Rackable systems

Roamer™-Serial

Remote Management Solution^{TM}

User's Manual

Firmware: 4.0 to 4.4.5

Roamer™-Serial Remote Management Solution™ User's Manual v1.0, Part # 40-01-00003

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   2/7/06 - v1.0
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Chapter 1 - Introduction

Overview

The Rackable Systems™ Roamer-Serial Remote Management Solution™ 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.

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

- Console access via serial redirection through the internal motherboard serial 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. The internal temperature of a server can be monitored with the Roamer temperature sensor. Unresponsive systems can be given a "hard" reset or powered down. The Roamer implements a user assigned power-on delay value to eliminate the tripping of electrical breakers from an initial power-on surge..

Centralized Management

Roamer-Serial is accessed via a standard RJ-45 serial connection. Each module can be accessed directly via any terminal emulation package. In a typical data center, the standard method for remote management consists of installing a console management device and wiring each server 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 module. Examples of such devices include the Digi CM32 console management server and the Cyclades TS-3000 terminal server.

The Roamer has three modes: pass-through mode, menu mode, and shell mode. When initially connected, the Roamer will be started in pass-through mode. If the OS supports a serial console session, this will be accessible. Entering "ctrl-6" will allow access to the menu mode command menu. Lastly, shell mode is designed for advanced scripting can be entered via a proper escape sequence – see the Chapter 4 for more information on shell mode.

Organization of this Manual

This manual provides details on using the Roamer™-Serial Remote Management Solution.

The module options for remote management can be accessed by:

- menu mode, accessible from a serial or telnet (when accessed via a terminal server) session
- shell mode, accessed from the local OS or externally as above

The Roamer also allows for serial redirection when this function is supported by the underlying operating system, including most distributions of Linux, and Windows™ 2003. This provides the ability to see the console messages, and obtain logging output or a management shell on the server over a serial connection. This session is available via the serial header on the

motherboard, making most boot processes are visible. The BIOS settings 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 Roamer-Serial. Please take the time to read this manual in its entirety before attempting installation or operation.

Chapter 2 – Accessing the Module

Remote Management Functions

The Rackable Systems Roamer-Serial 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
- Management functions in menu or shell mode

The Roamer 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.

Networking

The Roamer can be accessed via:

- a direct telnet session through the console manager (such as Unix telnet or putty in Windows)
- connecting directly from a laptop using terminal emulation software (such as Minicom or Hyperterm)

Centralized management is provided using a terminal server (also called a serial concentrator or console manager), such as the Digi CM32 or Cyclades TS-3000. Each module 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.

When connecting the module to most Cyclades brand terminal servers, a straight through Ethernet patch cable can be used. For modern Digi or Cisco brand equipment, Rackable Systems stocks a line of cables with the proper pinouts for connecting the module. For other equipment, please refer to Appendix II for the Roamer-Serial RJ-45 pinout.

Figure 1: PuTTY Configuration Options

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

- Protocol: serial
- Port: dependent upon client machine
- Baud rate: 9600 (unless changed – see menu options)
- Data/Parity/Stop bit settings: 8N1
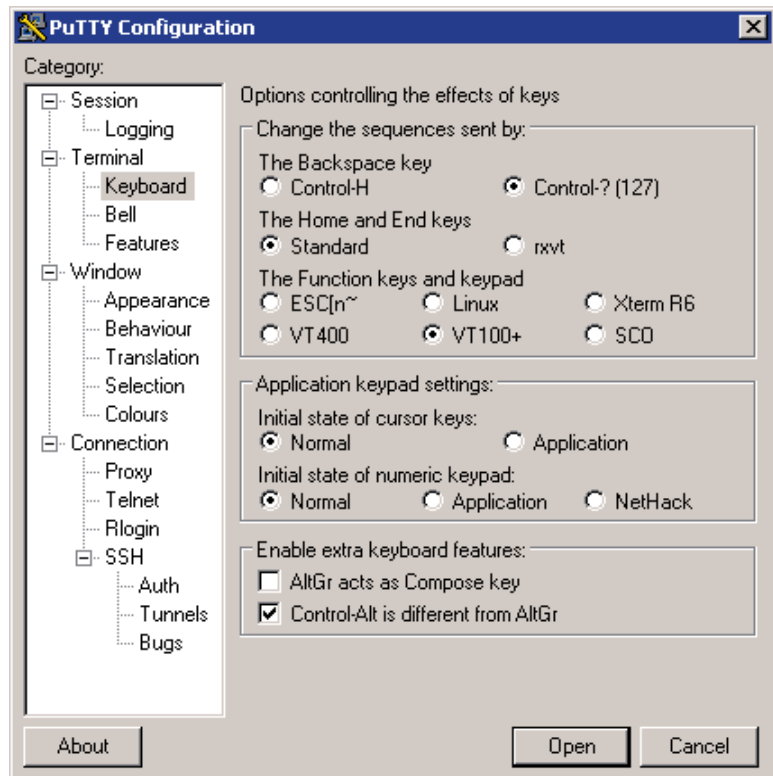- Flow control: none

The "puTTY" utility in Windows can be used as the terminal session to access the module. Figure 1 shows the relevant option settings for using "puTTY".

Configuring a Linux Serial Console

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

1. To get kernel messages, 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/inittab:
    ```
    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 for /etc/inittab:

    a. mgetty:
    ```
    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
    ```

If you have installed Linux kernel source documentation on your system, see /usr/src/linux*/Documentation/serial-console.txt for further information about setting up services on serial ports in Linux.

Another good source of information on the subject is the Linux Serial HOWTO at the Linux Documentation Project (www.tldp.org).

Microsoft™ Windows™ Serial Access Console (SAC)

In Microsoft Windows 2003, Microsoft introduced a serial console known as SAC, which provides advanced administrative functions and a command shell over a serial port. This functionality is fully supported by the Roamer in pass-through mode. Please see the Microsoft Windows documentation for details of this feature.

Chapter 3 – Pass-Through and Menu Modes

Pass-Through Mode

The default Roamer mode is pass-through mode. In pass-through mode, any serial communications from the serial port on the motherboard are passed through to the Ethernet port on the Roamer (and vice versa). Pass-through mode allows the user to monitor the serial redirection output and remotely adjust BIOS settings.

Menu Mode Access

Access to the Roamer will normally be achieved through a telnet session. Once the session is established, the menu prompt on the Roamer is reached by entering the key sequence Ctrl-6 (Ctrl-Shift-6 in some telnet programs). When this key sequence is entered, the following prompt will be displayed.

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

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

The menu ends with a prompt for a command. The escape key will return the Roamer to the standard interface status. If no input is received for 15 seconds, the Roamer will exit the menu and return to a blank screen.

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

Menu Commands

A – Change Baud Rate

This command can be used to change the default baud rate. The default is 9600. This function requires the "P4Confirm" password.

B– Start Blinking

This command enables/disables LED blinking.

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 is the default system setting.

D - Enter a new power on delay

The power on delay selection on the management menu prompts the user for a delay value. This value can range from 0 to 99. The value is read upon startup or reset and determines the amount of time to wait in seconds before turning the server on. The 99 setting instructs the module not to turn on the server

```
+------------------------------------------+
|              Rackable Systems            |
|                  Roamer                  |
|               Copyright 2005             |
|               Firmware  v4.4.5           |
|                                          |
| A - Change the Baud Rate                 |
| B - Start Blinking                       |
| C - Adjust LCD contrast                  |
| D - Enter a new power on delay           |
| E - Erase the LCD                        |
| I - Power Sense: Reset                   |
| L - Turn the LED On                      |
| M - Enter LCD message                    |
| N - Local OS Access: Yes                 |
| P - Turn the Server On                   |
| R - Reset the Server                     |
| S - Save LCD Message                     |
| T - Read Temperature                     |
| V - View LCD Message                     |
| W - Show Saved LCD Message: Yes          |
| X - Reset the Roamer                     |
| ESC - Quit                               |
|                                          |
| Choose a command                         |
+------------------------------------------+
```

Figure 2: Roamer 4.4.5 Help Menu

automatically. Valid inputs are a single-digit number followed by a carriage return, or a two-digit number followed by a carriage return.

Tech Note: For this feature to work, the BIOS must be set to keep the machine powered off after a hard power reset. 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 module will turn it off due to the power on delay setting.

E - Erase the LCD

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

I – Power Sense

The power sense option toggles between sensing server power on the reset header or on the J7 header. The option on the menu will display either "reset" or "J7", depending on the monitoring that is currently set. Most applications will use the "Reset" option. This option should be set before shipping from Rackable Systems, but may need to be reset if the setting was changed after shipping.

L - Turn the LED On

This command turns the LED on or off. It has only two states: "on" or "off".

M – Enter LCD message

LCD messages are sent to the module with this command. The display consists of two lines of twenty character text. The module will automatically advance to the second line after the 20th 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.

Note: VT100+ Statefulness

aka. Garbled output when first connecting to the module or when bringing up the menu.

In the simplest 'line mode' of a terminal session, the text output from the serial port is somewhat directly represented on a virtual terminal. This terminal mode is common in UNIX login prompts, shells, and the Windows Serial Access Console (SAC).

When more complex text mode 'drawing' is required, various control sequences are sent to represent color changes, cursor positioning, special graphical characters, and other more advanced character output. These more complex vt100+ sequences are sent in output from some shell programs, and in great quantity in all PC BIOS serial redirection output.

These control sequences are 'stateful' in nature, in that to represent a terminal command such as a 'clrscr', or 'clearscreen', the server must send specific high ASCII characters to send the client terminal into control mode, send a sequence of characters to represent the 'clearscreen', then another sequence of characters to return to normal output mode.

This is important in serial redirection because if your terminal enters the serial conversation somewhere mid-control character, it will be unaware of the state of the vt100 term, and will misinterpret the immediate stream of characters. On the output terminal, this will probably seen as apparently random garbage output.

As PC BIOS redirection is up to 75% vt control characters, the likelihood of seeing some garbage characters when initially connecting, or when initially entering the menu (which is unaware of your client terminal state) is fairly high. This is not abnormal, and is usually remedied by reentering the menu, by clearing your client terminal state, or simply by waiting until a clearing control sequence is eventually sent by the BIOS that corrects the client behavior.

This is a function of the client terminal, and not of the serial stream, and will not affect scripting or expect scripts that rely on direct communication without regard for vt state.

This behavior is most often seen on PC BIOS, and will not occur at normal login prompt, or other normal serial line-mode communications.

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

N - Local OS Access

This setting dictates which serial port configuration commands can originate from. If the setting is set to "Yes", then the module will be able to accept commands originating from the motherboard serial port. If set to "No", then it will only accept configuration commands from the front panel serial port.

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 menu prompt also displays the current state of the server's power. Confirmation from the user is required for this function.

Note: If this feature does not appear to be working, check the "I - Power Sense" setting, which is set correctly at the factory (varies based on motherboard platform).

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.

S – Save LCD Message to NVRAM

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

T – Read Temperature

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

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, will update to show the current state of the flag. The system default is "Yes".

X - Reset the Roamer

This command will reset the Roamer.

ESC – Quit

This command exits the menu, and returns to the blank initial screen.

? – Help Menu

This command displays the main menu screen of the Roamer and waits for a valid menu selection. Some menu items may be absent if the required hardware is not present. After 15 seconds of idling at this menu, the screen will revert back to the menu prompt.

Chapter 4 – Shell Mode

The Roamer has an alternate mode of operation named "shell mode". In this mode, the module does not 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 0x1D (Ctrl-]) to the module while it is at the menu prompt. Shell mode is exited by sending the byte 0x1E (Ctrl-6).

To access shell mode, type "Ctrl-]". This will prompt for the Roamer password. A correctly entered password will produce an "ok" response. Entering an incorrect password will yield a blank screen, and the Roamer will continue operating in Pass-Through mode.

Shell Mode Commands

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

Action	Cmd	Parameters	Responses	Comments
Change Server Power State	P*x*	'T' - toggle state '1' - turn server on '0' - 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 module fails to change the power state. "PT" is supported for legacy 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 module 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 Module	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

LCD Access From the Operating System

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

The Roamer will automatically advance to the second line after the 20th character is received. Messages with lines shorter than 20 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 I/O 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. A very common example in Linux is with "agetty" 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 that sets the LCD to display the hostname and IP address dynamically:

```perl
#!/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";
```
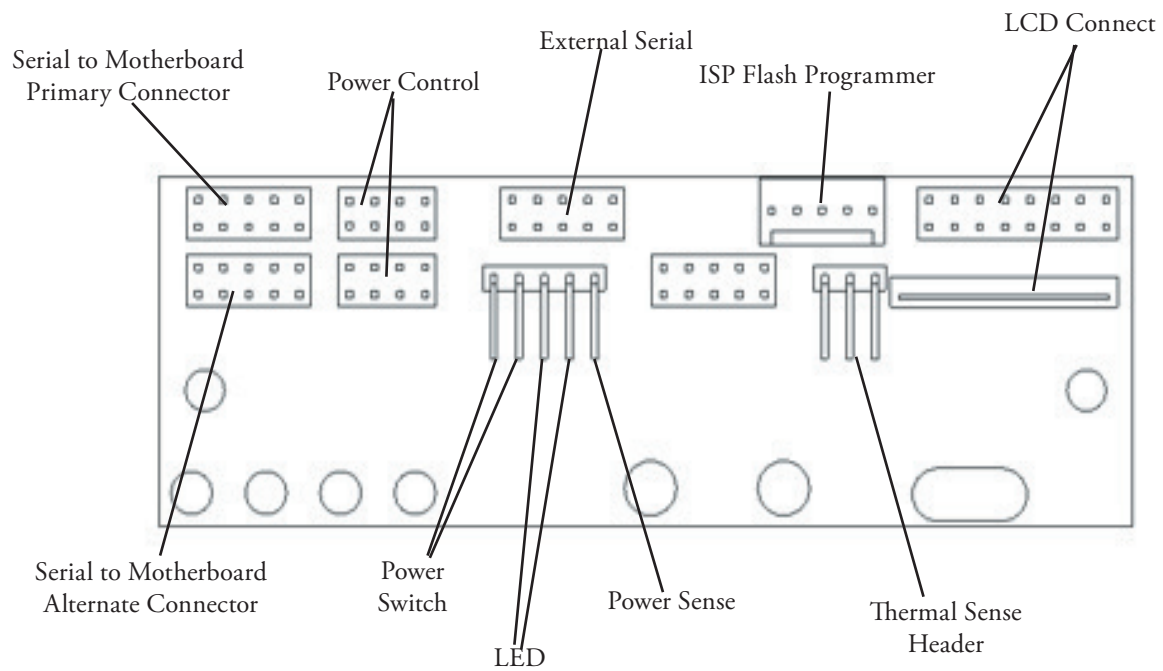
Appendix I: Roamer-Serial Diagram

Serial to Motherboard Primary Connector

Power Control

External Serial

ISP Flash Programmer

LCD Connect

Serial to Motherboard Alternate Connector

Power Switch

LED

Power Sense

Thermal Sense Header

Appendix II: RJ-45 Serial Pinout

Reference graphic is the male RJ-45 connector that plugs into the Roamer serial port, from the perspective of looking head-on into the connector.

Pin	Name	Description
1	RTS	Request to Send (from motherboard)
2	DSR	Data Set Ready
3	RxD	Receive Data
4	SG	Signal Ground
5	SG	Signal Ground
6	TxD	Transmit Data
7	DTR	Data Terminal Ready
8	CTS	Clear to Send (from motherboard)

Pin 1
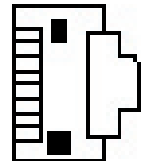
Pin 8

Appendix III - Contacting Support

Rackable Systems Inc.

1933 Milmont Ave.

Milpitas, CA, 95035 USA

Support: +1.866.722.5230

Return Material Authorization (RMA): +1.408.240.8000

Customer Service (General): +1.408.240.8000 Option 4

Fax: +1.408.321.0293

E-mail:

customerservice@rackable.com (General Information)

support@rackable.com (Technical Support)

Website:

http://www.rackable.com