 5 |
| Chapter 3 – Menu Options | 6 |
| Menu Access | 6 |
| Phantom Management Commands | 6 |
| Chapter 4 – Shell Mode | 9 |
| Phantom Shell Mode Commands | 9 |
| Chapter 5 – Server Commands | 11 |
| Local OS Access | 11 |
| Linux scripting sample | 11 |
| Appendix I: Connector Diagram | 13 |

# Chapter 1 - Introduction

## Overview

The Phantom remote management module provides standard motherboards with enhanced remote control capabilities as well as serial redirection. Administration can be performed on countless servers from one central location through a simple serial connection, resulting in dramatically reduced workload for system administrators while improving overall availability.

The Phantom provides true lights-out management of servers and clusters, including:

- Console access via serial redirection through COM header (including BIOS access)
- Management across LAN or isolated serial management network when used with a terminal server
- Power control: out-of-band access allows rebooting/turning on and off servers
- LCD screen can display text such as IP address, hostname, CPU load, or maintenance message
- LED or LCD can be used to help the operations staff locate servers to be serviced
- Remote monitoring of the system power status and ambient case temperature
- Power delay functionality minimizes peak power spike during rack-wide power on, reducing spike power requirements by up to 52%

All functionality can be scripted for automation through a serial port or from the local OS. A problematic server can be flagged for maintenance with an LED or a text message on its LCD. A server's internal temperature can be monitored by the Phantom's temperature sensor. Unresponsive systems can be given a "hard" reset or powered down. Initial power-on surge from a large rack of servers can cause electrical breakers to trip. The Phantom prevents this by implementing a user assigned power-on delay value.

## Centralized Management

The Phantom card is accessed via a standard RJ45 serial connection. Each Phantom can be accessed directly via any terminal emulation package. However, in a typical data center, the standard method for remote management consists of installing a console management device and wiring each Phantom to this device. This device is then available via the regular network as a central access point to all servers being managed remotely via the Phantom. One example of such a device is the Digi CM32 console management server.

The Phantom card has three modes: pass-through mode, menu mode, and shell mode. When initially connected, the session will be started in pass-through mode. If the OS supports a serial console session, this will be accessible in pass-through mode. Entering CTRL-6 will give access to the Phantom commands in menu mode. Shell mode can be entered with the proper escape sequence – see the following chapter on shell mode.

## Organization of this manual

This manual provides details on using the Phantom for remote management and serial console redirection

The Phantom options for remote management can be accessed in three ways:

- via a menu that is accessible from a serial or telnet (when accessed via a terminal server) session
- from shell mode
- from scripts that can be run from a management station or on the local OS

The Phantom also allows for serial redirection. This provides the ability to see the console messages, or collect the console messages to a centralized console server. This session is available via the COM header on the motherboard, so most boot processes are visible. The BIOS setting can be changed through this interface, allowing remote management of BIOS settings.

This manual will guide you through these, and other, useful features of the Phantom.  Please take the time to read this manual in its entirety before attempting installation or operation.

# Chapter 2 – Phantom Access

## Phantom Functions

The Phantom Remote Management Module provides three basic levels of functionality:

- serial redirection in pass-through mode, providing remote access to console messages for analysis: these messages can also be routed to a console messages server
- access to the BIOS settings via pass-through mode during boot
- Phantom management functions in menu or shell mode

The Phantom also allows for serial redirection, providing the ability to see the console messages, or collect the console messages to a centralized console server. This session is available via the COM header on the motherboard, so all boot processes are visible. The BIOS setting can be changed through this interface, allowing remote management of BIOS settings.

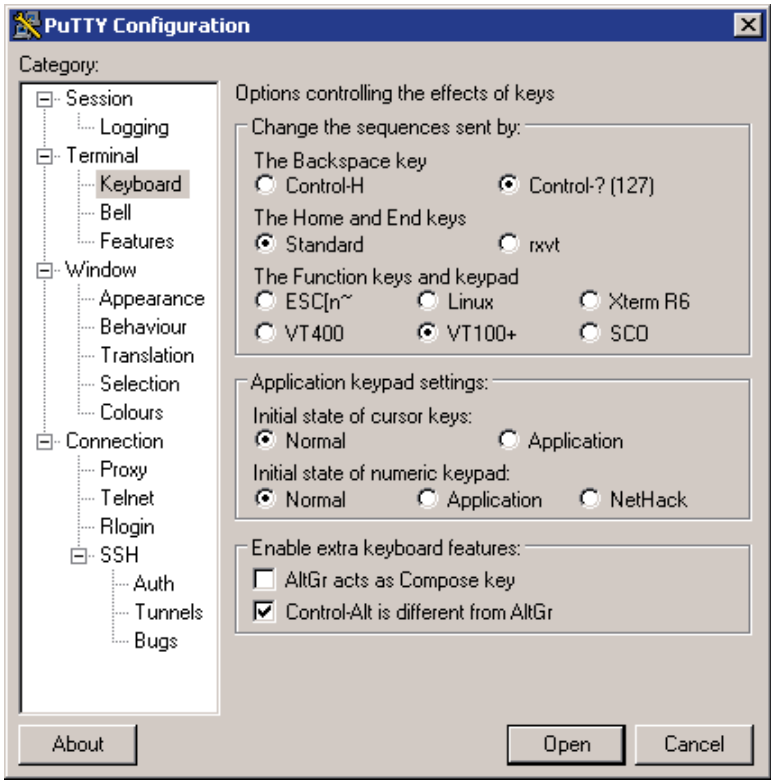


Figure 1: putty Configuration Options

## Networking the Phantom

The Phantom can be accessed via:

- a GUI interface if provided by the terminal server
- by a direct telnet session through the console manager
- connecting directly from a laptop using terminal emulation software

Centralized management is provided using a terminal server (also called a serial concentrator or console manager), such as the Digi CM32 or Cyclades. Each Phantom is connected to this device via the serial interface. This device is then available via an ethernet network as a central access point to all servers being managed remotely via the Phantom.

This session is initiated from a terminal program such as HyperTerminal, Minicom, or VanDyke Software™ SecureCRT™. Connecting via one of these sessions requires:

- Protocol: serial
- Port: dependent upon client machine

- Baud rate:  9600 (unless reset – see menu options)
- Data/Parity/Stop bit settings: 8N1
- Flow control: none

The “putty” utility in Windows can be used as the terminal session to access the Phantom. Figure 1 shows the option settings for using “putty” with the Phantom.

## Configuring a Linux Serial Console

The Linux serial console is available via the Phantom while the Phantom is in pass-through mode. To take advantage of this facility, Linux should be configured as follows:

1. Add the following to your kernel command line in either /etc/grub.conf, or /etc/lilo.conf:
   **`console=tty0  console=ttyS1,9600`**
2. Add the following to /etc/initab (See alternate serial logins for other options.): **`s1:2345: respawn:/sbin/agetty -L -t 60 ttyS1 9600 vt102`**
3. Add the following to /etc/securetty to allow root logins:
   **`ttyS1`**
4. Alternate serial logins
   a. mgetty /etc/initab**:**
      **`s1:2345:respawn:/sbin/mgetty ttyS1`**
   b. Bash shell (if you want a root shell without a login prompt. Be wary of the security concerns here.):
      **`s1:2345:respawn:/bin/bash </dev/ttyS1 >/dev/ttyS1 2>&1`**

See /usr/src/linux*/Documentation/serial-console.txt for further details and documentation about setting up services on serial ports in Linux.

# Chapter 3 – Menu Options

## Menu Access

Access to the Phantom will normally be via a console manager or serial concentrator. Once the session is established, the menu prompt on the Phantom module is reached by entering the key sequence Ctrl-6 (in Hyperterminal, Ctrl-Shift-6). When this key sequence is entered, the following prompt will be displayed.

```
Phantom [? for Help]:
Server is on/off
```

From this prompt, any of the Phantom menu options can be selected. If the "?" is entered, a menu will be displayed.

```
+-----------------------------------------------+
|               Rackable Systems                |
|                   Phantom                     |
|                Copyright 2003                 |
|                Firmware  v4.0                 |
|                                               |
| D - Enter a new power on delay                |
| R - Reset the Server                          |
| P - Turn the Server On                        |
| L - Turn the LED On                           |
| B - Start Blinking                            |
| E - Erase the LCD                             |
| M - Enter LCD message                         |
| S - Save LCD message                          |
| C - Adjust LCD contrast                       |
| V - View LCD message                          |
| W - Show Saved LCD message: No                |
| I - Power Sense: Reset                        |
| H - Change Hotkey                             |
| A - Change Baud Rate                          |
| X - Reset the Phantom                         |
| U - Upgrade Firmware                          |
| ESC - Quit                                    |
|                                               |
| Choose a command                              |
+-----------------------------------------------+
```

Figure 2: Phantom 4.0 Help Menu

The menu ends with a prompt for a command. The escape key will return to the standard interface status. If no input is received for 15 seconds, the Phantom will exit the menu and return to serial redirection. Each option is described in the following section.

To keep the user from inadvertently making a mistake, in Phantom versions >= 4.0.3 certain menu functions require a password phrase to be entered before accessing the menu function. In all cases, this password is "**P4Confirm**".

## Phantom Management Commands

**D - Enter a new power on delay**

The power on delay selection on the Phantom menu prompts the user for a delay value. This value can range from 00 to 99. The value is read upon Phantom startup and determines the amount of time to wait in seconds before turning the server on. The 99 setting instructs the Phantom not to turn on the server automatically. Valid inputs are one number followed by a carriage return or a two digit number.

Tech Note: The power on delay actually cycles the power, independent of its current state. If power on delay is set to 10 seconds, and the server loses and regains hard power, if the server is turned on within 10 seconds, the Phantom will turn it off due to the power on delay setting. This is slated to change in a future revision of the Phantom, but affects all Phantoms version <=4.4.3.

**R - Reset the Server**

This function allows the user to perform a remote hard reset of the attached server. The user will be prompted for confirmation before the server is reset.

**P - Turn the Server On/Off**

This function allows the user to either turn on or turn off the attached server remotely. If the server is detected to be off, the help menu item will read "`Turn the server on`". If the server is detected to be on, the help menu will read "`Turn the server off`". The Phantom menu prompt also displays the current state of the server's power. Confirmation from the user is required for this function.

**L – Turn the LED On/Off**

This command toggles power to the LED(s). If the LED is currently on, the menu will display "`Turn the LED off`". If the LED is presently off, the help menu will display "`Turn the LED on`". If the LED is currently blinking, this menu item will not be present.

**B - Start/Stop Blinking**

Selecting this command will toggle the blink state of the LED(s). If the LED is blinking, the help menu will read "`Stop Blinking`". If the LED is not blinking or is on, the help menu will read "`Start Blinking`".

**E - Erase the LCD**

This function clears the LCD display and is only visible when an LCD is attached to the Phantom.

**M – Enter LCD message**

LCD messages are sent to the Phantom with this command. The display consists of two lines of twenty character text. The Phantom will automatically advance to the second line after the 20$^{th}$ character is received. Messages with lines shorter than twenty characters can be displayed by entering a carriage return after the desired number of characters. The message is displayed after the user enters 40 characters, enters a total of two carriage returns, or enters one full 20 character line with another line having a carriage return. This option will only be visible if the LCD is present.

Non alphanumeric characters do not have representative fonts on the LCD and should not be used.

**S – Save LCD Message**

This function saves the current LCD text to the Phantom's memory. The message will not be erased if power is removed. The saved message can be displayed upon the server's startup. (See **W – Show Saved LCD**)

**C – Adjust LCD contrast**

Choose this menu item to adjust the LCD contrast for optimal viewing. The + and – keys are used to change the current setting. The ESCAPE key is used to save the setting. The contrast setting can range from 0 to 100. This option will only be visible if the LCD is present. A value of 30 usually gives good results.

**V – View LCD Message**

This function will return the current contents of the LCD display. The response is displayed in two lines of 20 characters exactly as it appears on the LCD. This option will only be visible if the LCD is present.

**W – Show Saved LCD Message**

This function toggles the flag for showing a saved LCD message upon server startup. The menu item on the help screen (figure 2), will update to show the current state of the flag.

**I – Power Sense**

The power sense option toggles between sensing server power on the reset header or on the J7 connector. Most applications will use the "Reset" option. This option should be set before shipping from Rackable Systems, but may need to be reset if somehow changed after shipping.

**A – Change Baud Rate**

This command can be used to change the default baud rate. The default 9600.

**T – Read Temperature**

This command displays the current temperature of the Phantom sensor. The temperature is in Fahrenheit degrees. This screen will be updated once per second until the ESCAPE key is pressed.

**ESC – Quit**

This command exits the menu prompt on the Phantom and allows serial pass through to the server.

**? – Help Menu**

This command displays the screen shown in Figure 2 and waits for a valid menu selection. Some menu items may be absent if the related hardware is missing.

# Chapter 4 – Shell Mode

The Phantom remote management module has a second mode of operation named "shell mode". In this mode, the Phantom doesn't display a menu prompt and only returns short responses to requests. No confirmation is required for any of the commands. This mode is meant to be controlled by third party software which can be GUI based. Shell mode is entered by sending the byte 0x1Dh to the Phantom while it is at the menu prompt. Shell mode is exited by sending the byte 0x1Eh (Ctrl-6).

## Phantom Shell Mode Commands

| Action | Cmd | Parameters | Responses | Comments |
|---|---|---|---|---|
| Change Baud Rate | A*x* | '1' - set to 9600<br>'2' - set to 19200<br>'3' - set to 38400<br>'4' - set to 57600<br>'5' - set to 115200<br>'?' - query setting | Success: "ok\r"<br>Failure: "er\r"<br>Query: "*[1-5]*\r" | Failure will occur if the parameter is out of range. Baud rate will take effect after power cycle or Phantom4 reset. |
| Toggle LED Blinking | B*x* | '0' - stop blinking<br>'1' - start blinking | Success: "ok\r"<br>Failure: "er\r" | Failure will occur if the parameter is not 0 or 1. |
| Set LCD Contrast | C*x* | *[0x00-0x64]* - setting<br>'?' - query setting | Success: "ok\r"<br>Failure: "er\r"<br>Query: "*[8 bit value]*\r" | *x* is a single byte.<br>Failure will occur if the 8 bit value is out of range. |
| Set Power-up Delay | D*x* | *[0x00-0x62]* - 0-98 sec.<br>*0x63* - Off<br>'?' - query setting | Success: "ok\r"<br>Failure: "er\r"<br>Query: "*[8 bit value]*\r" | *x* is a single byte.<br>Failure will occur if the 8 bit value is out of range. |
| Erase LCD | E | None | Success: "ok\r"<br>Failure: "er\r" | Failure will occur if command is issued without an LCD attached. |
| Change Hotkey | H*x* | *[0x00-0xFF]* - new hotkey<br>'?' - query setting | Success: "ok\r"<br>Query: "*[8 bit value]*\r" | *x* is a single byte.<br>Any 8 bit value is accepted, so there are no failures. |
| Change Power Sense Pin | I*x* | '0' - reset header<br>'1' - J7 header<br>'?' - query setting | Success: "ok\r"<br>Failure: "er\r"<br>Query: "*[0-1]*\r" | Failure will occur if the parameter is not 0, 1, or ?. |
| Toggle LED | L*x* | '0' - turn LED off<br>'1' - turn LED on<br>'?' - query setting | Success: "ok\r"<br>Failure: "er\r"<br>Query: "*[0-1,B]*\r" | Failure will occur if the parameter is not 0, 1, or ?. A response of 'B' indicates blinking. |

| Action | Cmd | Parameters | Responses | Comments |
|---|---|---|---|---|
| Display LCD Message | M*[40 chars]* | 40 characters of LCD data | Success: “ok\r” Failure: “er\r” | The LCD data must be padded with spaces to total 40 characters. Failure will occur if no LCD is attached. |
| Change Server Power State | P*x* | ‘T’ - toggle state ‘0’ - turn server on ‘1’ - turn server off ‘?’ - query power state | Success: “ok\r” Failure: “er\r” Query: “*[0-1]*\r” | Failure will occur with “P0” and “P1” if the Phantom4 fails to change the power state. “PT” is supported for Phantom3 compatibility. |
| Reset Server | R | None | Success: “ok\r” | Reset pulse is 500ms. There are no failures for this command. |
| Save Current LCD Message | S | None | Success: “ok\r” Failure: “er\r” | Failure will occur if no LCD is attached. This message can be displayed upon Phantom4 startup by setting “Show Saved LCD Message on Startup” to ‘1’. |
| Get Temperature | T | None | Success: “*XXX*\r” Failure: “er\r” | Temperature is returned in degrees Celsius and padded with zeroes to 3 characters. Failure will occur if no temperature sensor is detected. |
| Retrieve Current LCD Message | V | None | Success: “*[40 characters]*\r” Failure: “er\r” | Failure will occur if no LCD is attached. |
| Show Saved LCD Message on Startup | W*x* | ‘0’ - do not show message ‘1’ - show message ‘?’ - query setting | Success: “ok\r” Failure: “er\r” Query: “*[0-1]*\r” | Failure will occur if the parameter is not 0, 1, or ?. |
| Reset the Phantom4 | X | None | Success: “ok\r” | This command has no failure. |
| Exit Shell Mode | [0x1E] | None | Success: “ok\r” | The byte *0x1E* is the Ctrl-6 character. |

# Chapter 5 – Server Commands

## Local OS Access

The Phantom has the ability to write directly to the LCD panel from the local OS. Any of the menu options are available through the script mode to the local OS as described in the previous chapter. The server can only send direct write commands to the Phantom while it is not at a menu prompt and is not in shell mode.

The Phantom will automatically advance to the second line after the 20th character is received. Messages with lines shorter than twenty characters can be displayed by sending a carriage return and line feed after the desired number of characters. The message is displayed after the server sends 40 characters, a total of two carriage returns and line feeds, or one full 20 character line with another line having a carriage return and line feed.

This functionality can be scripted, allowing updates to the LCD panel with real-time information. This allows management functionality such as displaying the hostname and IP address at boot time, or displaying current IO rates, job rates, CPU utilization, or other real-time information on the LCD panel. Tying this together with the ability to change the contrast on the LCD or to make the LED turn on or blink can be a powerful method for visually identifying servers that our outside of normal operational parameters.

Note that the execution environment must have access to the serial port in order for this scripting to work. In the very common situation where agetty is running on the serial port (as a login prompt on the port), agetty locks the serial port and does not allow access by other programs. To get around this, try performing any LCD programming before agetty is launched (usually by init/inittab) in a startup rc.d file. This is generally done in rc.local under Red Hat Linux, or boot.local under SuSE Linux. Either file can be found in /etc/rc.d/.

## Linux scripting sample

The following is a sample Perl script setting the LCD to display the hostname and IP address dynamically:

```
#!/usr/bin/perl –w

#set default serial device
$dev=”ttyS1”;

#find ip address on eth0
$_= `ifconfig eth0 |grep inet`;
($inet) = ( /([0-9]+\.[0-9]+\.[0-9]+\.[0-9]+)/ );

#get hostname
$mesg=`hostname`;
chomp $mesg;
```

```
#write to lcd
open(LCD,”>/dev/$dev”)||die “ERROR: can not write to /dev/$dev\n”;
$|=1; print LCD “LCD:\n $mesg\n $inet \n”;

#uncomment this to debug your LCD message
#print “LCD:\n $mesg\n $inet \n”;
```

# Appendix I: Connector Diagram