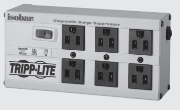
Owner's Manual

B093-00X-2E4U-X
Console Server



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Important Safety Instructions

Please take care to follow the safety precautions below when installing and operating the console server:

- Do not remove the metal covers. There are no operator serviceable components inside. Opening or removing the cover may expose you to dangerous voltage that may cause fire or electric shock. Refer all service to Tripp Lite qualified personnel.
- To avoid electric shock the power cord protective grounding conductor must be connected through to ground.
- Always pull on the plug, not the cable, when disconnecting the power cord from the socket.

Do not connect or disconnect the console server during an electrical storm. Also, it is recommended you use a Tripp Lite surge protector or UPS to protect the equipment from transient power fluctuations.

⚠ ***Proper backup systems and necessary safety devices should be utilized to protect against injury, death or property damage due to system failure. Such protection is the responsibility of the user.***

This console server device is not approved for use as a life-support or medical system.

Any changes or modifications made to this console server device without the explicit approval or consent of Tripp Lite will void Tripp Lite of any liability or responsibility of injury or loss caused by any malfunction.

This equipment is for indoor use and all the communication wirings are limited to inside of the building.

TABLE OF CONTENTS

1. Introduction

Tripp Lite's B093-00X-2E4U-X Series console / terminal servers is the most advanced platform available today. In a secure, desktop/rack-mountable appliance, B093 console servers offer in-band, out-band and cellular management solutions for serial console ports, servers, virtual servers, service processors, UPS systems and PDUs, environmental monitoring and more. Available in 4- and 8-port models, B093 console / terminal servers enable system administrators to securely access and control their data centers and networks from anywhere in the world. These enterprise-grade units are equipped with a built-in cellular modem, dual Gigabit Ethernet NIC, 4 GB internal NAND flash, four USB 2.0 console ports, a digital I/O port, and run on Linux for scalability and reduced downtime.

B093 console servers also offer advanced software features surpassing the requirements of even the most demanding applications. These features include network UPS tools for UPS monitoring, PowerMan for integrated PDU and UPS functions with in-session hotkey support, pattern match alerting, open access to the Linux shell for scripting, heartbeat monitoring with automatic failover, Cisco pinouts and much more.

2. Installation

2.1 Models

Each model contains a different number of network/serial/USB ports, power supply type and wireless configuration:

Model	Serial	USB	10/100 Ethernet	10/100/1000 Ethernet	Flash	Console Port	V.92 Modem	Wireless	Cellular	Power
B093-004-2E4U	4	4	-	2	4GB	-	-	-	-	External DC Power Supply
B093-008-2E4U	8	4	-	2	4GB	-	-	-	-	External DC Power Supply
B093-004-2E4U-V	4	4	-	2	4GB	-	-	4G	Multi Carrier	External DC Power Supply
B093-008-2E4U-V	8	4	-	2	4GB	-	-	4G	Multi Carrier	External DC Power Supply
B093-008-2E4U-M	8	4	-	2	4GB	-	Y	-	-	External DC Power Supply
B094-008-2E-M-F	8	2	2	-	4GB	-	Y	-	-	External DC Power Supply
B094-008-2E-V	8	2	2	-	4GB	-	-	4G	Verizon	External DC Power Supply
B095-003-1E-M	3	1	1	-	2GB	-	Y	-	-	External DC Power Supply
B095-004-1E	4	1	1	-	2GB	-	-	-	-	External DC Power Supply
B096-016	16	3	2	-	16GB	1	Y	-	-	Dual AC
B096-032	32	3	2	-	16GB	1	Y	-	-	Dual AC
B096-048	48	3	2	-	16GB	1	Y	-	-	Dual AC

2.2 Power Connection

***To avoid physical and electrical hazard, please read* Appendix C: Safety & Certifications.**

- Unpack your console server kit, verify you have all of the accessories and ensure all items appear to be in good working order.
- If you plan to install the console server in a rack, you will need to attach the rack-mount brackets supplied with the unit. See **Appendix C: Safety & Certifications** for more information.
- Connect your console server to the network, to the serial ports of the controlled devices, and to power supply.

2.2.1 Models with Internal AC Power Supplies

Some console server models use dual universal AC power supplies with built-in auto failover (see **2.1 Models** for model listing). These power supplies accept AC input voltage between 100 and 240V AC with a frequency of 50 or 60 Hz. The total power consumption per console server is less than 30W.

Two IEC AC power inlets are located at the rear of the unit. These power inlets use conventional IEC power cords. Power cords for various regions are available at www.tripplite.com, though a North American power cord is provided by default.

To avoid electrical shock, the power cord grounding conductor must be connected to ground.

2.2.2 Models with External Power Supplies

Some console servers use an external 12V wall-mount power supply (see **2.1 Models** for model listing). These models include a selection of wall socket adapters for each geographic region (North America, Europe, U.K., Japan and Australia). The power supply unit's 12V DC connector plugs into the 12V DC (*PWR*) power jack located on the side of the unit.

- ➢ Plug in the power supply AC power cable and the DC power cable.
- ➢ Turn on the unit and confirm the Power LED (*PWR*) is illuminated.

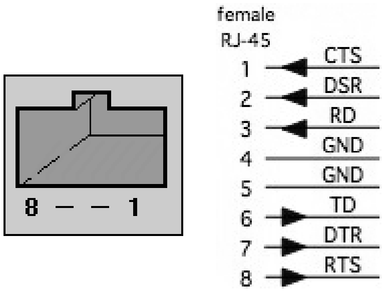
2.3 Network Connection

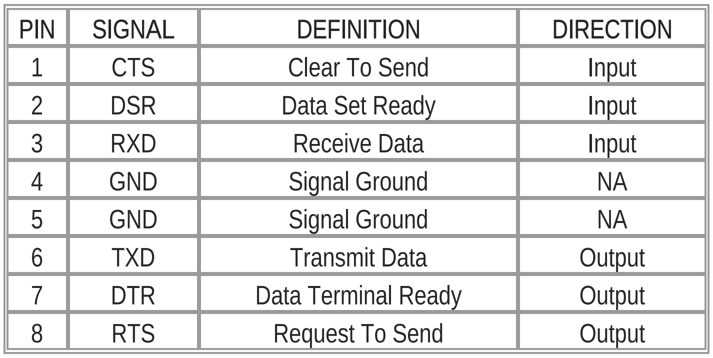
All console server models include Ethernet ports.

Network connections are made using Cat5e patch cables (Tripp Lite N001 and N002 Series Cables, sold separately). Connect the unit's LAN port to an Ethernet network. Upon first connecting and configuring the console server to a network, you must connect a computer to the console server's primary network port.

2.4 Serial Port Connection

Tripp Lite console servers use the RJ45 pin-out standard used by Cisco. Use straight-through RJ45 cabling to connect to Cisco, Juniper, SUN equipment and more.





PIN	SIGNAL	DEFINITION	DIRECTION
1	CTS	Clear To Send	Input
2	DSR	Data Set Ready	Input
3	RXD	Receive Data	Input
4	GND	Signal Ground	NA
5	GND	Signal Ground	NA
6	TXD	Transmit Data	Output
7	DTR	Data Terminal Ready	Output
8	RTS	Request To Send	Output

Conventional Cat5 cabling with RJ45 jacks is used for serial connections. Before connecting the console port of an external device to the console server's serial port, confirm the device supports standard RS-232C (EIA-232).

Select console server models also have a DB9 LOCAL (Console/Modem) port.

2.5 USB Port Connection

- Tripp Lite console servers have one or more USB ports. External USB devices can be plugged into these USB ports.
- ***Note**: Console servers ship with internal USB flash memory ranging from 2 GB to 16 GB, which can be used for extended log file storage.*
- External USB devices (including USB hubs) can be plugged into any Console Server USB port.

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3. System Configuration

This chapter provides step-by-step instructions for the initial configuration of your console server, and connecting it to the Management or Operational LAN.

Notes:

• System configuration must be done by a person with Administrator access.

*• For guidance on configuring large numbers of Tripp Lite console servers and/or automating provisioning, sections **15.15 Bulk Provisioning** and **15.16 Zero Touch Provisioning**.*

3.1 Management Console Connection

Your console server ships configured with a default IP Address 192.168.0.1 Subnet Mask 255.255.255.0

Directly connect a computer to the console server.

***Note:** For initial configuration, it is recommended that the console server be directly connected to a single computer. However, if you choose to connect your LAN before completing the initial setup steps, it is important that you ensure there are no other devices on the LAN with an address of 192.168.0.1, and the console server and the computer are on the same LAN segment, with no interposed router devices.*

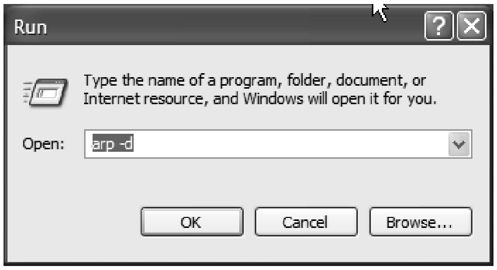
3.1.1 Connected Computer Setup

To configure the console server with a browser, the connected PC/workstation should have an IP address in the same range as the *console server* (for example, 192.168.0.100):

- To configure the IP Address of your Linux or UNIX computer, simply run *ifconfig.*
- For Windows PCs:
  - Click **Start** -> (**Settings** ->) **Control Panel** and double-click **Network Connections** (for 95/98/Me, double-click **Network**).
  - Right click on **Local Area Connection** and select **Properties.**

  - Select **Internet Protocol (TCP/IP)** and click **Properties.**
  - Select **Use the following IP address** and enter the following details:
    - IP address: **192.168.0.100**
    - Subnet mask: **255.255.255.0**
  - If you want to retain your existing IP settings for this network connection, click **Advanced** and **Add** the above as a secondary IP connection.

- If it is not convenient to change your computer network address, you can use the *ARP-Ping* command to reset the *console server* IP address. To do this from a Windows PC:
  - Click **S**tart -> R**un** (or select **All Programs** then **Accessories** then **Run**).
  - Type *cmd* and click **OK** to bring up the command line.
  - Type *arp –d* to flush the ARP cache.
  - Type *arp –a* to view the current ARP cache (this should be empty).



Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.

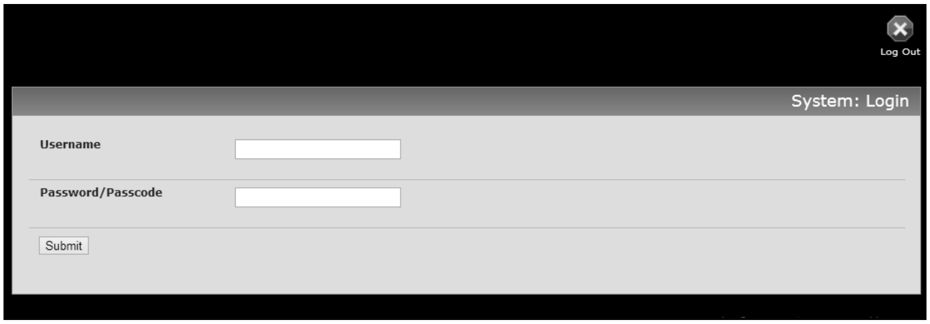
Open: arp -d

Now add a static entry to the ARP table and ping the console server to assign the IP address to the console server. In the example below, a console server has a MAC Address 00:06:67:12:DA:F1 (designated on the label on the bottom of the unit) and we are setting its IP address to 192.168.100.23. Also the computer issuing the *arp* command must be on the same network segment as the console server (that is, have an IP address of 192.168.100.xxx).

  - Type *arp -s 192.168.100.23 00-06-67-12-DA-F1* (for UNIX, the syntax is: *arp -s 192.168.100.23 00:06:12:DA:F1*).
  - Type *ping -t 192.18.100.23* to start a continuous ping to the new IP Address.
  - Turn on the console server and wait for it to configure itself with the new IP address. It will start replying to the ping at this point.
  - Type *arp –d* to flush the ARP cache again.

3.1.2 Browser Connection

- Activate your preferred browser on the connected PC / workstation and enter **https://192.168.0.1** . The management console supports all current versions of the popular browsers (Internet Explorer, Mozilla Firefox, Google Chrome, Apple Safari and more).



Username

Password/Passcode

A login prompt will appear. Enter the default administration username ***root*** and administration password ***default*.**

Note: *Console servers are factory configured with HTTPS access enabled and HTTP access disabled.*

A **Welcome** screen listing the initial installation configuration steps will display. These steps are:

Change default administration password (refer to **3.2 Administrator Setup**).

- Configure the local network settings (refer to **3.3 Network Configuration**).

To configure console server features:

- Configure serial ports settings (refer to **4. Serial Port, Host, Device and User Configuration**).
- Configure user port access (refer to **4. Serial Port, Host, Device and User Configuration**).

If your system has a cellular modem, you will also be provided steps to configure the cellular router features:

- Configure the cellular modem connection (refer to **5. Firewall, Failover & OOB Access**).
- Allow forwarding to the cellular destination network (refer to **5. Firewall, Failover & OOB Access**).
- Enable IP masquerading for cellular connection (refer to **5. Firewall, Failover & OOB Access**).

After completing each of the above steps, you can return to the configuration list by clicking the logo in the top left corner of the screen.

Note: *If you unable to connect to the management console at 192.168.0.1 or if the default Username / Password were not accepted, reset your console server (refer to **10. Nagios Integration**).*

3.2 Administrator Setup

3.2.1 Change Default Root System Password

For security reasons, only the Administrator user named ***root*** can initially log into your console server. Also, only users who know the root password can access and reconfigure the console server.

Since anyone who correctly guesses the root password could gain access (and the default root password is **default**), it is essential that you enter and confirm a new password before allow the console serve any access to, or control of, your computers and network devices.

Select ***Change default administration password*** from the **Welcome** page will take you to **Serial & Network: Users & Groups** where you can add a new confirmed **Password** for the user *root.*

Note: *There are no restrictions on what types of characters can be used in the user password (each can contain up to 254 characters). However, only the first eight password characters are used to make the password hash.*

Note: *If the console server uses flash memory, you will be given the option to save the password across firmware erases. Checking this will save the password hash in the non-volatile configuration partition, which is not erased on firmware reset. However, take care as if this password is lost, as the firmware will need to be recovered from the device.*

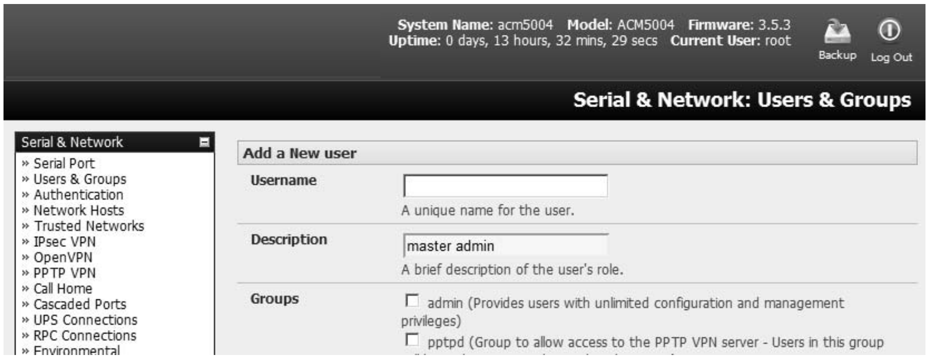
- Click **Apply**. As you have changed the password, you will be prompted to log in again. This time use the new password.

Note: *If you are unsure whether your console server is operating with the most current firmware version, Firmware Upgrades are available. Refer to* ***11.2 Upgrade Firmware*** *for more information.*

3.2.2 Set Up New Administrator

It is recommended you set up a new Administrator user as soon as possible for all ongoing administration functions (rather than *root*).

This Administrator can be configured in the *admin* group with full access privileges by selecting **Add a New User** in the **Serial & Network: Users & Groups** menu (refer ***4.2 Add and Edit Users*****).**



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 13 hours, 32 mins, 29 secs **Current User:** root

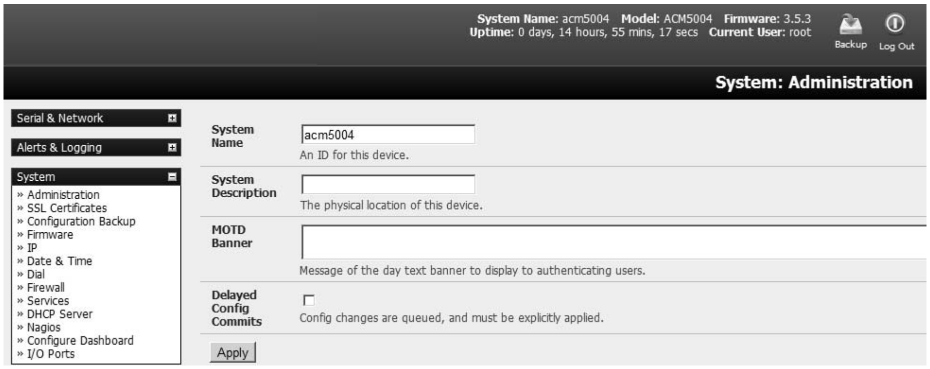
Serial & Network: Users & Groups

Add a New user

Username	A unique name for the user.
Description	master admin A brief description of the user's role.
Groups	□ admin (Provides users with unlimited configuration and management privileges) □ pptpd (Group to allow access to the PPTP VPN server - Users in this group

3.2.3 Name the System

- Select **System: Administration.**
- Enter a **System Name** and **System Description** for the console server to give it a unique ID and make it simple to identify.



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 14 hours, 55 mins, 17 secs **Current User:** root

System: Administration

System Name	acm5004 An ID for this device.
System Description	The physical location of this device.
MOTD Banner	Message of the day text banner to display to authenticating users.
Delayed Config Commits	□ Config changes are queued, and must be explicitly applied.

Note: *The System Name can contain from 1 to 64 alphanumeric characters (you can also use the special characters "-" "_" and ".”). There are no restrictions on the characters that can be used in the System Description (which can contain up to 254 characters).*

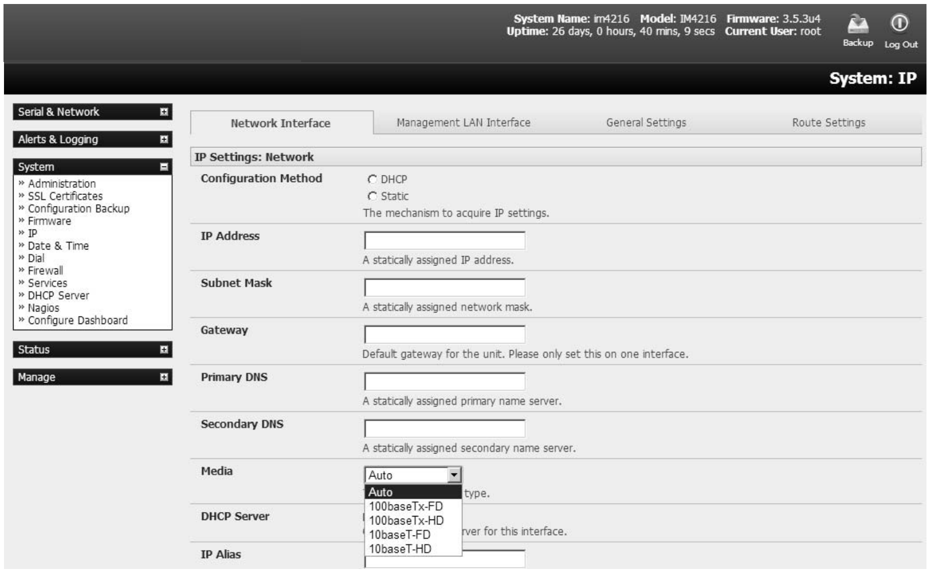
- The **MOTD Banner** can be used to display a “message of the day” text to users.
- Click **Apply.**

Note: *If you are unsure whether your console server is operating with the most current firmware version, Firmware Upgrades are available. Refer to* ***11.2 Upgrade Firmware*** *for more information.*

3.3 Network Configuration

Enter an IP address for the principal Ethernet (*LAN/Network/Network1*) port on the console server, or enable its DHCP client so that it automatically obtains an IP address from a DHCP server on the network it is to be connected to.

- On the **System: IP** menu, select the **Network Interface** page, then check **DHCP** or **Static** for the **Configuration Method.**
- If you selected **Static,** you must manually enter the new **IP Address**, **Subnet Mask**, **Gateway** and **DNS** server details. This selection automatically disables the DHCP client.



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.3u4
Uptime: 26 days, 0 hours, 40 mins, 9 secs **Current User:** root

System: IP

IP Settings: Network

Configuration Method ○ DHCP ○ Static
The mechanism to acquire IP settings.

IP Address
A statically assigned IP address.

Subnet Mask
A statically assigned network mask.

Gateway
Default gateway for the unit. Please only set this on one interface.

Primary DNS
A statically assigned primary name server.

Secondary DNS
A statically assigned secondary name server.

Media Auto
type.

DHCP Server
rver for this interface.

IP Alias

- By default, the console server LAN port auto-detects the Ethernet connection speed. However, you can use the **Media** menu to lock the Ethernet to 10 Mb/s or 100Mb/s and to Full Duplex (FD) or Half Duplex (HD).

Note: *If you encounter packet loss or poor network performance with the default auto-negotiation setting, try manually setting the Ethernet Media settings on the console server and the device it is connected to. In most cases, select 100baseTx-FD (100 megabits, full duplex). Make sure both sides are set identically.*

- If you selected **DHCP,** the console server will search for configuration details from a DHCP server. This selection automatically disables any static address. The console server MAC address can be found on a label on the base plate

***Note:** In its factory default state (with no configuration method selected), the console server has its DHCP client enabled, so it automatically accepts any network IP address assigned by a DHCP server on your network. In this initial state, the console server will then respond to both its Static address (192.168.0.1) and its newly assigned DHCP address.*

- ➢ You may also enter a secondary address or comma-separated list of addresses in CIDR notation, e.g. *192.168.1.1/24* as an **IP Alias.**

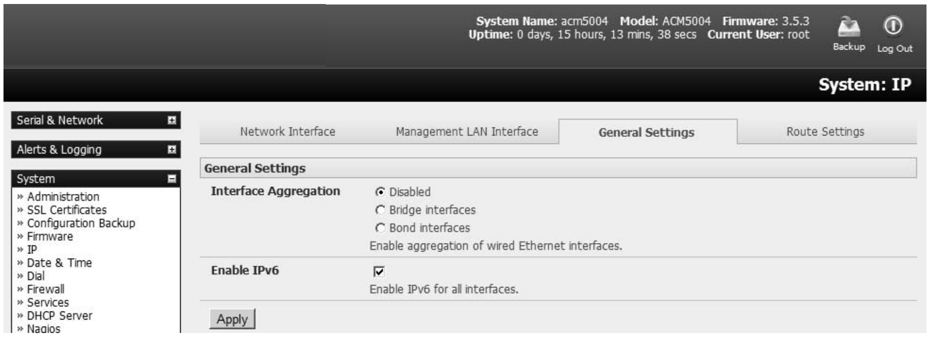
***Note:** If you have changed the console server IP address, you may need to reconfigure your computer so it has an IP address that is in the same network range as this new address (as detailed in an earlier note in this section).*

- ➢ Click **Apply.**
- ➢ You will need to reconnect the browser on the computer that is connected to the *console server* by entering **http://new IP address.**

3.3.1 IPv6 Configuration

By default, the console server Ethernet interfaces support IPv4. However, they can also be configured for IPv6 operation:

- ➢ On the **System: IP** menu, select **General Settings** page and check **Enable IPv6.**



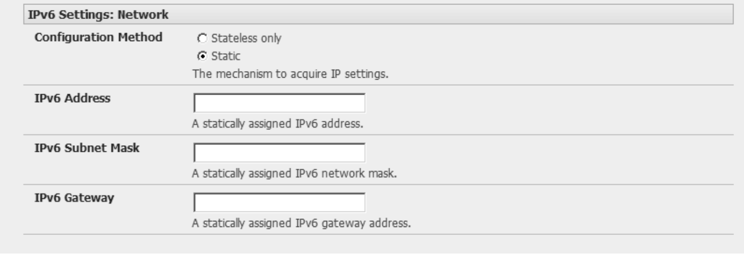
System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 15 hours, 13 mins, 38 secs **Current User:** root

General Settings

Interface Aggregation ● Disabled ○ Bridge interfaces ○ Bond interfaces
Enable aggregation of wired Ethernet interfaces.

Enable IPv6 ☑
Enable IPv6 for all interfaces.

- ➢ You will then need to configure the IPv6 parameters on each interface page.



IPv6 Settings: Network

Configuration Method ○ Stateless only ● Static
The mechanism to acquire IP settings.

IPv6 Address [ ]
A statically assigned IPv6 address.

IPv6 Subnet Mask [ ]
A statically assigned IPv6 network mask.

IPv6 Gateway [ ]
A statically assigned IPv6 gateway address.

3.3.2 Dynamic DNS (DDNS) Configuration

With Dynamic DNS (DDNS), an advanced console server whose IP address is dynamically assigned (and may change from time to time) can be located using a fixed host or domain name.

- ➢ The first step in enabling DDNS is to create an account with the supported DDNS service provider of your choice. Supported DDNS providers include:
  - DyNS www.dyns.cx
  - dyndns.org www.dyndns.org
  - GNUDip gnudip.cheapnet.net

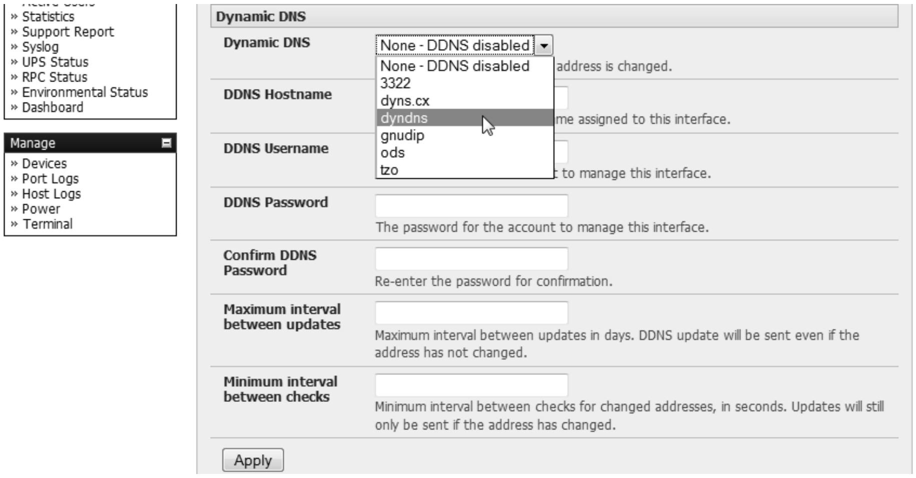
- ODS www.ods.org
- TZO www.tzo.com
- 3322.org (Chinese provider) www.3322.org

Upon registering with the DDNS service provider, you will select a username and password, as well as a hostname that you will use as the DNS name (to allow external access to your machine using a URL).

The Dynamic DNS service providers allow the user to choose a hostname URL and set an initial IP address to correspond to that hostname URL. Many Dynamic DNS providers offer a selection of URL hostnames available for free use with their service. However, with a paid plan, any URL hostname (including your own registered domain name) can be used.

You can now enable and configure DDNS on any of the Ethernet or cellular network connections on the console server (by default DDNS is disabled on all ports):

➢ Select the DDNS service provider from the dropdown **Dynamic DNS** list on the **System: IP** or **System: Dial** menu.



Dynamic DNS

Dynamic DNS: None - DDNS disabled
address is changed.

DDNS Hostname
me assigned to this interface.

DDNS Username
t to manage this interface.

DDNS Password
The password for the account to manage this interface.

Confirm DDNS Password
Re-enter the password for confirmation.

Maximum interval between updates
Maximum interval between updates in days. DDNS update will be sent even if the address has not changed.

Minimum interval between checks
Minimum interval between checks for changed addresses, in seconds. Updates will still only be sent if the address has changed.

➢ In **DDNS Hostname,** enter the fully qualified DNS hostname for your console server e.g. *your-hostname.dyndns.org.*

➢ Enter the **DDNS Username** and **DDNS Password** for the DDNS service provider account.

➢ Specify the **Maximum interval between updates** (in days). A DDNS update will be sent, even if the address has not changed.

➢ Specify the **Minimum interval between checks** for changed addresses (in seconds). Updates will still only be sent if the address has changed.

➢ Specify the **Maximum attempts per update,** i.e. the number of times to attempt an update before giving up (defaults to 3).

3.4 Services and Service Access

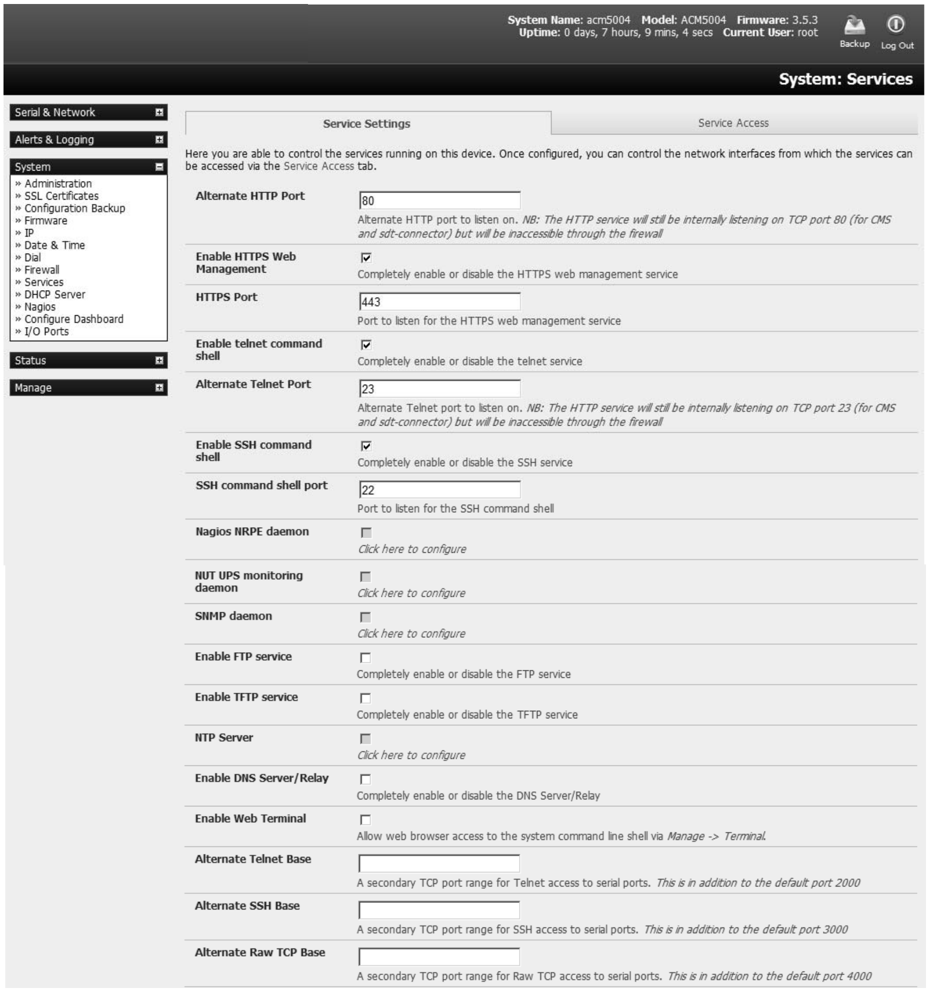
The Administrator can access the console server, connected serial ports and managed devices by using a range of access protocols/services. For each such access:

- The particular service must first be configured and enabled to run on the console server.
- Then, access through the firewall must be enabled for each network connection.

To enable and configure a service:

- Select the **Service Settings** tab on the **System: Services** page.

Note: *With firmware releases pre-3.5.3, services are enabled and configured using the* ***Service Access*** *tab on the* ***System: Firewall*** *page.*



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 7 hours, 9 mins, 4 secs **Current User:** root

System: Services

Here you are able to control the services running on this device. Once configured, you can control the network interfaces from which the services can be accessed via the Service Access tab.

Alternate HTTP Port	80 Alternate HTTP port to listen on. *NB: The HTTP service will still be internally listening on TCP port 80 (for CMS and sdt-connector) but will be inaccessible through the firewall*
Enable HTTPS Web Management	☑ Completely enable or disable the HTTPS web management service
HTTPS Port	443 Port to listen for the HTTPS web management service
Enable telnet command shell	☑ Completely enable or disable the telnet service
Alternate Telnet Port	23 Alternate Telnet port to listen on. *NB: The HTTP service will still be internally listening on TCP port 23 (for CMS and sdt-connector) but will be inaccessible through the firewall*
Enable SSH command shell	☑ Completely enable or disable the SSH service
SSH command shell port	22 Port to listen for the SSH command shell
Nagios NRPE daemon	□ *Click here to configure*
NUT UPS monitoring daemon	□ *Click here to configure*
SNMP daemon	□ *Click here to configure*
Enable FTP service	□ Completely enable or disable the FTP service
Enable TFTP service	□ Completely enable or disable the TFTP service
NTP Server	□ *Click here to configure*
Enable DNS Server/Relay	□ Completely enable or disable the DNS Server/Relay
Enable Web Terminal	□ Allow web browser access to the system command line shell via *Manage -> Terminal.*
Alternate Telnet Base	A secondary TCP port range for Telnet access to serial ports. *This is in addition to the default port 2000*
Alternate SSH Base	A secondary TCP port range for SSH access to serial ports. *This is in addition to the default port 3000*
Alternate Raw TCP Base	A secondary TCP port range for Raw TCP access to serial ports. *This is in addition to the default port 4000*

- Enable and configure basic services:

HTTP By default, the HTTP service is running and cannot be fully disabled. However, by default, HTTP access is disabled on all interfaces and it is recommended this access remains disabled if the console server is to be remotely accessed over the Internet.

Alternate HTTP also enables you to configure an alternate HTTP port to listen on. However, the HTTP service will continue internally listening on TCP port 80 (for CMS and sdt-connector communications), but will be inaccessible through the firewall.

HTTPS By default, the HTTPS service is running and this service is enabled on all network interfaces. It is recommended that only HTTPS access be used if the console server is to be managed over any public network (e.g. the Internet). This ensures the Administrator has secure browser access to all the menus on the *console server*. It also allows appropriately configured *Users* secure browser access to selected *Manage* menus. For information on certificate and user client software configuration, refer *Chapter 9 - Authentication*.

The HTTPS service can be completely disabled (or re-enabled) by checking **HTTPS Web Management** and an alternate port specified (default port is 443).

Telnet By default, the Telnet service is running. However, by default, the service is disabled on all network interfaces.

Telnet can be used to give the Administrator access to the system command line shell. While this may be suitable for a local direct connection over a management LAN, it is recommended this service be disabled if the console server is to be remotely administered. This service may also be useful for local Administrator and User access to selected serial consoles.

The **Enable telnet command shell** checkbox will completely enable or disable the telnet service. An alternate telnet port to listen on can be specified in **Alternate Telnet Port** (default port is 23).

SSH This service provides secure SSH access to the console server and attached devices. By default, the SSH service is running and enabled on all interfaces. It is recommended you choose SSH as the protocol where the Administrator connects to the console server over the Internet or any other public network. This will provide authenticated communications between the SSH client program on the remote computer and the SSH server in the console server. For more information on SSH configuration, refer to section **9. Authentication**.

The **Enable SSH command shell** checkbox will completely enable or disable this service. An alternate SSH port to listen on can be specified in **SSH command shell port** (default port is 22).

- Enable and configure other services:

TFTP/FTP If a USB flash drive or internal flash memory is detected on a console server, then checking **Enable TFTP (FTP) service** will enable this service and set up default *tftp* and *ftp* server on the USB flash. These servers are used to store config files, maintain access and transaction logs, etc. Files transferred using tftp and ftp will be stored under */var/mnt/storage.usb/tftpboot/* (or */var/mnt/storage.nvlog/tftpboot/* on B093 devices). Unchecking **Enable TFTP (FTP) service** will completely disable the TFTP (FTP) service.

DNS Relay Checking **Enable DNS Server/Relay** will enable the DNS relay feature so clients can be configured with the console server's IP for their DNS server setting. The console server will forward the DNS queries to the real DNS server.

Web Terminal Checking **Enable Web Terminal** will allow web browser access to the system command line shell via **Manage -> Terminal**.

- Specify alternate port numbers for Raw TCP, direct Telnet/SSH and unauthenticated Telnet/SSH services. The console server uses specific default ranges for the TCP/IP ports for the various access services that Users and Administrators can use to access devices attached to serial ports (refer to **4.1 Configure Serial Ports** for more information). The Administrator can also set alternate ranges for these services, and these secondary ports will then be used, in addition to the defaults.

The default TCP/IP **base** port address for *telnet* access is 2000, and the range for telnet is IP Address: Port (2000 + serial port #) *i.e.* 2001 – 2048. So if the Administrator were to set 8000 as a secondary base for telnet, then serial port #2 on the console server can be telnet accessed at IP Address:2002 and at IP Address:8002. The default base for SSH is 3000; for Raw TCP is 4000; and for RFC2217 it is 5000

- A number of other services can be enabled and configured indirectly from this menu by selecting *Click here to configure:*

Nagios Access to the Nagios NRPE monitoring daemons (refer to **8. Power, Environment & Digital I/O**).

NUT Access to the NUT UPS monitoring daemon (refer to **10. Nagios Integration**).

SNMP This will enable *netsnmp* in the *console server*. SNMP is disabled by default (refer to **7. Alerts, Auto-Response and Logging** and **15.5 SNMP Status Reporting**).

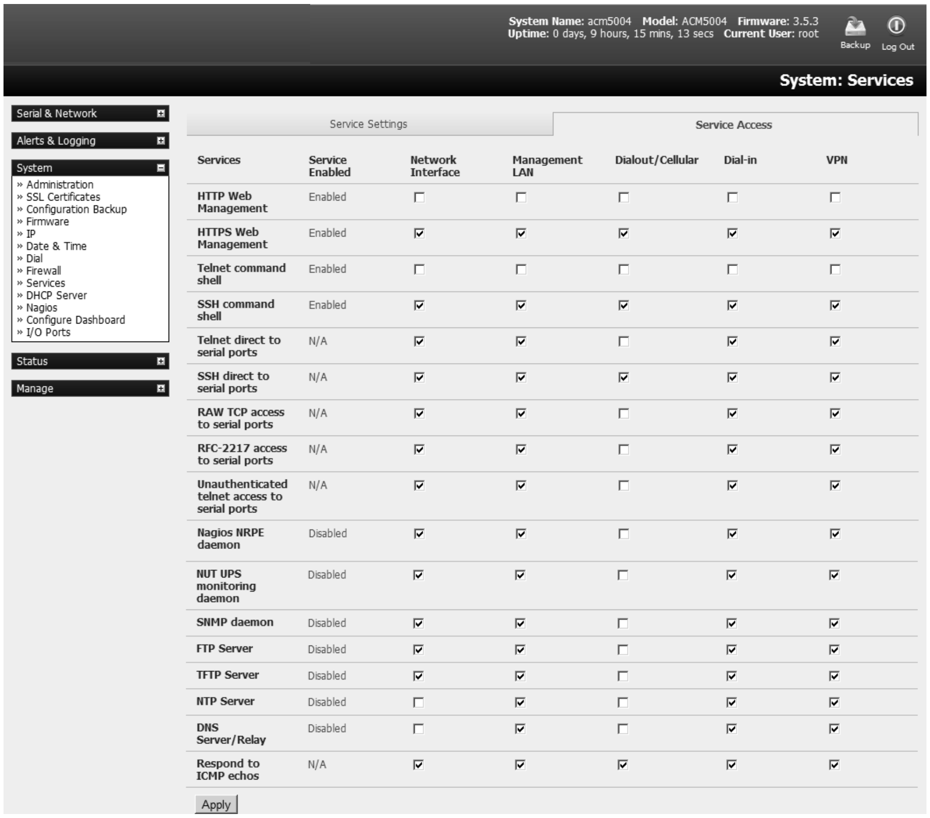
NTP Refer to **11. System Management**.

- Click **Apply**. As you apply your services selections, the screen will be updated with a confirmation message: ***Message Changes to configuration succeeded.***

The Services Access settings can now be set to allow or block access. This specifies which (enabled) services the Administrator can use over each network interface - to connect to the console server and through the console server to attached serial and network-connected devices.

- Select the **Service Access** tab on the **System: Services** page.

Note: *With firmware releases pre-3.5.3, the **Service Access** tab is found on the **System: Firewall** page.*



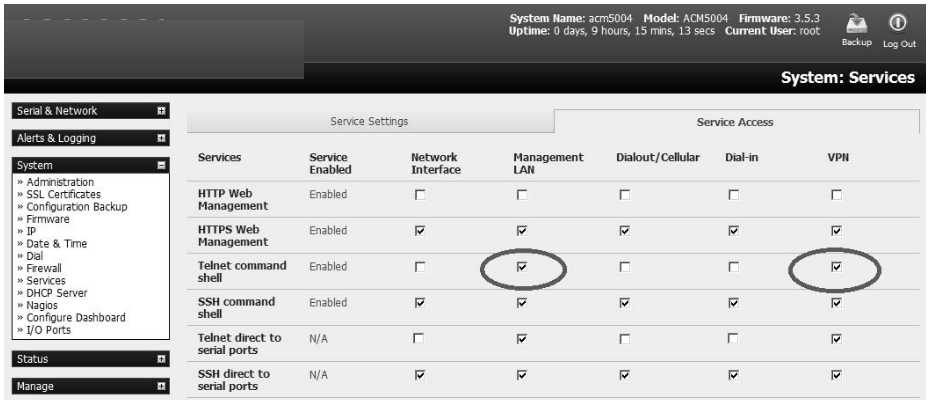
System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 9 hours, 15 mins, 13 secs **Current User:** root

System: Services

Services	Service Enabled	Network Interface	Management LAN	Dialout/Cellular	Dial-in	VPN
HTTP Web Management	Enabled	☐	☐	☐	☐	☐
HTTPS Web Management	Enabled	☑	☑	☑	☑	☑
Telnet command shell	Enabled	☐	☐	☐	☐	☐
SSH command shell	Enabled	☑	☑	☑	☑	☑
Telnet direct to serial ports	N/A	☑	☑	☐	☑	☑
SSH direct to serial ports	N/A	☑	☑	☑	☑	☑
RAW TCP access to serial ports	N/A	☑	☑	☐	☑	☑
RFC-2217 access to serial ports	N/A	☑	☑	☐	☑	☑
Unauthenticated telnet access to serial ports	N/A	☑	☑	☐	☑	☑
Nagios NRPE daemon	Disabled	☑	☑	☐	☑	☑
NUT UPS monitoring daemon	Disabled	☑	☑	☐	☑	☑
SNMP daemon	Disabled	☑	☑	☐	☑	☑
FTP Server	Disabled	☑	☑	☐	☑	☑
TFTP Server	Disabled	☑	☑	☐	☑	☑
NTP Server	Disabled	☐	☑	☐	☑	☑
DNS Server/Relay	Disabled	☐	☑	☐	☑	☑
Respond to ICMP echos	N/A	☑	☑	☑	☑	☑

- This will display the services currently enabled for the console server’s network interfaces. Depending on the particular console server model, the interfaces displayed may include:
  - Network interface (for the principal Ethernet connection)
  - Management LAN / OOB Failover (second Ethernet connections)
  - Dial-out/Cellular (V90 and 3G modem)
  - Dial-in (internal or external V90 modem)
  - Wi-Fi (802.11 wireless)
  - VPN (IPsec or Open VPN connection over any network interface)
- Check/uncheck for each network which service access is to be enabled /disabled.

  In the example shown below, local administrators on local Management LAN have direct telnet access to the console server (and attached serial ports), while remote administrators using dial-in or cellular have no such telnet access (unless they set up a VPN).



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 9 hours, 15 mins, 13 secs **Current User:** root

System: Services

Services	Service Enabled	Network Interface	Management LAN	Dialout/Cellular	Dial-in	VPN
HTTP Web Management	Enabled	□	□	□	□	□
HTTPS Web Management	Enabled	☑	☑	☑	☑	☑
Telnet command shell	Enabled	□	☑	□	□	☑
SSH command shell	Enabled	☑	☑	☑	☑	☑
Telnet direct to serial ports	N/A	□	☑	□	□	☑
SSH direct to serial ports	N/A	☑	☑	☑	☑	☑

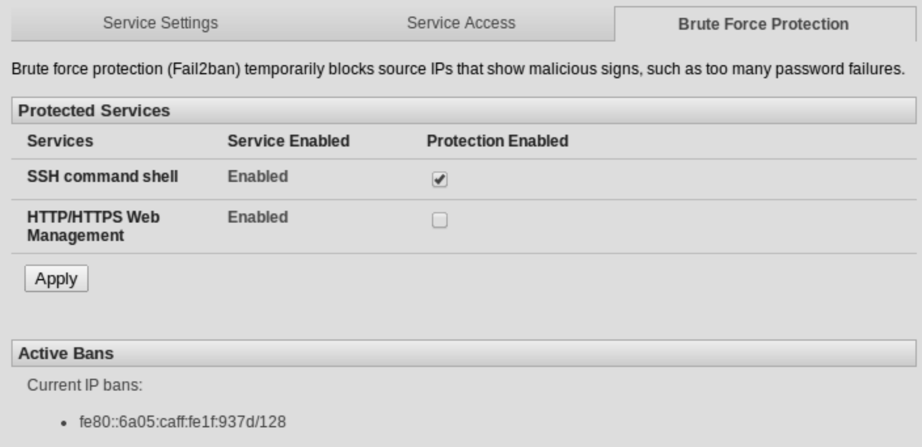
- **Respond to ICMP echoes** (i.e. *ping*) Service access options can be configured at this stage. This allows the console server to respond to incoming ICMP echo requests. Ping is enabled by default. However for security reasons, this service should generally be disabled post-initial configuration.

- You can also configure to allow serial port devices to be accessed from assigned network interfaces using Raw TCP, direct Telnet/SSH, unauthenticated Telnet/SSH services, etc.

- Click **Apply** to apply your services access selections.

3.4.1 Brute Force Protection

Brute force protection (Micro Fail2ban) temporarily blocks source IPs that show malicious signs, such as too many password failures. This may help mitigate scenarios where the Tripp Lite device's network services are exposed to an untrusted network such as the public WAN, and scripted attacks or software worms are attempting to guess (brute force) user credentials and gain unauthorized access.



Brute force protection (Fail2ban) temporarily blocks source IPs that show malicious signs, such as too many password failures.

Protected Services

Services	Service Enabled	Protection Enabled
SSH command shell	Enabled	☑
HTTP/HTTPS Web Management	Enabled	□

Active Bans

Current IP bans:

- fe80::6a05:caff:fe1f:937d/128

Brute Force Protection may be enabled for the listed services. Once protection is enabled, three or more failed connection attempts within 60 seconds from a specific source IP trigger it to be banned from connecting for the next 60 seconds. Active Bans are also listed and may be refreshed by reloading the page.

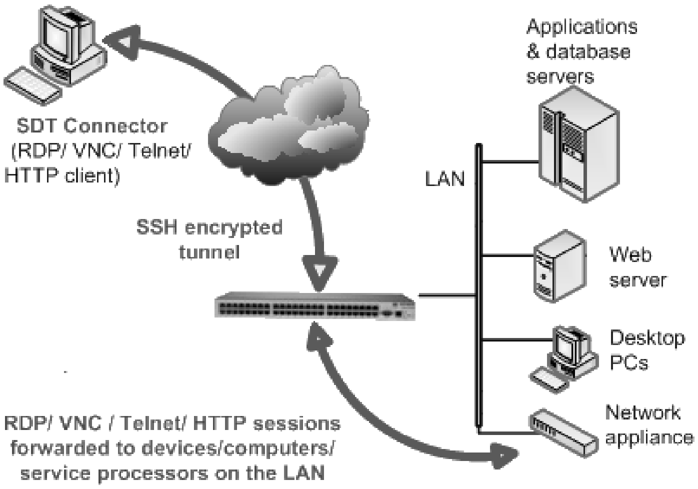
***Note:** When a Tripp Lite device is running on an untrusted network, it is recommended that a variety of strategies be used to lock down remote access. This includes strong passwords (or even better, SSH public key authentication), VPN, and using Firewall Rules to whitelist remote access from trusted source networks only. Refer to the Knowledge Base for details.*

3.5 Communications Software

You have configured access protocols for the Administrator client to use when connecting to the console server. User clients (who you may set up later) will also use these protocols when accessing console server serial attached devices and network attached hosts. Therefore, you will need to have appropriate communications software tools set up on the Administrator (and User) client's computer. Tripp Lite provides the SDT Connector as the recommended client software tool. However, other generic tools such as PuTTY and SSHTerm may be used.

3.5.1 SDT Connector

SDT Connector is a lightweight tool that enables Users and Administrators to securely access the Console server and the various computers, network devices and devices that may be serially- or network-connected to the console server.



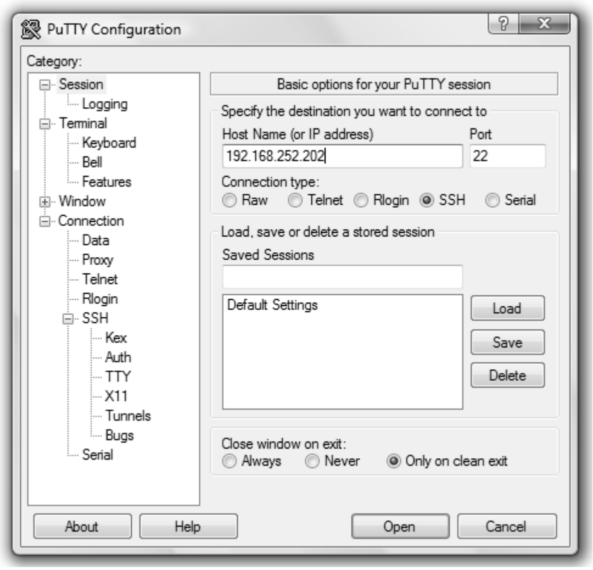
SDT Connector is a Java client program that couples the trusted SSH tunneling protocol with popular access tools such as telnet, SSH, HTTP, HTTPS, VNC, RDP to provide point-and-click secure remote management access to all systems and devices being managed.

Information on using SDT Connector for browser access to the console server's management console, telnet/SSH access to the console server command line, and TCP/UDP connecting to hosts that are network-connected to the console server can be found in section **6. Secure Tunneling***.*

SDT Connector can be installed on Windows PCs, Mac OS and on most Linux, UNIX and Solaris systems.

3.5.2 PuTTY

Communications packages like PuTTY can also be used to connect to the console server command line (and to connect serially attached devices, refer to **4. Serial Port, Host, Device and User Configuration**). PuTTY is a freeware implementation of telnet and SSH for Win32 and UNIX platforms. It runs as an executable application without needing to be installed onto your system. PuTTY (the telnet and SSH client itself) can be downloaded at http://www.tucows.com/preview/195286.html.



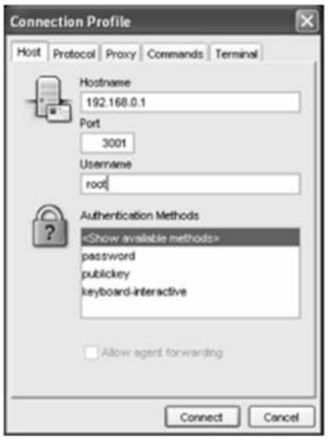
Host Name (or IP address): 192.168.252.202
Port: 22
Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial
Default Settings
Close window on exit: ○ Always ○ Never ● Only on clean exit

- To use PuTTY for an SSH terminal session from a Windows client, enter the console server's IP address as the "Host Name (or IP address)".
- To access the console server command line, select **SSH** as the protocol, and use the default IP Port 22.
- Click **Open**. You will be presented with the console server login prompt. You may also receive a security alert stating the host's key is not cached. If this is the case, choose **yes** to continue.
- Using the telnet protocol is similarly simple, except you use the default port 23.

3.5.3 SSHTerm

Another common communications package that may be useful is SSHTerm*,* an open source package that can be downloaded from http://sourceforge.net/projects/sshtools:

- To use SSHTerm for an SSH terminal session from a Windows Client, simply select the **File** option and click on **New Connection**.



Hostname: 192.168.0.1
Port: 3001
Username: root
Authentication Methods
<Show available methods>
password
publickey
keyboard-interactive
□ Allow agent forwarding

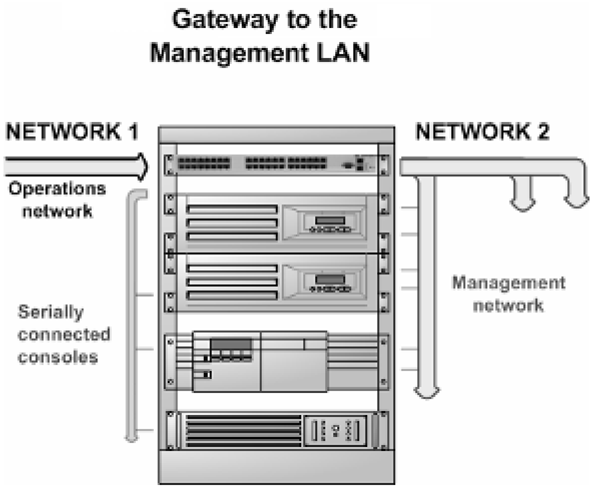
- A new Connection Profile dialog box will appear where you can type in the host name or IP address (for the console server unit) and the TCP port that the SSH session will use (port 22). Type in your username, choose password authentication and click **Connect**.
- You may receive a message about the host key fingerprint, and you will need to select Y**es** or **Always** to continue.
- The next step is password authentication, where a prompt will appear asking for your username and password from the remote system to log on to the console server.

3.6 Management Network Configuration

Select console servers have additional network ports that can be configured to provide management LAN access and/or failover or out-of-band access.

3.6.1 Enable the Management LAN

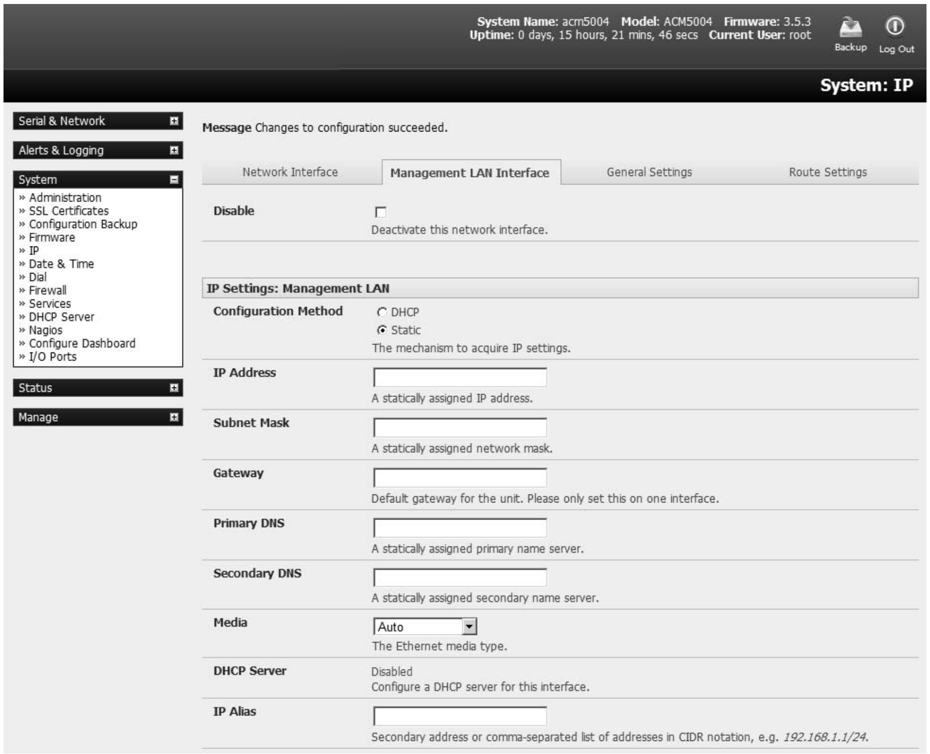
The console servers can be configured so the second Ethernet port provides a management LAN gateway. The gateway has firewall, router and DHCP server features. However, you will need to connect an external LAN switch to *Network/LAN 2* to attach hosts to this management LAN:



Note: *The second Ethernet port (Network/LAN2) on the console server can be configured as either a Management LAN gateway port or an OOB/Failover port—it cannot be both. As such, ensure you did not allocate* ***Network/LAN 2*** *as the* ***Failover Interface*** *when you configured the principal* ***Network*** *connection on the* ***System: IP*** *menu.*

The Management LAN features are all disabled by default. To configure the Management LAN gateway:

- Select the **Management LAN Interface** page on the **System: IP** menu and uncheck **Disable.**
- Configure the **IP Address** and **Subnet Mask** for the Management LAN (but leave the **DNS** fields blank).
- Click **Apply.**



Message Changes to configuration succeeded.

Disable □
Deactivate this network interface.

IP Settings: Management LAN

Configuration Method ○ DHCP ● Static
The mechanism to acquire IP settings.

IP Address
A statically assigned IP address.

Subnet Mask
A statically assigned network mask.

Gateway
Default gateway for the unit. Please only set this on one interface.

Primary DNS
A statically assigned primary name server.

Secondary DNS
A statically assigned secondary name server.

Media Auto
The Ethernet media type.

DHCP Server Disabled
Configure a DHCP server for this interface.

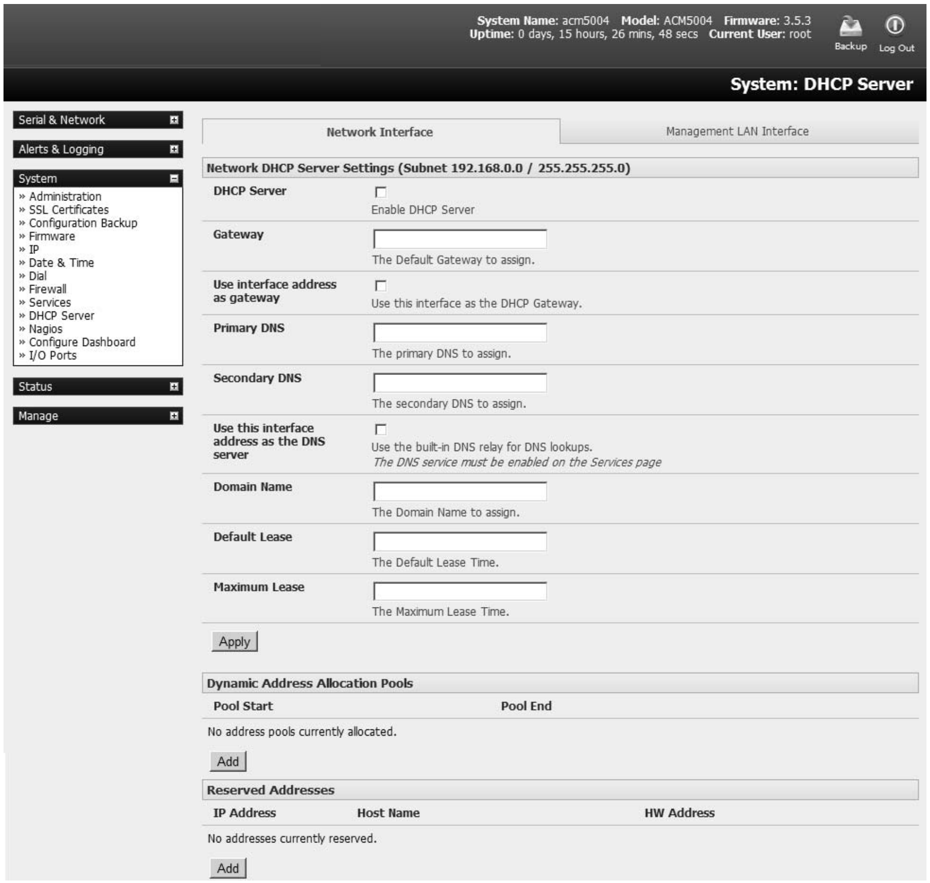
IP Alias
Secondary address or comma-separated list of addresses in CIDR notation, e.g. *192.168.1.1/24.*

The management gateway function is now enabled with default firewall and router rules. By default, these rules are configured so the Management LAN can only be accessed by SSH port forwarding. This ensures the remote and local connections to managed devices on the Management LAN are secure. The LAN ports can also be configured in bridged or bonded mode (as described later in this section) or they can be manually configured from the command line.

3.6.2 Configure the DHCP Server

All Tripp Lite devices host a DHCP server. However, this setting is disabled by default. The DHCP server enables the automatic distribution of IP addresses to devices on the Management LAN that are running DHCP clients. To enable the DHCP server:

- On the **System: IP** menu, select the **Management LAN** page and click the **Disabled** label in the **DHCP Server** field (or go directly to the **System: DHCP Server** menu).
- Check **Enable DHCP Server.**



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 15 hours, 26 mins, 48 secs **Current User:** root

System: DHCP Server

Network DHCP Server Settings (Subnet 192.168.0.0 / 255.255.255.0)

DHCP Server □ Enable DHCP Server

Gateway The Default Gateway to assign.

Use interface address as gateway □ Use this interface as the DHCP Gateway.

Primary DNS The primary DNS to assign.

Secondary DNS The secondary DNS to assign.

Use this interface address as the DNS server □ Use the built-in DNS relay for DNS lookups. *The DNS service must be enabled on the Services page*

Domain Name The Domain Name to assign.

Default Lease The Default Lease Time.

Maximum Lease The Maximum Lease Time.

Dynamic Address Allocation Pools

Pool Start	Pool End

No address pools currently allocated.

Reserved Addresses

IP Address	Host Name	HW Address

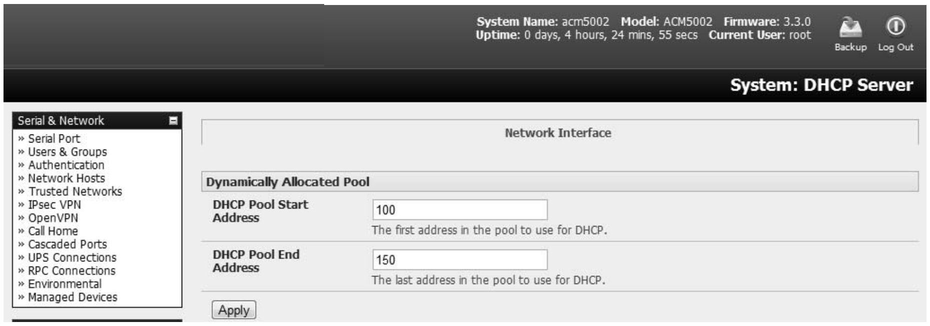
No addresses currently reserved.

- Enter the **Gateway** address that is to be issued to the DHCP clients. If this field is left blank, the console server’s IP address will be used.
- Enter the **Primary DNS** and **Secondary DNS** address to issue the DHCP clients. If this field is left blank, the console server’s IP address is used. Leave this field blank for automatic DNS server assignment.
- Optionally enter a **Domain Name** suffix to issue DHCP clients.
- Enter the **Default Lease** time and **Maximum Lease** time (in seconds). The lease time is the time that a dynamically assigned IP address is valid before the client must request it again.

- Click **Apply.**

The DHCP server will sequentially issue IP addresses from a specified address pool(s):

- Click **Add** in the **Dynamic Address Allocation Pools** field.
- Enter the **DHCP Pool Start Address** and **End Address**, then click **Apply.**



System Name: acm5002 **Model:** ACM5002 **Firmware:** 3.3.0
Uptime: 0 days, 4 hours, 24 mins, 55 secs **Current User:** root

System: DHCP Server

Network Interface

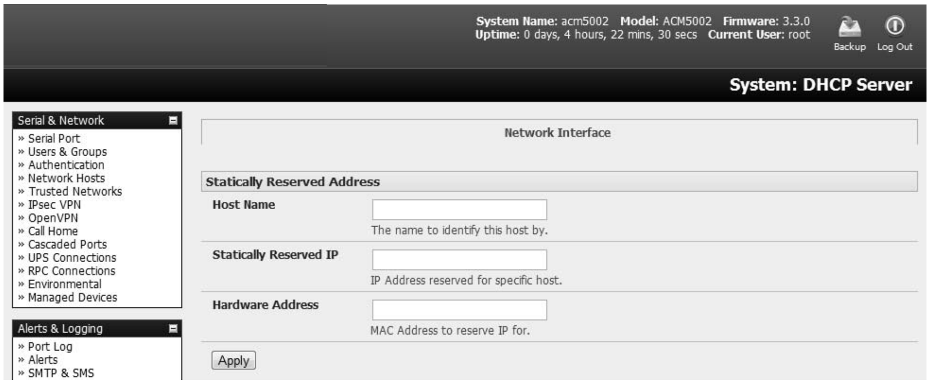
Dynamically Allocated Pool

DHCP Pool Start Address: 100
The first address in the pool to use for DHCP.

DHCP Pool End Address: 150
The last address in the pool to use for DHCP.

The DHCP server also supports pre-assigning IP addresses to be allocated only to specific MAC addresses and reserving IP addresses to be used by connected hosts with fixed IP addresses. To reserve IP addresses for a particular host:

- Click **Add** in the **Reserved Addresses** field.
- Enter the **Hostname,** the **Hardware Address** (MAC) and the **Statically Reserved IP** address for the DHCP client, then click **Apply.**



System Name: acm5002 **Model:** ACM5002 **Firmware:** 3.3.0
Uptime: 0 days, 4 hours, 22 mins, 30 secs **Current User:** root

System: DHCP Server

Network Interface

Statically Reserved Address

Host Name
The name to identify this host by.

Statically Reserved IP
IP Address reserved for specific host.

Hardware Address
MAC Address to reserve IP for.

When DHCP has initially allocated hosts' addresses, it is recommended to copy these into the pre-assigned list so the same IP address will be reallocated in the event of a reboot.

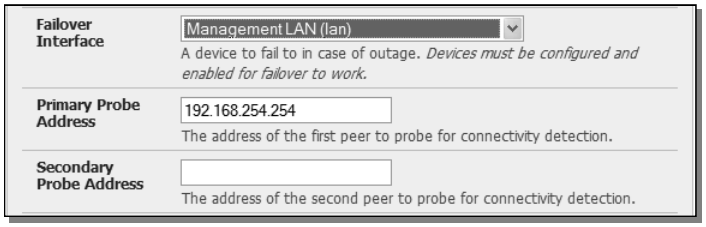
3.6.3 Select Failover or Broadband OOB

The console servers provide a failover option. In the event a problem arises while using the main LAN connection for accessing the console server, an alternate access path is automatically used.

By default, the failover is not enabled. To enable:

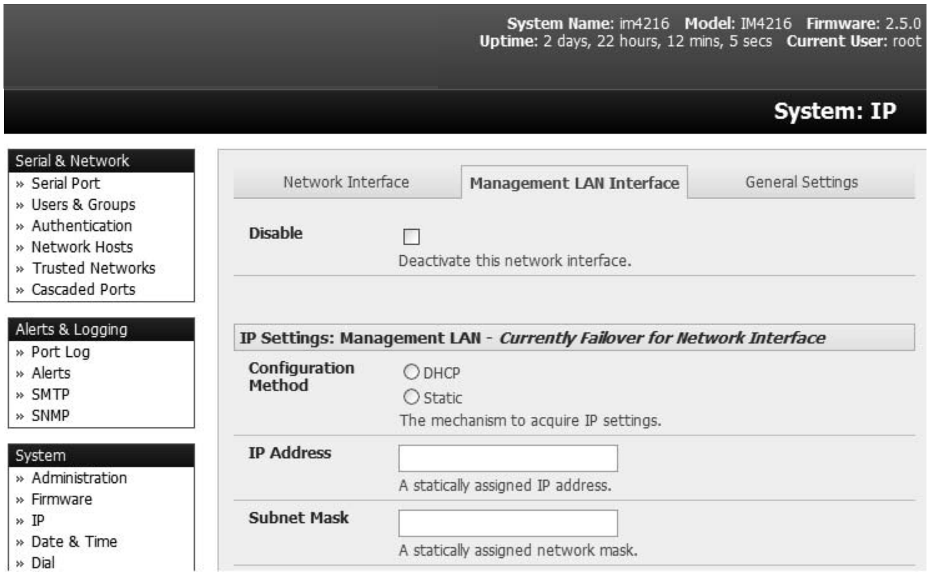
- Select the **Network** page on the **System: IP** menu.
- Now select the **Failover Interface** to be used in the event of an outage on the main network. This can be:
  - A second Ethernet connection on the console server.
  - The console server's internal modem.

- An external modem device connected to the console server.



Failover Interface	Management LAN (lan) A device to fail to in case of outage. *Devices must be configured and enabled for failover to work.*
Primary Probe Address	192.168.254.254 The address of the first peer to probe for connectivity detection.
Secondary Probe Address	The address of the second peer to probe for connectivity detection.

- Click **Apply**. You have selected the failover method. However, it is not active until you have specified the external sites to be probed to trigger failover and set up the failover ports themselves. For more information, refer to section **5. Firewall, Failover and OOB Access**.



System Name: im4216 **Model**: IM4216 **Firmware**: 2.5.0
Uptime: 2 days, 22 hours, 12 mins, 5 secs **Current User**: root

System: IP

Disable	□ Deactivate this network interface.

IP Settings: Management LAN - *Currently Failover for Network Interface*

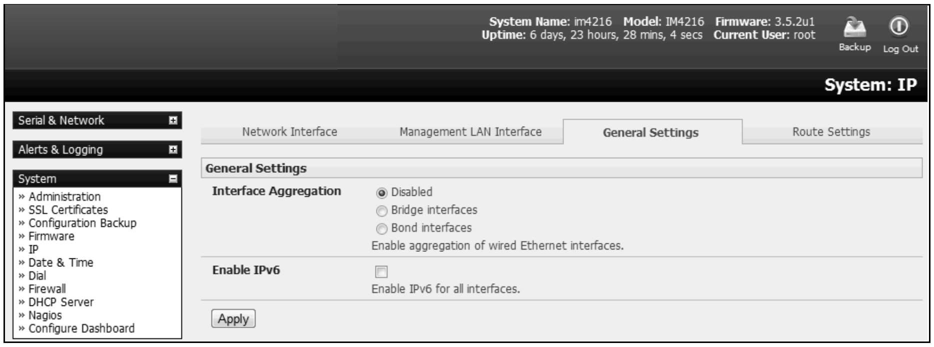
Configuration Method	○ DHCP ○ Static The mechanism to acquire IP settings.
IP Address	A statically assigned IP address.
Subnet Mask	A statically assigned network mask.

***Note:** The second Ethernet port on the console server can be configured as either a Management LAN gateway port or it can be configured as an OoB/Failover port, but not both. Ensure you did not configure this port as the **Management LAN** on the **System: IP** menu.*

3.6.4 Aggregating the Network Ports

By default, the console server's Management LAN network ports can only be accessed using SSH tunneling /port forwarding or by establishing an IPsec VPN tunnel to the console server.

However, all wired network ports on the console servers can be aggregated by being bridged or bonded.



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.2u1
Uptime: 6 days, 23 hours, 28 mins, 4 secs **Current User:** root

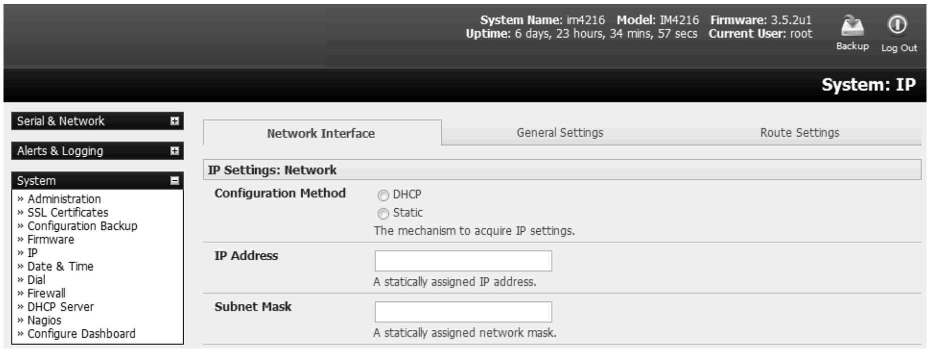
System: IP

General Settings

Interface Aggregation ● Disabled ○ Bridge interfaces ○ Bond interfaces
Enable aggregation of wired Ethernet interfaces.

Enable IPv6 □
Enable IPv6 for all interfaces.

- By default, **Interface Aggregation** is disabled on the **System: IP General Settings** menu.
- Select **Bridge Interfaces** or **Bond Interfaces**
  - When bridging is enabled, network traffic is forwarded across all Ethernet ports with no firewall restrictions. All the Ethernet ports are transparently connected at the data link layer (layer 2), so they do retain their unique MAC addresses.
  - With bonding, the network traffic is carried between the ports but they present with one MAC address.
  - Both modes remove all **Management LAN Interface** and **Out-of-Band/Failover Interface** functions and disable the **DHCP Server.**
- In aggregation mode, all Ethernet ports are configured collectively using the **Network Interface** menu.



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.2u1
Uptime: 6 days, 23 hours, 34 mins, 57 secs **Current User:** root

System: IP

IP Settings: Network

Configuration Method ○ DHCP ○ Static
The mechanism to acquire IP settings.

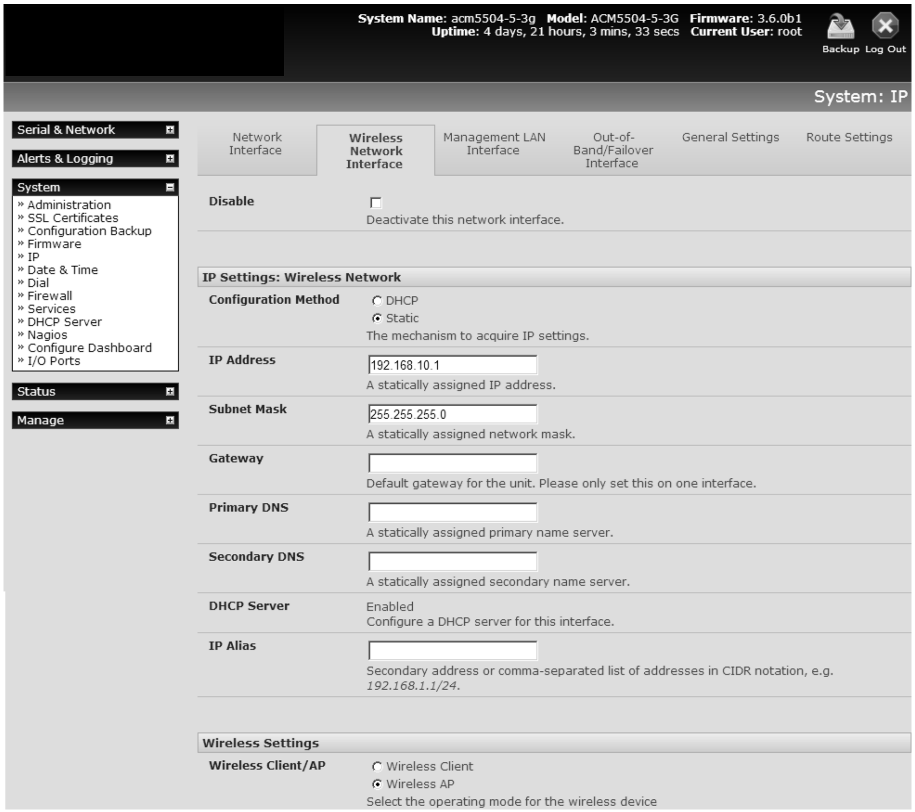
IP Address ▭
A statically assigned IP address.

Subnet Mask ▭
A statically assigned network mask.

3.6.5 Wi-Fi Wireless LAN

Console Servers can be fitted externally with an external 802.11 wireless USB dongle. The wireless device will then be auto-detected on power-up. You will be presented with a **Wireless LAN Interface** menu in the **System: IP** menu.

- To activate and configure the Wireless Access Point functionality, navigate to the **System: IP** page. Click the **Wireless Network Interface** tab.



System Name: acm5504-5-3g **Model:** ACM5504-5-3G **Firmware:** 3.6.0b1
Uptime: 4 days, 21 hours, 3 mins, 33 secs **Current User:** root

System: IP

Disable □
Deactivate this network interface.

IP Settings: Wireless Network

Configuration Method ○ DHCP ● Static
The mechanism to acquire IP settings.

IP Address 192.168.10.1
A statically assigned IP address.

Subnet Mask 255.255.255.0
A statically assigned network mask.

Gateway
Default gateway for the unit. Please only set this on one interface.

Primary DNS
A statically assigned primary name server.

Secondary DNS
A statically assigned secondary name server.

DHCP Server Enabled
Configure a DHCP server for this interface.

IP Alias
Secondary address or comma-separated list of addresses in CIDR notation, e.g. *192.168.1.1/24.*

Wireless Settings

Wireless Client/AP ○ Wireless Client ● Wireless AP
Select the operating mode for the wireless device

- Uncheck the **Disable** box.

<u>WAP Configuration</u>:

- Configure the **IP Settings** for the Wireless Network. Generally, if the device is being used as a Wireless AP, a static address is set here in the IP Settings. In this example, 192.168.10.1 is used. Set the IP address and the netmask (in this case, 255.255.255.0 to give 254 unique network addresses in subnet), but do not fill in the Gateway, Primary DNS and Secondary DNS. These settings are used if the interface is to be the primary network link to the outside world, or if it will be used for failover.

- Select **Wireless AP**, which will make the **Wireless AP Settings** section visible:

  Country: Select the correct country from the list. If the country does not appear, select the World Regulatory Domain.

  SSID: Select an SSID for the network. It should be unique.

  Broadcast SSID: Check this box to broadcast the SSID.

  Network Channel: Select the network channel. 6 is most commonly used, so it is best to do a site survey and pick another channel if the unit is being deployed in an office environment.

  Hardware Mode: The unit supports 802.11b and g, and single-band 802.11n. In most cases, selection 802.11b/g/n will provide the best interoperability with other hardware.

Supported Authentication Methods: Select the authentication method for the AP. If client equipment supports it, it is always best to select WPA/WPA2 and AES encryption. WEP and WPA with TKIP have been proven vulnerable to cryptanalysis.

If WEP is selected:

WEP Mode: Select Open System or Shared System. Open System is more secure than Shared, due to the way encryption keys are used.

WEP Key Length: Select the WEP key length. 128-bit keys offer more security, but are not supported on all devices. WEP keys must be entered in Hexidecimal.

WEP Key 1-4: Up to 4 WEP keys can be used on a single network.

Default Transmit Key: This selects the default transmit key for the network.

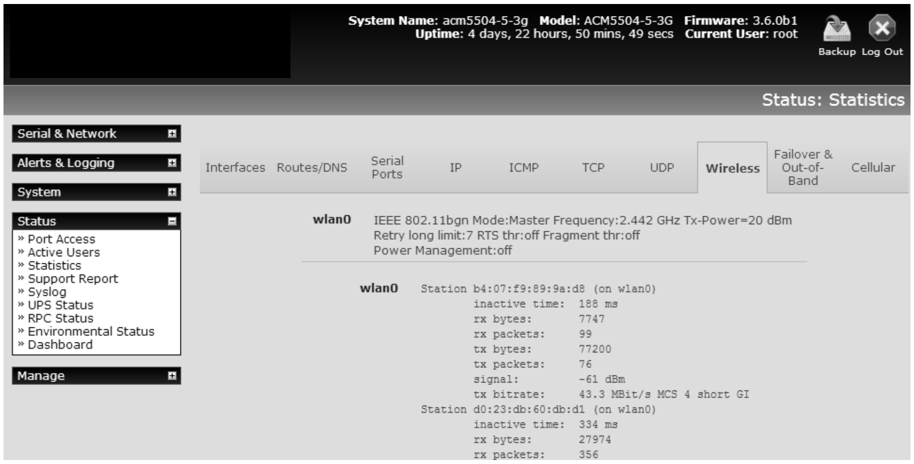
If WPA/WPA2 is selected:

WPA/WPA2 Encryption Methods: Select one or both of TKIP or AES for encrypting WPA/WPA2 connections. AES is more secure, and is required for the AP to advertise itself as 802.11n (if that hardware mode is selected).

WPA Password: The password that clients will use to connect to the AP.

- Once the Wireless AP Settings have been filled out, click **Apply**, then wait for the page to refresh.
- The next step is to set up a DHCP server for wireless clients. Click the link next to *DHCP Server* in the IP settings section, or go to **System: DHCP Server** page. More information on configuring DHCP can be found in **3.6.2 Configure the DHCP Server**.

Note: *The Wireless screen on the Status: Statistics page shows the list of clients connected to the WAP.*



[redacted]

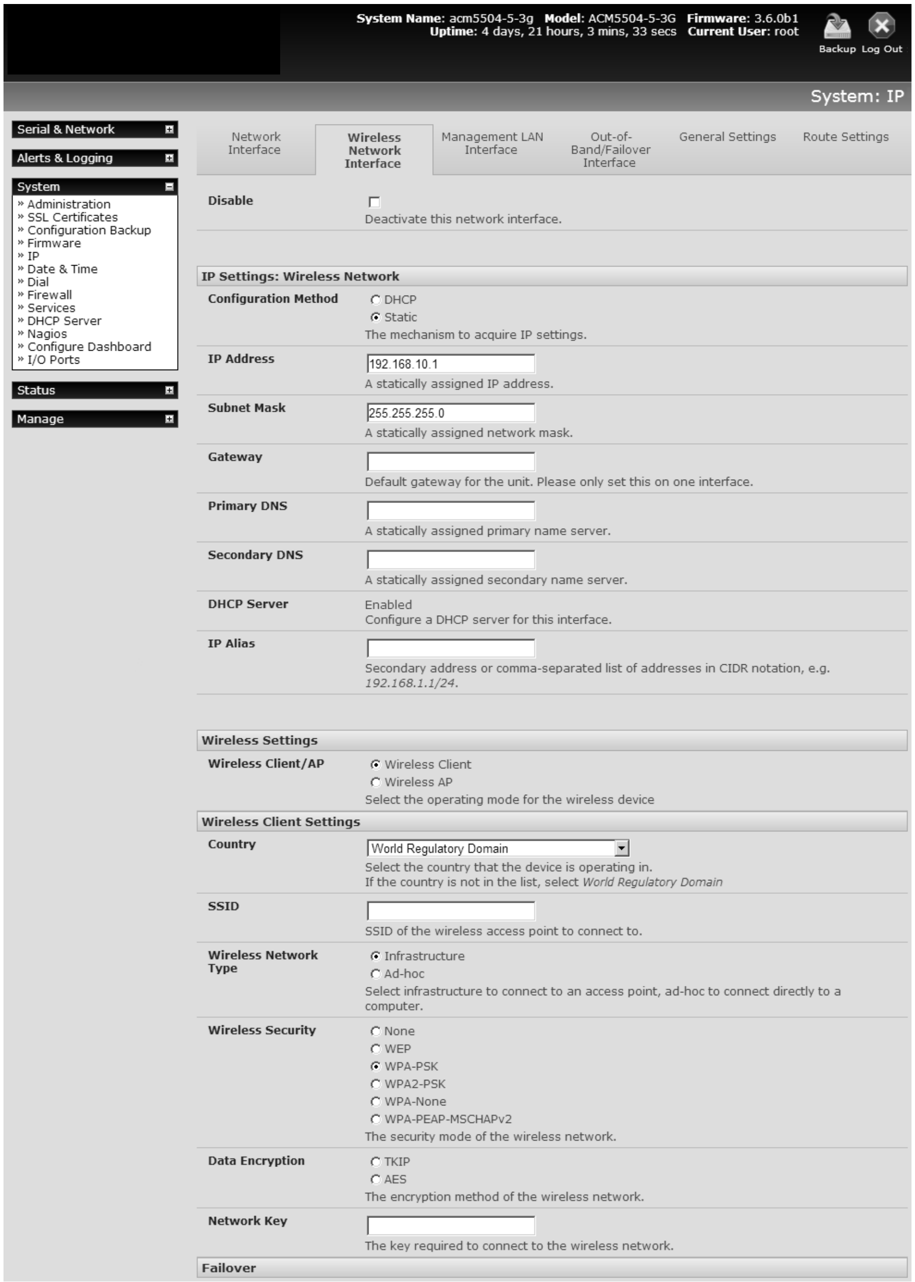
System Name: acm5504-5-3g **Model:** ACM5504-5-3G **Firmware:** 3.6.0b1
Uptime: 4 days, 22 hours, 50 mins, 49 secs **Current User:** root

Status: Statistics

```
wlan0   IEEE 802.11bgn Mode:Master Frequency:2.442 GHz Tx-Power=20 dBm
        Retry long limit:7 RTS thr:off Fragment thr:off
        Power Management:off

wlan0   Station b4:07:f9:89:9a:d8 (on wlan0)
                inactive time:  188 ms
                rx bytes:       7747
                rx packets:     99
                tx bytes:       77200
                tx packets:     76
                signal:         -61 dBm
                tx bitrate:     43.3 MBit/s MCS 4 short GI
        Station d0:23:db:60:db:d1 (on wlan0)
                inactive time:  334 ms
                rx bytes:       27974
                rx packets:     356
```

Wireless Client Configuration:

- Select **Wireless Client** in the **Wireless Settings** section. Doing this will make the **Wireless Client Settings** section visible.
- Select **DHCP** or **Static** for the **Configuration Method**
    - If you selected **Static,** manually enter the new **IP Address**, **Subnet Mask**, **Gateway** and **DNS** server details. This selection automatically disables the DHCP client.
    - If you selected **DHCP,** the device will search for configuration details from a DHCP server on your management LAN. This selection automatically disables any static address. The device MAC address can be found on a label on the base plate.
- When enabled in client mode, the wireless LAN will operate as the main network connection to the device. Failover is available, though it not enabled by default. Use **Failover Interface** to select the device to failover to in case of wireless outage and specify **Probe Addresses** of the peers to probe for connectivity detection.
- Configure the Wireless Client to select the local wireless network, which will serve as the main network connection to the console server.
    - Select the **Country** the device is to operate in.
    - Enter the appropriate **SSID** (Set Service Identifier) of the wireless access point to connect to.
    - Select the **Wireless Network Type** where **Infrastructure** is used to connect to an access point, and **Ad-hoc** to connect directly to a computer.
    - Select the **Wireless Security** mode of the wireless network (WEP, WPA etc.) and enter the required Key / Authentication / Encryption settings.



System Name: acm5504-5-3g **Model:** ACM5504-5-3G **Firmware:** 3.6.0b1
Uptime: 4 days, 21 hours, 3 mins, 33 secs **Current User:** root

System: IP

Disable □
Deactivate this network interface.

IP Settings: Wireless Network

Configuration Method ○ DHCP ● Static
The mechanism to acquire IP settings.

IP Address 192.168.10.1
A statically assigned IP address.

Subnet Mask 255.255.255.0
A statically assigned network mask.

Gateway
Default gateway for the unit. Please only set this on one interface.

Primary DNS
A statically assigned primary name server.

Secondary DNS
A statically assigned secondary name server.

DHCP Server Enabled
Configure a DHCP server for this interface.

IP Alias
Secondary address or comma-separated list of addresses in CIDR notation, e.g. *192.168.1.1/24*.

Wireless Settings

Wireless Client/AP ● Wireless Client ○ Wireless AP
Select the operating mode for the wireless device

Wireless Client Settings

Country World Regulatory Domain
Select the country that the device is operating in.
If the country is not in the list, select *World Regulatory Domain*

SSID
SSID of the wireless access point to connect to.

Wireless Network Type ● Infrastructure ○ Ad-hoc
Select infrastructure to connect to an access point, ad-hoc to connect directly to a computer.

Wireless Security ○ None ○ WEP ● WPA-PSK ○ WPA2-PSK ○ WPA-None ○ WPA-PEAP-MSCHAPv2
The security mode of the wireless network.

Data Encryption ○ TKIP ○ AES
The encryption method of the wireless network.

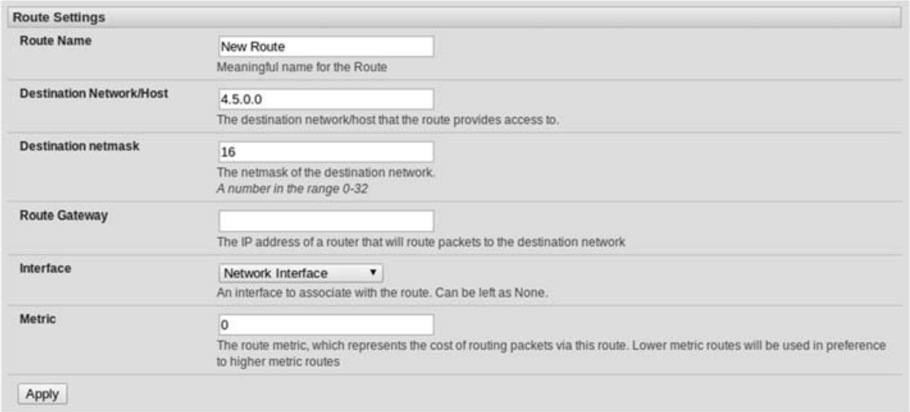
Network Key
The key required to connect to the wireless network.

Failover

Note: *The* ***Wireless*** *screen in* ***Status: Statistics*** *will display all locally accessible wireless LANs (with SSID and Encryption/Authentication settings). You can also use this screen to confirm you have successfully connected to the selected access point (refer to section* ***12. Status Reports*** *for more information.)*

3.6.6 Static Routes

Firmware 3.4 and later support static routes, which provide a quick way to route data from one subnet to a different subnet. You can hard code a path that specifies to the console server/router to get to a certain subnet by using a certain path. This may be useful for remotely accessing various subnets at a remote site when being accessed using the cellular OOB connection.



Route Settings

Route Name	New Route Meaningful name for the Route
Destination Network/Host	4.5.0.0 The destination network/host that the route provides access to.
Destination netmask	16 The netmask of the destination network. *A number in the range 0-32*
Route Gateway	 The IP address of a router that will route packets to the destination network
Interface	Network Interface ▾ An interface to associate with the route. Can be left as None.
Metric	0 The route metric, which represents the cost of routing packets via this route. Lower metric routes will be used in preference to higher metric routes

Apply

To add to the static route to the system's route table:

- Select the **Route Settings** tab on the **System: IP General Settings** menu.
- Enter a meaningful **Route Name** for the route.
- In the **Destination Network/Host** field, enter the IP address of the destination network/host that the route provides access to.
- Enter a value in the **Destination netmask** field that identifies the destination network or host. Any number between 0 and 32 can be used. A subnet mask of 32 identifies a host route.
- Enter **Route Gateway** with the IP address of a router that will route packets to the destination network. This field may be left blank.
- Select the **Interface** to use to reach the destination. This field may be left as ***None****.*
- Enter a value in the **Metric** field that represents the metric of this connection. This generally has to be set only if two or more routes conflict or have overlapping targets. Any number equal to or greater than 0.
- Click **Apply.**

Note: *The route details page provides a list of network interfaces and modems to which a route can be bound. In the case of a modem, the route will be attached to any dial-up session, which is established via that device. A route can be specified with a gateway, an interface or both. If the specified interface is not active for whatever reason, then the routes configured for that interface will not be active.*

3.7 Configuration over DHCP (ZTP)

Configuration-over-DHCP is available for all Tripp Lite console managers running firmware release 3.16 or later. With this feature, Tripp Lite devices can be provisioned during their initial boot from a DHCP server. Provisioning on untrusted networks can be facilitated by providing keys on a USB flash drive.

Preparation

The typical steps for configuration over a trusted network are:

- Manually configure a same-model Tripp Lite device.
- Save its configuration as a backup (.opg) file.
- Select **System > Configuration Backup > Remote Backup**.
- Click **Save Backup**.

A backup configuration file — *model-name_iso-format-date_*config.opg — is downloaded from the Tripp Lite device to the local system.

Alternately, you can save the configuration as an xml file:

- Select **System > Configuration Backup > XML Configuration**.

An editable field containing the configuration file in XML format is presented.

- Click into the field to make it active.
- If you are running any browser on Windows or Linux, right-click and choose **Select All** from the contextual menu or press Control-A. Then, right-click and choose **Copy** from the contextual menu or press Control-C.
- If you are using any browser on Mac OS, choose **Edit > Select All** or press Command-A. Then choose **Edit > Copy** or press Command-C.
- In your preferred text-editor, create a new empty document, paste the copied data into the empty document and save the file. Whatever file-name you choose, it must include the*.xml* filename suffix.
- Copy the saved *.opg* or *.xml* file to a public-facing directory on a file server serving at least one of the following protocols: HTTPS, HTTP, FTP or TFTP (only HTTPS can be used if the connection between the file server and a to-be-configured Tripp Lite device travels over an untrusted network).
- Configure your DHCP server to include a vendor-specific option for Tripp Lite devices (this will be performed in a DHCP server-specific way). The vendor-specific option should be set to a string containing the URL of the published *.opg* or *.xml* file in the step above. The option string must not exceed 250 characters and it must end in either *.opg* or *.xml*.
- Connect a new Tripp Lite device (either factory-reset or Config-Erased) to the network and apply power.

Note: *It may take up to 5 minutes for the device to find the .opg or .xml file (via DHCP), download, install and then reboot.*

Example ISC DHCP (dhcpd) Server Configuration

The following is an example DHCP server configuration fragment for serving an *.opg* configuration image via the ISC DHCP server, dhcpd:

```
option space tripp-lite  code width 1  length width 1;
   option tripp-lite.config-url code 1 = text;

   class " tripp-lite -config-over-dhcp-test" {
     match if option vendor-class-identifier ~~ "^Tripp Lite/";
     vendor-option-space tripp-lite;
     option tripp-lite.config-url "https://example.com/tripp-lite/${class}.opg";
   }
```

Setup When the LAN is Untrusted

If the connection between the file server and a to-be-configured Tripp Lite device includes an untrusted network, a two-handed approach can mitigate the issue.

Note: *This approach adds two physical steps where trust can be difficult, if not impossible, to establish completely. First, the custody chain from the creation of the data-carrying USB flash drive to its deployment. Second, the hands connecting the USB flash drive to the Tripp Lite device.*

- Generate an X.509 certificate for the Tripp Lite device.
- Concatenate the certificate and its private key into a single file named *client.pem*.
- Copy *client.pem* onto a USB flash drive.
- Set up an HTTPS server such that access to the *.opg* or *.xml* file is restricted to clients that can provide the X.509 client certificate generated above.

- Put a copy of the CA cert that signed the HTTP server's certificate — *ca-bundle.crt* — onto the USB flash drive bearing *client.pem*.
- Insert the USB flash drive into the Tripp Lite device before attaching power or network.
- Continue the procedure from 'Copy the saved *.opg* or *.xml* file to a public-facing directory on a file server' above using the HTTPS protocol between the client and server.

Prepare a USB Drive and Create the X.509 Certificate and Private Key

- Generate the CA certificate so the client and server Certificate Signing Requests (CSRs) can be signed.

```
# cp /etc/ssl/openssl.cnf .
# mkdir -p exampleCA/newcerts
# echo 00 > exampleCA/serial
# echo 00 > exampleCA/crlnumber
# touch exampleCA/index.txt
# openssl genrsa -out ca.key 8192
# openssl req -new -x509 -days 3650 -key ca.key -out demoCA/cacert.pem \
  -subj /CN=ExampleCA
# cp demoCA/cacert.pem ca-bundle.crt
```

Note: *This procedure generates a certificate called ExampleCA, but any allowed certificate name can be used. Also, this procedure uses openssl ca. If your organization has an enterprise-wide, secure CA generation process, that should be used instead.*

- Generate the server certificate.

```
# openssl genrsa -out server.key 4096
# openssl req -new -key server.key -out server.csr -subj /CN=demo.example.com
# openssl ca -days 365 -in server.csr -out server.crt \
         -keyfile ca.key -policy policy_anything -batch -notext
```

Note: *The hostname or IP address must be the same string as will be used in the serving URL. In the example above, the hostname is* demo.example.com*.*

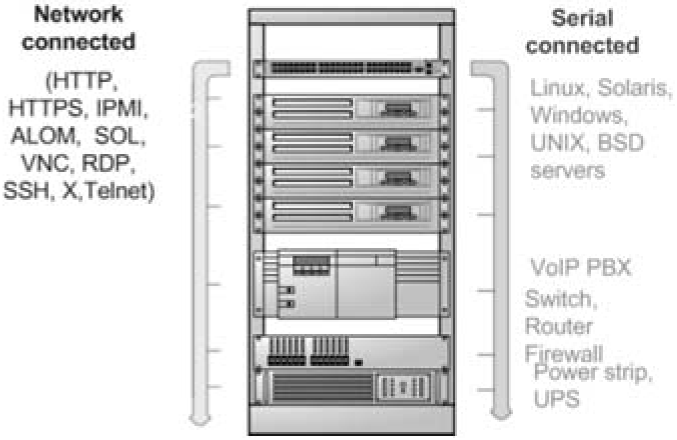
- Generate the client certificate.

```
# openssl genrsa -out client.key 4096
# openssl req -new -key client.key -out client.csr -subj /CN=ExampleClient
# openssl ca -days 365 -in client.csr -out client.crt \
         -keyfile ca.key -policy policy_anything -batch -notext
# cat client.key client.crt > client.pem
```

- Format a USB flash drive as a single FAT32 volume.
- Move the *client.pem* and *ca-bundle.crt* files onto the flash drive's root directory.

4. Serial Port, Host, Device and User Configuration

The console server enables access and control of serially attached devices and network-attached devices (hosts). The Administrator must configure access privileges for each of these devices, and specify the services that can be used to control the devices. The Administrator can also set up new users and specify each user's individual access and control privileges.


Network connected
(HTTP, HTTPS, IPMI, ALOM, SOL, VNC, RDP, SSH, X,Telnet)
Serial connected
Linux, Solaris, Windows, UNIX, BSD servers
VoIP PBX
Switch, Router Firewall
Power strip, UPS

4.1 Configure Serial Ports

The first step in configuring a serial port is to set the **Common Settings,** such as the protocols and the RS-232 parameters that are to be used for the data connection to that port (e.g. baud rate).

Then you select what mode the port is to operate in. Each port can be set to support one of these operating modes:

i. *Disabled mode* is the default. The serial port is inactive.

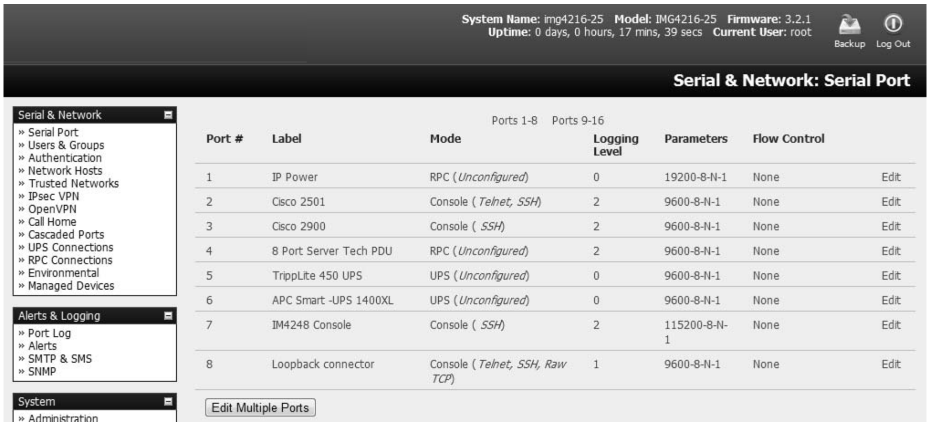
ii. *Console Server mode* enables general access to serial console port on the serially attached devices.

iii. *Device mode* sets the serial port up to communicate with an intelligent serial controlled PDU, UPS or Environmental Monitor Devices (EMD).

iv. *SDT mode* enables graphical console access (with RDP, VNC, HTTPS etc.) to hosts that are serially connected.

v. *Terminal Server mode* sets the serial port to await an incoming terminal login session.

vi. *Serial Bridge mode* enables the transparent interconnection of two serial port devices over a network.



Port #	Label	Mode	Logging Level	Parameters	Flow Control	
1	IP Power	RPC (*Unconfigured*)	0	19200-8-N-1	None	Edit
2	Cisco 2501	Console (*Telnet, SSH*)	2	9600-8-N-1	None	Edit
3	Cisco 2900	Console (*SSH*)	2	9600-8-N-1	None	Edit
4	8 Port Server Tech PDU	RPC (*Unconfigured*)	2	9600-8-N-1	None	Edit
5	TrippLite 450 UPS	UPS (*Unconfigured*)	0	9600-8-N-1	None	Edit
6	APC Smart -UPS 1400XL	UPS (*Unconfigured*)	0	9600-8-N-1	None	Edit
7	IM4248 Console	Console (*SSH*)	2	115200-8-N-1	None	Edit
8	Loopback connector	Console (*Telnet, SSH, Raw TCP*)	1	9600-8-N-1	None	Edit

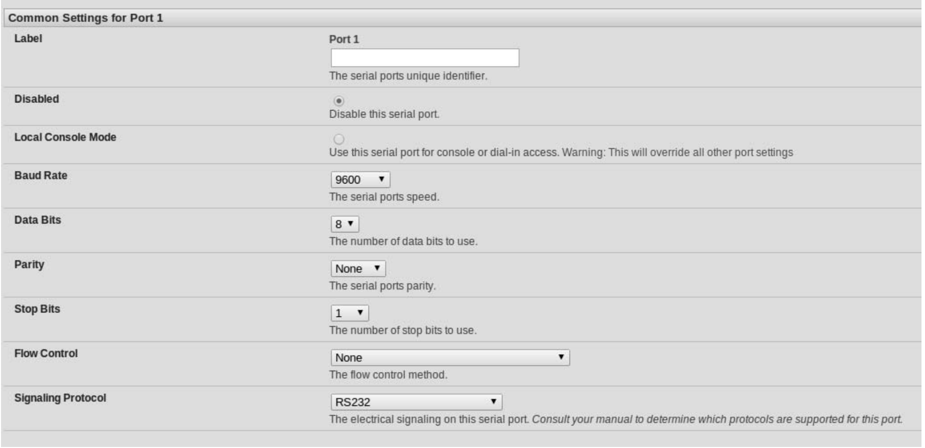
- ➢ Select **Serial & Network: Serial Port** to see details of the serial ports currently set up.
- ➢ By default, each serial port is set in Console Server mode. To reconfigure the port, click **Edit.**
- ➢ When you have reconfigured the common settings (see **4.1.1 Common Settings**) and the mode (see sections 4.1.2 - 4.1.6) for each port, set up any remote syslog (see **4.1.7 Syslog**), then click **Apply.**

Note: *If you wish to set the same protocol options for multiple serial ports at once, click* ***Edit Multiple Ports*** *and select which ports you wish to configure as a group.*

- ➢ If the console server has been configured with distributed Nagios monitoring enabled, then you will also be presented with **Nagios Settings** options to enable assigned services on the Host to be monitored (see section **10. Nagios Integration** for more information).

4.1.1 Common Settings

There are a number of common settings for each serial port. These are independent of the mode in which the port is being used. These serial port parameters must be set so they match the serial port parameters on the device you attach to that port:



Common Settings for Port 1

Label	**Port 1** The serial ports unique identifier.
Disabled	● Disable this serial port.
Local Console Mode	○ Use this serial port for console or dial-in access. Warning: This will override all other port settings
Baud Rate	9600 ▾ The serial ports speed.
Data Bits	8 ▾ The number of data bits to use.
Parity	None ▾ The serial ports parity.
Stop Bits	1 ▾ The number of stop bits to use.
Flow Control	None ▾ The flow control method.
Signaling Protocol	RS232 ▾ The electrical signaling on this serial port. *Consult your manual to determine which protocols are supported for this port.*

- ➢ Specify a label for the port.
- ➢ Select the appropriate **Baud Rate**, **Parity**, **Data Bits**, **Stop Bits** and **Flow Control** for each port.

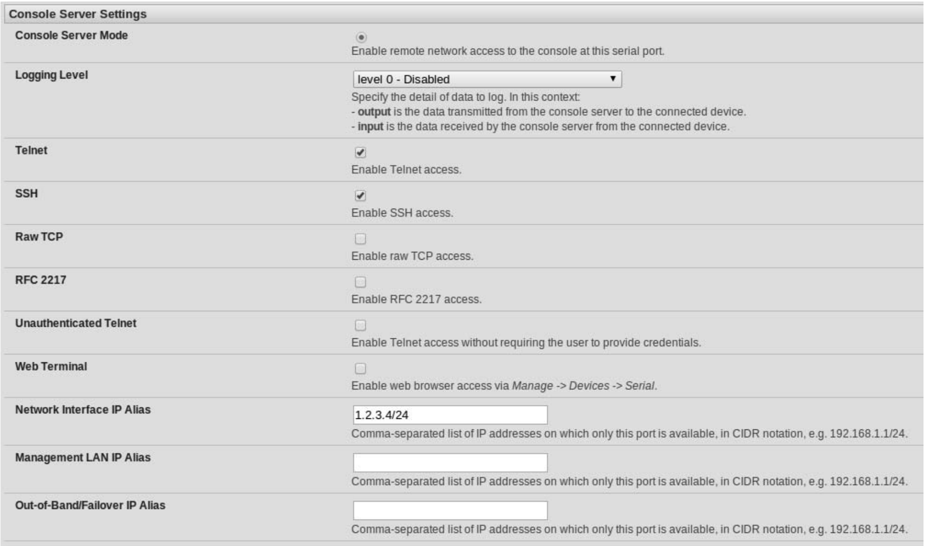
- Set the **Signaling Protocol**. This menu item only presents in ports with RS422/485 options. The options available are RS-232, RS-422, RS-485 and RS-485 Echo mode.

- Set the **Port Pin-Out**. This menu item is only for ports where pin-out for each RJ45 serial port can be set as either X2 (Cisco Straight) or X1 (Cisco Rolled).

- Before proceeding with further serial port configuration, you should connect the ports to the serial devices they will be controlling and ensure they have matching settings.

4.1.2 Console Server Mode

- Select **Console Server Mode** to enable remote management access to the serial console that is attached to this serial port:



Console Server Settings

Console Server Mode	● Enable remote network access to the console at this serial port.
Logging Level	level 0 - Disabled ▼ Specify the detail of data to log. In this context: - **output** is the data transmitted from the console server to the connected device. - **input** is the data received by the console server from the connected device.
Telnet	☑ Enable Telnet access.
SSH	☑ Enable SSH access.
Raw TCP	□ Enable raw TCP access.
RFC 2217	□ Enable RFC 2217 access.
Unauthenticated Telnet	□ Enable Telnet access without requiring the user to provide credentials.
Web Terminal	□ Enable web browser access via *Manage -> Devices -> Serial*.
Network Interface IP Alias	1.2.3.4/24 Comma-separated list of IP addresses on which only this port is available, in CIDR notation, e.g. 192.168.1.1/24.
Management LAN IP Alias	Comma-separated list of IP addresses on which only this port is available, in CIDR notation, e.g. 192.168.1.1/24.
Out-of-Band/Failover IP Alias	Comma-separated list of IP addresses on which only this port is available, in CIDR notation, e.g. 192.168.1.1/24.

Logging Level This specifies the level of information to be logged and monitored (refer to **7. Alerts and Logging**).

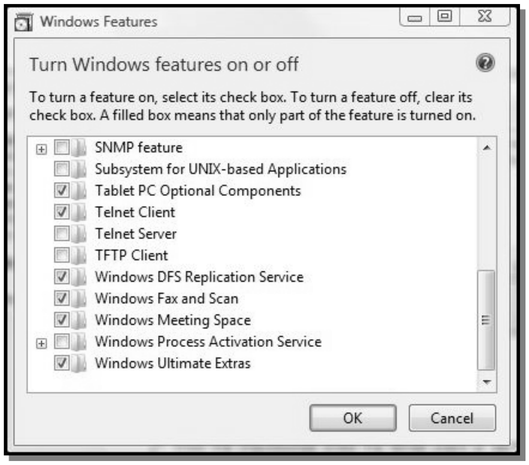
Telnet When the telnet service is enabled on the console server, a telnet client on a User's or Administrator's computer can connect to a serial device attached to this serial port on the console server. The telnet communications are unencrypted so this protocol is generally recommended only for local or VPN tunneled connections.

With Win2000/XP/NT, you can run telnet from the command prompt (*cmd.exe*). Windows Vista and later ships with a telnet client but it is not enabled by default. You can install it by following the simple steps below.

- Click the **Start** button, click **Control Panel**, click **Programs**, and then click **Turn Windows Features On or Off**. If you are prompted for an administrator password or confirmation, type the password or provide confirmation.

- In the **Windows Features** dialog box, select the **Telnet Client** check box.

- Click **OK**. The installation might take several minutes.



Turn Windows features on or off

To turn a feature on, select its check box. To turn a feature off, clear its check box. A filled box means that only part of the feature is turned on.

- ☐ SNMP feature
- ☐ Subsystem for UNIX-based Applications
- ☑ Tablet PC Optional Components
- ☑ Telnet Client
- ☐ Telnet Server
- ☐ TFTP Client
- ☑ Windows DFS Replication Service
- ☑ Windows Fax and Scan
- ☑ Windows Meeting Space
- ☐ Windows Process Activation Service
- ☑ Windows Ultimate Extras

If remote communications are being tunneled with SDT Connector, then telnet can be used for securely accessing these attached devices.

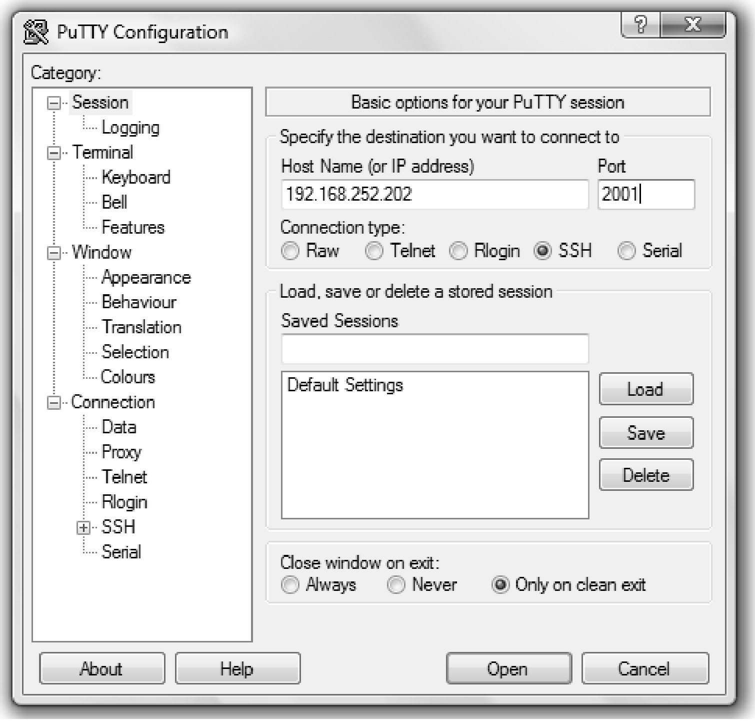
Note: *In Console Server mode, Users and Administrators can use SDT Connector to set up secure telnet connections that are SSH tunneled from their client computers to the serial port on the console server. The SDT Connector can be installed on Windows PCs and on most Linux platforms. It enables secure telnet connections to be selected with a simple point-and-click.*

To use SDT Connector to access consoles on the console server serial ports, configure the SDT Connector with the console server as a gateway, then as a host. Then enable telnet service on Port (2000 + serial port #) *i.e.* 2001–2048. Refer to **6. SSH Tunnels and SDT Connector** for more details on using the SDT Connector for telnet and SSH access to devices that are attached to the console server serial ports.

You can also use standard communications packages like PuTTY to set a direct telnet (or SSH) connection to the serial ports.

Note: *PuTTY also supports telnet (and SSH). The procedure to set up a telnet session is simple. Enter the console server's IP address as the 'Host Name (or IP address)'. Select* ***Telnet*** *as the protocol and set the TCP port to* ***2000, plus the physical serial port number*** *(i.e. 2001 to 2048).*

Click the ***Open*** *button. You may receive a security alert stating the host's key is not cached. If this is the case, you will need to choose* ***yes*** *to continue. You will then be presented with the login prompt of the remote system connected to the serial port chosen on the console server. You can login as normal and use the host serial console screen.*



Specify the destination you want to connect to

Host Name (or IP address): 192.168.252.202

Port: 2001

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Saved Sessions: Default Settings

Close window on exit: ○ Always ○ Never ● Only on clean exit

PuTTY can be downloaded at http://www.tucows.com/preview/195286.html

Note: *In Console Server mode, when you connect to a serial port, you connect via pmshell. To generate a BREAK on the serial port, type the character sequence ~b. If doing this over OpenSSH, type ~~b.*

SSH It is recommended you use SSH as the protocol where the User or Administrator connects to the console server (or connects through the console server to the attached serial consoles) over the Internet or any other public network. This will provide authenticated SSH communications between the SSH client program on the remote user's computer and the console server, so the user's communication with the serial device attached to the console server is secure.

For SSH access to the consoles on devices attached to the *console server* serial ports, you can use SDT Connector. You configure SDT Connector with the console server as a gateway, then as a host, and you enable SSH service on Port (3000 + serial port #) *i.e.* 3001-3048.

You can also use common communications packages like PuTTY or SSHTerm to SSH connect directly to port address IP Address _ Port (3000 + serial port #) *i.e.* 3001–3048.

Alternately, SSH connections can be configured using the standard SSH port 22. The serial port being accessed is then identified by appending a descriptor to the username. This syntax supports:

<username>:<portXX>

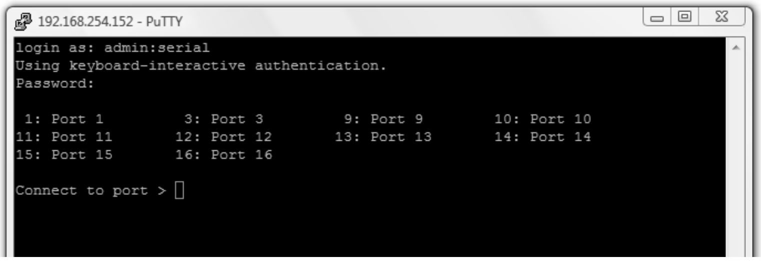
<username>:<port label>

<username>:<ttySX>

<username>:<serial>

For example, in order for a *User* named "Fred" to access serial port 2, when setting up the SSHTerm or the PuTTY SSH client, instead of typing *username = fred* and *ssh port = 3002*, the alternate is to type *username = fred:port02 (*or *username = fred:ttyS1)* and *ssh port = 22.*

Or, by typing *username=fred:serial* and *ssh port = 22,* the *User* is presented with a port selection option:



```
login as: admin:serial
Using keyboard-interactive authentication.
Password:

 1: Port 1          3: Port 3          9: Port 9         10: Port 10
11: Port 11        12: Port 12        13: Port 13        14: Port 14
15: Port 15        16: Port 16

Connect to port > 
```

This syntax enables *Users* to set up SSH tunnels to all serial ports with only a single IP port 22 having to be opened in their firewall/gateway

Note: *In Console Server mode, when you connect to a serial port, you connect via pmshell. To generate a BREAK on the serial port, type the character sequence ~b. If connecting over OpenSSH, type ~~b.*

TCP RAW TCP allows connections directly to a TCP socket. However, while communications programs like *PuTTY* also supports RAW TCP, this protocol would usually be used by a custom application.

For RAW TCP, the default port address is IP Address _ Port (4000 + serial port #) *i.e.* 4001 – 4048.

RAW TCP also enables the serial port to be tunneled to a remote console server, so two serial port devices can be transparently interconnect over a network (refer to section **4.1.6 Serial Bridging**).

RFC2217 Selecting *RFC2217* enables serial port redirection on that port. For RFC2217, the default port address is IP Address _ Port (5000 + serial port #) *i.e.* 5001 – 5048.

RFC2217 also enables the serial port to be tunneled to a remote console server, so two serial port devices can be transparently interconnect over a network (refer to section **4.1.6 Serial Bridging**).

Unauthenticated Telnet Selecting *Unauthenticated Telnet* enables telnet access to the serial port without authentication credentials. When a user accesses the console server to telnet to a serial port, they are normally provided a login prompt. However, with unauthenticated telnet, they connect directly to the port without any console server login restrictions (if a telnet client does prompt for authentication, any entered data will allow connection).

This mode is mainly used when you have an external system (such as conserver) to manage user authentication and access privileges at the serial device level.

NB: only the connection to the console server is unauthenticated. Logging into a device connected to the console server may still require authentication.

For Unauthenticated telnet, the default port address is IP Address _ Port (6000 + serial port #) i.e. 6001 – 6048.

Unauthenticated SSH Selecting *Unauthenticated SSH* enables SSH access to the serial port without authentication credentials. When a user accesses the console server to telnet to a serial port, they are normally provided a login prompt. However, with unauthenticated SSH, they connect directly to the port without any console server login challenge (if a SSH client does prompt for authentication, any entered data will allow connection).

This mode is primarily used when you have another system managing user authentication and access privileges at the serial device level, but still wish to encrypt the session across the network.

NB: only the connection to the console server is unauthenticated. Logging into a device connected to the console server may still require authentication.

For Unauthenticated telnet, the default port address is IP Address _ Port (7000 + serial port #) i.e. 7001 – 7048.

Note: *The <username>: method of port access (as described in the above* ***SSH*** *section) always requires authentication.*

Web Terminal Selecting Web Terminal enables web browser access to the serial port via **Manage: Devices: Serial** using the management console's built in AJAX terminal. Web Terminal connects as the currently authenticated management console user and does not re-authenticate. See section **13.3 Terminal Connection** for details.

IP Alias Enable access to the serial port using a specific IP address specified in CIDR format. Each serial port can be assigned one or more IP aliases, configured on a per-network-interface basis. For example, a serial port can be made accessible at both 192.168.0.148 (as part of the internal network) and 10.10.10.148 (as part of the Management LAN). It is also possible to make a serial port available on two IP addresses on the same network (e.g., 192.168.0.148 and 192.168.0.248).

These IP addresses can only be used to access the specific serial port using the standard protocol TCP port numbers of the console server services. For example, SSH on serial port 3 would be accessible on port 22 of a serial port IP alias (whereas on the console server's primary address, it is available on port 2003).

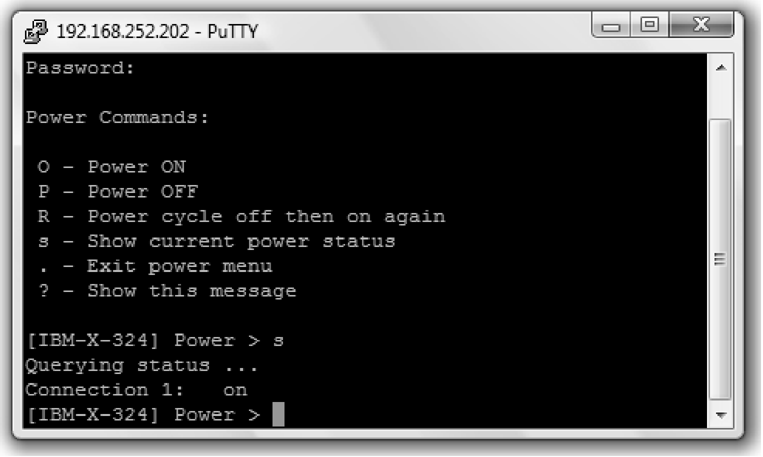
This feature can also be configured from the multiple port edit page. In this case, the IP addresses are applied sequentially. The first selected port receives the IP address entered, while subsequent ports receive incremental addresses with numbers being skipped for any ports unselected. For example, if ports 2, 3 and 5 are selected and the IP alias 10.0.0.1/24 is entered for the network interface, the following addresses will be assigned:

Port 2: 10.0.0.1/24 Port 3: 10.0.0.2/24 Port 5: 10.0.0.4/24

Accumulation Period By default, once a connection has been established for a particular serial port (such as an RFC2217 redirection or telnet connection to a remote computer), any incoming characters on that port are forwarded over the network on a character-by-character basis. The accumulation period changes this by specifying a period of time that incoming characters will be collected before being sent as a packet over the network.

Escape Character This enables you to change the character used for sending escape characters. The default is **~.**

Power Menu This setting enables the shell power command so a user can control the power connection to a managed device from command line when they are connected to the device via telnet or SSH. To operate, the managed device must be set up with both its serial port connection and power connection configured. The command to open the power menu is **~p**



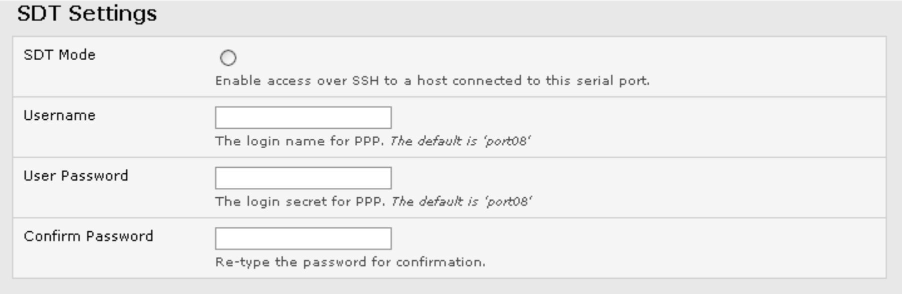
192.168.252.202 - PuTTY

```
Password:

Power Commands:

 O - Power ON
 P - Power OFF
 R - Power cycle off then on again
 s - Show current power status
 . - Exit power menu
 ? - Show this message

[IBM-X-324] Power > s
Querying status ...
Connection 1:   on
[IBM-X-324] Power > 
```

Single Connection This setting limits the port to a single connection, so multiple users have access privileges for a particular port. Only one user at a time can access that port (port "snooping" is not permitted).

4.1.3 SDT Mode

This secure tunneling setting allows port forwarding of RDP, VNC, HTPP, HTTPS, SSH, telnet and other LAN protocols to computers locally connected to the console server by their serial COM port. However, such port forwarding requires a PPP link to be set up over this serial port.



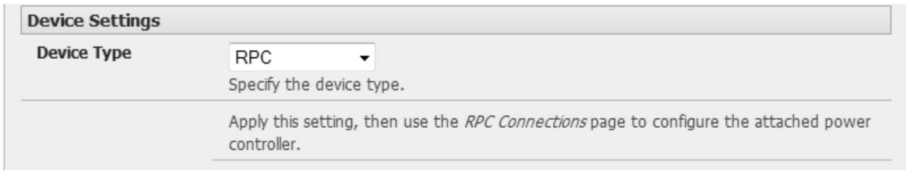
SDT Settings

SDT Mode	○ Enable access over SSH to a host connected to this serial port.
Username	 The login name for PPP. *The default is 'port08'*
User Password	 The login secret for PPP. *The default is 'port08'*
Confirm Password	 Re-type the password for confirmation.

For configuration details, refer to section ***6.4 SDT Connector: Using Telnet or SSH to Connect Devices that are Serially Attached to the Console Server***.

4.1.4 Device (RPC, UPS, EMD) Mode

This mode configures the selected serial port to communicate with a serial controlled Uninterruptable Power Supply (UPS), Remote Power Controller / Power Distribution Unit (RPC) or Environmental Monitoring Device (EMD).



Device Settings

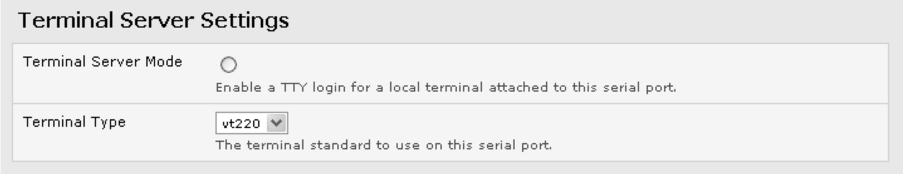
Device Type	RPC Specify the device type.
	Apply this setting, then use the *RPC Connections* page to configure the attached power controller.

- Select the desired **Device Type** (UPS, RPC or EMD).

- Proceed to the appropriate device configuration page (**Serial & Network: UPS Connections, RPC Connection** or **Environmental**) as detailed in section **8. Power, Environment and Digital I/O**.

4.1.5 Terminal Server Mode

- Select **Terminal Server Mode** and the **Terminal Type** (vt220, vt102, vt100, Linux or ANSI) to enable a getty on the selected serial port



Terminal Server Settings

Terminal Server Mode	○ Enable a TTY login for a local terminal attached to this serial port.
Terminal Type	vt220 The terminal standard to use on this serial port.

The getty will then configure the port and wait for a connection to be made. An active connection on a serial device is usually indicated by the Data Carrier Detect (DCD) pin on the serial device. When a connection is detected, the getty program issues a login: prompt, then invokes the login program to handle the actual system login.

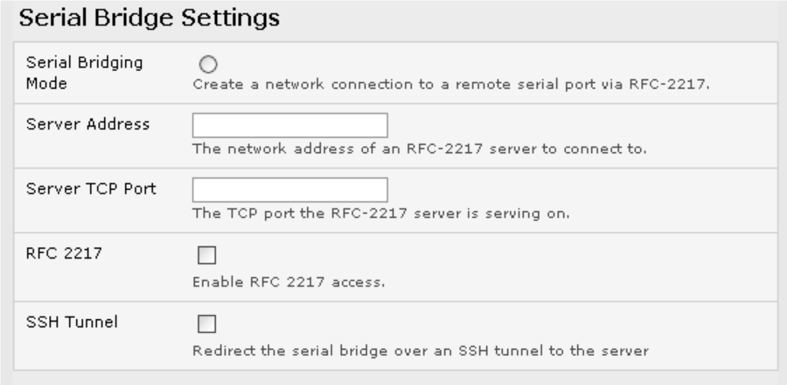
Note: *Selecting Terminal Server mode will disable Port Manager for that serial port. Data will no longer log for alerts etc.*

4.1.6 Serial Bridging Mode

With serial bridging, the serial data on a console server’s serial port is organized in network packets and transported over a network to a second console server, effectively allowing the two console servers to act as a virtual serial cable on an IP network.

One console server is configured to be the Server. The Server serial port to be bridged is set in Console Server mode with either RFC2217 or RAW enabled (refer to **4.1.2 Console Server Mode**).

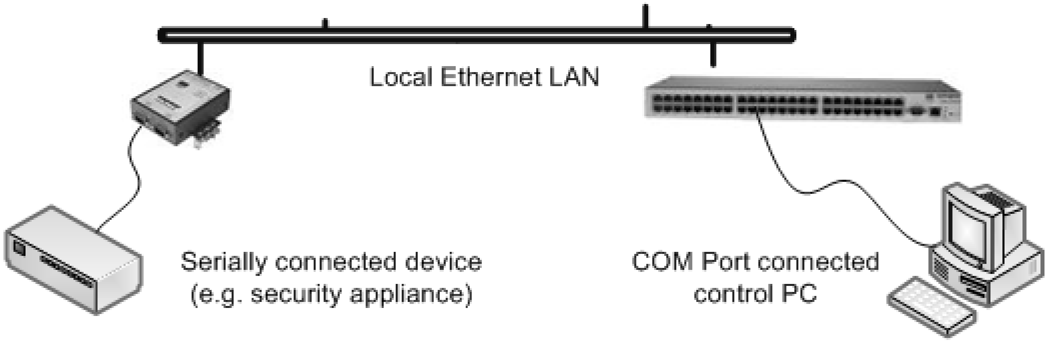
For the Client console server, the serial port to be bridged must be set in Serial Bridging Mode:



Serial Bridge Settings

Serial Bridging Mode	○ Create a network connection to a remote serial port via RFC-2217.
Server Address	The network address of an RFC-2217 server to connect to.
Server TCP Port	The TCP port the RFC-2217 server is serving on.
RFC 2217	□ Enable RFC 2217 access.
SSH Tunnel	□ Redirect the serial bridge over an SSH tunnel to the server

- Select **Serial Bridging Mode** and specify the IP address of the Server console and the TCP port address of the remote serial port (for RFC2217 bridging, this will be 5001-5048).
- By default, the bridging client will use RAW TCP. You must select RFC2217 if this is the console server mode you have specified on the server console.



- ➢ You may secure the communications over the local Ethernet by enabling SSH. However, you will need to generate and upload keys (refer to section **14. Configuration from the Command Line**).

4.1.7. Syslog

In addition to built-in logging and monitoring (which can be applied to serial-attached and network-attached management accesses, as covered in section **7. Alerts, Auto-Response and Logging**), the console server can also be configured to support the remote syslog protocol on a per serial port basis.

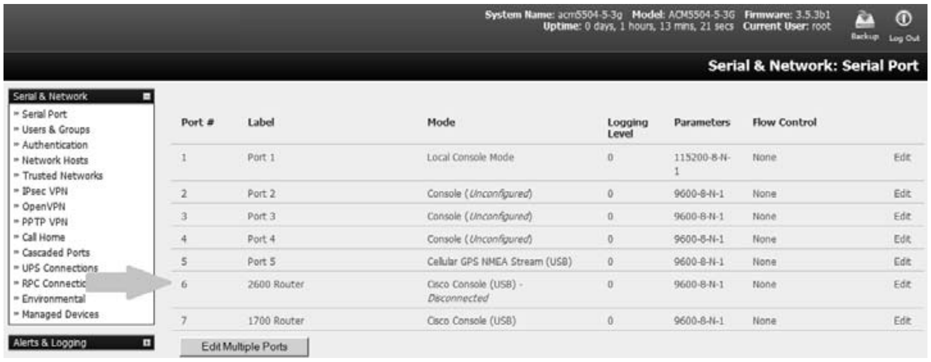
Select the *Syslog Facility* and *Syslog Priority* fields to enable traffic logging on the syslog server's selected. Doing so will appropriately sort and create an action for those logged messages (e.g., redirect or send an alert email).

For example, if the computer attached to serial port 3 should never send anything out on its serial console port, the Administrator can set the Syslog Facility for that port to local0 (local0 – local7 are meant for site local values), and the Syslog Priority to critical. At this priority, if the console server syslog server does receive a message, it will automatically create an alert. See **7. Alerts, Auto-Response and Logging** for more information.

4.1.8 Cisco USB Console Connection

The B094, B095 and B096 console servers support direct USB 2.0 connection to one or two Cisco USB console ports (in addition to the traditional RS-232 serial console port connections).

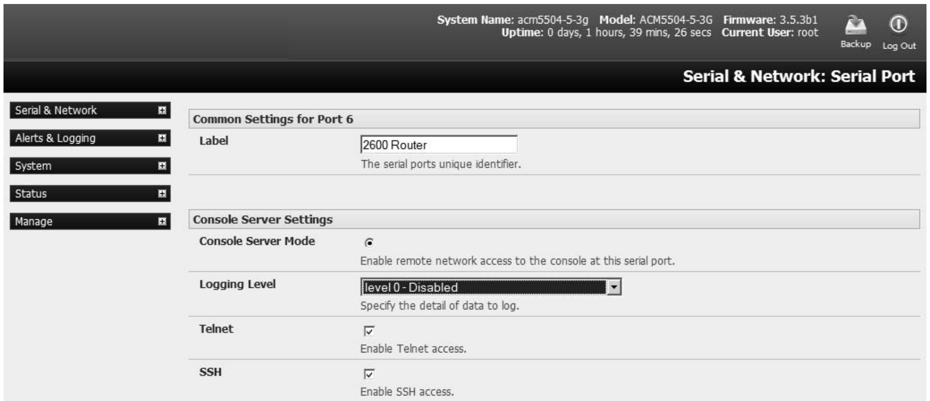
With a USB console connection, users can send IOS commands through the USB console port remotely (using a browser and the console server's built-in AJAX terminal) or monitor messages from the Cisco USB console ports and record rulebook actions (using the console server's built-in Auto-Response capabilities).



Port #	Label	Mode	Logging Level	Parameters	Flow Control	
1	Port 1	Local Console Mode	0	115200-8-N-1	None	Edit
2	Port 2	Console (*Unconfigured*)	0	9600-8-N-1	None	Edit
3	Port 3	Console (*Unconfigured*)	0	9600-8-N-1	None	Edit
4	Port 4	Console (*Unconfigured*)	0	9600-8-N-1	None	Edit
5	Port 5	Cellular GPS NMEA Stream (USB)	0	9600-8-N-1	None	Edit
6	2600 Router	Cisco Console (USB) - *Disconnected*	0	9600-8-N-1	None	Edit
7	1700 Router	Cisco Console (USB)	0	9600-8-N-1	None	Edit

For configuration and control, these USB consoles are presented as new serial ports.

The Common Settings (baud rate, etc.) are ignored when configuring the Cisco USB serial port. However, you can apply all the Console Server Mode, Syslog and Serial Bridging settings to this port.



System Name: acm5504-5-3g **Model:** ACM5504-5-3G **Firmware:** 3.5.3b1
Uptime: 0 days, 1 hours, 39 mins, 26 secs **Current User:** root

Serial & Network: Serial Port

Common Settings for Port 6

Label 2600 Router
The serial ports unique identifier.

Console Server Settings

Console Server Mode ●
Enable remote network access to the console at this serial port.

Logging Level level 0 - Disabled
Specify the detail of data to log.

Telnet ☑
Enable Telnet access.

SSH ☑
Enable SSH access.

Note: *The Cisco USB console must be manually configured upon initial connection. Any USB console disconnection is auto-detected. USB console re-connection on the same physical USB port will also be auto-detected, but only if the console server has been power cycled.*

4.1.9 USB Consoles

B093-Series console servers running firmware 3.16.5 or later support USB console connections to devices from a wide range of vendors, including Cisco, HP, Dell and Brocade. All the USB ports on these console servers can also function as plain RS-232 serial ports when a USB-to-serial adapter is connected.

These USB ports are available as regular port manager ports and are presented numerically in the web UI after all RJ45 serial ports.

The RJ45 serial ports are presented in **Serial & Network > Serial Port**.

The common settings (baud rate, etc.) are used when configuring the ports. Some operations (e.g., sending serial breaks) may not work, depending on the implementation of the underlying USB serial chip.

4**.1.1**0**. Link Layer Discovery Protocol (LLDP)**

The Link Layer Discovery Protocol (LLDP) is a protocol that allows system administrators to gather information about devices physically connected to managed switches. It is available for use on B093-Series devices.

The LLDP service is enabled through the **System > Services** page. When the service is enabled, the lldpd daemon is loaded and running. The **Service Access** tab controls which network interfaces are monitored by the lldpd daemon.

When LLDP is granted access to an interface, it will use that interface, even if the interface has been disabled through **System > IP**.

LLDP neighbors are visible through the **Status > LLDP Neighbors** page. This page shows neighbors detected and indicates the console manager is sending information.

Note: *Although the LLDP service can be granted access to non-Ethernet interfaces (for example, G3, G4 and PSTN dial-up interfaces), it currently ignores non-Ethernet interfaces.*

The lldpcli shell client interacts with and configures the running LLDP service.

Persistent custom configuration changes can be added to the system through configuration files placed in /etc/config/lldpd.d/. Custom configuration files (which **must** have filenames ending with *.conf*) will be read and executed by lldpcli when the LLDP service starts.

The /etc/ directory is read-only on Tripp Lite hardware. Most default configuration files otherwise stored in /etc/ are on Tripp Lite hardware in /**etc/config/**, which is writeable.

The default lldpd configuration file *lldpd.conf* is saved in **/etc/config/** on Tripp Lite hardware. It is not safe to save custom configuration details. There are circumstances in which this file is regenerated automatically, in which case all customizations will be lost.

The **etc/config/lldpd.d/** directory, which is also writable and created on first boot is safe to write to. Any Custom LLDP configurations must be stored as **.conf* files in this directory.

When enabled, LLDP frames issued by a Tripp Lite Console Manager will reveal sensitive information such as hostname and firmware version.

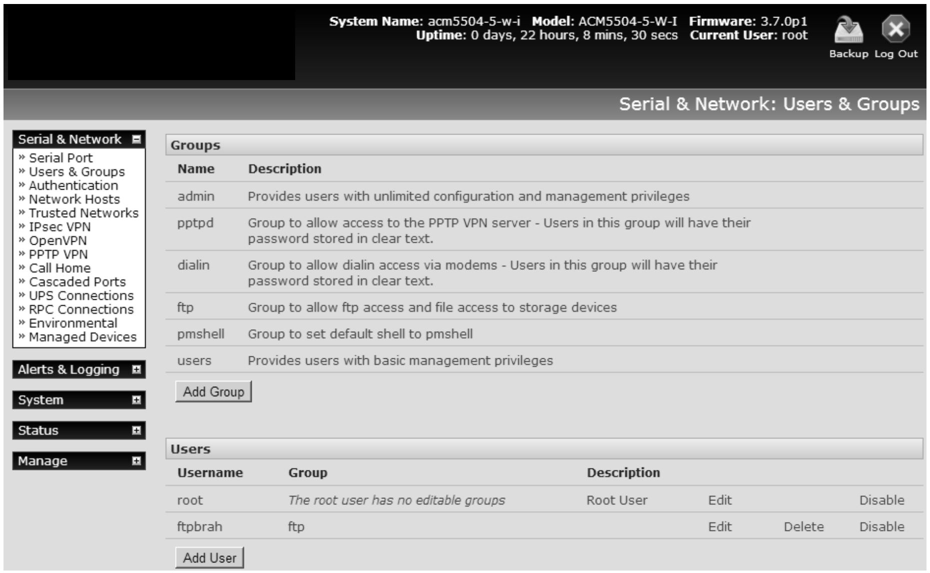
LLDP frames are not passed through by 802.3ab compliant switches.Tripp Lite Console Managers have the LLDP service disabled by default.

Both lldpd and lldpcli have standard manual pages but because of space concerns, these pages are not shipped with Tripp Lite hardware. However, both manual pages are available on the lldpd project: man lldpd can be found at **https:// vincentbernat.github.io/lldpd/usage.html#lldpd8**; and man lldpcli can be found at **https:// vincentbernat.github.io/lldpd/usage.html#lldpcli8**.

Note: *Tripp Lite uses lldpd 0.9.2.*

4.2 Add and Edit Users

The Administrator uses this menu selection to set up, edit and delete users, and define the access permissions for each of these users.



System Name: acm5504-5-w-i **Model:** ACM5504-5-W-I **Firmware:** 3.7.0p1
Uptime: 0 days, 22 hours, 8 mins, 30 secs **Current User:** root

Serial & Network: Users & Groups

Groups

Name	Description
admin	Provides users with unlimited configuration and management privileges
pptpd	Group to allow access to the PPTP VPN server - Users in this group will have their password stored in clear text.
dialin	Group to allow dialin access via modems - Users in this group will have their password stored in clear text.
ftp	Group to allow ftp access and file access to storage devices
pmshell	Group to set default shell to pmshell
users	Provides users with basic management privileges

Users

Username	Group	Description			
root	*The root user has no editable groups*	Root User	Edit		Disable
ftpbrah	ftp		Edit	Delete	Disable

Users can be authorized to access specified services, serial ports, power devices and specified network-attached hosts. These users can also be given full Administrator status (with full configuration, management and access privileges).

To simplify user set up, they can be configured as members of Groups. With firmware V3.5.2 and later, there are six Groups set up by default (earlier versions only had *admin* and *user* by default):

admin Provides users with unlimited configuration and management privileges.

pptpd Group to allow access to the PPTP VPN server. Passwords for users in this group are stored in plain text.

dialin	Group to allow dial-in access via modems. Passwords for users in this group are stored in plain text.
ftp	Group to allow ftp access and file access to storage devices.
pmshell	Group to set default shell to pmshell.
users	Provides users with basic management privileges.

Notes: *1. The **admin** group provides the admin user with full Administrator privileges. The admin user (Administrator) can access the console server using any of the services enabled in **System: Services** (e.g., if only HTTPS has been enabled, then the Administrator can only access the console server using HTTPS). However, once logged in, they can reconfigure the console server settings (e.g., to enabled HTTP/telnet for future access). They can also access any of the connected hosts or serial port devices using any of the services enabled for these connections. The Administrator can reconfigure the access services for any host or serial port. Only trusted users should have Administrator access.*

*2. The **user** group provides the general user with limited access to the console server, connected hosts and serial devices. These Users can access only the management section of the Management Console menu with no command line access to the console server. They also can only access those hosts and serial devices that have been checked for them.*

*3. If a user is set up with **pptd, dialin, ftp** or **pmshell** group membership, they will have restricted user shell access to the assigned managed devices but will not have any direct access to the console server itself. To add this function, the user must also be a member of the "users" or "admin" groups.*

4. The Administrator can also set up additional groups with permissions to a specific power device, serial port and host access. However, users in these additional groups do not have any access to the Management Console menu nor do they have any command line access to the console server itself.

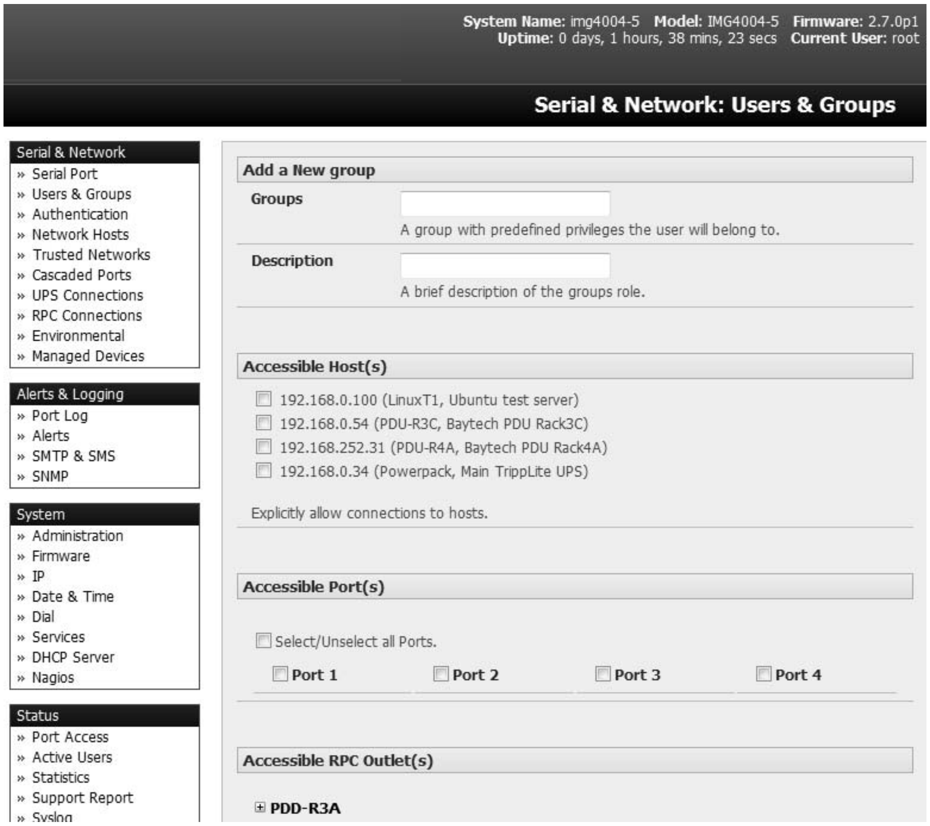
5. The Administrator can also set up users with specific power device, serial port and host access permissions, who are not a member of any Groups. Similarly, these users do not have any access to the Management Console menu, nor do they have any command line access to the console server itself.

6. For convenience, the SDT Connector “Retrieve Hosts” function retrieves and autoconfigures checked serial ports and checked hosts only, even for admin group users.

4.2.1 Set Up New Group

To set up new groups and users, and assign users to particular groups:

- Select **Serial & Network: Users & Groups** to display the configured Groups and Users.
- Click **Add Group** to add a new group.



Add a New group

Groups
A group with predefined privileges the user will belong to.

Description
A brief description of the groups role.

Accessible Host(s)

- □ 192.168.0.100 (LinuxT1, Ubuntu test server)
- □ 192.168.0.54 (PDU-R3C, Baytech PDU Rack3C)
- □ 192.168.252.31 (PDU-R4A, Baytech PDU Rack4A)
- □ 192.168.0.34 (Powerpack, Main TrippLite UPS)

Explicitly allow connections to hosts.

Accessible Port(s)

□ Select/Unselect all Ports.

□ Port 1 □ Port 2 □ Port 3 □ Port 4

Accessible RPC Outlet(s)

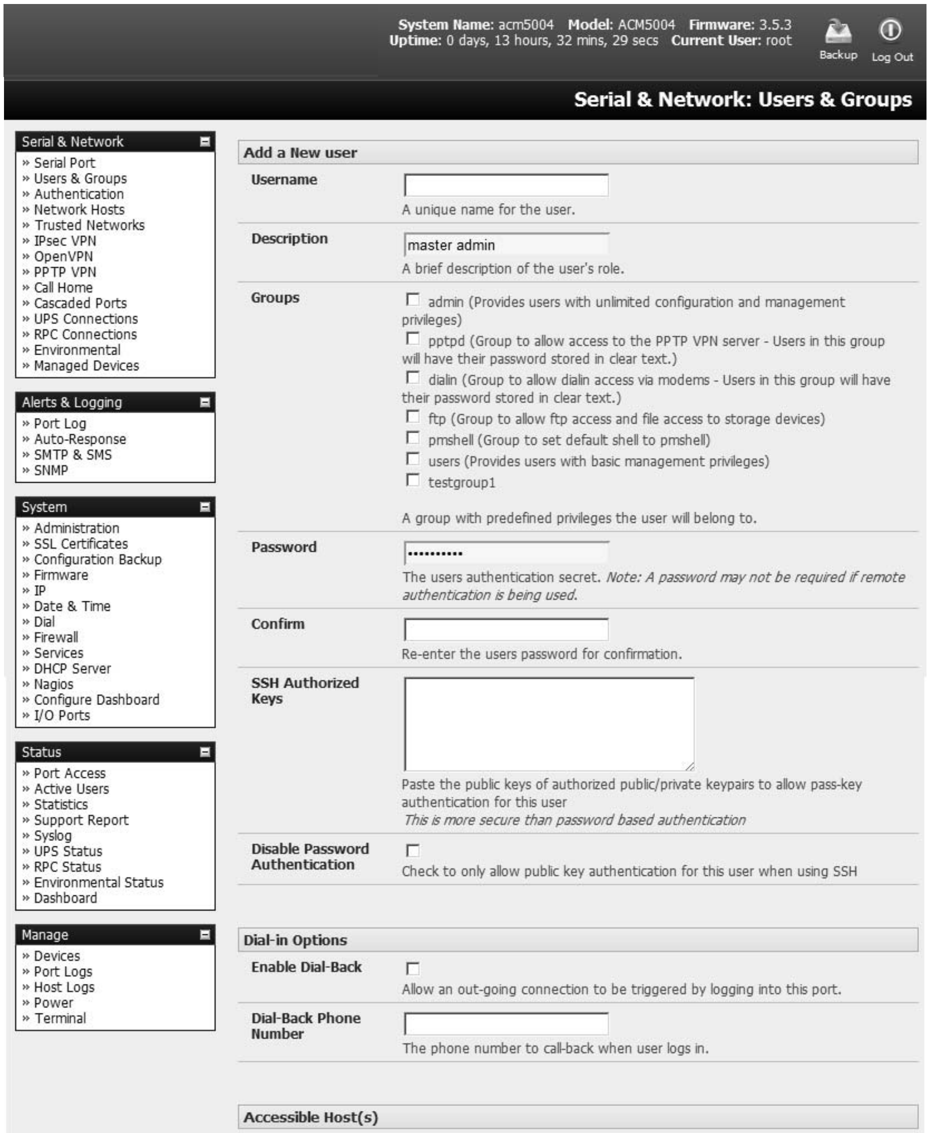
⊞ PDD-R3A

- Add a **Group** name and **Description** for each new Group. Then select the **Accessible Hosts, Accessible Ports** and **Accessible RPC Outlet(s)** you wish for users in this new group to be able to access.
- Click **Apply.**
- The Administrator can **Edit** or **Delete** any added group.

4.2.2 Set Up New Users

To set up new users, and assign users to particular groups:

- Select **Serial & Network: Users & Groups** to display the configured groups and user.
- Click **Add User** to add a new user.



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 13 hours, 32 mins, 29 secs **Current User:** root

Serial & Network: Users & Groups

Add a New user

Username
A unique name for the user.

Description master admin
A brief description of the user's role.

Groups
□ admin (Provides users with unlimited configuration and management privileges)
□ pptpd (Group to allow access to the PPTP VPN server - Users in this group will have their password stored in clear text.)
□ dialin (Group to allow dialin access via modems - Users in this group will have their password stored in clear text.)
□ ftp (Group to allow ftp access and file access to storage devices)
□ pmshell (Group to set default shell to pmshell)
□ users (Provides users with basic management privileges)
□ testgroup1

A group with predefined privileges the user will belong to.

Password ••••••••••
The users authentication secret. *Note: A password may not be required if remote authentication is being used.*

Confirm
Re-enter the users password for confirmation.

SSH Authorized Keys
Paste the public keys of authorized public/private keypairs to allow pass-key authentication for this user
This is more secure than password based authentication

Disable Password Authentication □
Check to only allow public key authentication for this user when using SSH

Dial-in Options

Enable Dial-Back □
Allow an out-going connection to be triggered by logging into this port.

Dial-Back Phone Number
The phone number to call-back when user logs in.

Accessible Host(s)

- Add a **Username** for each new user. You may also include information related to the user (*e.g.*, contact details) in the **Description** field.

***Note:** The username can contain from 1 to 127 alphanumeric characters (special characters "-" "_" and "." may also be used).*

- Specify which **Group** (or Groups) you wish to assign the user to.
- Add a confirmed **Password** for each new user.

***Note:** There are no restrictions on the characters that can be used for the user's password (which each can contain up to 254 characters). However, only the first eight password characters are used to make the password hash.*

- SSH pass-key authentication can be used. This is more secure than password-based authentication. Paste the public keys of authorized public/private key pairs for this user in the **Authorized SSH Key**s field.

- Check **Disable Password Authentication** if you wish to only allow public key authentication for this user when using SSH.
- Check **Enable Dial-Back** in the **Dial-in Options** menu to allow an outgoing dial-back connection to be triggered by logging into this port. Enter the **Dial-Back Phone Number** with the phone number to call back when user logs in.
- Check specific **Accessible Hosts** and/or **Accessible Ports** to assign the serial ports and network-connected hosts you wish the user to have access privileges to.
- If there are configured RPCs, you can check **Accessible RPC Outlets** to specify which outlets the user can control (i.e. Power On/Off).
- Click **Apply**. The new user will now be able to access the Network Devices, Ports and RPC Outlets you assigned as accessible. If the user is a group member, they can also access any other device/port/outlet that was set up as accessible to that group.

Note: *There are no specific limits on the number of users you can set up, nor on the number of users per serial port or host. Multiple users (Users and Administrators) can control/monitor the one port or host. Similarly, there are no specific limits on the number of groups. Each user can be a member of multiple groups (in which case, they assume the cumulative access privileges of each of those groups). A user does not have to be a member of any groups. If the user is not a member of the default user group, then they will not be able to use the management console to manage ports.*

While there are no specific limits, the time to reconfigure does increase as the number and complexity increases. As such, the recommended aggregate number of users and groups should be kept under 250.

The Administrator can also edit the access settings for any existing users:

- Select **Serial & Network: Users & Groups** and click **Edit** to modify the user access privileges.
- Alternately, click **Delete** to remove the user or click **Disable** to temporarily block any access privileges.

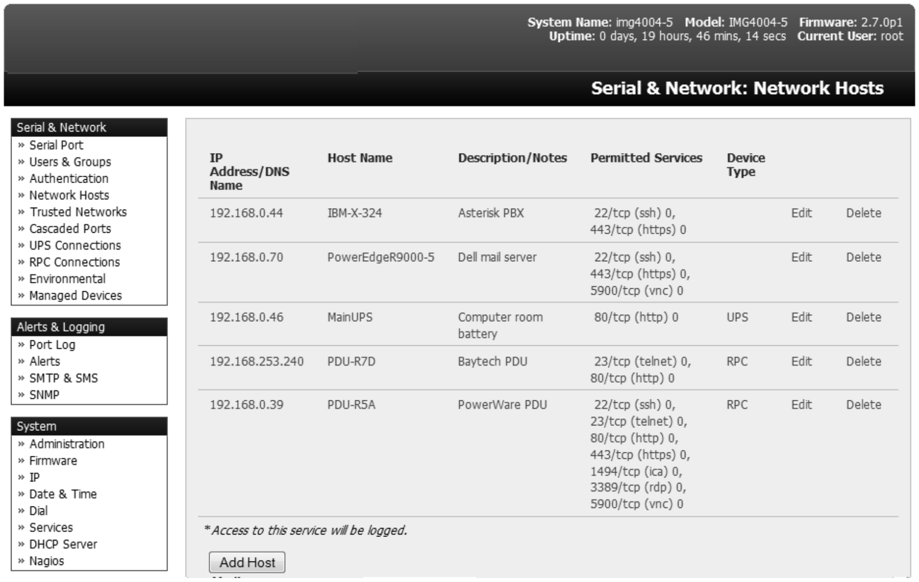
Note: *For more information on enabling the SDT Connector so each user has secure tunneled remote RPD/VNC/Telnet/HHTP/HTTPS/SoL access to the network-connected hosts, refer* ***6. SSH Tunnels and SDT Connector****.*

4.3 Authentication

Refer to *Chapter 9.1 - Remote Authentication Configuration* for authentication configuration details.

4.4 Network Hosts

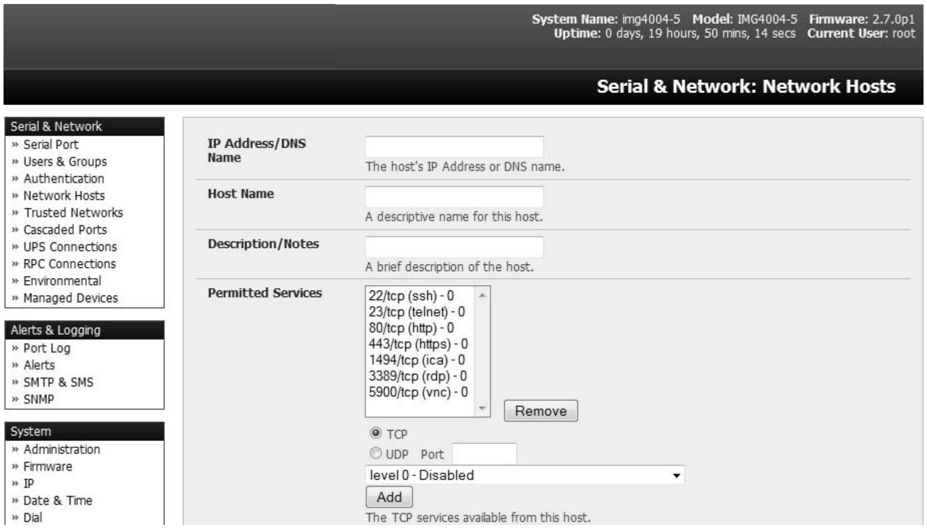
To monitor and remotely access a locally networked computer or device (referred to as a host), you must identify the host and specify the TCP or UDP ports/services that will be used to control that host:



IP Address/DNS Name	Host Name	Description/Notes	Permitted Services	Device Type		
192.168.0.44	IBM-X-324	Asterisk PBX	22/tcp (ssh) 0, 443/tcp (https) 0		Edit	Delete
192.168.0.70	PowerEdgeR9000-5	Dell mail server	22/tcp (ssh) 0, 443/tcp (https) 0, 5900/tcp (vnc) 0		Edit	Delete
192.168.0.46	MainUPS	Computer room battery	80/tcp (http) 0	UPS	Edit	Delete
192.168.253.240	PDU-R7D	Baytech PDU	23/tcp (telnet) 0, 80/tcp (http) 0	RPC	Edit	Delete
192.168.0.39	PDU-R5A	PowerWare PDU	22/tcp (ssh) 0, 23/tcp (telnet) 0, 80/tcp (http) 0, 443/tcp (https) 0, 1494/tcp (ica) 0, 3389/tcp (rdp) 0, 5900/tcp (vnc) 0	RPC	Edit	Delete

Access to this service will be logged.

- Selecting **Serial & Network: Network Hosts** presents all the network-connected hosts that have been enabled for access, as well as the related access TCP ports/services.
- Click **Add Host** to enable access to a new host (or select **Edit** to update the settings for existing host).



IP Address/DNS Name The host's IP Address or DNS name.

Host Name A descriptive name for this host.

Description/Notes A brief description of the host.

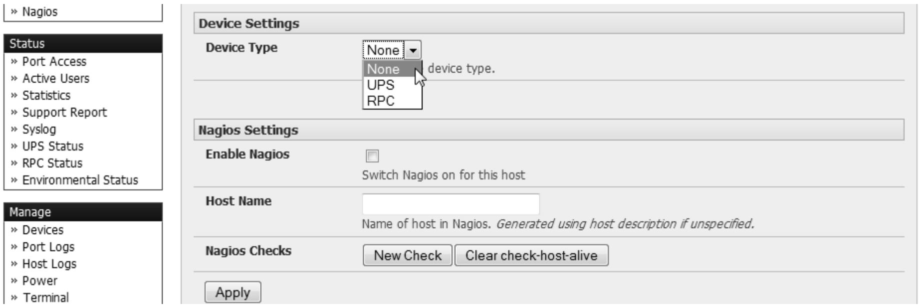
Permitted Services
22/tcp (ssh) - 0
23/tcp (telnet) - 0
80/tcp (http) - 0
443/tcp (https) - 0
1494/tcp (ica) - 0
3389/tcp (rdp) - 0
5900/tcp (vnc) - 0

● TCP
○ UDP Port

level 0 - Disabled

The TCP services available from this host.

- Enter the **IP Address** or **DNS Name** and a **Host Name** (up to 254 alphanumeric characters) for the new network-connected host. You can optionally enter a **Description**.
- Add or edit the **Permitted Services** (or TCP/UDP port numbers) authorized for controlling this host. Only these permitted services will be forwarded by SDT to the host. All other services (TCP/UDP ports) will be blocked.
- The **Logging Level** specifies the level of information to be logged and monitored for each host access (refer to **7. Alerts, Auto-response and Logging** for more information).
- If the host is a PDU or UPS power device or a server with IPMI power control, then specify **RPC** (for IPMI and PDU) or **UPS** and the **Device Type**. The Administrator can then configure these devices and enable which users have permissions to remotely cycle power etc. (refer to **8. Remote Power Control** for more information). Otherwise, leave the Device Type set to **None**.



Device Settings

Device Type None ▾ device type.

Nagios Settings

Enable Nagios □ Switch Nagios on for this host

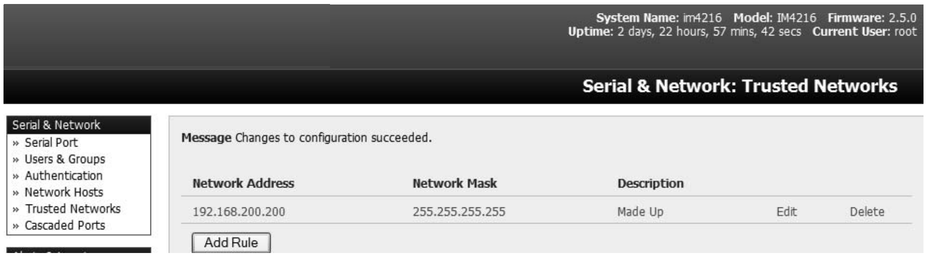
Host Name Name of host in Nagios. *Generated using host description if unspecified.*

Nagios Checks

- If the console server has been configured with distributed Nagios monitoring enabled, you will also be presented with **Nagios Settings** options to enable assigned services on the host to be monitored (refer to **10. Nagios Integration**).
- Click **Apply.** This will create the new host and create a new managed device with the same name.

4.5 Trusted Networks

The **Trusted Networks** facility provides an option to assign specific IP addresses that users (Administrators and Users) must be located in order to have access to console server serial ports:



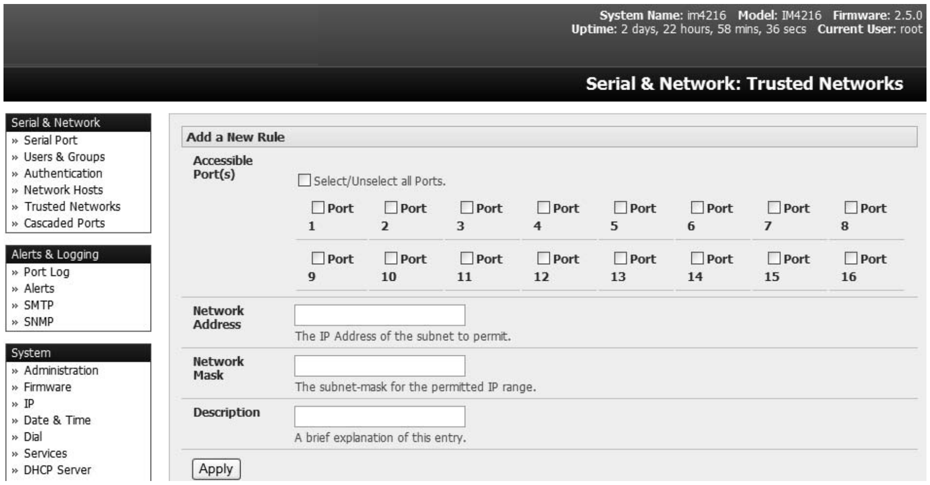
System Name: im4216 **Model:** IM4216 **Firmware:** 2.5.0
Uptime: 2 days, 22 hours, 57 mins, 42 secs **Current User:** root

Message Changes to configuration succeeded.

Network Address	Network Mask	Description		
192.168.200.200	255.255.255.255	Made Up	Edit	Delete

- Select **Serial & Network: Trusted Networks.**
- To add a new trusted network, select **Add Rule.**

***Note:** In the absence of rules, there are no access limitations to the IP address for which Users or Administrators can be located.*



System Name: im4216 **Model:** IM4216 **Firmware:** 2.5.0
Uptime: 2 days, 22 hours, 58 mins, 36 secs **Current User:** root

Add a New Rule

Accessible Port(s) □ Select/Unselect all Ports.

□ Port 1 □ Port 2 □ Port 3 □ Port 4 □ Port 5 □ Port 6 □ Port 7 □ Port 8

□ Port 9 □ Port 10 □ Port 11 □ Port 12 □ Port 13 □ Port 14 □ Port 15 □ Port 16

Network Address The IP Address of the subnet to permit.

Network Mask The subnet-mask for the permitted IP range.

Description A brief explanation of this entry.

- Select the **Accessible Port(s)** that the new rule is applied to.

- Enter the **Network Address** of the subnet to be permitted access.
- Specify the range of addresses that are to be permitted by entering a **Network Mask** for that permitted IP range.
  - To permit all the users located with a particular Class C network (204.15.5.0 say) connection to the assigned port then you would add the following Trusted Network New Rule:

Network IP Address	204.15.5.0
Subnet Mask	255.255.255.0

  - If you want to permit only the one user who is located at a specific IP address (204.15.5.13) to connect:

Network IP Address	204.15.5.13
Subnet Mask	255.255.255.255

  - If you wish to allow all users operating from within a specific range of IP addresses (any of the 30 addresses from 204.15.5.129 to 204.15.5.158) to be permitted connection to the assigned port:

Host /Subnet Address	204.15.5.128
Subnet Mask	255.255.255.224

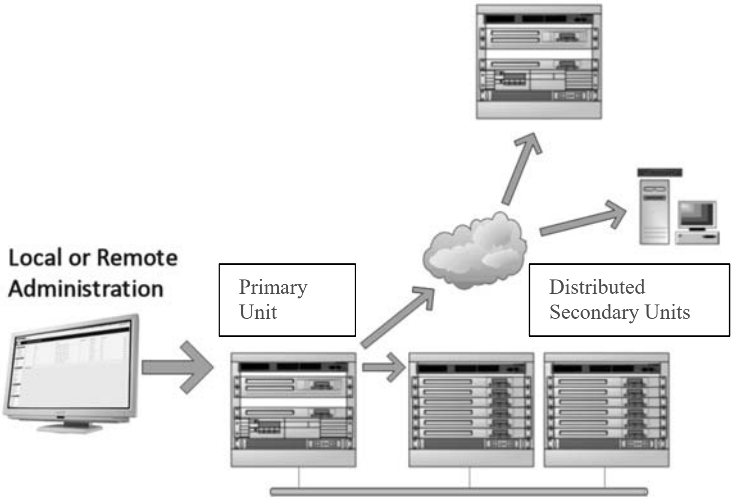
- Click **Apply.**

***Note:** The above trusted networks will limit access by Users and Administrators to the console serial ports. However, they do not restrict access by the Administrator to the console server itself or to attached hosts. To change the default settings for this access, you will to need to edit the iptables rules as described in section **14. Configuration from the Command Line**.*

4.6 Serial Port Cascading

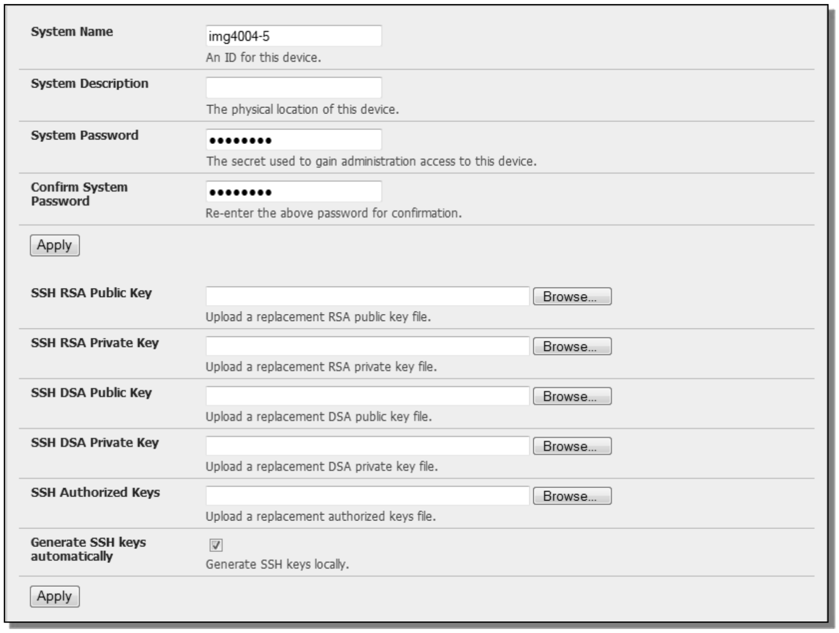
Cascaded Ports enable you to cluster distributed console servers so a large number of serial ports (up to 1000) can be configured and accessed through one IP address and managed through a single management console. The Primary console server controls other console servers as Secondary units and all the serial ports on the Secondary units appear as if they are part of the Primary.

Tripp Lite’s clustering connects each Secondary unit to the Primary unit via SSH connection. This is done using public key authentication so the Primary unit can access each Secondary unit using the SSH key pair (rather than using passwords). This ensures secure authenticated communications between Primary and Secondary units, enabling the Secondary units to be distributed locally on a LAN or remotely.



4.6.1 Automatically Generate and Upload SSH keys

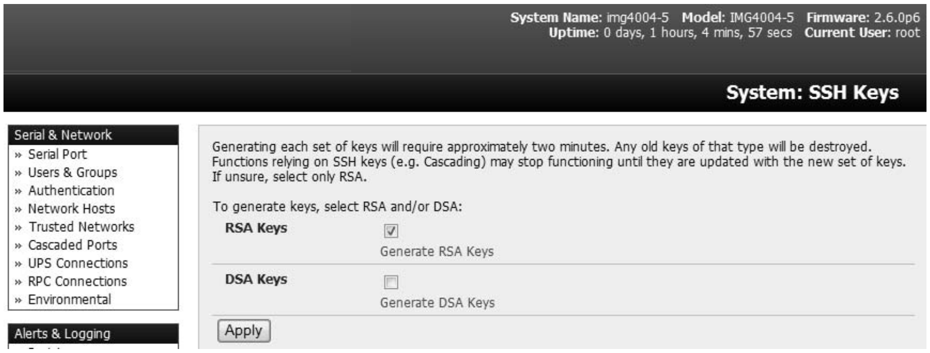
To set up public key authentication, you must first generate an RSA or DSA key pair and upload them into the Primary and Secondary console servers. This can all be done automatically from the Primary unit:



System Name	img4004-5 An ID for this device.
System Description	The physical location of this device.
System Password	•••••••• The secret used to gain administration access to this device.
Confirm System Password	•••••••• Re-enter the above password for confirmation.

SSH RSA Public Key	Browse... Upload a replacement RSA public key file.
SSH RSA Private Key	Browse... Upload a replacement RSA private key file.
SSH DSA Public Key	Browse... Upload a replacement DSA public key file.
SSH DSA Private Key	Browse... Upload a replacement DSA private key file.
SSH Authorized Keys	Browse... Upload a replacement authorized keys file.
Generate SSH keys automatically	☑ Generate SSH keys locally.

- Select **System: Administration** on the Primary unit’s management console.
- Check **Generate SSH keys automatically** and click **Apply.**



Generating each set of keys will require approximately two minutes. Any old keys of that type will be destroyed. Functions relying on SSH keys (e.g. Cascading) may stop functioning until they are updated with the new set of keys. If unsure, select only RSA.

To generate keys, select RSA and/or DSA:

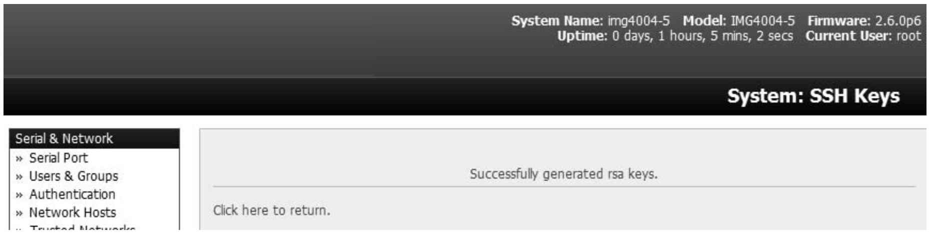
RSA Keys ☑ Generate RSA Keys

DSA Keys ☐ Generate DSA Keys

Apply

Next, you must select whether to generate keys using RSA and/or DSA (if unsure, select only RSA). Generating each set of keys will take approximately two minutes. During this time, the new keys will destroy any old keys that may previously been uploaded. Also, relying on SSH keys (e.g., cascading) may stop functioning until they are updated with the new set of keys. To generate keys:

- Select **RSA Keys** and/or **DSA Keys.**
- Click **Apply.**


System Name: img4004-5 Model: IMG4004-5 Firmware: 2.6.0p6
Uptime: 0 days, 1 hours, 5 mins, 2 secs Current User: root
System: SSH Keys
Serial & Network
» Serial Port
» Users & Groups
» Authentication
» Network Hosts

Successfully generated rsa keys.

Click here to return.

- Once the new keys have been successfully generated, simply **Click here to return**. The keys will automatically be uploaded to the Primary and connected Secondary units.

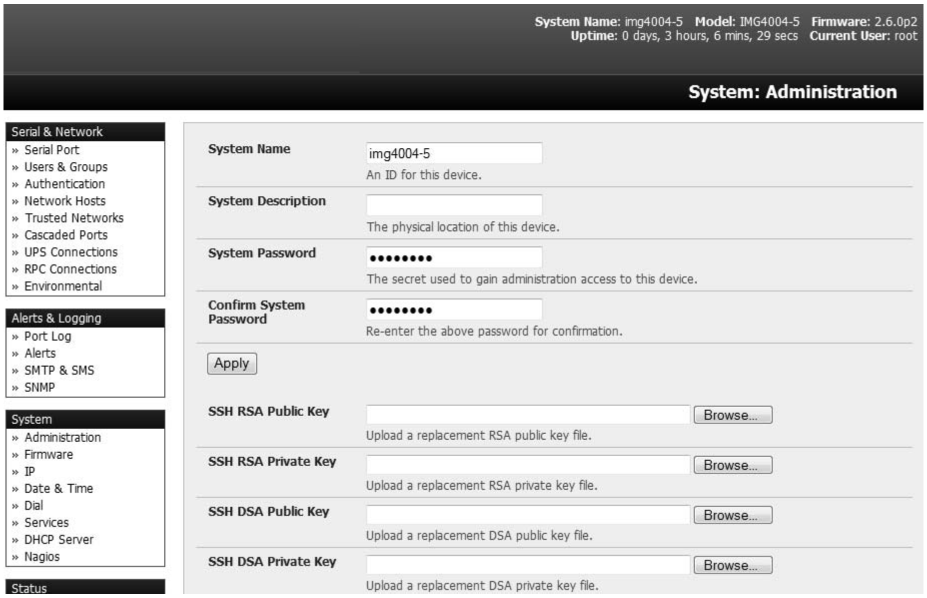
4.6.2 Manually Generate and Upload SSH Keys

Alternately, if you have a RSA or DSA key pair you can manually upload them to the Primary and Secondary console servers.

Note: *If you do not already have RSA or DSA key pair and you do not wish to use you will need to create a key pair using ssh-keygen, PuTTYgen or a similar tool as detailed in* ***15.6 Secure Shell (SSH) Public Key Authentication****.*

To manually upload the public and private key pair to the Primary console server:

- Select **System: Administration** on the Primary unit's management console.
- Browse to the location you saved the RSA (or DSA) public key and upload it to **SSH RSA (DSA) Public Key.**
- Browse to the saved RSA (or DSA) private key location and upload it to **SSH RSA (DSA) Private Key.**
- Click **Apply.**



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.6.0p2
Uptime: 0 days, 3 hours, 6 mins, 29 secs **Current User:** root

System: Administration

System Name img4004-5
An ID for this device.

System Description
The physical location of this device.

System Password ••••••••
The secret used to gain administration access to this device.

Confirm System Password ••••••••
Re-enter the above password for confirmation.

SSH RSA Public Key
Upload a replacement RSA public key file.

SSH RSA Private Key
Upload a replacement RSA private key file.

SSH DSA Public Key
Upload a replacement DSA public key file.

SSH DSA Private Key
Upload a replacement DSA private key file.

Next, you must register the public key as an authorized key on the Secondary unit. You will only need upload one RSA or DSA public key for each Secondary unit.

Note: *The use of key pairs may be confusing because in many cases, one file (public key) fulfills two roles – public key and authorized key. For a more information, refer to* ***15.6 Secure Shell (SSH) Public Key Authentication****.*

Select **System: Administration** on the Secondary unit's management console

- Browse again to the saved RSA (or DSA) public key and upload it to the Secondary unit's **SSH Authorized Key.**
- Click **Apply.**

The next step is to Fingerprint each new Secondary-Primary connection. This once-off step will validate your SSH session. On first connection, the Secondary will receive a fingerprint from the Primary unit, which will be used on all future connections:

- To establish the fingerprint, first log in to the Primary server as *root* and establish an SSH connection to the Secondary remote host:

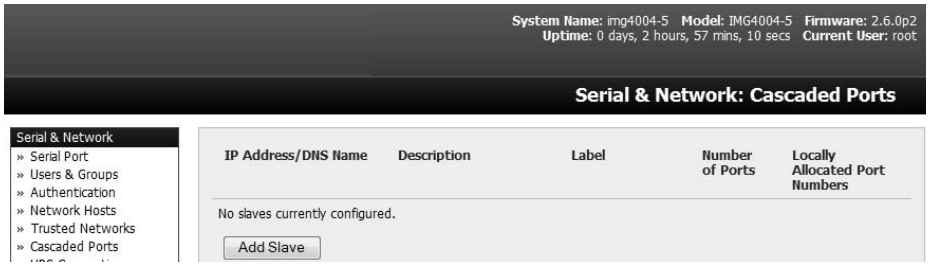
  # ssh remhost

Once the SSH connection has been established you will be asked to accept the key. Answer *yes* and the *fingerprint* will be added to the list of known hosts. Refer to **15.6 Secure Shell (SSH) Public Key Authentication** for more information.

- If asked to supply a password, there is a problem with uploading keys. The keys should remove any need to supply a password.

4.6.3 Configure the Secondary Units and their Serial Ports

To begin setting up the Secondary units and configuring Secondary serial ports from the Primary console server:

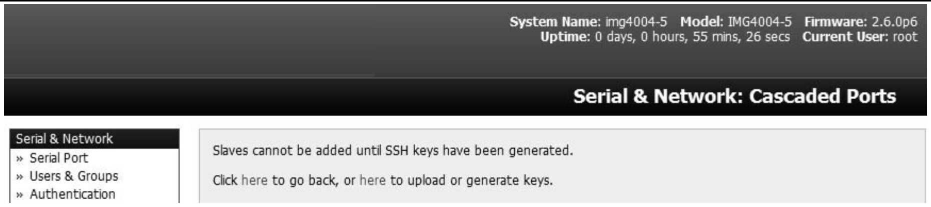

System Name: img4004-5 Model: IMG4004-5 Firmware: 2.6.0p2
Uptime: 0 days, 2 hours, 57 mins, 10 secs Current User: root
Serial & Network: Cascaded Ports
Serial & Network
» Serial Port
» Users & Groups
» Authentication
» Network Hosts
» Trusted Networks
» Cascaded Ports
Add Slave

IP Address/DNS Name	Description	Label	Number of Ports	Locally Allocated Port Numbers

No slaves currently configured.

- Select **Serial & Network: Cascaded Ports** on the Primary unit's management console:
- To add clustering support, select **Add Slave** (Secondary)**.**

Note: *You will be prevented from adding any Secondary units until you have automatically or manually generated SSH keys*:

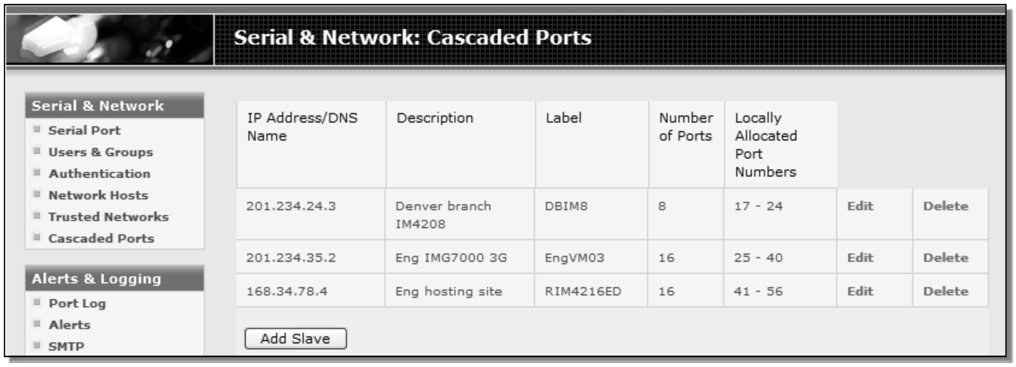

System Name: img4004-5 Model: IMG4004-5 Firmware: 2.6.0p6
Uptime: 0 days, 0 hours, 55 mins, 26 secs Current User: root
Serial & Network: Cascaded Ports
Serial & Network
» Serial Port
» Users & Groups
» Authentication

Slaves cannot be added until SSH keys have been generated.

Click here to go back, or here to upload or generate keys.

To define and configure a Secondary console server:

- Enter the remote **IP Address** (or DNS Name) for the Secondary console server.
- Enter a brief **Description** and a short **Label** for the Secondary unit (use a convention here that enables effective management of large networks of clustered console servers and the connected devices).
- Enter the full number of serial ports on the Secondary unit in **Number of Ports.**
- Click **Apply**. This will establish the SSH tunnel between the Primary unit and the new Secondary unit.



IP Address/DNS Name	Description	Label	Number of Ports	Locally Allocated Port Numbers		
201.234.24.3	Denver branch IM4208	DBIM8	8	17 - 24	Edit	Delete
201.234.35.2	Eng IMG7000 3G	EngVM03	16	25 - 40	Edit	Delete
168.34.78.4	Eng hosting site	RIM4216ED	16	41 - 56	Edit	Delete

The **Serial & Network: Cascaded Ports** menu displays all Secondary units and port numbers that have been allocated on the Primary unit. For example, if the Primary console server has 16 ports of its own, then ports 1-16 are pre-allocated to the Primary unit. As a result, the first Secondary unit added will be assigned port number 17.

Once you have added all the Secondary console servers, the Secondary's serial ports and the connected devices are configurable and accessible from the Primary unit's management console menu, accessible through the Primary's IP address.

- Select the appropriate **Serial & Network: Serial Port** and **Edit** to configure the serial ports on the Secondary unit.

- Select the appropriate **Serial & Network: Users & Groups** to add new users with access privileges to the Secondary unit's serial ports (or to extend existing users access privileges).
- Select the appropriate **Serial & Network: Trusted Networks** to specify network addresses that can access assigned Secondary serial ports.
- Select the appropriate **Alerts & Logging: Alerts** to configure Secondary port Connection, State Change or Pattern Match alerts.
- The configuration changes made on the Primary unit are propagated out to all the Secondarys when you click **Apply**.

4.6.4 Managing the Secondary Serial Ports

The Primary console server is in control of the Secondary unit's serial ports. For example, when changing a User's access privileges or editing any serial port setting on the Primary unit, the updated configuration files will be sent out to each Secondary in parallel. Each Secondary unit will then automatically make changes to their local configurations (and only make those changes that relate to its particular serial ports).

You can still use the local secondary management console to change the settings on any Secondary serial port (e.g., alter the baud rates). However, these changes will be overwritten the next time the Primary console server sends out a configuration file update.

Also, while the Primary unit is in control of all Secondary serial port related functions, it is not Primary over the Secondary network host connections or over the Secondary console server system itself.

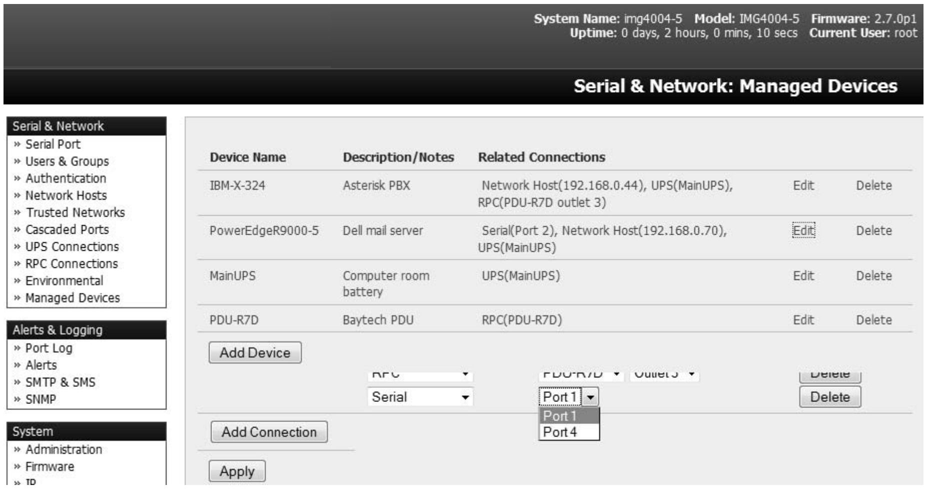
So Secondary functions such as IP, SMTP & SNMP Settings and Date & Time, DHCP server must be managed by accessing each Secondary unit directly. These functions are not overwritten when configuration changes are propagated from the Primary console server. Similarly, the Secondary unit's Network Host and IPMI settings have to be configured at each Secondary unit.

The Primary unit's management console also provides a consolidated view of the settings for both serial ports as well as the serial ports for the entire Secondary units. However, the Primary unit does not provide a fully consolidated view. For example, if you want to view who has logged in to cascaded serial ports from the Primary unit, you will see that *Status: Active Users* only displays those users active on the Primary unit's ports and you may need to write custom scripts to provide this view. For more information, refer to **10. Nagios Integration**.

4.7 Managed Devices

Managed devices present a consolidated view of all connections to a device that can be accessed and monitored through the console server. To view the connections to devices:

- Select **Serial & Network: Managed Devices.**



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 2 hours, 0 mins, 10 secs **Current User:** root

Serial & Network: Managed Devices

Device Name	Description/Notes	Related Connections		
IBM-X-324	Asterisk PBX	Network Host(192.168.0.44), UPS(MainUPS), RPC(PDU-R7D outlet 3)	Edit	Delete
PowerEdgeR9000-5	Dell mail server	Serial(Port 2), Network Host(192.168.0.70), UPS(MainUPS)	Edit	Delete
MainUPS	Computer room battery	UPS(MainUPS)	Edit	Delete
PDU-R7D	Baytech PDU	RPC(PDU-R7D)	Edit	Delete

Serial — Port 1 (Port 1, Port 4)

This screen displays all the managed devices with their Description/Notes and lists of all configured connections:

- *Serial Port #* (if serially connected) or
- *USB* (if USB connected)
- IP Address (if network connected)
- Power PDU/outlet details (if applicable) and any UPS connections

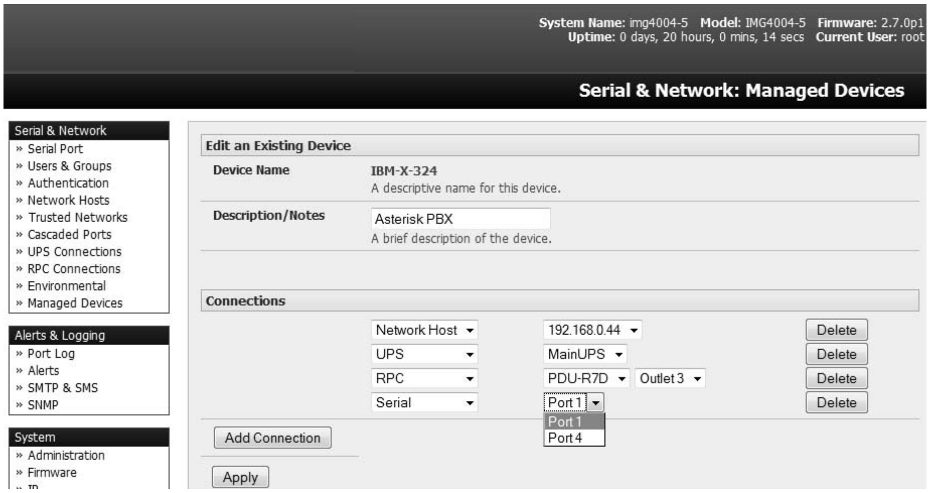
Devices such as servers will commonly have more than one power connection (e.g., dual power supplied) and more than one network connection (e.g., for BMC/service processor).

All users can view (but not edit) these managed device connections by selecting **Manage: Devices**. Only the Administrator can edit and add/delete managed devices and their connections.

To edit an existing device and add a new connection:

➢ Select **Edit** on the **Serial & Network: Managed Device**s and click **Add Connection.**

➢ Select the connection type for the new connection (Serial, Network Host, UPS or RPC). Then select the specific connection from the presented list of configured unallocated hosts/ports/outlets.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 20 hours, 0 mins, 14 secs **Current User:** root

Serial & Network: Managed Devices

Edit an Existing Device

Device Name — **IBM-X-324**
A descriptive name for this device.

Description/Notes — Asterisk PBX
A brief description of the device.

Connections

Network Host	192.168.0.44	Delete
UPS	MainUPS	Delete
RPC	PDU-R7D Outlet 3	Delete
Serial	Port 1 (Port 1, Port 4)	Delete

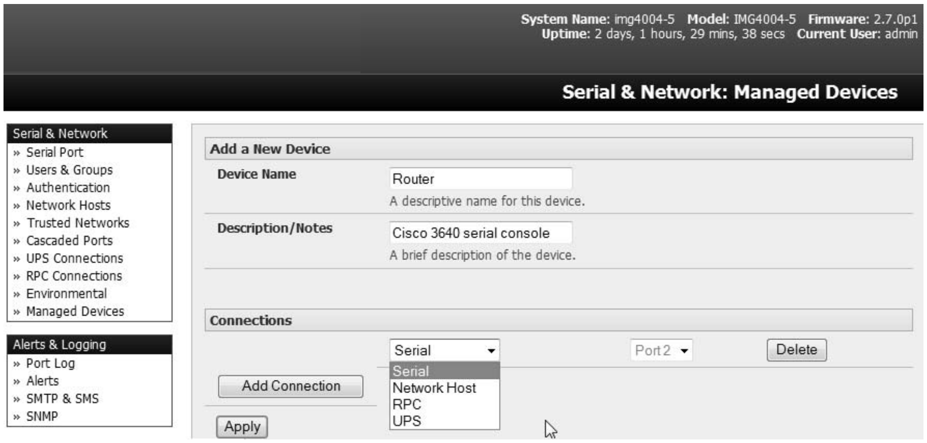
To add a new network-connected managed device:

- ➢ The Administrator adds a new network-connected Managed Device using **Add Host** on the **Serial & Network: Network Host** menu. This automatically creates a corresponding new managed device (refer to 4.4 Network Hosts*)*
- ➢ When adding a new network-connected RPC or UPS power device, you set up a Network Host, designate it as RPC or UPS, then go to **RPC Connections** (or **UPS Connections**) to configure the relevant connection. Again corresponding new Managed Device (with the same Name /Description as the RPC/UPS Host) is not created until this connection step is completed (refer *Chapter8 - Power, Environment and Digital I/O)*

Note: *The outlet names on this newly created PDU are by default "Outlet 1" "Outlet 2". When connecting a particular managed device that draws power from the outlet, the outlet will take the name of the powered managed device.*

To add a new serially connected managed device:

- ➢ Configure the serial port using the **Serial & Network: Serial Port** menu (refer to **4.1 Configure Serial Ports**).
- ➢ Select **Serial & Network: Managed Devices** and click **Add Device.**
- ➢ Enter a **Device Name** and **Description** for the managed device.



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.7.0p1
Uptime: 2 days, 1 hours, 29 mins, 38 secs Current User: admin

Serial & Network: Managed Devices

Add a New Device

Device Name: Router
A descriptive name for this device.

Description/Notes: Cisco 3640 serial console
A brief description of the device.

Connections

Serial | Port2

- ➢ Click **Add Connection**. Select **Serial** and the **Port** that connects to the managed device.
- ➢ To add a UPS/RPC power connection, network connection or another serial connection, click **Add Connection.**
- ➢ Click **Apply.**

Note: *To set up a new serially connected RPC, UPS or EMD device, first configure the serial port, designate it as a device, and then enter a name and description for that device in the* ***Serial & Network: RPC Connections*** *(or* ***UPS Connections*** *or* ***Environmental****). When applied, this will automatically create a corresponding new managed device with the same name/description as the RPC/UPS host (refer to* ***8. Power, Environment and Digital I/O****).*

The outlet names on the PDU are by default "Outlet 1" "Outlet 2". When connecting a particular managed device that draws power from the outlet, the outlet will take the name of the powered managed device.

4.8 IPsec VPN

The console servers include Openswan, a Linux implementation of the IPsec (IP security) protocols, which can be used to configure a Virtual Private Network (VPN). The VPN allows multiple sites or remote administrators to access the Tripp Lite advanced console server (and managed devices) securely over the internet.

The administrator can establish encrypted authenticated VPN connections between advanced console servers distributed at remote sites and a VPN gateway (such as Cisco router running *IOS IPsec)* on their central office network:

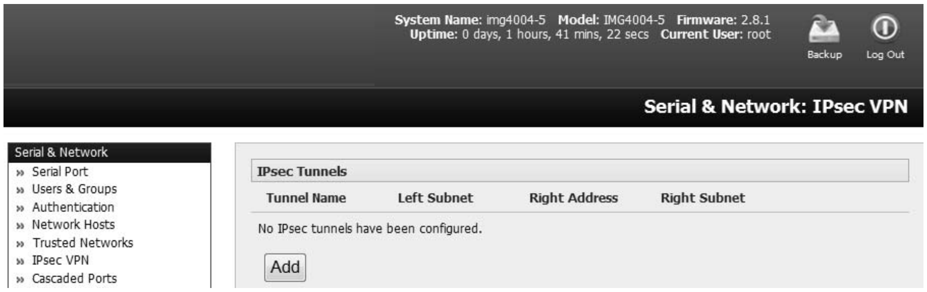
- Users and administrators at the central office can then securely access the remote console. servers and connected serial console devices and machines on the Management LAN subnet at the remote location as though they were local.
- With serial bridging, serial data from controller at the central office machine can be securely connected to the serially controlled devices at the remote sites (refer to **4.1 Configure Serial Ports**).

The road warrior administrator can use a VPN IPsec software client such as TheGreenBow (www.thegreenbow.com/vpn_gateway.html) or Shrew Soft (www.shrew.net/support) to remotely access the advanced *console server* and every machine on the Management LAN subnet at the remote location.

Configuration of IPsec is quite complex so Tripp Lite provides a simple GUI interface for basic set up as described below. However, for more detailed information on configuring Openswan IPsec at the command line and interconnecting with other IPsec VPN gateways and road warrior IPsec software, refer **http://wiki.openswan.org**

4.8.1 Enable the VPN Gateway

- ➢ Select **IPsec VPN** on the **Serial & Networks** menu.


System Name: img4004-5 Model: IMG4004-5 Firmware: 2.8.1
Uptime: 0 days, 1 hours, 41 mins, 22 secs Current User: root
Backup
Log Out
Serial & Network: IPsec VPN
Serial & Network
» Serial Port
» Users & Groups
» Authentication
» Network Hosts
» Trusted Networks
» IPsec VPN
» Cascaded Ports
Add

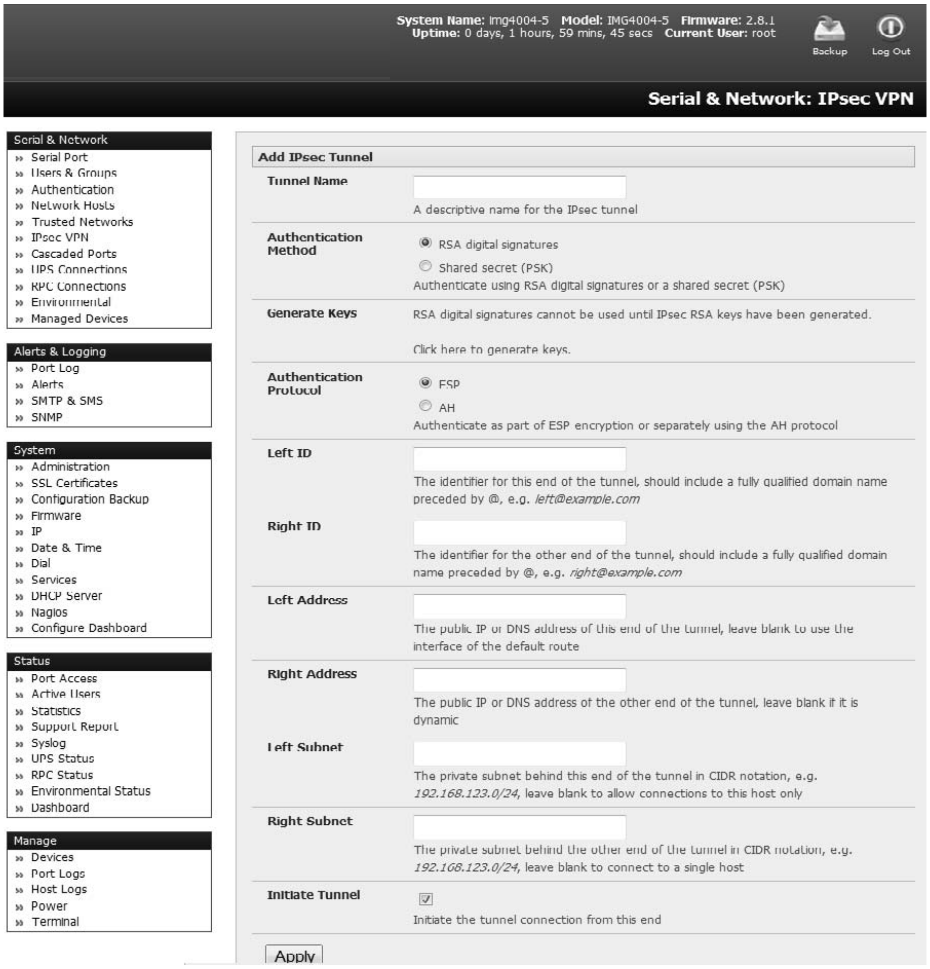
IPsec Tunnels

Tunnel Name	Left Subnet	Right Address	Right Subnet

No IPsec tunnels have been configured.

- ➢ Click **Add** and complete the *Add IPsec Tunnel* screen.

- ➢ Enter any descriptive name you wish to identify the IPsec Tunnel you are adding, such as *WestStOutlet-VPN.*



Add IPsec Tunnel

Tunnel Name

A descriptive name for the IPsec tunnel

Authentication Method

● RSA digital signatures

○ Shared secret (PSK)

Authenticate using RSA digital signatures or a shared secret (PSK)

Generate Keys

RSA digital signatures cannot be used until IPsec RSA keys have been generated.

Click here to generate keys.

Authentication Protocol

● ESP

○ AH

Authenticate as part of ESP encryption or separately using the AH protocol

Left ID

The identifier for this end of the tunnel, should include a fully qualified domain name preceded by @, e.g. *left@example.com*

Right ID

The identifier for the other end of the tunnel, should include a fully qualified domain name preceded by @, e.g. *right@example.com*

Left Address

The public IP or DNS address of this end of the tunnel, leave blank to use the interface of the default route

Right Address

The public IP or DNS address of the other end of the tunnel, leave blank if it is dynamic

Left Subnet

The private subnet behind this end of the tunnel in CIDR notation, e.g. *192.168.123.0/24*, leave blank to allow connections to this host only

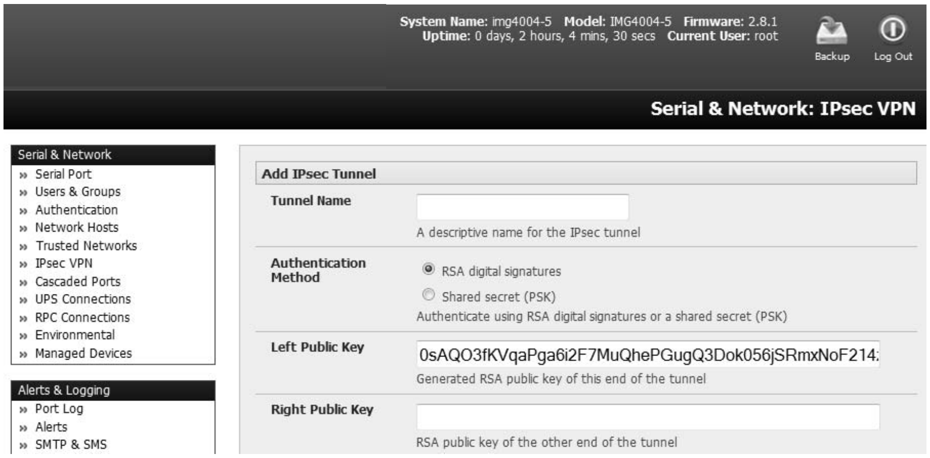
Right Subnet

The private subnet behind the other end of the tunnel in CIDR notation, e.g. *192.168.123.0/24*, leave blank to connect to a single host

Initiate Tunnel

☑ Initiate the tunnel connection from this end

- Select the **Authentication Method** to be used, either *RSA digital signatures* or a *Shared secret (PSK).*
    - If you select *RSA,* you will be asked *click here to generate keys*. This will generate an RSA public key for the console server (the *Left Public Key*). You will need to find out the key to be used on the remote gateway, and then cut and paste it into the *Right Public Key.*



Add IPsec Tunnel

Tunnel Name

A descriptive name for the IPsec tunnel

Authentication Method

● RSA digital signatures

○ Shared secret (PSK)

Authenticate using RSA digital signatures or a shared secret (PSK)

Left Public Key

0sAQO3fKVqaPga6i2F7MuQhePGugQ3Dok056jSRmxNoF214

Generated RSA public key of this end of the tunnel

Right Public Key

RSA public key of the other end of the tunnel

  - If you select *Shared secret,* you will need to enter a pre-shared secret (PSK). The PSK must match the PSK configured at the other end of the tunnel.

- In **Authentication Protocol,** select the authentication protocol to be used. Either authenticate as part of *ESP* (Encapsulating Security Payload) encryption or separately using the *AH* (Authentication Header) protocol.

- Enter a **Left ID** and **Right ID**. The local host/gateway and remote host/gateway use this identifier for IPsec negotiation and authentication. Each ID must include a '@' and can include a fully qualified domain name preceded by '@' (e.g. *left@example.com*).

- Enter the public IP or DNS address of this Tripp Lite VPN gateway as the **Left Address**. You can leave this blank to use the interface of the default route.

- In **Right Address,** enter the public IP or DNS address of the remote end of the tunnel (only if the remote end has a static or dyndns address). Otherwise, leave this blank.

- If the Tripp Lite VPN gateway is serving as a VPN gateway to a local subnet (e.g. the console server has a management LAN configured), enter the private subnet details in **Left Subnet.** Use the CIDR notation (where the IP address number is followed by a slash and the number of 'one' bits in the binary notation of the netmask). For example, 192.168.0.0/24 indicates an IP address where the first 24 bits are used as the network address. This is the same as 255.255.255.0. If the VPN access is only to the console server itself and to its attached serial console devices, leave **Left Subnet** blank.

- If there is a VPN gateway at the remote end, enter the private subnet details in **Right Subnet**. Again, use the CIDR notation and leave blank if there is only a remote host.

- Select **Initiate Tunnel** if the tunnel connection is to be initiated from the Left console server end. This can only be initiated from the VPN gateway (Left) if the remote end was configured with a static (or dyndns) IP address.

- Click **Apply** to save changes.

Note: *It is essential the configuration details set up on the advanced console server (referred to as the Left or Local host) exactly match the setup entered when configuring the Remote (Right) host/gateway or software client.*

4.9 OpenVPN

Console servers with firmware version 3.2 and later include OpenVPN. OpenVPN uses the OpenSSL library for encryption, authentication, and certification, which means it uses SSL/TSL (Secure Socket Layer/Transport Layer Security) for key exchange and can encrypt both data and control channels. Using OpenVPN allows for the building of cross-platform, point-to-point VPNs using either X.509 PKI (Public Key Infrastructure) or custom configuration files.

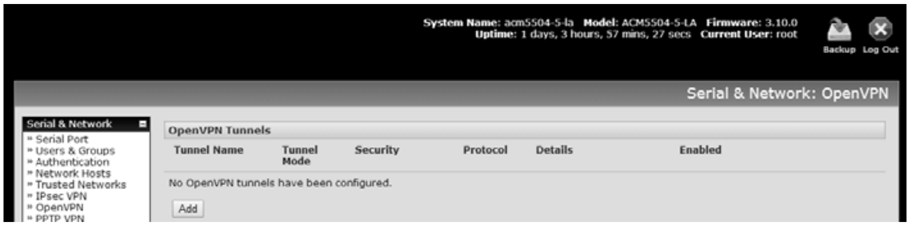
OpenVPN allows secure tunneling of data through a single TCP/UDP port over an unsecured network, thus providing secure access to multiple sites and secure remote administration to a console server over the Internet.

OpenVPN also allows the use of Dynamic IP addresses by both the server and client, thus providing client mobility. For example, an OpenVPN tunnel may be established between a roaming windows client and a Tripp Lite advanced console server within a data center.

Configuration of OpenVPN can be a complex undertaking. For ease and convenience, Tripp Lite provides a simple GUI interface for basic set up as described below. For more detailed information on configuring OpenVPN Access server or client, refer to the HOW TO and FAQs at **http://www.openvpn.net.**

4.9.1 Enable the OpenVPN

- Select **OpenVPN** on the **Serial & Networks** menu.



System Name: acm5504-5-la **Model:** ACM5504-5-LA **Firmware:** 3.10.0
Uptime: 1 days, 3 hours, 57 mins, 27 secs **Current User:** root

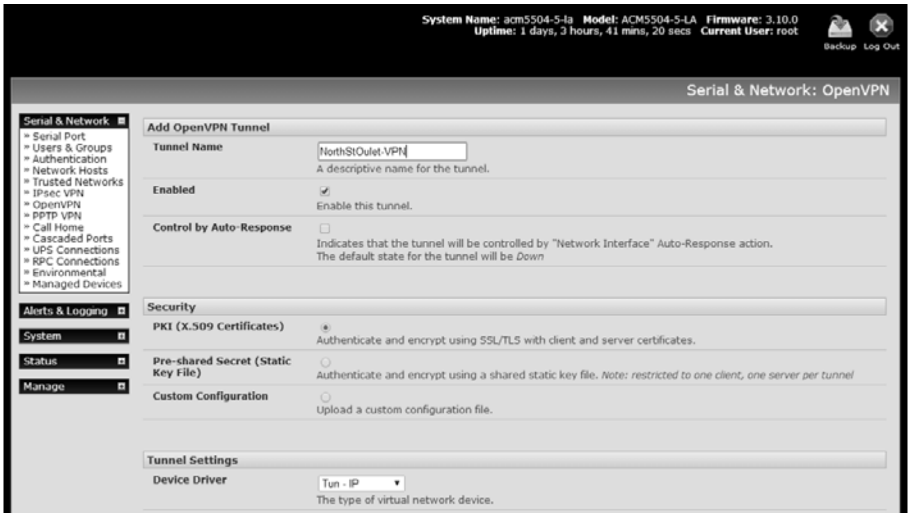
Serial & Network: OpenVPN

OpenVPN Tunnels

Tunnel Name	Tunnel Mode	Security	Protocol	Details	Enabled

No OpenVPN tunnels have been configured.

- Click **Add** and complete the *Add OpenVPN Tunnel* screen.
- Enter any descriptive name you wish to identify the OpenVPN Tunnel you are adding, for example *NorthStOutlet-VPN.*



System Name: acm5504-5-la **Model:** ACM5504-5-LA **Firmware:** 3.10.0
Uptime: 1 days, 3 hours, 41 mins, 20 secs **Current User:** root

Serial & Network: OpenVPN

Add OpenVPN Tunnel

Tunnel Name: NorthStOulet-VPN
A descriptive name for the tunnel.

Enabled: ☑
Enable this tunnel.

Control by Auto-Response: □
Indicates that the tunnel will be controlled by "Network Interface" Auto-Response action.
The default state for the tunnel will be *Down*

Security

PKI (X.509 Certificates): ●
Authenticate and encrypt using SSL/TLS with client and server certificates.

Pre-shared Secret (Static Key File): ○
Authenticate and encrypt using a shared static key file. *Note: restricted to one client, one server per tunnel*

Custom Configuration: ○
Upload a custom configuration file.

Tunnel Settings

Device Driver: Tun - IP
The type of virtual network device.

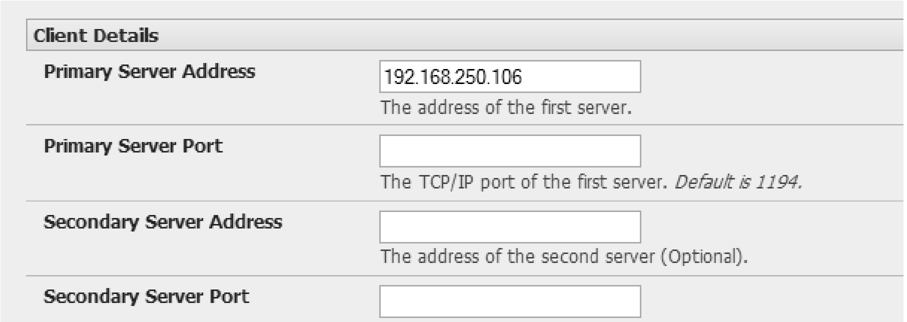
- Select the authentication method to be used. To authenticate using certificates, select *PKI (X.509 Certificates)* or select Custom Configuration to upload custom configuration files. Custom configurations must be stored in */etc/config*.

Note: *If you select PKI (public key infrastructure), you will need to establish:*

- *Separate certificate (also known as a public key). This Certificate File will be a *.crt file type*
- *Private Key for the server and each client. This Private Key File will be a *.key file type*
- *Primary Certificate Authority (CA) certificate and key, which is used to sign each of the server and client certificates. This Root CA Certificate will be a *.crt file type*

For a server you may also need dh1024.pem (*Diffie Hellman* parameters). Refer to http://openvpn.net/easyrsa.html for a guide on basic RSA key management. For alternative authentication methods, go to http://openvpn.net/index.php/documentation/howto.html#auth. For more information, go to http://openvpn.net/howto.html.

- Select the **Device Driver** to be used, either *Tun-IP* or *Tap-Ethernet*. The TUN (network tunnel) and TAP (network tap) drivers are virtual network drivers that support IP tunneling and Ethernet tunneling, respectively. TUN and TAP are part of the Linux kernel.
- Select either *UDP* or *TCP* as the **Protocol.** UDP is the default and preferred protocol for OpenVPN.
- In **Tunnel Mode,** assign whether this is the *Client* or *Server* end of the tunnel. When running as a server, the advanced *console server* supports multiple clients connecting to the VPN server over the same port.
- Check or uncheck the **Compression** button to enable or disable compression.

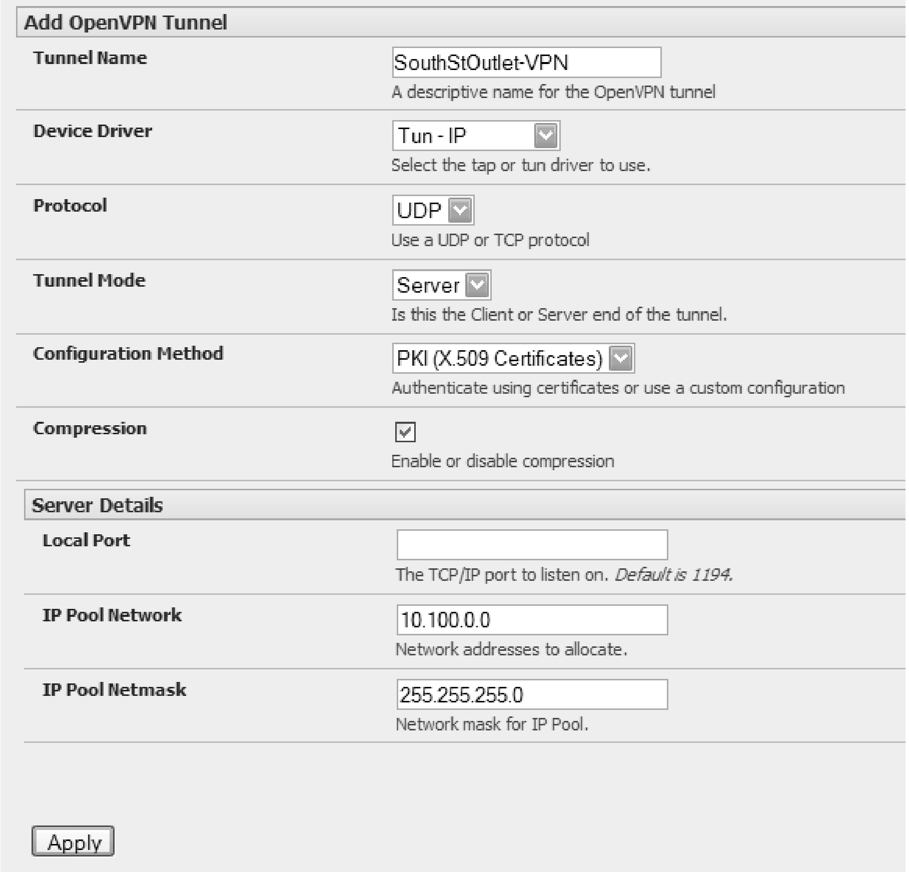


Client Details

Primary Server Address	192.168.250.106 The address of the first server.
Primary Server Port	The TCP/IP port of the first server. *Default is 1194.*
Secondary Server Address	The address of the second server (Optional).
Secondary Server Port	

4.9.2 Configure as Server or Client

- Complete the **Client Details** or **Server Details,** depending on the Tunnel Mode selected.
  - If *Client* has been selected, the Primary Server Address will be the address of the OpenVPN Server.
  - If *Server* has been selected, enter the IP Pool Network address and the IP Pool Network mask for the IP Pool. The network defined by the IP Pool Network address/mask is used to provide the addresses for connecting clients.
- Click **Apply** to save changes.



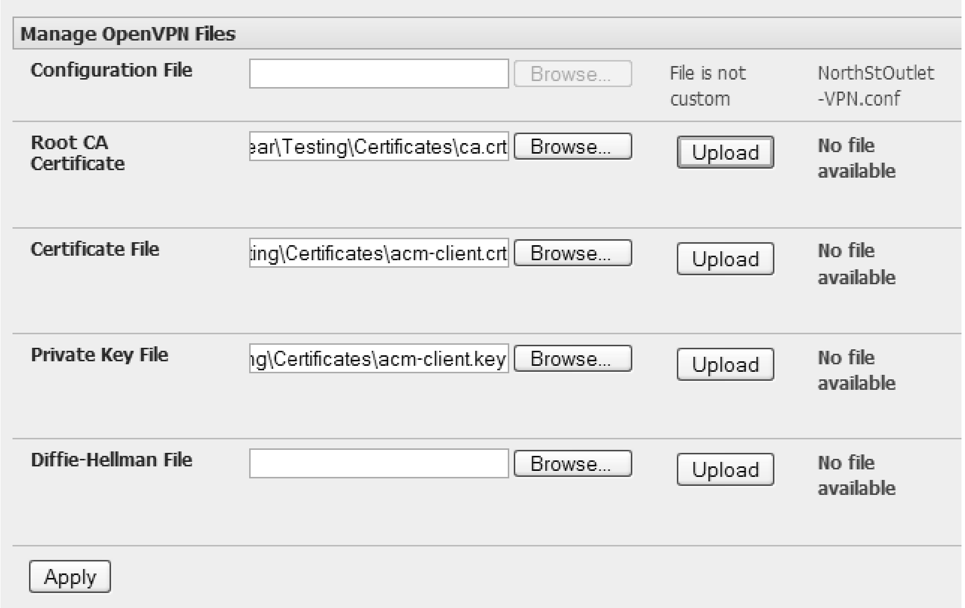
Add OpenVPN Tunnel

Tunnel Name	SouthStOutlet-VPN A descriptive name for the OpenVPN tunnel
Device Driver	Tun - IP Select the tap or tun driver to use.
Protocol	UDP Use a UDP or TCP protocol
Tunnel Mode	Server Is this the Client or Server end of the tunnel.
Configuration Method	PKI (X.509 Certificates) Authenticate using certificates or use a custom configuration
Compression	☑ Enable or disable compression

Server Details

Local Port	The TCP/IP port to listen on. *Default is 1194.*
IP Pool Network	10.100.0.0 Network addresses to allocate.
IP Pool Netmask	255.255.255.0 Network mask for IP Pool.

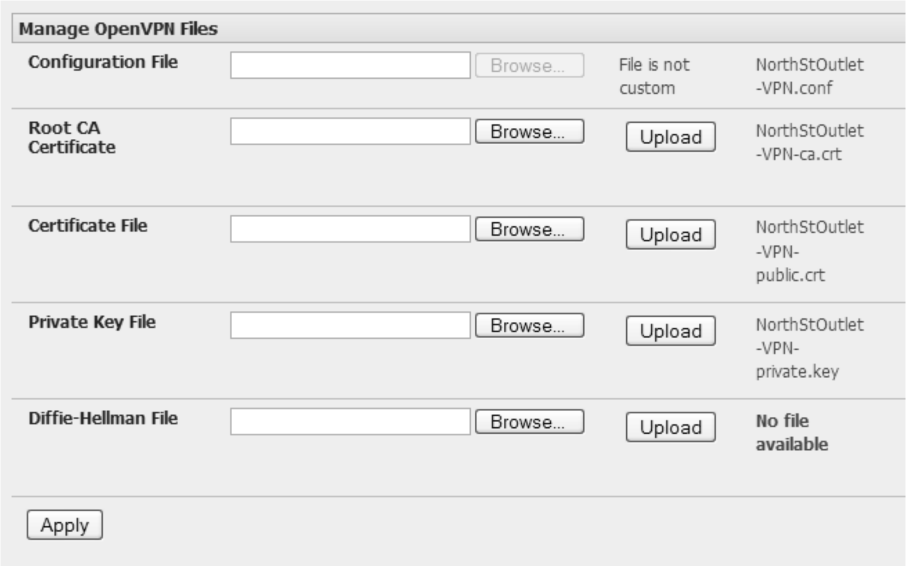
- To enter authentication certificates and files, **Edit** the OpenVPN tunnel.
- Select the **Manage OpenVPN Files** tab. Upload or browse to relevant authentication certificates and files.



Manage OpenVPN Files

Configuration File		Browse...	File is not custom	NorthStOutlet-VPN.conf
Root CA Certificate	ear\Testing\Certificates\ca.crt	Browse...	Upload	**No file available**
Certificate File	ting\Certificates\acm-client.crt	Browse...	Upload	**No file available**
Private Key File	ng\Certificates\acm-client.key	Browse...	Upload	**No file available**
Diffie-Hellman File		Browse...	Upload	**No file available**

- Click **Apply** to save changes. Saved files will be displayed in red on the right-hand side of the Upload button.

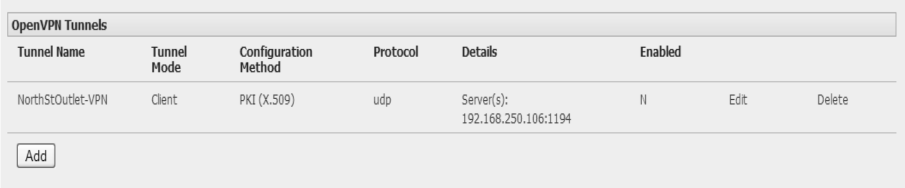


Manage OpenVPN Files

Configuration File	Browse...	File is not custom	NorthStOutlet-VPN.conf
Root CA Certificate	Browse...	Upload	NorthStOutlet-VPN-ca.crt
Certificate File	Browse...	Upload	NorthStOutlet-VPN-public.crt
Private Key File	Browse...	Upload	NorthStOutlet-VPN-private.key
Diffie-Hellman File	Browse...	Upload	No file available

Apply

- To enable OpenVPN**, Edit** the OpenVPN tunnel.



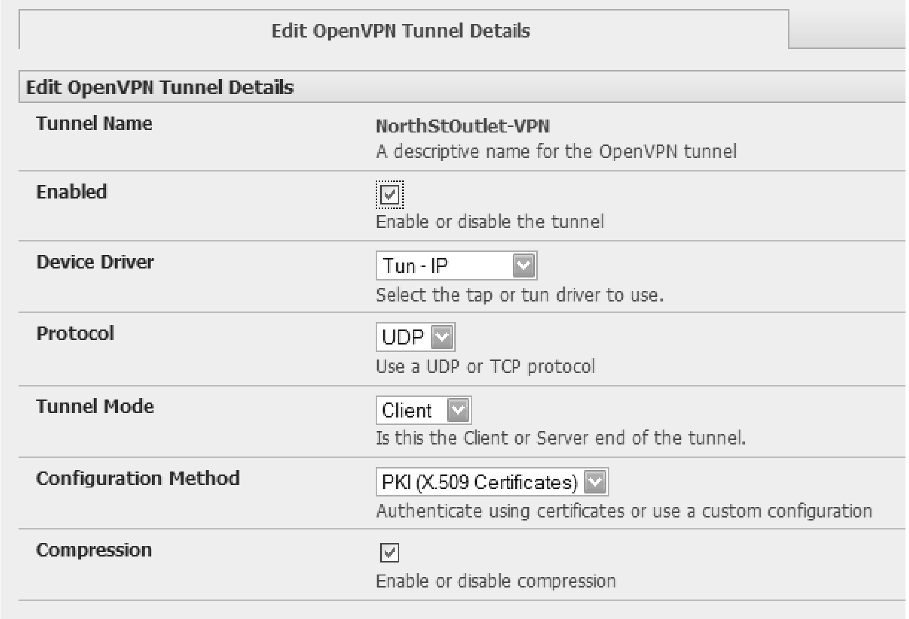
OpenVPN Tunnels

Tunnel Name	Tunnel Mode	Configuration Method	Protocol	Details	Enabled		
NorthStOutlet-VPN	Client	PKI (X.509)	udp	Server(s): 192.168.250.106:1194	N	Edit	Delete

Add

- Check the **Enabled** button.
- Click **Apply** to save changes.

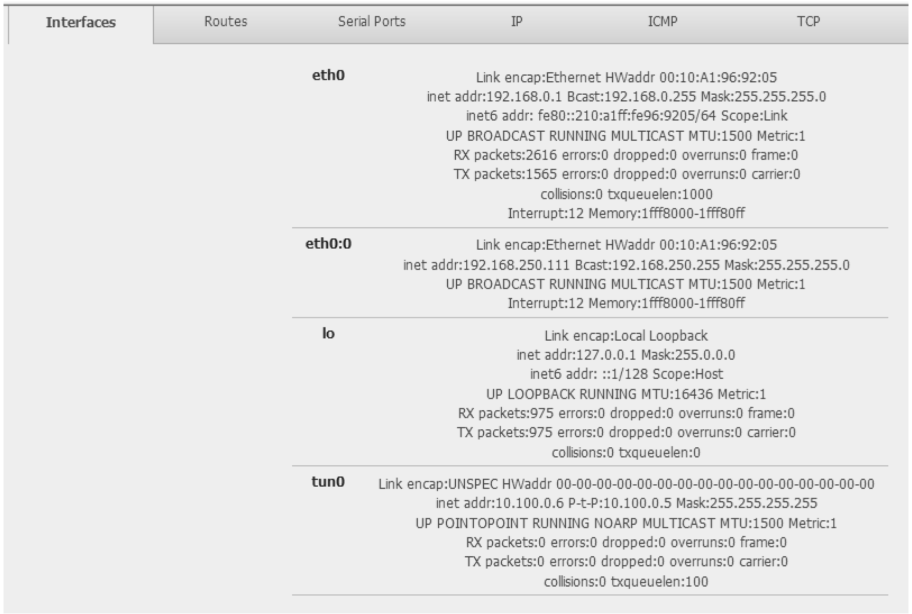
***Note:** Please make sure that the console server system time is correct when working with OpenVPN. Otherwise, authentication issues may arise.*



Edit OpenVPN Tunnel Details

Tunnel Name	NorthStOutlet-VPN A descriptive name for the OpenVPN tunnel
Enabled	☑ Enable or disable the tunnel
Device Driver	Tun - IP Select the tap or tun driver to use.
Protocol	UDP Use a UDP or TCP protocol
Tunnel Mode	Client Is this the Client or Server end of the tunnel.
Configuration Method	PKI (X.509 Certificates) Authenticate using certificates or use a custom configuration
Compression	☑ Enable or disable compression

- Select **Statistics** on the **Status** menu to verify that the tunnel is operational.

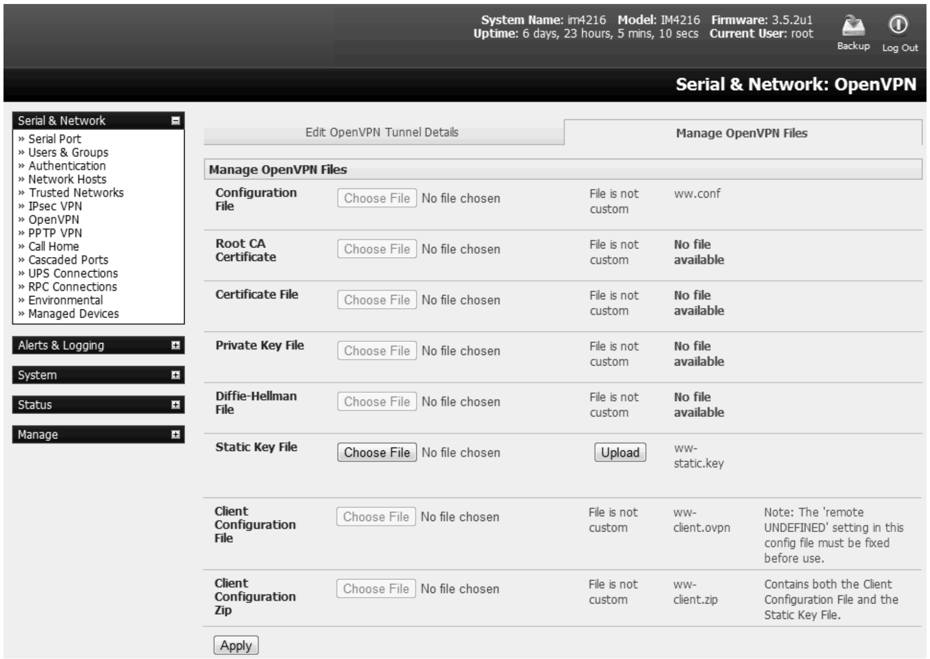


```
eth0     Link encap:Ethernet HWaddr 00:10:A1:96:92:05
         inet addr:192.168.0.1 Bcast:192.168.0.255 Mask:255.255.255.0
         inet6 addr: fe80::210:a1ff:fe96:9205/64 Scope:Link
         UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
         RX packets:2616 errors:0 dropped:0 overruns:0 frame:0
         TX packets:1565 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         Interrupt:12 Memory:1fff8000-1fff80ff

eth0:0   Link encap:Ethernet HWaddr 00:10:A1:96:92:05
         inet addr:192.168.250.111 Bcast:192.168.250.255 Mask:255.255.255.0
         UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
         Interrupt:12 Memory:1fff8000-1fff80ff

lo       Link encap:Local Loopback
         inet addr:127.0.0.1 Mask:255.0.0.0
         inet6 addr: ::1/128 Scope:Host
         UP LOOPBACK RUNNING MTU:16436 Metric:1
         RX packets:975 errors:0 dropped:0 overruns:0 frame:0
         TX packets:975 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:0

tun0     Link encap:UNSPEC HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
         inet addr:10.100.0.6 P-t-P:10.100.0.5 Mask:255.255.255.255
         UP POINTOPOINT RUNNING NOARP MULTICAST MTU:1500 Metric:1
         RX packets:0 errors:0 dropped:0 overruns:0 frame:0
         TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:100
```

4.9.3 Set Up Windows OpenVPN Client and Server

Windows does not come standard with any OpenVPN server or client. This section outlines the installation and configuration of a Windows OpenVPN client or a Windows OpenVPN server and setting up a VPN connection to a console server.

Console servers with firmware version 3.5.2 and later will generate Windows client configurations automatically from the GUI for **Pre-shared Secret (Static Key File)** configurations.



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.2u1
Uptime: 6 days, 23 hours, 5 mins, 10 secs **Current User:** root

Serial & Network: OpenVPN

Manage OpenVPN Files

Configuration File	No file chosen	File is not custom	ww.conf	
Root CA Certificate	No file chosen	File is not custom	**No file available**	
Certificate File	No file chosen	File is not custom	**No file available**	
Private Key File	No file chosen	File is not custom	**No file available**	
Diffie-Hellman File	No file chosen	File is not custom	**No file available**	
Static Key File	No file chosen	Upload	ww-static.key	
Client Configuration File	No file chosen	File is not custom	ww-client.ovpn	Note: The 'remote UNDEFINED' setting in this config file must be fixed before use.
Client Configuration Zip	No file chosen	File is not custom	ww-client.zip	Contains both the Client Configuration File and the Static Key File.

Alternately, OpenVPN GUI for Windows software (which includes the standard OpenVPN package, plus a Windows GUI) can be downloaded from *http://openvpn.se/download.html*.

- ➢ Once installed on the Windows machine, an OpenVPN icon will have been created in the Notification Area located in the right side of the taskbar. Right click on this icon to start (and stop) VPN connections, edit configurations and view logs.

When the OpenVPN software is running, the *C:\Program Files\OpenVPN\config* folder will be scanned for "*.opvn*" files. This folder will be rechecked for new configuration files whenever the OpenVPN GUI icon is right clicked. Once OpenVPN is installed, a configuration file will need to be created:

- ➢ Using a text editor, create an *xxxx.ovpn* file and save *in C:\Program Files\OpenVPN\config*. For example, *C:\Program Files\OpenVPN\config\client.ovpn.*

  An example of an OpenVPN Windows client configuration file is shown below:

```
# description: B096_client
client
proto udp
verb 3
dev tun
remote 192.168.250.152
port 1194
ca c:\\openvpnkeys\\ca.crt
cert c:\\openvpnkeys\\client.crt
key c:\\openvpnkeys\\client.key
nobind
persist-key
persist-tun
comp-lzo
```

  An example of an OpenVPN Windows Server configuration file is shown below:

```
server 10.100.10.0 255.255.255.0
port 1194
keepalive 10 120
proto udp
```

```
mssfix 1400
persist-key
persist-tun
dev tun
ca c:\\openvpnkeys\\ca.crt
cert c:\\openvpnkeys\\server.crt
key c:\\openvpnkeys\\server.key
dh c:\\openvpnkeys\\dh.pem
comp-lzo
verb 1
syslog B096_OpenVPN_Server
```

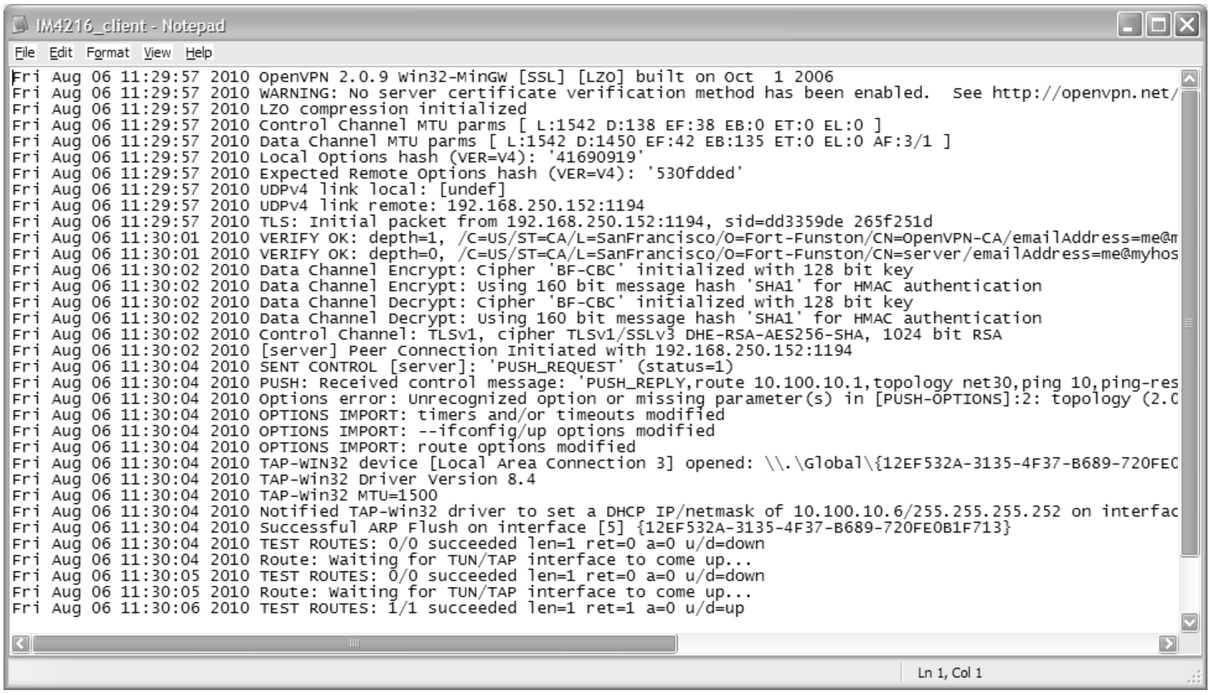
The Windows client/server configuration file options are:

Options	**Description**
#description:	This is a comment describing the configuration. Comment lines start with “#” and are ignored by OpenVPN.
Client server	Specify whether this will be a client or server configuration file. In the server configuration file, define the IP address pool and netmask. For example, server 10.100.10.0 255.255.255.0.
proto udp proto tcp	Set the protocol to UDP or TCP. The client and server must use the same settings.
mssfix <max. size>	Mssfix sets the maximum size of the packet. This is only useful for UDP if problems occur.
verb <level>	Set log file verbosity level. Log verbosity level can be set from 0 (minimum) to 15 (maximum). For example, 0 = silent except for fatal errors 3 = medium output, good for general usage 5 = helps with debugging connection problems 9 = extremely verbose, excellent for troubleshooting
dev tun dev tap	Select **dev tun** to create a routed IP tunnel or **dev tap** to create an Ethernet tunnel. The client and server must use the same settings.
remote <host>	The hostname/IP of OpenVPN server when operating as a client. Enter either the DNS hostname or the static IP address of the server.
Port	The UDP/TCP port of the server.
Keepalive	Keepalive uses ping to keep the OpenVPN session alive. “Keepalive 10 120” pings every 10 seconds and assumes the remote peer is down if no ping has been received over a 120 second time period.
http-proxy <proxy server> <proxy port #>	If a proxy is required to access the server, enter the proxy server DNS name or IP and port number.
ca <file name>	Enter the CA certificate file name and location. The same CA certificate file can be used by the server and all clients. ***Note:*** *Ensure each “\” in the directory path is replaced with “\\”. For example, c:\openvpnkeys\ca.crt will become c:\\openvpnkeys\\ca.crt.*
cert <file name>	Enter the client’s or server’s certificate file name and location. Each client should have its own certificate and key files. ***Note:*** *Ensure each “\” in the directory path is replaced with “\\”.*
key <file name>	Enter the file name and location of the client’s or server’s key. Each client should have its own certificate and key files. ***Note:*** *Ensure each “\” in the directory path is replaced with “\\”.*
dh <file name>	This is used by the server only. Enter the path to the key with the Diffie-Hellman parameters.
Nobind	“Nobind” is used when clients do not need to bind to a local address or specific local port number. This is the case in most client configurations.
persist-key	This option prevents the reloading of keys across restarts.
persist-tun	This option prevents the close and reopen of TUN/TAP devices across restarts.
cipher BF-CBC Blowfish (default) cipher AES-128-CBC AES	Select a cryptographic cipher. The client and server must use the same settings.

cipher DES-EDE3-CBC Triple-DES	
comp-lzo	Enable compression on the OpenVPN link. This must be enabled on both the client and the server.
syslog	By default, logs are located in syslog or, if running as a service on Window, in \Program Files\OpenVPN\log directory.

To initiate the OpenVPN tunnel following the creation of the client/server configuration files:

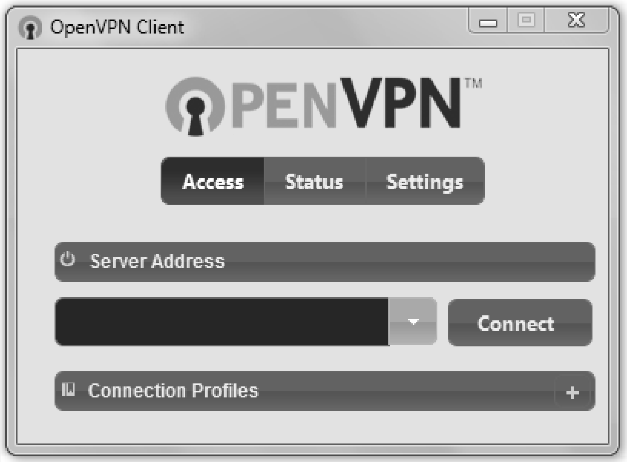
- Right click on the **OpenVPN** icon in the Notification Area.
- Select the newly created client or server configuration. For example, B096_client.
- Right click on the OpenVPN icon in the lower-right corner, select the desired client and click **Connect**.
- The log file will display as the connection is established.



```
Fri Aug 06 11:29:57 2010 OpenVPN 2.0.9 Win32-MinGW [SSL] [LZO] built on Oct  1 2006
Fri Aug 06 11:29:57 2010 WARNING: No server certificate verification method has been enabled.  See http://openvpn.net/
Fri Aug 06 11:29:57 2010 LZO compression initialized
Fri Aug 06 11:29:57 2010 Control Channel MTU parms [ L:1542 D:138 EF:38 EB:0 ET:0 EL:0 ]
Fri Aug 06 11:29:57 2010 Data Channel MTU parms [ L:1542 D:1450 EF:42 EB:135 ET:0 EL:0 AF:3/1 ]
Fri Aug 06 11:29:57 2010 Local Options hash (VER=V4): '41690919'
Fri Aug 06 11:29:57 2010 Expected Remote Options hash (VER=V4): '530fdded'
Fri Aug 06 11:29:57 2010 UDPv4 link local: [undef]
Fri Aug 06 11:29:57 2010 UDPv4 link remote: 192.168.250.152:1194
Fri Aug 06 11:29:57 2010 TLS: Initial packet from 192.168.250.152:1194, sid=dd3359de 265f251d
Fri Aug 06 11:30:01 2010 VERIFY OK: depth=1, /C=US/ST=CA/L=SanFrancisco/O=Fort-Funston/CN=OpenVPN-CA/emailAddress=me@m
Fri Aug 06 11:30:01 2010 VERIFY OK: depth=0, /C=US/ST=CA/L=SanFrancisco/O=Fort-Funston/CN=server/emailAddress=me@myhos
Fri Aug 06 11:30:02 2010 Data Channel Encrypt: Cipher 'BF-CBC' initialized with 128 bit key
Fri Aug 06 11:30:02 2010 Data Channel Encrypt: Using 160 bit message hash 'SHA1' for HMAC authentication
Fri Aug 06 11:30:02 2010 Data Channel Decrypt: Cipher 'BF-CBC' initialized with 128 bit key
Fri Aug 06 11:30:02 2010 Data Channel Decrypt: Using 160 bit message hash 'SHA1' for HMAC authentication
Fri Aug 06 11:30:02 2010 Control Channel: TLSv1, cipher TLSv1/SSLv3 DHE-RSA-AES256-SHA, 1024 bit RSA
Fri Aug 06 11:30:02 2010 [server] Peer Connection Initiated with 192.168.250.152:1194
Fri Aug 06 11:30:04 2010 SENT CONTROL [server]: 'PUSH_REQUEST' (status=1)
Fri Aug 06 11:30:04 2010 PUSH: Received control message: 'PUSH_REPLY,route 10.100.10.1,topology net30,ping 10,ping-res
Fri Aug 06 11:30:04 2010 Options error: Unrecognized option or missing parameter(s) in [PUSH-OPTIONS]:2: topology (2.0
Fri Aug 06 11:30:04 2010 OPTIONS IMPORT: timers and/or timeouts modified
Fri Aug 06 11:30:04 2010 OPTIONS IMPORT: --ifconfig/up options modified
Fri Aug 06 11:30:04 2010 OPTIONS IMPORT: route options modified
Fri Aug 06 11:30:04 2010 TAP-WIN32 device [Local Area Connection 3] opened: \\.\Global\{12EF532A-3135-4F37-B689-720FE0
Fri Aug 06 11:30:04 2010 TAP-Win32 Driver Version 8.4
Fri Aug 06 11:30:04 2010 TAP-Win32 MTU=1500
Fri Aug 06 11:30:04 2010 Notified TAP-Win32 driver to set a DHCP IP/netmask of 10.100.10.6/255.255.255.252 on interfac
Fri Aug 06 11:30:04 2010 Successful ARP Flush on interface [5] {12EF532A-3135-4F37-B689-720FE0B1F713}
Fri Aug 06 11:30:04 2010 TEST ROUTES: 0/0 succeeded len=1 ret=0 a=0 u/d=down
Fri Aug 06 11:30:04 2010 Route: Waiting for TUN/TAP interface to come up...
Fri Aug 06 11:30:05 2010 TEST ROUTES: 0/0 succeeded len=1 ret=0 a=0 u/d=down
Fri Aug 06 11:30:05 2010 Route: Waiting for TUN/TAP interface to come up...
Fri Aug 06 11:30:06 2010 TEST ROUTES: 1/1 succeeded len=1 ret=1 a=0 u/d=up
```

- Once established, the OpenVPN icon will display a message notifying the successful connection and assigned IP. This information, as well as the time the connection was established, is available anytime by scrolling over the OpenVPN icon.

Note: *An alternate OpenVPN Windows client can be downloaded from http://www.openvpn.net/index.php/openvpn-client/downloads.html. Refer to http://www.openvpn.net/index.php/openvpn-client/howto-openvpn-client.html for help.*


OpenVPN Client
OPENVPN™
Access
Status
Settings
Server Address
Connect
Connection Profiles
+

4.10 PPTP VPN

Console servers with firmware version 3.5.2 and later include a PPTP (Point-to-Point Tunneling Protocol) server. PPTP is typically used for communications over a physical or virtual serial link. The PPP endpoints define a virtual IP address to themselves. Routes to networks can then be defined with these IP addresses as the gateway, which results in traffic being sent across the tunnel. PPTP establishes a tunnel between the physical PPP endpoints and securely transports data across the tunnel.

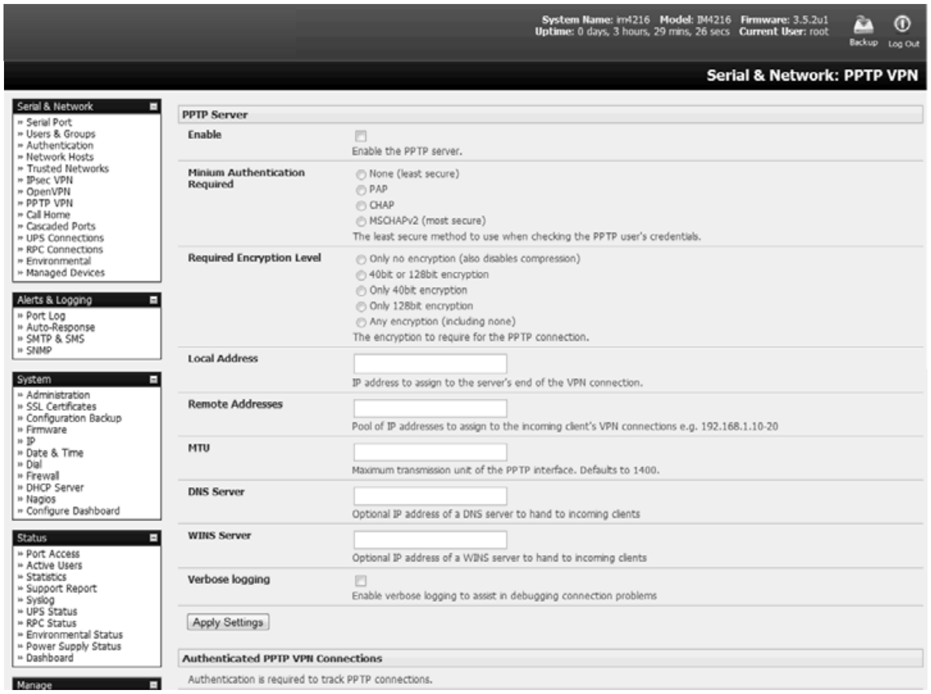
The strength of PPTP is its ease of configuration and integration into existing Microsoft infrastructure. It is generally used for connecting single remote Windows clients. If you take your portable computer on a business trip, you can dial a local number to connect to your Internet access service provider (ISP) and then create a second connection (*tunnel*) into your office network across the Internet and have the same access to your corporate network as if you were connected directly from your office. Similarly, telecommuters also set up a VPN tunnel over their cable modem or DSL links to their local ISP.

To set up a PPTP connection from a remote Windows client to your Tripp Lite console server and local network:

1. Enable and configure the PPTP VPN server on your Tripp Lite console server.
2. Set up VPN user accounts on the Tripp Lite console server and enable the appropriate authentication.
3. Configure the VPN clients at the remote sites. The client does not require special software as the PPTP Server supports the standard PPTP client software included with Windows NT and later.
4. Connect to the remote VPN.

4.10.1 Enable the PPTP VPN Server

- ➢ Select **PPTP VPN** on the **Serial & Networks** menu.



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.2u1
Uptime: 0 days, 3 hours, 29 mins, 26 secs **Current User:** root

Serial & Network: PPTP VPN

PPTP Server

Enable □
Enable the PPTP server.

Minium Authentication Required
○ None (least secure)
○ PAP
○ CHAP
○ MSCHAPv2 (most secure)
The least secure method to use when checking the PPTP user's credentials.

Required Encryption Level
○ Only no encryption (also disables compression)
○ 40bit or 128bit encryption
○ Only 40bit encryption
○ Only 128bit encryption
○ Any encryption (including none)
The encryption to require for the PPTP connection.

Local Address
IP address to assign to the server's end of the VPN connection.

Remote Addresses
Pool of IP addresses to assign to the incoming client's VPN connections e.g. 192.168.1.10-20

MTU
Maximum transmission unit of the PPTP interface. Defaults to 1400.

DNS Server
Optional IP address of a DNS server to hand to incoming clients

WINS Server
Optional IP address of a WINS server to hand to incoming clients

Verbose logging □
Enable verbose logging to assist in debugging connection problems

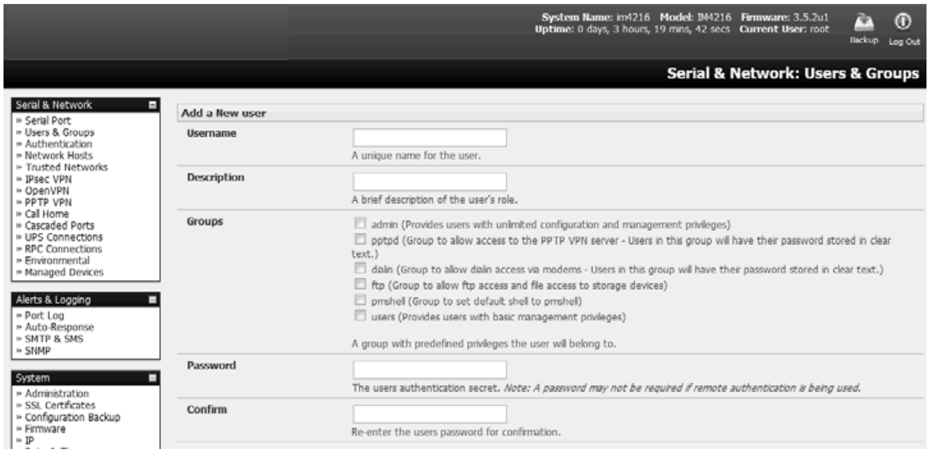
Authenticated PPTP VPN Connections
Authentication is required to track PPTP connections.

- ➢ Select the **Enable** check box to enable the PPTP Server.

- Select the **Minimum Authentication Required**. Access is denied to remote users attempting to connect using an authentication scheme weaker than the selected scheme. The schemes are described below, from strongest to weakest.
  - **Encrypted Authentication (MS-CHAP v2):** This is the strongest type of authentication to use and is the recommended option.
  - **Weakly Encrypted Authentication (CHAP):** This is the weakest type of encrypted password authentication to use. It is not recommended that clients connect using this as it provides very little password protection. Also, note that clients connecting using CHAP are unable to encrypt traffic.
  - **Unencrypted Authentication (PAP):** This is plain text password authentication. When using this type of authentication, the client password is transmitted unencrypted.
  - **None.**
- Select the **Required Encryption Level**. Access is denied to remote users attempting to connect not using this encryption level. Strong **40-bit or 128-bit encryption** is recommended.
- In **Local Address,** enter the IP address to assign to the server's end of the VPN connection.
- In **Remote Addresses,** enter the pool of IP addresses to assign to the incoming client's VPN connections (e.g. 192.168.1.10-20). This must be a free IP address (or a range of free IP addresses), from the network (typically the LAN) that remote users are assigned while connected to the Tripp Lite console server.
- Enter the desired value of the Maximum Transmission Unit (MTU) for the PPTP interfaces into the **MTU** field (defaults to 1400).
- In the **DNS Server** field, enter the IP address of the DNS server that assigns IP addresses to connecting PPTP clients.
- In the **WINS Server** field, enter the IP address of the WINS server that assigns IP addresses to connecting PPTP client.
- Enable **Verbose Logging** to assist in debugging connection problems.
- Click **Apply Settings.**

4.10.2 Add a PPTP User

- Select **Users & Groups** on the **Serial & Networks** menu, and complete the fields as covered in section **4.2 Add and Edit Users**.
- Ensure the *pptpd* **Group** has been checked to allow access to the PPTP VPN server. ***Note:*** *Users in this group will have their password stored in plain text.*
- Keep a note of the username and password for when you need to connect to the VPN connection.
- Click **Apply.**



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.2u1
Uptime: 0 days, 3 hours, 19 mins, 42 secs **Current User:** root

Serial & Network: Users & Groups

Add a New user

Username
A unique name for the user.

Description
A brief description of the user's role.

Groups
□ admin (Provides users with unlimited configuration and management privileges)
□ pptpd (Group to allow access to the PPTP VPN server - Users in this group will have their password stored in clear text.)
□ dialin (Group to allow dialin access via modems - Users in this group will have their password stored in clear text.)
□ ftp (Group to allow ftp access and file access to storage devices)
□ pmshell (Group to set default shell to pmshell)
□ users (Provides users with basic management privileges)

A group with predefined privileges the user will belong to.

Password
The users authentication secret. *Note: A password may not be required if remote authentication is being used.*

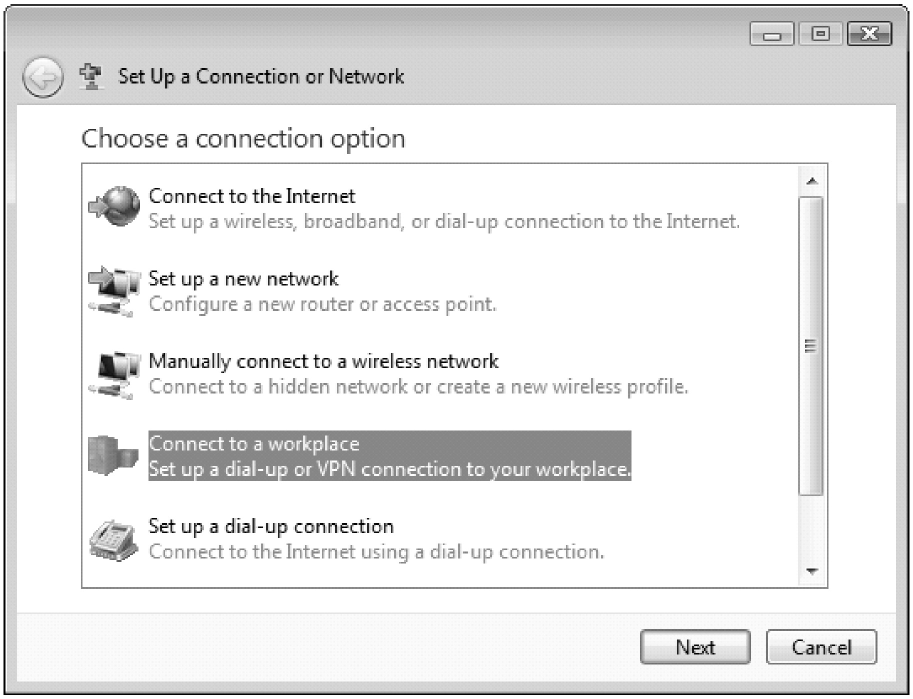
Confirm
Re-enter the users password for confirmation.

4.10.3 Set Up a Remote PPTP Client

Ensure the remote VPN client PC has Internet connectivity. To create a VPN connection across the Internet, you must set up two networking connections. One connection is for the ISP and the other connection is for the VPN tunnel to the Tripp Lite console server.

Note: *This procedure sets up a PPTP client in the Windows 7 Professional operating system. The steps may vary slightly depending on your network access or if you are using an alternate version of Windows. More detailed instructions are available from the Microsoft web site.*

- Log in to your Windows client with administrator privileges.
- From the **Network & Sharing Center** on the **Control Panel,** select **Network Connections** and create a new connection.



Set Up a Connection or Network

Choose a connection option

Connect to the Internet
Set up a wireless, broadband, or dial-up connection to the Internet.

Set up a new network
Configure a new router or access point.

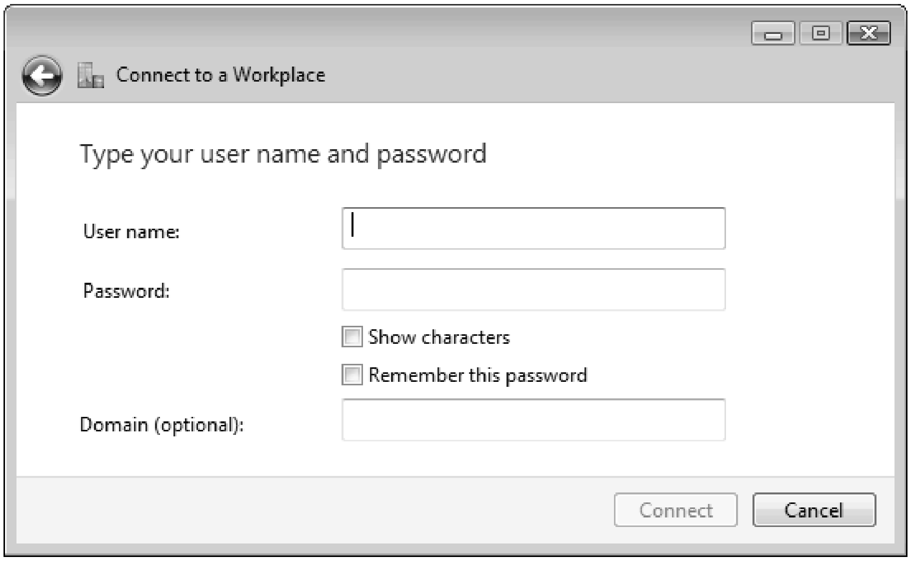
Manually connect to a wireless network
Connect to a hidden network or create a new wireless profile.

Connect to a workplace
Set up a dial-up or VPN connection to your workplace.

Set up a dial-up connection
Connect to the Internet using a dial-up connection.

- Select **Use My Internet Connection (VPN)** and enter the IP Address of the Tripp Lite console server.

***Note:** To connect remote VPN clients to the local network, you need to know the user name and password for the PPTP account you added, as well as the Internet IP address of the Tripp Lite console server. If your ISP has not allocated you a static IP address, consider using a dynamic DNS service. Otherwise, you must modify the PPTP client configuration each time your Internet IP address changes.*



4.11 IP Passthrough

IP passthrough is used to make a modem connection (e.g., Tripp Lite's internal cellular modem) appear as a regular Ethernet connection to a third-party downstream router. This allows the downstream router to use Tripp Lite's modem connection as a primary or backup WAN interface.

The console server provides the modem IP address and DNS details to the downstream device over DHCP and transparently passes network traffic to and from the modem and router.

While IP passthrough essentially turns a console server into a modem-to-Ethernet half-bridge, some specific layer 4 services (HTTP/HTTPS/SSH) may still be terminated at the console server (*Service Intercepts*). Also, services running on the console server can initiate outbound cellular connections independent of the downstream router.

This allows the console server to continue to be used for out-of-band management and alerts while in IP passthrough mode.

4.11.1 Downstream Router Setup

To use failover connectivity on the downstream router (*Failover to Cellular* or *F2C*), it must have two or more WAN interfaces.

***Note:** Failover in IP passthrough context is performed entirely by the downstream router. The built-in, out-of-band failover logic on the console server itself is not available while in IP passthrough mode.*

Connect an Ethernet WAN interface on the downstream router to the network interface or management LAN port with an Ethernet cable.

Configure this interface on the downstream router to receive its network settings via DHCP. If failover is required, configure the downstream router for failover between its primary interface and the Ethernet port connected to the console server.

4.11.2 IP Passthrough Pre-Configuration

To enable IP passthrough:

- Configure the network interface and (where applicable) management LAN interfaces with static network settings
  - Click **Serial & Network: IP.**
  - For network interface and (where applicable) management LAN, select **Static** for the **Configuration Method** and enter the network settings (see section **3.3 Network Connection** for more information).
  - For the interface connected to the downstream router, you may choose any dedicated private network. The chosen network will only exist between the console server and downstream router and will not normally be accessible.
  - For the other interface, configure it as you would per normal on the local network.
  - For both interfaces, leave **Gateway** blank.
- Configure the modem in Always On Out-of-band mode
  - For a cellular connection, click **System: Dial: Internal Cellular Modem.**
  - Select **Enable Dial-Out** and enter carrier details such as **APN** (see section **5.6 Cellular Modem Connection** for more information).

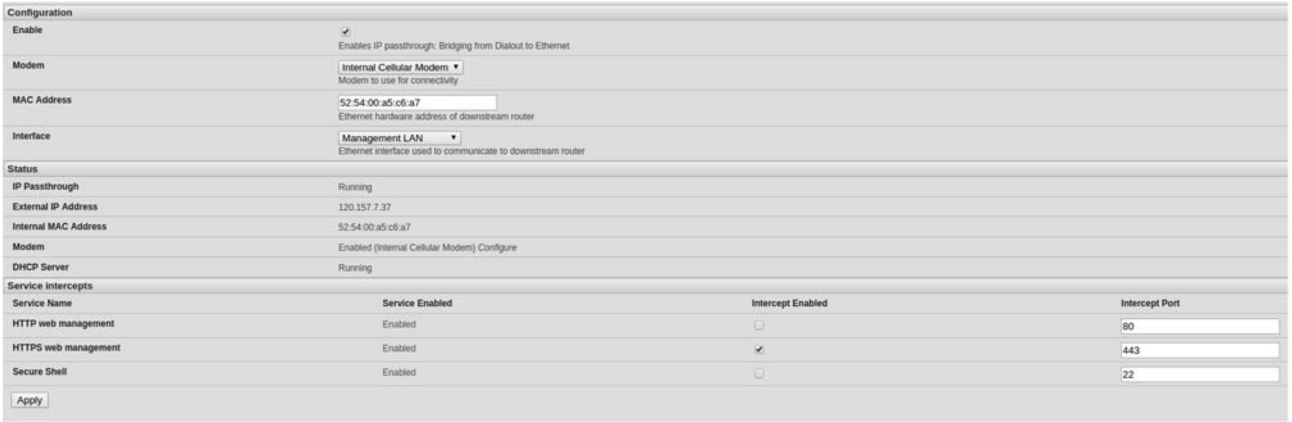
4.11.3 IP Passthrough Configuration

To configure IP passthrough:

- Click **Serial & Network: IP Passthrough** and check **Enable.**
- Select the **Modem** to use for upstream connectivity.
- Optionally, enter the **MAC Address** of downstream router's connected interface.

Note: *If the MAC address is not specified, the console server will pass through to the first downstream device requesting a DHCP address.*

- Select the Ethernet **Interface** to use for connectivity to the downstream router.
- Click **Apply.**



Configuration

Enable	☑ Enables IP passthrough: Bridging from Dialout to Ethernet
Modem	Internal Cellular Modem ▾ Modem to use for connectivity
MAC Address	52:54:00:a5:c6:a7 Ethernet hardware address of downstream router
Interface	Management LAN ▾ Ethernet interface used to communicate to downstream router

Status

IP Passthrough	Running
External IP Address	120.157.7.37
Internal MAC Address	52:54:00:a5:c6:a7
Modem	Enabled (Internal Cellular Modem) *Configure*
DHCP Server	Running

Service Intercepts

Service Name	Service Enabled	Intercept Enabled	Intercept Port
HTTP web management	Enabled	☐	80
HTTPS web management	Enabled	☑	443
Secure Shell	Enabled	☐	22

4.11.4 Service Intercepts

These allow the console server to continue to provide services for out-of-band management when in IP passthrough mode. Connections to the modem address on the specified intercept port(s) will be handled by the console server, rather than being passed through to the downstream router.

- For the required service of **HTTP**, **HTTPS** or **SSH**, check **Enable.**
- Optionally modify the **Intercept Port** to an alternate port (e.g. 8443 for HTTPS). This is useful if you want to continue to allow the downstream router to remain accessible via its regular port.

4.11.5 IP Passthrough Status

Refresh the page to view the **Status** section. It displays the modem's **External IP Address** being passed through, the **Internal MAC Address** of the downstream router (only populated when the downstream router accepts the DHCP lease), and the overall running status of the **IP passthrough** service.

Additionally, you may be alerted to the failover status of the downstream router by configuring a **Routed Data Usage Check** under **Alerts & Logging: Auto-Response**.

4.11.6 Caveats

Some downstream routers may be incompatible with the gateway route. This may happen when IP passthrough is bridging a 3G cellular network where the gateway address is a point-to-point destination address and no subnet information is available. The console server sends a DHCP netmask of 255.255.255.255. Devices will normally interpret this as a "single host route" on the interface, but as this is an unusual setting for Ethernet, some older downstream devices may encounter issues.

Intercepts for local services will not work if the console server is using a default route other than the modem. As per normal operation, they will also not work unless the service is enabled and access to the service is enabled (see **System: Services: Service Access: Dial-Out/Cellular**).

Outbound connections originating from the console server to remote services are supported (e.g. sending SMTP email alerts, SNMP traps, getting NTP time, IPSec tunnels). There is a minor risk of connection failure should both the console server and the downstream device try to access the same UDP or TCP port on the same remote host and at the same time where they have randomly chosen the same originating local port number.

5. Firewall, Failover and OOB Access

To ensure high availability, the console server has a number of out-of-band access capabilities and transparent failover features. If there is difficulty in accessing the console server through the main network path, all console server models provide out-of-band (OOB) access and the Administrator can still access it (and its Managed Devices) from a remote location.

- All console server models support serially attaching an external dial-up modem and configuring dial-in OOB access. Some models with USB ports support attaching an external USB modem. Some models also come standard with an internal modem. These modems can also be configured for dial-in OOB access.
- All console server models with an internal or external attached modem (and firmware version 3.4 or later) can be configured for out-dial to be permanently connected.
- The advanced console server models can also be configured for transparent out-dial failover. In the event of a disruption in the principal management network, an external dial-up ppp connection is automatically established.
- These advanced console server models can also be accessed out-of-band using an alternate broadband link and offer transparent broadband failover.
- Models with an internal cellular modem can be configured for OOB cellular access, cellular transparent failover, or as a cellular router.

5.1 Dialup Modem Connection

To enable dial-in or dial-out, first ensure there is a modem attached to the console server.

- The B096 comes with an internal modem, which can provide OOB dial-in access. These models will display an **Internal Modem Port** tab under **System --> Dial** (as well as the **Serial DB9 Port** tab).
- Other models support external USB modems. The USB modem will be auto-detected and an **External USB Modem Port** tab will appear under **System -> Dial** (in addition to the **Serial DB9 Port** tab). All console server models supports an external modem (any brand) attached via a serial cable to the console/modem port for OOB dial-in access.
- The serial ports on the B093, B094 and B095 are by default configured as RJ serial console server ports. However, Port 1 can be configured to be the local console/modem port.

5.2 OOB Dial-In Access

Once a modem has been attached to the console server, you can configure the console server for dial-in PPP access. The console server will then await an incoming connection from a dial-in at remote site. Next, the remote client dial-in software needs to be configured to establish the connection between the Administrator's client modem to the dial-in modem on the console server.

5.2.1 Configure Dial-In PPP

Enable PPP access on the internal or externally attached modem:

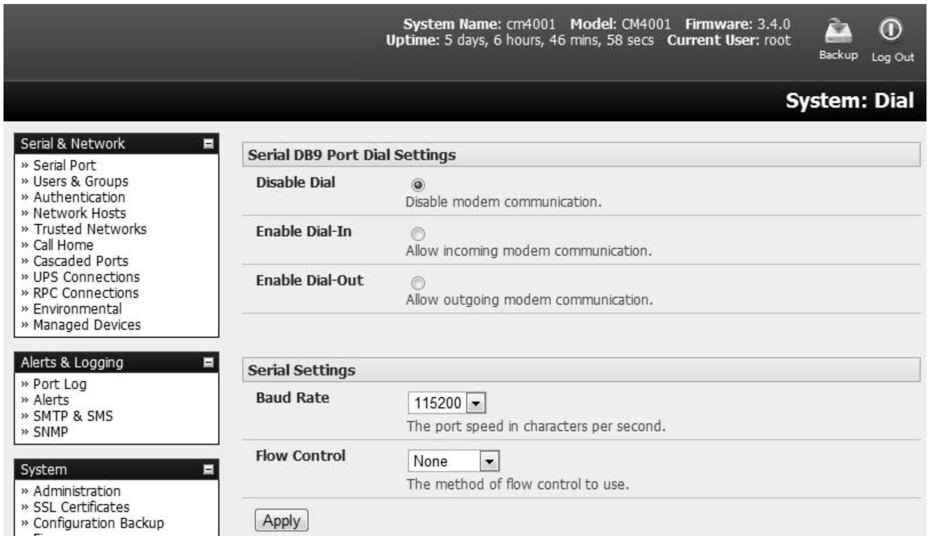
- ➢ Select the **System: Dial** menu option and the port to be configured (**Serial DB9 Port**, **Internal Modem Port** or **External USB Port**).
- ➢ Select the **Baud Rate** and **Flow Control** that will communicate with the modem.

***Note:** By default, the modem port on all Tripp Lite console servers is set with software flow control. The baud rate is set at:*

- 115200 for external modems connected to the local console port on B096 console servers.

- 9600 for the internal modem or external USB modem and for external modems connected to the console serial ports, which have been reassigned for dial-in access.

When enabling OOB dial-in, it is recommended the Serial Setting be changed to 38400 baud with Hardware Flow Control.



System Name: cm4001 **Model:** CM4001 **Firmware:** 3.4.0
Uptime: 5 days, 6 hours, 46 mins, 58 secs **Current User:** root

System: Dial

Serial DB9 Port Dial Settings

Disable Dial ● Disable modem communication.

Enable Dial-In ○ Allow incoming modem communication.

Enable Dial-Out ○ Allow outgoing modem communication.

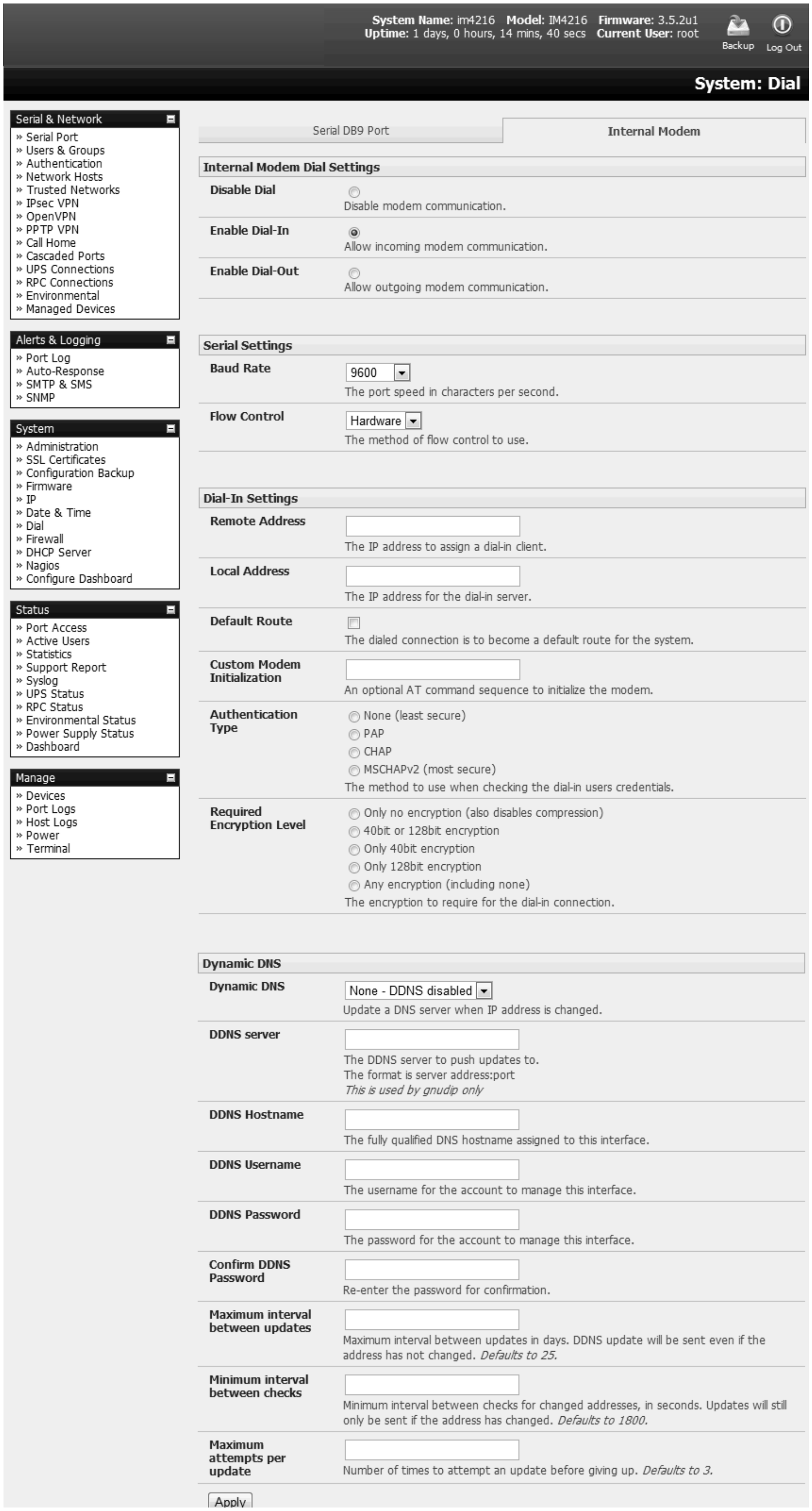
Serial Settings

Baud Rate 115200 — The port speed in characters per second.

Flow Control None — The method of flow control to use.

***Note:** You can further configure the console/modem port (e.g. to include modem init strings) by editing /etc/mgetty.config files as described in **14. Configuration from the Command Line**.*

- Check the **Enable Dial-In Access** box.
- In the **Remote Address** field, enter the IP address to be assigned to the dial-in client. You can select any address for the Remote IP Address. However, it must be in the same network range as the Local IP Address (e.g,. 200.100.1.12 and 200.100.1.67).
- In the **Local Address** field, enter the IP address for the Dial-In PPP Server. This IP address will be used by the remote client to access the console server once the modem connection is established. You can select any address for the Local IP Address, but it must both be in the same network range as the Remote IP Address.
- The **Default Route** option enables the dialed PPP connection to become the default route for the console server.
- The **Custom Modem Initialization** option allows a custom AT string modem initialization string to be entered (*e.g*. AT&C1&D3&K3).



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.2u1
Uptime: 1 days, 0 hours, 14 mins, 40 secs **Current User:** root

System: Dial

Internal Modem Dial Settings

Disable Dial ○
Disable modem communication.

Enable Dial-In ●
Allow incoming modem communication.

Enable Dial-Out ○
Allow outgoing modem communication.

Serial Settings

Baud Rate 9600
The port speed in characters per second.

Flow Control Hardware
The method of flow control to use.

Dial-In Settings

Remote Address
The IP address to assign a dial-in client.

Local Address
The IP address for the dial-in server.

Default Route □
The dialed connection is to become a default route for the system.

Custom Modem Initialization
An optional AT command sequence to initialize the modem.

Authentication Type
○ None (least secure)
○ PAP
○ CHAP
○ MSCHAPv2 (most secure)
The method to use when checking the dial-in users credentials.

Required Encryption Level
○ Only no encryption (also disables compression)
○ 40bit or 128bit encryption
○ Only 40bit encryption
○ Only 128bit encryption
○ Any encryption (including none)
The encryption to require for the dial-in connection.

Dynamic DNS

Dynamic DNS None - DDNS disabled
Update a DNS server when IP address is changed.

DDNS server
The DDNS server to push updates to.
The format is server address:port
This is used by gnudip only

DDNS Hostname
The fully qualified DNS hostname assigned to this interface.

DDNS Username
The username for the account to manage this interface.

DDNS Password
The password for the account to manage this interface.

Confirm DDNS Password
Re-enter the password for confirmation.

Maximum interval between updates
Maximum interval between updates in days. DDNS update will be sent even if the address has not changed. *Defaults to 25.*

Minimum interval between checks
Minimum interval between checks for changed addresses, in seconds. Updates will still only be sent if the address has changed. *Defaults to 1800.*

Maximum attempts per update
Number of times to attempt an update before giving up. *Defaults to 3.*

- Select the **Authentication Type** required. Access is denied to remote users attempting to connect using an authentication scheme weaker than the selected scheme. The schemes are described below, from strongest to weakest.
  - **Encrypted Authentication (MS-CHAP v2):** This is the strongest type of authentication to use and is the recommended option.
  - **Weakly Encrypted Authentication (CHAP):** This is the weakest type of encrypted password authentication to use. It is not recommended that clients connect using this as it provides very little password protection. Also, note that clients connecting using CHAP are unable to encrypt traffic.
  - **Unencrypted Authentication (PAP):** This is plain text password authentication. When using this type of authentication, the client password is transmitted unencrypted.
  - **None.**

- Select the **Required Encryption Level**. Access is denied to remote users attempting to connect not using this encryption level. Strong **40-bit or 128-bit encryption** is recommended.

Notes:

*Firmware version 3.5.2 and beyond support multiple dial-in users with dial-in group membership. The **Username** and **Password** to be used for the dial-in PPP link, and any dial-back phone numbers are configured when the User is set up. Earlier firmware is only supported for one PPP dial-in account.*

*Section **13. Management** contains examples of Linux commands that can be used to control the modem port operation at the command line level.*

5.2.2 Using SDT Connector Client

Administrators can use their SDT connector client to set up secure OOB dial-in access to remote console servers. The SDT connector Java client software provides point-and-click secure remote access. OOB access uses an alternate path for connecting to the console server to that used for regular data traffic.

Starting an OOB connection in SDT connector may be achieved by initiating a dial-up connection, or adding an alternate route to the console server. SDT connector allows for maximum flexibility is this regard by allowing you to provide your own scripts or commands for starting and stopping the OOB connection. Refer **6.5 Using SDT Connector for Out-of-Band Connection to the Gateway for more information**.

5.2.3 Set Up Windows XP or Later Client

- Open **Network Connections** in Control Panel and click the **New Connection Wizard.**
- Select **Connect to the Internet** and click **Next.**
- On the **Getting Ready** screen, select **Set up my connection manually** and click **Next.**
- On the **Internet Connection** screen, select **Connect using a dial-up modem** and click **Next.**
- Enter a **Connection Name** (any name you choose) and the dial-up **Phone number** that will connect to the console server modem.
- Enter the PPP **Username** and **Password** to set up for the console server.

5.2.4 Set Up Earlier Windows Clients

- For Windows 2000, the PPP client set up procedure is the same as above, except you go to the **Dial-Up Networking Folder** by clicking the **Start** button and selecting **Settings.** Then click **Network and Dial-up Connections** and click **Make New Connection.**

- Similarly, for Windows 98, double-click **My Computer** on the Desktop, then open **Dial-Up Networking**, double-click **Make New Connection** and proceed as above.

5.2.5 Set Up Linux Clients

The online tutorial http://www.yolinux.com/TUTORIALS/LinuxTutorialPPP.html presents a selection of methods for establishing a dial-up PPP connection:

- Command line PPP and manual configuration (which works with any Linux distribution).
- Using the *Linuxconf* configuration tool (for Red Hat compatible distributions). This configures the scripts *ifup/ifdown* to start and stop a PPP connection.
- Using the Gnome control panel configuration tool.
- WVDIAL and the Redhat "Dialup configuration tool".
- GUI dial program X-isp. Download/Installation/Configuration.

Note: *For all PPP clients:*

- *Set the PPP link up with TCP/IP as the only protocol enabled.*
- *Specify the Server will assign IP address and do DNS.*
- *Do not set up the console server PPP link as the default for Internet connection.*

5.3 Dial-Out Access

The internal or external attached modem on the console server can be set up in either:

- Failover mode, where a dial-out connection is only established in event of a *ping* failure

or

- With the dial-out connection always on.

In both of the above cases, during a disruption in the dial-out connection, the console server will work to re-establish the connection.

5.3.1 Always-On Dial-Out

With firmware version 3.4 (and later), the console server modem can be configured for out-dial to be always on, with a permanent external dial-up ppp connection.

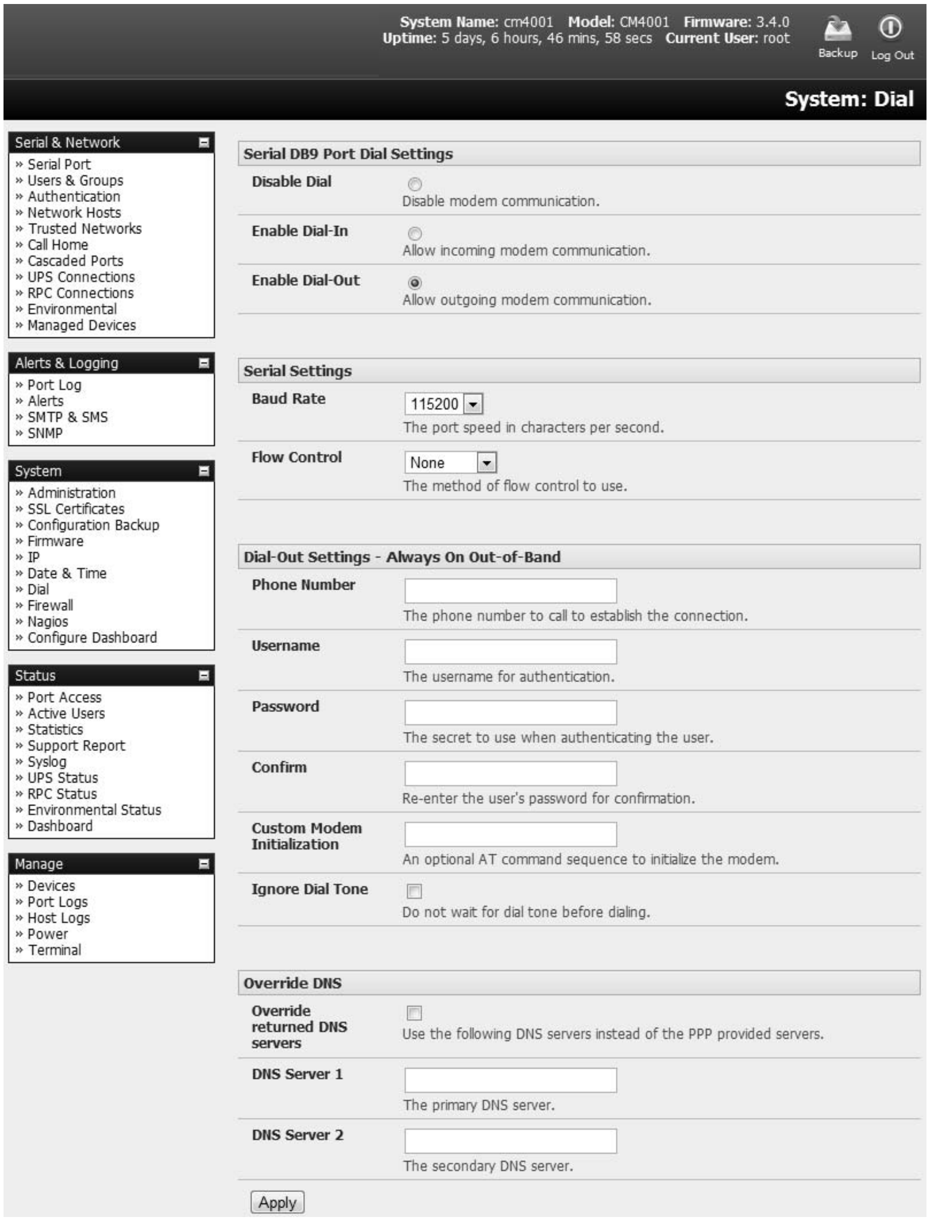
- Select the **System: Dial** menu option and check **Enable Dial-Out** to allow outgoing modem communications.

- Select the **Baud Rate** an**d Flow Control** that will communicate with the modem.

- In the **Dial-Out Settings - Always On Out-of-Band** field, enter the access details for the remote PPP server to be called.

Override DNS is available for PPP Devices, such as modems. Override DNS allows the use of alternate DNS servers from those provided by your ISP. For example, an alternative DNS may be required for OpenDNS used for content filtering.

- To enable Override DNS, check the **Override Returned DNS Servers** box. Enter the IP of the DNS servers into the spaces provided.



System Name: cm4001 **Model:** CM4001 **Firmware:** 3.4.0
Uptime: 5 days, 6 hours, 46 mins, 58 secs **Current User:** root

System: Dial

Serial DB9 Port Dial Settings

Disable Dial ○ Disable modem communication.

Enable Dial-In ○ Allow incoming modem communication.

Enable Dial-Out ● Allow outgoing modem communication.

Serial Settings

Baud Rate 115200 — The port speed in characters per second.

Flow Control None — The method of flow control to use.

Dial-Out Settings - Always On Out-of-Band

Phone Number — The phone number to call to establish the connection.

Username — The username for authentication.

Password — The secret to use when authenticating the user.

Confirm — Re-enter the user's password for confirmation.

Custom Modem Initialization — An optional AT command sequence to initialize the modem.

Ignore Dial Tone □ Do not wait for dial tone before dialing.

Override DNS

Override returned DNS servers □ Use the following DNS servers instead of the PPP provided servers.

DNS Server 1 — The primary DNS server.

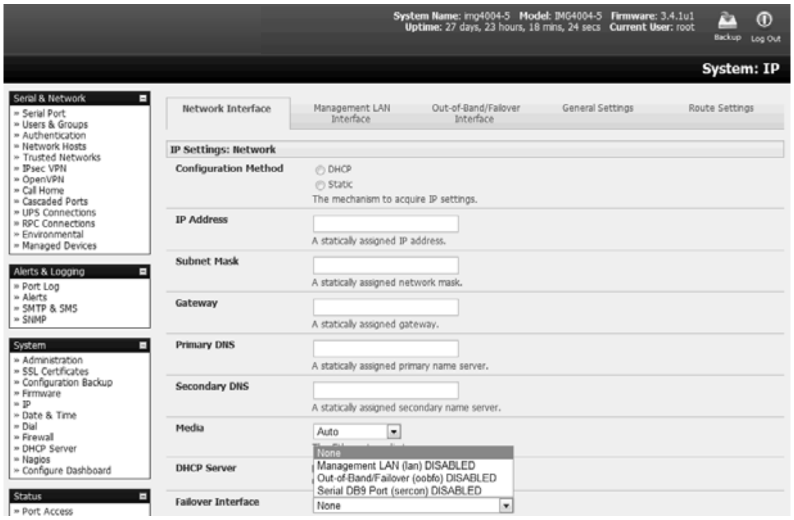
DNS Server 2 — The secondary DNS server.

5.3.2 Failover Dial-Out

The console servers can be configured so a dial-out PPP connection is automatically set up in the event of a disruption in the principal management network.

Note: *Only SSH access is enabled on the failover connection. In firmware versions later than 3.0.2, HTTPS access is also enabled so the administrator can use SSH (or HTTPS) to connect to the console server and fix the problem.*

When configuring the principal network connection in System: IP, specify the failover interface that will be used when a fault has been detected with Network / Network1 (eth0). This can be either internal modem or the dial serial DB9 (if you are using an external modem on the console port) or USB modem (if you are using a plug-in USB modem).



System Name: img4004-5 Model: IMG4004-5 Firmware: 3.4.1u1
Uptime: 27 days, 23 hours, 18 mins, 24 secs Current User: root

System: IP

IP Settings: Network

Configuration Method: ○ DHCP ○ Static
The mechanism to acquire IP settings.

IP Address: A statically assigned IP address.

Subnet Mask: A statically assigned network mask.

Gateway: A statically assigned gateway.

Primary DNS: A statically assigned primary name server.

Secondary DNS: A statically assigned secondary name server.

Media: Auto

DHCP Server

Failover Interface: None

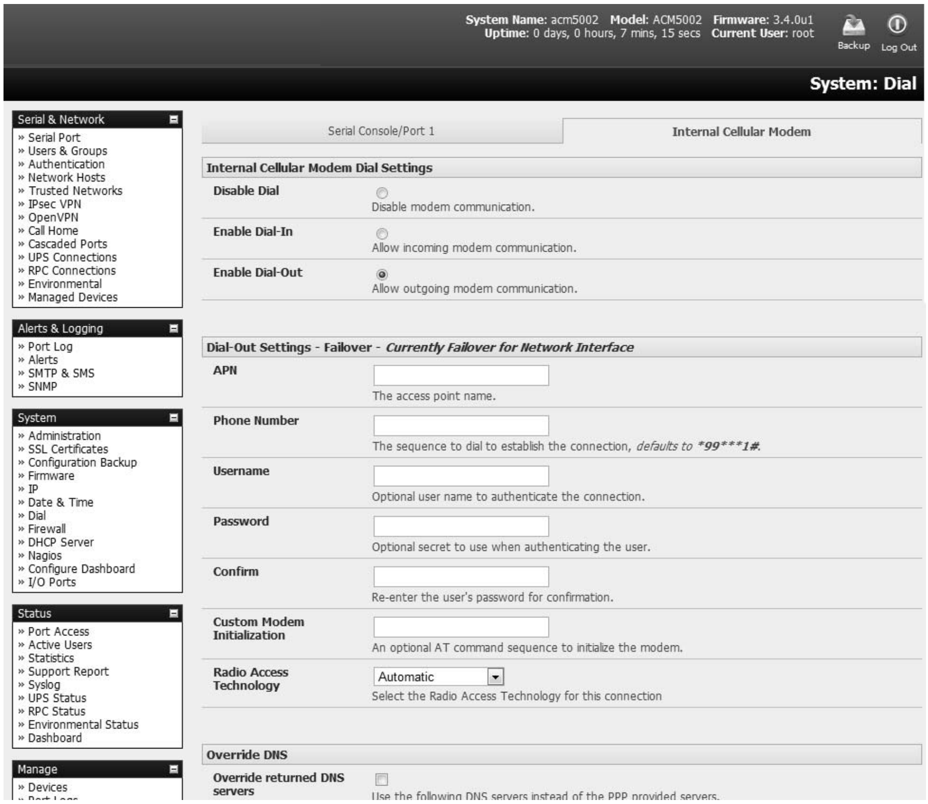
- Specify the Probe Addresses of two sites (the Primary and Secondary) that the IM console server is to ping to determine if Network / Network1 is still operational.
- Select the **System: Dial** menu option and the port to be configured (**Serial DB9 Port, PC Card** or **Internal Modem Port**).
- Select the **Baud Rate** and **Flow Control** that will communicate with the modem.

Note: *You can further configure the console/modem port to include modem init strings by editing /etc/mgetty.config files as described in the* ***13. Management****.*

- Check the **Enable Dial-Out Access** box and enter the access details for the remote PPP server.

Override DNS is available for PPP devices, such as modems. Override DNS allows the use of alternate DNS servers from those provided by your ISP. For example, an alternative DNS may be required for OpenDNS used for content filtering.

- To enable **Override DNS**, check the Override returned DNS Servers box. Enter the IP of the DNS servers into the spaces provided.



Internal Cellular Modem Dial Settings

Disable Dial	○ Disable modem communication.
Enable Dial-In	○ Allow incoming modem communication.
Enable Dial-Out	● Allow outgoing modem communication.

Dial-Out Settings - Failover - ***Currently Failover for Network Interface***

APN	The access point name.
Phone Number	The sequence to dial to establish the connection, *defaults to *99***1#*.
Username	Optional user name to authenticate the connection.
Password	Optional secret to use when authenticating the user.
Confirm	Re-enter the user's password for confirmation.
Custom Modem Initialization	An optional AT command sequence to initialize the modem.
Radio Access Technology	Automatic Select the Radio Access Technology for this connection

Override DNS

Override returned DNS servers	□ Use the following DNS servers instead of the PPP provided servers.

Note: *By default, the advanced console server supports automatic failure-recovery that reverts it back to its original state prior to failover (firmware version 3.1.0 and later). The advanced console server continually pings probe addresses while in original and failover states. The original state will automatically be set as a priority and reestablished following three successful pings of the probe addresses during failover. The failover state will be removed once the original state has been re-established.*

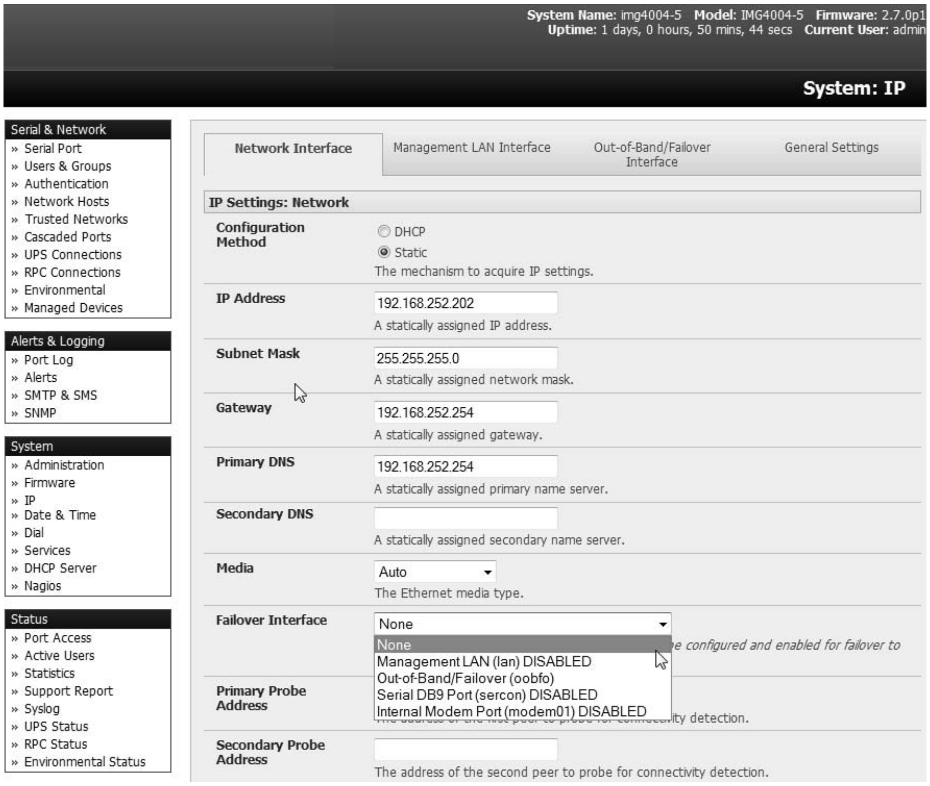
5.4 OOB Broadband Ethernet Access

The console servers have a second Ethernet port that can be configured for alternate and OOB (out-of-band) broadband access. With two active broadband access paths to these advanced console servers, you can still access it through the alternate broadband path in the event you are unable to access through the primary management network (*LAN1, Network or Network1*).

- On the **System: IP** menu, select **Management LAN Interface** and configure the **IP Address, Subnet Mask**, **Gateway** and **DNS** with the access settings that relate to the alternate link.
- Ensure when configuring the principal **Network Interface** connection the **Failover Interface** is set to **None***.*

5.5 Broadband Ethernet Failover

The second Ethernet port on the console servers can also be configured for failover to ensure transparent high availability.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 1 days, 0 hours, 50 mins, 44 secs **Current User:** admin

System: IP

IP Settings: Network

Configuration Method ○ DHCP ● Static
The mechanism to acquire IP settings.

IP Address 192.168.252.202
A statically assigned IP address.

Subnet Mask 255.255.255.0
A statically assigned network mask.

Gateway 192.168.252.254
A statically assigned gateway.

Primary DNS 192.168.252.254
A statically assigned primary name server.

Secondary DNS
A statically assigned secondary name server.

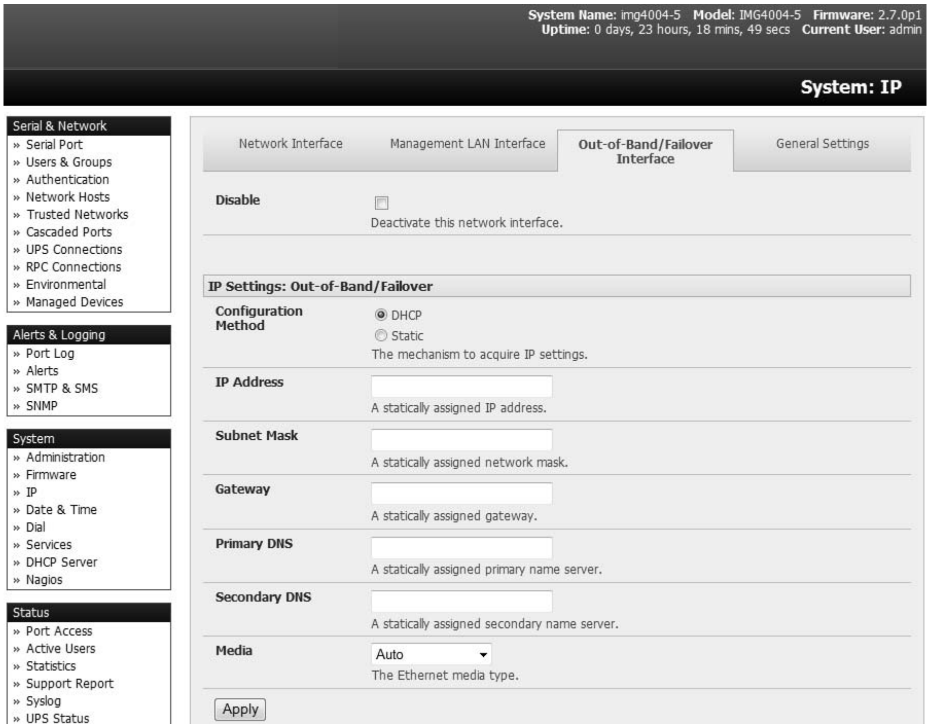
Media Auto
The Ethernet media type.

Failover Interface None
None
Management LAN (lan) DISABLED
Out-of-Band/Failover (oobfo)
Serial DB9 Port (sercon) DISABLED
Internal Modem Port (modem01) DISABLED
e configured and enabled for failover to

Primary Probe Address
ity detection.

Secondary Probe Address
The address of the second peer to probe for connectivity detection.

- When configuring the principal network connection, specify **Management LAN Interface** as the **Failover Interface** to be used when a fault has been detected with **Network Interface.**
- Specify the **Probe Addresses** of two sites (the **Primary** and **Secondary**) that the advanced console server is to ping to determine if **Network Interface** is still operational.
- On the **Management LAN Interface,** configure the **IP Address**, **Subnet Mask** and **Gateway** the same as you used for **Network Interface**.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 23 hours, 18 mins, 49 secs **Current User:** admin

System: IP

Disable ☐ Deactivate this network interface.

IP Settings: Out-of-Band/Failover

Configuration Method ● DHCP ○ Static
The mechanism to acquire IP settings.

IP Address A statically assigned IP address.

Subnet Mask A statically assigned network mask.

Gateway A statically assigned gateway.

Primary DNS A statically assigned primary name server.

Secondary DNS A statically assigned secondary name server.

Media Auto
The Ethernet media type.

In this mode, **Management LAN Interface** is available as the transparent back-up port to **Network Interface** for accessing the management network. In the event **Network Interface** becomes unavailable, **Management LAN Interface** will automatically and transparently take over the work of **Network Interface**.

Notes: *Only SSH access is enabled on the failover connection. In firmware versions later than 3.0.2, HTTPS access is also enabled so the administrator can connect to the console server using SSH (or HTTPS) to fix the problem.*

By default, the advanced console server supports automatic failure-recovery back to the original state prior to failover (firmware version 3.1.0 and later). The advanced console server continually pings probe addresses while in original and failover states. The original state will automatically be set as a priority and reestablished following three successful pings of the probe addresses during failover. The failover state will be removed once the original state has been re-established.

For firmware pre-V3.1.0, the advanced console server does not support automatic failure-recovery back to the original state prior to the failover. To restore networking to a recovered state, the following command needs to be run:

```
rm -f /var/run/*-failed-over && config -r ipconfig
```

If required, you can run a custom bash script when the device fails over. It is possible to use this script to implement automatic failure recovery, depending on your network setup. The script to create is:

```
/etc/config/scripts/interface-failover-alert
```

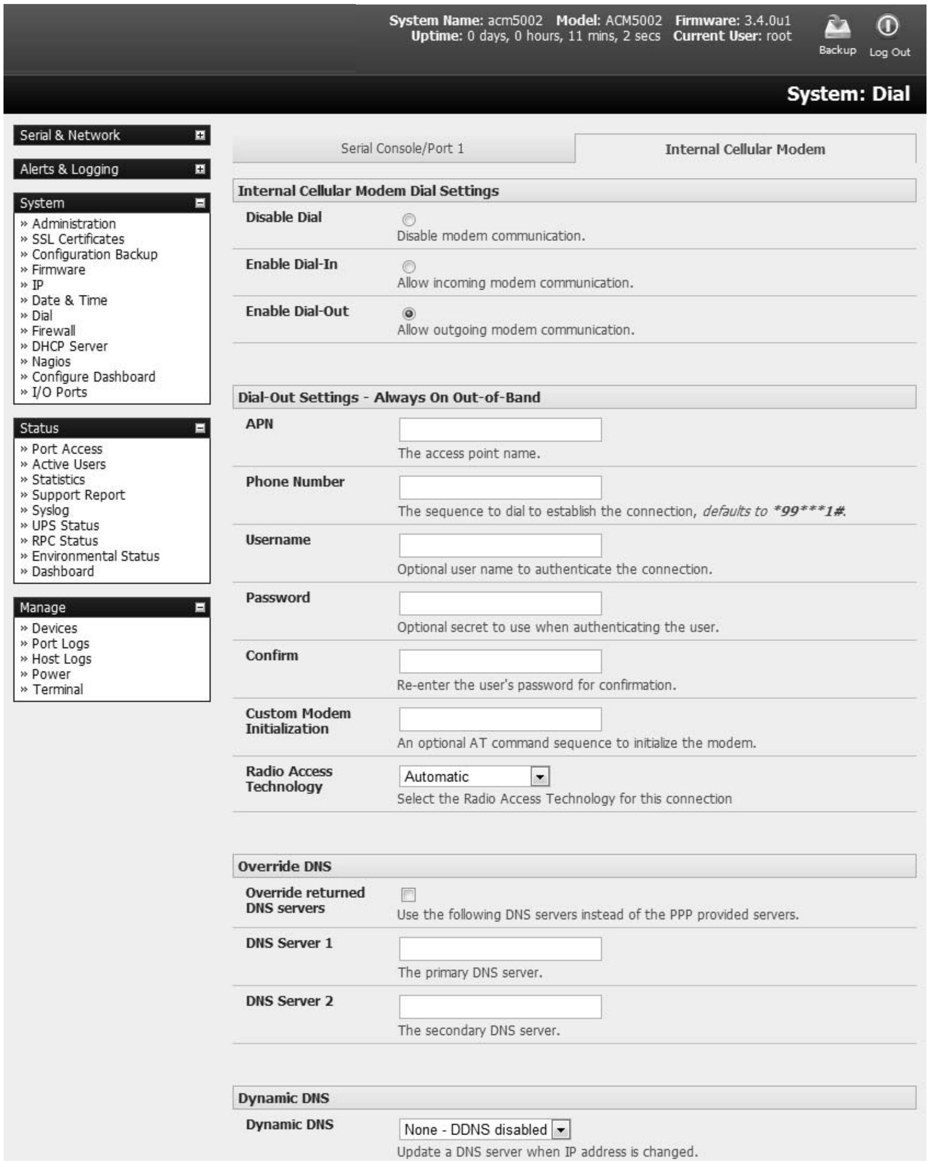
5.6 Cellular Modem Connection

5.6.1 Connecting to a *4G LTE* Carrier Network

The B093 and B094-008-2E-V models have an internal cellular modem that can connect to Verizon’s 4G LTE network (USA).

- Before powering on the B093 and B094-008-2E-V, install the SIM card provided by your cellular carrier and attach the external aerial.

- Select **Internal Cellular Modem** panel on the **System: Dial** menu.
- Check **Enable Dial-Out Settings.**



Internal Cellular Modem Dial Settings

Disable Dial	○ Disable modem communication.
Enable Dial-In	○ Allow incoming modem communication.
Enable Dial-Out	● Allow outgoing modem communication.

Dial-Out Settings - Always On Out-of-Band

APN	The access point name.
Phone Number	The sequence to dial to establish the connection, *defaults to *99***1#*.
Username	Optional user name to authenticate the connection.
Password	Optional secret to use when authenticating the user.
Confirm	Re-enter the user's password for confirmation.
Custom Modem Initialization	An optional AT command sequence to initialize the modem.
Radio Access Technology	Automatic Select the Radio Access Technology for this connection

Override DNS

Override returned DNS servers	□ Use the following DNS servers instead of the PPP provided servers.
DNS Server 1	The primary DNS server.
DNS Server 2	The secondary DNS server.

Dynamic DNS

Dynamic DNS	None - DDNS disabled Update a DNS server when IP address is changed.

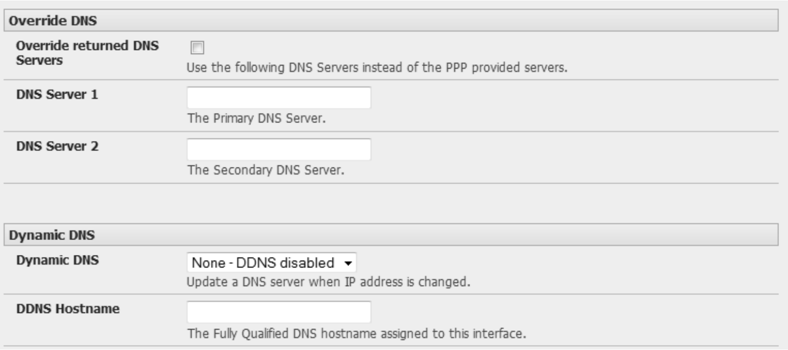
Note:** Your 4G LTE carrier may have provided you with details for configuring the connection, including APN (Access Point Name), PIN Code (optional PIN code which may be required to unlock the SIM card), Phone Number (the sequence to dial to establish the connection, defaults to *991#), Username / Password (optional) and Dial string (optional AT commands). However, you generally will only need to enter your provider's APN and leave the other fields blank.*

- Enter the carrier's **APN—**e.g., for AT&T (USA), simply enter *i2gold*; for T-Mobile (USA), enter *epc.tmobile.com*; for InterNode (Aust), enter *internode;* and for Telstra (Aust), enter *telstra.internet*

- If the SIM card is configured with a PIN code, you will be required to unlock the card by entering the PIN code. If the PIN code is entered incorrectly three times, the PUK Code will be required to unlock the card.

You may also need to set Override DNS to use alternate DNS servers from those provided by your carrier.

- To enable Override DNS, check the **Override Returned DNS Servers** box. Enter the IP of the DNS servers into the spaces provided.



Override DNS

Override returned DNS Servers □ Use the following DNS Servers instead of the PPP provided servers.

DNS Server 1 — The Primary DNS Server.

DNS Server 2 — The Secondary DNS Server.

Dynamic DNS

Dynamic DNS: None - DDNS disabled — Update a DNS server when IP address is changed.

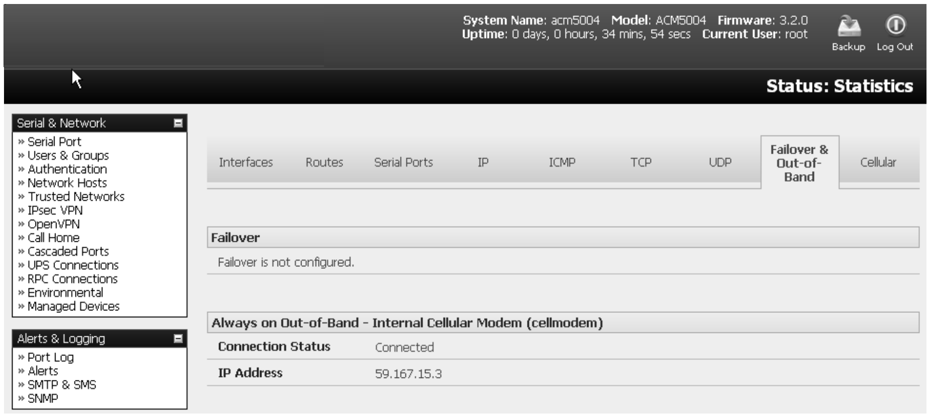
DDNS Hostname — The Fully Qualified DNS hostname assigned to this interface.

- Check **Apply.** A radio connection will be established with your cellular carrier.

5.6.2 Verifying the Cellular Connection

Out-of-band access is enabled by default, so the cellular modem connection should now be on.

- You can verify the connection status from **Status: Statistics**
  - Select the **Cellular** tab. In Service Availability, verify Mode is set to **Online.**
  - Select **Failover & Out-of-Band**. The Connection Status should read “Connected*”.*
  - Check your allocated IP address.



System Name: acm5004 Model: ACM5004 Firmware: 3.2.0
Uptime: 0 days, 0 hours, 34 mins, 54 secs Current User: root

Status: Statistics

Failover

Failover is not configured.

Always on Out-of-Band - Internal Cellular Modem (cellmodem)

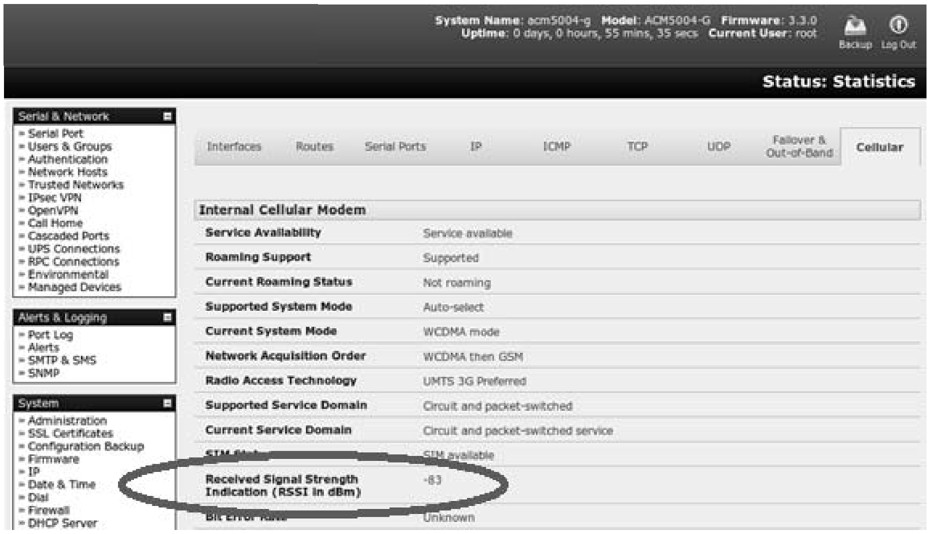
Connection Status: Connected

IP Address: 59.167.15.3

- You can measure the received signal strength from the **Cellular Statistics** page on the **Status: Statistics** screen. This will display the current state of the cellular modem, including the Received Signal Strength Indicator (**RSSI**).

Note: *Received Signal Strength Indicator (**RSSI**) is a measurement of the Radio Frequency (RF) power present in a received radio signal at the mobile device. It is generally expressed in dBm. The best* *throughput comes from placing the device in an area with the highest RSSI.*

-100 dbm or less = Unacceptable Coverage
-99 dbm to -90 dbm = Weak Coverage
-89 dbm to -70 dbm = Medium to High Coverage
-69 dbm or greater = Strong Coverage



System Name: acm5004-g **Model**: ACM5004-G **Firmware**: 3.3.0
Uptime: 0 days, 0 hours, 55 mins, 35 secs **Current User**: root

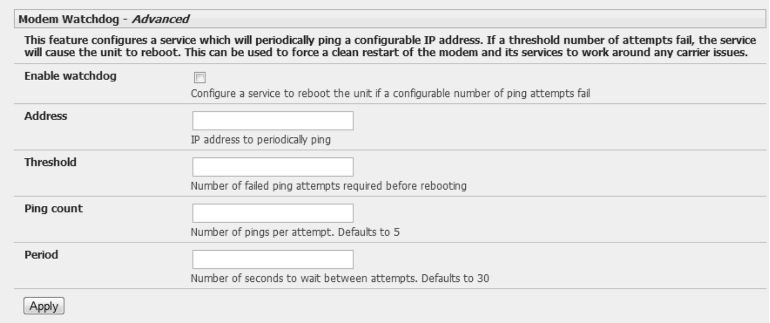
Status: Statistics

Internal Cellular Modem	
Service Availability	Service available
Roaming Support	Supported
Current Roaming Status	Not roaming
Supported System Mode	Auto-select
Current System Mode	WCDMA mode
Network Acquisition Order	WCDMA then GSM
Radio Access Technology	UMTS 3G Preferred
Supported Service Domain	Circuit and packet-switched
Current Service Domain	Circuit and packet-switched service
SIM Status	SIM available
Received Signal Strength Indication (RSSI in dBm)	-83
Bit Error Rate	Unknown

- ➢ With the cellular modem connection on, you can also see the connection status from the LEDs on top of unit.

5.6.3 Cellular Modem Watchdog

When you select **Enable Dial-Out** on the **System: Dial** menu, you will be given the option to configure a cellular modem watchdog service (with firmware version 3.5.2u13 and later). This service will periodically ping a configurable IP address. If a set threshold number of consecutive attempts fail, the service will cause the unit to reboot. This can be used to force a clean restart of the modem and its services to work around any carrier issues.



Modem Watchdog - *Advanced*

This feature configures a service which will periodically ping a configurable IP address. If a threshold number of attempts fail, the service will cause the unit to reboot. This can be used to force a clean restart of the modem and its services to work around any carrier issues.

Enable watchdog	☐ Configure a service to reboot the unit if a configurable number of ping attempts fail
Address	IP address to periodically ping
Threshold	Number of failed ping attempts required before rebooting
Ping count	Number of pings per attempt. Defaults to 5
Period	Number of seconds to wait between attempts. Defaults to 30

5.7 Cellular Operation

The cellular modem can be set up to connect to the carrier in either:

- **Cellular router mode**. In this mode, the dial-out connection to the carrier cellular network is always on, and IP traffic is routed between the cellular connected network and the console server's local network ports. This is the default mode of operation.
- **OOB mode**. In this mode, the dial-out connection to the carrier's cellular network is always on and awaiting incoming access from a remote site to the console server or attached serial consoles/network hosts.
- **Failover mode**. In this mode, a dial-out cellular connection is established only in event of a ping failure.

5.7.1 Set Up OOB Access

In this mode, the dial-out connection to the carrier cellular network is always on and awaiting any incoming traffic. By default, the only traffic enabled is incoming SSH access to the console server, its serial ports, and incoming HTTPS access to the console server. There is a low level of management traffic going over the cellular network. Generally, the status reports and alerts from the site can be carried over the main network.

This mode is typically used for out-of-band (OOB) access to remote sites. To directly access the Tripp Lite console server, a public IP address is needed and must not have SSH access firewalled. This OOB mode is the default for Tripp Lite console servers with internal cellular modems. OOB access is enabled by default and the cellular modem connection is always on.

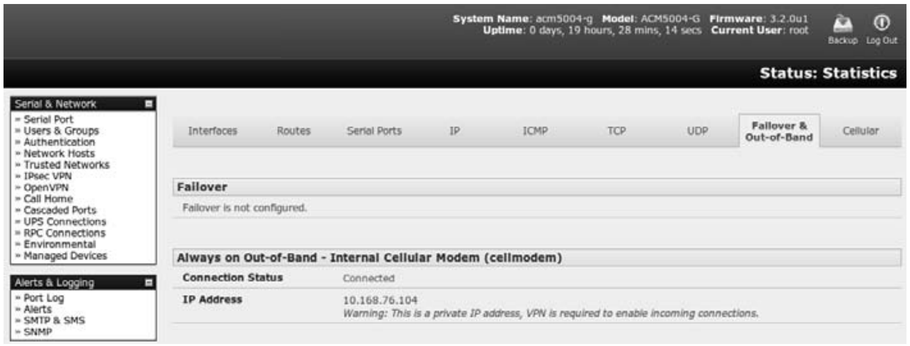
For direct access, the console server needs to have a public IP address and must not have SSH access firewalled.

Almost all carriers offer corporate mobile data service/plans with a public (static or dynamic) IP address. These plans often have a service fee attached.

- ➢ If you have a static public IP address plan, you can also try accessing the console server using the public IP address provided by the carrier. By default, only HTTPS and SSH access is enabled on the OOB connection so you can browse to the console server, but you cannot ping it.
- ➢ If you have a dynamic public IP address plan, a DDNS service will need to be configured to enable the remote administrator to initiate incoming access. Once this is done, you can also try accessing the console server using the allocated domain name.

By default, most providers offer a consumer grade service, which provides dynamic private IP address assignments to 3G devices. This IP address is not visible across the Internet, but generally, it is adequate for home and general business use.

- ➢ With such a plan, the **Failover & Out-of-Band** tab on the **Status: Statistics** will identify that your carrier has allocated you a private IP address (i.e. in the range 10.0.0.0 – 10.255.255.255, 172.16.0.0 – 172.31.255.255 or 192.168.0.0 – 192.168.255.255).



System Name: acm5004-g **Model**: ACM5004-G **Firmware**: 3.2.0u1
Uptime: 0 days, 19 hours, 28 mins, 14 secs **Current User**: root

Status: Statistics

Failover

Failover is not configured.

Always on Out-of-Band - Internal Cellular Modem (cellmodem)

Connection Status	Connected
IP Address	10.168.76.104 *Warning: This is a private IP address, VPN is required to enable incoming connections.*

- ➢ For inbound OOB connection, you will need to set up a VPN.

In out-of-band access mode, the internal cellular modem will continually stay connected. The alternative is to set up failover mode on the console server (detailed in the next section).

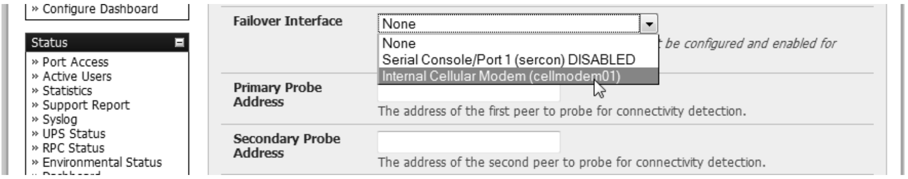
5.7.2 Set Up Cellular Failover

In this mode, a dial-out cellular connection is only established in the event of a disruption to the main network. The cellular connection normally remains idle in a low power state and is only activated in the event of a ping failure. Standby mode is ideal for remote sites with expensive power or very high cellular traffic costs.

In this mode, the console server continually pings select probe addresses over the main network connection. During a ping failure, it dials out and sets up a dial-out *ppp* over the cellular modem and access is switched transparently to this network connection. When the main network connection is restored, access is switched back.

Once you have configured the carrier connection, the cellular modem can be configured for failover.

This will tell the cellular connection to remain idle in a low power state. If the primary and secondary probe addresses are not available, it will reestablish the cellular connection and reconnect to the cellular carrier.



Failover Interface: None

be configured and enabled for

Primary Probe Address: The address of the first peer to probe for connectivity detection.

Secondary Probe Address: The address of the second peer to probe for connectivity detection.

- ➢ Navigate to the **Network Interface** on the **System: IP** menu and specify **Internal Cellular modem (cell modem 01**) as the **Failover Interface** to be used when a fault has been detected.
- ➢ Specify the **Probe Addresses** of two sites (the **Primary** and **Secondary**) that the console server is to ping to determine if the principal network is still operational.
- ➢ In event of a failure of the principal network, the cellular network connection is activated as the access path to the console server (and Managed Devices). Only HTTPS and SSH access is enabled on the failover connection (which should enable the administrator to connect and fix the problem).

Note *By default, the advanced console server supports automatic failure-recovery back to the original state prior to failover (firmware version 3.1.0 and later). The advanced console server continually pings probe addresses while in original and failover states. The original state will automatically be set as a priority and reestablished following three successful pings of the probe addresses during failover. The failover state will be removed once the original state has been re-established.*

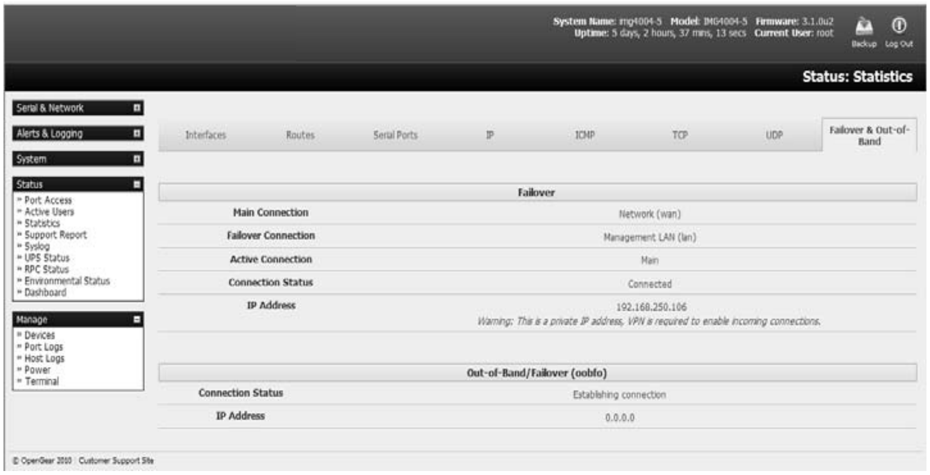
For earlier firmware that does not support automatic failure-recovery, restore networking to a recovered state by running the following command:

```
rm -f /var/run/*-failed-over && config -r ipconfig
```

If required, you can run a custom bash script when the device fails over. It is possible to use this script to implement automatic failure recovery, depending on your network setup. The script to create is:

```
/etc/config/scripts/interface-failover-alert
```

- ➢ You can check the connection status by selecting the **Cellular** panel on the **Status: Statistics** menu.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 3.1.0u2
Uptime: 5 days, 2 hours, 37 mins, 13 secs **Current User:** root

Status: Statistics

Failover	
Main Connection	Network (wan)
Failover Connection	Management LAN (lan)
Active Connection	Main
Connection Status	Connected
IP Address	192.168.250.106 *Warning: This is a private IP address, VPN is required to enable incoming connections.*

Out-of-Band/Failover (oobfo)	
Connection Status	Establishing connection
IP Address	0.0.0.0

- The operational status will change as the cellular modem finds a channel and connects to the network.
- The **Failover & Out-of-Band** screen will display information relating to a configured Failover/OOB interface and the status of that connection. The IP address of the Failover / OOB interface will be presented in the **Failover & Out-of-Band** screen once the Failover/OOB interface has been triggered.

5.7.3 Cellular Routing

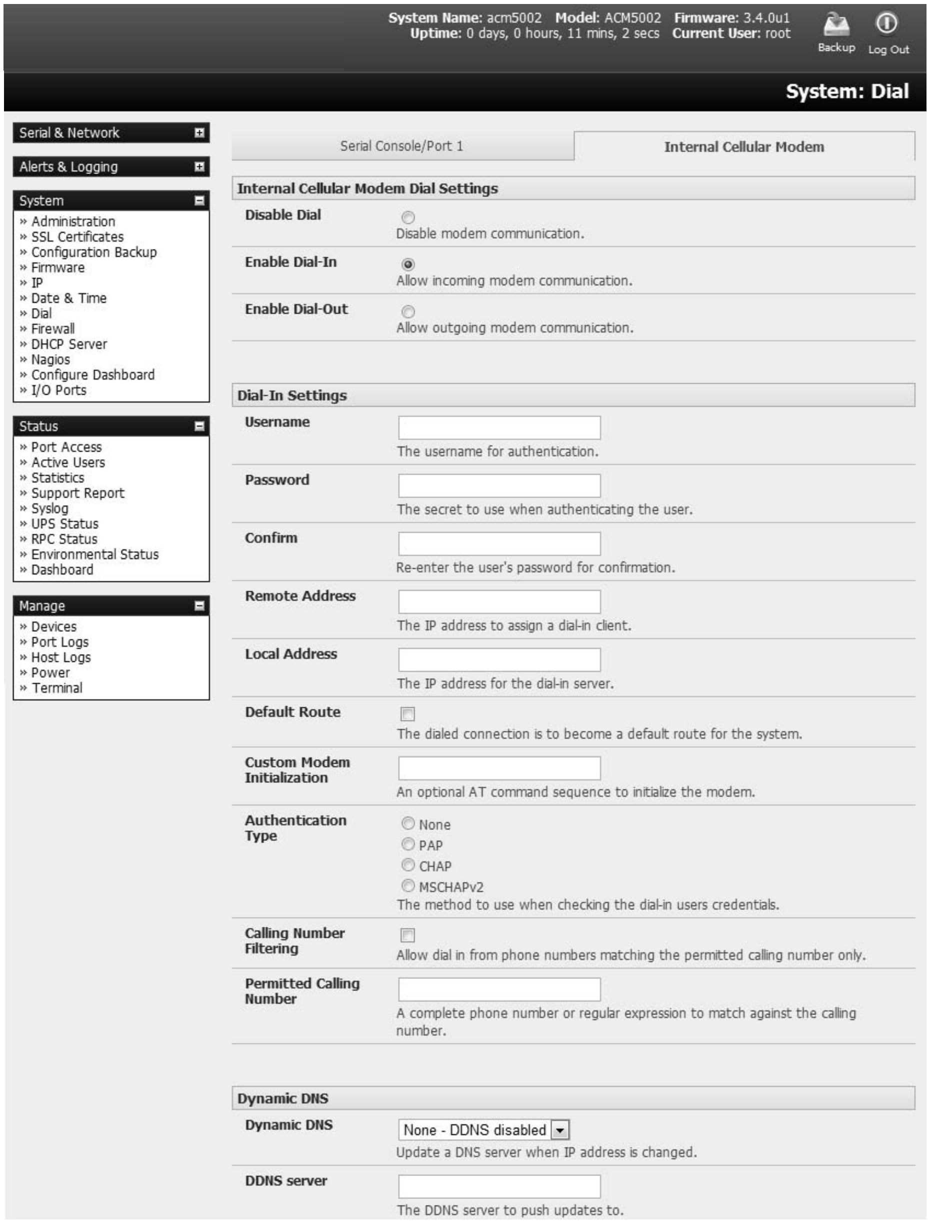
Once you have configured the carrier connection, the cellular modem can be configured to route traffic through the console server. This requires setting up forwarding and masquerading (refer to **5.8 Firewall and Forwarding**).

5.7.4 Set Up Cellular CSD Dial-In

Once you have configured the carrier connection, the cellular modem can be configured to receive Circuit Switched Data (CSD) calls.

Note: *CSD is a legacy form of data transmission developed for the TDMA-based mobile phone systems like GSM. CSD uses a single radio time slot to deliver 9.6kb/s data transmission to the GSM Network and Switching Subsystem, where it could be connected through the equivalent of a normal modem to the Public Switched Telephone Network (PSTN) an allow direct calls to any dial-up service. CSD is provided selectively by carriers. As such, it is important you receive a Data Terminating number as part of the mobile service your carrier provides. This is the number that external modems will call to access the console server.*

- Select the **Cellular Modem** panel on the **System: Dial** menu.
- Check **Enable Dial-In** and configure the **Dial-In Settings**.



System Name: acm5002 **Model:** ACM5002 **Firmware:** 3.4.0u1
Uptime: 0 days, 0 hours, 11 mins, 2 secs **Current User:** root

System: Dial

Internal Cellular Modem Dial Settings

Disable Dial ○ Disable modem communication.

Enable Dial-In ● Allow incoming modem communication.

Enable Dial-Out ○ Allow outgoing modem communication.

Dial-In Settings

Username The username for authentication.

Password The secret to use when authenticating the user.

Confirm Re-enter the user's password for confirmation.

Remote Address The IP address to assign a dial-in client.

Local Address The IP address for the dial-in server.

Default Route □ The dialed connection is to become a default route for the system.

Custom Modem Initialization An optional AT command sequence to initialize the modem.

Authentication Type ○ None ○ PAP ○ CHAP ○ MSCHAPv2
The method to use when checking the dial-in users credentials.

Calling Number Filtering □ Allow dial in from phone numbers matching the permitted calling number only.

Permitted Calling Number A complete phone number or regular expression to match against the calling number.

Dynamic DNS

Dynamic DNS None - DDNS disabled
Update a DNS server when IP address is changed.

DDNS server The DDNS server to push updates to.

5.8 Firewall and Forwarding

Tripp Lite console servers with version 3.3 firmware (and beyond) have basic routing, NAT (Network Address Translation), packet filtering and port forwarding support on all network interfaces. This enables the console server to function as an Internet or external network gateway, via cellular connections or other Ethernet networks on two Ethernet port models:

– **Network Forwarding** allows the network packets on one network interface (i.e. LAN1 / eth0) to be forwarded to another network interface (i.e. LAN2/eth1 or dial-out/cellular). Locally networked devices can IP connect through the console server to devices on remote networks.

– **IP Masquerading** is used to allow all devices on your local private network to hide behind and share one public IP address when connecting to a public network. This type of translation is only used for connections originating within the private network destined for the outside public network. Each outbound connection is maintained using a different source IP port number.

  When using IP masquerading, devices on the external network cannot initiate connections to devices on the internal network. **Port Forwards** allow external users to connect to a specific port on the external interface of the console server and be redirected to a specified internal address for a device on the internal network.

– With **Firewall Rules**, packet filtering inspects each packet passing through the firewall and accepts or rejects it based on user-defined rules.

– Then **Service Access Rules** can be set for connecting to the console server/router itself.

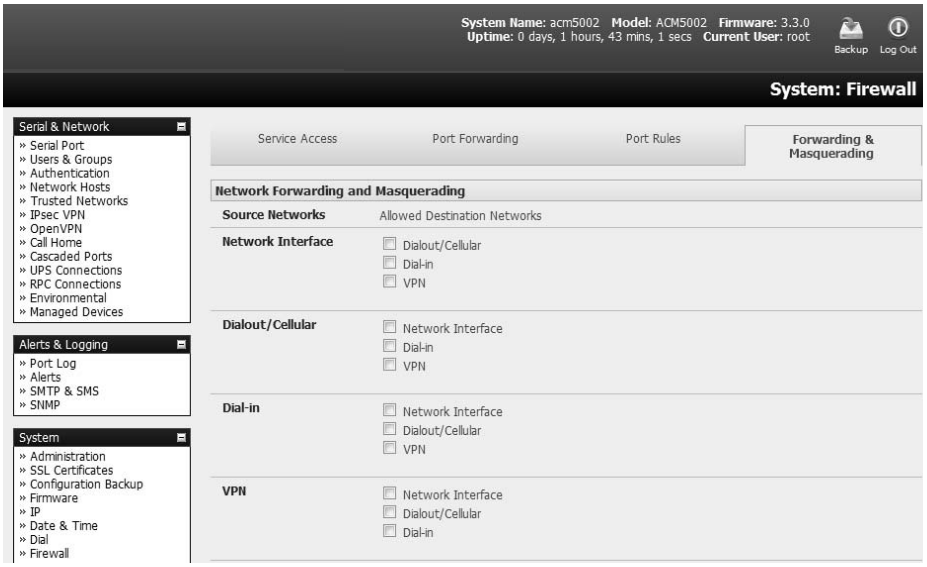
5.8.1 Configuring Network Forwarding and IP Masquerading

To use a console server as an Internet or external network gateway requires establishing an external network connection, then enabling forwarding and masquerading functions.

Note: *Network forwarding allows the network packets on one network interface (i.e. LAN1 / eth0) to be forwarded to another network interface (i.e. LAN2/eth1 or dial-out/cellular) so locally networked devices can IP connect through the console server to devices on a remote network. IP masquerading is used to allow all the devices on your local private network to hide behind and share one public IP address when connecting to a public network. This type of translation is only used for connections originating within the private network destined for the outside public network, and each outbound connection is maintained by using a different source IP port number.*

By default, all console server models are configured so they will not route traffic between networks. To use the console server as an Internet or external network gateway, forwarding must be enabled so traffic can be routed from the internal network to the Internet/external network.

➢ Navigate to the **System: Firewall** page, then click on the **Forwarding & Masquerading** tab.



System Name: acm5002 **Model:** ACM5002 **Firmware:** 3.3.0
Uptime: 0 days, 1 hours, 43 mins, 1 secs **Current User:** root

System: Firewall

Network Forwarding and Masquerading

Source Networks	Allowed Destination Networks
Network Interface	□ Dialout/Cellular □ Dial-in □ VPN
Dialout/Cellular	□ Network Interface □ Dial-in □ VPN
Dial-in	□ Network Interface □ Dialout/Cellular □ VPN
VPN	□ Network Interface □ Dialout/Cellular □ Dial-in

- Find the **Source Network** to be routed, then select the relevant **Destination Network** to enable Forwarding.

For example, to configure a single Ethernet device (such as a B095) as a cellular router:

- The **Source Network** would be the **Network Interface** and the **Destination Network** would be **Dial-Out/Cellular.**

IP masquerading is generally required if the console server will be routed to the Internet or if the external network it is being routed to does not have routing information about the internal network behind the console server.

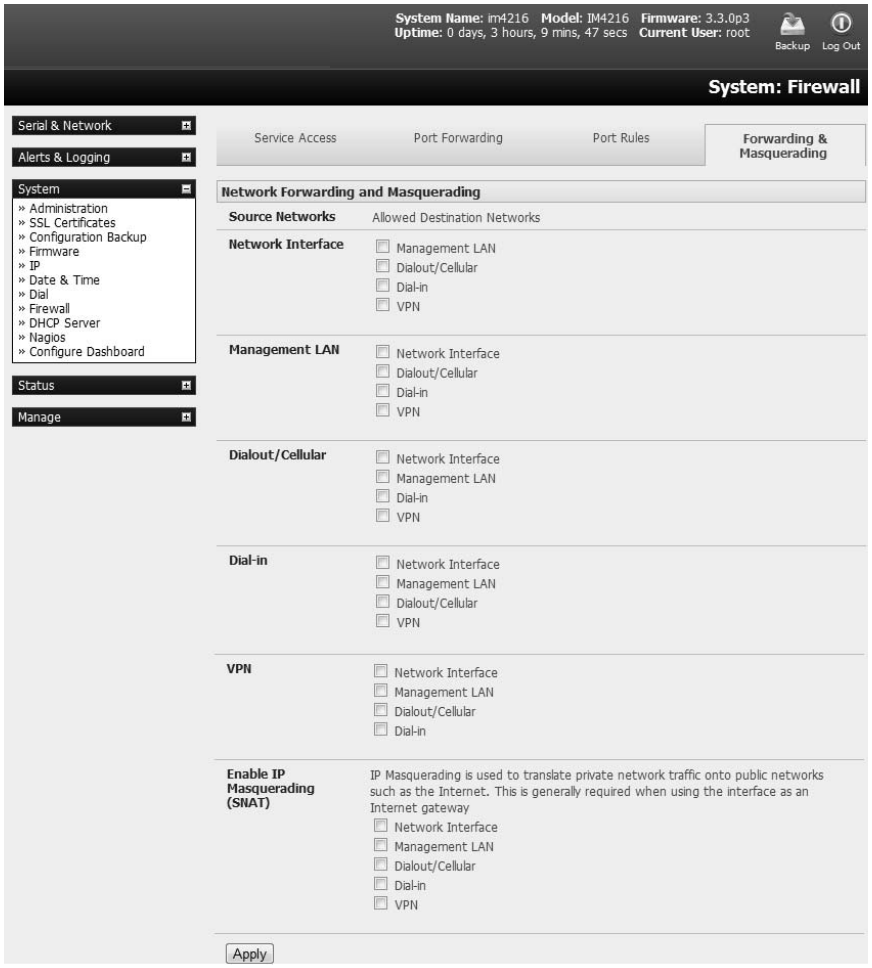
IP masquerading performs Source Network Address Translation (SNAT) on outgoing packets to make them appear as if they are from the console server (rather than devices on the internal network). When response packets come back to devices on the external network, the console server will translate the packet address back to the internal IP so that it is routed correctly. This allows the console server to provide full outgoing connectivity for internal devices using a single IP address on the external network.

By default, IP masquerading is disabled for all networks. To enable masquerading:

- Select **Forwarding & Masquerading** panel on the **System: Firewall** menu.

- Check **Enable IP Masquerading (SNAT)** on the network interfaces where masquerading is to be enabled.

Masquerading is typically applied to any interface that is connecting with a public network such as the Internet (e.g., for the B095, the IP masquerading would be enabled on **Dial-Out/Cellular**).



System Name: im4216 **Model:** IM4216 **Firmware:** 3.3.0p3
Uptime: 0 days, 3 hours, 9 mins, 47 secs **Current User:** root

System: Firewall

Network Forwarding and Masquerading

Source Networks	Allowed Destination Networks
Network Interface	☐ Management LAN ☐ Dialout/Cellular ☐ Dial-in ☐ VPN
Management LAN	☐ Network Interface ☐ Dialout/Cellular ☐ Dial-in ☐ VPN
Dialout/Cellular	☐ Network Interface ☐ Management LAN ☐ Dial-in ☐ VPN
Dial-in	☐ Network Interface ☐ Management LAN ☐ Dialout/Cellular ☐ VPN
VPN	☐ Network Interface ☐ Management LAN ☐ Dialout/Cellular ☐ Dial-in
Enable IP Masquerading (SNAT)	IP Masquerading is used to translate private network traffic onto public networks such as the Internet. This is generally required when using the interface as an Internet gateway ☐ Network Interface ☐ Management LAN ☐ Dialout/Cellular ☐ Dial-in ☐ VPN

5.8.2 Configuring Client Devices

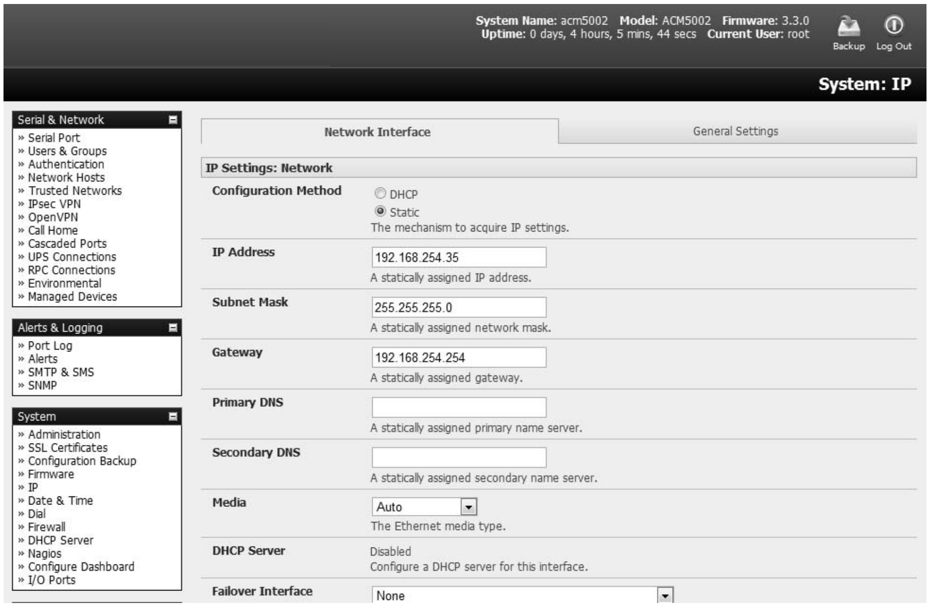
Client devices on the local network must be configured with Gateway and DNS settings. This can be done statically on each device or using DHCP.

Manual Configuration

Manually set a static gateway address (the address of the console server) and set the DNS server address to be the same as used on the external network. If the console server is acting as an internet gateway or a cellular router, use the ISP provided DNS server address.

DHCP Configuration

- Navigate to the **System: IP** page.
- Click the tab of the interface connected to the internal network. To use DHCP, a static address must be set. Check that the static IP and subnet mask fields are set.



System Name: acm5002 **Model:** ACM5002 **Firmware:** 3.3.0
Uptime: 0 days, 4 hours, 5 mins, 44 secs **Current User:** root

System: IP

IP Settings: Network

Configuration Method ○ DHCP ● Static
The mechanism to acquire IP settings.

IP Address 192.168.254.35
A statically assigned IP address.

Subnet Mask 255.255.255.0
A statically assigned network mask.

Gateway 192.168.254.254
A statically assigned gateway.

Primary DNS
A statically assigned primary name server.

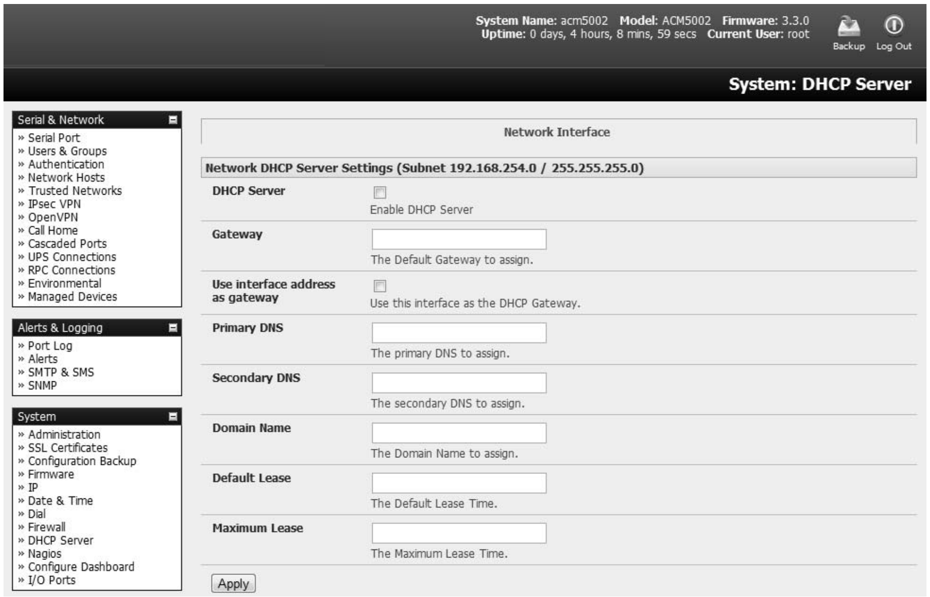
Secondary DNS
A statically assigned secondary name server.

Media Auto
The Ethernet media type.

DHCP Server Disabled
Configure a DHCP server for this interface.

Failover Interface None

- Click on the **Disabled** link next to **DHCP Server**, which will open the System: DHCP Server page.



System Name: acm5002 **Model:** ACM5002 **Firmware:** 3.3.0
Uptime: 0 days, 4 hours, 8 mins, 59 secs **Current User:** root

System: DHCP Server

Network DHCP Server Settings (Subnet 192.168.254.0 / 255.255.255.0)

DHCP Server □
Enable DHCP Server

Gateway
The Default Gateway to assign.

Use interface address as gateway □
Use this interface as the DHCP Gateway.

Primary DNS
The primary DNS to assign.

Secondary DNS
The secondary DNS to assign.

Domain Name
The Domain Name to assign.

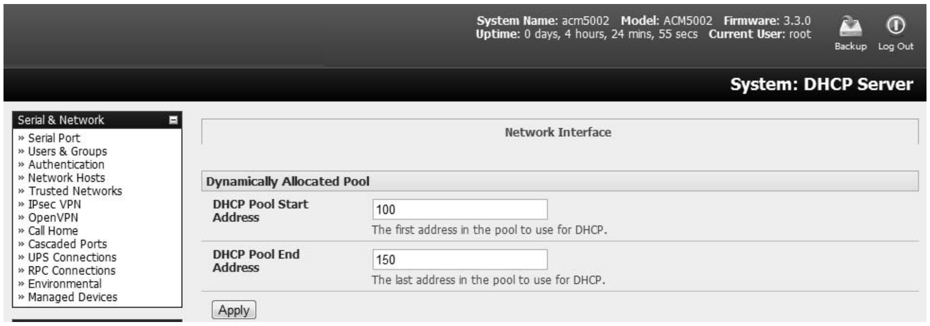
Default Lease
The Default Lease Time.

Maximum Lease
The Maximum Lease Time.

- Check **Enable DHCP Server.**
- To configure the DHCP server, select the **Use interface address as gateway** check box**.**
- Set the DNS server address(es) to be the same as used on the external network. If the console server is acting as an internet gateway or a cellular router, then use the ISP provided DNS server address
- Enter the **Default Lease** time and **Maximum Lease** time in seconds. The lease time is the time that a dynamically assigned IP address is valid before the client must request it again.
- Click **Apply.**

The DHCP server will sequentially issue IP addresses from a specified address pool(s):

- ➢ Click **Add** in the **Dynamic Address Allocation Pools** field.
- ➢ Enter the **DHCP Pool Start Address** and **End Address**. Click **Apply.**



System Name: acm5002 Model: ACM5002 Firmware: 3.3.0
Uptime: 0 days, 4 hours, 24 mins, 55 secs Current User: root

System: DHCP Server

Network Interface

Dynamically Allocated Pool

DHCP Pool Start Address: 100
The first address in the pool to use for DHCP.

DHCP Pool End Address: 150
The last address in the pool to use for DHCP.

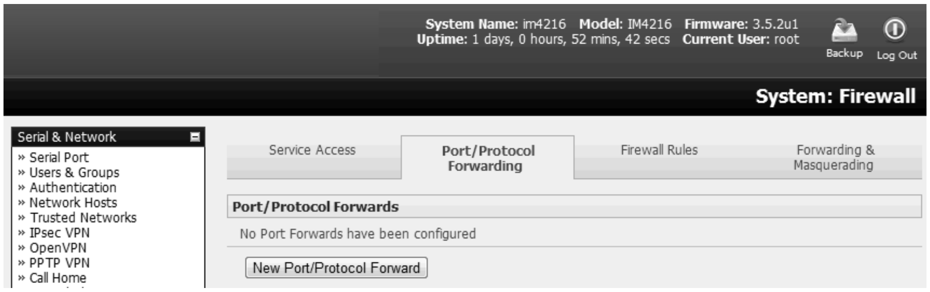
The DHCP server also supports pre-assigning IP addresses to be allocated only to specific MAC addresses and reserving IP addresses to be used by connected hosts with fixed IP addresses.

Once applied, devices on the internal network will be able to access resources on the external network.

5.8.3 Port / Protocol Forwarding

When using IP masquerading, devices on the external network cannot initiate connections to devices on the internal network.

To work around this, port forwarding can be set up to allow external users to connect to a specific port or range of ports on the external interface of the console server/cellular router. The console server/cellular router redirects the data to a specified internal address and port range.



System Name: im4216 Model: IM4216 Firmware: 3.5.2u1
Uptime: 1 days, 0 hours, 52 mins, 42 secs Current User: root

System: Firewall

Port/Protocol Forwards

No Port Forwards have been configured

To set up a port/protocol forward:

- ➢ Navigate to the **System: Firewall** page and click on the **Port Forwarding** tab.
- ➢ Click **Add New Port Forward.**
- ➢ Fill in the following fields:

Name: Name for the port forward. This should describe the target and the service that the port forward is used to access.

Input Interface: This allows the user to only forward the port from a specific interface. In most cases, this should be left as "Any".

Source Address/Address Range: This allows the user to restrict access to a port forward to a specific source IP address or IP address range of the data. This may be left blank. IP address ranges use the format *ip/netmask* (where netmask is in bits 1-32).

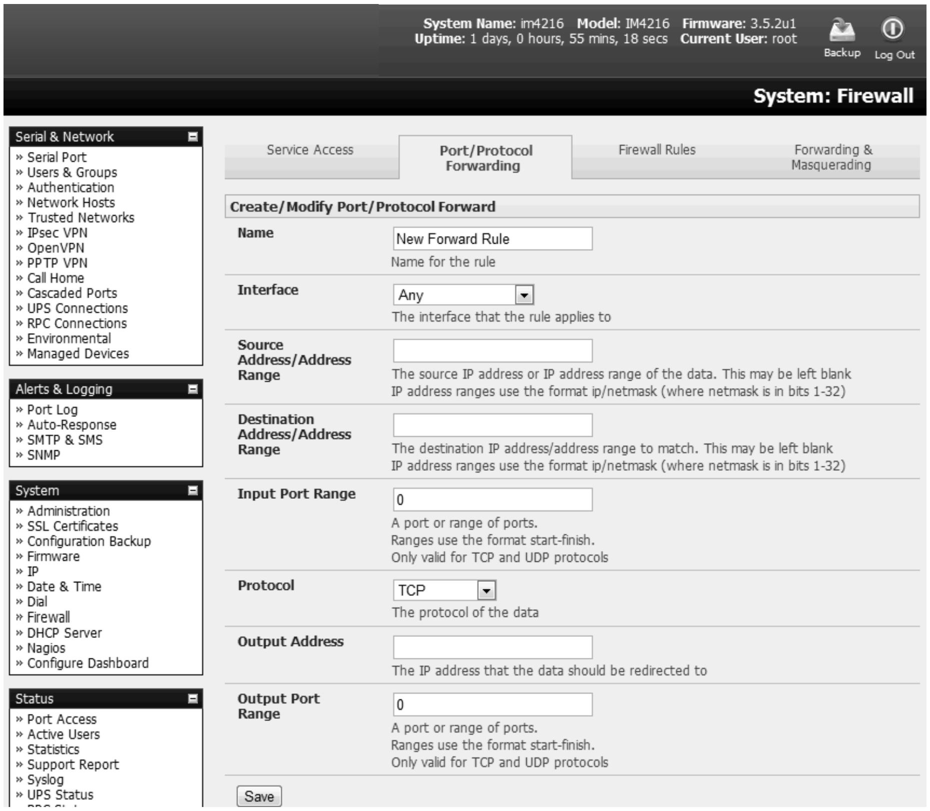
Destination Address/Address Range: The destination IP address/address range to match. This may be left blank. IP address ranges use the format ip/netmask (where netmask is in bits 1-32).

Input Port Range: The range of ports to forward to the destination IP. These will be the port(s) specified when accessing the port forward. These ports do not need to be the same as the output port range.

Protocol: The protocol of the data being forwarded. The options are *TCP* or *UDP, TCP and UDP, ICMP, ESP, GRE and Any.*

Output Address: The target of the port forward. This is an address on the internal network where packets sent to the Input Interface on the input port range are sent.

Output Port Range: The port or range of ports that the packets will be redirected to on the Output Address. Ranges use the format start-finish. This option is only valid for TCP and UDP protocols.



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.2u1
Uptime: 1 days, 0 hours, 55 mins, 18 secs **Current User:** root

System: Firewall

Create/Modify Port/Protocol Forward

Name	New Forward Rule Name for the rule
Interface	Any The interface that the rule applies to
Source Address/Address Range	The source IP address or IP address range of the data. This may be left blank IP address ranges use the format ip/netmask (where netmask is in bits 1-32)
Destination Address/Address Range	The destination IP address/address range to match. This may be left blank IP address ranges use the format ip/netmask (where netmask is in bits 1-32)
Input Port Range	0 A port or range of ports. Ranges use the format start-finish. Only valid for TCP and UDP protocols
Protocol	TCP The protocol of the data
Output Address	The IP address that the data should be redirected to
Output Port Range	0 A port or range of ports. Ranges use the format start-finish. Only valid for TCP and UDP protocols

For example, to forward port 8443 to an internal HTTPS server on 192.168.10.2, the following settings are used:

Input Interface: Any

Input Port Range: 8443

Protocol: TCP

Output Address: 192.168.10.2

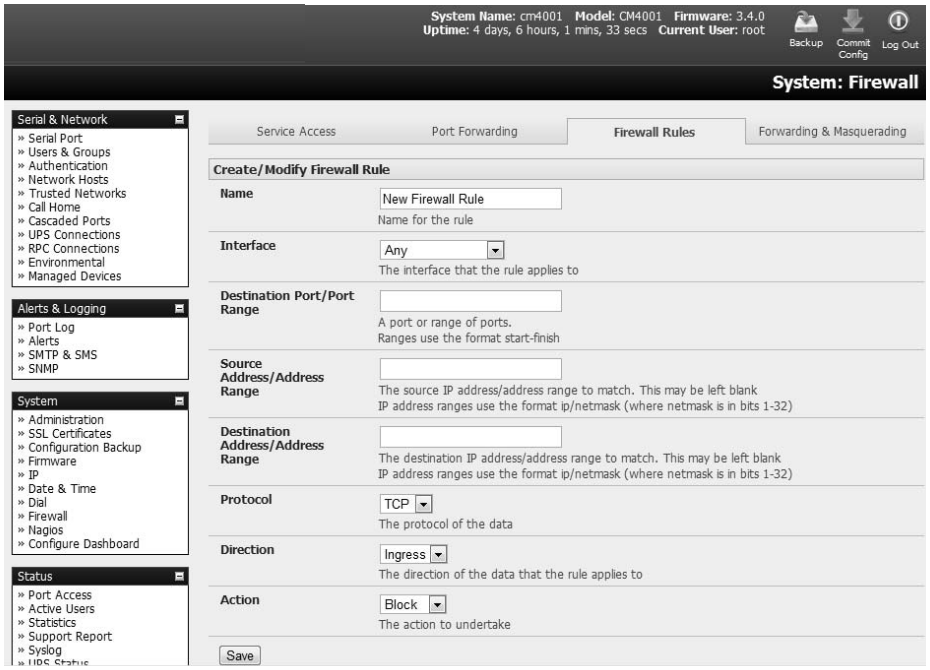
Output Port Range: 443

5.8.4 Firewall Rules

Firewall rules can be used to block or allow traffic through an interface based on port number, the source and/or destination IP address (range), the direction (ingress or egress) and the protocol. This can be used to allow custom on-box services, or block traffic based on policy.

To set up a firewall rule:

- Navigate to the **System: Firewall** page and click on the **Firewall Rules** tab.



System Name: cm4001 **Model:** CM4001 **Firmware:** 3.4.0
Uptime: 4 days, 6 hours, 1 mins, 33 secs **Current User:** root

System: Firewall

Create/Modify Firewall Rule

Name: New Firewall Rule — Name for the rule

Interface: Any — The interface that the rule applies to

Destination Port/Port Range: — A port or range of ports. Ranges use the format start-finish

Source Address/Address Range: — The source IP address/address range to match. This may be left blank. IP address ranges use the format ip/netmask (where netmask is in bits 1-32)

Destination Address/Address Range: — The destination IP address/address range to match. This may be left blank. IP address ranges use the format ip/netmask (where netmask is in bits 1-32)

Protocol: TCP — The protocol of the data

Direction: Ingress — The direction of the data that the rule applies to

Action: Block — The action to undertake

Note: *Prior to firmware version 3.4, this tab was labeled* ***Port Rules*** *and fewer firewall rules could be configured.*

- Click **New Firewall Rule.**
- Fill in the following fields:

Name — Name the rule. This name should describe the firewall rule policy being implemented (e.g., *block ftp, Allow Tony).*

Interface — Select the interface the firewall rule will be applied to (i.e. *Any, Dial-Out/Cellular, VPN, Network Interface, Dial-in* etc).

Port Range — Specify the Port or range of Ports (e.g. 1000 – 1500) the rule will apply to. This may be left blank.

Source MAC Address — Specify the source MAC address to be matched. This may be left blank. MAC addresses use the format XX:XX:XX:XX:XX:XX, where XX are hex digits.

Source Address Range — Specify the source IP address (or address range) to match. IP address ranges use the format ip/netmask (where netmask is in bits 1-32). This may be left blank.

Destination Range — Specify the destination IP address/range to match. IP address ranges use the format ip/netmask (where netmask is in bits 1-32). This may be left blank.

Protocol Select if the firewall rule will apply to *TCP* or *UDP, TCP and UDP, ICMP, ESP, GRE* or *Any.*

Direction Select the traffic direction the firewall rule will apply to (*Ingress* = incoming, or *Egress*).

Action Select the action (*Accept* or *Block*) that will be applied to the detected packets that match the Interface + Port Range + Source/Destination Address Range + Protocol + Direction.

For example, to block all SSH traffic from leaving Dial-Out Interface, the following settings can be used:

Interface: Dial-Out/Cellular

Port Range: 22

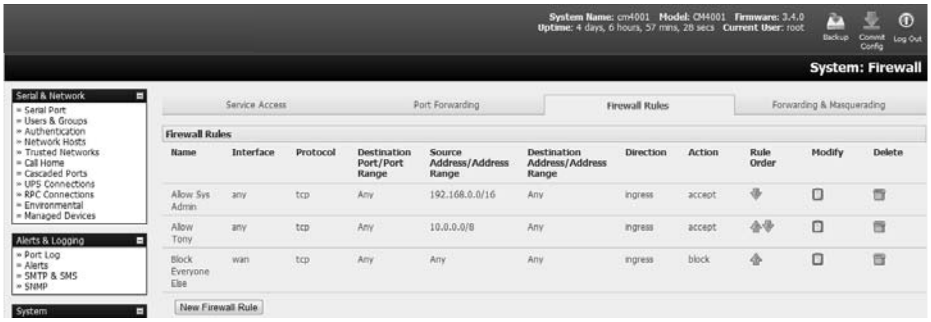
Protocol: TCP

Direction: Egress

Action: Block

Firewall rules are processed in a set order- from top to bottom. As such, rule placement is important. For example, with the following rules, all incoming traffic over the Network Interface is blocked, except when it comes from two assigned IP addresses (*SysAdmin* and *Tony*):

	To allow all incoming traffic on all interfaces from the SysAdmin:	To allow all incoming traffic from Tony:	To block all incoming traffic from the Network Interface:
Interface	*Any*	*Any*	*Network Interface*
Port Range	*Any*	*Any*	*Any*
Source MAC	*Any*	*Any*	*Any*
Source IP	*IP address of SysAdmin*	*IP address of Tony*	*Any*
Destination IP	*Any*	*Any*	*Any*
Protocol	*TCP*	*TCP*	*TCP*
Direction	*Ingress*	*Ingress*	*Ingress*
Action	*Accept*	*Accept*	*Block*



System Name: cm4001 **Model:** CM4001 **Firmware:** 3.4.0
Uptime: 4 days, 6 hours, 57 mins, 28 secs **Current User:** root

System: Firewall

Firewall Rules

Name	Interface	Protocol	Destination Port/Port Range	Source Address/Address Range	Destination Address/Address Range	Direction	Action	Rule Order	Modify	Delete
Allow Sys Admin	any	tcp	Any	192.168.0.0/16	Any	ingress	accept	↓	□	🗑
Allow Tony	any	tcp	Any	10.0.0.0/8	Any	ingress	accept	↑↓	□	🗑
Block Everyone Else	wan	tcp	Any	Any	Any	ingress	block	↑	□	🗑

However, if the above **Rule Order** changed so the "*Block Everyone Else*" rule was second on the list, then the incoming traffic over the network interface from Tony would be blocked.

5.8.5 Packet State Matching in Firewall Rules

As of firmware version 4.0.0, firewall rules can include packet state matching. This is implemented using an *iptables* extension module and can be set as follows:

Navigate to **System > Firewall > Firewall Rules**.

In either the IPv4 or IPv6 section, click the **New Firewall Rule** button.

Enter a **Name** for the new rule in the Name field.

Select the interface the new rule will be applied against from the **Interface** pop-up menu. ***Note:*** *the available interfaces vary depending on the exact hardware available on the console server. By default, new firewall rules are applied against* ***Any*** *(i.e. all) available interface.*

If the selected interface operates the TCP or UDP protocol, enter a port or port range of the rule's destination.

If the firewall rule is to apply against a particular MAC address, enter this value in the **Source MAC** address field. MAC addresses must be entered in standard xx:xx:xx:xx:xx:xx format (where each xx is a hexadecimal value).

If the firewall rule is to apply against a particular source address or range of source addresses, enter this address or address range in the **Source Address/Address Range** field. Address ranges can be entered using the ip-address/netmask syntax.

If the firewall rule is to apply to a particular destination address or address range, enter this address or address range in the **Destination Address/Address Range** field. As with the Source Address/Address Range field, address ranges can be entered using the ip-address/netmask syntax.

Set the data protocol against which firewall rule will apply. By default, new firewall rules apply against the TCP protocol.

Set the direction of data travel against which firewall rule will apply. This setting can take one of two values: Ingress or Egress. The default is Ingress. Ingress means data arriving at an interface from elsewhere. Egress means data leaving an interface and going to elsewhere.

Select the desired packet state to match against from the **Connection State** pop-up menu. Available options are New, Established/Related and Any. The default option is Any.

Note: *The default option leaves packet state matching inactive. With this option, no extra specifications are added to the firewall rule.*

Select the desired action to be taken regarding packets of the chosen state from the Action pop-up menu. The two available options are Block and Accept. The default action is Block.

Click the **Save** button. Using the **Connection State** pop-up menu in **System > Firewall > Firewall Rules > IPv4 > New Firewall Rule** to set packet state matching to New or Established/Related is equivalent to running one of the following at a shell-prompt:

```
# iptables -m state --state NEW□# iptables -m state --state \

  ESTABLISHED,RELATED
```

For example:

```
# iptables -I INPUT -p tcp --dport 23 -m state --state \

  ESTABLISHED,RELATED -j ACCEPT
```

This tells the firewall to accept incoming Telnet traffic for previously established Telnet sessions.

If the rule is created in **IPv6 > New Firewall Rule**, it is the equivalent of running one of the following at a shell-prompt:

```
# ip6tables -m state --state NEW
# ip6tables -m state --state ESTABLISHED,RELATED
```

For example:

```
# ip6tables -I INPUT -p tcp --dport 23 -m state --state \
  ESTABLISHED,RELATED -j ACCEPT
```

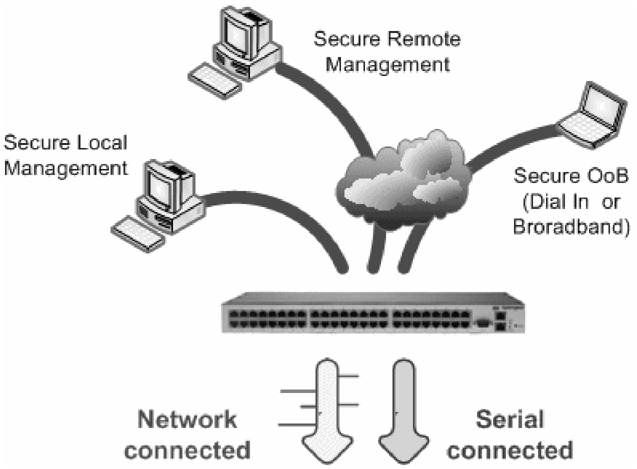
As with the iptables example, this tells the firewall to accept incoming telnet traffic for previously established telnet sessions.

For more on iptables, ip6tables and iptables-extensions, see the respective man pages: iptables, ip6tables and iptables-extensions.

6. SSH Tunnels and SDT Connector

Each console server has an embedded SSH server and uses SSH tunneling so remote users can securely connect through the console server to managed devices by using text-based console tools (e.g., SSH, telnet, SoL), or graphical tools (e.g., VNC, RDP, HTTPS, HTTP, X11, VMware, DRAC, iLO).

The managed devices being accessed can be located on the same local network as the console server, or they can be attached to the console server via serial port. The remote User/Administrator connects to the console server by way of SSH tunnel using a dial-up, wireless or ISDN modem, broadband Internet connection, enterprise VPN or local network connection.



To set up the secure SSH tunnel from the client PC to the console server, you must install and launch SSH client software on the User/Administrator PC. Tripp Lite recommends you use the SDT Connector client software supplied with the console server for this task. SDT Connector is simple to install and auto-configure and will provide all users with point-and-click access to all systems and devices in the secure network. With one click, SDT Connector sets up a secure SSH tunnel from the client to the selected console server, establishes a port forward connection to the target network-connected host or serial connected device, and executes the client application used in communicating with the host.

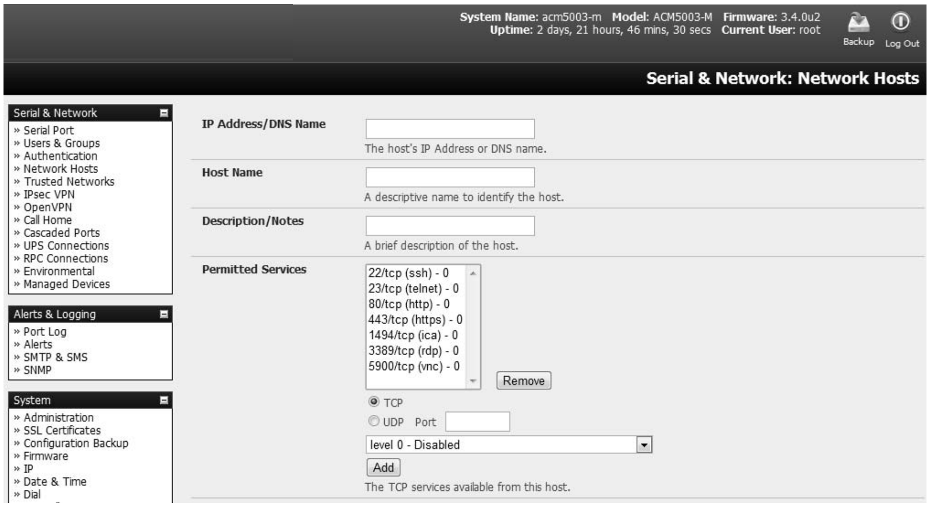
6.1 Configuring for SSH Tunneling to Hosts

To set up the console server for SSH tunneled access a network attached host:

- Add the new host and the permitted services using the **Serial & Network: Network Hosts** menu as detailed in section **4.4 Network Hosts**. Only these permitted services will be forwarded by SSH to the host. All other services (TCP/UDP ports) will be blocked.

***Note**: Some TCP Ports used by SDT in the console server include:*

22	*SSH (All SDT tunneled connections)*
23	*Telnet on local LAN (forwarded inside tunnel)*
80	*HTTP on local LAN (forwarded inside tunnel)*
3389	*RDP on local LAN (forwarded inside tunnel)*
5900	*VNC on local LAN (forwarded inside tunnel)*
73XX	*RDP over serial from local LAN – where XX is the serial port number (i.e. 7301 to 7348 on a 48-port console server)*
79XX	*VNC over serial from local LAN – where XX is the serial port number*



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.4.0u2
Uptime: 2 days, 21 hours, 46 mins, 30 secs **Current User:** root

Serial & Network: Network Hosts

IP Address/DNS Name
The host's IP Address or DNS name.

Host Name
A descriptive name to identify the host.

Description/Notes
A brief description of the host.

Permitted Services
22/tcp (ssh) - 0
23/tcp (telnet) - 0
80/tcp (http) - 0
443/tcp (https) - 0
1494/tcp (ica) - 0
3389/tcp (rdp) - 0
5900/tcp (vnc) - 0

● TCP
○ UDP Port

level 0 - Disabled

The TCP services available from this host.

- Add new Users using the **Serial & Network: Users & Groups** menu as detailed in **4.4 Network Hosts**. Users can be authorized to access the console server ports and specified network-attached hosts. To simplify configuration, the Administrator can first set up Groups with group access permissions, then assign Users to those Group(s).

6.2 SDT Connector Client Configuration

The SDT Connector client works with all Tripp Lite console servers. Each of these remote console servers have an embedded OpenSSH-based server, which can be configured to port forward connections from the SDT Connector client to hosts on their local network, as detailed in the previous chapter. The SDT Connector can also be pre-configured with access tools and applications available to be run when access to a particular host has been established.

SDT Connector can connect to the console server using alternate OOB access. It can also access the console server itself and access devices connected to serial ports on the console server.

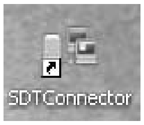
6.2.1 SDT Connector Client Installation

- The SDT Connector set up program (***SDTConnector Setup-1.n.exe*** or ***sdtcon-1.n.tar.gz***) is included on the CD supplied with your Tripp Lite console server product.
- Run the set-up program.

***Note:** For Windows clients, the SDTConnectorSetup-1.n.exe application will install the SDT Connector 1.n.exe and the config file defaults.xml. If there is already a config file on the Windows PC, then it will not be overwritten. To remove the earlier config file, run the regedit command and search for "SDT Connector", then remove the directory with this name.*

For Linux and other UNIX clients, *SDTConnector.tar.gz* application will install the *sdtcon-1.n.jar* and the config file *defaults.xml.*

Once the installer completes, you will have a working SDT Connector client installed on your machine and an icon on your desktop:



- Click the SDT Connector icon on your desktop to start the client.

Note: *SDT Connector is a Java application, so it must have a Java Runtime Environment (JRE) installed. It will install on Windows 2000 and later and on most Linux platforms. Solaris platforms are also supported. However, they must have Firefox installed. SDT Connector can run on any system with Java 1.4.2 and above installed, but it assumes the web browser is Firefox, and that xterm -e telnet opens a telnet window.*

6.2.2 Configuring a New Gateway in the SDT Connector Client

To create a secure SSH tunnel to a new console server:

- Click the New Gateway icon or select the **File: New Gateway** menu option.

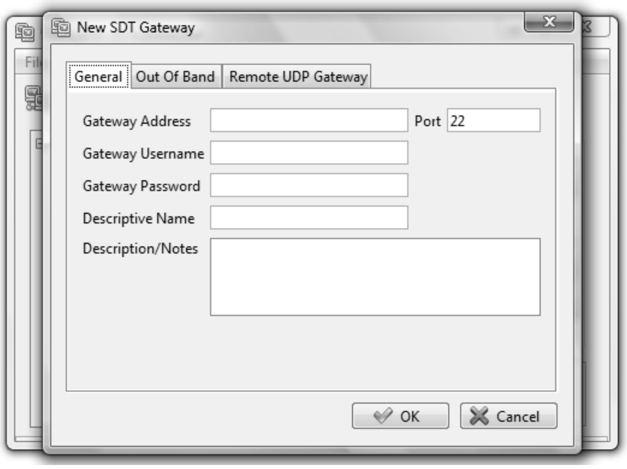
- Enter the IP or DNS **Address** of the console server and the SSH port that will be used (typically 22).

Note: *If SDT Connector is connecting to a remote console server through the public Internet or routed network you will need to:*

  - *Determine the public IP address of the console server (or of the router / firewall that connects the console server to the Internet) as assigned by the ISP. One way to find the public IP address is to access / or / from a computer on the same network as the console server and note the reported IP address.*

  - *Set port forwarding for TCP port 22 through any firewall/NAT/router located between SDT Connector and the console server so it points to the console server. For port forwarding instructions for a range of routers, visit http://www.portforward.com. Also, you can use the Open Port Check tool at http://www.canyouseeme.org to check whether port forwarding through local firewall/NAT/router devices has been properly configured.*

- Enter the **Username** and **Password** of a user on the gateway that has been enabled to connect via SSH and/or create SSH port redirections.



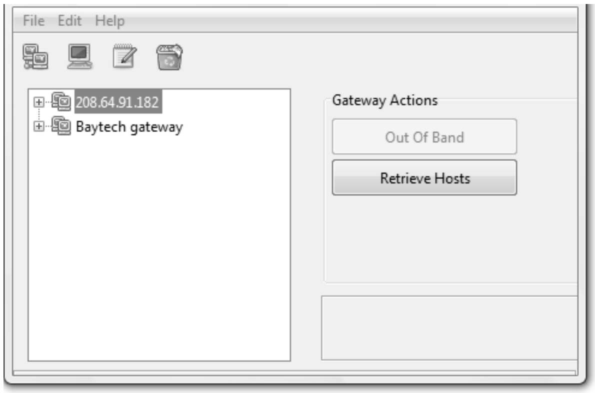
Port 22

- Optionally, enter a **Descriptive Name** to display, instead of the IP or DNS address, and any **Notes** or a **Description** of this gateway (such as its firmware version, site location or anything special about its network configuration).
- Click **OK** and an icon for the new gateway will now appear in the *SDT Connector* home page.

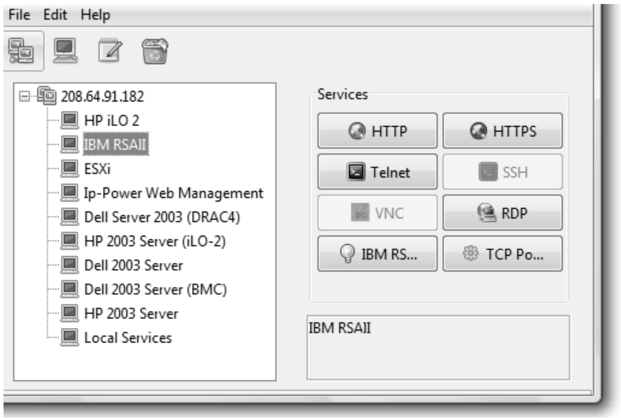
Note: *For an SDT Connector user to access a console server (and access specific hosts or serial devices connected to that console server), that user must first be set up on the console server, and must be authorized to access the specific ports / hosts (refer to* ***5. Firewall, Failover and OOB Access****). Only these permitted services will be forwarded by SSH to the Host. All other services (TCP/UDP ports) will be blocked.*

6.2.3 Auto-Configure SDT Connector Client with the User's Access Privileges

Each user on the console server has an access profile configured with access privileges to specific connected hosts and serial port devices. This configuration can be auto-uploaded into the SDT Connector client:



- Click on the new gateway icon and select **Retrieve Hosts**. This will:
  - Configure access to network-connected hosts the user is authorized to access and set up (for each of these Hosts), the services (e.g. HTTPS, IPMI2.0) and the related IP ports being redirected.
  - Configure access to the console server itself (this is displayed as a Local Services host).
  - Configure access with the enabled services for the serial port devices connected to the console server.

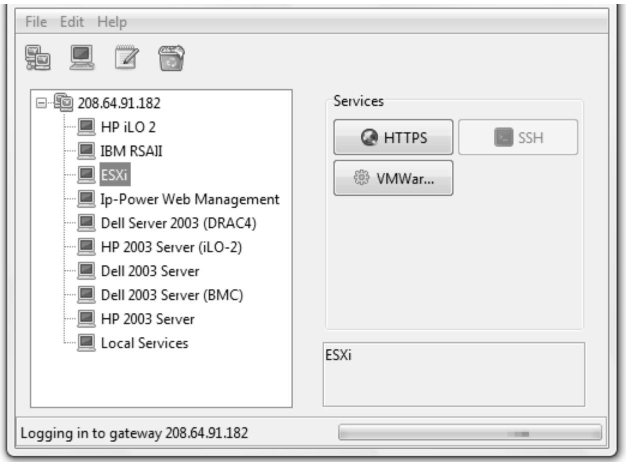


IBM RSAII

Note: *The Retrieve Hosts function auto-configures all user classes (i.e. they can be members of user or admin or some other group or no group). The SDT Connector will not auto-configure the root; it is recommended the account only be used for initial configuration and for adding an initial Administrator account to the console server.*

6.2.4 Make an SDT Connection Through the Gateway to a Host

- Simply **point** at the host to be accessed, and **click** on the service to be used in accessing that host. The SSH tunnel to the gateway is automatically established, the appropriate ports redirected through to the host and the appropriate local client application is launched pointing at the local endpoint of the redirection:



ESXi

Logging in to gateway 208.64.91.182

Note: *The SDT Connector client can be configured with an unlimited number of gateways. Each gateway can be configured to port forward an unlimited number of locally networked hosts. Similarly, there is no limit on the number of SDT Connector clients who can be configured to access the gateway. Nor are there limits on the number of host connections that an SDT Connector client can concurrently have open through the one gateway tunnel.*

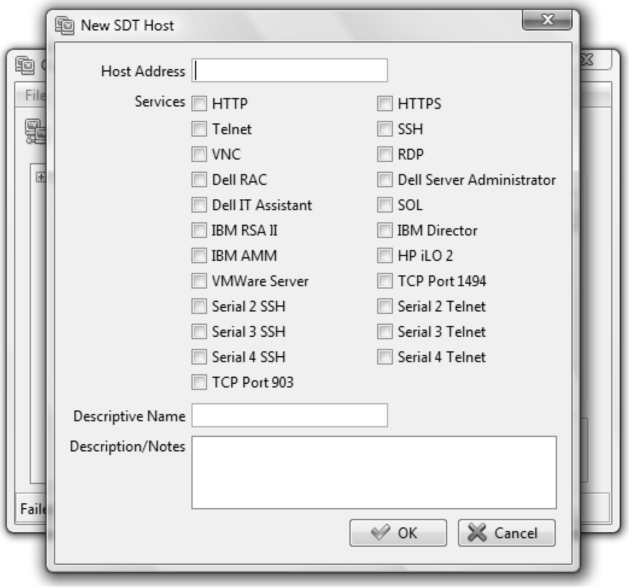
There is a limit on the number of SDT Connector SSH tunnels that can be open at the same time on a particular gateway. Tripp Lite console servers support at least 50 concurrent connections. For example, a site with a Tripp Lite gateway can have up to 50 users securely controlling an unlimited number of network attached computers and devices (servers, routers, etc.) at that site, at any time.

Tripp Lite console servers support hundreds of simultaneous client tunnels.

6.2.5 Manually Adding Hosts to the SDT Connector Gateway

For each gateway, you can manually specify the network-connected hosts accessed through that console server. For each host, specify the services used in communicating with the host.

- Select the newly added gateway and click the host icon to create a host that is accessible via the gateway. Alternately, you can select **File: New Host.**

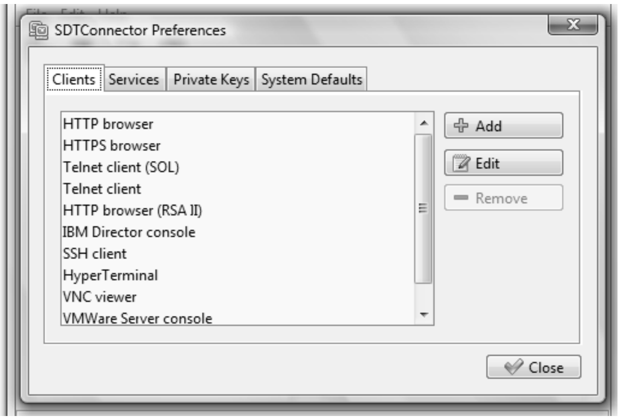


- Enter the IP or DNS **Host Address** (if this is a DNS address, it must be resolvable by the gateway).
- Select which **Services** are to be used in accessing the new host. A range of service options are pre-configured in the default SDT Connector client (RDP, VNC, HTTP, HTTPS, Dell RAC, VMware, etc.).
- Optionally, enter a **Descriptive Name** for the host to display (instead of the IP or DNS address) and any **Notes** or **Description** of this host (such as its operating system/release, or anything special about its configuration).
- Click **OK.**

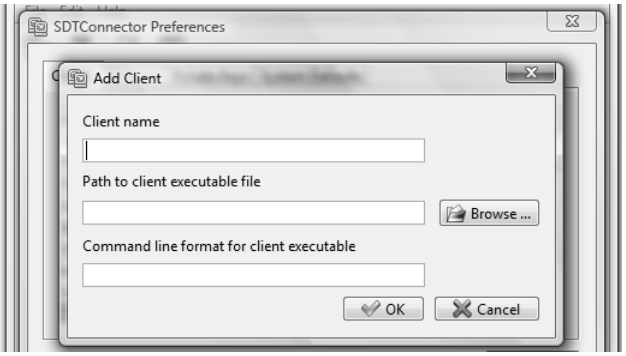
6.2.6 Manually Adding New Services to the New Hosts

To extend the range of services that can be used when accessing hosts with SDT Connector:

- Select **Edit: Preferences** and click the **Services** tab. Click **Add.**
- Enter a **Service Name** and click **Add.**
- Under the **General** tab, enter the TCP Port that this service runs on (e.g. 80 for HTTP). Optionally, select the client to access the local endpoint of the redirection.



- Select which **Client** application is associated with the new service. A range of client application options are pre-configured in the default SDT Connector (RDP client, VNC client, HTTP browser, HTTPS browser, Telnet client, etc.). If you wish to add new client applications to this range, proceed to **6.2.7 Adding a Client to Be Started for the New Service,** then return to this step.

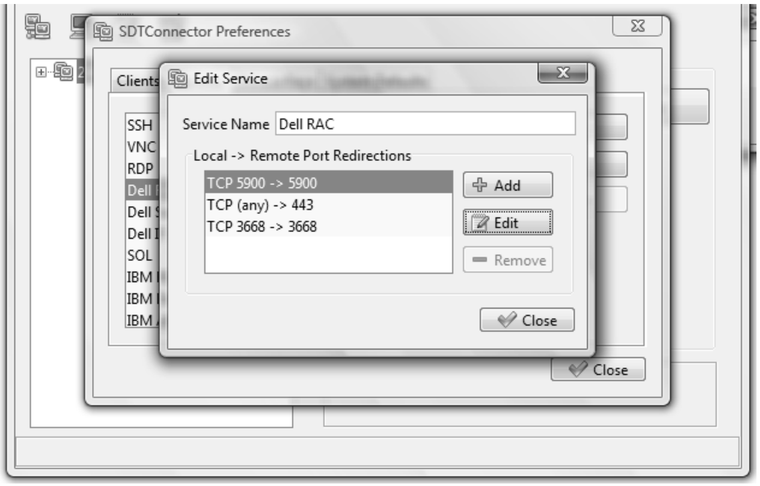

SDTConnector Preferences
Add Client
Client name
Path to client executable file
Browse ...
Command line format for client executable
OK
Cancel

- Click **OK**, and then **Close.**

A service typically consists of a single SSH port redirection and a local client to access it. However, it may consist of several redirections, some or all of which may have clients associated with them.

One example of this is the Dell RAC service. The first redirection is for the HTTPS connection to the RAC server. The RAC server has a client associated with it (web browser) that is launched immediately upon clicking the button for this service.

The second redirection is the VNC service that the user may choose to later launch from the RAC web console. It is automatically loads in a Java client served through the web browser, so it does not need a local client associated with it.



Service Name: Dell RAC

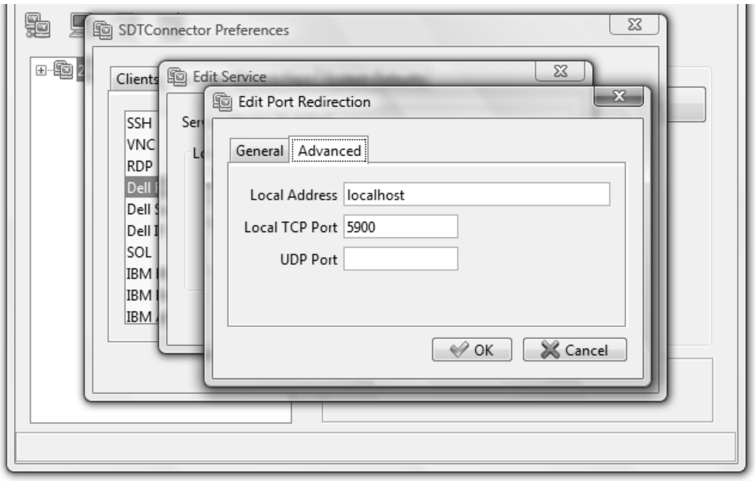
Local -> Remote Port Redirections

TCP 5900 -> 5900
TCP (any) -> 443
TCP 3668 -> 3668

- ➢ On the Add Service screen, you can click **Add** as many times as needed to add multiple new port redirections and associated clients.

You may also specify **Advanced** port redirection options:

- ➢ Enter the local address to bind to when creating the local endpoint of the redirection. It is not usually necessary to change this from "localhost".
- ➢ Enter a local TCP port to bind to when creating the local endpoint of the redirection. If this is left blank, a random port will be selected.



Local Address: localhost
Local TCP Port: 5900
UDP Port:

Note: *SDT Connector can also tunnel UDP services. SDT Connector tunnels the UDP traffic through the TCP SSH redirection, effectively making it is a tunnel within a tunnel.*

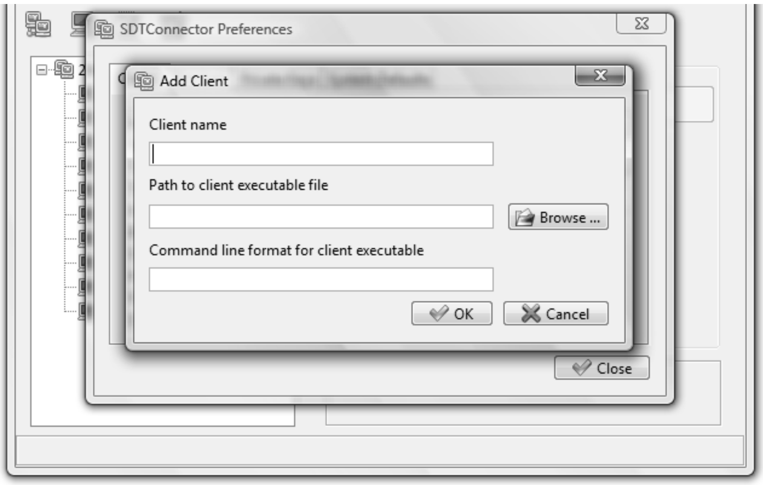
Enter the UDP port on which the service is running on the host. This will also be the local UDP port the SDT Connector binds to as the local endpoint of the tunnel.

For UDP services, you will need to specify a TCP port under the ***General*** *tab. This will be an arbitrary TCP port that is not in use on the gateway. An example of this is the SOL Proxy service. It redirects local UDP port 623 to remote UDP port 623 over the arbitrary TCP port 6667.*

6.2.7 Adding a Client Program to Be Started for the New Service

Clients are local applications that may be launched when a related service is clicked. To add to the pool of client programs:

- Select **Edit: Preferences** and click the **Client** tab. Click **Add.**



SDTConnector Preferences
Add Client
Client name
Path to client executable file
Browse ...
Command line format for client executable
OK
Cancel
Close

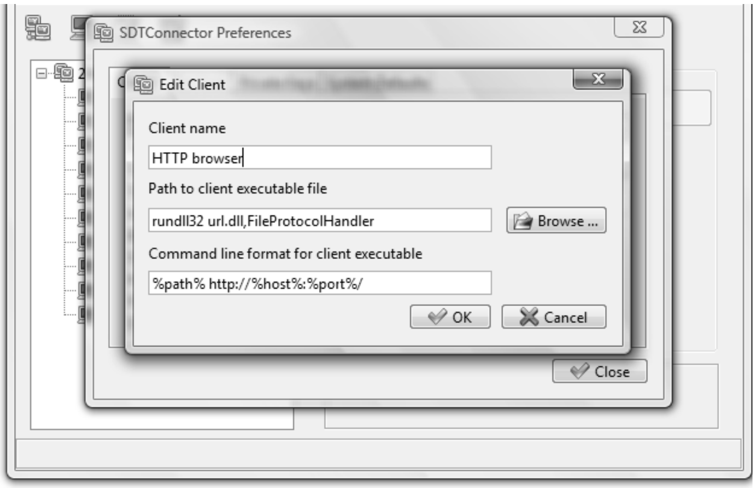
- Enter a **Name** for the client. Enter the **Path** to the executable file for the client (or click **Browse** to locate the executable).
- Enter a **Command Line** associated with launching the client application. SDT Connector typically launches a client using command line arguments to point it at the local endpoint of the redirection. There are three special keywords for specifying the command line format. When launching the client, SDT Connector substitutes these keywords with the appropriate values:

  %path% is path to the executable file, i.e. the previous field.

  %host% is the local address to which the local endpoint of the redirection is bound, i.e. the Local Address field for the Service redirection Advanced options.

  %port% is the local port to which the local endpoint of the redirection is bound, i.e. the Local TCP Port field for the Service redirection Advanced options. If this port is unspecified (i.e. "Any"), the appropriate randomly selected port will be substituted.

For example, SDT Connector is preconfigured for Windows installations with a HTTP service client that will connect with whichever local browser the local Windows user has configured as the default. Otherwise, the default browser used is Firefox:



Client name

HTTP browser

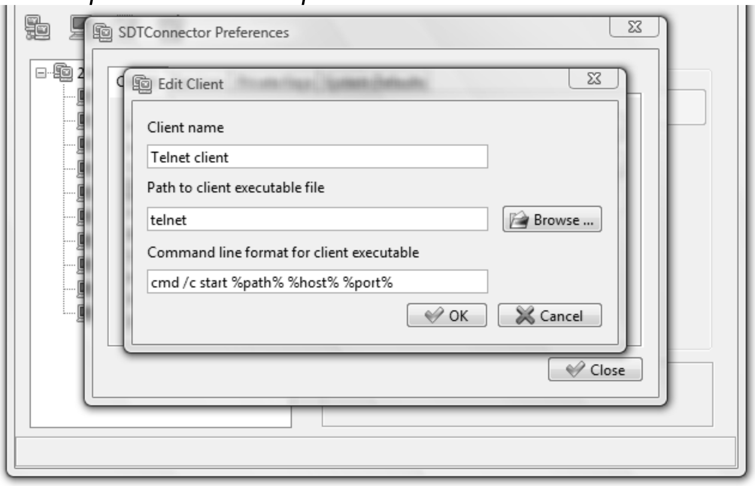
Path to client executable file

rundll32 url.dll,FileProtocolHandler

Command line format for client executable

%path% http://%host%:%port%/

Also, some clients are launched in a command line or terminal window. The telnet client is an example of this. As such, the “Path to client executable file” is *telnet* and the “Command line format for client executable” is *cmd /c start %path% %host% %port%:*



Client name

Telnet client

Path to client executable file

telnet

Command line format for client executable

cmd /c start %path% %host% %port%

- Click **OK.**

6.2.8 Dial-In Configuration

If the client PC is dialing in to the *Local/Console* port on the console server, you will need to set up a dial-in PPP link:

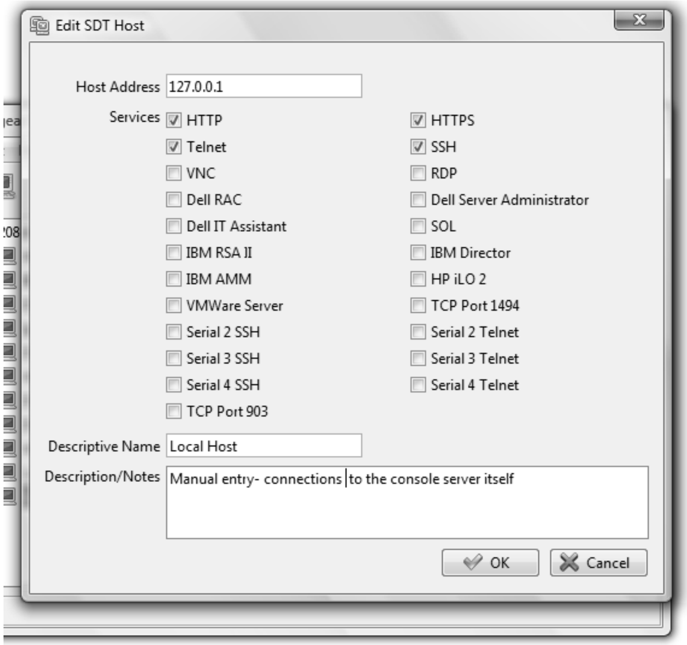
- Configure the console server for dial-in access (refer to **5.2.1 Configuring Dial-In PPP**).
- Set up the PPP client software at the remote User PC.

Once you have a dial-in PPP connection established, you can set up the secure SSH tunnel from the remote Client PC to the console server.

6.3 SDT Connector to Management Console

SDT Connector can also be configured for browser access the gateway’s Management Console – and for Telnet or SSH access to the gateway command line. For these connections to the gateway itself, you must configure *SDT Connector* to access the gateway (itself) by setting the *Console server* up as a *host*, and then configuring the appropriate services:

- Launch *SDT Connector* on your PC. Assuming you have already set up the *console server* as a *Gateway* in your *SDT Connector* client (with *username / password,* etc.), select this newly added *Gateway* and click the Host icon to create a host. Alternately, select **File: New Host**
- Enter 127.0.0.1 as the **Host Address** and provide details in **Descriptive Name/Notes**. Click **OK**.



Edit SDT Host

Host Address: 127.0.0.1

Services:

☑ HTTP	☑ HTTPS
☑ Telnet	☑ SSH
□ VNC	□ RDP
□ Dell RAC	□ Dell Server Administrator
□ Dell IT Assistant	□ SOL
□ IBM RSA II	□ IBM Director
□ IBM AMM	□ HP iLO 2
□ VMWare Server	□ TCP Port 1494
□ Serial 2 SSH	□ Serial 2 Telnet
□ Serial 3 SSH	□ Serial 3 Telnet
□ Serial 4 SSH	□ Serial 4 Telnet
□ TCP Port 903	

Descriptive Name: Local Host

Description/Notes: Manual entry- connections to the console server itself

- Click the **HTTP** or **HTTPS** services icon to access the gateway's management console, and/or click **SSH** or **Telnet** to access the gateway command line console.

Note: *To enable SDT access to the gateway console, you must configure the console server to allow port forwarded network access.*

With firmware version 3.3 and later, this can be done using the console server management Console. Simply browse to the console server and select the ***Service Access*** *tab on the* ***System: Firewall*** *menu. Ensure* ***SSH Command Shell*** *is enabled on the network interface and any out of band interfaces.*

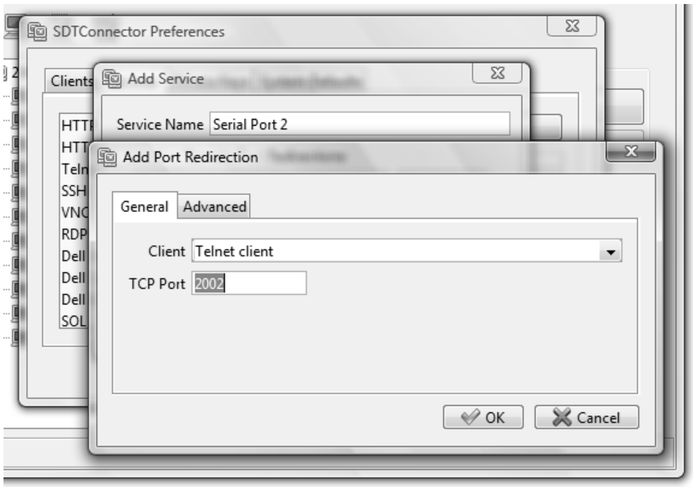
With earlier firmware:

- *Browse to the console server and select* ***Network Hosts*** *from* ***Serial & Network****. Click* ***Add Host.*** *In the* ***IP Address/DNS Name*** *field, enter 127.0.0.1 (this is the console server's network loopback address) and enter Loopback in* ***Description****.*
- *Remove all entries under* ***Permitted Services,*** *except those that will be used in accessing the management console (80/http or 443/https) or the command line (22/ssh or 23/telnet). Then scroll to the bottom and click* ***Apply.***
- *By default, Administrators have gateway access privileges. For Users to access the gateway management console, you will need to provide those Users the required access privileges. Select* ***Users & Groups*** *from* ***Serial & Network****. Click* ***Add User****. Enter a* ***Username****,* ***Description*** *and* ***Password/Confirm****. Select 127.0.0.1 from* ***Accessible Host****(s) and click* ***Apply.***

6.4 SDT Connector: Telnet or SSH Connect to Serially Attached Devices

SDT Connector can also be used to access text consoles on devices that are attached to the console server’s serial ports. For these connections, you must configure the SDT Connector client software with a service that will access the target gateway serial port, and then set the gateway up as a host:

- Launch *SDT Connector* on your PC. Select **Edit: Preferences** and click the **Services** tab. Click **Add.**
- Enter *"Serial Port 2"* in **Service Name** and click **Add.**
- Select **Telnet** client as the Client. Enter 2002 in **TCP Port**. Click **OK**, then **Close** and **Close** again.



Service Name: Serial Port 2

Client: Telnet client

TCP Port: 2002

- Assuming you have already set up the target console server as a gateway in your SDT Connector client (with username / password, etc.), select this gateway and click the **Host** icon to create a host. Alternately, select **File: New Host**.
- Enter 127.0.0.1 as the **Host Address** and select **Serial Port 2** for service. In **Descriptive Name**, enter something along the lines of Loopback ports, or Local serial ports. Click **OK.**
- Click the **Serial Port 2** icon for Telnet access to the serial console on the device attached to serial port 2 on the gateway.

To enable SDT Connector to access to devices connected to the gateway’s serial ports, you must also configure the console server itself to allow port forwarded network access to itself, and enable access to the assigned serial port:

- Browse to the console server and select **Serial Port** from **Serial & Network.**
- Click **Edit** next to selected Port # (e.g. Port 2 if the target device is attached to the second serial port). Ensure the port's serial configuration is appropriate for the attached device.
- Scroll down to **Console Server Setting** and select **Console Server Mode**. Check **Telnet** (or **SSH**). Scroll to the bottom and click **Apply.**
- Select **Network Hosts** from **Serial & Network** and click **Add Host.**
- In the **IP Address/DNS Name** field, enter *127.0.0.1* (this is the console server's network loopback address) and enter *Loopback* in **Description.**
- Remove all entries under **Permitted Services**, select **TCP** and enter *200n* in **Port**. This configures the telnet port enabled in the previous step, so for Port 2 you would enter *2002*.
- Click **Add**, then scroll to the bottom and click **Apply.**

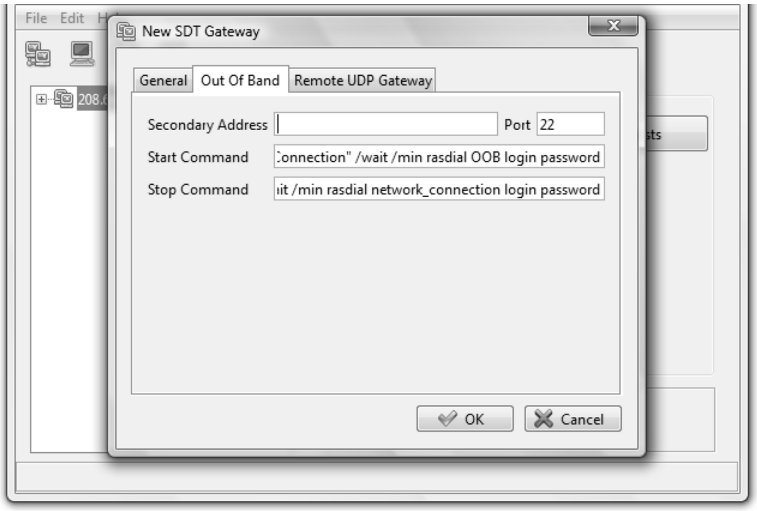
- By default, Administrators have gateway and serial port access privileges. For Users to access the gateway and serial port, you will need to provide those *Users* the required access privileges. Select **Users & Groups** from **Serial & Network**. Click **Add User**. Enter a **Username**, **Description** and **Password/Confirm**. Select 127.0.0.1 from **Accessible Host**(s) and select Port 2 from Accessible Port(s). Click **Apply.**

6.5 Using SDT Connector for Out-of-Band (OOB) Connection to the Gateway

SDT Connector can also be set up to connect to the console server (gateway) out-of-band (OOB). OOB access uses an alternate path for connecting to the gateway to that used for regular data traffic. OOB access is useful when the primary link to the gateway is unavailable or unreliable.

A gateway's primary link is typically a broadband Internet connection or Internet connection via LAN or VPN. Secondary out-of-band connectivity is provided by a dial-up or wireless modem directly attached to the gateway. Out-of-band access enables you to access the hosts and serial devices on the network, diagnose any connectivity issues, and restore the gateway's primary link.

In SDT Connector, OOB access is configured by providing the gateway’s secondary IP address and communicating to the SDT Connector how to start and stop the OOB connection. Starting an OOB connection may be achieved by initiating a dial-up connection, or adding an alternate route to the gateway. SDT Connector allows for maximum flexibility is this regard by allowing you to provide your own scripts or commands for starting and stopping the OOB connection.



Secondary Address
Port 22
Start Command :onnection" /wait /min rasdial OOB login password
Stop Command ıit /min rasdial network_connection login password

To configure SDT Connector for OOB access:

- When adding a new gateway or editing an existing gateway, select the **Out Of Band** tab.
- Enter the gateway’s secondary OOB IP address (e.g., the accessible IP address used when dialed in directly). You also may modify the gateway's SSH port if it is not using the default of *22*.
- In **Start Command,** enter the command or path to a script to start the OOB connection.
  - To initiate a pre-configured dial-up connection under Windows, use the following Start Command:

    cmd /c start "Starting Out of Band Connection" /wait /min rasdial network_connection login password where network_connection is the name of the network connection as displayed in Control Panel -> Network Connections, **login** is the dial-in username, and **password** is the dial-in password for the connection.

- To initiate a pre-configured dial-up connection under Linux, use the following Start Command:

  pon network_connection

  where *network_connection* is the name of the connection.

➢ Enter the command or path to a script to stop the OOB connection in **Stop Command.**

- To stop a pre-configured dial-up connection under Windows, use the following Stop Command:

  cmd /c start "Stopping Out of Band Connection" /wait /min rasdial network_connection /disconnect

  where *network connection* is the name of the network connection as displayed in *Control Panel -> Network Connections*.

- To stop a pre-configured dial-up connection under Linux, use the following Stop Command:

  poff network_connection

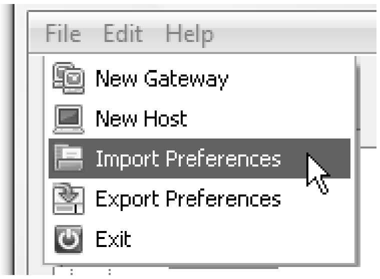
To make the OOB connection using SDT Connector*:*

➢ Select the gateway and click Out Of Band. The status bar will change color to indicate this gateway is now being accessed using the OOB link rather than the primary link.

When you connect to a service on a host behind the gateway, or to the console server gateway itself, SDT Connector will initiate the OOB connection using the provided Start Command. The OOB connection isn't stopped (using the provided Stop Command) until Out Of Band under Gateway Actions is clicked off, at which point the status bar will return to its normal color.

6.6 Importing (and Exporting) Preferences

To enable the distribution of pre-configured client configuration files, use the SDT Connector's Export/Import function:



➢ To save a configuration .xml file (for backup or importing into other SDT Connector clients), select **File: Export Preferences** and select the location to save the configuration file.

➢ To import a configuration, select **File: Import Preferences** and select the .xml configuration file to be installed.

6.7 SDT Connector Public Key Authentication

SDT Connector can authenticate against an SSH gateway using your SSH key pair, rather than requiring you to enter your password. This is known as public key authentication.

To use public key authentication with SDT Connector, first add the public part of your SSH key pair to your SSH gateway:

- ➢ Ensure the SSH gateway allows public key authentication. This is typically the default behavior.
- ➢ If you do not already have a public/private key pair for your client PC (the one running SDT Connector) generate them using *ssh-keygen, PuTTYgen* or a similar tool. You may use RSA or DSA, however, it is important you leave the passphrase field blank:
  - PuTTYgen: http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html
  - OpenSSH: http://www.openssh.org/
  - OpenSSH (Windows): http://sshwindows.sourceforge.net/download/
- ➢ Upload the public part of your SSH key pair (this file is typically named *id_rsa.pub* or *id_dsa.pub*) to the SSH gateway. Otherwise, add to *.ssh/authorized keys* in your home directory on the SSH gateway.
- ➢ Next, add the private part of your SSH key pair (this file is typically named *id_rsa* or *id_dsa*) to SDT Connector. Click **Edit: Preferences: Private Keys: Add** and locate the private key file. Click **OK.**

You do not have to add the public part of your SSH key pair, it is calculated using the private key.

SDT Connector will now use public key authentication when connecting through the SSH gateway (console server). You may have to restart SDT Connector to shut down any existing tunnels that were established using password authentication.

Also, if you have a host behind the console server that you connect to by clicking the SSH button in SDT Connector, you may also wish to configure access for public key authentication. This configuration is entirely independent of SDT Connector and the SSH gateway. You must configure the SSH client that SDT Connector launches (e.g., Putty, OpenSSH) and the host's SSH server for public key authentication. Essentially, what you are using is SSH over SSH, and the two SSH connections are entirely separate.

6.8 Setting up SDT for Remote Desktop Access

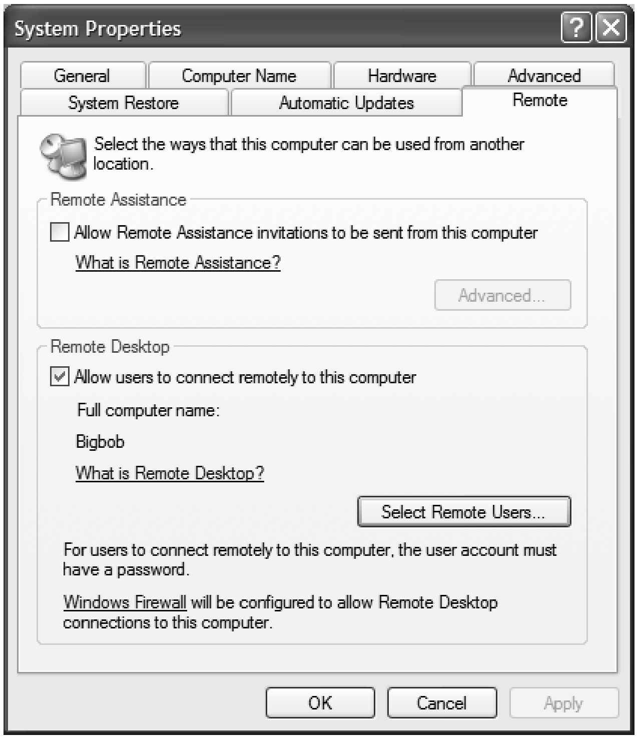
Microsoft's Remote Desktop Protocol (RDP) enables the system manager to securely access and manages remote Windows computers – to reconfigure applications and user profiles, upgrade the server's operating system, reboot the machine, etc. Tripp Lite's Secure Tunneling uses SSH tunneling, so this RDP traffic is securely transferred through an authenticated and encrypted tunnel.

SDT with RDP also allows remote users to connect to Windows XP and later computers and to Windows 2000 Terminal Servers. Doing so allows access to all applications, files, and network resources (with full graphical interface). To set up a secure remote desktop connection, you must enable **Remote Desktop** on the target Windows computer that is to be accessed and then configure the RPD client software on the client PC.

6.8.1 Enable Remote Desktop on the Target Windows Computer to Be Accessed

To enable **Remote Desktop** on the Windows computer being accessed:

- ➢ Open **System** in the Control Panel and click the **Remote** tab.



Select the ways that this computer can be used from another location.

Remote Assistance

☐ Allow Remote Assistance invitations to be sent from this computer

What is Remote Assistance?

Remote Desktop

☑ Allow users to connect remotely to this computer

Full computer name:

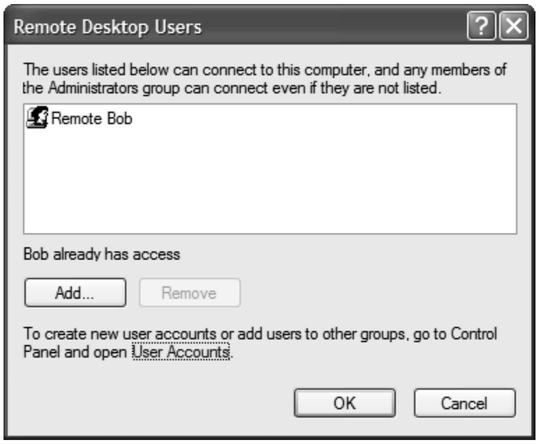
Bigbob

What is Remote Desktop?

For users to connect remotely to this computer, the user account must have a password.

Windows Firewall will be configured to allow Remote Desktop connections to this computer.

- Check **Allow users to connect remotely to this computer.**
- Click **Select Remote Users.**



The users listed below can connect to this computer, and any members of the Administrators group can connect even if they are not listed.

Remote Bob

Bob already has access

To create new user accounts or add users to other groups, go to Control Panel and open User Accounts.

- To set the user(s) who can remotely access the system with RDP, click **Add** on the **Remote Desktop Users** dialog box.

Notes: *If you need to set up new users for Remote Desktop access, open **User Accounts** in the Control Panel and proceed through the steps to assign the new user's name, password and account type (Administrator or Limited).*

With Windows XP Professional and Vista, you have only one remote desktop session, and it connects directly to the Windows root console. With Windows Server 2008, you can have multiple sessions (with Server 2003 you have three sessions - the console session and two other general sessions).

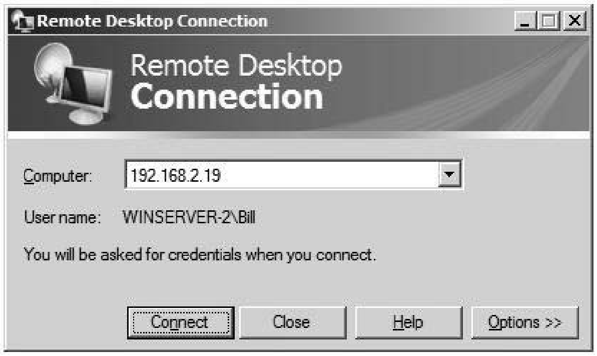
When the remote user connects to the accessed computer on the console session, remote desktop automatically locks that computer so no other user can access the applications and files. When you return to your computer, you can unlock it by typing CTRL+ALT+DEL.

6.8.2 Configure the Remote Desktop Connection Client

With the Client PC securely connected to the console server (locally, remotely from the enterprise VPN, or a secure SSH internet tunnel or dial-in SSH tunnel), you can establish the remote desktop connection from the client. Simply enable the **Remote Desktop Connection** on the remote client PC, and then point it to the SDT Secure Tunnel port in the console server:

A. On a Windows client PC

- ➢ Click **Start**. Point to **Programs**, then to **Accessories**, then **Communications**. Click **Remote Desktop Connection.**

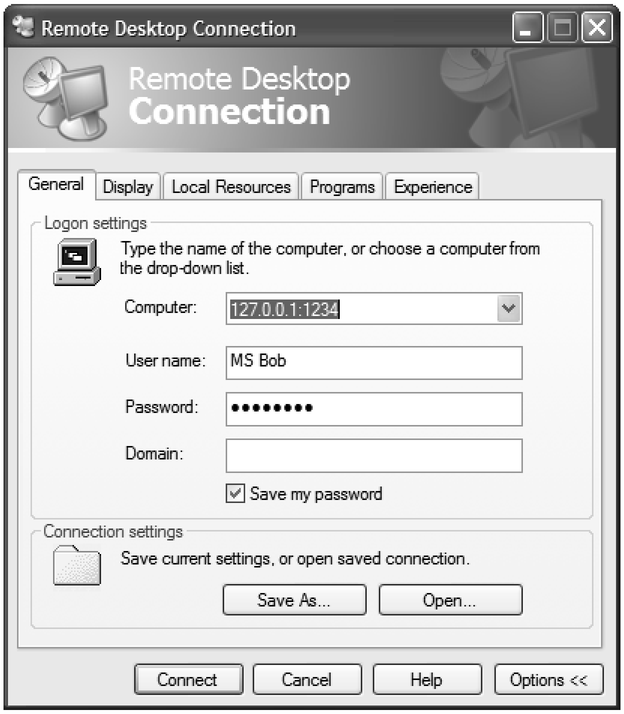


Computer: 192.168.2.19

User name: WINSERVER-2\Bill

You will be asked for credentials when you connect.

- ➢ In **Computer**, enter the appropriate IP Address and Port Number:
  - ▪ Where there is a direct local or enterprise VPN connection, enter the console server's IP Address and the Port Number of the SDT Secure Tunnel for the console server serial port that is attached to the Windows computer to be controlled. For example, if the Windows computer is connected to serial Port 3 on a *console server* located at 192.168.0.50, then you would enter *192.168.0.50:7303.*
- ➢ Where there is an SSH tunnel over a dial-up PPP connection, public internet connection, or private network connection, simply enter the localhost as the IP address *127.0.0.1.* For the port number, enter the source port you created when setting SSH tunneling /port forwarding (e.g., *:1234).*
- ➢ Click **Option.** In the **Display** section, specify an appropriate color depth (e.g., for a modem connection it is recommended you not use over 256 colors). In **Local Resources,** specify the peripherals on the remote Windows computer that are to be controlled (printer, serial port, etc.).



Logon settings

Type the name of the computer, or choose a computer from the drop-down list.

Computer: 127.0.0.1:1234

User name: MS Bob

Password: ••••••••

Domain:

☑ Save my password

Connection settings

Save current settings, or open saved connection.

- Click **Connect.**

Note: *The Remote Desktop Connection software is pre-installed with Windows XP and later. For earlier Windows PCs, you will need to download the RDP client:*

*Go to the Microsoft Download Center site http://www.microsoft.com/downloads/details.aspx?familyid=80111F21-D48D-426E-96C2-08AA2BD23A49&displaylang=en and click the **Download** button.*

This software package will install the client portion of Remote Desktop on Windows 95, Windows 98 and 98 Second Edition, Windows Me, Windows NT 4.0 and Windows 2000. When run, this software allows these older Windows platforms to remotely connect to a computer running the current Windows version.

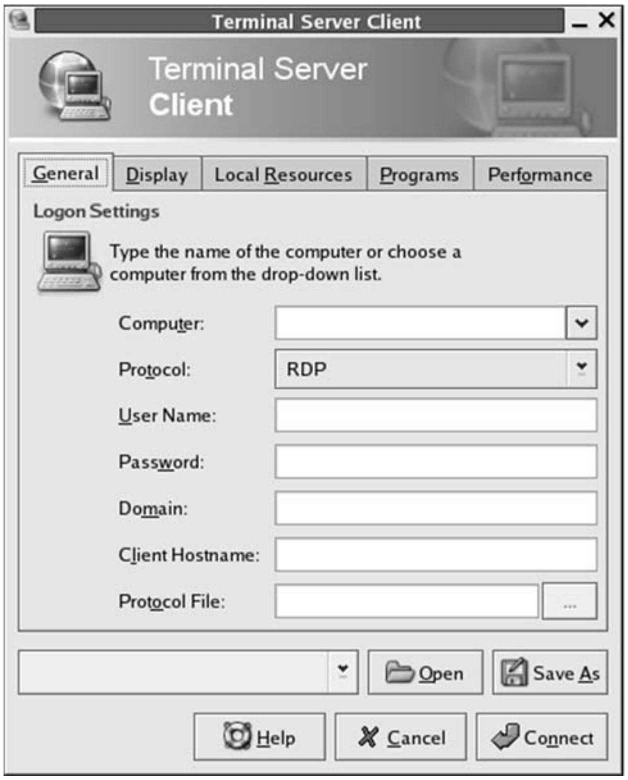
B. On a Linux or UNIX client PC:

- Launch the open source *rdesktop* client:

  rdesktop -u *windows-user-id* -p *windows-password* -g 1200x950 *ms-windows-terminal-server-host-name*

Option	Description
-a	Color depth: 8, 16, 24
-r	Device redirection. i.e. Redirect sound on remote machine to local device i.e. -0 -r sound (MS/Windows 2003)
-g	Geometry: *widthxheight* or 70% screen percentage.
-p	Use -p - to receive password prompt.

- You can use GUI front end tools like the GNOME Terminal Services Client *tsclient* to configure and launch the *rdesktop* client (using *tsclient* also enables you to store multiple configurations of *rdesktop* for connection to many servers).



Type the name of the computer or choose a computer from the drop-down list.

Protocol: RDP

Note: *The rdesktop client is supplied with Red Hat 9.0:*

rpm -ivh rdesktop-1.2.0-1.i386.rpm

For Red Hat 8.0 or other distributions of Linux; download source, untar, configure, make, make then install.

rdesktop currently runs on most UNIX based platforms with the X Window System and can be downloaded from /

C. On a Macintosh client:

- Download Microsoft's free Remote Desktop Connection client for Mac OS X http://www.microsoft.com/mac/otherproducts/otherproducts.aspx?pid=remotedesktopclient

6.9 SDT SSH Tunnel for VNC

Alternately, with SDT and Virtual Network Computing (VNC), users and administrators can securely access and control Windows, Linux, Macintosh, Solaris and UNIX computers. There is a wide range of free popular VNC software options available (UltraVNC, RealVNC, TightVNC). To set up a secure VNC connection, you must install and configure the VNC Server software on the computer to be accessed, then install and configure the VNC Viewer software on the Viewer PC.

6.9.1 Install and Configure the VNC Server on the Computer to be Accessed

Virtual Network Computing (VNC) software enables users to remotely access computers running Linux, Macintosh, Solaris, UNIX, all versions of Windows and most other operating systems.

A. For Microsoft Windows servers (and clients):

Windows does not include VNC software, so you will need to download, install and activate a third party VNC Server software package:

RealVNC http://www.realvnc.com is fully cross-platform, so a desktop running on a Linux machine may be displayed on a Windows PC, on a Solaris machine, or on any number of other architectures. There is a Windows server allowing you to view the desktop of a remote Windows machine on any of these platforms using exactly the same viewer. RealVNC was founded by members of the AT&T team who originally developed VNC.

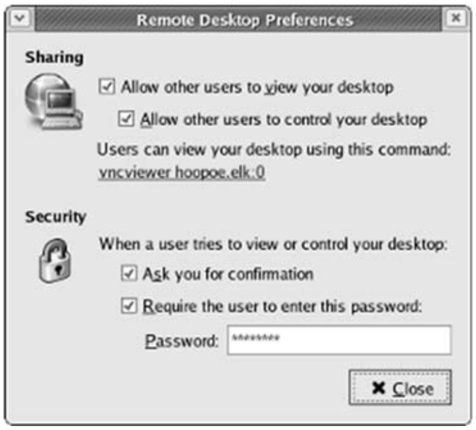
TightVNC http://www.tightvnc.com is an enhanced version of VNC. It has added features such as file transfer, performance improvements, and read-only password support. They have just recently included a video drive much like UltraVNC. TightVNC is still free, cross-platform (Windows UNIX and Linux) and compatible with the standard (Real) VNC.

UltraVNC http://ultravnc.com is easy to use, fast and free VNC software that has pioneered and perfected features that the other flavors have consistently refused or been very slow to implement for cross platform and minimalist reasons. UltraVNC runs under Windows operating systems (95, 98, Me, NT4, 2000, XP, 2003) Download UltraVNC from Sourceforge's UltraVNC file list.

B. For Linux servers (and clients):

Most Linux distributions now include VNC Servers and Viewers and generally can be launched from the (Gnome/KDE etc) front end (e.g. with Red Hat Enterprise Linux 4, there is VNC Server software and a choice of Viewer client software). To launch:

- Select the **Remote Desktop** entry in the **Main Menu: Preferences** menu.
- Check the **Allow other users…** checkbox to allow remote users to view and control your desktop.



Remote Desktop Preferences

Sharing

☑ Allow other users to view your desktop

☑ Allow other users to control your desktop

Users can view your desktop using this command:
vncviewer hoopoe.elk:0

Security

When a user tries to view or control your desktop:

☑ Ask you for confirmation

☑ Require the user to enter this password:

Password: ********

- To set up a persistent VNC server on Red Hat Enterprise Linux 4:
  - Set a password using **vncpasswd.**
  - Edit **/etc/sysconfig/vncservers.**
  - Enable the service with **chkconfig vncserver on.**
  - Start the service with **service vncserver start.**
  - Edit **/home/*username*/.vnc/xstartup** if you want a more advanced session than just *twm* and an xterm.

C. For Macintosh servers (and clients):

OSXvnc http://www.redstonesoftware.com/vnc.html is a robust, full-featured VNC server for Mac OS X that allows any VNC client to remotely view and/or control the Mac OS X machine. OSXvnc is supported by Redstone Software.

D. Most other operating systems (Solaris, HPUX, PalmOS, etc.) either come with VNC bundled, or have third party VNC software that you can download.

6.9.2 Install, Configure and Connect the VNC Viewer

VNC is truly platform-independent. A VNC Viewer on any operating system can connect to a VNC Server on any other operating system. There are Viewers (and Servers) from a wide selection of sources (e.g.,UltraVNC TightVNC or RealVNC) for most operating systems. There are also a wealth of Java viewers available so any desktop can be viewed with a Java-capable browser (http://en.wikipedia.org/wiki/VNC lists many of the VNC Viewers sources).

- Install the VNC Viewer software and set it up for the appropriate speed connection.

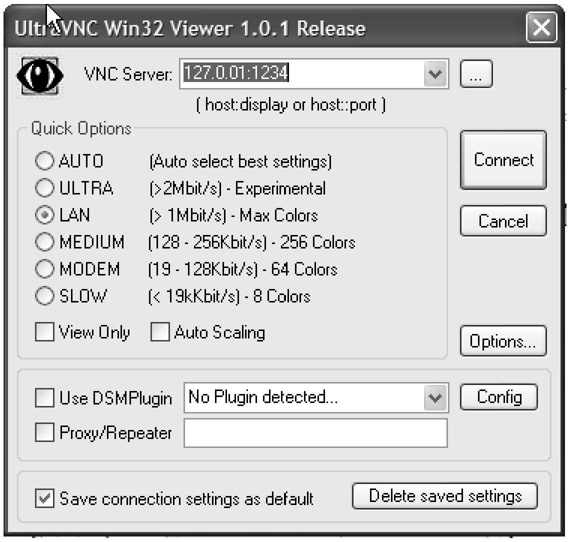
Note: *To make VNC faster, when you set up the Viewer:*

- *Set encoding to ZRLE (if you have a fast enough CPU)*
- *Decrease color level (e.g., 64 bit)*
- *Disable the background transmission on the Server or use a plain wallpaper*

(refer to http://doc.uvnc.com for detailed configuration instructions).

- To establish the VNC connection, first configure the VNC Viewer by entering the VNC Server IP address.

A. When the Viewer PC is connected to the console server through an SSH tunnel (over the public Internet, dial-in connection, or private network connection), enter **localhost** (or 127.0.0.1) as the IP VNC Server IP address. Use the source port you entered when setting SSH tunneling /port forwarding (in section **6.2.6 Manually Adding New Services to the New Hosts**) e.g., *:1234.*



UltraVNC Win32 Viewer 1.0.1 Release

VNC Server: 127.0.01:1234

(host:display or host::port)

Quick Options

○ AUTO (Auto select best settings)
○ ULTRA (>2Mbit/s) - Experimental
● LAN (> 1Mbit/s) - Max Colors
○ MEDIUM (128 - 256Kbit/s) - 256 Colors
○ MODEM (19 - 128Kbit/s) - 64 Colors
○ SLOW (< 19kKbit/s) - 8 Colors

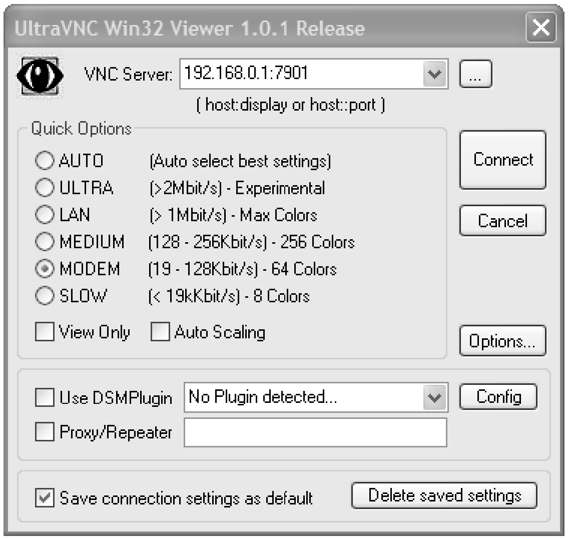
□ View Only □ Auto Scaling

□ Use DSMPlugin No Plugin detected...

□ Proxy/Repeater

☑ Save connection settings as default

B. When the Viewer PC is directly connected to the console server (i.e,. locally or remotely through a VPN or dial-in connection) and the VNC Host computer is serially connected to the console server; enter the IP address of the console server unit with the TCP port that the SDT tunnel will use. The TCP port will be 7900 plus the physical serial port number. For example, with TCP ports 7901 to 7948, all traffic directed to port 79xx on the console server is tunneled through to port 5900 on the PPP connection on serial Port xx (e.g., for a Windows Viewer PC using UltraVNC connecting to a VNC Server, which is attached to Port 1 on a console server located 192.168.0.1).



UltraVNC Win32 Viewer 1.0.1 Release

VNC Server: 192.168.0.1:7901

(host:display or host::port)

Quick Options

○ AUTO (Auto select best settings)
○ ULTRA (>2Mbit/s) - Experimental
○ LAN (> 1Mbit/s) - Max Colors
○ MEDIUM (128 - 256Kbit/s) - 256 Colors
● MODEM (19 - 128Kbit/s) - 64 Colors
○ SLOW (< 19kKbit/s) - 8 Colors

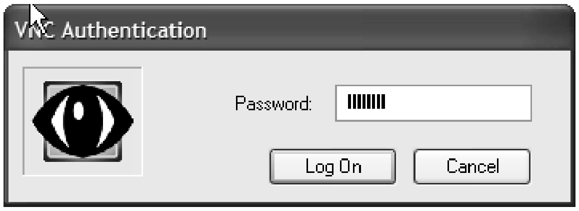
□ View Only □ Auto Scaling

□ Use DSMPlugin No Plugin detected...

□ Proxy/Repeater

☑ Save connection settings as default

- You can then establish the VNC connection by simply activating the VNC Viewer software on the Viewer PC and entering the password.



VNC Authentication

Password: ||||||||

Note: *For general background reading on Remote Desktop and VNC access, we recommend the following:*

- *The Microsoft Remote Desktop How-To http://www.microsoft.com/windowsxp/using/mobility/getstarted/remoteintro.mspx*
- *The Illustrated Network Remote Desktop help page http://theillustratednetwork.mvps.org/RemoteDesktop/RemoteDesktopSetupandTroubleshooting.html*
- *What is Remote Desktop in Windows XP and Windows Server 2003? by Daniel Petri http://www.petri.co.il/what's_remote_desktop.htm*
- *Frequently Asked Questions about Remote Desktop http://www.microsoft.com/windowsxp/using/mobility/rdfaq.mspx*
- *Secure remote access of a home network using SSH, Remote Desktop and VNC for the home user http://theillustratednetwork.mvps.org/RemoteDesktop/SSH-RDP-VNC/RemoteDesktopVNCandSSH.html*
- *Taking your desktop virtual with VNC, Red Hat magazine / and /*
- *Wikipedia general background on VNC http://en.wikipedia.org/wiki/VNC*

6.10 Using SDT to IP Connect to Hosts that are Serially Attached to the Gateway

Network (IP) protocols like RDP, VNC and HTTP can also be used for connecting to the host’s serially connected devices through their COM port to the console server. To do this:

- Establish a PPP connection between the host and the gateway.
- Set up Secure Tunneling - Ports on the console server.
- Configure SDT Connector to use the appropriate network protocol to access IP consoles on the host devices that are attached to the Console server serial ports.

6.10.1 Establish a PPP Connection between the Host COM Port and Console Server

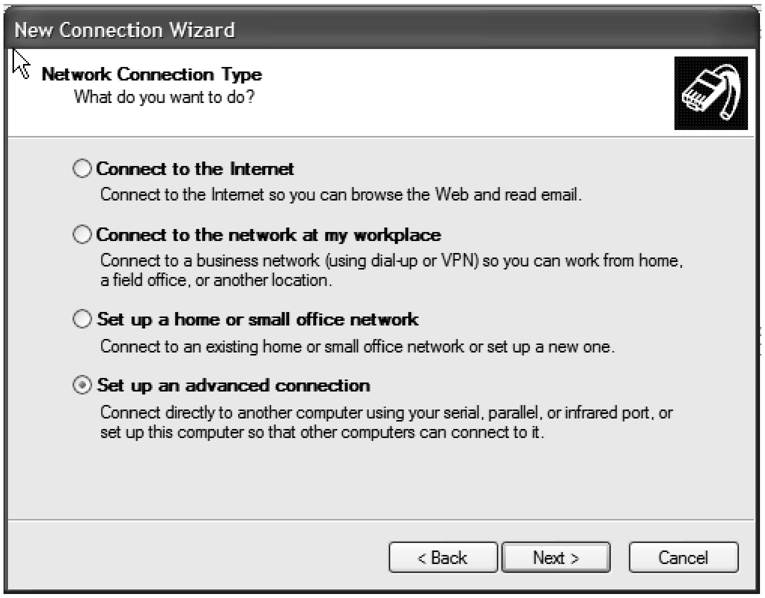
(This step is only necessary for serially connected computers)

Physically connect the COM port on the host computer to the serial port on the console server.

A. For non-Windows (Linux, UNIX, Solaris, etc.) computers, establish a PPP connection over the serial port. The online tutorial (http://www.yolinux.com/TUTORIALS/LinuxTutorialPPP.html) presents a selection of methods for establishing a PPP connection for Linux.

B. For Windows XP and 2003 computers, follow the steps below to set up an advanced network connection between the Windows computer and through its COM port to the console server. Both Windows 2003 and Windows XP Professional allow you to create a simple dial-in service which can be used for the Remote Desktop/VNC/HTTP/X connection to the console server:

- ➢ Open **Network Connections** in Control Panel and click the **New Connection Wizard.**


New Connection Wizard

Network Connection Type
What do you want to do?

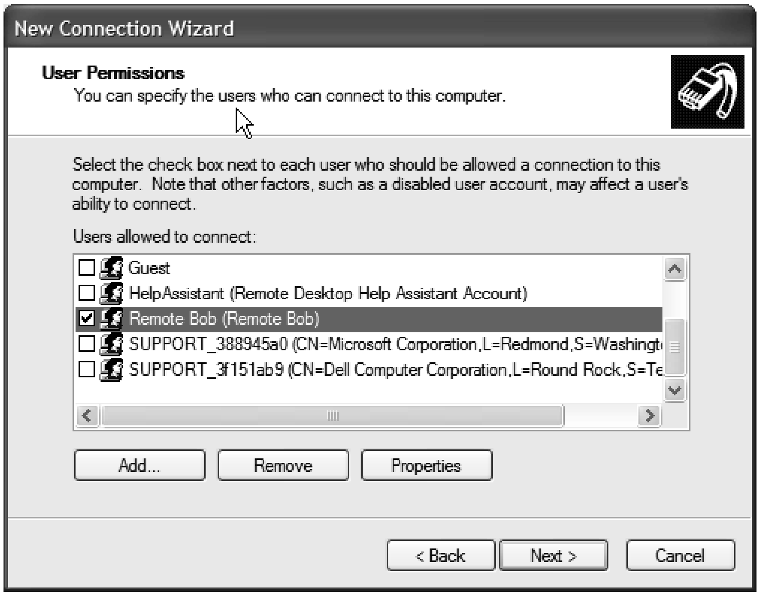
○ **Connect to the Internet**
Connect to the Internet so you can browse the Web and read email.

○ **Connect to the network at my workplace**
Connect to a business network (using dial-up or VPN) so you can work from home, a field office, or another location.

○ **Set up a home or small office network**
Connect to an existing home or small office network or set up a new one.

● **Set up an advanced connection**
Connect directly to another computer using your serial, parallel, or infrared port, or set up this computer so that other computers can connect to it.

- Select **Set up an advanced connection** and click **Next.**
- On the **Advanced Connection Options** screen, select **Accept Incoming Connections** and click **Next.**
- Select the **Connection Device** (i.e. the serial COM port on the Windows computer that is connected to the console server). By default, select **COM1**. The COM port on the Windows computer should be configured to its maximum baud rate. Click **Next.**
- On the **Incoming VPN Connection Options** screen, select **Do not allow virtual private connections**. Click **Next.**


New Connection Wizard

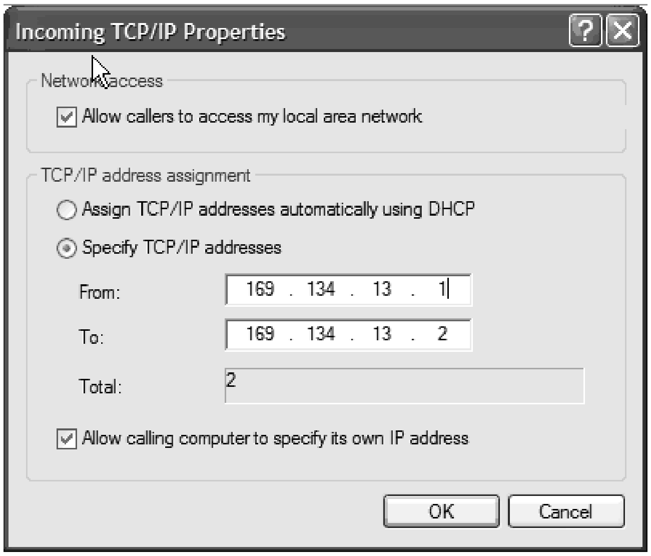
User Permissions
You can specify the users who can connect to this computer.

Select the check box next to each user who should be allowed a connection to this computer. Note that other factors, such as a disabled user account, may affect a user's ability to connect.

Users allowed to connect:

□ Guest
□ HelpAssistant (Remote Desktop Help Assistant Account)
☑ Remote Bob (Remote Bob)
□ SUPPORT_388945a0 (CN=Microsoft Corporation,L=Redmond,S=Washingt
□ SUPPORT_3f151ab9 (CN=Dell Computer Corporation,L=Round Rock,S=Te

- Specify which users will be allowed to use this connection. These should be the same users who were given remote desktop access privileges in the earlier step. Click **Next.**
- On the **Network Connection** screen, select **TCP/IP**, then click **Properties.**



Network access

☑ Allow callers to access my local area network

TCP/IP address assignment

○ Assign TCP/IP addresses automatically using DHCP

● Specify TCP/IP addresses

From: 169 . 134 . 13 . 1

To: 169 . 134 . 13 . 2

Total: 2

☑ Allow calling computer to specify its own IP address

- Select **Specify TCP/IP addresses** on the **Incoming TCP/IP Properties** screen, then select **TCP/IP.** Assign a *From:* and a *To:* TCP/IP address. Click **Next.**

Note: *You can choose any TCP/IP addresses as long as they are not used anywhere else on your network. The From: address will be assigned to the Windows XP/2003 computer and the To: address will be used by the console server. For simplicity, use the following IP address:*
From: 169.134.13.1
To: 169.134.13.2
Alternately, you can set the advanced connection and access on the Windows computer to use the console server defaults:

- *Specify 10.233.111.254 as the From: address.*
- *Select Allow calling computer to specify its own address.*

Additionally, you can use the console server default username and password when you set up the new Remote Desktop User. In doing so, the user is granted permission to use the advanced connection to access the Windows computer:

- *The console server default username is **portXX**, where XX is the serial port number on the console server.*
- *The default Password is **portXX**.*

To use the defaults for a RDP connection to the serial port 2 on the console server, you will need to set up a Windows user named port02.

- When the PPP connection has been set up, a network icon will appear in the Windows task bar.

Note: *The above notes describe setting up an incoming connection for Windows XP. The steps are similar for later versions with some slight differences:*

*• You need to check the box for **Always allow directly connected devices**.*

*• Also, the option for to **Set up an advanced connection** is not available in Windows 2003 if RRAS is configured. If RRAS has been configured, it is a simply task to enable the null modem connection for the dial-in configuration.*

C. For earlier versions of Windows, follow the steps in Section B. To get to the **Make New Connection** button:

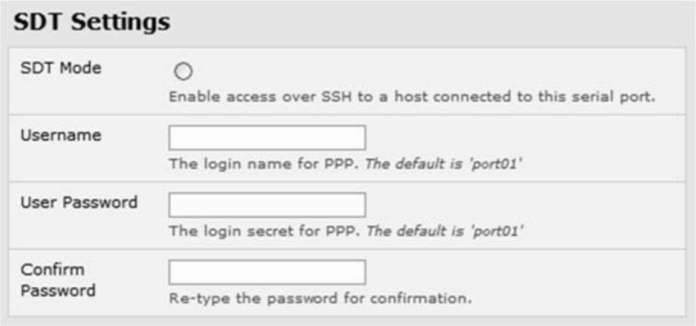
- For Windows 2000, click **Start** and select **Settings**. At the **Dial-Up Networking Folder,** click **Network and Dial-up Connections,** then click **Make New Connection.** You may need to first set up connection over the COM port using **Connect directly to another computer** before proceeding to **Set up an advanced connection.**

- For Windows 98, double-click **My Computer** on the Desktop, then open **Dial-Up Networking** and double-click.

6.10.2 Set Up SDT Serial Ports on Console Server

To set up RDP (and VNC) forwarding on the console server serial port that is connected to the Windows computer's COM port:

- ➢ Select the **Serial & Network: Serial Port** menu option and click **Edit** (for the particular Serial Port that is connected to the Windows computer COM port).
- ➢ On the SDT Settings menu, select **SDT Mode** (which will enable port forwarding and SSH tunneling) and enter a **Username** and **User Password.**



SDT Settings

SDT Mode	○ Enable access over SSH to a host connected to this serial port.
Username	The login name for PPP. *The default is 'port01'*
User Password	The login secret for PPP. *The default is 'port01'*
Confirm Password	Re-type the password for confirmation.

Notes:

• Enabling SDT will override all other configuration protocols on that port.

• If you leave the Username and Password fields blank, they default to portXX and portXX, where XX is the serial port number. For example, the default username and password for Secure RDP over Port 2 is port02.

- ➢ Ensure the console server **Common Settings** (Baud Rate, Flow Control) are the same as were set up on the Windows computer COM port and click **Apply.**
- ➢ RDP and VNC forwarding over serial ports is enabled by port. You can add users with access to these ports (or reconfigure User profiles) by selecting **Serial & Network: User & Groups** menu tag. Refer to **4.1 Configure Serial Ports** for more information.

6.10.3 Set Up SDT Connector to SSH Port Forward over Console Server Serial Port

In the SDT Connector software running on your remote computer, specify the gateway IP address of your console server and a username/password for a user you have set up on the console server that has access to the desired port.

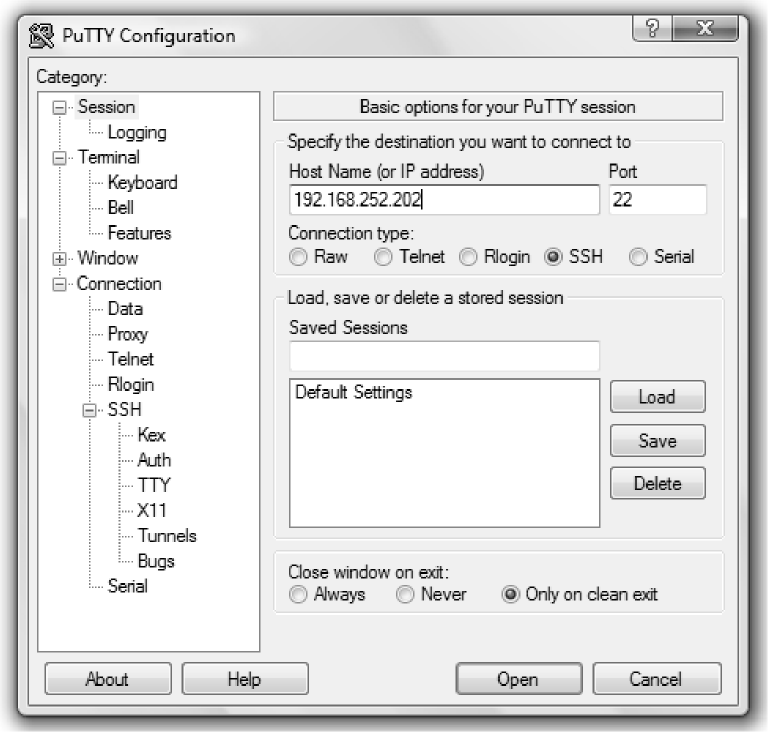
Next you need to add a new SDT Host. In the host address, put *portxx* where xx = the port you are connecting to. For example, for port 3, you would have a Host Address of: port03, then select the **RDP Service** check box.

6.11 SSH Tunneling Using Other SSH Clients (e.g. PuTTY)

It is recommend you use the SDT Connector client software supplied with the console server. However, there is also a wide selection of commercial and free SSH client programs that can provide the secure SSH connections to the console servers and secure tunnels to connected devices:

- **PuTTY** is a complete (though not very user-friendly) freeware implementation of SSH for Win32 and UNIX platforms.
- **SSHTerm** is a useful open source SSH communications package.
- **SSH Tectia** is the leading end-to-end commercial communications security solution for enterprise.
- **Reflection for Secure IT** (formerly F-Secure SSH) is another good commercial SSH-based security solution.

The steps below show the establishment of an SSH tunneled connection to a network-connected device using the PuTTY client software.



PuTTY Configuration

Basic options for your PuTTY session

Specify the destination you want to connect to

Host Name (or IP address): 192.168.252.202

Port: 22

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

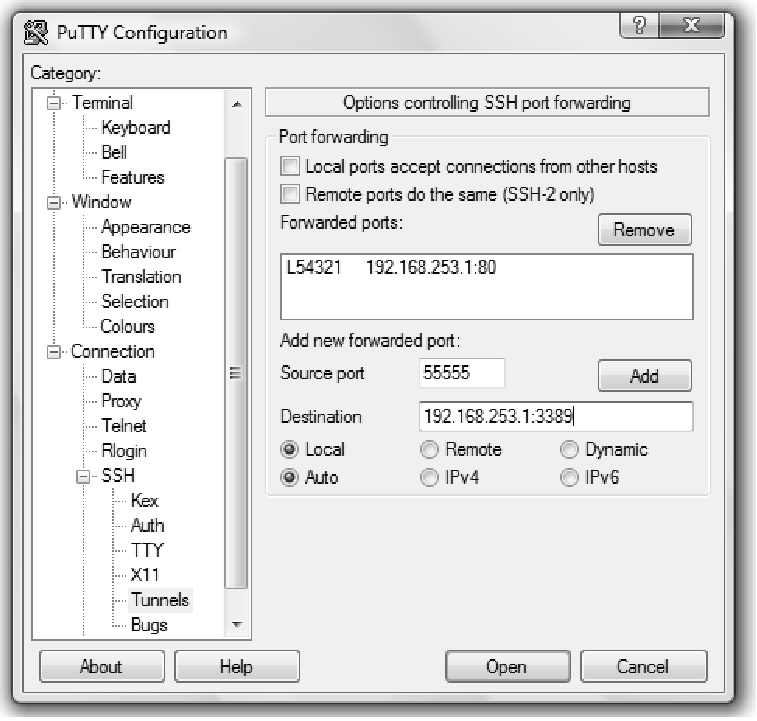
Load, save or delete a stored session

Saved Sessions: Default Settings

Close window on exit: ○ Always ○ Never ● Only on clean exit

- In the **Session** menu, enter the console server's IP address in the **Host Name or IP address** field.
  - For dial-in connections, this IP address will be the **Local** address you assigned to the console server when you set it up as the Dial-In PPP Server.
  - For Internet (or local/VPN connections) connections, this will be the public IP address of the console server.
- Select the **SSH Protocol**. The port will be set as 22.
- Go to the **SSH: Tunnels** menu. In **Add new forwarded port**, enter any high unused port number for the source port (e.g., *54321).*
- Set the **Destination:** IP details.

- If your destination device is network-connected to the console server using RDP, set the destination as *<Managed Device IP address/DNS Name>:3389*. If when setting up the Managed Device as Network Host on the console server, you specified its IP address to be 192.168.253.1 (or its DNS Name was *accounts.myco.intranet.com*), then specify the destination as *192.168.523.1:3389* (or *accounts.myco.intranet.com:3389).* Only devices that have been configured as networked hosts can be accessed using SSH tunneling (except by the "root" user who can tunnel to any IP address the console server can route to).



□ Local ports accept connections from other hosts

□ Remote ports do the same (SSH-2 only)

Forwarded ports:

L54321   192.168.253.1:80

Add new forwarded port:

Source port: 55555

Destination: 192.168.253.1:3389

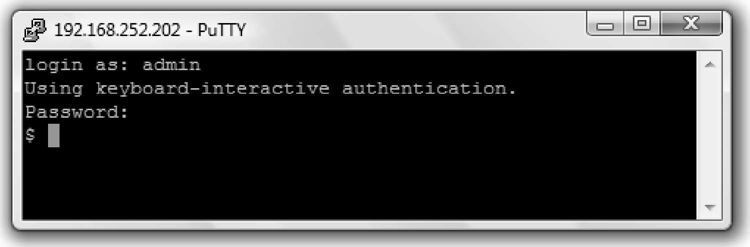
● Local ○ Remote ○ Dynamic

● Auto ○ IPv4 ○ IPv6

- If your destination computer is serially connected to the console server, set the destination as *<port label>:3389*. If the label you specified on the console server's serial port is *win2k3*, then specify the remote host as *win2k3:3389*. Alternately, you can set the destination as *portXX:3389,* where XX is the SDT enabled serial port number. For example, if port 4 on the console server is used to carry the RDP traffic, then specify *port04:3389.*

***Note:** http://www.jfitz.com/tips/putty_config.html provides useful examples on configuring PuTTY for SSH tunneling.*

- Select **Local** and click the **Add** button.
- Click **Open** to SSH-connect the client PC to the console server. You will be prompted to enter the Username/Password for the console server user.



```
login as: admin
Using keyboard-interactive authentication.
Password:
$ 
```

- If you are connecting as a User in the “users” group, you can only SSH tunnel to hosts and serial ports where you have specific access permissions.

- If you are connecting as an Administrator (in the “admin” group), you can connect to any configured host or serial ports (which has SDT enabled).

To set up the secure SSH tunnel for a HTTP browser connection to the managed device, specify port 80 (rather than port 3389 as was used for RDP) in the destination IP address.

To set up the secure SSH tunnel from the client (Viewer) PC to the console server for VNC, follow the steps above. When configuring the VNC port redirection, specify port 5900 in the destination IP address.

6.12. VNC Security

VNC access generally allows access to your whole computer, so maintaining strong security is important. VNC uses a random challenge-response system to provide the basic authentication that allows you to connect to a VNC server. This is reasonably secure and the password is not sent over the network.

Once connected, all subsequent VNC traffic is unencrypted and a malicious user could snoop your VNC session. VNC scanning programs are also available, which scan a subnet that searches for PCs listening on VNC ports.

Tunneling VNC over a SSH connection ensures all traffic is strongly encrypted. When using this method, no VNC port is ever open to the internet, so no one scanning for open VNC ports will be able to find your computers. When tunneling VNC over a SSH connection, the only port which you are opening on your console server is SDT port 22.

Sometimes it may be prudent to tunnel VNC through SSH, even when the viewer PC and the console server are both on the same local network.

7. Alerts, Auto-Response and Logging

This chapter describes the automated response, alert generation and logging features of the *console server*.

The Auto-Response facility extends on the basic Alert facility available in earlier (pre-V3.5) firmware revisions. With auto-response, the console server monitors selected serial ports, logins, the power status and environmental monitors and probes for check condition triggers. The console server will then initiate a sequence of actions in response to these triggers.

All console server models can also maintain log records of all access and communications with the console server and the attached serial devices. A log of all system activity is maintained as well as history of the status of any attached environmental monitors.

Some models can also log access and communications with network-attached hosts and maintain a history of the UPS and PDU power status.

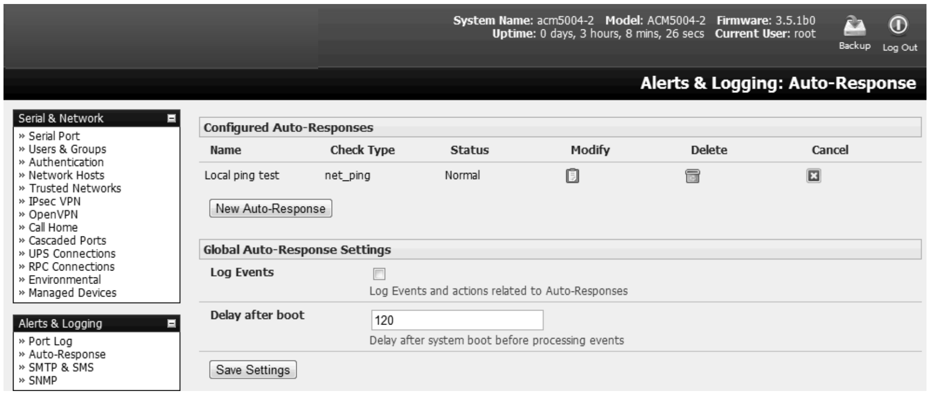
- If port logs are to be maintained on a remote server, then the access path to this location needs to be configured. To do so, activate and set the desired levels of logging for each serial and/or network port *(*refer to **7.6 Logging***)* and/or **Power, Environment and Digital I/O UPS** (refer section 8*.*)

7.1 Configure Auto-Response

With the Auto-Response feature, a sequence of trigger actions is initiated in the event of a specified trigger condition (check condition). Subsequent resolve actions can also be performed when the trigger condition has been resolved.

To configure, first set the general parameters that will be applied to all auto-responses:

- ➢ Check **Log Events** on **Alerts & Logging: Auto-Response** to enable logging all auto-response activities.
- ➢ Check **Delay After Boot** to set any general delay to be applied after console server system boot before processing events.



System Name: acm5004-2 **Model:** ACM5004-2 **Firmware:** 3.5.1b0
Uptime: 0 days, 3 hours, 8 mins, 26 secs **Current User:** root

Alerts & Logging: Auto-Response

Configured Auto-Responses

Name	Check Type	Status	Modify	Delete	Cancel
Local ping test	net_ping	Normal			☒

New Auto-Response

Global Auto-Response Settings

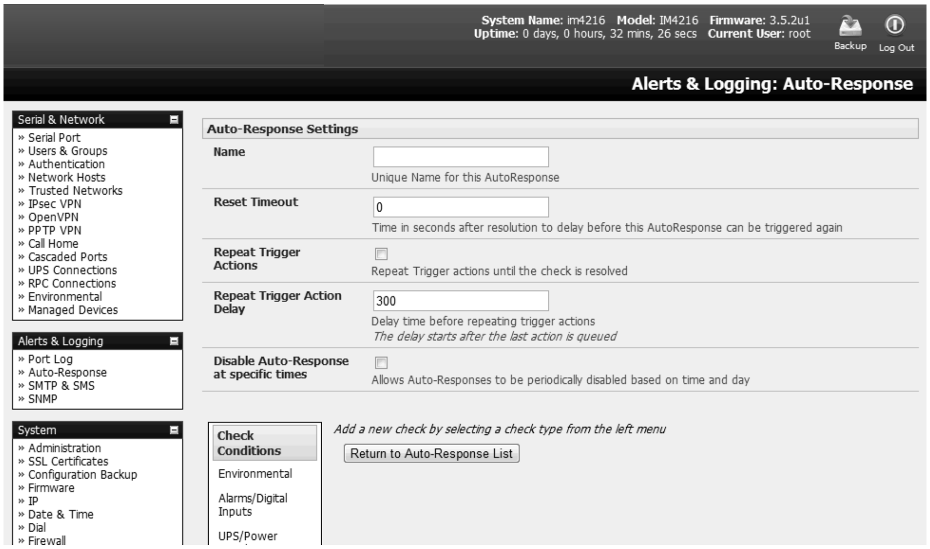
Log Events □ Log Events and actions related to Auto-Responses

Delay after boot 120
Delay after system boot before processing events

Save Settings

To configure a new auto-response:

- Select **New Auto-Response** in the **Configured Auto-Response** field. You will be presented with a new **Auto-Response Settings** menu.
- Enter a unique **Name** for the new auto-response.
- Specify the **Reset Timeout** for the time in seconds after resolution to delay before this Auto-Response can be triggered again.
- Check **Repeat Trigger Actions** to continue to repeat trigger action sequences until the check is resolved.
- Enter any required delay time before repeating trigger actions in **Repeat Trigger Action Delay**. This delay starts after the last action is queued.



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.2u1
Uptime: 0 days, 0 hours, 32 mins, 26 secs **Current User:** root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name — Unique Name for this AutoResponse

Reset Timeout 0 — Time in seconds after resolution to delay before this AutoResponse can be triggered again

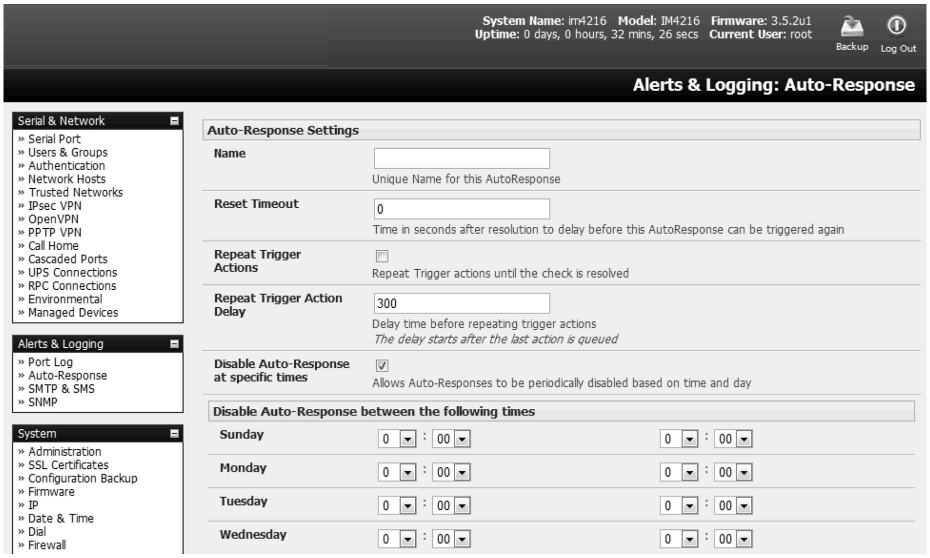
Repeat Trigger Actions □ Repeat Trigger actions until the check is resolved

Repeat Trigger Action Delay 300 — Delay time before repeating trigger actions
The delay starts after the last action is queued

Disable Auto-Response at specific times □ Allows Auto-Responses to be periodically disabled based on time and day

Add a new check by selecting a check type from the left menu

- Check **Disable Auto-Response at specific times**. You will be able to periodically disable auto-responses between specified times of day.



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.2u1
Uptime: 0 days, 0 hours, 32 mins, 26 secs **Current User:** root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name — Unique Name for this AutoResponse

Reset Timeout 0 — Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions □ Repeat Trigger actions until the check is resolved

Repeat Trigger Action Delay 300 — Delay time before repeating trigger actions
The delay starts after the last action is queued

Disable Auto-Response at specific times ☑ Allows Auto-Responses to be periodically disabled based on time and day

Disable Auto-Response between the following times

Sunday	0 : 00	0 : 00
Monday	0 : 00	0 : 00
Tuesday	0 : 00	0 : 00
Wednesday	0 : 00	0 : 00

7.2 Check Conditions

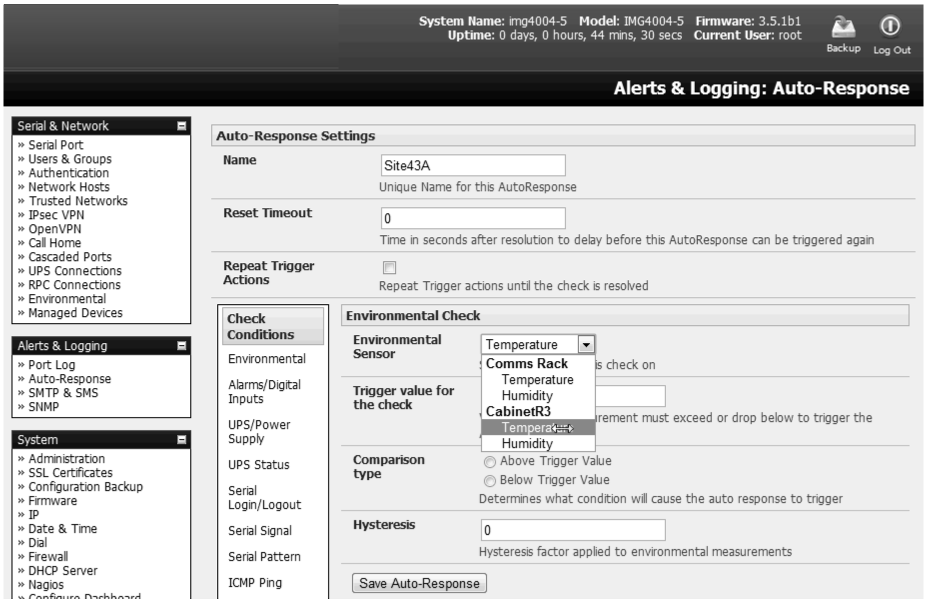
To configure the condition that will trigger the auto-response:

- Click on the **Check Condition** type (e.g. *Environmental*, *UPS Status* or *ICMP ping*) to be configured as the trigger for this new auto-response in the **Auto-Response Settings** menu.

7.2.1 Environmental

To configure humidity or temperature levels as the trigger event:

- Click on **Environmental** as the **Check Condition.**



System Name: img4004-5 Model: IMG4004-5 Firmware: 3.5.1b1
Uptime: 0 days, 0 hours, 44 mins, 30 secs Current User: root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name: Site43A
Unique Name for this AutoResponse

Reset Timeout: 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions: □
Repeat Trigger actions until the check is resolved

Environmental Check

Environmental Sensor: Temperature
is check on

Trigger value for the check:
urement must exceed or drop below to trigger the

Comparison type: ○ Above Trigger Value ○ Below Trigger Value
Determines what condition will cause the auto response to trigger

Hysteresis: 0
Hysteresis factor applied to environmental measurements

- In the **Environmental Check** menu, select the specific **Environmental Sensor** to be checked for the trigger.
- Specify the **Trigger value** (in °C / °F for Temp and % for Humidity) that the check measurement must exceed or drop below to trigger the auto-response.
- Select **Comparison type** as being Above Trigger Value or Below Trigger Value to trigger.
- Specify any **Hysteresis** factor that is to be applied to environmental measurements (e.g., if an Auto-Response was set up with a trigger event of a temp reading above 49°C with a Hysteresis of 4, then the trigger condition would not be seen as having been resolved until the temp reading was below 45°C) .
- Check **Save Auto-Response.**

***Note:** Before configuring environmental checks as the trigger in auto-response, you will need first to configure the temperature and/or humidity sensors on your attached EMD.*

7.2.2 Alarms and Digital Inputs

To set the status of any attached smoke or water sensors or digital inputs as the trigger event:

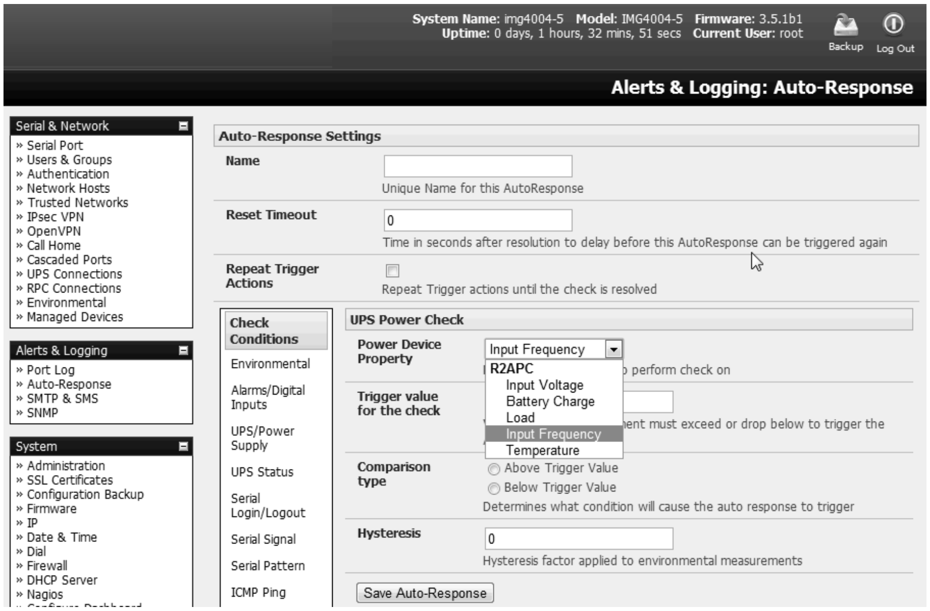
- Click on **Alarms / Digital Inputs** as the **Check Condition.**
- In the **Alarms / Digital Inputs Check** menu, select the specific **Alarm/Digital IO Pin** that will trigger the Auto-Response.
- Select **Trigger on Change** to trigger when alarm signal changes, or select to trigger when the alarm signal state changes to either a **Trigger Value** of *Open (0)* or *Closed (1).*
- Check **Save Auto-Response.**

Note: *Before configuring Alarms / Digital Inputs checks in Auto-Response, you first must configure the sensor/DIO that is to be attached to your EMD.*

7.2.3 UPS/Power Supply

To use the properties of any attached UPS as the trigger event:

- Click on **UPS / Power Supply** as the **Check Condition.**
- Select UPS **Power Device Property** (Input Voltage, Battery Charge %, Load %, Input Frequency Hz or Temperature in °C) that will checked for the trigger.
- Specify the **Trigger value** that the check measurement must exceed or drop below in order to trigger the auto-response.
- Select **Comparison type** as being **Above Trigger Value** or **Below Trigger Value** to trigger.
- Specify any **Hysteresis** factor that is to be applied to environmental measurements (e.g. if an auto-response was set up with a trigger event of a battery charge below 20% with a hysteresis of 5, then the trigger condition would not be seen as having been resolved until the battery charge was above 25%).
- Check **Save Auto-Response.**



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 3.5.1b1
Uptime: 0 days, 1 hours, 32 mins, 51 secs **Current User:** root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name:
Unique Name for this AutoResponse

Reset Timeout: 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions: □
Repeat Trigger actions until the check is resolved

UPS Power Check

Power Device Property: Input Frequency
...o perform check on

Trigger value for the check:
...ent must exceed or drop below to trigger the

Comparison type: ○ Above Trigger Value ○ Below Trigger Value
Determines what condition will cause the auto response to trigger

Hysteresis: 0
Hysteresis factor applied to environmental measurements

Note: *Before configuring UPS checks in auto-response, you first must configure the attached UPS.*

7.2.4 UPS Status

To use the alert state of any attached UPS as the auto-response trigger event:

- Click on **UPS Status** as the **Check Condition.**
- Select the reported **UPS State** to trigger the auto-response (either *On Battery* or *Low Battery*)**.** The auto-response will resolve when the UPS state returns to the "Online" state.
- Select which connected **UPS Device** to monitor and check **Save Auto-Response.**

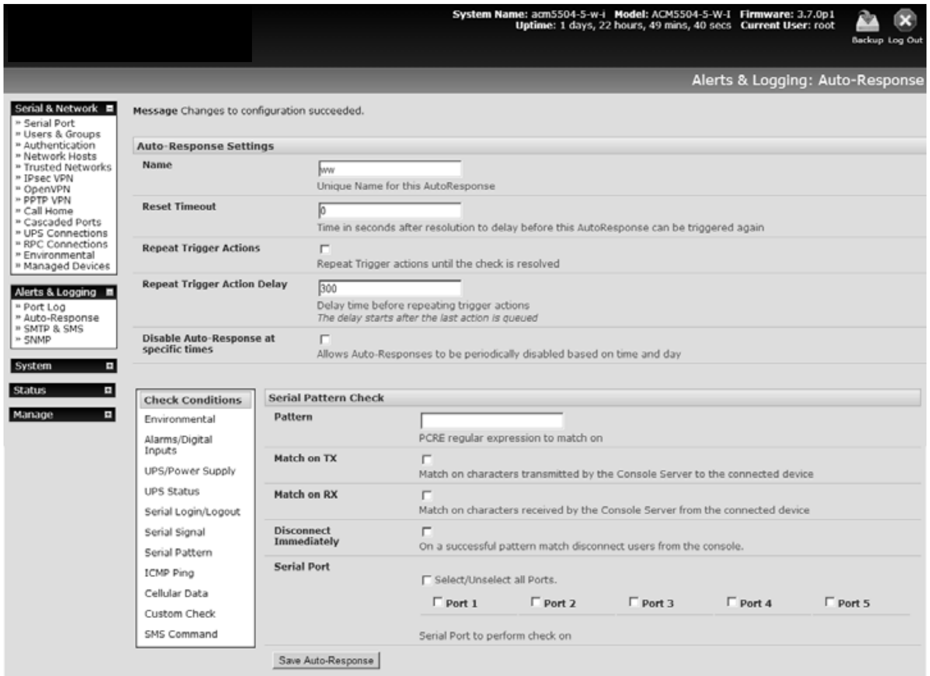
Note: *Before configuring UPS state checks in auto-response, you first must configure the attached UPS.*

7.2.5 Serial Login, Signal or Pattern

To monitor serial ports and check for login/logout or pattern matches for auto-response triggers events:

- Click on **Serial Login/Logout** as the **Check Condition**. In the **Serial Login/Logout Check** menu, select **Trigger on Login** (to trigger when any user logs into the serial port) or **Trigger on Logout.** Specify the **Serial Port** to perform a check on.
- Click on **Serial Signal** as the **Check Condition**. In the **Serial Signal Check** menu, select the **Signal** (CTS, DCD, DSR) to trigger on the **Trigger** condition (either on serial signal change, or check level). Specify the **Serial Port** to perform a check on.
- Click on **Serial Pattern** as the **Check Condition**. In the **Serial Pattern Check** menu, select the **PCRE** and the serial line (**TX** or **RX**) and **Serial Port** to pattern check on.

Note: *With serial pattern checks, you can assign to "Disconnect Immediately" all users from the serial being monitored in the event of a successful pattern match.*



[redacted]

System Name: acm5504-5-w-i **Model:** ACM5504-5-W-I **Firmware:** 3.7.0p1
Uptime: 1 days, 22 hours, 49 mins, 40 secs **Current User:** root

Message Changes to configuration succeeded.

Auto-Response Settings

Name ww
Unique Name for this AutoResponse

Reset Timeout 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions □
Repeat Trigger actions until the check is resolved

Repeat Trigger Action Delay 300
Delay time before repeating trigger actions
The delay starts after the last action is queued

Disable Auto-Response at specific times □
Allows Auto-Responses to be periodically disabled based on time and day

Serial Pattern Check

Pattern
PCRE regular expression to match on

Match on TX □
Match on characters transmitted by the Console Server to the connected device

Match on RX □
Match on characters received by the Console Server from the connected device

Disconnect Immediately □
On a successful pattern match disconnect users from the console.

Serial Port
□ Select/Unselect all Ports.
□ **Port 1** □ **Port 2** □ **Port 3** □ **Port 4** □ **Port 5**
Serial Port to perform check on

- Check **Save Auto-Response.**

Note: *Before configuring serial port checks in auto-response, you first must configure the serial port in console server mode. Most serial port checks are not resolvable, so resolve actions will not be run.*

7.2.6 USB Console Status

Note: *USB port labels in the Web interface match the USB port labels printed on a console server, with two exceptions. Some console servers include discrete pairs of USB ports, which do not have printed labels. In this case, the Web interface denotes them as either Upper or Lower. That is, the Web interface lists them by their physical relationship to each other. Also, some console servers ship with an array of four USB ports. A limited number of these console servers have labels A – D printed by these ports, even though the Web interface will denote them as USB ports 1 – 4.*

To monitor USB ports:

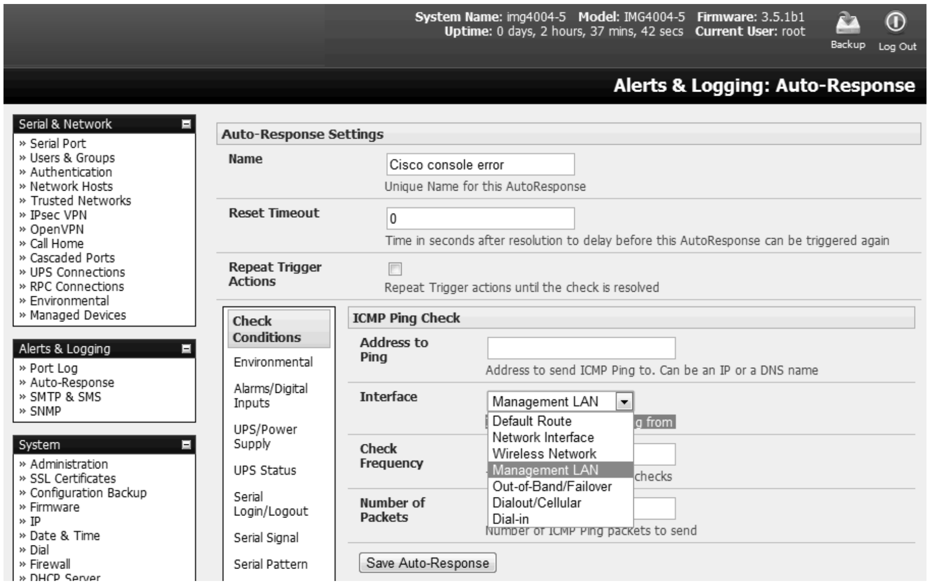
- Click USB **Console Status** as the **Check Condition**.
- Check the **Trigger on Connect** checkbox, the **Trigger on Disconnect** checkbox, or **both** checkboxes to set which actions trigger the auto-response.
- Check each USB port to be monitored (or click the **Select/Unselect all Ports** checkbox to select or deselect all USB ports).
- Click the **Save Auto-Response** button.
- Select an option from the **Add Trigger Action** list.
- Enter a unique action name for the trigger action being created.
- Set an action delay time. By default, this is 0 seconds.
- Enter the specific details of the selected action. For example, the Send Email action requires a recipient email address and allows for a subject and email text.
- Click the **Save New Action** button.

Note: *USB console status checks are not resolvable. Trigger actions run but resolve actions do not.*

7.2.7 ICMP Ping

To use a ping result as the auto-response trigger event:

- Click on **ICMP Ping** as the **Check Condition.**
- Specify which **Address to Ping** (i.e. IP address or DNS name to send ICMP Ping to) and which **Interface** to send ICMP Ping from (e.g. Management LAN or Wireless network).
- Set the **Check Frequency** (i.e. the time in seconds between checks) and the **Number** of ICMP Ping packets to send.
- Check **Save Auto-Response.**



System Name: img4004-5 Model: IMG4004-5 Firmware: 3.5.1b1
Uptime: 0 days, 2 hours, 37 mins, 42 secs Current User: root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name: Cisco console error
Unique Name for this AutoResponse

Reset Timeout: 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions: □
Repeat Trigger actions until the check is resolved

ICMP Ping Check

Address to Ping:
Address to send ICMP Ping to. Can be an IP or a DNS name

Interface: Management LAN

Check Frequency:
checks

Number of Packets:
Number of ICMP Ping packets to send

7.2.8 Link Layer Discovery Protocol (LLDP)

The Link Layer Discovery Protocol (LLDP) is a protocol that allows system administrators to glean information about devices physically connected to managed switches.

Using LLDP

The LLDP service is enabled through the **System > Services** page. When the service is enabled, the lldpd daemon is loaded and running. The **Service Access** tab controls which network interfaces are monitored by the lldpd daemon.

When LLDP is granted access to an interface, it will use that interface, even if the interface has been disabled via **System > IP**.

LLDP neighbors are visible through the **Status > LLDP Neighbors** page. This page shows neighbors are recognized and indicates the information the console manager is sending.

Note: *Although the LLDP service can be granted access to non-Ethernet interfaces (for example, G3, G4 and PSTN dial-up interfaces), it currently ignores non-Ethernet interfaces.*

Customising LLDP

The `lldpcli` shell client interacts with and configures the running LLDP service.

Persistent custom configuration changes can be added to the system through configuration files placed in `/etc/config/lldpd.d/`. Custom configuration files — which must have filenames ending with `.conf` — will be read and executed by `lldpcli` when the LLDP service starts.

Note: *The* `/etc/` *directory is read-only on Tripp Lite hardware. Most default configuration files otherwise stored in* `/etc/` *are, on Tripp Lite hardware, in* `/etc/config/`*, which is writeable.*

The default lldpd configuration file — `lldpd.conf` *— is stored in* `/etc/config/` *on Tripp Lite hardware. It is not safe as a store of custom configuration details, however. There are circumstances in which this file is regenerated automatically, in which case all customisations will be lost.*

The `etc/config/lldpd.d/` *directory, which is also writable and which is created on first boot, is safe to write to. Any Custom LLDP configurations must be stored as* `*.conf` *files in this directory.*

Security

When enabled, LLDP frames issued by a Tripp Lite Console Manager will reveal sensitive information such as hostname and firmware version.

However, LLDP frames are not passed through by 802.3ab compliant switches, and Tripp Lite Console Managers have the LLDP service disabled by default.

Documentation

Both `lldpd` and `lldpcli` have standard manual pages. However, due to space constraints, these manual pages are not shipped with Tripp Lite hardware.

Both manual pages are available on the lldpd project web-site however:

man lldpd.

man lldpcli.

Note: *Tripp Lite uses lldpd 0.9.2.*

7.2.9 Cellular Data

This check monitors the inbound and outbound aggregate data traffic through the cellular modem as an auto-response trigger event.

- Click on **Cellular Data** as the **Check Condition.**

Note: *Before configuring cellular data checks in auto-response, the internal cellular modem must be configured and detected by the console server.*

7.2.10 Custom Check

This check allows users to run an assigned custom script with assigned arguments whose return value is used as an auto-response trigger event:

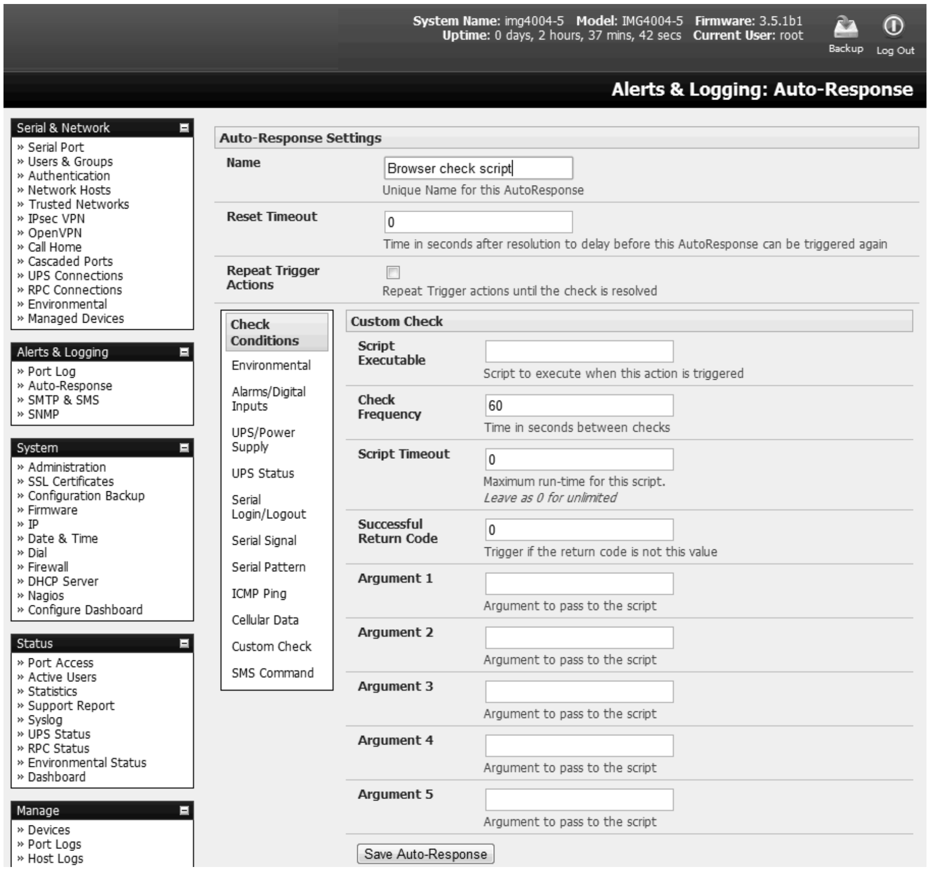
- Click on **Custom Check** as the **Check Condition.**
- Create an executable trigger check script file (e.g. */etc/config/test.sh*):

```
#!/bin/sh
logger "A test script"
logger Argument1 = $1
logger Argument2 = $2
logger Argument3 = $3
logger Argument4 = $4
if [ -f /etc/config/customscript.0 ]; then
    rm /etc/config/customscript.0
    exit 7
fi
touch /etc/config/customscript.0
exit 1
```

Refer to the online FAQ for a sample web page html and other script file templates.

- Enter the **Script Executable** file name (e.g. */etc/config/test.sh*).
- Set the **Check Frequency** (i.e. the time in seconds between re-running the script) and the **Script Timeout** (i.e. the maximum run-time for the script).
- Specify the **Successful Return Code**. An auto-response is triggered if the return code from the script is not this value.

- Enter **Arguments** that are to be passed to the script (e.g., with a web page html check script, these Arguments may specify the web page address/DNS and user logins).
- Check **Save Auto-Response.**



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 3.5.1b1
Uptime: 0 days, 2 hours, 37 mins, 42 secs **Current User:** root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name: Browser check script
Unique Name for this AutoResponse

Reset Timeout: 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions: ☐
Repeat Trigger actions until the check is resolved

Custom Check

Script Executable:
Script to execute when this action is triggered

Check Frequency: 60
Time in seconds between checks

Script Timeout: 0
Maximum run-time for this script.
Leave as 0 for unlimited

Successful Return Code: 0
Trigger if the return code is not this value

Argument 1:
Argument to pass to the script

Argument 2:
Argument to pass to the script

Argument 3:
Argument to pass to the script

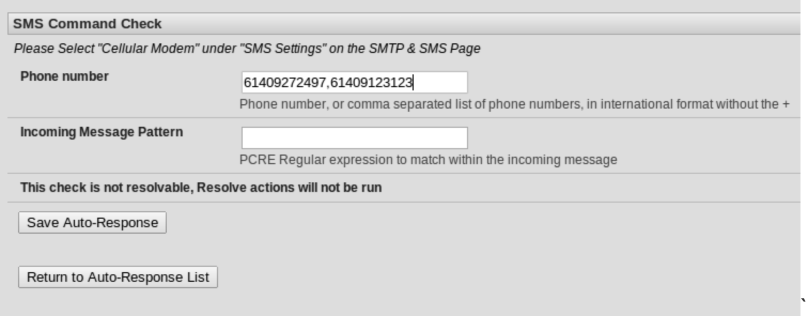
Argument 4:
Argument to pass to the script

Argument 5:
Argument to pass to the script

7.2.11 SMS Command

An incoming SMS command from an assigned caller can trigger an auto-response:

- Click on **SMS Command** as the **Check Condition.**
- Specify which **Phone Number** (in international format) of the phone sending the SMS message. For multiple trusted SMS sources, separate the numbers with a comma.
- Set the **Incoming Message Pattern** (PCRE regular expression) to match to create trigger event.



SMS Command Check

Please Select "Cellular Modem" under "SMS Settings" on the SMTP & SMS Page

Phone number: 61409272497,61409123123
Phone number, or comma separated list of phone numbers, in international format without the +

Incoming Message Pattern:
PCRE Regular expression to match within the incoming message

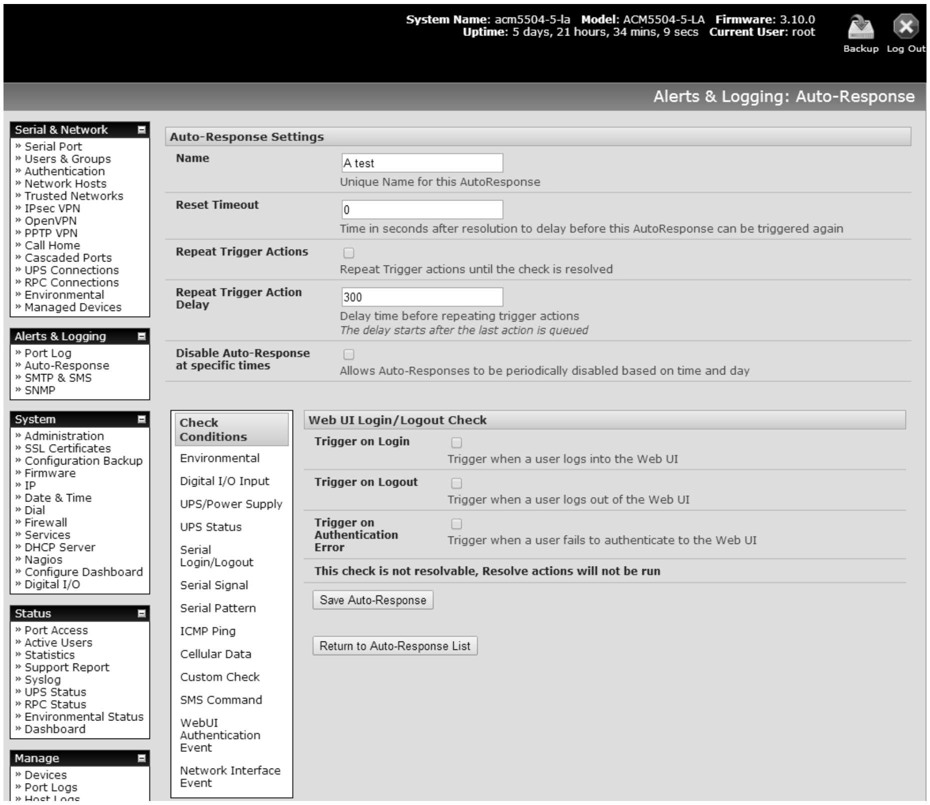
This check is not resolvable, Resolve actions will not be run

***Note:** The SMS command trigger condition can only be set if an internal cellular modem is detected.*

7.2.12 Log In/Out Check

To configure web login/out as the trigger event:

- Click on the **Web UI Authentication** as the **Check Condition.**



Auto-Response Settings

Name: A test
Unique Name for this AutoResponse

Reset Timeout: 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions: □
Repeat Trigger actions until the check is resolved

Repeat Trigger Action Delay: 300
Delay time before repeating trigger actions
The delay starts after the last action is queued

Disable Auto-Response at specific times: □
Allows Auto-Responses to be periodically disabled based on time and day

Web UI Login/Logout Check

Trigger on Login: □
Trigger when a user logs into the Web UI

Trigger on Logout: □
Trigger when a user logs out of the Web UI

Trigger on Authentication Error: □
Trigger when a user fails to authenticate to the Web UI

This check is not resolvable, Resolve actions will not be run

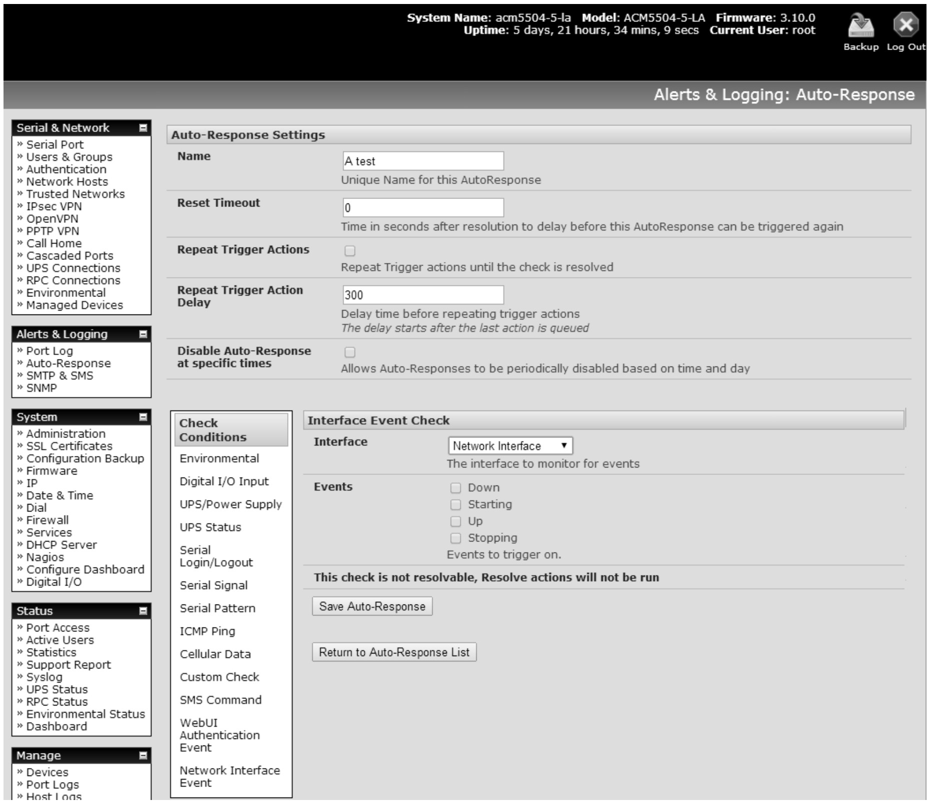
- Check **Trigger on Login (Logout)** to trigger when a user logs into (or out of) the Web UI.
- Check **Trigger on Authentication Error** to trigger when a user fails to authenticate to the Web UI.

Note: *This check is not resolvable. Resolve actions will not run.*

7.2.13 Network Interface Event

You may wish to configure a change in the network status as the trigger event (e.g., to send an alert or restart a VPN tunnel connection):

- Click on **Network Interface** as the **Check Condition.**



Auto-Response Settings

Name	A test Unique Name for this AutoResponse
Reset Timeout	0 Time in seconds after resolution to delay before this AutoResponse can be triggered again
Repeat Trigger Actions	□ Repeat Trigger actions until the check is resolved
Repeat Trigger Action Delay	300 Delay time before repeating trigger actions *The delay starts after the last action is queued*
Disable Auto-Response at specific times	□ Allows Auto-Responses to be periodically disabled based on time and day

Interface Event Check

Interface	Network Interface ▾ The interface to monitor for events
Events	□ Down □ Starting □ Up □ Stopping Events to trigger on.

This check is not resolvable, Resolve actions will not be run

- ➢ Select the **Interface** (Ethernet /Failover OOB Interface or Modem or VPN) to monitor.
- ➢ Check what type of network interface **Event** to trigger on (interface Down, Starting, Up or Stopping).

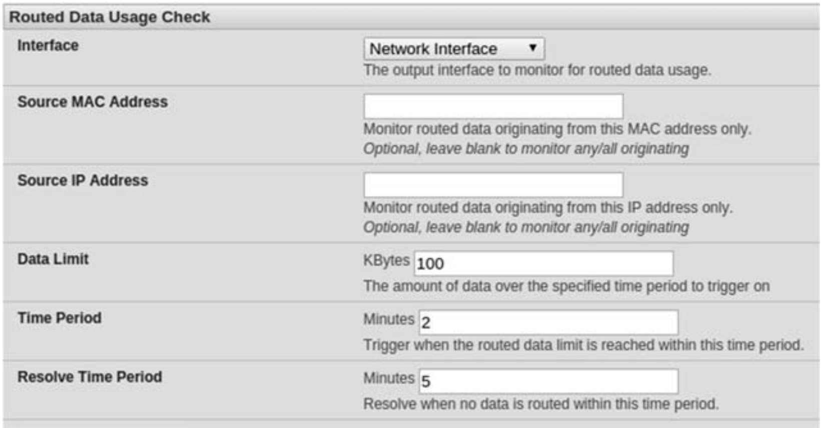
Note: *This check is not resolvable. Resolve actions will not run.*

7.2.14 Routed Data Usage Check

This check monitors the specified input interface for data usage being routed through the console server and out through another interface, such as the Internal Cellular Modem.

Routed data usage check is particularly useful in IP Passthrough mode to detect when the downstream router has failed over and is now routing via the console server's modem as a backup connection.

This check may be configured with these parameters:



Routed Data Usage Check

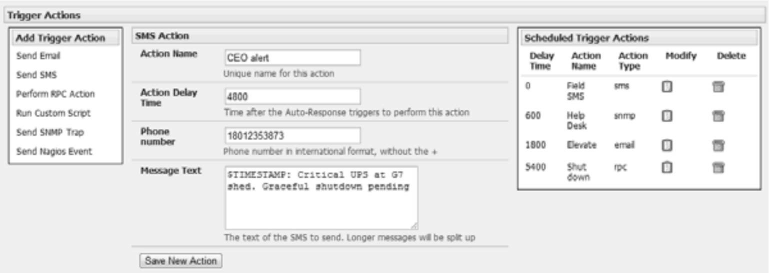
Interface	Network Interface ▾ The output interface to monitor for routed data usage.
Source MAC Address	 Monitor routed data originating from this MAC address only. *Optional, leave blank to monitor any/all originating*
Source IP Address	 Monitor routed data originating from this IP address only. *Optional, leave blank to monitor any/all originating*
Data Limit	KBytes 100 The amount of data over the specified time period to trigger on
Time Period	Minutes 2 Trigger when the routed data limit is reached within this time period.
Resolve Time Period	Minutes 5 Resolve when no data is routed within this time period.

- The console server’s incoming **Interface** to monitor.
- An optional **Source MAC/IP Address**, to monitor traffic from a specific host (e.g., the downstream router).
- A **Data Limit** threshold, the auto-response will trigger when this is hit in the specified **Time Period.**
- The auto-response will resolve if no matching data is routed for the **Resolve Period.**

7.3 Trigger Actions

To configure the sequence of actions to be taken in the event of the trigger condition:

- For an assigned auto-response with a defined check condition, click on **Add Trigger Action** (e.g. *Send Email* or *Run Custom Script)* to select the action type to be taken. Then configure the selected action (as detailed in the following sections).
- Each action is configured with an assigned **Action Delay Time** which specifies how long (in seconds) after the auto-response trigger event to wait before performing the action. You can add follow-on actions to create a sequence of actions that will be taken in the event of the one trigger condition.
- To edit (or delete) an existing action, click the **Modify** (or **Delete**) icon in the **Scheduled Trigger Action** table.



Action Name: CEO alert
Unique name for this action

Action Delay Time: 4800
Time after the Auto-Response triggers to perform this action

Phone number: 18012353873
Phone number in international format, without the +

Message Text:

```
$TIMESTAMP: Critical UPS at G7
shed. Graceful shutdown pending
```

The text of the SMS to send. Longer messages will be split up

Scheduled Trigger Actions

Delay Time	Action Name	Action Type	Modify	Delete
0	Field SMS	sms	□	🗑
600	Help Desk	snmp	□	🗑
1800	Elevate	email	□	🗑
5400	Shut down	rpc	□	🗑

***Note:** A message text can be sent with Email, SMS and Nagios actions. This configurable message can include selected values:*

$AR_TRIGGER_VAL = the trigger value for the check e.g. for UPS Status, it could be onbatt or battlow
$AR_VAL = the value returned by the check e.g. for ups status, it could be online/onbatt/battlow
$AR_CHECK_DEV = the device name of the device being checked e.g. for Alarm, the alarm name
$TIMESTAMP = the current timestamp
$HOSTNAME = the hostname of the console server

The default message text is: $TIMESTAMP: This action was run - Check details: value $AR_VAL vs trigger value $AR_TRIGGER_VAL.

7.3.1 Send Email

- Click on **Send Email** as the **Add Trigger Action**. Enter a unique **Action Name** and set the **Action Delay Time**
- Specify the **Recipient Email Address** for whom to send this email and the **Subject** of the email. For multiple recipients, you can enter comma-separated addresses.

- Edit the **Email Text** message to send. Click **Save New Action.**

***Note:** An SMS alert can also be sent via an SMTP (email) gateway. You will need to specify the **Recipient Email Address** in the format specified by the gateway provider (e.g,. for T-Mobile it is phonenumber@tmomail.net).*

7.3.2 Send SMS

- Click on **Send SMS** as the **Add Trigger Action**. Enter a unique **Action Name** and set the **Action Delay Time.**
- Specify the **Phone number** that the SMS will be sent to in international format (without the +).
- Edit the **Message Text** to send and click **Save New Action.**

***Note:** The SMS alert can only be sent if there is an internal cellular modem attached. However, an SMS alert can also be sent via a SMTP SMS gateway as described above*.

7.3.3 Perform RPC Action

- Click on **Perform RPC Action** as the **Add Trigger Action**. Enter a unique **Action Name** and set the **Action Delay Time**
- Select a power **Outlet** and specify the **Action** to be performed (power ON, OFF or Cycle).
- Click **Save New Action.**

7.3.4 Run Custom Script

- Click on **Run Custom Script** as the **Add Trigger Action**. Enter a unique **Action Name,** and set the **Action Delay Time**.

- Create a script file to execute when this action is triggered, and enter the **Script Executable** file name (e.g., */etc/config/action.sh).*

- Set the **Script Timeout** (the maximum run-time for the script). Leave as 0 for unlimited.

- Enter any **Arguments** that are to be passed to the script, and click **Save New Action.**

7.3.5 Send SNMP Trap

- Click on **Send SNMP Trap** as the **Add Trigger Action**. Enter a unique **Action Name**, and set the **Action Delay Time.**

Note: *SNMP Trap actions are valid for Serial, Environmental, UPS and Cellular data triggers.*

7.3.6 Send Nagios Event

- Click on **Send Nagios Event** as the **Add Trigger Action.** Enter a unique **Action Name**, and set the **Action Delay Time.**

- Edit the **Nagios Event Message** text to display on the Nagios status screen for the service.

- Specify the **Nagios Event State** (*OK, Warning, Critical* or *Unknown*) to return to Nagios for this service.

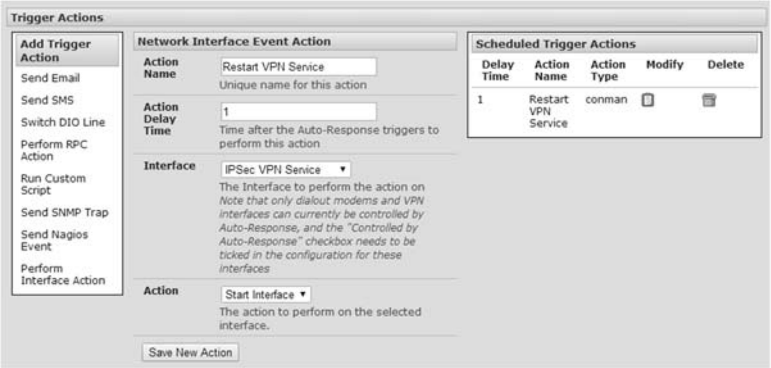
- Click **Save New Action.**

Note: *To notify the central Nagios server of Alerts, NSCA must be enabled under System: Nagios and Nagios must be enabled for each applicable host or port.*

7.3.7 Perform Interface Action

- Click on **Perform Interface Action** as the **Add Trigger Action.** Enter a unique **Action Name**, and set the **Action Delay Time.**

- **Select the Interface** (Modem or VPN service) and the **Action** (Start or Stop Interface) to be taken. You may wish to start an IPsec VPN service in response to an incoming SMS, or set up an OpenVPN tunnel whenever your Tripp Lite device fails over to use the cellular connection.



Network Interface Event Action

Action Name	Restart VPN Service Unique name for this action
Action Delay Time	1 Time after the Auto-Response triggers to perform this action
Interface	IPSec VPN Service ▾ The Interface to perform the action on *Note that only dialout modems and VPN interfaces can currently be controlled by Auto-Response, and the "Controlled by Auto-Response" checkbox needs to be ticked in the configuration for these interfaces*
Action	Start Interface ▾ The action to perform on the selected interface.

Scheduled Trigger Actions

Delay Time	Action Name	Action Type	Modify	Delete
1	Restart VPN Service	conman	□	🗑

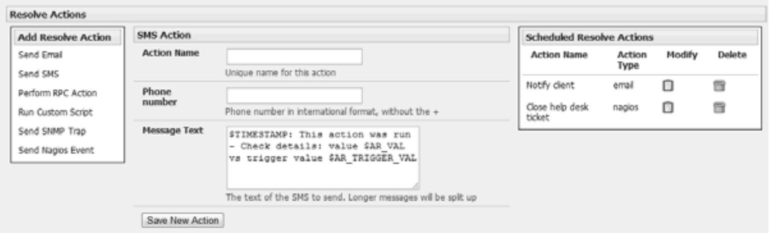
__Note:__ If any IPsec service or OpenVPN tunnel is to be controlled by the Network Interface Event Action, you will need to have checked the **Control by Auto-Response** *box when configuring that service. If selected, the default state for the VPN tunnel / service will be down.*

7.4 Resolve Actions

Actions can also be scheduled for when a trigger condition has been resolved:

- For an assigned auto-response with a defined trigger check condition, click on **Add Resolve Action** (e.g., *Send Email* or *Run Custom Script)* to select the action type to be taken.

__Note:__ Resolve Actions are configured exactly the same as Trigger Actions, except the designated Resolve Actions are all executed on resolution of the trigger condition and there are no Action Delay Times set.



Action Name: Unique name for this action

Phone number: Phone number in international format, without the +

Message Text:

```
$TIMESTAMP: This action was run
- Check details: value $AR_VAL
vs trigger value $AR_TRIGGER_VAL
```

The text of the SMS to send. Longer messages will be split up

Scheduled Resolve Actions

Action Name	Action Type	Modify	Delete
Notify client	email	▯	🗑
Close help desk ticket	nagios	▯	🗑

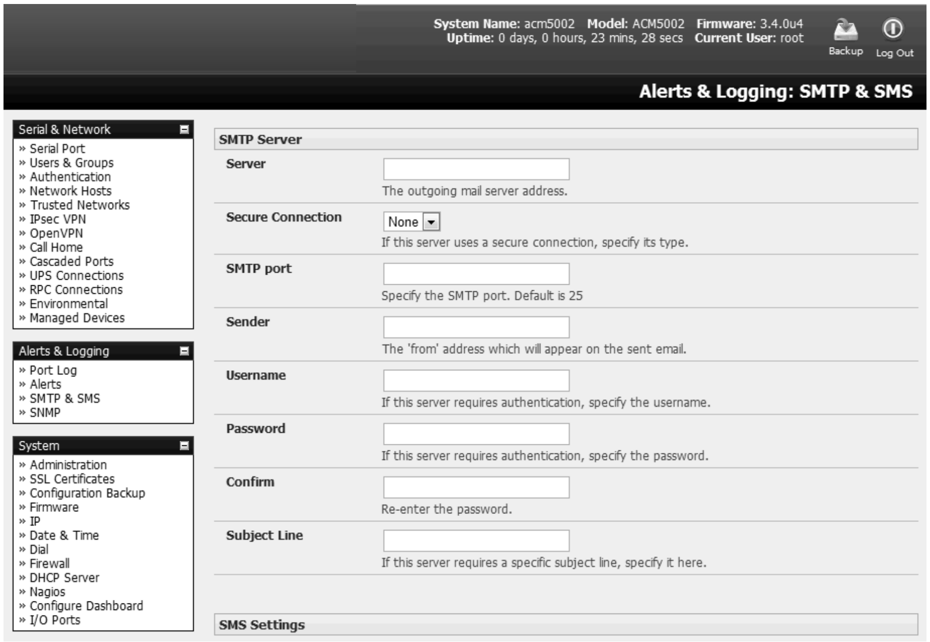
7.5 Configure SMTP, SMS, SNMP and/or Nagios Service for Alert Notifications

The auto-response facility enables remote alerts to be sent as Trigger and Resolve Actions. Before such alert notifications can be sent, you must configure the assigned alert service.

7.5.1 Send Email Alerts

The console server uses SMTP (Simple Mail Transfer Protocol) for sending the email alert notifications. To use SMTP, the Administrator must configure a valid SMTP server for sending the email:

- Select **Alerts & Logging: SMTP & SMS.**



System Name: acm5002 **Model:** ACM5002 **Firmware:** 3.4.0u4
Uptime: 0 days, 0 hours, 23 mins, 28 secs **Current User:** root

Alerts & Logging: SMTP & SMS

SMTP Server

Server — The outgoing mail server address.

Secure Connection — None — If this server uses a secure connection, specify its type.

SMTP port — Specify the SMTP port. Default is 25

Sender — The 'from' address which will appear on the sent email.

Username — If this server requires authentication, specify the username.

Password — If this server requires authentication, specify the password.

Confirm — Re-enter the password.

Subject Line — If this server requires a specific subject line, specify it here.

SMS Settings

- In the **SMTP Server** field, enter the IP address of the outgoing mail **Server.**
- If this mail server uses a **Secure Connection**, specify its type. You may also specify the IP port to use for SMTP. The default **SMTP Port** is 25.
- You may enter a **Sender** email address which will appear as the "*from"* address in all email notifications sent from this console server. Many SMTP servers check the sender's email address with the host domain name to verify the address as authentic. It may be useful to assign an email address for the console server, such as consoleserver2@mydomian.com.
- You may also enter a **Username** and **Password** if the SMTP server requires authentication.
- Similarly can specify the specific **Subject Line** that will be sent with the email.
- Click **Apply** to activate SMTP.

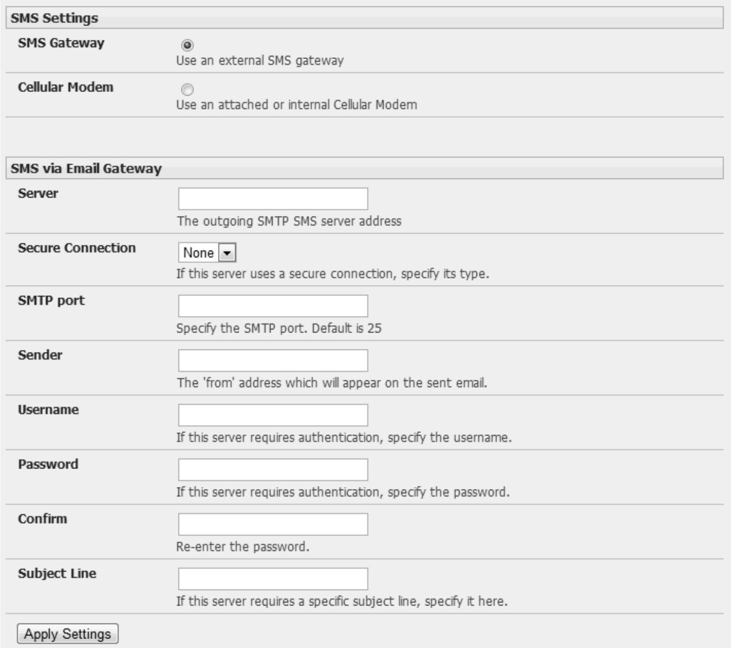
7.5.2 Send SMS Alerts

With any model console server, you can use email-to-SMS services to send SMS alert notifications to mobile devices. Almost all mobile phone carriers provide an SMS gateway service that forwards email to mobile phones on their networks. A wide selection of SMS gateway aggregators provide email to SMS forwarding to phones on any carrier.

Alternately, if your console server has an embedded or externally attached cellular modem, you will be given the option to send the SMS directly over the carrier connection.

SMS via Email Gateway

To use SMTP SMS, the Administrator must configure a valid SMTP server for sending the email:



SMS Settings

SMS Gateway	● Use an external SMS gateway
Cellular Modem	○ Use an attached or internal Cellular Modem

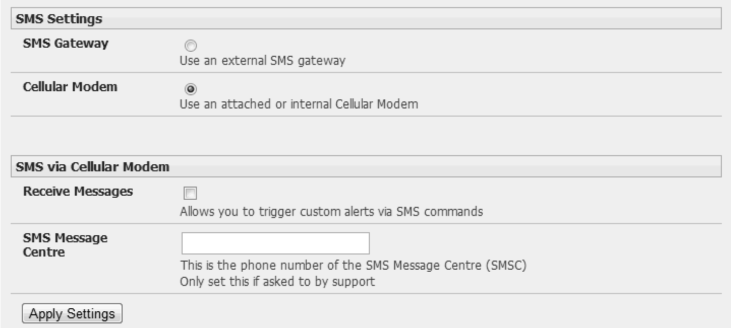
SMS via Email Gateway

Server	The outgoing SMTP SMS server address
Secure Connection	None ▾ If this server uses a secure connection, specify its type.
SMTP port	Specify the SMTP port. Default is 25
Sender	The 'from' address which will appear on the sent email.
Username	If this server requires authentication, specify the username.
Password	If this server requires authentication, specify the password.
Confirm	Re-enter the password.
Subject Line	If this server requires a specific subject line, specify it here.

- In the **SMTP Settings** field in the **Alerts & Logging: SMTP & SMS** menu, select **SMS Gateway**. An **SMS via Email Gateway** field will appear.
- Enter the IP address of the outgoing mail **Server** SMS gateway.
- Select a **Secure Connection** (if applicable) and specify the **SMTP port** to be used (if other than the default port 25).
- You may also enter a **Sender** email address which will appear as the "*from"* address in all email notifications sent from this console server. Some SMS gateway service providers only forward email to SMS when the email has been received from authorized senders. You may need to assign a specific authorized email address for the console server*.*
- You may also enter a **Username** and **Password,** as some SMS gateway service providers use SMTP servers that require authentication.
- Similarly, you can specify the specific **Subject Line** that will be sent with the email. Generally, the email subject will contain a truncated version of the alert notification message (which is contained in full in the body of the email). Some SMS gateway service providers require blank subjects or require specific authentication headers to be included in the subject line
- Click **Apply Settings** to activate SMS SMTP connection.

SMS via Cellular Modem

To use an attached or internal cellular modem for SMS, the Administrator must enable SMS:


SMS Settings

SMS Gateway ○ Use an external SMS gateway

Cellular Modem ● Use an attached or internal Cellular Modem

SMS via Cellular Modem

Receive Messages □ Allows you to trigger custom alerts via SMS commands

SMS Message Centre This is the phone number of the SMS Message Centre (SMSC)
Only set this if asked to by support

- Select **Cellular Modem** in the **SMS Settings** field.
- Check **Receive Messages** to enable incoming SMS messages to be received. A custom script will be called on receipt of incoming SMS messages.
- You may need to enter the phone number of the carrier’s **SMS Message Centre** (only if advised by your carrier or tech support).
- Click **Apply Settings** to activate SMS SMTP connection.

Note: *The option to directly send SMS alerts via cellular modem was included in the Management GUI in firmware version 3.4. Advanced console servers have had the gateway software (SMS Server Tools 3) embedded since version 3.1. However, this can only be accessed from the command line to send SMS messages.*

7.5.3 Send SNMP Trap Alerts

The Administrator can configure the Simple Network Management Protocol (SNMP) agent that resides on the console server to send SNMP trap alerts to an NMS management application:

- Select **Alerts & Logging: SNMP.**

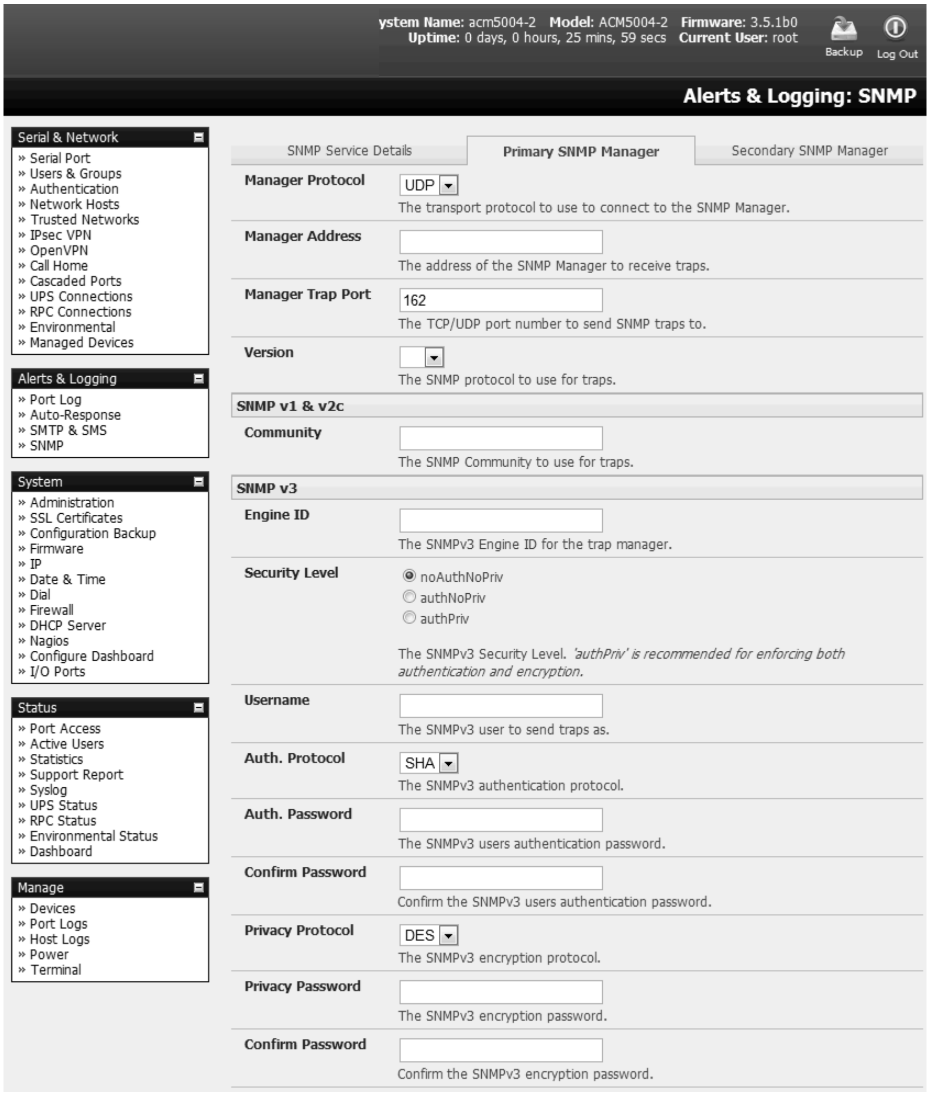
Notes: *In firmware versions 3.10.2 and above, new SNMP status and trap MIBS provide more and better-structured SNMP status and traps from console servers. There is an option in the SNMP menu to* ***Use Legacy Notifications*** *for the SNMP traps. Setting this option means the console server will send SNMP traps that are compatible with those sent in older firmware before the new MIBS were added, ensuring that the firmware upgrade will not upset existing SNMP management.*

When upgrading from old firmware that does not support the newer SNMP MIBs/traps (versions before 3.10.2) to firmware that does support the new MIBs/traps:

- *If the SNMP service was enabled and an SNMP manager was configured before upgrading the firmware, the console server will be configured to use the legacy traps after upgrading.*
- *If the SNMP service was not enabled or SNMP manager was not configured before the upgrade, then the console server will be configured to use the new SNMP traps after the upgrade (this will not have any effect until the SNMP service is turned on and an SNMP manager is configured).*
- *When starting up in the new firmware after a configuration erase, the console server will be configured to use the new SNMP traps.*
- *When upgrading from a firmware version that supports the new traps to a newer version that supports the new traps, the* ***use legacy traps*** *setting should just be kept the same; no checking on snmp service/manager configuration is needed.*

- Select the **Primary SNMP Manager** tab. The Primary and Secondary SNMP Manager tabs configure where and how outgoing SNMP alerts and notifications are sent. If you require your console server to send alerts via SNMP, then a Primary SNMP Manager must be configured (at a minimum). Optionally, a second SNMP Network Manager with its own SNMP settings can be specified on the **Secondary SNMP Manager** tab.

Note: *All console servers can also be configured to provide status information on demand using snmpd. This SNMP agent is configured using the SNMP Service Detail on Alerts & Logging: SNMP (refer to* ***15. Advanced Configuration*** *for more information).*



ystem Name: acm5004-2 Model: ACM5004-2 Firmware: 3.5.1b0
Uptime: 0 days, 0 hours, 25 mins, 59 secs Current User: root

Alerts & Logging: SNMP

Manager Protocol UDP
The transport protocol to use to connect to the SNMP Manager.

Manager Address
The address of the SNMP Manager to receive traps.

Manager Trap Port 162
The TCP/UDP port number to send SNMP traps to.

Version
The SNMP protocol to use for traps.

SNMP v1 & v2c

Community
The SNMP Community to use for traps.

SNMP v3

Engine ID
The SNMPv3 Engine ID for the trap manager.

Security Level
● noAuthNoPriv
○ authNoPriv
○ authPriv

The SNMPv3 Security Level. *'authPriv' is recommended for enforcing both authentication and encryption.*

Username
The SNMPv3 user to send traps as.

Auth. Protocol SHA
The SNMPv3 authentication protocol.

Auth. Password
The SNMPv3 users authentication password.

Confirm Password
Confirm the SNMPv3 users authentication password.

Privacy Protocol DES
The SNMPv3 encryption protocol.

Privacy Password
The SNMPv3 encryption password.

Confirm Password
Confirm the SNMPv3 encryption password.

- Select the **Manager Protocol.** SNMP is generally a **UDP**-based protocol, though infrequently it uses **TCP** instead.
- Enter the host address of the SNMP Network Manager into the **Manager Address** field.
- Enter the TCP/IP port number into the **Manager Trap Port** field (default =162).
- Select the **Version** to be used. The console server SNMP agent supports SNMP v1, v2 and v3.
- Enter the **Community** name for SNMP v1 or SNMP v2c. At a minimum, a community needs to be set for either SNMP v1 or v2c traps to work. An SNMP community is the group to which devices and management stations running SNMP belong. It helps define where information is sent. SNMP default

communities are ***private*** for Write and ***public*** for Read.

- Configure **SNMP v3** (if required). For SNMP v3 messages, the user's details and security level must match what the receiving SNMP Network Manager is expecting. SNMP v3 mandates that the message will be rejected unless the SNMPv3 user sending the trap already exists in the user database on the SNMP Manager. The user database in a SNMP v3 application is actually referenced by a combination of the Username and the Engine ID for the given SNMP application you are talking to.
  - Enter the **Engine ID** for the user sending messages as a hex number e.g. 0x8000000001020304.
  - Specify the **Security Level**. The level of security has to be compatible with the settings of the remote SNMP Network Manager.

    noAuthNoPriv No authentication or encryption.

    authNoPriv Authentication only. An authentication protocol (SHA or MD5) and password will be required.

    authPriv Uses both authentication and encryption. This is the highest level of security and requires an encryption protocol (DES or AES) and password in addition to the authentication protocol and password.

  - Complete the **Username.** This is the Security Name of the SNMPv3 user sending the message. This field is mandatory and must be completed when configuring the console server for SNMPv3.
  - An **Authentication Protocol (SHA** or **MD5**) and **Authentication Password** must be given for a Security Level of either **authNoPriv** or **authPriv**. The password must contain at least 8 characters to be valid.
  - A **Privacy Protocol** (**DES** or **AES**) must be specified for the **authPriv** level of security to be used as the encryption algorithm. AES is recommended for stronger security. A password of at least 8 characters must be provided for encryption to work.
- Click **Apply.**

Note: *Console servers with firmware version 3.0 (and later) also embed the net-snmpd daemon which can accept SNMP requests from remote SNMP management servers and provides information on alert / serial / device status (refer to* ***15.5 SNMP Status Reporting*** *for more information). Console servers with firmware earlier than V3.3 could only configure a Primary SNMP server from the Management Console. Refer* ***15.5 SNMP Status Reporting*** *for details on configuring the snmptrap daemon to send traps/notifications to multiple remote SNMP servers.*

7.5.4 Send Nagios Event Alerts

To notify the central Nagios server of Alerts, NSCA must be enabled under **System: Nagios** and Nagios must be enabled for each applicable host or port under **Serial & Network: Network Hosts** or **Serial & Network: Serial Ports** *(refer to* ***10. Nagios Integration****).*

7.6 Logging

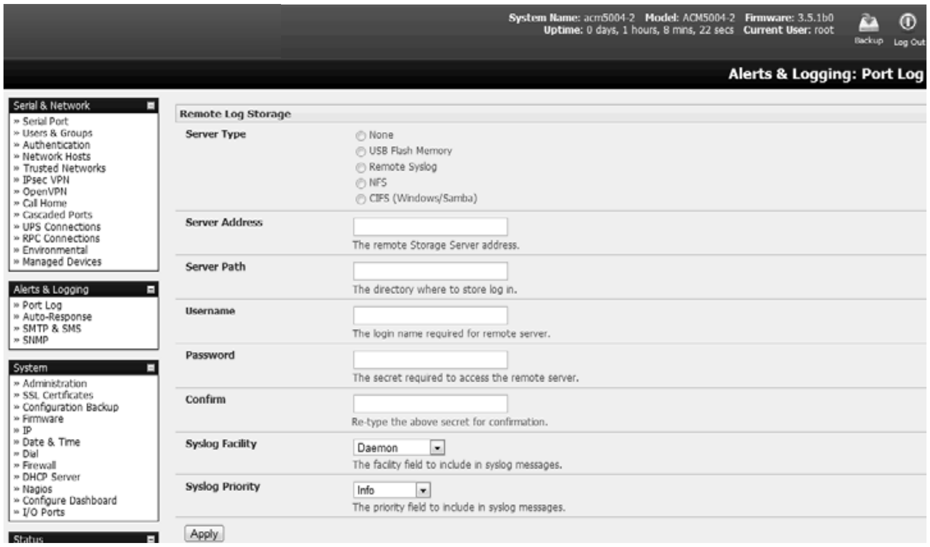
The console server can maintain log records of auto-response, access and communications events (with the console server and the attached serial, network and power devices).

A log of all system activity is also maintained by default, as is a history of the status of any attached environmental monitors.

7.6.1 Log Storage

Before activating any Event, Serial, Network or UPS logging, you must specify where those logs are to be saved. These records are stored off-server or in the Tripp Lite gateway's USB flash memory.

- Select the **Alerts & Logging: Port Log** menu option and specify the **Server Type** to be used, as well as the details to enable log server access.



System Name: acm5004-2 **Model:** ACM5004-2 **Firmware:** 3.5.1b0
Uptime: 0 days, 1 hours, 8 mins, 22 secs **Current User:** root

Alerts & Logging: Port Log

Remote Log Storage

Server Type
○ None
○ USB Flash Memory
○ Remote Syslog
○ NFS
○ CIFS (Windows/Samba)

Server Address
The remote Storage Server address.

Server Path
The directory where to store log in.

Username
The login name required for remote server.

Password
The secret required to access the remote server.

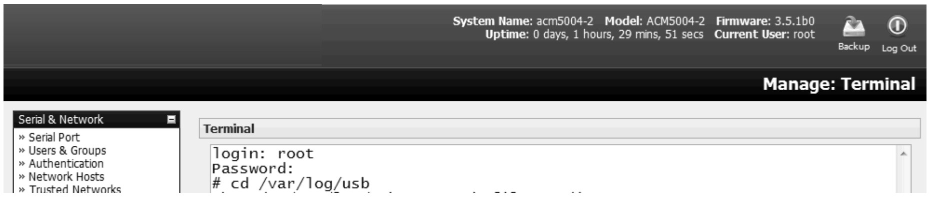
Confirm
Re-type the above secret for confirmation.

Syslog Facility Daemon
The facilty field to include in syslog messages.

Syslog Priority Info
The priority field to include in syslog messages.

From the **Manage: Devices** menu, the Administrator can view serial, network and power device logs stored in the console reserve memory (or flash USB). The User will only see logs for the managed devices they (or their group) have been given access privileges for (refer to section **13. Management**).

Event logs on the USB can be viewed using the web terminal or by ssh/telnet connecting to the console server.



System Name: acm5004-2 **Model:** ACM5004-2 **Firmware:** 3.5.1b0
Uptime: 0 days, 1 hours, 29 mins, 51 secs **Current User:** root

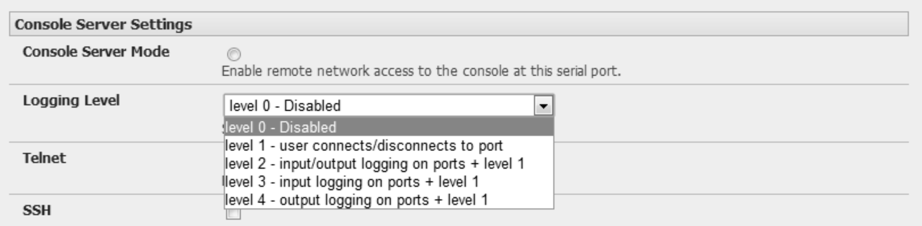
Manage: Terminal

Terminal

```
login: root
Password:
# cd /var/log/usb
```

7.6.2 Serial Port Logging

In Console Server mode, activity logs can be maintained of all serial port activity. To specify which serial ports are to have activities recorded and to what level data is to be logged:



Console Server Settings

Console Server Mode ○ Enable remote network access to the console at this serial port.

Logging Level level 0 - Disabled ▾

- level 0 - Disabled
- level 1 - user connects/disconnects to port
- level 2 - input/output logging on ports + level 1
- level 3 - input logging on ports + level 1
- level 4 - output logging on ports + level 1

Telnet

SSH □

- ➢ Select **Serial & Network: Serial Port. Edit** the port to be logged.
- ➢ Specify the **Logging Level** of for each port as:

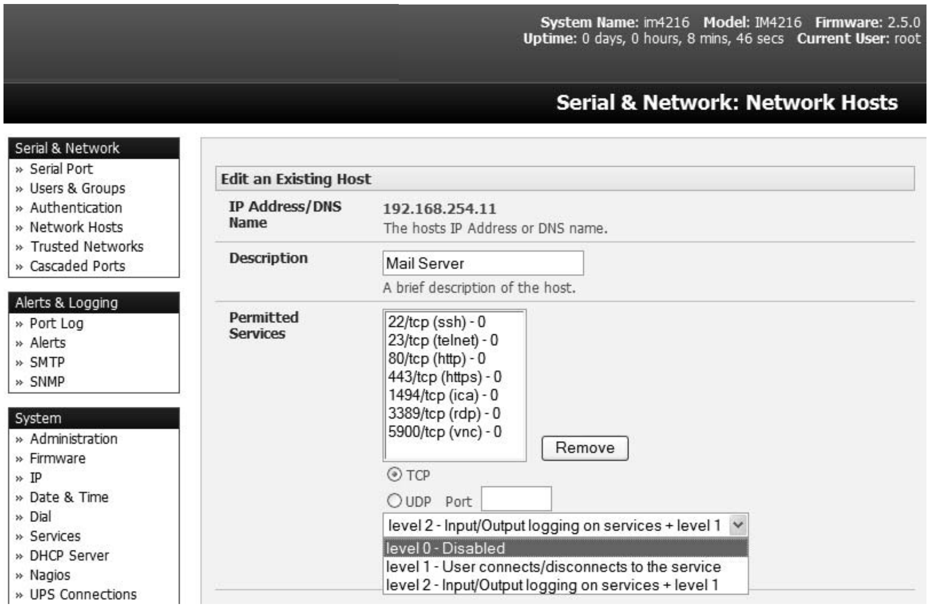
  Level 0 Turns off logging for the selected port.
  Level 1 Logs all user connection events to the port.
  Level 2 Logs all data transferred to and from the port and all changes in hardware flow control status and all user connection events.
  Level 3 Logs all data transferred from the port and all changes in hardware flow control status and all user connection events.
  Level 4 Logs all data transferred to the port, all changes in hardware flow control status and all user connection events.
- ➢ Click **Apply**

Note:** A cache of the most recent 8K of logged data per serial port is maintained locally (in addition to the logs, which are transmitted for remote/USB flash storage). To view the local cache of logged serial port data select **Manage: Port Logs.

7.6.3 Network TCP and UDP Port Logging

The console server supports optional logging of access to and communications with network-attached hosts.

- ➢ For each host, when you set up the permitted services that are authorized to be used, you also must set up the level of logging that is to be maintained for each service.



System Name: im4216 **Model:** IM4216 **Firmware:** 2.5.0
Uptime: 0 days, 0 hours, 8 mins, 46 secs **Current User:** root

Serial & Network: Network Hosts

Edit an Existing Host

IP Address/DNS Name 192.168.254.11
The hosts IP Address or DNS name.

Description Mail Server
A brief description of the host.

Permitted Services
22/tcp (ssh) - 0
23/tcp (telnet) - 0
80/tcp (http) - 0
443/tcp (https) - 0
1494/tcp (ica) - 0
3389/tcp (rdp) - 0
5900/tcp (vnc) - 0

● TCP
○ UDP Port

level 2 - Input/Output logging on services + level 1 ▾
- level 0 - Disabled
- level 1 - User connects/disconnects to the service
- level 2 - Input/Output logging on services + level 1

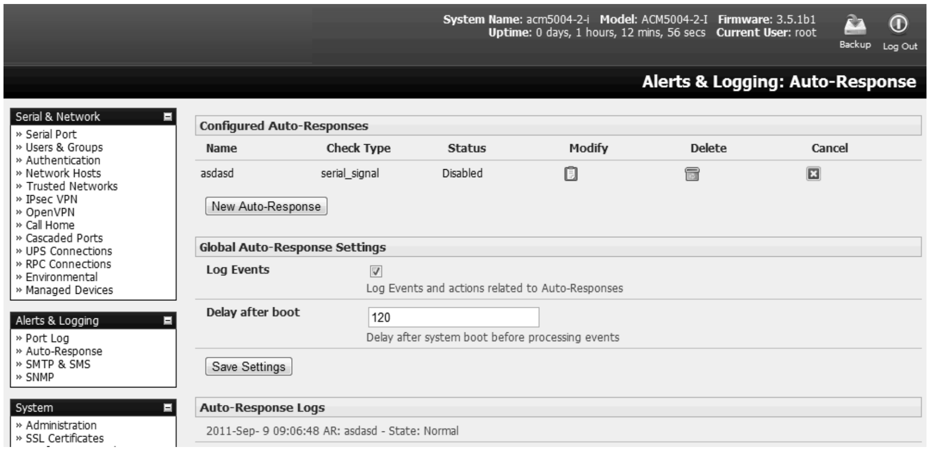
- ➢ Specify the logging level that is to be maintained for that particular TDC/UDP port/service on that particular host:

Level 0 Turns off logging for the selected TDC/UDP port to the selected host.
Level 1 Logs all connection events to the port.
Level 2 Logs all data transferred to and from the port.

- Click **Add,** then click **Apply.**

7.6.4 Auto-Response Event Logging

- Check **Log Events** on **Alerts & Logging: Auto-Response** to enable logging for all auto-response activities.



System Name: acm5004-2-i **Model:** ACM5004-2-I **Firmware:** 3.5.1b1
Uptime: 0 days, 1 hours, 12 mins, 56 secs **Current User:** root

Alerts & Logging: Auto-Response

Configured Auto-Responses

Name	Check Type	Status	Modify	Delete	Cancel
asdasd	serial_signal	Disabled			☒

Global Auto-Response Settings

Log Events ☑
Log Events and actions related to Auto-Responses

Delay after boot 120
Delay after system boot before processing events

Auto-Response Logs

```
2011-Sep- 9 09:06:48 AR: asdasd - State: Normal
```

7.6.5 Power Device Logging

The console server also logs access and communications with network-attached hosts and maintains a history of the UPS and PDU power status.

To activate and set the desired levels of logging for each serial, refer to **7.4 Resolve Actions**; for network ports, refer to **7.5 Configure SMTP, SMS, SNMP and/or Nagios Service for Alert Notifications***;* and for Power, Environment and Digital I/O UPS, refer to **section 8***.*

8. Power, Environment and Digital I/O

Console servers manage Remote Power Control devices (PDUs and IPMI devices) and Uninterruptible Power Supplies (UPS). They also monitor remote operating environments using Environmental Monitoring Devices (EMDs) and sensors and can provide digital I/O control.

8.1 Remote Power Control (RPC)

The console server management console monitors and controls Remote Power Control (RPC) devices using the embedded PowerMan and Network UPS Tools, open source management tools, and Tripp Lite’s power management software. RPCs include power distribution units (PDUs) and IPMI power devices.

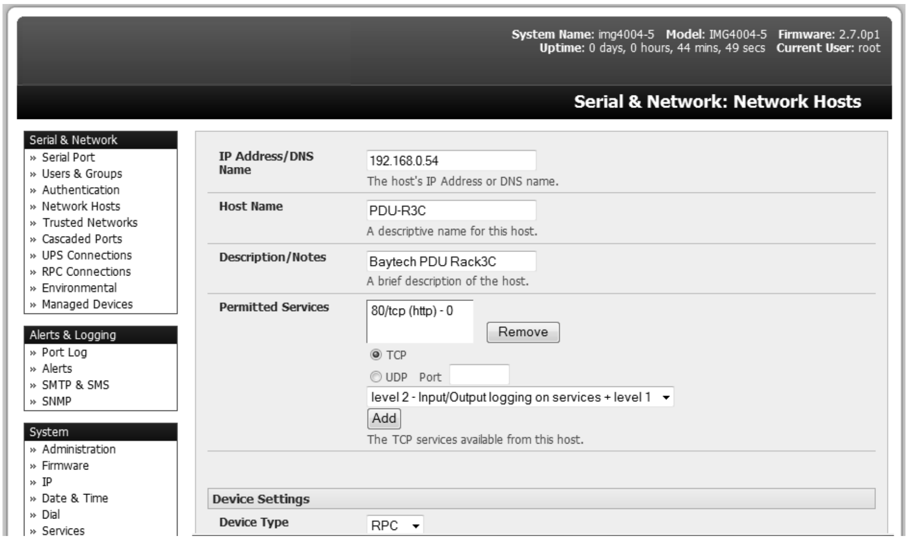
Serial PDUs can be controlled using their command line console, so you could manage the PDU through the console server using a remote telnet client. Also, you could use proprietary software tools no doubt supplied by the vendor. This generally runs on a remote Windows PC and you could configure the console server serial port to operate with a serial COM port redirector in the PC (refer to section **4. Serial Port, Host, Device and User Configuration**). Similarly, network-attached PDUs can be controlled with a browser (e.g., with SDT as detailed in section **6.3 SDT Connector Management Console**), an SNMP management package, or using the vendor supplied control software. Servers and network-attached devices with embedded IPMI service processors or BMCs are supplied with their own management tools (like SoL) that provide secure management when connected using with SDT Connector.

For simplicity, all these devices can be controlled through one window with the Management Console’s RPC remote power control tools.

8.1.1 RPC Connection

Serial and network-connected RPCs must first be connected to and configured to communicate with the console server:

- For serial RPCs, connect the PDU to the selected serial port on the console server. From the **Serial and Network: Serial Port** menu, configure the **Common Settings** of that port with the RS-232 properties required by the PDU (refer to **4.1.1 Common Settings**). Select **RPC** as the **Device Type.**
- Similarly, for each network-connected RPC go to **Serial & Network: Network Hosts** menu and configure the RPC as a connected host by specifying it as **Device Type: RPC** and clicking **Apply** (refer to **4.4 Network Hosts**).



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 0 hours, 44 mins, 49 secs **Current User:** root

Serial & Network: Network Hosts

IP Address/DNS Name: 192.168.0.54
The host's IP Address or DNS name.

Host Name: PDU-R3C
A descriptive name for this host.

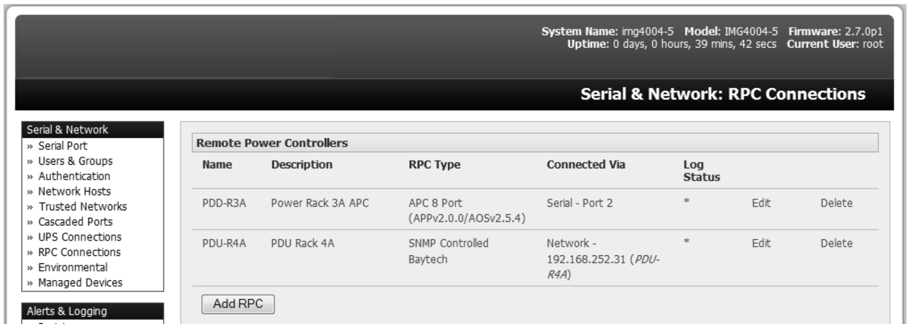
Description/Notes: Baytech PDU Rack3C
A brief description of the host.

Permitted Services: 80/tcp (http) - 0
● TCP
○ UDP Port
level 2 - Input/Output logging on services + level 1
The TCP services available from this host.

Device Settings

Device Type: RPC

- Select the **Serial & Network: RPC Connections** menu. This will display all RPC connections that have already been configured.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 0 hours, 39 mins, 42 secs **Current User:** root

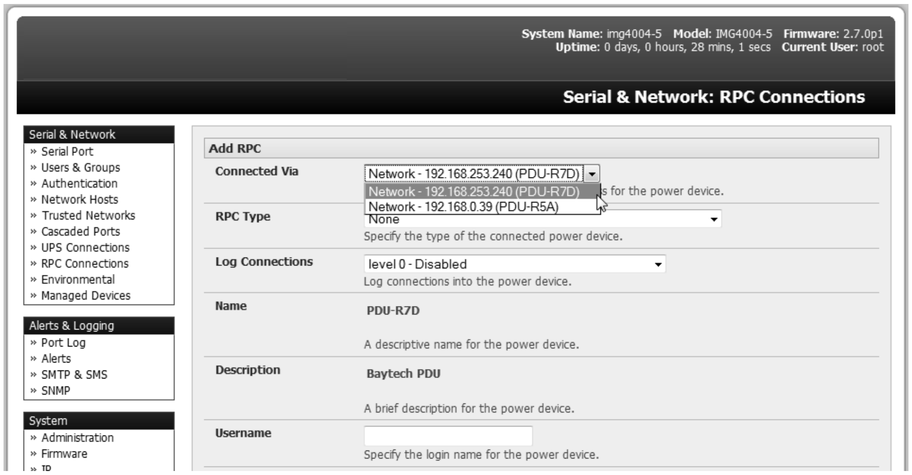
Serial & Network: RPC Connections

Remote Power Controllers

Name	Description	RPC Type	Connected Via	Log Status		
PDD-R3A	Power Rack 3A APC	APC 8 Port (APPv2.0.0/AOSv2.5.4)	Serial - Port 2	*	Edit	Delete
PDU-R4A	PDU Rack 4A	SNMP Controlled Baytech	Network - 192.168.252.31 (*PDU-R4A*)	*	Edit	Delete

- Click **Add RPC.**

- **Connected Via** presents a list of serial ports and network host connections you have set up with device type RPC (but have yet to connect to a specific RPC device):



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 0 hours, 28 mins, 1 secs **Current User:** root

Serial & Network: RPC Connections

Add RPC

Connected Via: Network - 192.168.253.240 (PDU-R7D)
Network - 192.168.253.240 (PDU-R7D)
Network - 192.168.0.39 (PDU-R5A)
...s for the power device.

RPC Type: None
Specify the type of the connected power device.

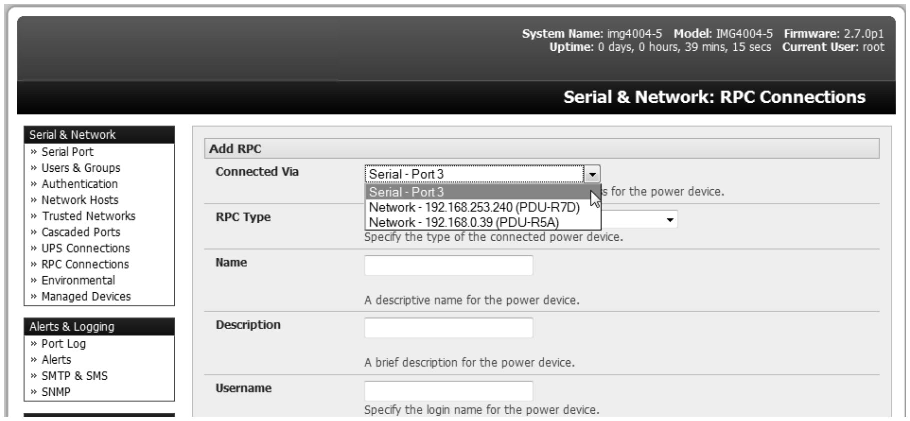
Log Connections: level 0 - Disabled
Log connections into the power device.

Name: PDU-R7D
A descriptive name for the power device.

Description: Baytech PDU
A brief description for the power device.

Username:
Specify the login name for the power device.

- When you select **Connect Via** for a Network RPC connection, the corresponding host name/description you set for that connection will be entered as the **Name** and **Description** for the power device.
- Alternately, if you select to **Connect Via** a serial connection, you will need to enter a **Name** and **Description** for the power device.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 0 hours, 39 mins, 15 secs **Current User:** root

Serial & Network: RPC Connections

Add RPC

Connected Via: Serial - Port 3
Serial - Port 3
Network - 192.168.253.240 (PDU-R7D)
Network - 192.168.0.39 (PDU-R5A)
...s for the power device.

RPC Type:
Specify the type of the connected power device.

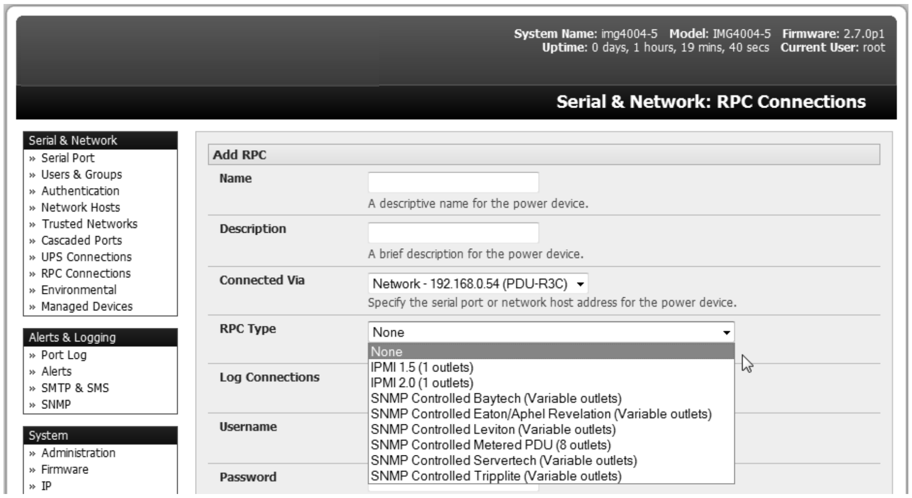
Name:
A descriptive name for the power device.

Description:
A brief description for the power device.

Username:
Specify the login name for the power device.

- Select the appropriate **RPC Type** for the PDU (or IPMI) being connected:

- If you are connecting to the RPC via the network, you will be presented with the IPMI protocol options and the SNMP RPC Types currently supported by the embedded Network UPS Tools.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 1 hours, 19 mins, 40 secs **Current User:** root

Serial & Network: RPC Connections

Add RPC

Name — A descriptive name for the power device.

Description — A brief description for the power device.

Connected Via — Network - 192.168.0.54 (PDU-R3C) — Specify the serial port or network host address for the power device.

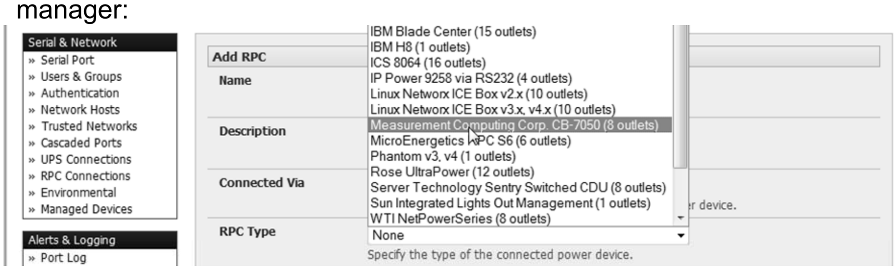
RPC Type — None
None
IPMI 1.5 (1 outlets)
IPMI 2.0 (1 outlets)
SNMP Controlled Baytech (Variable outlets)
SNMP Controlled Eaton/Aphel Revelation (Variable outlets)
SNMP Controlled Leviton (Variable outlets)
SNMP Controlled Metered PDU (8 outlets)
SNMP Controlled Servertech (Variable outlets)
SNMP Controlled Tripplite (Variable outlets)

Log Connections

Username

Password

- If you are connecting to the RPC by a serial port you will be presented with all the serial RPC types currently supported by the embedded PowerMan and Tripp Lite's power manager:



Add RPC

Name

Description

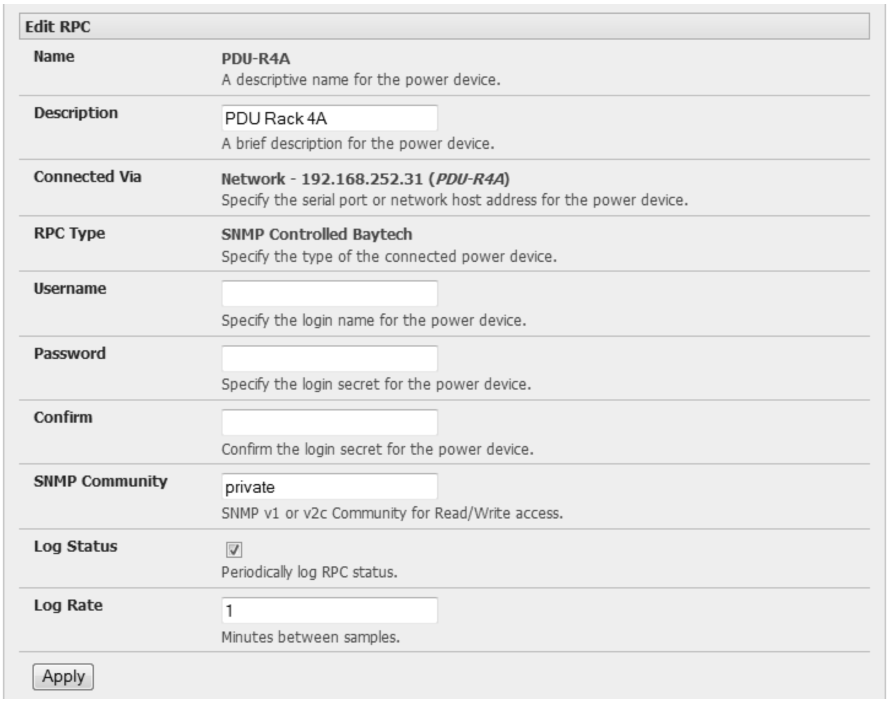
Connected Via — r device.

RPC Type — None — Specify the type of the connected power device.

IBM Blade Center (15 outlets)
IBM H8 (1 outlets)
ICS 8064 (16 outlets)
IP Power 9258 via RS232 (4 outlets)
Linux Networx ICE Box v2.x (10 outlets)
Linux Networx ICE Box v3.x, v4.x (10 outlets)
Measurement Computing Corp. CB-7050 (8 outlets)
MicroEnergetics RPC S6 (6 outlets)
Phantom v3, v4 (1 outlets)
Rose UltraPower (12 outlets)
Server Technology Sentry Switched CDU (8 outlets)
Sun Integrated Lights Out Management (1 outlets)
WTI NetPowerSeries (8 outlets)

- ➢ Enter the **Username** and **Password** used to log in to the RPC. ***Note:*** *These login credentials are not related. The users and access privileges you will have configured in* ***Serial & Networks: Users & Groups****.*

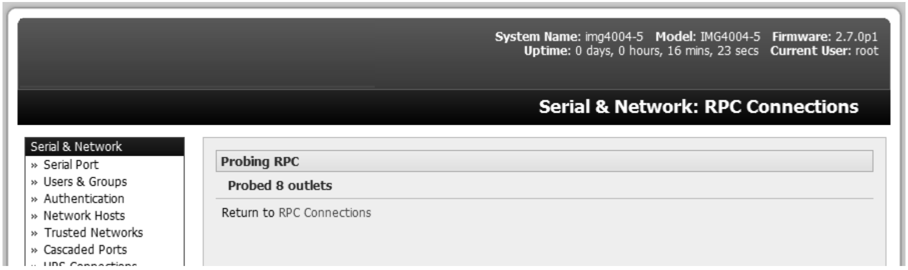
- ➢ If you selected SNMP protocol, you will need to enter the SNMP v1 or v2c Community for Read/Write access (by default this is set to "private").



Edit RPC

Name	**PDU-R4A** A descriptive name for the power device.
Description	PDU Rack 4A A brief description for the power device.
Connected Via	**Network - 192.168.252.31 (*PDU-R4A*)** Specify the serial port or network host address for the power device.
RPC Type	**SNMP Controlled Baytech** Specify the type of the connected power device.
Username	Specify the login name for the power device.
Password	Specify the login secret for the power device.
Confirm	Confirm the login secret for the power device.
SNMP Community	private SNMP v1 or v2c Community for Read/Write access.
Log Status	☑ Periodically log RPC status.
Log Rate	1 Minutes between samples.

- Check **Log Status** and specify the **Log Rate** (minutes between samples) if you wish the status from this RPC to be logged. These logs can be viewed from the **Status: RPC Status** screen.
- Click **Apply.**
- For SNMP PDUs, the console server will now probe the configured RPC to confirm the RPC Type matches and will report the number of outlets it finds that can be controlled. If unsuccessful, it will report **Unable to probe outlets** and you will need to check the RPC settings or network/serial connection.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 0 hours, 16 mins, 23 secs **Current User:** root

Serial & Network: RPC Connections

Probing RPC

Probed 8 outlets

Return to RPC Connections

- For serially connected RPC devices, a new managed device with the same name as given to the RPC will be created. The console server will then configure the RPC with the number of outlets specified in the selected RPC Type or will query the RPC itself for this information.

Note: *Tripp Lite's console servers support most network and serial PDUs. If your PDU is not on the default list, support can be added directly (refer to* ***14. Configuration from the Command Line****) or by having the PDU support added to either the Network UPS Tools or PowerMan open source projects.*

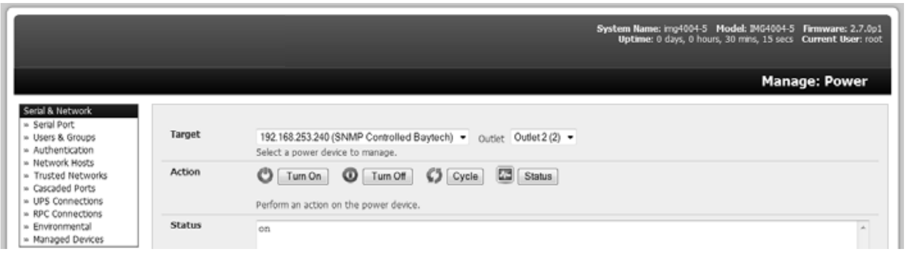
IPMI service processors and BMCs can be configured so all authorized users can use the management console to remotely cycle power and reboot computers, even when their operating system is unresponsive. To set up IPMI power control, the Administrator will first enter the IP address/domain name of the BMC or service processor (e.g. a Dell DRAC) in ***Serial & Network: Network Hosts,*** *then in* ***Serial & Network: RPC Connections****. The* ***RPC Type*** *should be IPMI1.5 or 2.0.*

8.1.2 RPC Access, Privileges and Alerts

You can set PDU and IPMI alerts using **Alerts & Logging: Alerts** (refer to **7. Alerts, Auto-Response and Logging**). You can also assign which user can access and control a particular outlet on each RPC using **Serial & Network: User & Groups** (refer to **4. Serial Port, Host, Device and User Configuration**).

8.1.3 User Power Management

The power manager enables both users and administrators to access and control the configured serial and network attached PDU power strips, servers with embedded IPMI service processors or BMCs:



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 0 hours, 30 mins, 15 secs **Current User:** root

Manage: Power

Target: 192.168.253.240 (SNMP Controlled Baytech) Outlet: Outlet 2 (2)
Select a power device to manage.

Action: Turn On | Turn Off | Cycle | Status
Perform an action on the power device.

Status: on

- Select **Manage: Power**, the particular **Target** power device to be controlled and the outlet to be controlled (if the RPC supports outlet level control).
- The outlet status is displayed. You can initiate the desired **Action** to be taken by selecting the appropriate icon:

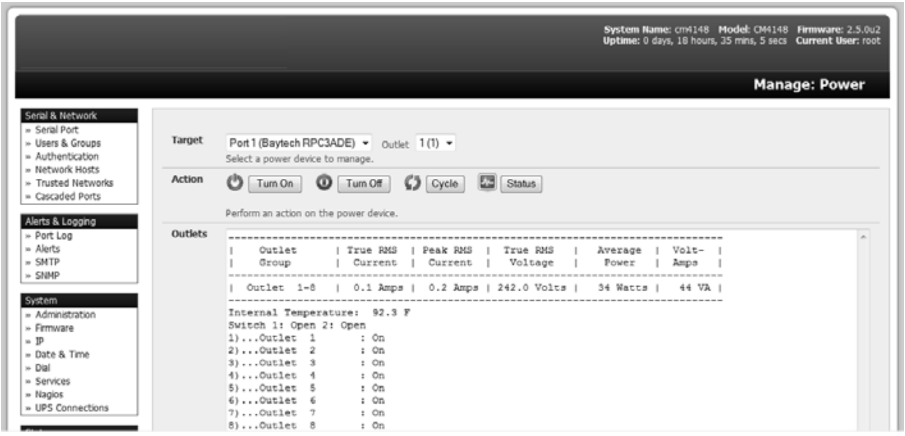
  Turn ON

  Turn OFF

  Cycle

  Status

  You will only be presented with icons for those operations that are supported by the **Target** you have selected.



System Name: cm4148 **Model:** CM4148 **Firmware:** 2.5.0u2
Uptime: 0 days, 18 hours, 35 mins, 5 secs **Current User:** root

Manage: Power

Target: Port 1 (Baytech RPC3ADE) Outlet: 1 (1)
Select a power device to manage.

Action: Turn On | Turn Off | Cycle | Status
Perform an action on the power device.

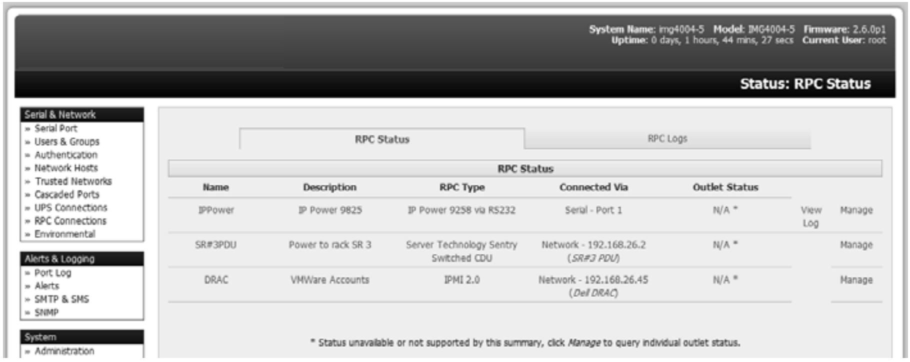
Outlets:

```
-------------------------------------------------------------------------------
|    Outlet       | True RMS  | Peak RMS  |  True RMS    |   Average  |  Volt-  |
|    Group        |  Current  |  Current  |   Voltage    |    Power   |  Amps   |
-------------------------------------------------------------------------------
|  Outlet  1-8    |  0.1 Amps |  0.2 Amps | 242.0 Volts  |   34 Watts |   44 VA |
-------------------------------------------------------------------------------
Internal Temperature:  92.3 F
Switch 1: Open 2: Open
1)...Outlet  1        : On
2)...Outlet  2        : On
3)...Outlet  3        : On
4)...Outlet  4        : On
5)...Outlet  5        : On
6)...Outlet  6        : On
7)...Outlet  7        : On
8)...Outlet  8        : On
```

8.1.4 RPC Status

You can monitor the current status of your network and serially connected PDUs and IPMI RPCs.

- Select the **Status: RPC Status** menu. A table with the summary status of all connected RPC hardware will display.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.6.0p1
Uptime: 0 days, 1 hours, 44 mins, 27 secs **Current User:** root

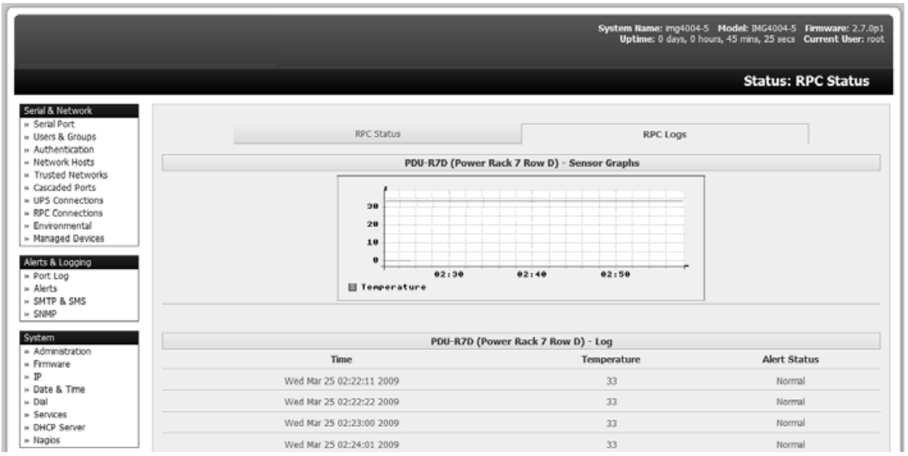
Status: RPC Status

RPC Status

Name	Description	RPC Type	Connected Via	Outlet Status		
IPPower	IP Power 9825	IP Power 9258 via RS232	Serial - Port 1	N/A *	View Log	Manage
SR#3PDU	Power to rack SR 3	Server Technology Sentry Switched CDU	Network - 192.168.26.2 (*SR#3 PDU*)	N/A *		Manage
DRAC	VMWare Accounts	IPMI 2.0	Network - 192.168.26.45 (*Dell DRAC*)	N/A *		Manage

* Status unavailable or not supported by this summary, click *Manage* to query individual outlet status.

- Click on **View Log** or select the **RPCLogs** menu. You will be presented with a table of the history and detailed graphical information on the selected RPC.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 0 hours, 45 mins, 25 secs **Current User:** root

Status: RPC Status

PDU-R7D (Power Rack 7 Row D) - Sensor Graphs

PDU-R7D (Power Rack 7 Row D) - Log

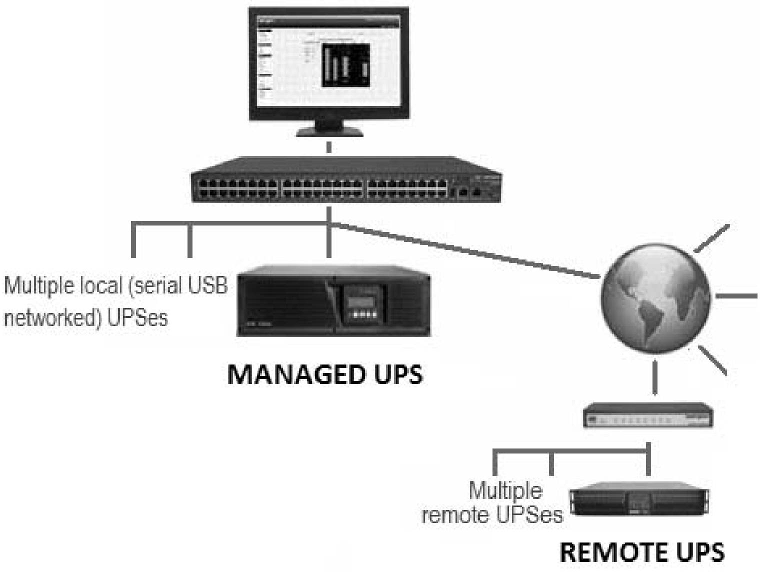
Time	Temperature	Alert Status
Wed Mar 25 02:22:11 2009	33	Normal
Wed Mar 25 02:22:22 2009	33	Normal
Wed Mar 25 02:23:00 2009	33	Normal
Wed Mar 25 02:24:01 2009	33	Normal

- Click **Manage** to query or control the individual power outlet. This will take you to the **Manage: Power** screen.

8.2 Uninterruptible Power Supply (UPS) Control

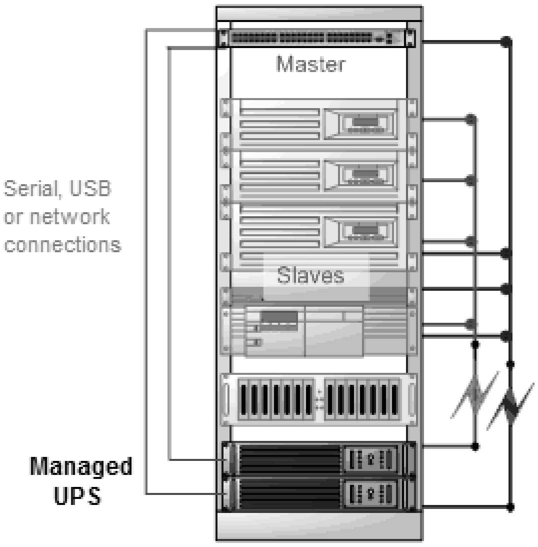
All Tripp Lite console servers can be configured to manage locally and remotely connected UPS hardware using Network UPS Tools.

Network UPS Tools (NUT) is a group of open source programs that provide a common interface for monitoring and administering UPS hardware to ensure safe shutdowns of connected systems. NUT is built on a networked model with a layered scheme of drivers, server and clients (refer to **8.2.6 Overview of Network UPS Tools**).



8.2.1 Managed UPS Connections

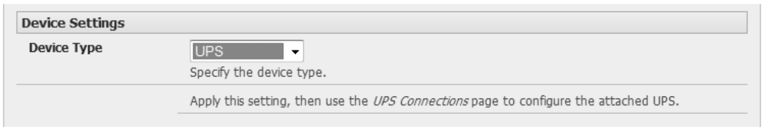
A managed UPS directly connects as a managed device to the console server. It can be connected by serial cable, USB cable, or the network. The console server becomes the Primary unit of this UPS, and runs a *upsd* server to allow other computers that are drawing power through the UPS (Secondary units) to monitor the UPS status and take appropriate action, such as shutdown in event of low UPS battery.



The console server may or may not be drawing power through the managed UPS. When the UPS battery power reaches a critical point, the console server will signal and wait for Secondary units to shut down before powering off the UPS.

Serial and network-connected UPS systems must first be connected to and configured to communicate with the console server:

- For serial UPS systems, attach the UPS to the selected serial port on the console server. From the **Serial and Network: Serial Port** menu, configure the **Common Settings** of that port with the RS-232 properties required by the UPS (refer to **4.1.1 Common Settings**). Select **UPS** as the **Device Type.**
- Similarly, for each network-connected UPS, go to **Serial & Network: Network Hosts** menu and configure the UPS as a connected host by specifying it as **Device Type: UPS**. Click **Apply.**



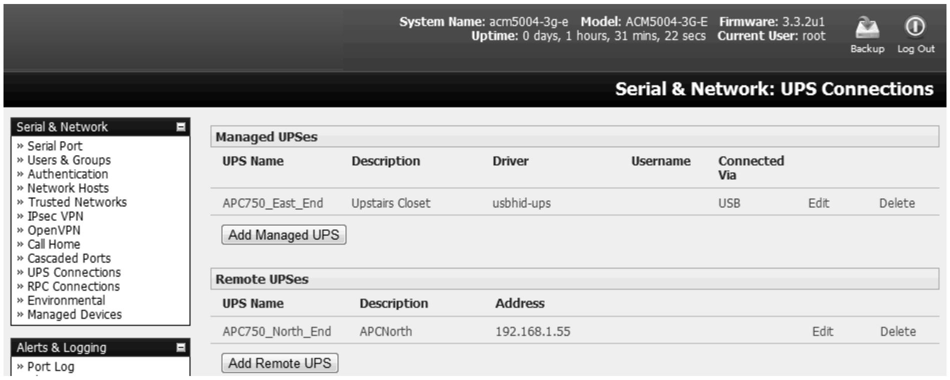
Device Settings

Device Type: UPS

Specify the device type.

Apply this setting, then use the *UPS Connections* page to configure the attached UPS.

- No such configuration is required for USB-connected UPS hardware.



System Name: acm5004-3g-e **Model:** ACM5004-3G-E **Firmware:** 3.3.2u1
Uptime: 0 days, 1 hours, 31 mins, 22 secs **Current User:** root

Serial & Network: UPS Connections

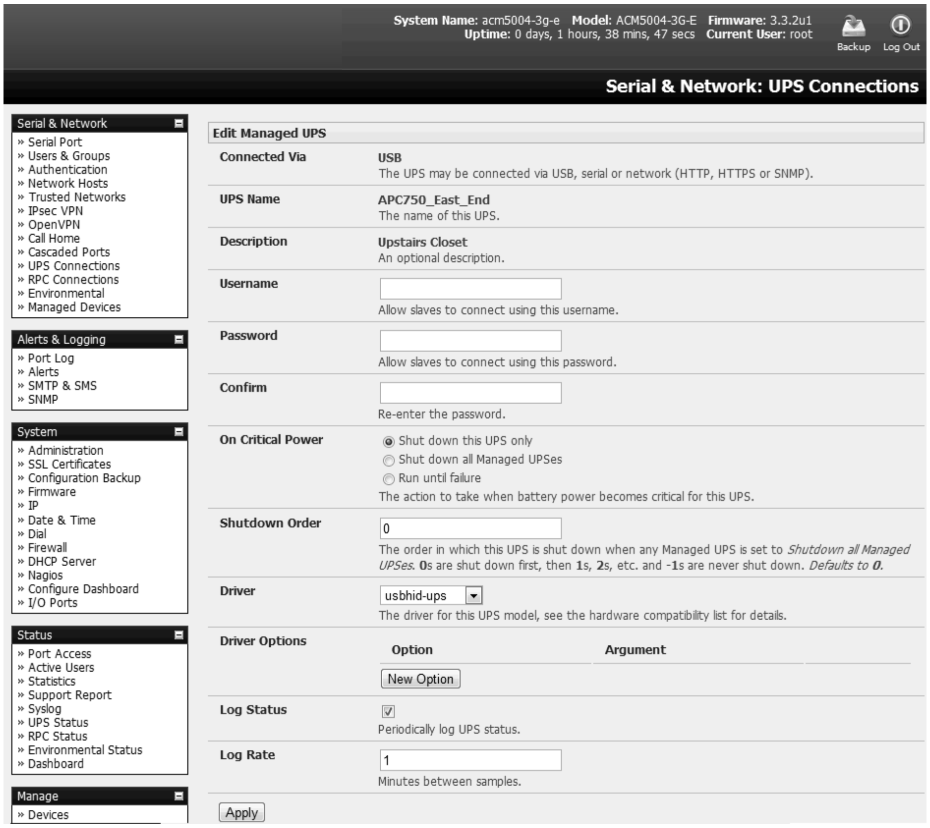
Managed UPSes

UPS Name	Description	Driver	Username	Connected Via		
APC750_East_End	Upstairs Closet	usbhid-ups		USB	Edit	Delete

Remote UPSes

UPS Name	Description	Address		
APC750_North_End	APCNorth	192.168.1.55	Edit	Delete

- Select the **Serial & Network: UPS Connections** menu. The **Managed UPS** section will display all UPS connections that have already been configured.
- Click **Add Managed UPS.**



Serial & Network: UPS Connections

Edit Managed UPS

Connected Via: USB
The UPS may be connected via USB, serial or network (HTTP, HTTPS or SNMP).

UPS Name: APC750_East_End
The name of this UPS.

Description: Upstairs Closet
An optional description.

Username:
Allow slaves to connect using this username.

Password:
Allow slaves to connect using this password.

Confirm:
Re-enter the password.

On Critical Power:
● Shut down this UPS only
○ Shut down all Managed UPSes
○ Run until failure
The action to take when battery power becomes critical for this UPS.

Shutdown Order: 0
The order in which this UPS is shut down when any Managed UPS is set to *Shutdown all Managed UPSes*. **0**s are shut down first, then **1**s, **2**s, etc. and **-1**s are never shut down. *Defaults to **0**.*

Driver: usbhid-ups
The driver for this UPS model, see the hardware compatibility list for details.

Driver Options:

Option	Argument

Log Status: ☑
Periodically log UPS status.

Log Rate: 1
Minutes between samples.

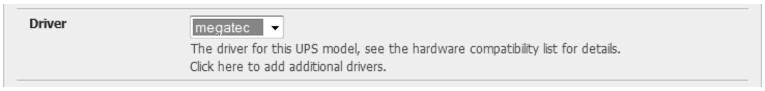
- Select if the UPS will be **Connected Via** USB, over pre-configured serial port or SNMP/HTTP/HTTPS over the preconfigured network host connection.
- When you select a network UPS connection, the corresponding host name/description you set up for that connection will be entered as the **Name** and **Description** for the power device. Alternately, if you selected to **Connect Via** USB or serial connection, you will need to enter a **Name** and **Description** for the power device (these details will also be used to create a new managed device entry for the serial/USB-connected UPS devices).
- Enter the login details. This **Username** and **Password** is used by Secondary units of this UPS (i.e. other computers that are drawing power through this UPS) to connect to the console server to monitor the UPS status so they can shut themselves down when battery power is low. Monitoring will typically be performed using the *upsmon* client running on the Secondary server (refer to **8.2.3 Controlling UPS Powered Computers**).

***Note**: These login credentials are not related to the users and access privileges configured in Serial & Networks: Users & Groups.*

- Select the action to take when UPS battery power becomes critical (i.e. shut down the UPS or shut down all managed UPS systems) or simply allow the unit(s) to run until failure.

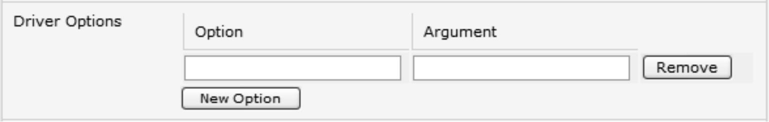
***Note**: The shutdown script /etc/scripts/ups-shutdown can be customized in the event of a critical power failure (when the UPS battery runs out). In doing so, you can program the console server to perform final shutdown actions before backup power is lost. However, it is easier to perform final shutdown actions by triggering auto-response on the UPS. Refer **7. Alerts, Auto-Response and Logging** for more information.*

- If you have multiple UPS systems and require them to be shut down in a specific order, specify the **Shutdown Order** for this UPS. This is a whole positive number, or *-1*. *0s* are shut down first, then *1s*, *2s*, etc. *-1s* are not shut down at all. The default setting is *0.*
- Select the **Driver** that will be used to communicate with the UPS.



Driver: megatec ▾
The driver for this UPS model, see the hardware compatibility list for details.
Click here to add additional drivers.

- Click **New Options** in **Driver Options** if you need to set driver-specific options for your selected NUT driver and hardware combination (more details can be found at http://www.networkupstools.org/doc).

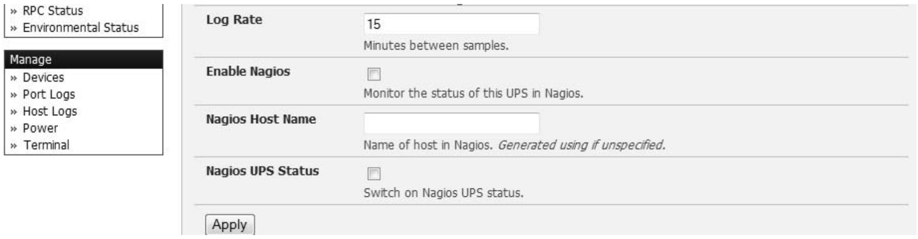


Driver Options

Option	Argument	
		Remove

New Option

- Check **Log Status** and specify the **Log Rate** (minutes between samples) if you wish to have the status from this UPS be logged. These logs can then be viewed from the **Status: UPS Status** screen.
- If Nagios services are enabled, you will be presented with an option for Nagios monitoring. Check the **Enable Nagios** checkbox to allow the UPS to be monitored using Nagios central management.



Log Rate: 15
Minutes between samples.

Enable Nagios: □
Monitor the status of this UPS in Nagios.

Nagios Host Name:
Name of host in Nagios. *Generated using if unspecified.*

Nagios UPS Status: □
Switch on Nagios UPS status.

Apply

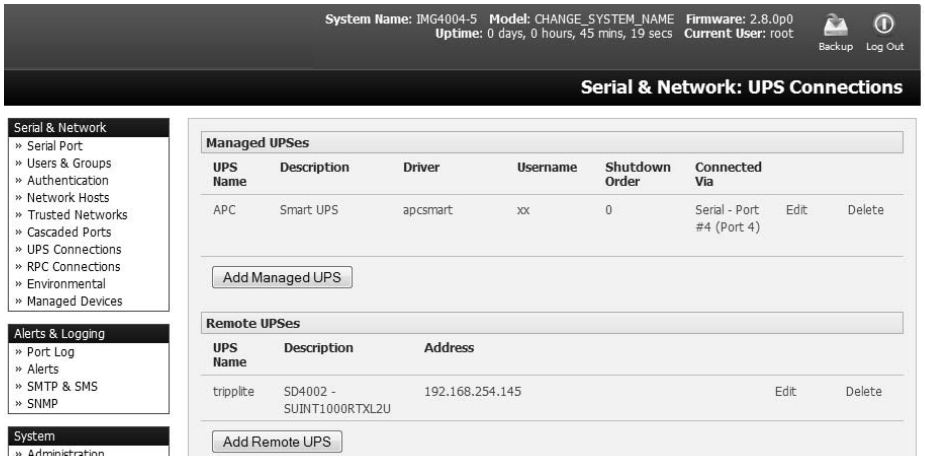
- Check **Enable Shutdown Script** if the UPS is providing power to the console server. In the event of a critical power failure, you can perform any final shutdown actions on the console server before power is lost. This is done by placing a custom script in */etc/config/scripts/ups-shutdown* (you may use the provided */etc/scripts/ups-shutdown* as a template). This script is only run when the UPS reaches critical battery status.
- Click **Apply.**

***Note**: You can also customize the* upsmon, upsd *and* upsc *settings for this UPS hardware directly from the command line.*

8.2.2 Remote UPS Management

A remote UPS is a managed device connected to a remote console server that is being monitored (but not managed) by your console server.

The *upsc* and *upslog* clients in the Tripp Lite console server can configured to monitor remote servers running Network UPS Tools that manage their locally connected UPS systems. These remote servers may be other Tripp Lite console servers or generic Linux servers running NUT. All distributed UPS systems may be spread in a row in a data center, around a campus property or across the country, and can be centrally monitored through a single central console server window. To add a remote UPS:



System Name: IMG4004-5 **Model:** CHANGE_SYSTEM_NAME **Firmware:** 2.8.0p0
Uptime: 0 days, 0 hours, 45 mins, 19 secs **Current User:** root

Serial & Network: UPS Connections

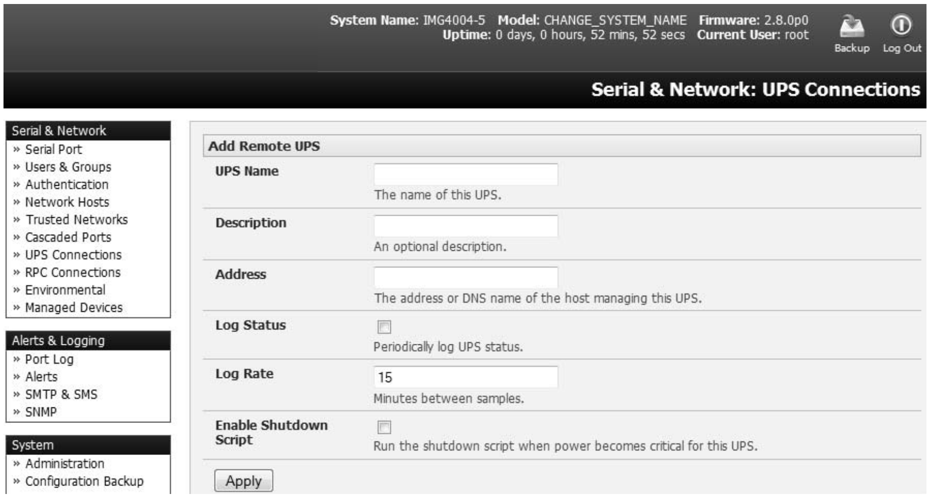
Managed UPSes

UPS Name	Description	Driver	Username	Shutdown Order	Connected Via		
APC	Smart UPS	apcsmart	xx	0	Serial - Port #4 (Port 4)	Edit	Delete

Remote UPSes

UPS Name	Description	Address		
tripplite	SD4002 - SUINT1000RTXL2U	192.168.254.145	Edit	Delete

- ➢ Select the **Serial & Network: UPS Connections** menu. The **Remote UPS** section will display all the remote UPS devices being monitored.
- ➢ Click **Add Remote UPS.**



System Name: IMG4004-5 **Model:** CHANGE_SYSTEM_NAME **Firmware:** 2.8.0p0
Uptime: 0 days, 0 hours, 52 mins, 52 secs **Current User:** root

Serial & Network: UPS Connections

Add Remote UPS

UPS Name	The name of this UPS.
Description	An optional description.
Address	The address or DNS name of the host managing this UPS.
Log Status	□ Periodically log UPS status.
Log Rate	15 Minutes between samples.
Enable Shutdown Script	□ Run the shutdown script when power becomes critical for this UPS.

- ➢ Enter the **Name** of the particular remote UPS to be remotely monitored. This name must be the name that the remote UPS was configured with on the remote console server (as the remote console server may have multiple UPS units that it is managing locally with NUT). Optionally, you may also enter a **Description.**
- ➢ Enter the IP **Address** or DNS name of the remote console server* that is managing the remote UPS. (*This may be another Tripp Lite console server or it may be a generic Linux server running Network UPS Tools).

Note: *An example where centrally monitored and remotely distributed UPS systems are useful is a campus or large business site where a multitude of computer and other equipment sites are widely spread out and with each containing its own UPS supply. Many of these sites (particularly the smaller sites) will be USB or serially connected.*

Having a B094 or B095 console server at these remote sites allows the system manager to centrally monitor the status of the power supplies at all sites and centralize alarms. In doing so, the system manager can receive warning to initiate a call-out or shut down.

- Check **Log Status** and specify the **Log Rate** (minutes between samples) if you wish the status from the UPS to be logged. These logs can then be viewed from the **Status: UPS Status** screen.
- Check **Enable Shutdown Script** if the remote UPS is providing power to the console server. In the event the UPS reaches critical battery status, the custom script in */etc/config/scripts/ups-shutdown* will run, allowing you to perform any final shutdown actions.
- Click **Apply.**

***Note**: The remote UPS feature is supported on all console servers with firmware version 2.8 and later. Earlier versions support a single remote "Monitored UPS", which could be set to trigger the console server shutdown script.*

8.2.3 Controlling UPS Powered Computers

One advantage of using a managed UPS is you can configure computers that draw power through that UPS to be shut down gracefully in the event of a prolonged power failure.

For Linux computers, this is done by setting up *upsmon* on each computer and directing them to monitor the console server managing their UPS. This will set the specific conditions used to initiate a computer shut down. Non-critical servers may be powered down seconds after the UPS starts running on battery, whereas servers that are more critical may not shut down until a low battery warning is received. Refer to the online NUT documentation for details:

http://eu1.networkupstools.org/doc/2.2.0/INSTALL.html

http://linux.die.net/man/5/upsmon.conf

http://linux.die.net/man/8/upsmon

An example upsmon.conf entry might look like:

MONITOR managedups@192.168.0.1 1 username password Secondary

- *managedups* is the UPS Name of the Managed UPS

- *192.168.0.1* is the IP address of the Tripp Lite *console server*

- *1* indicates the server has a single power supply attached to this UPS

- *username* is the Username of the Managed UPS

- password is the Password of the Manager UPS

NUT monitoring clients are available for Windows computers (WinNUT).

If you have an RPC (PDU), it is also possible to shut down UPS-powered computers and other equipment without them have a client running (e.g., communications and surveillance gear).

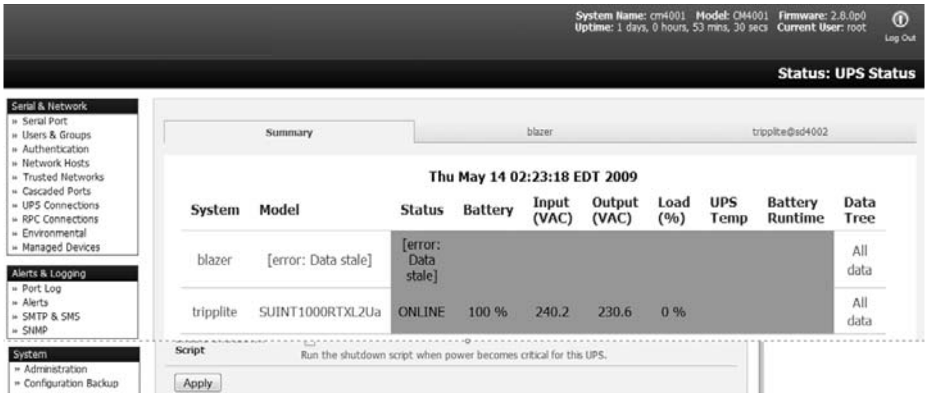
8.2.4 UPS Alerts

You can set UPS alerts using **Alerts & Logging: Alerts** (refer to **7. Alerts, Auto-Repsonse and Logging**).

8.2.5 UPS Status

You can monitor the current status of your network, serial or USB-connected managed UPS systems and any configured remote UPS systems.

- Select the **Status: UPS Status** menu. A table with the summary status of all connected UPS hardware will display.

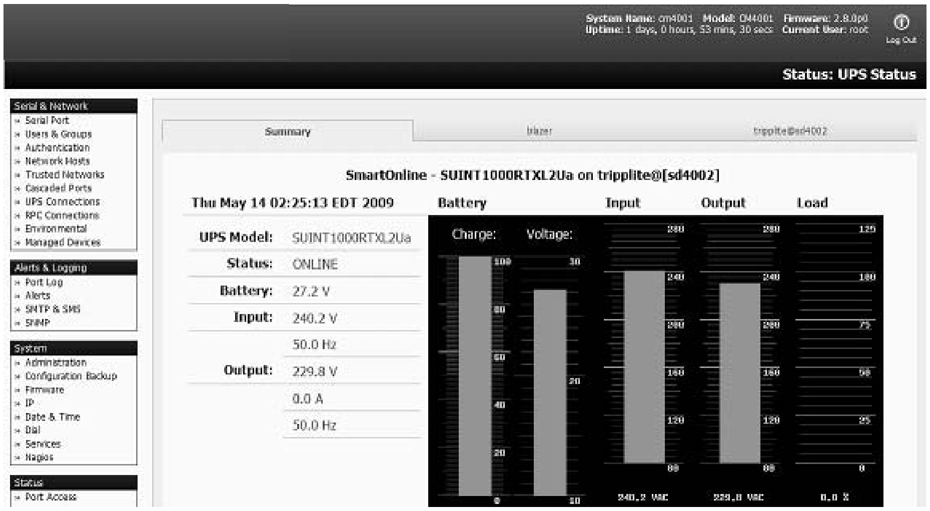


Thu May 14 02:23:18 EDT 2009

System	Model	Status	Battery	Input (VAC)	Output (VAC)	Load (%)	UPS Temp	Battery Runtime	Data Tree
blazer	[error: Data stale]	[error: Data stale]							All data
tripplite	SUINT1000RTXL2Ua	ONLINE	100 %	240.2	230.6	0 %			All data

Script Run the shutdown script when power becomes critical for this UPS.

➢ Click on any UPS **System** name in the table and you will be presented with detailed graphical information.

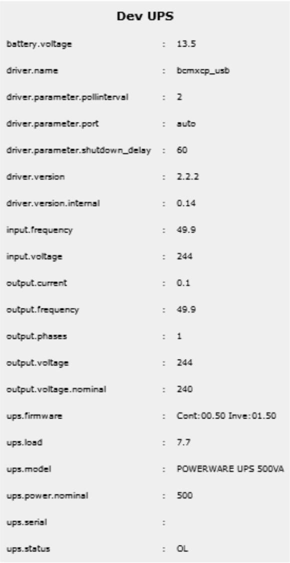


SmartOnline - SUINT1000RTXL2Ua on tripplite@[sd4002]

Thu May 14 02:25:13 EDT 2009

UPS Model:	SUINT1000RTXL2Ua
Status:	ONLINE
Battery:	27.2 V
Input:	240.2 V
	50.0 Hz
Output:	229.8 V
	0.0 A
	50.0 Hz

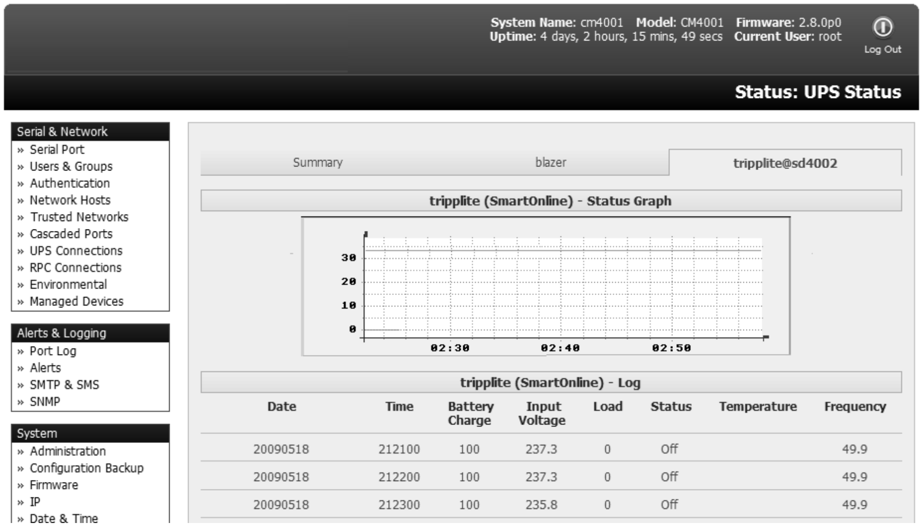
➢ Click on **All Data** for any UPS System in the table for more status and configuration information of a UPS System.



Dev UPS

battery.voltage	:	13.5
driver.name	:	bcmxcp_usb
driver.parameter.pollinterval	:	2
driver.parameter.port	:	auto
driver.parameter.shutdown_delay	:	60
driver.version	:	2.2.2
driver.version.internal	:	0.14
input.frequency	:	49.9
input.voltage	:	244
output.current	:	0.1
output.frequency	:	49.9
output.phases	:	1
output.voltage	:	244
output.voltage.nominal	:	240
ups.firmware	:	Cont:00.50 Inve:01.50
ups.load	:	7.7
ups.model	:	POWERWARE UPS 500VA
ups.power.nominal	:	500
ups.serial	:	
ups.status	:	OL

- By selecting **UPS Logs**, you will be presented with the log table of the load, battery charge level, temperature and other status information from all managed and monitored UPS systems. This information is logged for all UPS systems configured with the **Log Status** box checked. The information is also presented graphically.



System Name: cm4001 **Model:** CM4001 **Firmware:** 2.8.0p0
Uptime: 4 days, 2 hours, 15 mins, 49 secs **Current User:** root

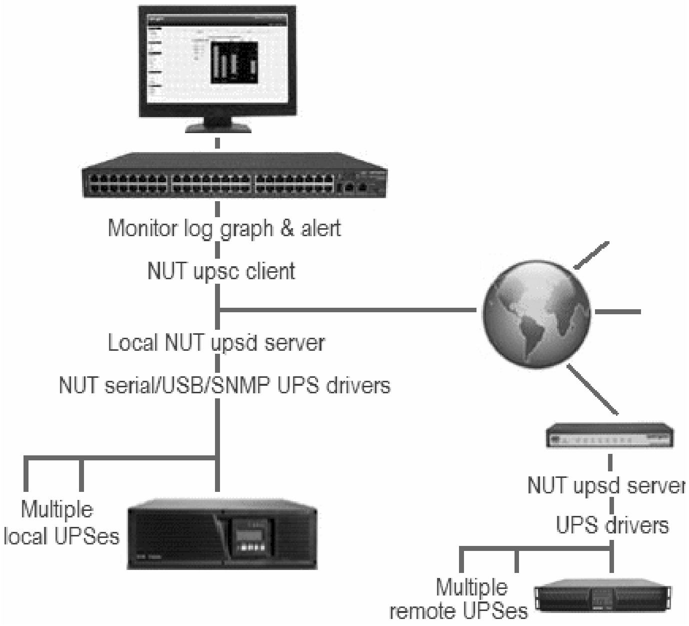
Status: UPS Status

tripplite (SmartOnline) - Log

Date	Time	Battery Charge	Input Voltage	Load	Status	Temperature	Frequency
20090518	212100	100	237.3	0	Off		49.9
20090518	212200	100	237.3	0	Off		49.9
20090518	212300	100	235.8	0	Off		49.9

8.2.6 Overview of Network UPS Tools (NUT)

NUT is built on a networked model with a layered scheme of drivers, server and clients. NUT can be configured using the management console as described above, or you can configure the tools and manage the UPS systems directly from the command line. This section provides an overview of NUT. Full documentation is available at *http://www.networkupstools.org/doc*.



NUT is built on a networked model with a layered scheme of drivers, server and clients:

- The **driver** programs communicate directly to the UPS equipment and run on the same host as the NUT network server (*upsd*). Drivers are provided for a wide assortment of equipment from most of the popular UPS vendors. They understand the specific language of each UPS. They communicate to serial, USB and SNMP network-connected UPS hardware and map the communications back to a compatibility layer. As a result, both a "smart" protocol UPS and a simple "power strip" model can be handled transparently.

- The NUT network **server** program *upsd* is responsible for passing status data from the drivers to the client programs via the network. *upsd* can cache the status from multiple UPS systems and then serve this status data to many clients. *upsd* also contains access control features to limit the abilities of the clients, so only authorized hosts may monitor or control the UPS hardware.

- There are a number of NUT **clients** that connect to *upsd* to check on the status of the UPS hardware and perform actions based on the status. These clients can run on the same host as the NUT server or they can communicate with the NUT server over the network, enabling them to monitor any UPS anywhere:

  - The *upsc* client provides a quick way to poll the status of a UPS server. It can be used inside shell scripts and other programs that require UPS data but do not want to include the full interface.
  - The *upsmon* client enables servers that draw power through the UPS to shutdown gracefully when the battery power reaches a critical low point.
  - There are also logging clients (*upslog*) and third party interface clients (Big Sister, Cacti, Nagios, Windows and more) available.

- The latest release of NUT (2.4) also controls PDU systems, either natively using SNMP or through a binding to Powerman (open source software from Livermore Labs is embedded in Tripp Lite console servers).

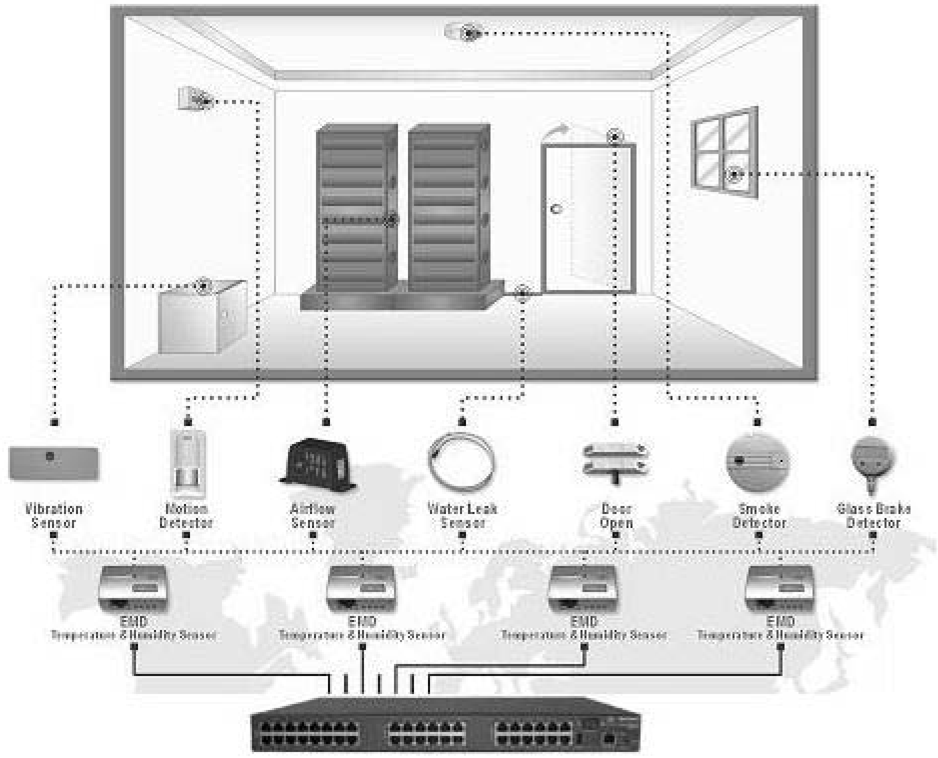
NUT clients and servers all are embedded in each Tripp Lite console server, with a management console presentation layer added. They also are run remotely on distributed console servers and other remote NUT monitoring systems. Layered distributed NUT architecture enables:

- **Multiple manufacturer support:** NUT can monitor UPS models from 79 different manufacturers - and PDUs from a growing number of vendors - with a unified interface.
- **Multiple architecture support:** NUT can manage serial and USB-connected UPS models with the same common interface. Network-connected USB and PDU equipment can also be monitored using SNMP.
- **Multiple clients monitoring the one UPS:** Multiple systems may monitor a single UPS using only their network connections. A wide selection of client programs that support monitoring UPS hardware via NUT (Big Sister, Cacti, Nagios and more) is available.
- **Central management of multiple NUT servers:** A central NUT client can monitor multiple NUT servers that may be distributed throughout the data center, across a campus or around the world.

NUT supports complex power architectures found in data centers, communications centers and distributed office environments where UPS systems from various vendors power systems and clients of all sizes and types.

8.3 Environmental Monitoring

The Environmental Monitoring Device (EMD), model B090-EMD, can be connected to any Console Server serial port and each Console Server can support multiple EMD's. Each EMD has one temperature sensor, one humidity sensor and one general-purpose status sensor that can be connected to a smoke detector, water detector, vibration or open-door sensor.



8.3.1 Connecting the EMD and its Sensors

The Environmental Monitor Device (EMD) connects to any serial port on the console server via special EMD Adapter and standard Cat5 cable. The sensors screw into the EMD.

EMD

EMD Adapter

- The EMD is powered over the serial port connection and communicates using a custom handshake protocol. It is not an RS-232 device and should not be connected without the adapter.
- Plug the male RJ plug on the EMD adapter (model B090-EMD-ADP) into the EMD. Then connect the adapter to the console server serial port using the provided UTP cable. If the 6 ft. (2 m) UTP cable provided with the EMD is not long enough, it can be replaced with a standard Cat5 UTP cable up to 33 ft. (10 m) in length (Tripp Lite N002-Series cables).

EMD sensor

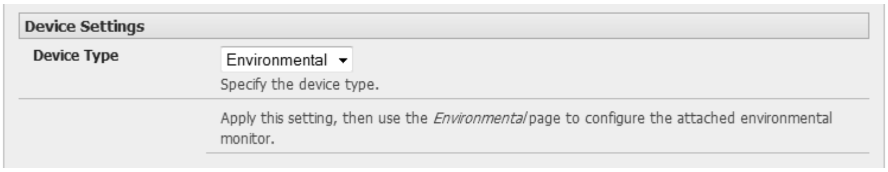
- Screw the bare wires on any smoke detector, water detector, vibration sensor, open-door sensor or general purpose open/close status sensors into the terminals on the EMD.

- B090-WLS – Console Server Water Leak Sensor
- B090-DCS – Console Server Door Contact Sensor
- B090-VS – Console Server Vibration Sensor
- B090-SD-110 – Console Server Smoke Detector – 110V
- B090-SD-220 – Console Server Smoke Detector – 120V

***Note**: Console servers only support attaching a single sensor to each EMD.*

The EMD can only be used with a console server and cannot be connected to standard RS-232 serial ports on other devices.

- Select **Environmental** as the **Device Type** in the **Serial & Network: Serial Port** menu for the port to which the EMD is to be attached. No particular common settings are required.
- Click **Apply.**



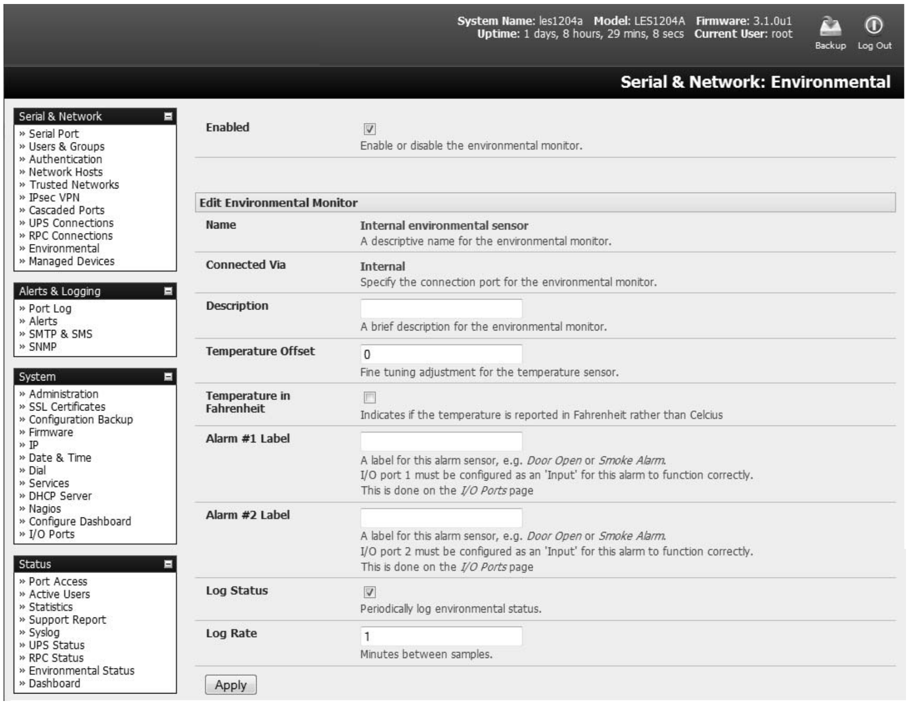
Device Settings

Device Type: Environmental

Specify the device type.

Apply this setting, then use the *Environmental* page to configure the attached environmental monitor.

- When configured as Inputs, the *SENSOR* and *DIO* ports are notionally attached to the internal EMD. Go to the **Serial & Network: Environmental** page and enable the **Internal EMD.** Then configure the attached sensors as alarms as covered in the next section.



Enabled ☑
Enable or disable the environmental monitor.

Edit Environmental Monitor

Name Internal environmental sensor
A descriptive name for the environmental monitor.

Connected Via Internal
Specify the connection port for the environmental monitor.

Description
A brief description for the environmental monitor.

Temperature Offset 0
Fine tuning adjustment for the temperature sensor.

Temperature in Fahrenheit □
Indicates if the temperature is reported in Fahrenheit rather than Celcius

Alarm #1 Label
A label for this alarm sensor, e.g. *Door Open* or *Smoke Alarm*.
I/O port 1 must be configured as an 'Input' for this alarm to function correctly.
This is done on the *I/O Ports* page

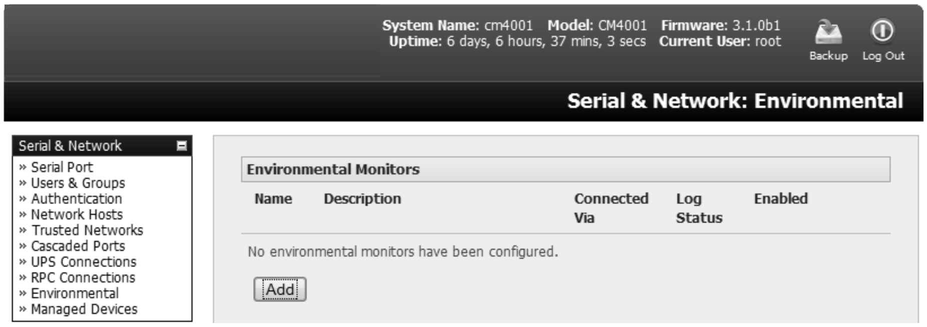
Alarm #2 Label
A label for this alarm sensor, e.g. *Door Open* or *Smoke Alarm*.
I/O port 2 must be configured as an 'Input' for this alarm to function correctly.
This is done on the *I/O Ports* page

Log Status ☑
Periodically log environmental status.

Log Rate 1
Minutes between samples.

8.3.2 Adding EMDs and Configuring the Sensors

- Select the **Serial & Network: Environmental** menu. This will display any external EMDs or any "internal EMD" (i.e. sensors that may be directly attached to B093, B094 or B095) that have already been configured.

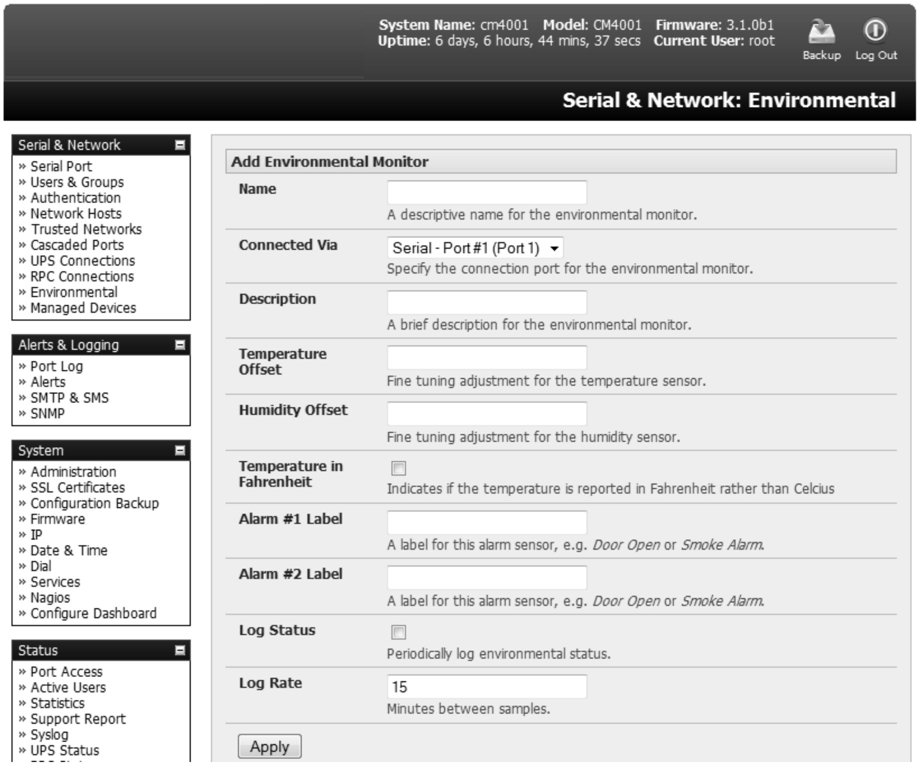


Environmental Monitors

Name	Description	Connected Via	Log Status	Enabled

No environmental monitors have been configured.

- To add a new EMD, click **Add** and configure an external EMD. Enter a **Name** and (optionally) a **Description.** Select the pre-configured serial port the EMD will be **Connected Via.**



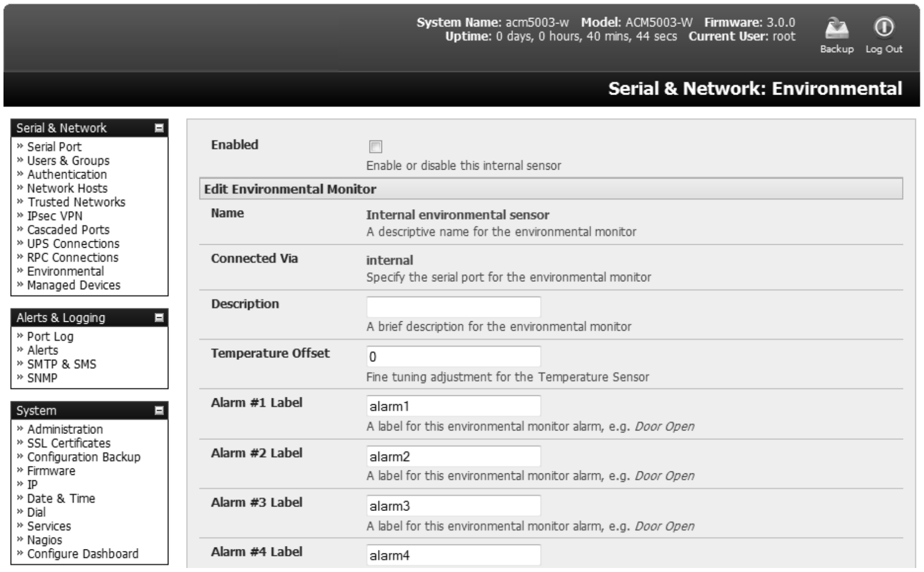
System Name: cm4001 **Model:** CM4001 **Firmware:** 3.1.0b1
Uptime: 6 days, 6 hours, 44 mins, 37 secs **Current User:** root

Serial & Network: Environmental

Add Environmental Monitor

Name	A descriptive name for the environmental monitor.
Connected Via	Serial - Port #1 (Port 1) Specify the connection port for the environmental monitor.
Description	A brief description for the environmental monitor.
Temperature Offset	Fine tuning adjustment for the temperature sensor.
Humidity Offset	Fine tuning adjustment for the humidity sensor.
Temperature in Fahrenheit	□ Indicates if the temperature is reported in Fahrenheit rather than Celcius
Alarm #1 Label	A label for this alarm sensor, e.g. *Door Open* or *Smoke Alarm.*
Alarm #2 Label	A label for this alarm sensor, e.g. *Door Open* or *Smoke Alarm.*
Log Status	□ Periodically log environmental status.
Log Rate	15 Minutes between samples.

- You may optionally calibrate the EMD with a Temperature Offset (+ or - °C) or Humidity Offset (+ or percent).If you check **Temperature in Fahrenheit**, the temperature will be reported in Fahrenheit. Otherwise, it will be reported in degrees Celsius.
- Provide **Labels** for each of the alarm sensors that will be used (e.g., door open or smoke alarm).
- Check **Log Status** and specify the **Log Rate** (minutes between samples) if you wish the status from this EMD to be logged. These logs can be views from the **Status: Environmental Status** screen.
- Click **Apply**. This will also create a new managed device with the same name.



System Name: acm5003-w **Model:** ACM5003-W **Firmware:** 3.0.0
Uptime: 0 days, 0 hours, 40 mins, 44 secs **Current User:** root

Serial & Network: Environmental

Enabled	□ Enable or disable this internal sensor

Edit Environmental Monitor

Name	**Internal environmental sensor** A descriptive name for the environmental monitor
Connected Via	**internal** Specify the serial port for the environmental monitor
Description	A brief description for the environmental monitor
Temperature Offset	0 Fine tuning adjustment for the Temperature Sensor
Alarm #1 Label	alarm1 A label for this environmental monitor alarm, e.g. *Door Open*
Alarm #2 Label	alarm2 A label for this environmental monitor alarm, e.g. *Door Open*
Alarm #3 Label	alarm3 A label for this environmental monitor alarm, e.g. *Door Open*
Alarm #4 Label	alarm4

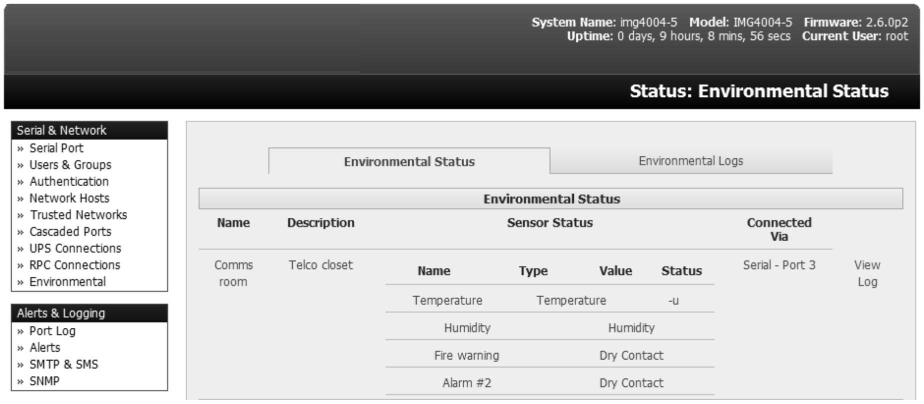
8.3.3 Environmental Alerts

Set temperature, humidity and probe status alerts using **Alerts & Logging: Alerts** (refer to **7. Alerts, Auto-Response and Logging** for more information.)

8.3.4 Environmental Status

You can monitor the current status of all configured external EMDs and their sensors, as well as any internal or directly attached sensors.

- ➢ Select the **Status: Environmental Status** menu. A table with the summary status of all connected EMD hardware will display.



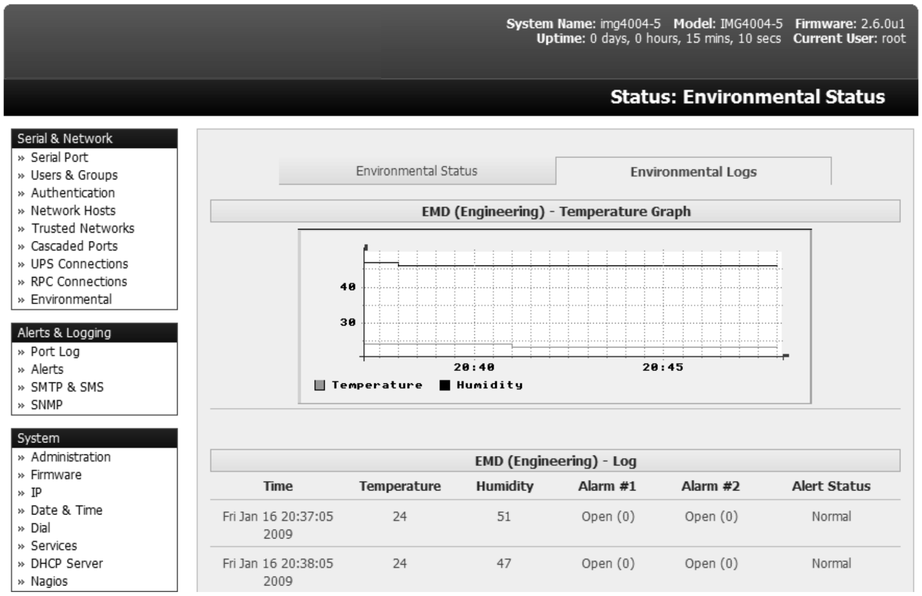
System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.6.0p2
Uptime: 0 days, 9 hours, 8 mins, 56 secs **Current User:** root

Status: Environmental Status

Environmental Status

Name	Description	Sensor Status				Connected Via	
		Name	Type	Value	Status		
Comms room	Telco closet	Temperature	Temperature		-u	Serial - Port 3	View Log
		Humidity	Humidity				
		Fire warning	Dry Contact				
		Alarm #2	Dry Contact				

- ➢ Click on **View Log** or select the **Environmental Logs** menu. You will be presented with a table and graphical plot of the log history of the select EMD.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.6.0u1
Uptime: 0 days, 0 hours, 15 mins, 10 secs **Current User:** root

Status: Environmental Status

EMD (Engineering) - Log

Time	Temperature	Humidity	Alarm #1	Alarm #2	Alert Status
Fri Jan 16 20:37:05 2009	24	51	Open (0)	Open (0)	Normal
Fri Jan 16 20:38:05 2009	24	47	Open (0)	Open (0)	Normal

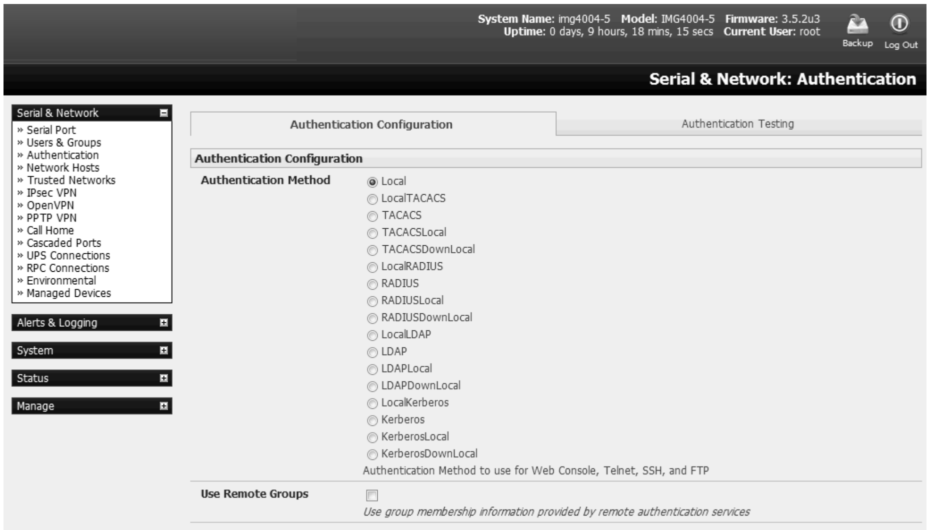
9. Authentication

The console server platform is a dedicated Linux computer and embodies myriad popular and proven Linux software modules for networking, secure access (OpenSSH), communications (OpenSSL) and sophisticated user authentication (PAM, RADIUS, TACACS+, Kerberos and LDAP).

More details on RSA SecurID and working with Windows IAS can be found on online FAQs.

9.1 Authentication Configuration

Authentication can be performed locally or remotely using an LDAP, Radius, Kerberos or TACACS+ authentication server. The default authentication method for the console server is **Local**.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 3.5.2u3
Uptime: 0 days, 9 hours, 18 mins, 15 secs **Current User:** root

Serial & Network: Authentication

Authentication Configuration

Authentication Method
● Local
○ LocalTACACS
○ TACACS
○ TACACSLocal
○ TACACSDownLocal
○ LocalRADIUS
○ RADIUS
○ RADIUSLocal
○ RADIUSDownLocal
○ LocalLDAP
○ LDAP
○ LDAPLocal
○ LDAPDownLocal
○ LocalKerberos
○ Kerberos
○ KerberosLocal
○ KerberosDownLocal
Authentication Method to use for Web Console, Telnet, SSH, and FTP

Use Remote Groups □
Use group membership information provided by remote authentication services

Any authentication method that is configured will be used for authentication of any user who attempts to log in through telnet, SSH or the web manager to the console server, connected serial port and network host devices.

The console server can be configured to the default (**Local**) or an alternate authentication method (**TACACS**, **RADIUS**, **LDAP** or **Kerberos**) with the option of a selected order in which local and remote authentication is used:

Local ***TACACS /RADIUS/LDAP/Kerberos***: Tries local authentication first, then remote if local fails.

TACACS /RADIUS/LDAP/Kerberos **Local**: Tries remote authentication first, the local if remote fails.

TACACS /RADIUS/LDAP/Kerberos **Down Local**: Tries remote authentication first, then local if the remote authentication returns an error condition (e.g., the remote authentication server is down or inaccessible).

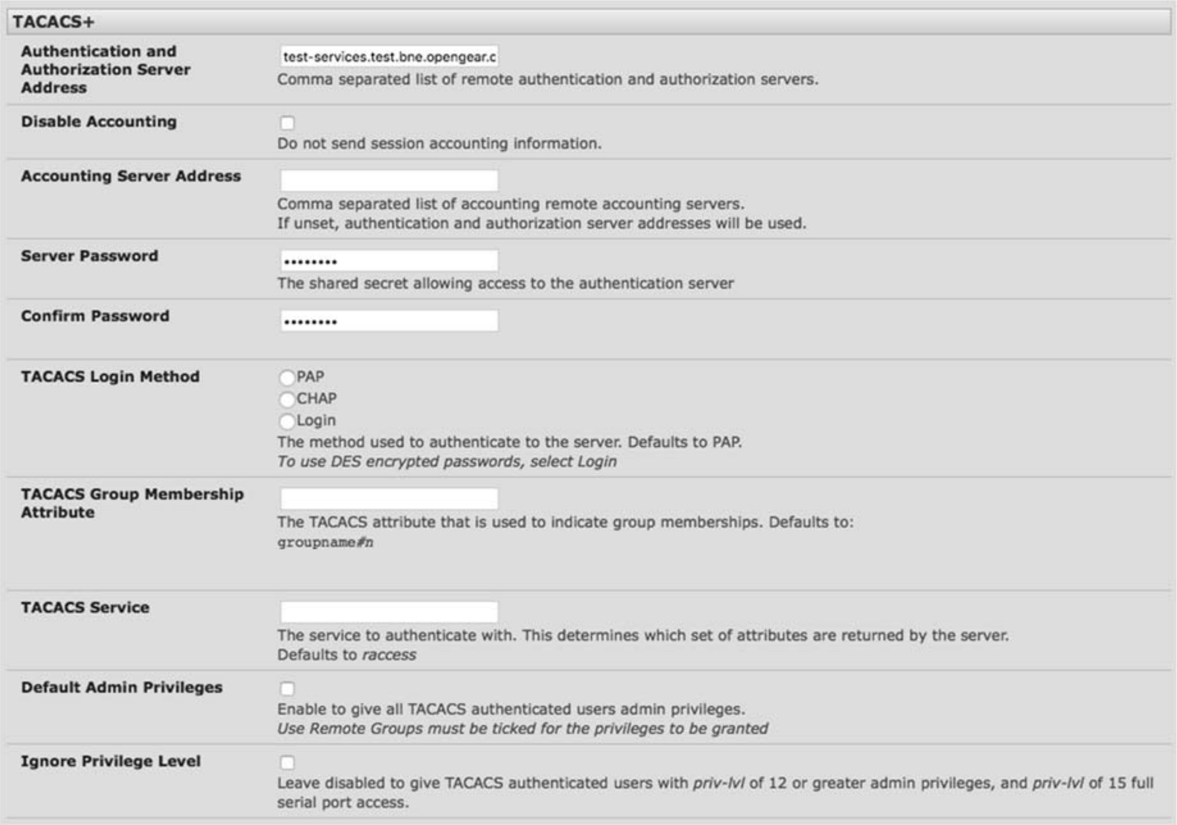
9.1.1 Local Authentication

- Select **Serial and Network > Authentication**. Check **Local**.
- Click **Apply.**

9.1.2 TACACS Authentication

Perform the following procedure to configure the TACACS+ authentication method used whenever the console server or any of its serial ports or hosts is accessed:

- ➢ Select **Serial and Network > Authentication** and check **TACAS**, **LocalTACACS**, **TACACSLocal** or **TACACSDownLocal**.



TACACS+

Authentication and Authorization Server Address	test-services.test.bne.opengear.c Comma separated list of remote authentication and authorization servers.
Disable Accounting	□ Do not send session accounting information.
Accounting Server Address	Comma separated list of accounting remote accounting servers. If unset, authentication and authorization server addresses will be used.
Server Password	•••••••• The shared secret allowing access to the authentication server
Confirm Password	••••••••
TACACS Login Method	○ PAP ○ CHAP ○ Login The method used to authenticate to the server. Defaults to PAP. *To use DES encrypted passwords, select Login*
TACACS Group Membership Attribute	The TACACS attribute that is used to indicate group memberships. Defaults to: `groupname#n`
TACACS Service	The service to authenticate with. This determines which set of attributes are returned by the server. Defaults to *raccess*
Default Admin Privileges	□ Enable to give all TACACS authenticated users admin privileges. *Use Remote Groups must be ticked for the privileges to be granted*
Ignore Privilege Level	□ Leave disabled to give TACACS authenticated users with *priv-lvl* of 12 or greater admin privileges, and *priv-lvl* of 15 full serial port access.

- ➢ Enter the **Server Address** (IP or host name) of the remote authentication/authorization server. Multiple remote servers may be specified in a comma-separated list. Each server is tried in succession.
- ➢ Session accounting is on by default. If session accounting information is not desired, check the **Disable Accounting** checkbox. One reason often cited for not wanting session accounting is, if the authentication server does not respond to accounting requests, the said request may introduce a delay when logging in.
- ➢ In addition to multiple remote servers, you can also enter separate lists of authentication/authorization servers and accounting servers. If no Accounting servers are specified, the authentication/authorization servers are used.
- ➢ Enter and confirm the **Server Password**. Then select the method to be used to authenticate to the server (defaults to **PAP**). To use DES encrypted passwords, select **Login.**
- ➢ If required, enter the **TACACS Group Membership Attribute** to be used to indicate group memberships (defaults to *groupname#n).*
- ➢ If required, specify the **TACACS Service** used to authenticate. This determines which set of attributes are returned by the server (defaults to *raccess*).

- If required, check **Default Admin Privileges** to give all TACAS+ authenticated users administrator privileges. **Use Remote Groups** must also be checked for these privileges to be granted.
- The TACACS **Privilege Level** feature only applies to TACACS remote authentication. When **Ignore Privilege Level** is enabled, the *priv-lvl* setting for all of the users defined on the TACACS AAA server will be ignored.

Note: *A Tripp Lite device normally interprets a user with a TACACS priv-lvl of 12 or above as an administrator. There is a special case where a user with a priv-lvl of 15 is also given access to all configured serial ports. When the* ***Ignore Privilege Level*** *option is enabled (checked in the UI), there are no escalations of privileges based on the priv-lvl value from the TACACS server.*

If the only thing configured for one or more TACACS users is priv-lvl (e.g., no specific port access or group memberships set), console server access will be revoked for those users, as they will not be a member of any groups, even if the Retrieve Remote groups option in the Authentication menu is enabled.

- Click **Apply.** TACAS+ remote authentication will be used for all user access to the console server and serially or network attached devices

TACACS+ The Terminal Access Controller Access Control System (TACACS+) security protocol is a recent protocol developed by Cisco. It provides detailed accounting information and flexible administrative control over authentication and authorization processes. TACACS+ allows a single access control server (the TACACS+ daemon) to provide authentication, authorization and accounting services independently. Each service can be tied into its own database to take advantage of other services available on that server or network, depending on the capabilities of the daemon. There is a draft RFC detailing this protocol. Further information on configuring remote TACACS+ servers can be found at the following websites:

http://www.cisco.com/en/US/tech/tk59/technologies_tech_note09186a0080094e99.shtml

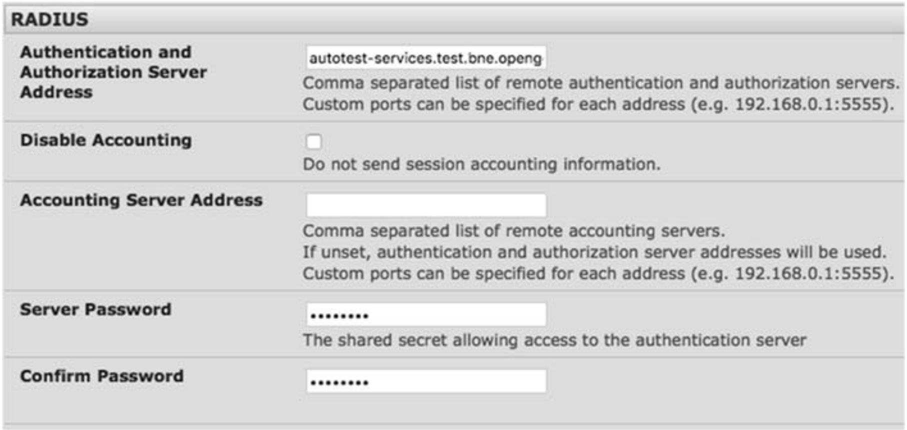
http://www.cisco.com/en/US/products/sw/secursw/ps4911/products_user_guide_chapter09186a00800eb6d6.html

http://cio.cisco.com/univercd/cc/td/doc/product/software/ios113ed/113ed_cr/secur_c/scprt2/sctplus.htm

9.1.3 RADIUS Authentication

Perform the following procedure to configure the RADIUS authentication method used whenever the console server or any of its serial ports or hosts are accessed:

- Select **Serial and Network: Authentication**. Check **RADIUS, LocalRADIUS, RADIUSLocal** or **RADIUSDownLocal**.



RADIUS

Authentication and Authorization Server Address	autotest-services.test.bne.openg Comma separated list of remote authentication and authorization servers. Custom ports can be specified for each address (e.g. 192.168.0.1:5555).
Disable Accounting	□ Do not send session accounting information.
Accounting Server Address	 Comma separated list of remote accounting servers. If unset, authentication and authorization server addresses will be used. Custom ports can be specified for each address (e.g. 192.168.0.1:5555).
Server Password	•••••••• The shared secret allowing access to the authentication server
Confirm Password	••••••••

- Enter the **Server Address** (IP or host name) of the remote authentication/authorization server. Multiple remote servers may be specified in a comma-separated list. Each server is tried in succession.
- Session accounting is on by default. If session accounting information is not desired, check the **Disable Accounting** checkbox. One reason often cited for not wanting session accounting is, if the authentication server does not respond to accounting requests, the said request may introduce a delay when logging in.
- In addition to multiple remote servers, you can also enter separate lists of authentication/authorization servers and accounting servers. If no accounting servers are specified, the authentication/authorization servers are used instead.
- Enter the **Server Password.**
- Click **Apply.** RADIUS remote authentication will now be used for all user access to console server and serially or network attached devices.

RADIUS The Remote Authentication Dial-In User Service (RADIUS) protocol was developed by Livingston Enterprises as an access server authentication and accounting protocol. The RADIUS server can support a variety of methods to authenticate a user. When provided with the username and original password by the user, it can support PPP, PAP or CHAP, UNIX login and other authentication mechanisms. Further information on configuring remote RADIUS servers can be found at the following websites:

http://www.microsoft.com/technet/prodtechnol/windowsserver2003/library/DepKit/d4fe8248-eecd-49e4-88f6-9e304f97fefc.mspx

http://www.cisco.com/en/US/tech/tk59/technologies_tech_note09186a00800945cc.shtml

http://www.freeradius.org/

9.1.4 LDAP Authentication

With firmware version 3.11 and later, LDAP authentication now supports OpenLDAP servers using the Posix style schema for user and group definitions.

Performing simple authentication against any LDAP server (AD or OpenLDAP) is straightforward, as both follow common LDAP standards and protocols. More difficult is configuring how to obtain extra data about the users, such as groups they are in, etc.

On a Tripp Lite device, it may be configured to analyze group information from an LDAP server for authentication and authorization. This group information is stored in a number of different ways. Active Directory has one method, and OpenLDAP has two other methods:

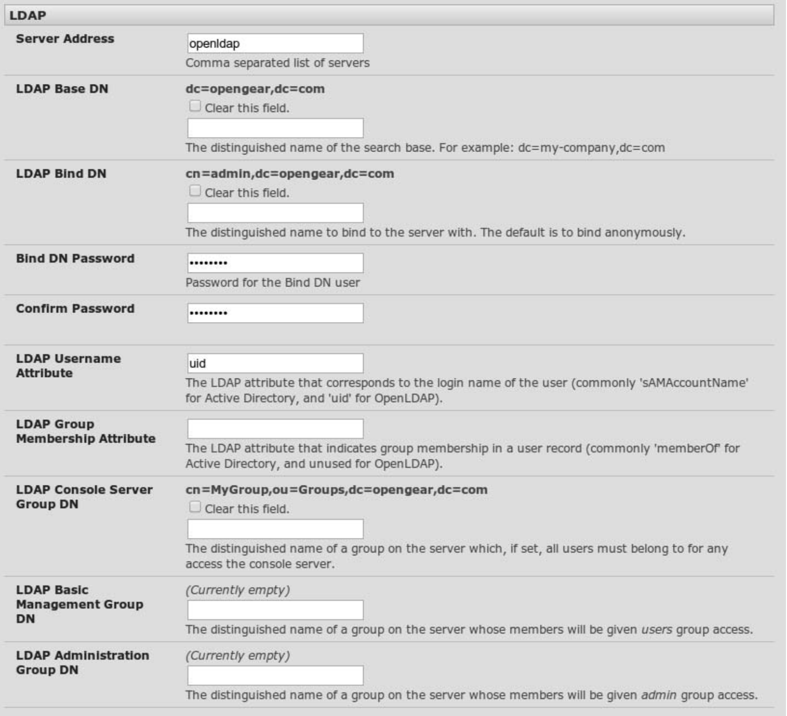
- Active Directory: Each user entry will have multiple 'memberOf' attributes. Each 'memberOf' value is the full DN of the group they belong to. The entry for the user will be of objectClass "user".
- OpenLDAP / Posix: Each entry for a user must have a 'gidNumber' attribute. This will be an integer value, which is the user's primary group (e.g., mapping to the /etc/passwd file with the group ID field). To determine which group this is, search for an entry in the directory that has that group ID, which will provide the group name. The users are of objectClass "posixAccount", and the groups are of objectClass "posixGroup".
- OpenLDAP / Posix: Each group entry in the group tree (of objectClass 'posixGroup') may have multiple 'memberUid' attributes. These represent secondary groups (e.g,. mapping to the /etc/groups file). Each attribute contains a username.

To accommodate all possibilities, the *pam_ldap* module has been modified to perform group searches for each of the three styles. This allows for a relatively 'generic' configuration and not be concerned with how the LDAP directory is set up.

Only two parameters need to be configured based on what the user wishes to look up: these are the LDAP username and group membership attributes.

To clarify to the user what parameters to use, the descriptions for these fields are updated to prompt the user for common or likely attributes. For example, two configuration fields have descriptions as follows:

> *LDAP Username Attribute*: Corresponds to the login name of the user (commonly 'sAMAccountName' for Active Directory, and 'uid' for OpenLDAP).
>
> *LDAP Group Membership Attribute*: Indicates group membership in a user record (commonly 'memberOf' for Active Directory, and unused for OpenLDAP).

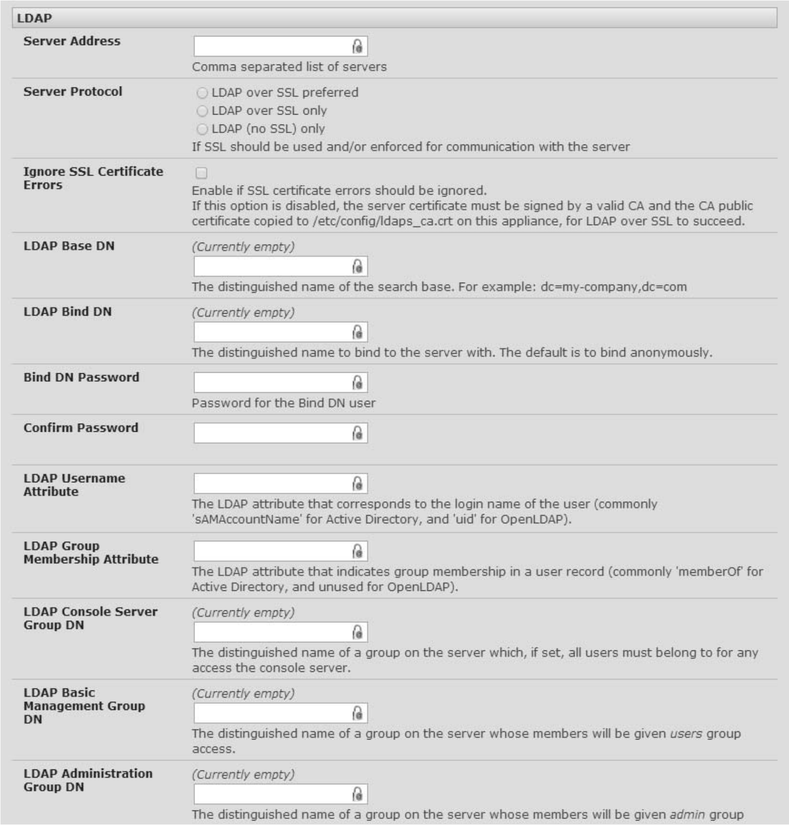


LDAP	
Server Address	openldap Comma separated list of servers
LDAP Base DN	**dc=opengear,dc=com** □ Clear this field. The distinguished name of the search base. For example: dc=my-company,dc=com
LDAP Bind DN	**cn=admin,dc=opengear,dc=com** □ Clear this field. The distinguished name to bind to the server with. The default is to bind anonymously.
Bind DN Password	•••••••• Password for the Bind DN user
Confirm Password	••••••••
LDAP Username Attribute	uid The LDAP attribute that corresponds to the login name of the user (commonly 'sAMAccountName' for Active Directory, and 'uid' for OpenLDAP).
LDAP Group Membership Attribute	The LDAP attribute that indicates group membership in a user record (commonly 'memberOf' for Active Directory, and unused for OpenLDAP).
LDAP Console Server Group DN	**cn=MyGroup,ou=Groups,dc=opengear,dc=com** □ Clear this field. The distinguished name of a group on the server which, if set, all users must belong to for any access the console server.
LDAP Basic Management Group DN	*(Currently empty)* The distinguished name of a group on the server whose members will be given *users* group access.
LDAP Administration Group DN	*(Currently empty)* The distinguished name of a group on the server whose members will be given *admin* group access.

Note: *The* libldap *library is particular about ensuring SSL connections are using certificates signed by a trusted CA. As such, it is often not easy to set up a connection to an LDAP server using SSL.*

Perform the following procedure to configure the LDAP authentication method used whenever the console server or any of its serial ports or hosts are accessed:

- Select **Serial and Network: Authentication** and check **LDAP** or **LocalLDAP** or **LDAPLocal** or **LDAPDownLocal**.



LDAP

Server Address	Comma separated list of servers
Server Protocol	○ LDAP over SSL preferred ○ LDAP over SSL only ○ LDAP (no SSL) only If SSL should be used and/or enforced for communication with the server
Ignore SSL Certificate Errors	□ Enable if SSL certificate errors should be ignored. If this option is disabled, the server certificate must be signed by a valid CA and the CA public certificate copied to /etc/config/ldaps_ca.crt on this appliance, for LDAP over SSL to succeed.
LDAP Base DN	*(Currently empty)* The distinguished name of the search base. For example: dc=my-company,dc=com
LDAP Bind DN	*(Currently empty)* The distinguished name to bind to the server with. The default is to bind anonymously.
Bind DN Password	Password for the Bind DN user
Confirm Password	
LDAP Username Attribute	The LDAP attribute that corresponds to the login name of the user (commonly 'sAMAccountName' for Active Directory, and 'uid' for OpenLDAP).
LDAP Group Membership Attribute	The LDAP attribute that indicates group membership in a user record (commonly 'memberOf' for Active Directory, and unused for OpenLDAP).
LDAP Console Server Group DN	*(Currently empty)* The distinguished name of a group on the server which, if set, all users must belong to for any access the console server.
LDAP Basic Management Group DN	*(Currently empty)* The distinguished name of a group on the server whose members will be given *users* group access.
LDAP Administration Group DN	*(Currently empty)* The distinguished name of a group on the server whose members will be given *admin* group

- Enter the **Server Address** (IP or host name) of the remote authentication server. Multiple remote servers may be specified in a comma-separated list. Each server is tried in succession.

- Check the **Server Protocol** box to select if SSL is to be used and/or enforced for communications with the LDAP server. Console servers running firmware version 3.11 and above offer three options for LDAPS (LDAP over SSL):

  - **LDAP over SSL preferred:** will attempt to use SSL for authentication. If it fails, it will default to LDAP without SSL. For example, LDAP over SSL may fail due to certificate errors or the LDAP server cannot be contacted on the LDAPS port.

  - **LDAP over SSL only**: will configure the Tripp Lite device to only accept LDAP over SSL. If LDAP over SSL fails, you will only be able to log into the console server as root.

  - **LDAP (no SSL) only**: will configure the Tripp Lite device to only accept LDAP without SSL. If LDAP without SSL fails, you will only be able to log into the console server as root.

- The **Ignore SSL Certificate Error** checkbox enables you to ignore SSL certificate errors, in effect allowing LDAP over SSL to work, regardless of these errors. You can use any certificate, self-signed or otherwise, on the LDAP server without having to install any certificates on the console server*.* If this setting is not checked, you must install the CA (certificate authority) certificate with which the LDAP server's certificate was signed onto the console server. For example, the LDAP server provides a certificate signed *myCA.crt*.

***Note:** The certificate needs to be in CRT format and* myCA.crt *needs to be installed on console server at* /etc/config/ldaps_ca.crt*. Also, the file name must be* ldaps_ca.crt*. You will need to copy the file to this location and manually name using 'scp' or the like. Some examples include:*

scp /local/path/to/myCA.c
rt root@console_server:/etc/config/ldaps_ca.crt

- Enter the **Server Password.**
- Click **Apply.** LDAP remote authentication will now be used for all user access to the console server and serially or network attached devices.

LDAP The Lightweight Directory Access Protocol (LDAP) is based on the X.500 standard, but is significantly simpler and more readily adapted to meet custom needs. The core LDAP specifications are all defined in RFCs. LDAP is a protocol used to access information stored in an LDAP server. Further information on configuring remote RADIUS servers can be found at the following websites:

http://www.ldapman.org/articles/intro_to_ldap.html

http://www.ldapman.org/servers.html

http://www.linuxplanet.com/linuxplanet/tutorials/5050/1/

http://www.linuxplanet.com/linuxplanet/tutorials/5074/4/

9.1.5 RADIUS/TACACS User Configuration

Users may be added to the local console server. If they are not added and they log in via remote AAA, a user will be added for them. This user will not show up in the Tripp Lite configurators unless they are specifically added, at which point they are transformed into a local user. The newly added user must authenticate using the remote AAA server and will have no access if it is down.

If a local user logs in, they may be authenticated/authorized from the remote AAA server, depending on the chosen priority of the remote AAA. A local user's authorization is the union of local and remote privileges.

Example 1:

User Tim is locally added and has access to ports 1 and 2. He is also defined on a remote TACACS server, which says he has access to ports 3 and 4. Tim may log in with either his local or TACACS password, and will have access to ports 1 through 4. If TACACS is down, he will need to use his local password, and will only be able to access ports 1 and 2.

Example 2:

User Ben is only defined on the TACACS server, which says he has access to ports 5 and 6. When he attempts to log in, a new user will be created for him and he will be able to access ports 5 and 6. If the TACACS server is down, he will have no access.

Example 3:

User Paul is defined on a RADIUS server only. He has access to all serial ports and network hosts.

Example 4:

User Don is locally defined on an appliance using RADIUS for AAA. Even if Don is also defined on the RADIUS server, he will only have access to those serial ports and network hosts he has been authorized to use on the appliance.

If a “no local AAA” option is selected, the root will still be authenticated locally.

Remote users may be added to the administrator group via RADIUS or TACACS. Users may have a set of authorizations set on the remote TACACS server. Users automatically added by RADIUS will have authorization for all resources, whereas those added locally will still need their authorizations specified.

LDAP has not been modified and will still need locally defined users.

Note: *To interact with RADIUS, TACACS+ and LDAP with console server firmware pre-2.4.2, you must also set up the user accounts on the local console server. All resource authorizations must be added to the local appliance. With this release, if remote AAA is selected, it is used for password checking only. Root is always authenticated locally. Any changes to PAM configurations will be destroyed next time the authentication configurator is run.*

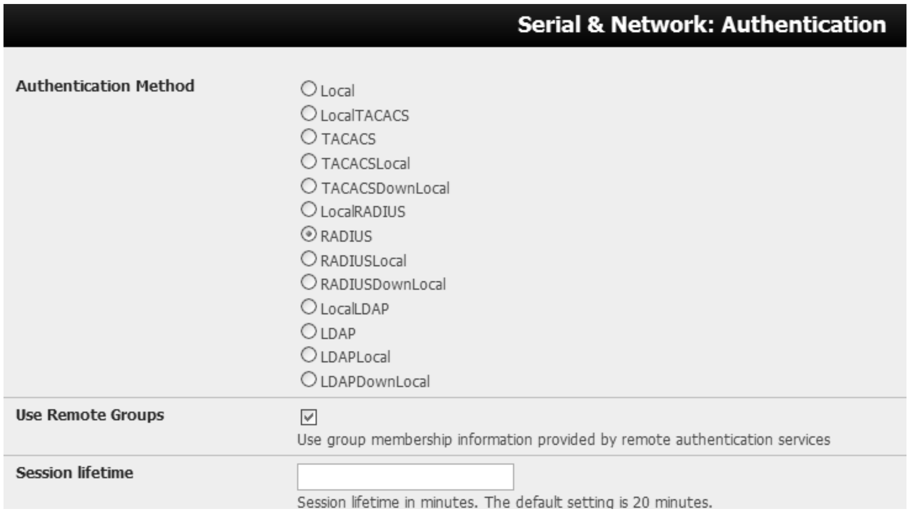
9.1.6 Group Support with Remote Authentication

All console servers allow remote authentication via RADIUS, LDAP and TACACS+. With firmware version 3.2 and later, RADIUS and LDAP provide additional restrictions on user access based on group information or membership. For example, with remote group support, users can belong to a local group that has been setup to have restricted access to serial ports, network hosts and managed devices.

Remote authentication with group support works by matching a local group name with a remote group name provided by the authentication service. If the list of remote group names returned by the authentication service matches any local group names, the user is given permissions as configured in the local groups.

To enable group support by remote authentication services:

- Select **Serial & Network: Authentication.**
- Select the relevant **Authentication Method.**
- Check the **Use Remote Groups** button.



Serial & Network: Authentication

Authentication Method

○ Local
○ LocalTACACS
○ TACACS
○ TACACSLocal
○ TACACSDownLocal
○ LocalRADIUS
● RADIUS
○ RADIUSLocal
○ RADIUSDownLocal
○ LocalLDAP
○ LDAP
○ LDAPLocal
○ LDAPDownLocal

Use Remote Groups

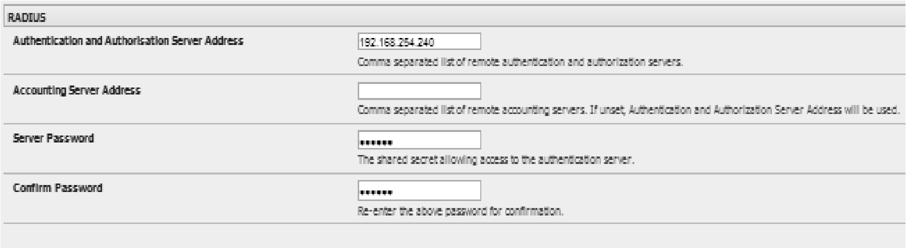
☑ Use group membership information provided by remote authentication services

Session lifetime

Session lifetime in minutes. The default setting is 20 minutes.

9.1.7 Remote Groups with RADIUS Authentication

- Enter the RADIUS **Authentication and Authorization Server Address** and **Server Password.**
- Click **Apply**.



RADIUS

Authentication and Authorisation Server Address: 192.168.254.240
Comma separated list of remote authentication and authorization servers.

Accounting Server Address:
Comma separated list of remote accounting servers. If unset, Authentication and Authorization Server Address will be used.

Server Password: ••••••
The shared secret allowing access to the authentication server.

Confirm Password: ••••••
Re-enter the above password for confirmation.

- ➢ Edit the RADIUS user's file to include group information and restart the RADIUS server.

When using RADIUS authentication, group names are provided to the console server using the Framed-Filter-Id attribute. This is a standard RADIUS attribute and may be used by other devices that authenticate via RADIUS.

To interoperate with other devices using this field, the group names can be added to the end of any existing content in the attribute:

:group_name=testgroup1,users:

The above example sets the remote user as a member of testgroup1 and users if groups with those names exist on the console server. Any groups that do not exist on the console server are ignored.

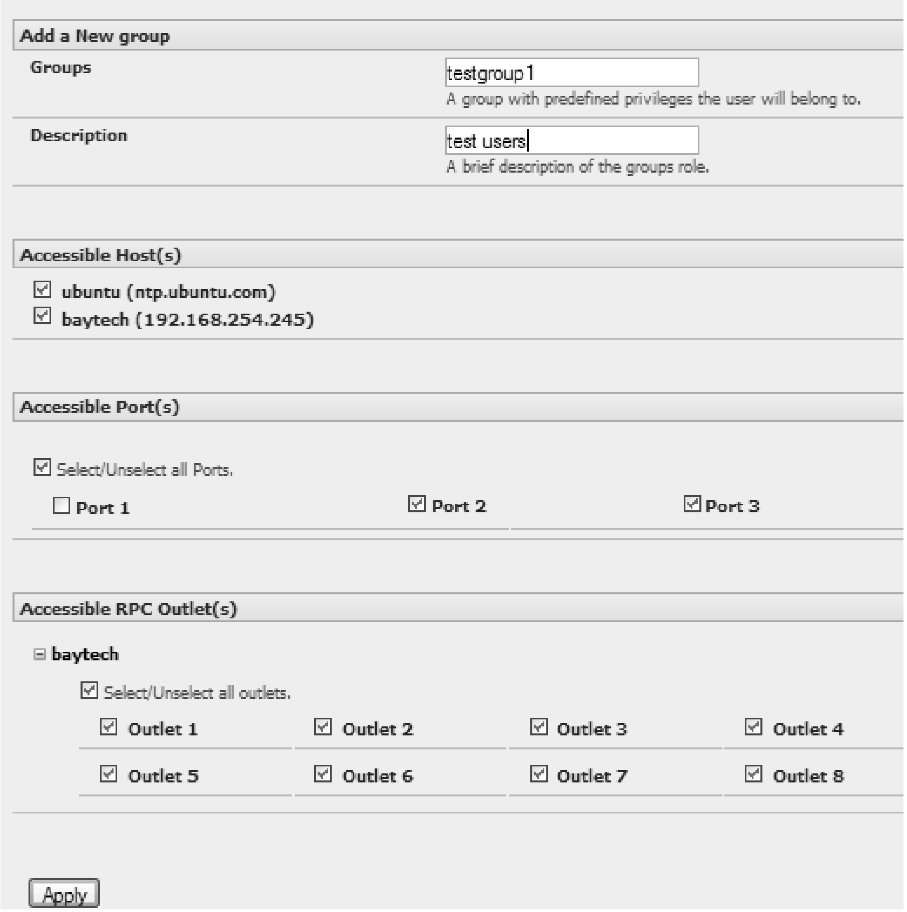
When setting the Framed-Filter-Id, the system may also remove the leading colon for an empty field. To work around this, add some dummy text to the start of the string. For example:

dummy:group_name=testgroup1,users:

- ➢ If no group is specified for a user, for example AmandaJones, the user will have no user interface and serial port access, but limited console access.
- ➢ Default groups available on the console server include *admin* for administrator access and *users* for general user access.

```
TomFraser      Cleartext-Password := ”FraTom70”
               Framed-Filter-Id=”:group_name=admin:”
AmandaJones    Cleartext-Password := ”JonAma83”
FredWhite      Cleartext-Password := ”WhiFre62”
               Framed-Filter-Id=”:group_name=testgroup1,users:”
JanetLong      Cleartext-Password := ”LonJan57”
               Framed-Filter-Id=”:group_name=admin:”
```

- ➢ Additional local groups such as testgroup1 can be added via **Users & Groups: Serial & Network.**



Add a New group

Groups	testgroup1 A group with predefined privileges the user will belong to.
Description	test users A brief description of the groups role.

Accessible Host(s)

☑ ubuntu (ntp.ubuntu.com)
☑ baytech (192.168.254.245)

Accessible Port(s)

☑ Select/Unselect all Ports.

☐ Port 1	☑ Port 2	☑ Port 3

Accessible RPC Outlet(s)

⊟ baytech

☑ Select/Unselect all outlets.

☑ Outlet 1	☑ Outlet 2	☑ Outlet 3	☑ Outlet 4
☑ Outlet 5	☑ Outlet 6	☑ Outlet 7	☑ Outlet 8

9.1.8 Remote Groups with LDAP Authentication

Unlike RADIUS, LDAP has built-in support for group provisioning, which makes setting up remote groups easier. The console server will retrieve a list of all the remote groups the user is a direct member of and compare their names with local groups on the console server.

Note: *Any spaces in the group name will be converted to underscores.*

For example, in an existing Active Directory setup, a group of users may be part of the *UPS Admin* and *Router Admin* groups. On the console server, these users will be required to have access to a group *Router_Admin*, with access to port 1 (connected to the router), and another group *UPS_Admin*, with access to port 2 (connected to the UPS). Once LDAP is set up, users that are members of each group will have the appropriate permissions to access the router and UPS.

Currently, the only LDAP directory service that supports group provisioning is Microsoft Active Directory. Support is planned for OpenLDAP later.

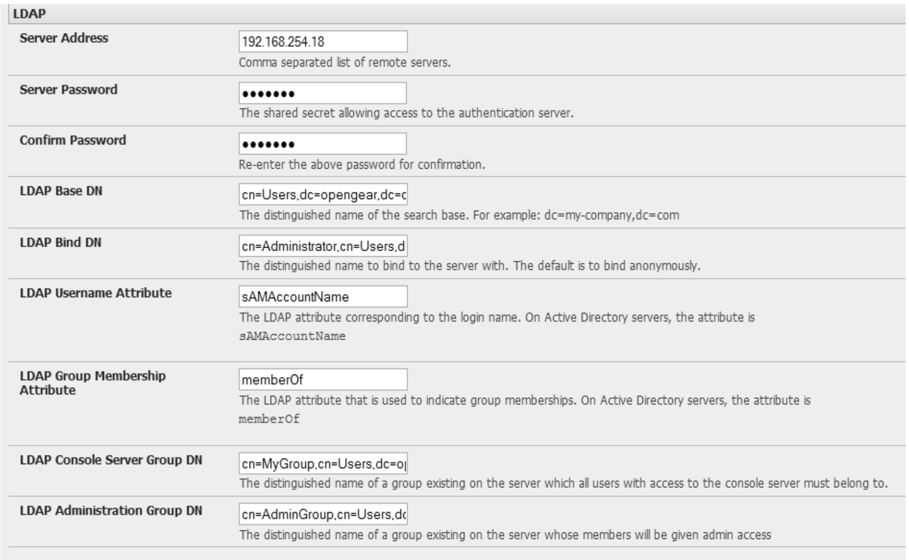
To enable group information to be used with an LDAP server:

- Complete the fields for standard LDAP authentication, including LDAP Server Address, Server Password, LDAP Base DN, LDAP Bind DN and LDAP Username Attribute.
- Enter memberOf for **LDAP Group Membership Attribute,** as group membership is currently only supported on Active Directory servers.
- If required, enter the group information for **LDAP Console Server Group DN** and/or **LDAP Administration Group DN.**

A user must be a member of the LDAP Console Server Group DN group in order to gain access to the console and user interface. For example, the user must be a member of “MyGroup” on the Active Server to gain access to the console server.

Additionally, a user must be a member of the LDAP Administration Group DN in order to gain administrator access to the console server. For example, the user must be a member of “AdminGroup” on the Active Server to receive administration privileges on the console server.

- Click Apply.

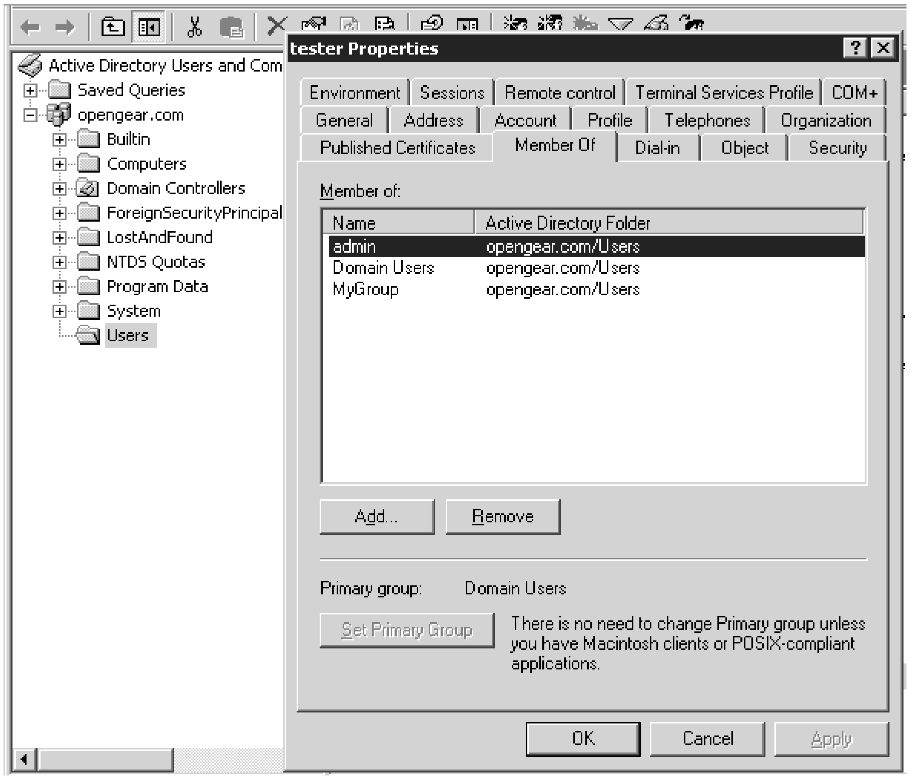


LDAP

Server Address	192.168.254.18 Comma separated list of remote servers.
Server Password	••••••• The shared secret allowing access to the authentication server.
Confirm Password	••••••• Re-enter the above password for confirmation.
LDAP Base DN	cn=Users,dc=opengear,dc=c The distinguished name of the search base. For example: dc=my-company,dc=com
LDAP Bind DN	cn=Administrator,cn=Users,d The distinguished name to bind to the server with. The default is to bind anonymously.
LDAP Username Attribute	sAMAccountName The LDAP attribute corresponding to the login name. On Active Directory servers, the attribute is `sAMAccountName`
LDAP Group Membership Attribute	memberOf The LDAP attribute that is used to indicate group memberships. On Active Directory servers, the attribute is `memberOf`
LDAP Console Server Group DN	cn=MyGroup,cn=Users,dc=o The distinguished name of a group existing on the server which all users with access to the console server must belong to.
LDAP Administration Group DN	cn=AdminGroup,cn=Users,dc The distinguished name of a group existing on the server whose members will be given admin access

- Ensure the LDAP service is operational and group names are correct within the Active Directory.

***Note:** When using remote groups with LDAP remote authorization, you need to have corresponding local groups on the console server. However, where the LDAP group names can contain upper case and space characters, the local group name on the console server must be all lower case and the spaces replaced with underscores. For example, a remote group on the LDAP server may be **My Ldap Access Group** needs a corresponding local group on the console server called **my_ldap_access_group** (both without the single quotes). The local group on the console server must specify what the group member is granted access to for any group membership to be effective.*



Member of:

Name	Active Directory Folder
admin	opengear.com/Users
Domain Users	opengear.com/Users
MyGroup	opengear.com/Users

Primary group: Domain Users

There is no need to change Primary group unless you have Macintosh clients or POSIX-compliant applications.

9.1.9 Remote Groups with TACACS+ Authentication

When using TACACS+ authentication, there are two ways to grant a remotely authenticated user privileges. The first is to set the priv-lvl and port attributes of the raccess service to 12 (refer to **9.2 PAM** for more information). Group names can also be provided to the console server using the groupname custom attribute of the raccess service.

An example Linux tac-plus config snippet might look like:

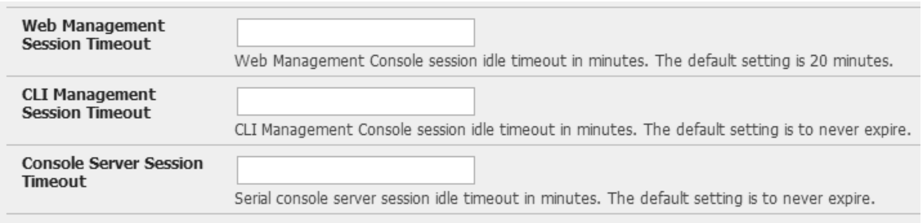
```
user = myuser {
        service = raccess {
                groupname="users"
                groupname1="routers"
                groupname2="dracs"
        }
}
```

You may also specify multiple groups in one comma-delimited (e.g., *groupname="users,routers,dracs"*), but be aware that the maximum length of the attribute value string is 255 characters.

To use an attribute name other than *groupname,* set **Authentication -> TACACS+ -> TACACS Group Membership Attribute**.

9.1.10 Idle Timeout

You can specify amount of time in minutes the *console server* waits before it terminates an idle ssh, pmshell or web connection.



Web Management Session Timeout	Web Management Console session idle timeout in minutes. The default setting is 20 minutes.
CLI Management Session Timeout	CLI Management Console session idle timeout in minutes. The default setting is to never expire.
Console Server Session Timeout	Serial console server session idle timeout in minutes. The default setting is to never expire.

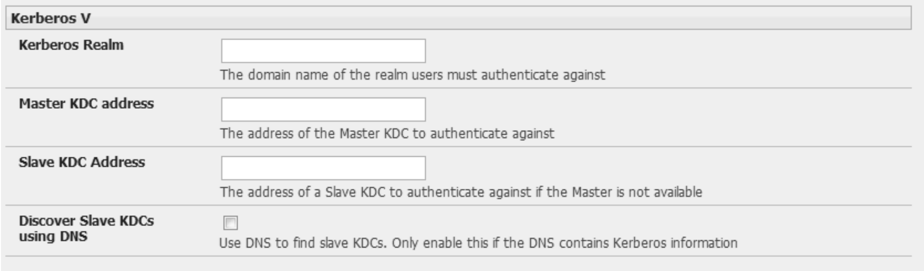
- Select **Serial and Network: Authentication.**
- **Web Management Session Timeout** specifies the browser console session idle timeout in minutes. The default setting is 20 minutes.
- **CLI Management Session Timeout** specifies the ssh console session idle timeout in minutes. The default setting is to never expire.
- **Console Server Session Timeout** specifies the pmshell serial console server session idle timeout in minutes. The default setting is to never expire.

9.1.11 Kerberos Authentication

The Kerberos authentication can be used with UNIX and Windows (Active Directory) Kerberos servers. This form of authentication does not provide group information, so a local user with the same username must be created and permissions set.

***Note:** Kerberos is very sensitive to time differences between the Key Distribution Center (KDC) authentication server and the client device. Make sure NTP is enabled and the time zone is set correctly on the console server.*

When authenticating against Active Directory, the Kerberos Realm will be the domain name and the Primary KDC will be the address of the primary domain controller.

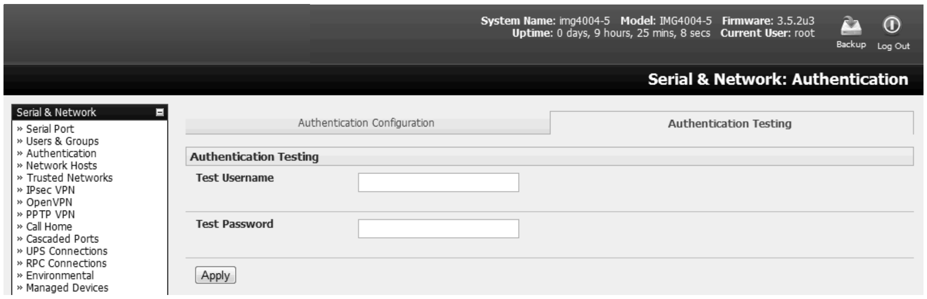


Kerberos V

Kerberos Realm	The domain name of the realm users must authenticate against
Master KDC address	The address of the Master KDC to authenticate against
Slave KDC Address	The address of a Slave KDC to authenticate against if the Master is not available
Discover Slave KDCs using DNS	☐ Use DNS to find slave KDCs. Only enable this if the DNS contains Kerberos information

9.1.12 Authentication Testing

The Authentication Testing tab (firmware version 3.5.2u3 and later) enables the connection to the remote authentication server to be tested.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 3.5.2u3
Uptime: 0 days, 9 hours, 25 mins, 8 secs **Current User:** root

Serial & Network: Authentication

Authentication Testing

Test Username

Test Password

9.2 PAM (Pluggable Authentication Modules)

The console server supports RADIUS, TACACS+ and LDAP for two-factor authentication via PAM (Pluggable Authentication Modules). PAM is a flexible mechanism for authenticating users. A number of new ways of authenticating users have become popular. The challenge is that each time a new authentication scheme is developed, it requires all the necessary programs (login, ftpd, etc.) to be rewritten to support it.

PAM provides a way to develop programs that are independent of authentication scheme. These programs need "authentication modules" to be attached to them at run-time in order to work. Which authentication module is to be attached is dependent upon the local system setup and is at the discretion of the local Administrator.

The console server family supports PAM with the following modules added for remote authentication:

RADIUS	- pam_radius_auth	(http://www.freeradius.org/pam_radius_auth/)
TACACS+	- pam_tacplus	(http://echelon.pl/pubs/pam_tacplus.html)
LDAP	- pam_ldap	(http://www.padl.com/OSS/pam_ldap.html)

Further modules can be added, as required.

Changes may be made to files in */etc/config/pam.d /* which will persist, even if the authentication configurator is run.

- Users added on demand:

  When a user attempts to log in, but does not already have an account on the console server, a new user account will be created. This account will have no rights and no password set. They will not appear in the Tripp Lite configuration tools.

Automatically added accounts will not be able to log in if the remote servers are unavailable.

.

- Administrator rights granted over AAA:

  Users may be granted Administrator rights via networked AAA. For TACACS, a priv-lvl of 12 of above indicates an administrator. For RADIUS, administrators are indicated via Framed Filter ID. See the example configuration files below for more information.

- Authorization via TACACS, LDAP or RADIUS for using remote groups:

  Refer to **9.1.6 Group Support with Remote Authentication**.

- Authorization via TACACS for both serial ports and host access:

Permission to access resources may be granted via TACACS by indicating a Tripp Lite device and a port or networked host the user may access. See the example configuration files below for more information.

TACACS Example:

```
user = tim {
 service = raccess {
    priv-lvl = 11
    port1 = b093/port02
 }
 global = cleartext mit
}
```

RADIUS Example:

```
paul  Cleartext-Password := "luap"
    Service-Type = Framed-User,
    Fall-Through = No,
    Framed-Filter-Id=":group_name=admin:"
```

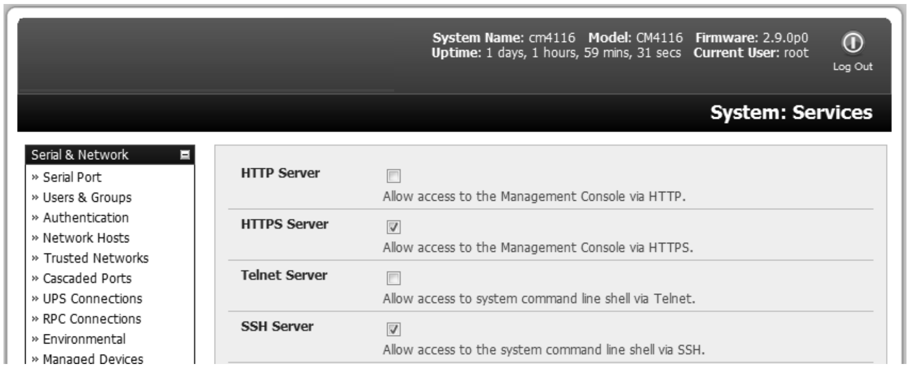
The list of groups may include any number of entries separated by a comma. If the administrator group is included, the user will be made an Administrator.

If there is already a Framed-Filter-Id, simply add the list of *group_names* after the existing entries, including the separating colon ":".

9.3 SSL Certificate

The console server uses the Secure Socket Layer (SSL) protocol for encrypted network traffic between itself and a connected user. While establishing a connection, the console server has to expose its identity to the user's browser using a cryptographic certificate. The default certificate that comes with the console server device upon delivery is for testing purposes only and should not be relied on for secured global access.

The System Administrator should not rely on the default certificate as the secured global access mechanism for use on the Internet.



System Name: cm4116 **Model:** CM4116 **Firmware:** 2.9.0p0
Uptime: 1 days, 1 hours, 59 mins, 31 secs **Current User:** root

HTTP Server □ Allow access to the Management Console via HTTP.

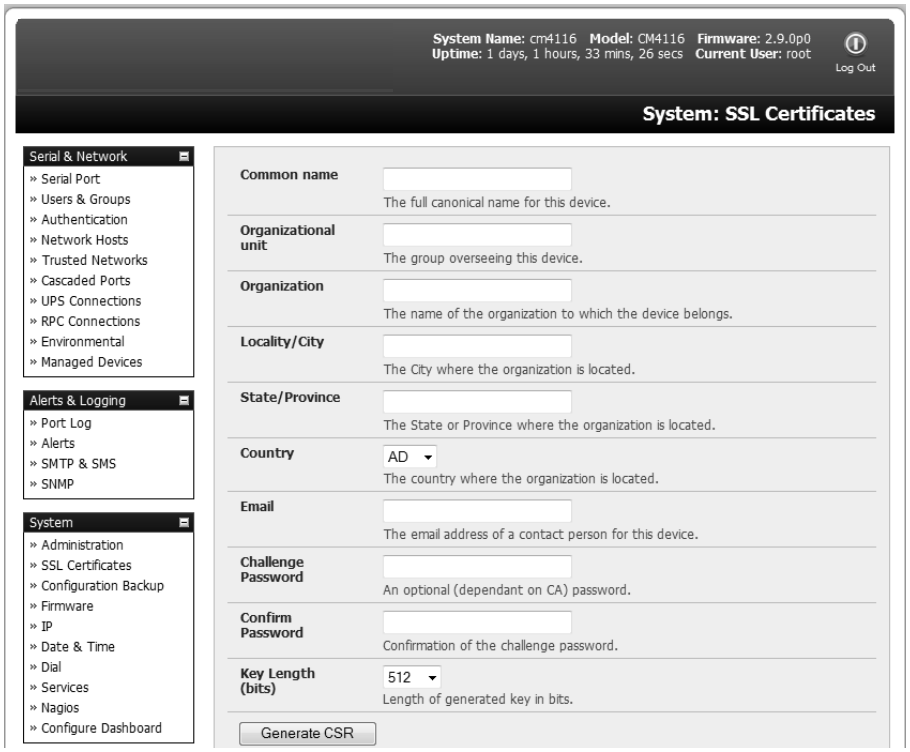
HTTPS Server ☑ Allow access to the Management Console via HTTPS.

Telnet Server □ Allow access to system command line shell via Telnet.

SSH Server ☑ Allow access to the system command line shell via SSH.

- ➢ Activate your preferred browser and enter https:/ / *IP address.* Your browser may respond with a message verifying the validity of the security certificate, while noting that it is not necessarily verified by a trusted authority. To proceed, click Y**es** if using Internet Explorer or select **Accept this certificate permanently (or temporarily)** if using Mozilla Firefox.
- ➢ You will be prompted for the administrator account and password.

It is recommended you generate and install a new base64 X.509 certificate that is unique for a particular console server.



System: SSL Certificates

Common name — The full canonical name for this device.

Organizational unit — The group overseeing this device.

Organization — The name of the organization to which the device belongs.

Locality/City — The City where the organization is located.

State/Province — The State or Province where the organization is located.

Country AD — The country where the organization is located.

Email — The email address of a contact person for this device.

Challenge Password — An optional (dependant on CA) password.

Confirm Password — Confirmation of the challenge password.

Key Length (bits) 512 — Length of generated key in bits.

The console server must be enabled to generate a new cryptographic key and the associated Certificate Signing Request (CSR) that needs to be certified by a Certification Authority (CA). A certification authority verifies you are the person who you claim you are and signs and issues you a SSL certificate. To create and install an SSL certificate for the console server:

- ➢ Select **System: SSL Certificate** and fill out the fields as explained below:

  Common name: This is the network name of the console server once it is installed in the network (usually the fully qualified domain name). It is identical to the name that is used to access the console server with a web browser (without the “http://” prefix). In case the name given here and the actual network name differ, the browser will pop up a security warning when the console server is accessed using HTTPS.

  Organizational Unit: This field is used for specifying which department the console server belongs within an organization.

  Organization: The name of the organization which the console server belongs.

  Locality/City: The city where the organization is located.

  State/Province: The state or province where the organization is located.

  Country: The country where the organization is located. This is the two-letter ISO code (e.g., DE for Germany, or US for the USA). The country code msut be entered in capital letters.

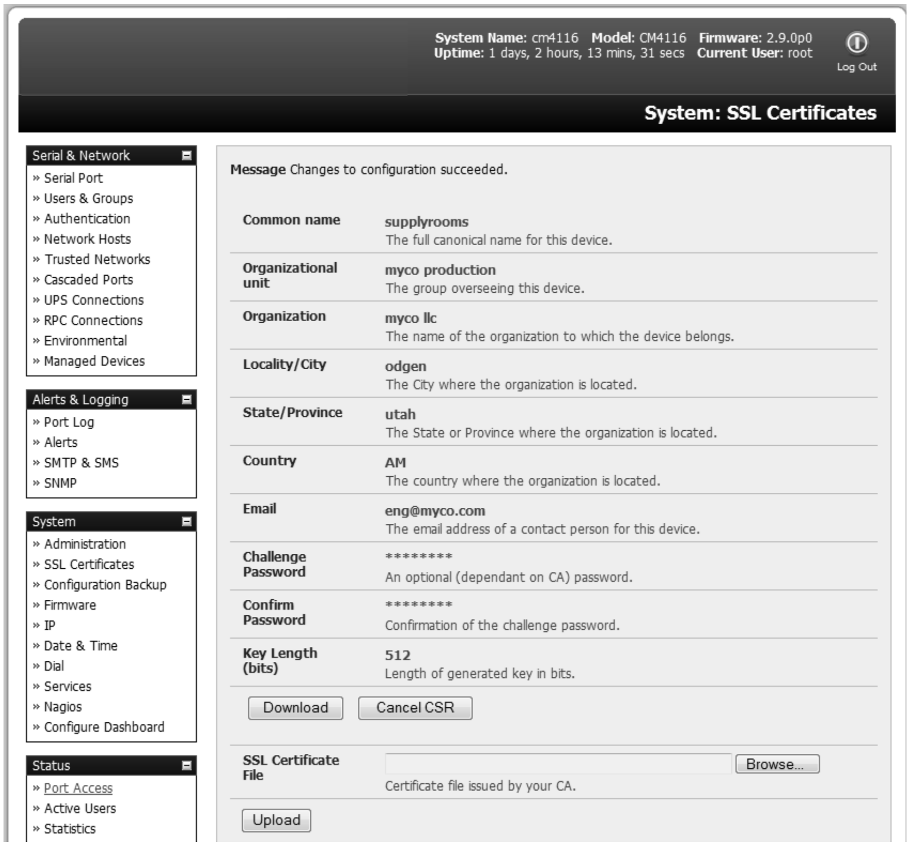
Email: The email address of the contact person responsible for the console server and its security.

Challenge Password: Some certification authorities require a challenge password to authorize later changes on the certificate (e.g., revocation of the certificate). The minimal password is 4 characters.

Confirm Challenge Password: Confirmation of the challenge password.

Key Length: This is the length of the generated key in bits. 1024 bits are sufficient for most cases. Longer keys may result in slower console server response time when establishing a connection.

- ➢ Click on the **Generate CSR** button to initiate the Certificate Signing Request. The CSR can be downloaded to the Administrator's machine with the **Download** button.
- ➢ Send the saved CSR string to a Certification Authority (CA) for certification. A new certificate from the CA will be sent.
  - ➢ Upload the certificate to the console server using the **Upload** button.



System Name: cm4116 **Model:** CM4116 **Firmware:** 2.9.0p0
Uptime: 1 days, 2 hours, 13 mins, 31 secs **Current User:** root

System: SSL Certificates

Message Changes to configuration succeeded.

Common name	**supplyrooms** The full canonical name for this device.
Organizational unit	**myco production** The group overseeing this device.
Organization	**myco llc** The name of the organization to which the device belongs.
Locality/City	**odgen** The City where the organization is located.
State/Province	**utah** The State or Province where the organization is located.
Country	**AM** The country where the organization is located.
Email	**eng@myco.com** The email address of a contact person for this device.
Challenge Password	******** An optional (dependant on CA) password.
Confirm Password	******** Confirmation of the challenge password.
Key Length (bits)	512 Length of generated key in bits.
SSL Certificate File	Certificate file issued by your CA.

The console server should now have its own certificate that is used for identifying the console server to its users.

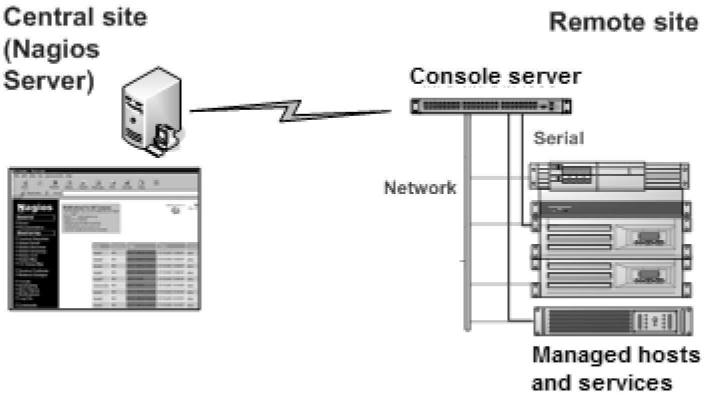
Note: *Information on issuing certificates and configuring HTTPS from the command line can be found in* ***15. Advanced Configuration****.*

10. Nagios Integration

Nagios is a powerful and highly configurable open source tool for monitoring network hosts and services. The core Nagios software package is typically installed on a server or virtual server, the central Nagios server.

Console servers operate in conjunction with a central/upstream Nagios server to provide distributing monitoring of attached network hosts and serial devices. They embed the NSCA (Nagios Service Checks Acceptor) and NRPE (Nagios Remote Plug-in Executor) add-ons, allowing them to communicate with the central Nagios server and eliminating the need for a dedicated secondary Nagios server at remote sites.

Tripp Lite console servers support distributed monitoring. Even if distributed monitoring is not required, the console servers can be deployed locally alongside the Nagios monitoring host serve, to provide additional diagnostics and points of access to managed devices.



Note: *If you have an existing Nagios deployment, you may wish to use the console server gateways in a distributed monitoring server capacity only. If this is the case and you are already familiar with Nagios, skip to section* ***10.3 Advanced Distributed Monitoring Configuration****.*

10.1 Nagios Overview

Nagios provides central monitoring of the hosts and services in your distributed network. Nagios is a free, downloadable, open source software. This section provides a brief overview of Nagios and its capabilities. For a more comprehensive overview, visit *http://www.nagios.org.*

10.2 Configuring Nagios Distributed Monitoring

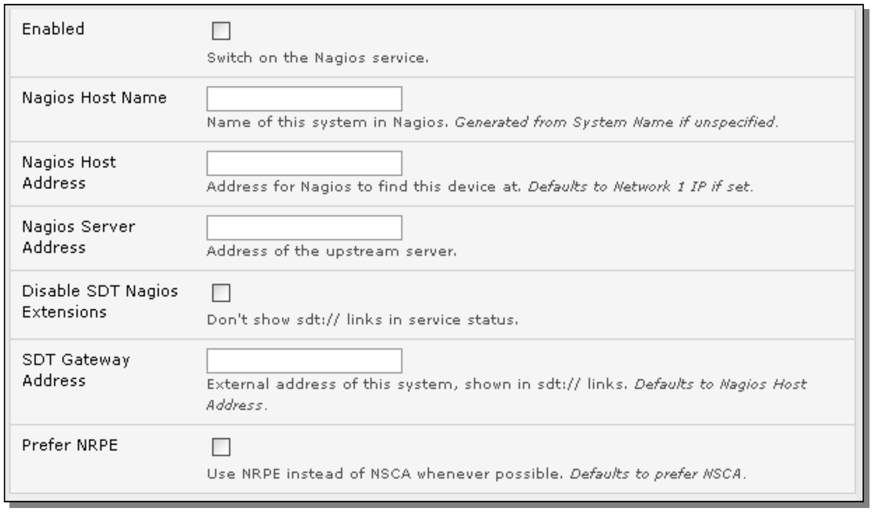
To activate Nagios distributed monitoring on the console server:

- Nagios integration must be enabled and a path established to the central/upstream Nagios server.
- If the console server is to periodically report on Nagios monitored services, the NSCA client embedded in the console server must be configured so as to enable scheduled check-ins with the remote Nagios server and send passive check results across the network to the remote server.
- If the Nagios server is to actively request status updates from the console server, the NRPE server embedded in the console server must be configured with the Nagios daemon for executing plug-ins on remote hosts.

- Each of the serial ports and hosts connected to the console server to be monitored must have Nagios enabled and any specific Nagios checks configured.
- The central/upstream Nagios monitoring host must be configured.

10.2.1 Enable Nagios on the Console Server

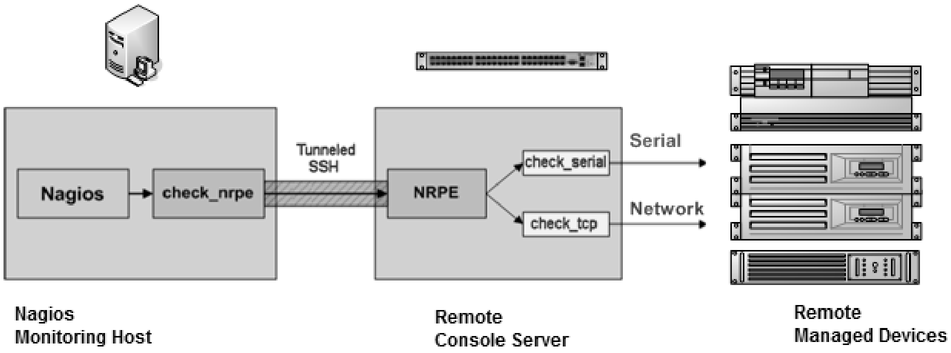
- ➢ Select **System: Nagios** on the console server management console and check the service **Enabled** checkbox.



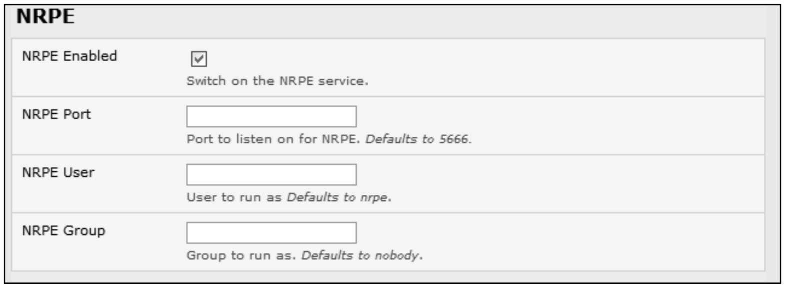
Enabled	□ Switch on the Nagios service.
Nagios Host Name	 Name of this system in Nagios. *Generated from System Name if unspecified.*
Nagios Host Address	 Address for Nagios to find this device at. *Defaults to Network 1 IP if set.*
Nagios Server Address	 Address of the upstream server.
Disable SDT Nagios Extensions	□ Don't show sdt:// links in service status.
SDT Gateway Address	 External address of this system, shown in sdt:// links. *Defaults to Nagios Host Address.*
Prefer NRPE	□ Use NRPE instead of NSCA whenever possible. *Defaults to prefer NSCA.*

- ➢ Enter the **Nagios Host Name** the *console server* will be referred to in the Nagios central server. This will be generated from local System Name (entered in **System: Administration**) if unspecified.
- ➢ In **Nagios Host Address,** enter the IP address or DNS name the upstream Nagios server will use to reach the console server. If unspecified, this will default to the first network port's IP (*Network (1)* as entered in **System: IP**).
- ➢ In **Nagios Server Address,** enter the IP address or DNS name the console server will use to reach the upstream Nagios monitoring server.
- ➢ Check the **Disable SDT Nagios Extensions** option if you wish to disable the SDT connector integration with your Nagios server at the head end. Only select this option if you want to run basic Nagios monitoring.
- ➢ Otherwise, enter the IP address or DNS name the SDT Nagios clients will use to connect the console server in **SDT Gateway Address.**
- ➢ When NRPE and NSCA are both enabled, NSCA is the preferred method for communicating with the upstream Nagios server. Make sure to check **Prefer NRPE** to use NRPE whenever possible (i.e., for all communication except for alerts).

10.2.2 Enable NRPE Monitoring



Enabling NRPE allows you to execute plug-ins such as *check_tcp* and *check_ping* on the remote console server to monitor serial or network attached remote servers. This will offload the CPU from the upstream Nagios monitoring machine, which is especially valuable if monitoring hundreds or thousands of hosts. To enable NRPE:



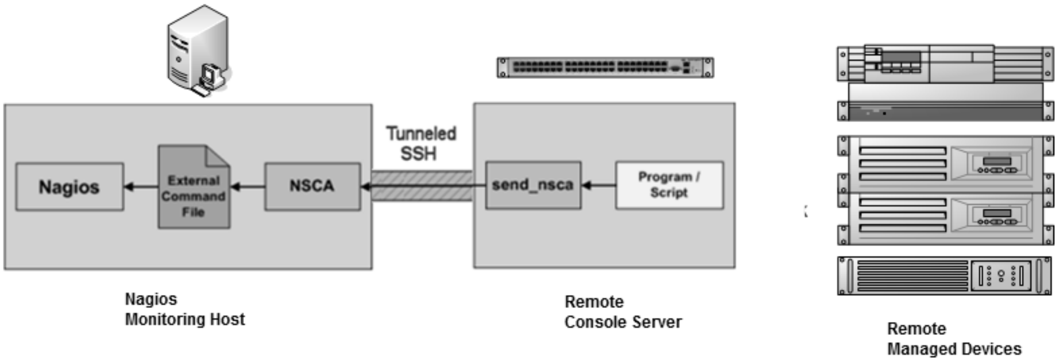
NRPE

NRPE Enabled	☑ Switch on the NRPE service.
NRPE Port	Port to listen on for NRPE. *Defaults to 5666.*
NRPE User	User to run as *Defaults to nrpe.*
NRPE Group	Group to run as. *Defaults to nobody.*

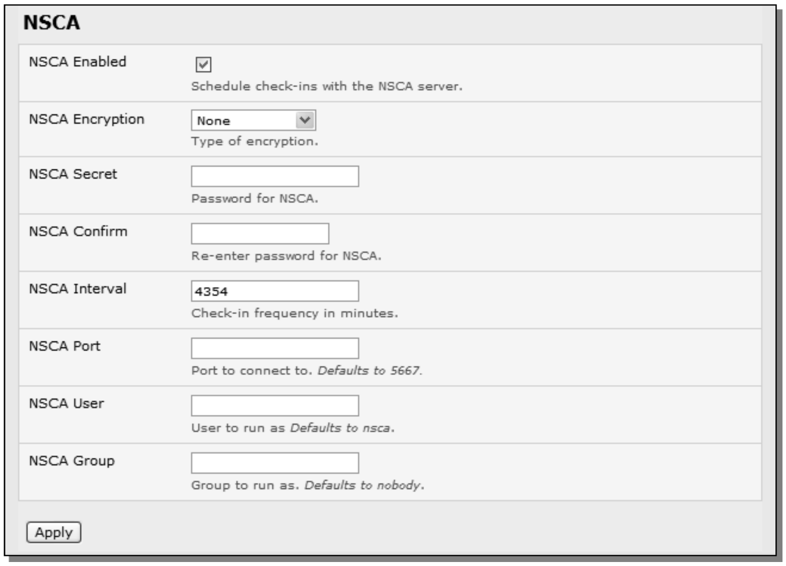
- Select **System: Nagios** and check **NRPE Enabled.**
- Enter the user details to connect the upstream Nagios monitoring server. Refer to the sample Nagios configuration example below for details of configuring specific NRPE checks.

By default, the console server will accept a connection between the upstream Nagios monitoring server and the NRPE server with SSL encryption, without SSL, or tunneled through SSH. The security for the connection is configured at the Nagios server.

10.2.3 Enable NSCA Monitoring



NSCA sends passive check results from the remote console server to the Nagios daemon running on the monitoring server. To enable NSCA:



NSCA

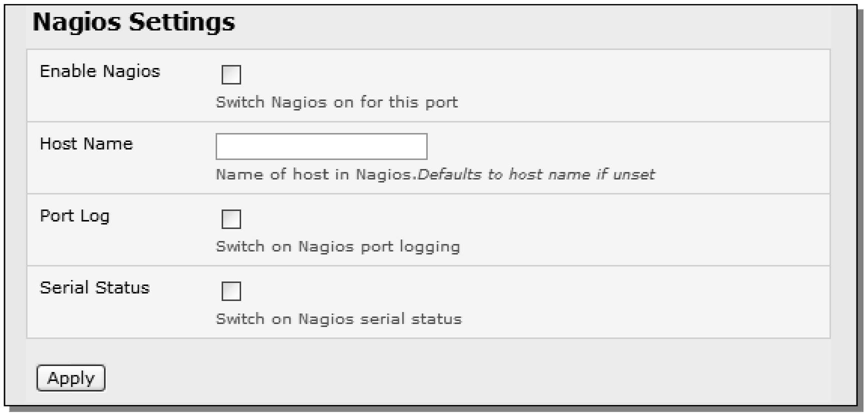
NSCA Enabled	☑ Schedule check-ins with the NSCA server.
NSCA Encryption	None Type of encryption.
NSCA Secret	 Password for NSCA.
NSCA Confirm	 Re-enter password for NSCA.
NSCA Interval	4354 Check-in frequency in minutes.
NSCA Port	 Port to connect to. *Defaults to 5667.*
NSCA User	 User to run as *Defaults to nsca.*
NSCA Group	 Group to run as. *Defaults to nobody.*

- Select **System: Nagios** and check **NSCA Enabled.**
- Select the **Encryption** to be used from the dropdown menu. Enter a **Secret** password and specify a check **Interval.**
- Refer to the sample Nagios configuration section below for examples of configuring specific NSCA checks.

10.2.4 Configure Selected Serial Ports for Nagios Monitoring

Individual serial ports connected to the console server to be monitored must be configured for Nagios checks (refer to **4.4 Network Host Configuration** for details on enabling Nagios monitoring for hosts that are network-connected to the console server). To enable Nagios to monitor a device connected to the console server serial port:

- Select **Serial & Network: Serial Port** and click **Edit** on the serial port to be monitored.
- Select **Enable Nagios,** specify the name of the device on the upstream server and determine the check to be run on this port. **Serial Status** monitors the handshaking lines on the serial port and **Check Port** monitors the data logged for the serial port.



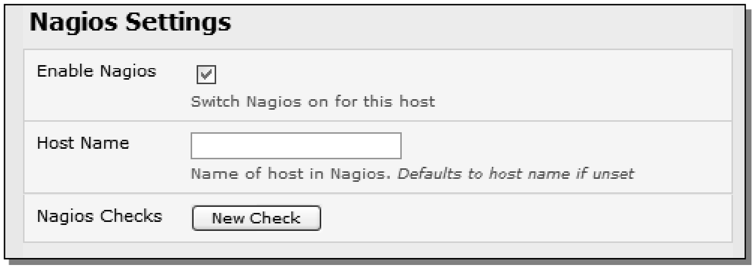
Nagios Settings

Enable Nagios	□ Switch Nagios on for this port
Host Name	 Name of host in Nagios.*Defaults to host name if unset*
Port Log	□ Switch on Nagios port logging
Serial Status	□ Switch on Nagios serial status

10.2.5 Configure Selected Network Hosts for Nagios Monitoring

The individual network hosts connected to the console server to be monitored must also be configured for Nagios checks:

- Select **Serial & Network: Network Port** and click **Edit** on the network host to be monitored.



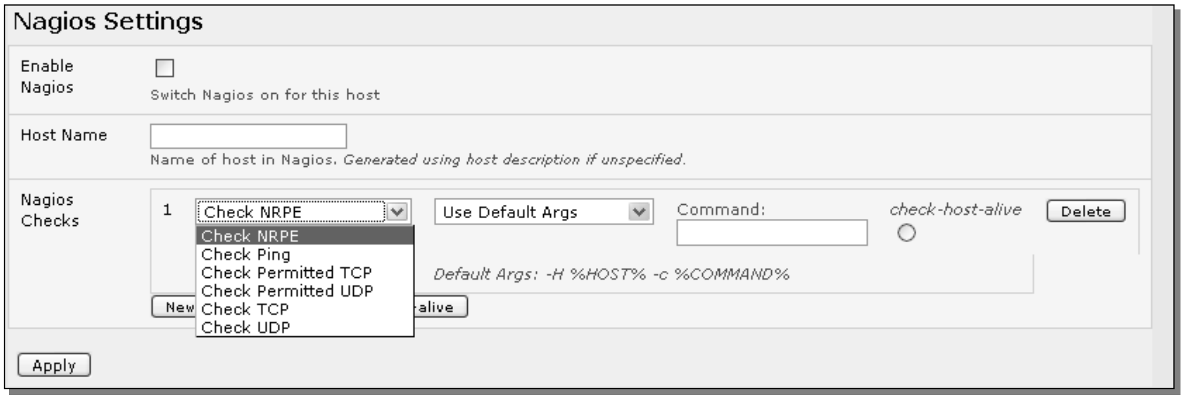
Nagios Settings

Enable Nagios ☑
Switch Nagios on for this host

Host Name
Name of host in Nagios. *Defaults to host name if unset*

Nagios Checks

- Select **Enable Nagios** and specify the name of the device as it will appear on the upstream Nagios server.
- Click **New Check** to add a specific check to be run on this host.
- Select **Check Permitted TCP/UDP** to monitor a service you have previously added as a **Permitted Service.**
- Select **Check TCP/UDP** to specify a service port you wish to monitor, but do not wish to allow external (SDT Connector) access to.
- Select **Check TCP** to monitor.



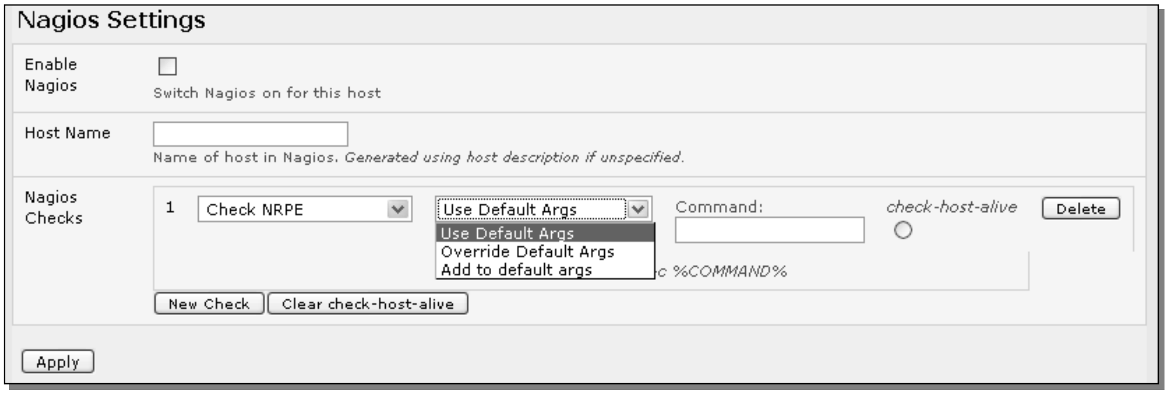
Nagios Settings

Enable Nagios □
Switch Nagios on for this host

Host Name
Name of host in Nagios. *Generated using host description if unspecified.*

Nagios Checks
1 Check NRPE | Use Default Args | Command: | *check-host-alive* ○
Default Args: -H %HOST% -c %COMMAND%

- The **Nagios Check** assigned as the ***check-host-alive*** check determines whether the network host is up or down.
- Typically, this will be *Check Ping*. In some cases, the host will be configured to not respond to pings.
- If no ***check-host-alive*** is selected, the host will always be assumed to be up.
- You may deselect ***check-host-alive*** by clicking **Clear *check-host-alive.***
- If required, customize the selected **Nagios Checks** to use custom arguments.
- Click **Apply.**



Nagios Settings

Enable Nagios □ Switch Nagios on for this host

Host Name: Name of host in Nagios. *Generated using host description if unspecified.*

Nagios Checks: 1 Check NRPE | Use Default Args | Command: | *check-host-alive* ○

10.2.6 Configure the Upstream Nagios Monitoring Host

Refer to the Nagios documentation (found at http://www.nagios.org/docs/) for configuring the upstream server:

- The section *Distributed Monitoring* provides step-by-step detail for configuring NSCA on the upstream server (under *Central Server Configuration*).
- *NRPE Documentation* has recently added steps for configuring NRPE on the upstream server. For more information, visit *http://nagios.sourceforge.net/docs/nrpe/NRPE.pdf.*

At this point, Nagios upstream monitoring server has been configured and individual serial port and network host connections on the console server have been configured for Nagios monitoring. If NSCA is enabled, each selected check will be executed once over the period of the check interval. If NRPE is enabled, the upstream server will be able to request status updates under its own scheduling.

10.3 Advanced Distributed Monitoring Configuration

10.3.1 Sample Nagios Configuration

An example configuration for Nagios is listed below. The example configuration shows how to set up a remote console server to monitor a single host with both network and serial connections. Each check contains two configurations: one for NRPE and one for NSCA. In practice, these would be combined into a single check using NSCA as a primary method and defaulting to NRPE if checked late. For more information, refer to Nagios documentation (http://www.nagios.org/docs/) on *Service and Host Freshness Checks.*

```
; Host definitions
;
; Tripp Lite Console server
define host{
   use          generic-host
   host_name       tripp-lite
   alias         Console server
   address       192.168.254.147
   }

; Managed Host
define host{
   use          generic-host
   host_name       server
   alias        server
   address       192.168.254.227
   }

; NRPE daemon on gateway
define command {
          command_name          check_nrpe_daemon
          command_line  $USER1$/check_nrpe -H 192.168.254.147 -p 5666
          }

define service {
          service_description       NRPE Daemon
          host_name                 tripp-lite
          use                       generic-service
          check_command                       check_nrpe_daemon
          }

; Serial Status
define command {
          command_name          check_serial_status
          command_line  $USER1$/check_nrpe -H 192.168.254.147 -p 5666 -c
check_serial_$HOSTNAME$
          }

define service {
          service_description       Serial Status
          host_name                 server
          use                       generic-service
          check_command                       check_serial_status
          }

define service {
          service_description       serial-signals-server
          host_name                 server
          use                       generic-service
          check_command                       check_serial_status
          active_checks_enabled 0
          passive_checks_enabled          1
          }

define servicedependency{
          name                                tripp-lite_nrpe_daemon_dep
          host_name                           tripp-lite
          dependent_host_name                 server
          dependent_service_description  Serial Status
          service_description                 NRPE Daemon
          execution_failure_criteria          w,u,c
          }

; Port Log
define command{
          command_name  check_port_log
          command_line  $USER1$/check_nrpe -H 192.168.254.147 -p 5666 -c port_log_$HOSTNAME$
   }

define service {
          service_description       Port Log
          host_name                 server
          use                       generic-service
          check_command                     check_port_log
          }

define service {
          service_description       port-log-server
          host_name                 server
          use                       generic-service
          check_command                     check_port_log
          active_checks_enabled 0
          passive_checks_enabled            1
          }

define servicedependency{
          name                              tripp-lite_nrpe_daemon_dep
          host_name                         tripp-lite
          dependent_host_name               server
          dependent_service_description  Port Log
          service_description               NRPE Daemon
          execution_failure_criteria        w,u,c
          }

; Ping
define command{
          command_name  check_ping_via_tripp-lite
          command_line  $USER1$/check_nrpe -H 192.168.254.147 -p 5666 -c host_ping_$HOSTNAME$
   }

define service {
          service_description       Host Ping
          host_name                 server
          use                       generic-service
          check_command                     check_ping_via_tripp-lite
          }

define service {
          service_description       host-ping-server
          host_name                 server
          use                       generic-service
          check_command                     check_ping_via_tripp-lite
          active_checks_enabled 0
          passive_checks_enabled            1
          }

define servicedependency{
          name                              tripp-lite_nrpe_daemon_dep
          host_name                         tripp-lite
          dependent_host_name               server
          dependent_service_description  Host Ping
          service_description               NRPE Daemon
          execution_failure_criteria        w,u,c
          }

; SSH Port
```

```
define command{
   command_name  check_conn_via_tripp-lite
   command_line  $USER1$/check_nrpe -H 192.168.254.147 -p 5666 -c
host_$HOSTNAME$_$ARG1$_$ARG2$
   }

define service {
          service_description       SSH Port
          host_name                 server
          use                       generic-service
          check_command                       check_conn_via_tripp-lite!tcp!22
          }

define service {
          service_description       host-port-tcp-22-server
                                    ; host-port-<protocol>-<port>-<host>
          host_name                 server
          use                       generic-service
          check_command                       check_conn_via_tripp-lite!tcp!22
          active_checks_enabled 0
          passive_checks_enabled            1
          }

define servicedependency{
          name                                tripp-lite_nrpe_daemon_dep
          host_name                           tripp-lite
          dependent_host_name                 server
          dependent_service_description  SSH Port
          service_description                 NRPE Daemon
          execution_failure_criteria          w,u,c
          }
```

10.3.2 Basic Nagios Plug-Ins

Plug-ins are compiled executables or scripts that can be scheduled to be run on the console server to check the status of a connected host or service. This status is then communicated to the upstream Nagios server, which uses the results to monitor the current status of the distributed network. Each console server is pre-configured with checks that are part of the Nagios plug-ins package:

check_tcp and *check_udp* are used to check open ports on network hosts.

check_ping is used to check network host availability.

check_nrpe is used to execute arbitrary plug-ins in other devices.

Each *console server* is preconfigured with two checks that are specific to Tripp Lite:

check_serial_signals is used to monitor the handshaking lines on the serial ports.

check_port_log is used to monitor the data logged for a serial port.

10.3.3 Additional Plug-Ins

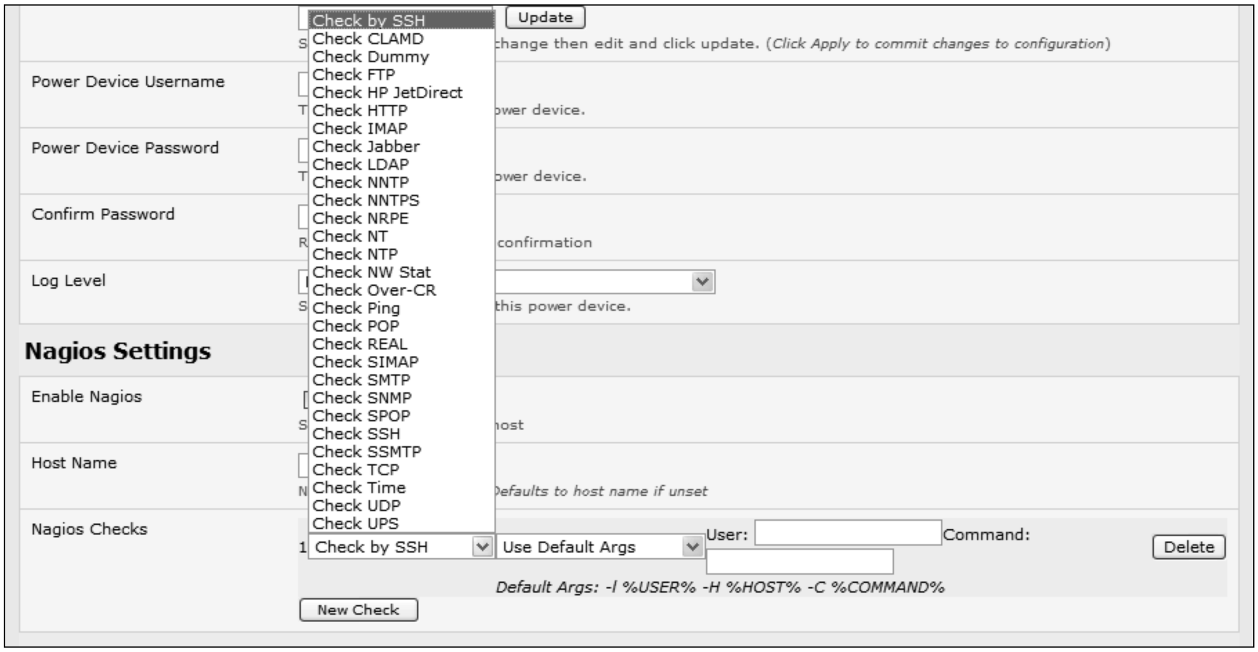
Additional Nagios plug-ins (listed below) are available for all B096 models:

check_apt
check_by_ssh

check_clamd
check_dig
check_dns
check_dummy
check_fping
check_ftp
check_game
check_hpjd
check_http
check_imap
check_jabber
check_ldap
check_load
check_mrtg
check_mrtgtraf
check_nagios
check_nntp
check_nntps
check_nt
check_ntp
check_nwstat
check_overcr
check_ping
check_pop
check_procs
check_real
check_simap
check_smtp
check_snmp
check_spop
check_ssh
check_ssmtp
check_swap
check_tcp
check_time
check_udp
check_ups
check_users

Bash scripts can also be downloaded and run (primarily *check_log.sh).*

- To configure additional checks, the downloaded plug-in program must be saved in the tftp *addins* directory on the USB flash and the downloaded text plug-in file saved in */etc/config.*
- To enable these new additional checks, you select **Serial & Network: Network Port.** Select **Edit** for the network host to be monitored and **New Checks**. The additional check option will be included in the updated **Nagios Checks** list, where you can again customize the arguments.



change then edit and click update. (*Click Apply to commit changes to configuration*)

Power Device Username

ower device.

Power Device Password

ower device.

Confirm Password

confirmation

Log Level

this power device.

Nagios Settings

Enable Nagios

ost

Host Name

Defaults to host name if unset

Nagios Checks

1 Check by SSH | Use Default Args | User: | Command:

Default Args: -l %USER% -H %HOST% -C %COMMAND%

10.3.4 Number of Supported Devices

The number of devices that can be supported by a console server is a function of the number of checks being made and how often they are performed. Access method also plays a role. The table below shows the performance of three console server models (1/2 port, 8 port and 16/48 port):

Time	No encryption	3DES	SSH tunnel
NSCA for single check	~ ½ second	~ ½ second	~ ½ second
NSCA for 100 sequential checks	100 seconds	100 seconds	100 seconds
NSCA for 10 sequential checks, batched upload	1 ½ seconds	2 seconds	1 second
NSCA for 100 sequential checks, batched upload	7 seconds	11 seconds	6 seconds

	No encryption	SSL	no encryption - tunneled over existing SSH session
NRPE time to service 1 check	1/10th second	1/3rd second	1/8th second
NRPE time to service 10 simultaneous checks	1 second	3 seconds	1 ¼ seconds
Maximum number of simultaneous checks before timeouts	30	20 (1,2 and 8) or 25 (16 and 48 port)	25 (1,2 and 8 port), 35 (16 and 48 port)

The results were from running tests five times in succession with no timeouts on any runs. However, there are a number of ways to increase the number of checks you can do:

When using NRPE checks, an individual request will need to set up and tear down an SSL connection. This overhead can be avoided by setting up an SSH session to the console server and tunneling the NRPE port. This allows the NRPE daemon to run securely without SSL encryption, as SSH will handle security.

When the console server submits NSCA results, it staggers them over a time period (e.g., 20 checks over 10 minutes will result in two check results every minute). Staggering the results like this means that in the event of a power failure or other incident that causes multiple problems, the individual refresh checks will be staggered too.

NSCA checks are also batched. In the previous example, the two checks per minute will be sent through in a single transaction.

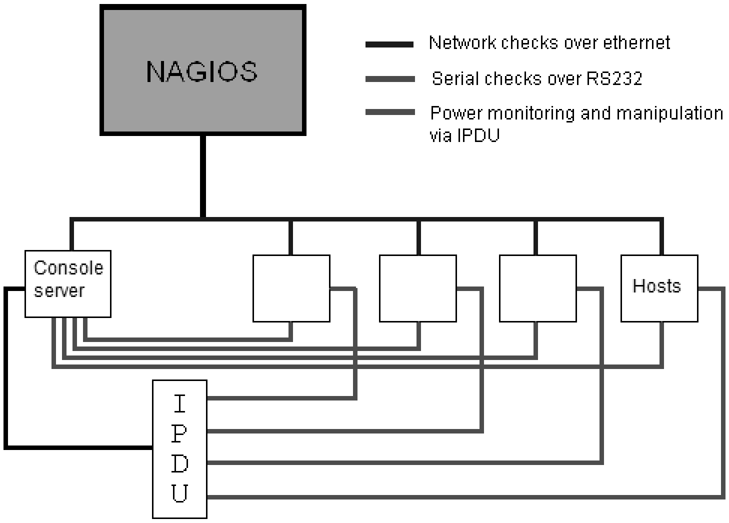
10.3.5 Distributed Monitoring Usage Scenarios

Below are examples of distributed monitoring Nagios scenarios:

I. Local office

In this scenario, the console server is set up to monitor the console of each managed device. It can be configured to perform a number of checks (actively at the Nagios server's request, or passively at preset intervals) and submit the results to the Nagios server in a batch.

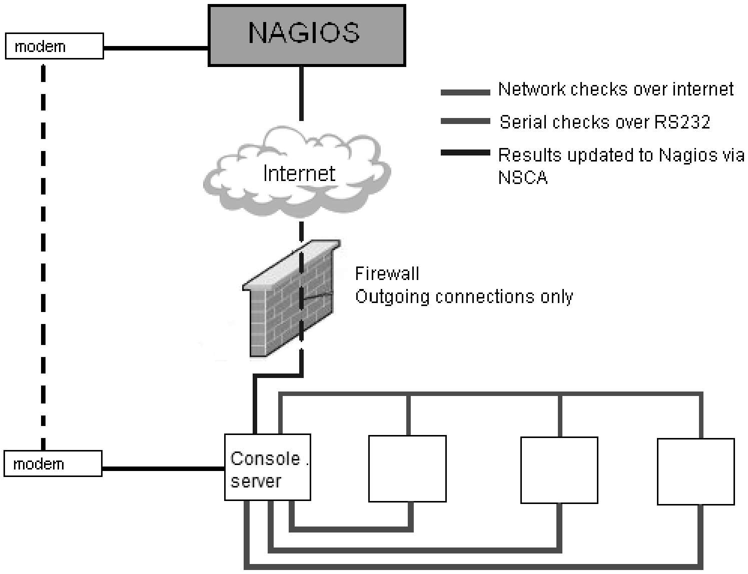
The console server may be augmented at the local office site by one or more Intelligent Power Distribution Units (IPDUs) to remotely control the power supply to the managed devices.


NAGIOS
Network checks over ethernet
Serial checks over RS232
Power monitoring and manipulation via IPDU
Console server
Hosts
IPDU

II. Remote site

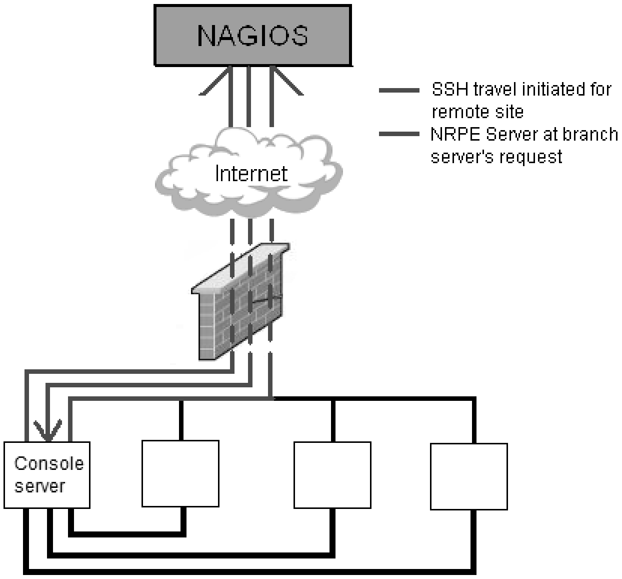
In this scenario, the console server, NRPE server or NSCA client can be configured to make active checks of configured services and upload to the Nagios server waiting passively. It can also be configured to service NRPE commands to perform checks on demand.

In this situation, the console server will perform checks based on both serial and network access.


NAGIOS
modem
Network checks over internet
Serial checks over RS232
Results updated to Nagios via NSCA
Internet
Firewall
Outgoing connections only
modem
Console server

Remote Site with Restrictive Firewall

In this scenario, the console server's role will vary. One aspect may be to upload check results through NSCA. Another may be to provide an SSH tunnel to allow the Nagios server to run NRPE commands.


NAGIOS
SSH travel initiated for remote site
NRPE Server at branch server's request
Internet
Console server

Remote Site with No Network Access

In this scenario, the console server allows dial-in access to the Nagios server. Periodically, the Nagios server will establish a connection to the console server and execute any NRPE commands before dropping the connection.

11. System Management

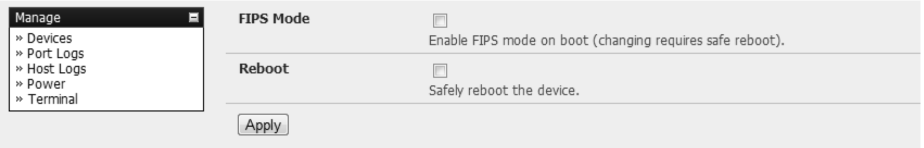
This chapter describes how the Administrator can perform a range of general console server system administrative and configuration tasks.

11.1 System Administration and Reset

The Administrator can reboot or reset the gateway to default settings.

To perform a soft reset:

- ➢ Select **Reboot** in the **System: Administration** menu and click **Apply.**



FIPS Mode ☐ Enable FIPS mode on boot (changing requires safe reboot).

Reboot ☐ Safely reboot the device.

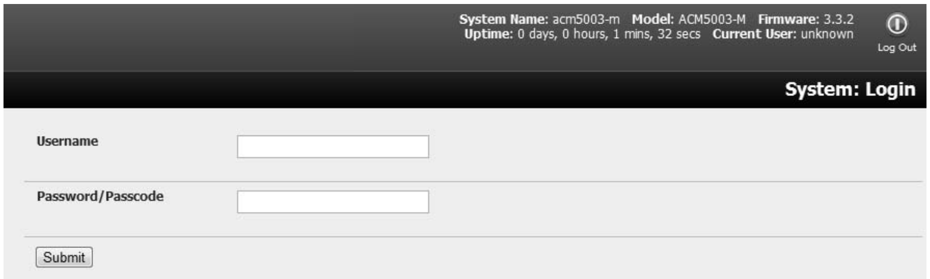
The console server reboots with all settings (e.g., the assigned network IP address) preserved. However, this soft reset disconnects all users and ends any SSH sessions that had been established.

A soft reset will also be affected when you switch OFF power from the console server and switch the power back ON. If you cycle the power and the unit is writing data to flash memory, you could corrupt or lose data. As such, a software reboot is the safer option.

To perform a hard erase (hard reset):

- ➢ Push the *Erase* button on the rear panel twice. A ballpoint pen or bent paper clip is a suitable tool for performing this procedure. **Do not use a graphite pencil**. Depress the button gently twice (within a couple of second period) while the unit is powered ON.

This will reset the console server to its factory default settings and clear the console server's stored configuration information (i.e. the IP address will be reset to 192.168.0.1). You will be prompted to log in and must enter the default administration username and administration password (Username: **root** Password: **default**).



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 0 days, 0 hours, 1 mins, 32 secs **Current User:** unknown

11.2 Upgrade Firmware

Before upgrading, you should determine whether your Tripp Lite device is running the most current firmware. Your Tripp Lite device will not allow you to upgrade to the same version or an earlier version.

- ➢ The **Firmware** version is displayed in the header of each page.

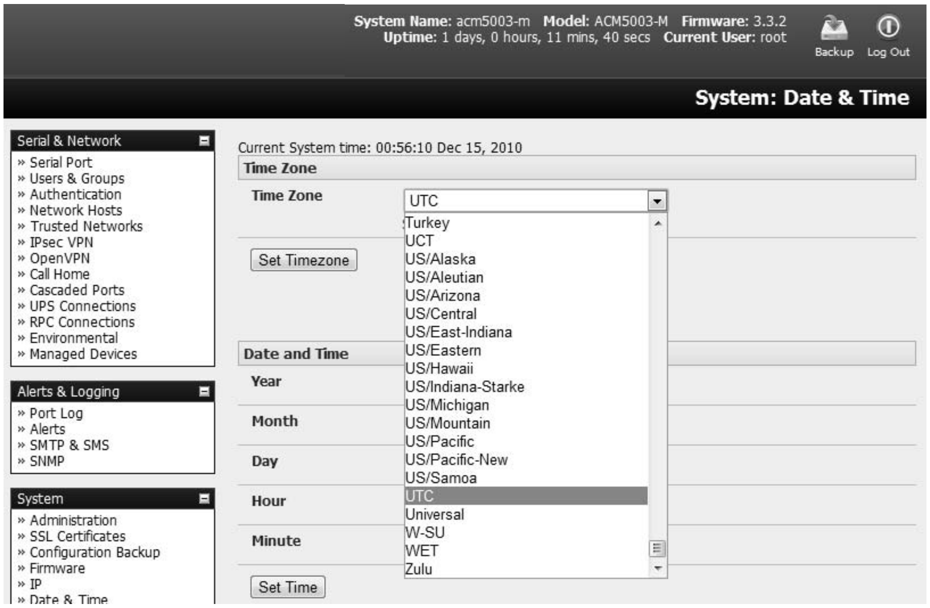
- Alternately, selecting **Status: Support Report** reports the **Firmware Version.**
- To upgrade, you first must download the latest firmware image from *www.tripplite.com/support.*
- Save this downloaded firmware image file on to a system on the same subnet as the Tripp Lite device.
- Download and read the *Release Notes* file for the latest update information.
- To upload the firmware image file, select **System: Firmware.**
- Specify the address and name of the downloaded Firmware Upgrade File, or **Browse** the local subnet and locate the downloaded file.
- Click **Apply.** The Tripp Lite device will undergo a soft reboot and begin upgrading the firmware. This process will take several minutes.
- After the firmware upgrade has completed, click **here** to return to the management console. Your Tripp Lite device will have retained all pre-upgrade configuration information.

11.3 Configure Date and Time

It is important to set the local date and time in your Tripp Lite device as soon as it is configured. Features such as Syslog and NFS logging use the system time for time-stamping log entries, while certificate generation depends on a correct timestamp to check the validity period of the certificate.

Your Tripp Lite appliance can synchronize its system time with a remote Network Time Protocol (NTP) server. NTP uses Coordinated Universal Time (UCT) for all time synchronizations, so it is not affected by different time zones. However, you will need to specify your local time zone in order for the system clock to show the correct local time:

- Set your appropriate region/locality in the **Time Zone** selection box and click **Set Timezone.**



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 0 hours, 11 mins, 40 secs **Current User:** root

System: Date & Time

Current System time: 00:56:10 Dec 15, 2010

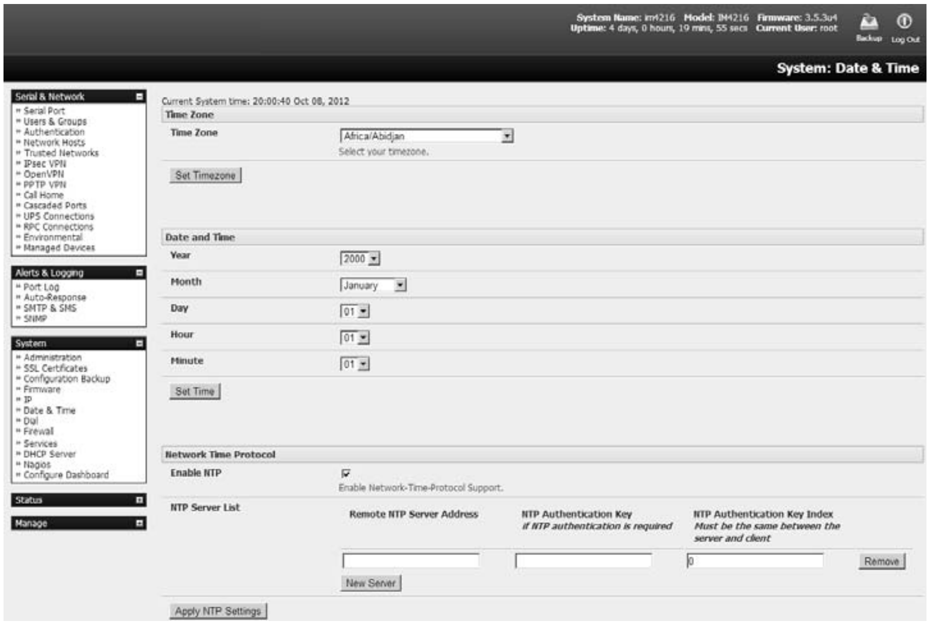
Time Zone

Time Zone: UTC

***Note:** With firmware version 3.2.0, the time zone can also be set to UCT, which replaced Greenwich Mean Time (GMT) as the world standard for time.*

Configuring NTP ensures the Tripp Lite device's clock is accurate (once Internet connection has been established).

- ➢ Select the **Enable NTP** checkbox in the **Network Time Protocol** section of the **System: Date & Time** page.
- ➢ Enter the IP address of the remote **NTP Server.**
- ➢ If your external NTP server requires authentication, specify the **NTP Authentication Key** and the K**ey Index** to use when authenticating with the NTP server.
- ➢ Click **Apply NTP Settings.**



System Name: im4216 **Model:** IM4216 **Firmware:** 3.5.3u4
Uptime: 4 days, 0 hours, 19 mins, 55 secs **Current User:** root

System: Date & Time

Current System time: 20:00:40 Oct 08, 2012

Time Zone

Time Zone: Africa/Abidjan
Select your timezone.

Date and Time

Year: 2000
Month: January
Day: 01
Hour: 01
Minute: 01

Network Time Protocol

Enable NTP: ☑ Enable Network-Time-Protocol Support.

NTP Server List

Remote NTP Server Address	NTP Authentication Key *if NTP authentication is required*	NTP Authentication Key Index *Must be the same between the server and client*
		0

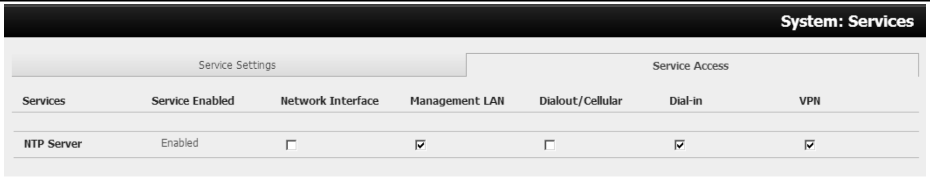
If remote NTP is not used, the time can be set manually:

- ➢ Enter the **Year**, **Month**, **Day**, **Hour** and **Minute** using the **Date** and **Time** selection boxes.
- ➢ Check **Set Time.**

Notes:

• All Tripp Lite devices have an internal battery-backed hardware clock. When the time and date is set manually through the management console or retrieved from an NTP server, the hardware clock of the Tripp Lite device is automatically updated. The hardware clock uses a battery to allow the current time and date to be maintained across reboots and after the appliance has been powered down for longer periods.

• With the NTP peering model, the Tripp Lite device can share its time information with other devices connected to it so all devices can be time synchronized. To do this, click ***Enable NTP*** *on the Time and Date page and ensure the appropriate networks are selected on the Service Access page.*



System: Services

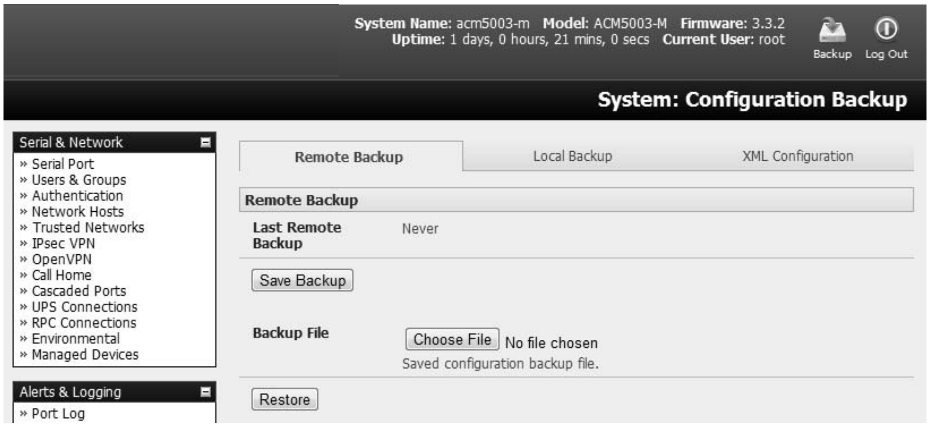
Services	Service Enabled	Network Interface	Management LAN	Dialout/Cellular	Dial-in	VPN
NTP Server	Enabled	☐	☑	☐	☑	☑

11.4 Configuration Backup

It is recommended that you back up the console server configuration whenever you make significant changes (such as adding new users or managed devices) or before performing a firmware upgrade.

- Select the **System: Configuration Backup** menu option or click the Backup icon.

Note: *The configuration files can also be backed up from the command line (refer to* ***14. Configuration from the Command Line****).*



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 0 hours, 21 mins, 0 secs **Current User:** root

System: Configuration Backup

Remote Backup

Last Remote Backup: Never

Backup File: No file chosen
Saved configuration backup file.

With all console servers models, you can save the backup file remotely on your PC and restore configurations from remote locations:

- Click **Save Backup** in the Remote Configuration Backup menu.
- The config backup file (*System Name_date_config.opg*) will be downloaded to your PC and saved in the location you assign.

To restore a remote backup:

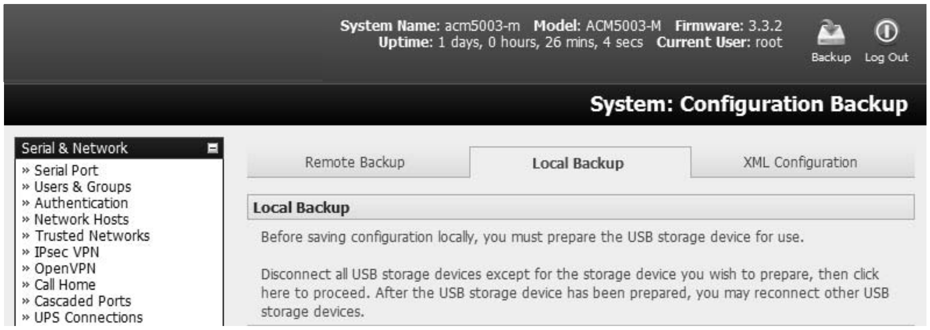
- Click **Browse** in the Remote Configuration Backup menu and select the **Backup File** you wish to restore.
- Click **Restore**, then click **OK.** This will overwrite all the current configuration settings in your console server.

Some console server models can allow you to save the backup file locally onto the USB storage. To do so, your console server must support USB and have an internal or external USB flash drive installed.

To backup and restore using USB:

- Ensure the USB flash is the only USB device attached to the console server.

- Select the **Local Backup** tab and **click here to proceed**. This will set a volume label on the USB storage device. This preparation step is only necessary the first time and will not affect any other information saved onto the USB storage device. It is recommended you back up any critical data from the USB storage device before using it with your console server. If there are multiple USB devices installed, you will be asked to remove them.



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 0 hours, 26 mins, 4 secs **Current User:** root

System: Configuration Backup

Local Backup

Before saving configuration locally, you must prepare the USB storage device for use.

Disconnect all USB storage devices except for the storage device you wish to prepare, then click here to proceed. After the USB storage device has been prepared, you may reconnect other USB storage devices.

- To back up to USB, enter a brief **Description** of the backup in the Local Backup menu and select **Save Backup.**
- The Local Backup menu will display all configuration backup files stored onto the USB flash.
- To restore a backup from the USB, simply select **Restore** on the particular backup you wish to restore and click **Apply.**

After saving a local configuration backup, you may choose to use it as the alternate default configuration. When the console server is reset to factory default, it will load your alternate default configuration (instead of its factory settings):

- To set an alternate default configuration, check **Load On Erase** and click **Apply.**

Note: *Before selecting **Load On Erase**, please ensure you have tested your alternate default configuration by clicking **Restore**.*

If for some reason your alternate default configuration causes the console server to become unbootable, recover your unit to factory settings using the following steps:

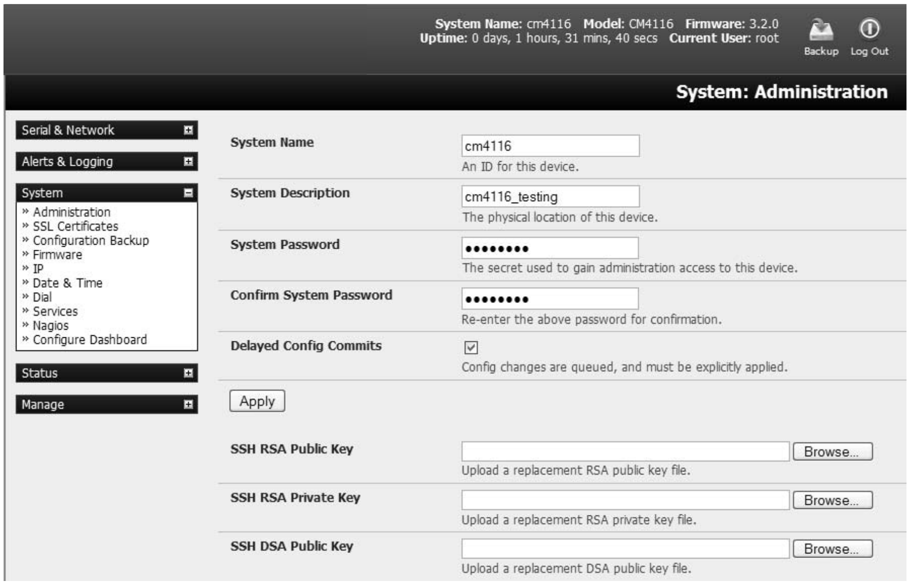
- *If the configuration is stored on an external USB storage device, unplug the storage device and reset to factory defaults (refer to **11.1 System Administration and Reset**).*
- *If the configuration is stored on an internal USB storage device, reset to factory defaults using a specially prepared USB storage device:*
    - *The USB storage device must be formatted with a Windows FAT32/VFAT file system on the first partition or the entire disk (most USB thumb drives are already formatted this way).*
    - *The file system must have the volume label: OPG_DEFAULT.*
    - *Insert this USB storage device into an external USB port on the console server and reset to factory defaults as per section **11.1 System Administration and Reset.***

After recovering your console server, ensure the problematic configuration is no longer selected for Load On Erase.

11.5 Delayed Configuration Commit

This mode allows the grouping or queuing of configuration changes and the simultaneous application of these changes to a specific device. For example, changes to authentication methods or user accounts may be grouped and run once to minimize system downtime. To enable:

- Check the **Delayed Config Commits** button under **System: Administration.**
- Click **Apply.**



System Name: cm4116 Model: CM4116 Firmware: 3.2.0
Uptime: 0 days, 1 hours, 31 mins, 40 secs Current User: root

System: Administration

System Name: cm4116
An ID for this device.

System Description: cm4116_testing
The physical location of this device.

System Password: ••••••••
The secret used to gain administration access to this device.

Confirm System Password: ••••••••
Re-enter the above password for confirmation.

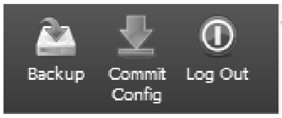
Delayed Config Commits: ☑
Config changes are queued, and must be explicitly applied.

SSH RSA Public Key:
Upload a replacement RSA public key file.

SSH RSA Private Key:
Upload a replacement RSA private key file.

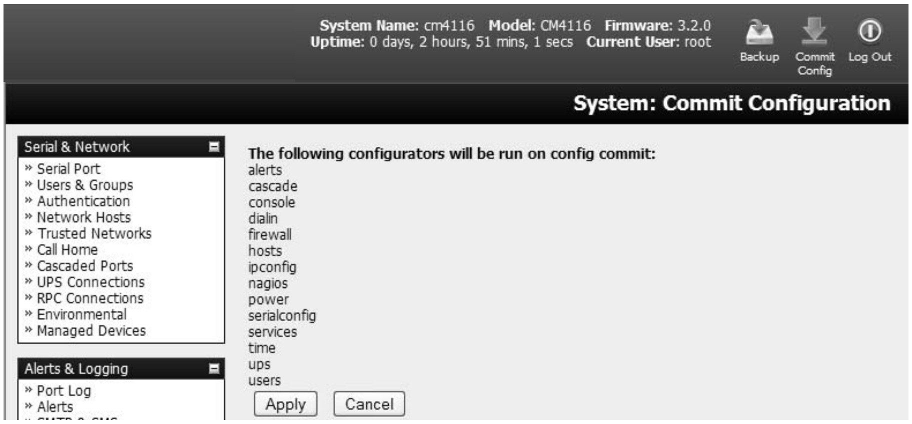
SSH DSA Public Key:
Upload a replacement DSA public key file.

- The Commit Config icon will display in top right-hand corner of the screen between the Backup and Log Out icons.



To queue, then run configuration changes:

- First, apply all the required changes to the configuration (e.g., modify user accounts, amend authentication method, enable OpenVPN tunnel or modify system time).
- Click the **Commit Config** button. This will generate the **System: Commit Configuration** screen displaying all the configurators to be run.



System Name: cm4116 Model: CM4116 Firmware: 3.2.0
Uptime: 0 days, 2 hours, 51 mins, 1 secs Current User: root

System: Commit Configuration

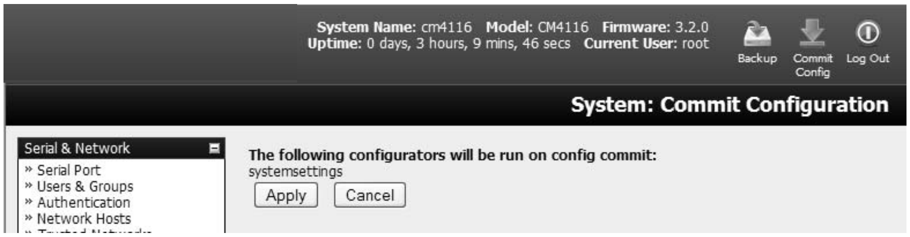
The following configurators will be run on config commit:
alerts
cascade
console
dialin
firewall
hosts
ipconfig
nagios
power
serialconfig
services
time
ups
users

- Click **Apply** to run all configurators in the queue.
- Alternately, click **Cancel.** This will discard all the delayed configuration changes.

Note: *All queued configuration changes will be lost if Cancel is selected.*

To disable the Delayed Configuration Commits mode:

- Uncheck the **Delayed Config Commits** button under **System: Administration** and click **Apply.**
- Click the **Commit Config** button in top right-hand corner of the screen to display the **System: Commit Configuration** screen.
- Click **Apply** to run the *systemsettings* configurator.


System Name: cm4116 Model: CM4116 Firmware: 3.2.0
Uptime: 0 days, 3 hours, 9 mins, 46 secs Current User: root
Backup
Commit Config
Log Out
System: Commit Configuration
Serial & Network
» Serial Port
» Users & Groups
» Authentication
» Network Hosts
Apply
Cancel

The following configurators will be run on config commit:
systemsettings

The **Commit Config** button will no longer display in the top right-hand corner of the screen and configurations will no longer be queued.

11.6 FIPS Mode

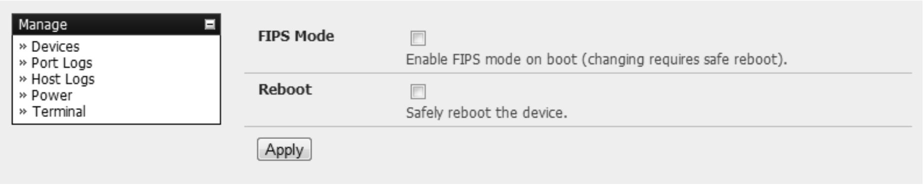
All Tripp Lite console server models use an embedded cryptographic module that has been validated to meet the FIPS 140-2 standards.

Note: *The US National Institute of Standards and Technology (NIST) publishes the FIPS (Federal Information Processing Standard) series of standards. FIPS 140-1 and FIPS 140-2 are both technical standards and worldwide de-facto standards for the implementation of cryptographic modules. These standards and guidelines are issued by NIST for use government-wide. NIST develops FIPS when there are compelling Federal government requirements such as for security and interoperability and there are no acceptable industry standards or solutions.*

Tripp Lite advance console servers use an embedded OpenSSL cryptographic module that has been validated to meet the FIPS 140-2 standards and has received Certificate #1051.

When configured in FIPS mode, all SSH, HTTPS and SDT Connector access to all services on the advanced console servers will use the embedded FIPS-compliant cryptographic module. To connect, you must also use FIPS-approved cryptographic algorithms found in your browser or client. Otherwise, the connection will fail.

- Select the **System: Administration** menu option.
- Check **FIPS Mode** to enable FIPS mode on boot, then check **Reboot** to safely reboot the console server.



FIPS Mode □ Enable FIPS mode on boot (changing requires safe reboot).

Reboot □ Safely reboot the device.

- Click **Apply.** The console server will now reboot. It will take several minutes to reconnect as secure communications with your browser are validated. When reconnected, it will display "*FIPs mode: Enabled*" in the banner.

Note: *To enable FIPS mode from the command line, login and run these commands:*

```
config -s config.system.fips=on
touch /etc/config/FIPS
chmod 444 /etc/config/FIPS
flatfsd -b
```

The final command saves to flash and reboots the unit. The unit will take a few minutes to boot into FIPS mode. To disable FIPS mode:

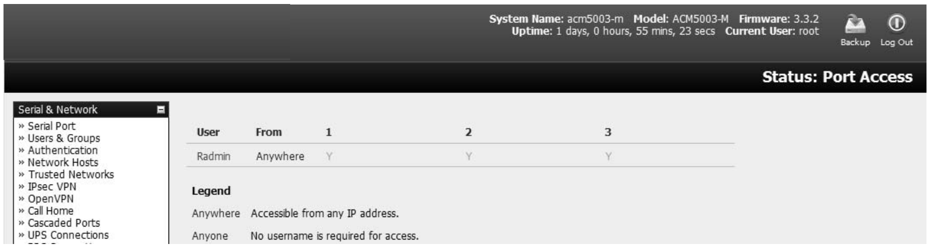
```
config -d config.system.fips
rm /etc/config/FIPS
flatfsd –b
```

12. Status Reports

12.1 Port Access and Active Users

The Administrator can see which Users have access privileges with which serial ports:

- Select **Status: Port Access.**



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 0 hours, 55 mins, 23 secs **Current User:** root

Status: Port Access

User	From	1	2	3
Radmin	Anywhere	Y	Y	Y

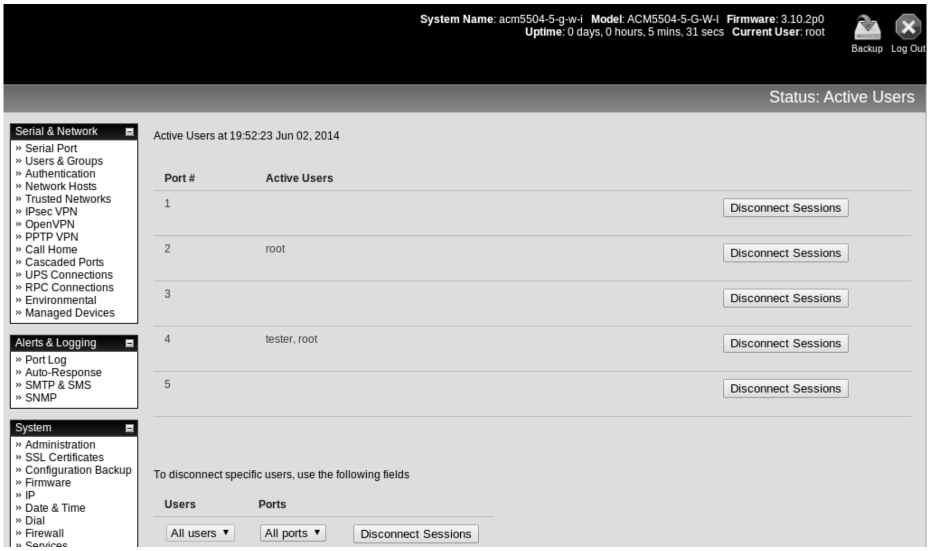
Legend

Anywhere Accessible from any IP address.

Anyone No username is required for access.

The Administrator can also see the current status of Users who have active sessions on those ports:

- Select **Status: Active Users.**



System Name: acm5504-5-g-w-i **Model**: ACM5504-5-G-W-I **Firmware**: 3.10.2p0
Uptime: 0 days, 0 hours, 5 mins, 31 secs **Current User**: root

Status: Active Users

Active Users at 19:52:23 Jun 02, 2014

Port #	Active Users	
1		Disconnect Sessions
2	root	Disconnect Sessions
3		Disconnect Sessions
4	tester, root	Disconnect Sessions
5		Disconnect Sessions

To disconnect specific users, use the following fields

Users	Ports	
All users ▼	All ports ▼	Disconnect Sessions

With firmware version 3.11 and later, the **Status: Active Users** menu has been extended to enable Administrators to selectively terminate serial sessions. Telnet, SSH, raw TCP and unauthenticated telnet connections can be disconnected. However, you cannot disconnect an RFC2217 session.

The root user or any user in the *admin* group can access the **Active Users** page, which shows a snapshot of the connected sessions with a timestamp displayed at the top of the page. This page only shows the local console ports, and does not include any cascaded ports.

There are **Disconnect Sessions** buttons along the right hand side of the table listing active users. These buttons disconnect all sessions from the port they correspond to. If the port is not set up in console server mode, the user will see a pop up error informing them that the port needs to be configured in console server mode before they can connect and disconnect.

After the buttons have been pressed, the selected sessions will be disconnected and the number of disconnect sessions will display to the user.

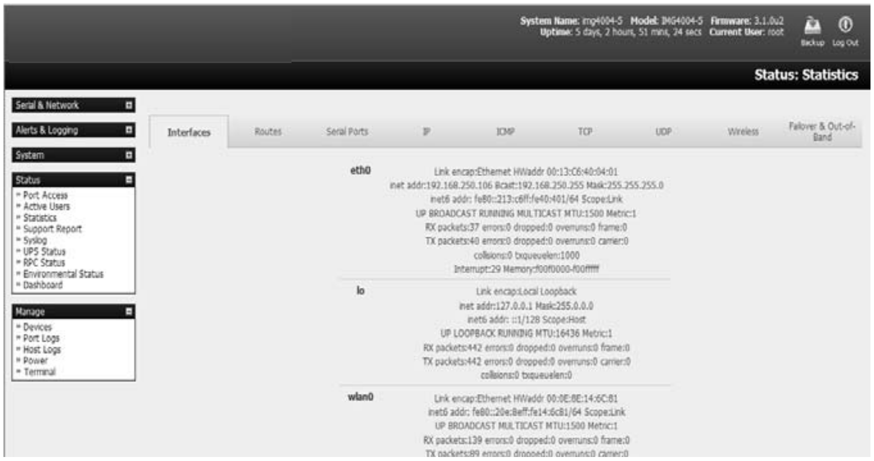
To allow more detailed control of which users to disconnect, a table at the bottom of the page with a dropdown menu lists all connected users and connected ports. For example, if you wish to disconnect the user “*tester*” from all ports, choose “*tester*” in the *Users* box, and **All ports** in the Ports box, then hit the **Disconnect Sessions** button.

Note: *You can also disconnect serial sessions from the command line using the* --disconnect option with the pmusers *command.*

12.2 Statistics

The Statistics report provides a snapshot of the status, current traffic and other activities and operations of your console server:

- Select **Status: Statistics.**



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 3.1.0u2
Uptime: 5 days, 2 hours, 51 mins, 24 secs **Current User:** root

```
eth0    Link encap:Ethernet HWaddr 00:13:C6:40:04:01
        inet addr:192.168.250.106 Bcast:192.168.250.255 Mask:255.255.255.0
        inet6 addr: fe80::213:c6ff:fe40:401/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:37 errors:0 dropped:0 overruns:0 frame:0
        TX packets:40 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        Interrupt:29 Memory:f00f0000-f00fffff
lo      Link encap:Local Loopback
        inet addr:127.0.0.1 Mask:255.0.0.0
        inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING MTU:16436 Metric:1
        RX packets:442 errors:0 dropped:0 overruns:0 frame:0
        TX packets:442 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0
wlan0   Link encap:Ethernet HWaddr 00:0E:8E:14:6C:81
        inet6 addr: fe80::20e:8eff:fe14:6c81/64 Scope:Link
        UP BROADCAST MULTICAST MTU:1500 Metric:1
        RX packets:139 errors:0 dropped:0 overruns:0 frame:0
        TX packets:89 errors:0 dropped:0 overruns:0 carrier:0
```

- Detailed statistics reports can be found by selecting from the various submenus.

12.3 Support Reports

The Support Report provides useful status information that will assist the Tripp Lite technical support team to solve any problems you may experience with your console server.

If you experience a problem and have to contact support, ensure you include the Support Report with your email support request. The Support Report should be generated when the issue is occurring, and attached in plain text format.

- Select **Status: Support Report** and you will be presented with a status snapshot.
- Save the file as a text file and attach it to your support email.

Note: *For console servers running firmware version 3.11 and above and for devices where the serial number can be retrieved, there is now a Feature Set section in the support report where the serial number is among the information displayed. For devices not supporting this feature, there is no change to the support report.*

12.4 Syslog

The Linux System Logger in the console server maintains a record of all system messages and errors:

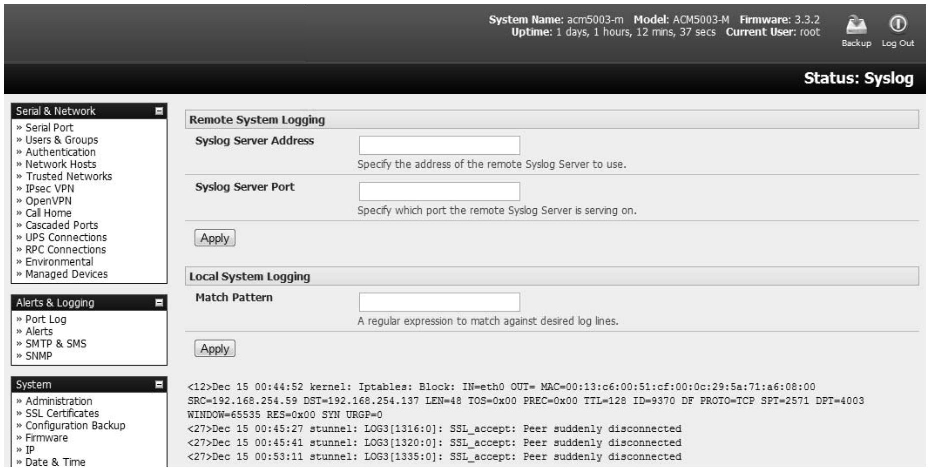
- Select **Status: Syslog.**

The syslog record can be redirected to a remote Syslog Server:

- Enter the remote **Syslog Server Address** and **Syslog Server Port** details. Click **Apply.**

The console maintains a local syslog. To view the local syslog file:

- Select **Status: Syslog.**



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 1 hours, 12 mins, 37 secs **Current User:** root

Status: Syslog

Remote System Logging

Syslog Server Address
Specify the address of the remote Syslog Server to use.

Syslog Server Port
Specify which port the remote Syslog Server is serving on.

Local System Logging

Match Pattern
A regular expression to match against desired log lines.

```
<12>Dec 15 00:44:52 kernel: Iptables: Block: IN=eth0 OUT= MAC=00:13:c6:00:51:cf:00:0c:29:5a:71:a6:08:00
SRC=192.168.254.59 DST=192.168.254.137 LEN=48 TOS=0x00 PREC=0x00 TTL=128 ID=9370 DF PROTO=TCP SPT=2571 DPT=4003
WINDOW=65535 RES=0x00 SYN URGP=0
<27>Dec 15 00:45:27 stunnel: LOG3[1316:0]: SSL_accept: Peer suddenly disconnected
<27>Dec 15 00:45:41 stunnel: LOG3[1320:0]: SSL_accept: Peer suddenly disconnected
<27>Dec 15 00:53:11 stunnel: LOG3[1335:0]: SSL_accept: Peer suddenly disconnected
```

To make it easier to find information in the local syslog file, a pattern-matching filter tool is provided.

- Specify the **Match Pattern** that is to be searched for and click **Apply.** The syslog will then be represented with only those entries that actually include the specified pattern.

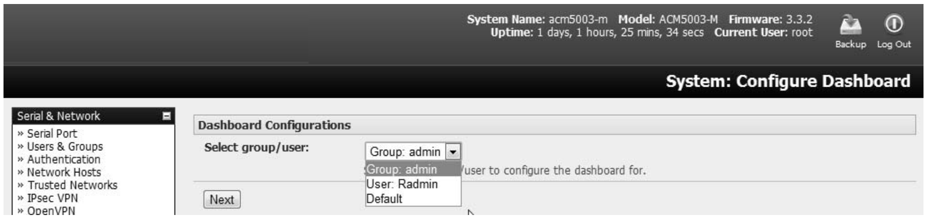
12.5 Dashboard

The Dashboard provides the Administrator with a summary of the status of the console server and its managed devices. Custom dashboards can be configured for each user group.

12.5.1 Configuring the Dashboard

Only users in the *admin* group (and the *root* user) can configure and access the dashboard. To configure a custom dashboard:

- Select **System: Configure Dashboard** and select the user (or group) for whom to configure this custom dashboard layout for.



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 1 hours, 25 mins, 34 secs **Current User:** root

System: Configure Dashboard

Dashboard Configurations

Select group/user: Group: admin
/user to configure the dashboard for.

Note: *You can configure a custom dashboard for any* admin *user or for the* admin *group, or you can reconfigure the default dashboard*

*The **Status: Dashboard** screen is the first screen displayed when admin users (other than root) log into the console manager. For example, if you log in as "John" and John is member of the admin group, a dashboard layout will be configured for John that you can view upon log-in and each time you click on the Status: Dashboard menu item.*

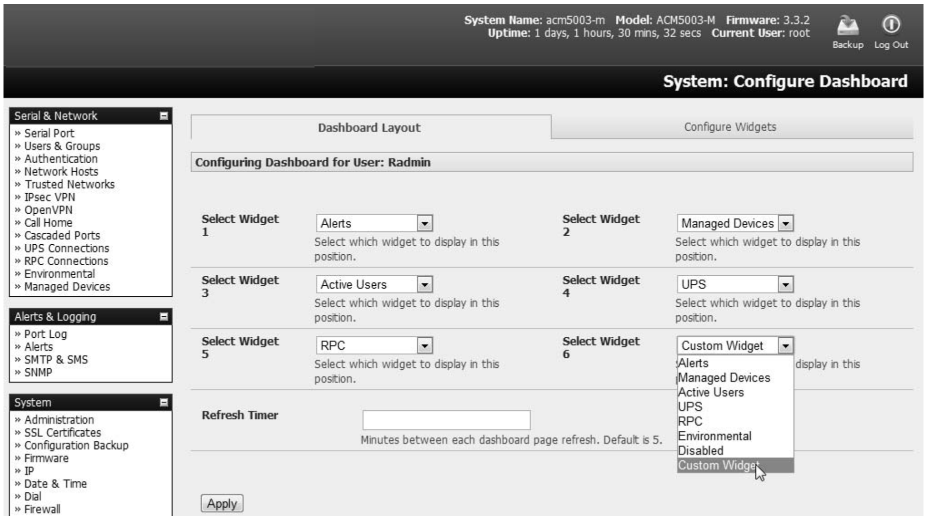
If there is no dashboard layout configured for John, but an admin group dashboard is configured, you will see the admin group dashboard instead. If there is no user dashboard or admin group dashboard configured, you will see the default dashboard.

The root user does not have its own dashboard.

The above configuration options are intended to enable admin users to set up their own custom dashboards.

The dashboard displays a configurable number of *widgets*. These widgets include status for major subsystems such as *conma*, *Auto-Response*, *Managed Devices* and cellular. The *admin* user can configure which widgets are to be displayed and where:

- ➢ Go to the **Dashboard layout** panel and select which widget is to be displayed in each of the **Widget Slots.**
- ➢ Click Apply.



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 1 hours, 30 mins, 32 secs **Current User:** root

System: Configure Dashboard

Configuring Dashboard for User: Radmin

Select Widget 1: Alerts
Select which widget to display in this position.

Select Widget 2: Managed Devices
Select which widget to display in this position.

Select Widget 3: Active Users
Select which widget to display in this position.

Select Widget 4: UPS
Select which widget to display in this position.

Select Widget 5: RPC
Select which widget to display in this position.

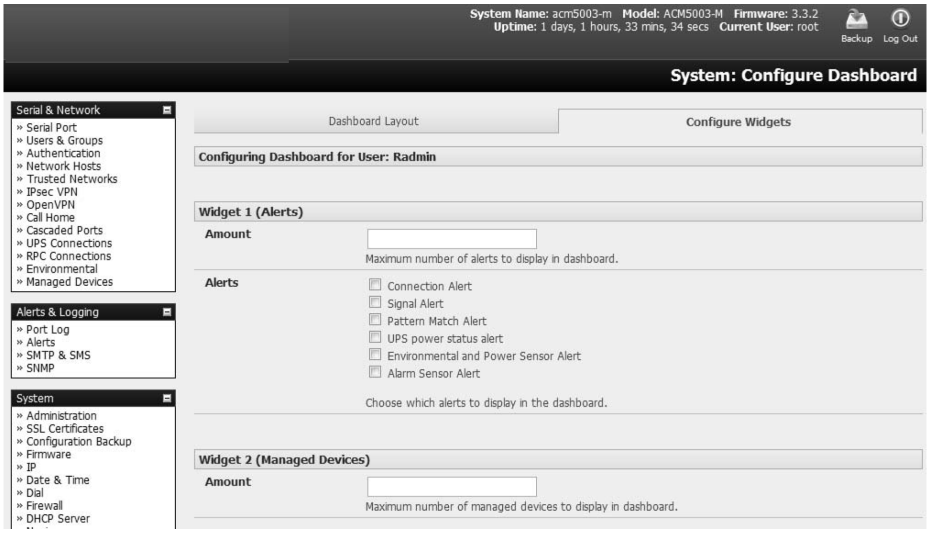
Select Widget 6: Custom Widget
display in this

Refresh Timer:
Minutes between each dashboard page refresh. Default is 5.

Note: *The Alerts widget is a new screen that shows the current alerts status. When an alert is triggered, a corresponding .XML file is created in /var/run/alerts/. The dashboard scans all of these files and displays a summary status in the alerts widget. When an alert is deleted, the corresponding .XML files belonging to that alert are also deleted.*

To configure what is to be displayed by each widget:

- ➢ Go to the **Configure widgets** panel and configure each selected widget (e.g., specify which UPS status is to be displayed on the *ups widget* or the maximum number of managed devices to be displayed in the devices widget*.*
- ➢ Click Apply.



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 1 hours, 33 mins, 34 secs **Current User:** root

System: Configure Dashboard

Configuring Dashboard for User: Radmin

Widget 1 (Alerts)

Amount ___
Maximum number of alerts to display in dashboard.

Alerts
□ Connection Alert
□ Signal Alert
□ Pattern Match Alert
□ UPS power status alert
□ Environmental and Power Sensor Alert
□ Alarm Sensor Alert
Choose which alerts to display in the dashboard.

Widget 2 (Managed Devices)

Amount ___
Maximum number of managed devices to display in dashboard.

Note: *Dashboard configuration is stored in the /etc/config/config.xml file. Each configured dashboard will increase the config file. If this file gets too big, you can run out of memory space on the console server.*

12.5.2 Creating Custom Widgets for the Dashboard

To run a custom script inside a dashboard widget:

Create a file called *widget-<name>.sh* in the folder */etc/config/scripts /* , where *<name>* can be of your choosing. You can have as many custom dashboard files as desired.

Inside this file, you can use any code you wish. When configuring the dashboard, choose ***widget-<name>.sh*** in the dropdown list. The dashboard will run the script and display the output of the script commands inside the specific widget.

The best way to format the output is to send HTML commands back to the browser by adding echo commands in the script:

echo '<table>'

You can run any command and its output will display in the widget window directly.
Below is an example script writing the current date to a file and echoing HTML code back to the browser.
The HTML code gets an image from a specific URL and displays it in the widget.

```
#!/bin/sh

date >> /tmp/test
echo '<table>'
echo '<tr><td> This is my custom script running </td></tr>'
echo '<tr><td>'
echo '<img src="http://www.vinras.com/images/linux-online-inc.jpg">'
echo '</td></tr>'
echo '</table>'

exit 0
```

13. Management

The console server has a small number of **Manage** reports and tools available to both Administrators and Users:

- Access and control authorized devices
- View serial port logs and host logs for those devices
- Use SSH or Web Terminal to access serially attached consoles
- Control power devices (where authorized)

All other management console menu items are available to Administrators only.

13.1 Device Management

Note: *The manage devices UI has received substantial updates in firmware version 3.12.*

To display managed devices and their grouped serial, network and power connections:

- Select **Manage: Devices** or click the **Manage Devices** icon in the top right of the UI.

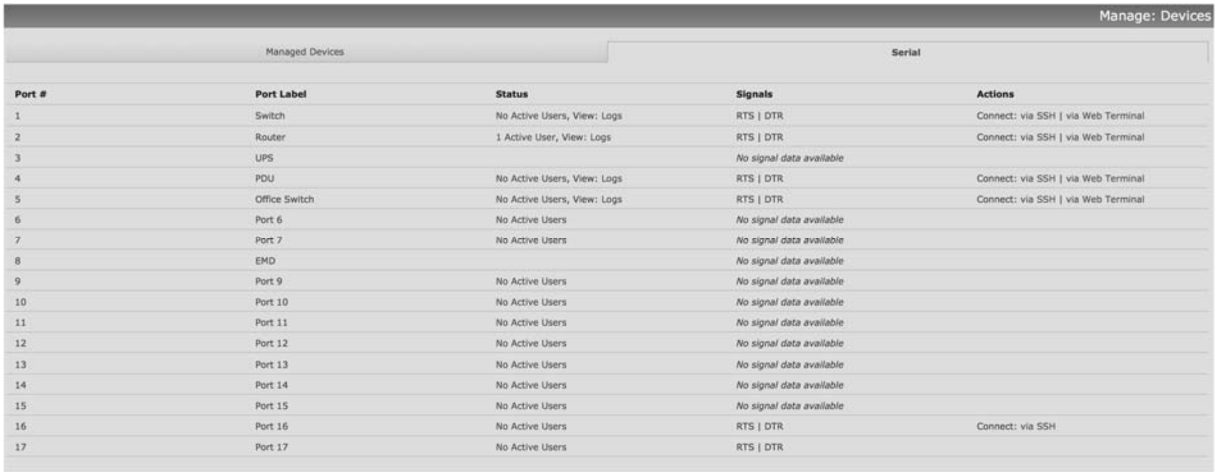
- Admin-group users are presented with a list of all configured managed devices and their constituent connections. User-group users only see the managed devices where they have been explicitly permitted access.

- The **Status** column displays the current status for each related connection (e.g., active users for serial connections and power status for RPC outlet connections) with links to detailed status.

- The links in the **Actions** column are used to control the managed device (e.g., connect to a console session or power cycle – power actions are not performed until the action has been confirmed via pop-up message).

- The Administrator will be presented with a list of all configured managed devices, whereas the User will only see the managed devices they (or their Group) have been given access privileges for.

- Alternately, select the **Serial** tab for an ungrouped view of permitted serial port connections for the current user.



Port #	Port Label	Status	Signals	Actions
1	Switch	No Active Users, View: Logs	RTS | DTR	Connect: via SSH | via Web Terminal
2	Router	1 Active User, View: Logs	RTS | DTR	Connect: via SSH | via Web Terminal
3	UPS		*No signal data available*	
4	PDU	No Active Users, View: Logs	RTS | DTR	Connect: via SSH | via Web Terminal
5	Office Switch	No Active Users, View: Logs	RTS | DTR	Connect: via SSH | via Web Terminal
6	Port 6	No Active Users	*No signal data available*	
7	Port 7	No Active Users	*No signal data available*	
8	EMD		*No signal data available*	
9	Port 9	No Active Users	*No signal data available*	
10	Port 10	No Active Users	*No signal data available*	
11	Port 11	No Active Users	*No signal data available*	
12	Port 12	No Active Users	*No signal data available*	
13	Port 13	No Active Users	*No signal data available*	
14	Port 14	No Active Users	*No signal data available*	
15	Port 15	No Active Users	*No signal data available*	
16	Port 16	No Active Users	RTS | DTR	Connect: via SSH
17	Port 17	No Active Users	RTS | DTR	

- An additional **Signals** column displays the current state of the serial pins.

Note: *To use the Connect: via SSH links, your computer's operating system must recognize the ssh:/ / URI scheme and have a protocol handler configured (e.g., an SSH client like SecureCRT).*

13.2 Port and Host Logs

Administrators and Users can view and download logs of data transferred to and from connected devices.

- Select **Manage: Port Logs** and the serial port number to be displayed.
- To display host logs, select **Manage: Host Logs** and the host to be displayed.

This will display logs stored locally on the console server memory or USB flash memory.

13.3 Terminal Connection

There are two methods available for accessing the console server command line and devices attached to the console server serial ports directly from a web browser:

- The web terminal service uses AJAX to enable the web browser to connect to the console server using HTTP or HTTPS as a terminal, without the need for additional client installation on the user's PC.
- The SDT Connector service launches a pre-installed SDT Connector client on the user's PC to establish secure SSH access, then uses pre-installed client software on the client PC to connect to the console server.

Web browser access is available to users who are a member of the admin or users groups.

13.3.1 Web Terminal

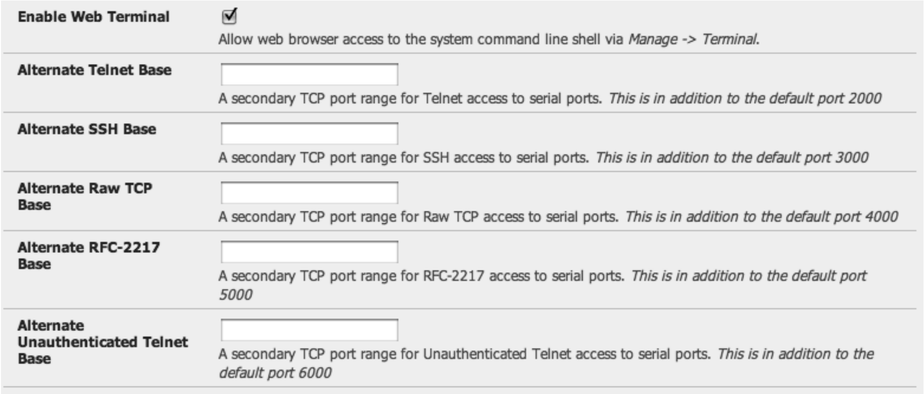
The AJAX-based web terminal service may be used to access the console server command line or attached serial devices.

Note: *Any communication using the web terminal service with HTTP is unencrypted and not secure. The web terminal connects to the command line or serial device using the same protocol being used to browse the Tripp Lite management console, i.e. if you are browsing using an https:/ / URL (this is the default), the web terminal connects using HTTPS.*

13.3.1.1 Web Terminal to Command Line

To enable the web terminal service for the console server:

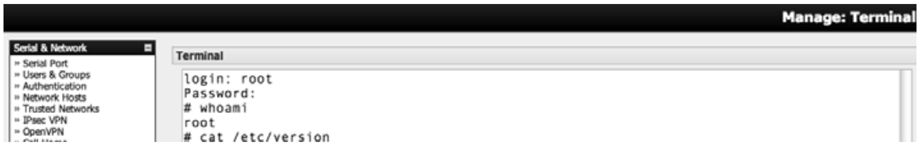
- Select **System: Firewall.**
- Check **Enable Web Terminal**, then click **Apply.**



Enable Web Terminal	☑ Allow web browser access to the system command line shell via *Manage -> Terminal.*
Alternate Telnet Base	 A secondary TCP port range for Telnet access to serial ports. *This is in addition to the default port 2000*
Alternate SSH Base	 A secondary TCP port range for SSH access to serial ports. *This is in addition to the default port 3000*
Alternate Raw TCP Base	 A secondary TCP port range for Raw TCP access to serial ports. *This is in addition to the default port 4000*
Alternate RFC-2217 Base	 A secondary TCP port range for RFC-2217 access to serial ports. *This is in addition to the default port 5000*
Alternate Unauthenticated Telnet Base	 A secondary TCP port range for Unauthenticated Telnet access to serial ports. *This is in addition to the default port 6000*

Administrators can now communicate directly with the console server command line from their browser:

- Select **Manage: Terminal** to display the web terminal from which you can log in to the console server command line.

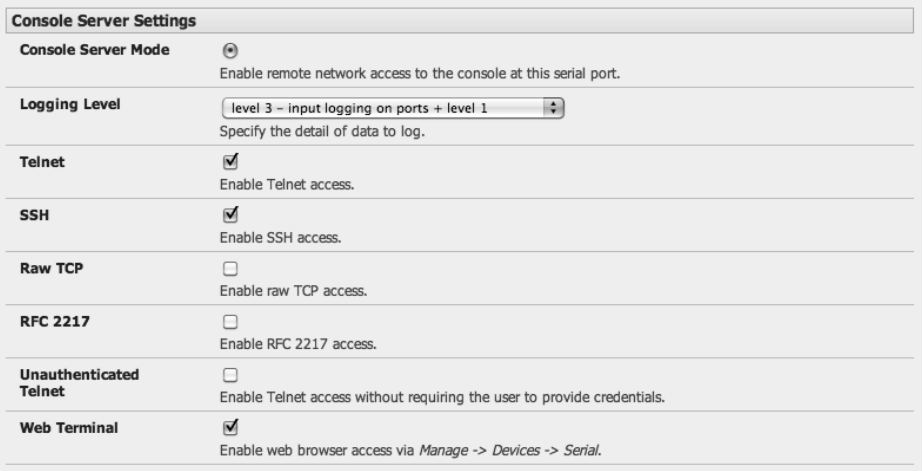


```
login: root
Password:
# whoami
root
# cat /etc/version
```

13.3.1.2 Web Terminal to Serial Device

To enable the web terminal service for each serial port you want to access:

- Select **Serial & Network: Serial Port** and click **Edit**. Ensure the serial port is in *Console Server Mode.*
- Check **Web Terminal** and click **Apply.**

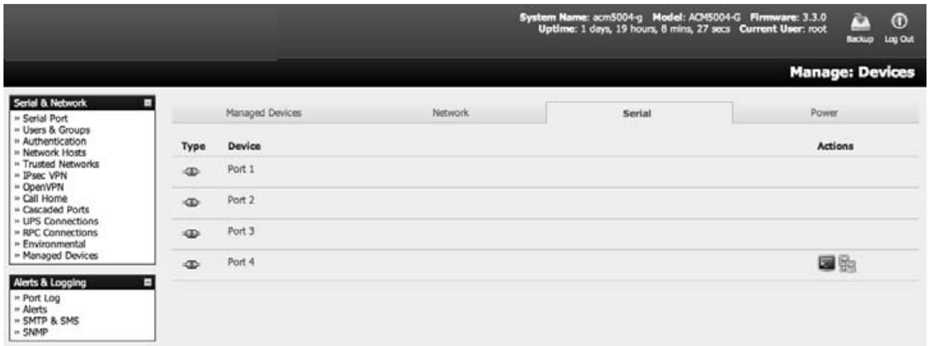


Console Server Settings

Console Server Mode	● Enable remote network access to the console at this serial port.
Logging Level	level 3 – input logging on ports + level 1 Specify the detail of data to log.
Telnet	☑ Enable Telnet access.
SSH	☑ Enable SSH access.
Raw TCP	□ Enable raw TCP access.
RFC 2217	□ Enable RFC 2217 access.
Unauthenticated Telnet	□ Enable Telnet access without requiring the user to provide credentials.
Web Terminal	☑ Enable web browser access via *Manage -> Devices -> Serial.*

Administrator and Users can communicate directly with serial port attached devices from their browser:

- Select the **Serial** tab on the **Manage: Devices** menu.
- Under the **Action** column, click the **Web Terminal** icon to display the web terminal connected directly to the attached serial device.



System Name: acm5004-g **Model:** ACM5004-G **Firmware:** 3.3.0
Uptime: 1 days, 19 hours, 8 mins, 27 secs **Current User:** root

Manage: Devices

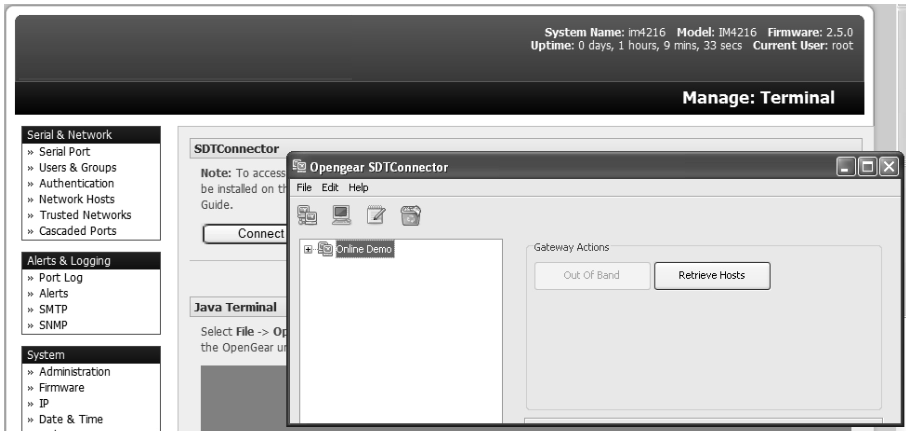
Type	Device	Actions
	Port 1	
	Port 2	
	Port 3	
	Port 4	

Note: *The web terminal feature was introduced in firmware version 3.3. Earlier releases had an open source* jcterm *java terminal applet, which and be downloaded to your browser to connect to the console server and attached serial port devices. However,* jcterm *is known to have JRE compatibility issues and is no longer supported.*

13.3.2 SDT Connector Access

Administrator and Users can communicate directly with the console server command line and devices attached to the console server serial ports using SDT Connector and their local tenet client, or using a Web terminal and browser.

- Select **Manage: Terminal.**
- Click **Connect to SDT Connector**. This will activate the SDT Connector client on the computer you and load your local telnet client to connect to the command line or serial port using SSH.



System Name: im4216 **Model:** IM4216 **Firmware:** 2.5.0
Uptime: 0 days, 1 hours, 9 mins, 33 secs **Current User:** root

Manage: Terminal

SDTConnector

Note: To access
be installed on th
Guide.

Java Terminal

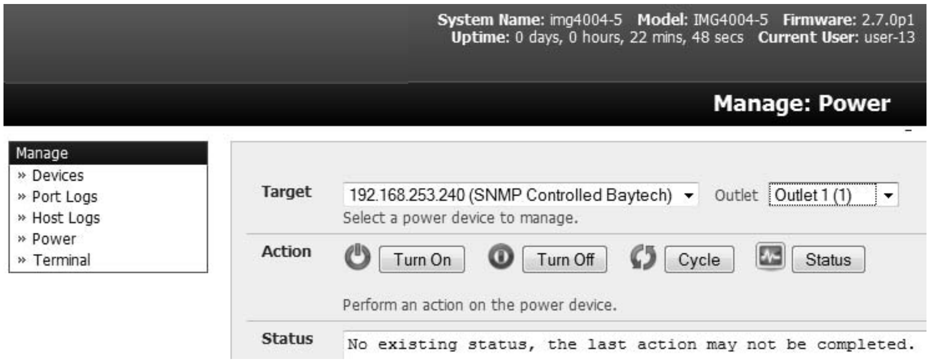
Select **File** -> **Op**
the OpenGear u

Note: *SDT Connector must be installed on the computer you are using. The console server must also be added as a gateway (refer to* ***6. SSH Tunnels and SDT Connector****).*

13.4 Power Management

Administrators and Users can access and manage the connected power devices.

- Select **Manage: Power**. This enables the user to power Off/On/Cycle any power outlet on any PDU the user has been given access privileges to (refer to **8. Power, Management and Digital I/O**).



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 0 hours, 22 mins, 48 secs **Current User:** user-13

Manage: Power

Target 192.168.253.240 (SNMP Controlled Baytech) Outlet Outlet 1 (1)
Select a power device to manage.

Action

Perform an action on the power device.

Status

```
No existing status, the last action may not be completed.
```

14. Configuration from the Command Line

For those who prefer to configure their console server at the Linux command line level (rather than use a browser and the management console), this chapter describes using command line access and the ***config*** tool to manage the console server and configure the ports.

When displaying a command, this chapter uses single quotes ('') for user defined values (e.g., descriptions and names). Element values without single quotes must be typed exactly as shown.

14.1 Accessing *Config* from the Command Line

The console server runs a standard Linux kernel and embeds a suite of open source applications. If you do not want to use a browser and the management console tools, you can configure the console server and manage connected devices from the command line using standard Linux and Busybox commands as well as applications like *ifconfig, gettyd, stty, powerman, NUT,* etc. However, without careful management, these settings may not withstand a power-cycle-reset or reconfiguration.

Tripp Lite provides a number of custom command line utilities and scripts easily configure the console server and ensure the changes are stored in the console server's flash memory.

The **config** utility allows manipulation of the system configuration from the command line. With *config,* a new configuration can be activated by running the relevant configurator, which performs the action necessary to make the configuration changes live.

To access *config* from the command line:

- ➢ Power up the console server and connect the “terminal” device:
  - o If connecting using the serial line, plug a serial cable between the console server’s local DB-9 console port and the terminal device. Configure the serial connection of the terminal device you are using to 115200bps, 8 data bits, no parity and one stop bit.
  - o If you are connecting over LAN, you will need to interconnect the Ethernet ports and direct your terminal emulator program to the IP address of the console server (192.168.0.1 by default).
- ➢ Log on to the console server by pressing *return* a few times. The console server will request a username and password. Enter the username ***root*** and the password ***default***. The command line prompt should appear as a hash (#).

This section is not intended to teach you Linux. In following these instructions, we assume you already have a certain level of understanding before executing Linux kernel level commands.

The *config* tool

Syntax

config [-ahv] [-d id] [-g id] [-p path] [-r configurator] [-s id=value] [-P id]

Description

The config tool is designed to perform multiple actions from one command so options can be chained together.

The config tool allows manipulation and querying of the system configuration from the command line. Using config, the new configuration can be activated by running the relevant *configurator*, which performs the necessary action to apply the configuration changes in real-time.

The custom user configuration is saved in the */etc/config/config.xml* file. This file is transparently accessed and edited when configuring the device using the management console browser GUI. Only the user '*root*' can configure from the shell.

By default, the config elements are separated by a '.' character. The root of the config tree is <*config*>*.* To address a specific element, place a '.' between each node/branch. To access and display the description of *user1*, type:

```
# config -g config.users.user1.description
```

The root node of the *config* tree is <config>. To display the entire *config* tree, type:

```
# config -g config
```

To display the help text for the *config* command, type:

```
# config -h
```

The *config* application resides in the */bin* directory. The environmental variable *PATH* contains a route to the */bin* directory. This allows a user to simply type *config* at the command prompt instead of the full path */bin/config*.

Options

-a –run-all Run all registered configurators. This performs every configuration synchronization action pushing all changes to the live system.

-h –help Display a brief usage message.

-v –verbose Log extra debug information.

-d –del=id Remove the given configuration element specified by a '.' separated identifier.

-g –get=id Display the value of a configuration element.

-p –path=file Specify an alternate configuration file to use. The default file is located at */etc/config/config.xml.*

-r –run=configurator Run the specified registered configurator. Registered configurators are listed below.

-s --set=id=value Change the value of configuration element specified by a '.' separated identifier.

-e --export=file Save active configuration to file.

-i --import=file Load configuration from file.

-t --test-import=file Pretend to load configuration from file.

-S --separator=char The pattern to separate fields with, default is '.'

-P --password=id Prompt user for a value. Hash the value, and then save.

The registered configurators are:

alerts
auth
cascade
console
dhcp
dialin
eventlog
hosts
ipaccess
ipconfig
nagios
power
serialconfig
services
Secondary
systemsettings
time
ups
users

There are three ways to delete a config element value. The simplest way is use the *delete-node* script detailed in **15. Advanced Configuration**. You can also assign the config element to "", or delete the entire config node using *-d*:

```
# /bin/config -d 'element name'
```

All passwords are saved in plaintext *except* the user passwords and system passwords, which are encrypted.

Note: *The config command does not verify whether the nodes edited/added by the user are valid. As such, any node may be added to the tree. For example, if a user were to run the following command:*

```
# /bin/config -s config.fruit.apple=sweet
```

the configurator will not verify, though this command is clearly useless. When the configurators are run to turn the config.xml file into live config, they will simply ignore this <fruit> node. Administrators must make sure of the spelling when typing config commands. Incorrect spelling for a node will not be flagged.

Most configurations made to the XML file will be immediately active. To ensure all configuration changes are active, especially when editing user passwords, run all the configurators:

```
# /bin/config -a
```

For information on backing up and restoring the configuration file, refer to **15. Advanced Configuration**.

14.1.1 Serial Port Configuration

RS-232 common settings are the first set of configurations to be made to any serial port. For example, to set up serial port 5, use the following properties:

Baud Rate	*9600*
Parity	*None*
Data Bits	*8*
Stop Bits	*1*
label	*Myport*
log level	*0*
protocol	*RS232*
flow control	*None*

Use the following commands:

```
# config -s config.ports.port5.speed=9600
# config -s config.ports.port5.parity=None
# config -s config.ports.port5.charsize=8
# config -s config.ports.port5.stop=1
# config -s config.ports.port5.label=myport
# config -s config.ports.port5.loglevel=0
# config -s config.ports.port5.protocol=RS232
# config -s config.ports.port5.flowcontrol=None
```

The following command will synchronize the live system with the new configuration:

```
# config -r serialconfig
```

Note: *Supported serial port baud-rates are ‘50’, ‘75’, ‘110’, ‘134’, ‘150’, ‘200’, ‘300’, ‘600’, ‘1200’, ‘1800’, ‘2400’, ‘4800’, ‘9600’, '19200', '38400', '57600', '115200', and '230400'.*
Supported parity values are 'None', 'Odd', 'Even', 'Mark' and 'Space'.
Supported data-bits values are '8', '7', '6' and '5'.
Supported stop-bits values are '1', '1.5' and '2'.
Supported flow-control values are 'Hardware', 'Software' and 'None'.

Additionally, before any port can function properly, the port mode needs to be set. Any port can be set to run in one of the five possible modes: [*Console Server* mode | Device mode | SDT mode | Terminal server mode | Serial bridge mode]. All these modes are mutually exclusive. Refer to **4. Serial Port, Host, Device and User Configuration** for details.

Console Server Mode

The command to set the port in *portmanager* mode:

```
# config -s config.ports.port5.mode=portmanager
```

To set the following optional config elements for this mode:

Data accumulation period	*100 ms*
Escape character	*% (default is ~)*
log level	*2 (default is 0)*
Shell power command menu	*Enabled*
RFC2217 access	*Enabled*
Limit port to 1 connection	*Enabled*
SSH access	*Enabled*
TCP access	*Enabled*
telnet access	*Disabled*
Unauthorized telnet access	*Disabled*

```
# config -s config.ports.port5.delay=100
# config -s config.ports.port5.escapechar=%
# config -s config.ports.port5.loglevel=2
# config -s config.ports.port5.powermenu=on
# config -s config.ports.port5.rfc2217=on
# config -s config.ports.port5.singleconn=on
# config -s config.ports.port5.ssh=on
# config -s config.ports.port5.tcp=on
# config -d config.ports.port5.telnet
# config -d config.ports.port5.unauthtel
```

Device Mode

For a device mode port, set the port type to either *ups, rpc,* or *enviro:*

```
# config -s config.ports.port5.device.type=[ups | rpc | enviro]
```

For port 5 as a UPS port:

```
# config -s config.ports.port5.mode=reserved
```

For port 5 as an RPC port:

```
# config -s config.ports.port5.mode=powerman
```

For port 5 as an Environmental port:

```
# config -s config.ports.port5.mode=reserved
```

SDT Mode

To enable access over SSH to a host connected to serial port 5:

```
# config -s config.ports.port5.mode=sdt
# config -s config.ports.port5.sdt.ssh=on
```

To configure a username and password when accessing this port with Username = user1 and Password = secret:

```
# config -s config.ports.port#.sdt.username=user1
# config -s config.ports.port#.sdt.password=secret
```

Terminal Server Mode

Enable a TTY login for a local terminal attached to serial port 5:

```
# config -s config.ports.port5.mode=terminal
# config -s config.ports.port5.terminal=[vt220 | vt102 | vt100 | linux | ansi]
```

The default terminal is vt220.

Serial Bridge Mode

Create a network connection to a remote serial port via RFC-2217 on port 5:

```
# config -s config.ports.port5.mode=bridge
```

Optional configurations for the network address of RFC-2217 server of 192.168.3.3 and TCP port used by the RFC-2217 service = 2500:

```
# config -s config.ports.port5.bridge.address=192.168.3.3
# config -s config.ports.port5.bridge.port=2500
```

To enable RFC-2217 access: *# config -s config.ports.port5.bridge.rfc2217=on*

To redirect the serial bridge over an SSH tunnel to the server: *# config -s config.ports.port5.bridge.ssh.enabled=on*

Syslog settings

Additionally, the global system log settings can be set for any specific port, in any mode:

```
# config -s config.ports.port#.syslog.facility='facility'
'facility' can be:
        Default
        local 0-7
        auth
        authpriv
        cron
        daemon
        ftp
        kern
        lpr
        mail
        news
        user
        uucp
# config -s config.ports.port#.syslog.priority='priority'
'priority' can be:
        Default
        warning
        notice
        Info
        error
        emergency
        debug
        critical
        alert
```

14.1.2 Adding and Removing Users

First, determine the total number of existing Users (if you have no existing Users, you can assume this is 0):

```
# config -g config.users.total
```

This command should display *config.users.total 1*. If you see *config.users.total* , this means you have 0 Users configured.

Your new User will be the existing total, plus 1. For example, if the previous command is 0, then start with user number 1. If you already have 1 User, your new User will be number 2, etc.

To add a user (with Username=John, Password=secret and Description=mySecondUser), issue the commands:

```
# config -s config.users.total=2 (assuming we already have 1 user configured)
# config -s config.users.user2.username=John
# config -s config.users.user2.description=mySecondUser
# config -P config.users.user2.password
```

Note: *The -P parameter will prompt the user for a password and encrypt it. In fact, the value of any config element can be encrypted using the -P parameter, but only encrypted user passwords and system passwords are supported. If any other element value were to be encrypted, the value will become inaccessible and have to be reset.*

To add this user to specific groups (admin/users):

```
# config -s config.users.user2.groups.group1='groupname'
# config -s config.users.user2.groups.group2='groupname2'
etc...
```

To give this user access to a specific port:

```
# config -s config.users.user2.port1=on
# config -s config.users.user2.port2=on
# config -s config.users.user2.port5=on
etc...
```

To remove port access:

```
# config -s config.users.user2.port1='' (the value is left blank)
or simply:
# config -d config.users.user2.port1
```

The port number can be anything from 1 to 48, depending on the available ports on the specific console server.

For example, assume we have an RPC device connected to port 1 on the console server and the RPC is configured. To allow this user access to RPC outlet number 3 on the RPC device, run the commands below:

```
# config -s config.ports.port1.power.outlet3.users.user2=John
# config -s config.ports.port1.power.outlet3.users.total=2 (total number of users that have access to this outlet)
```

If more users are allowed access to this power outlet, increment the *'config.ports.port1.power.outlet3.users.total'* element accordingly.

To allow this user access to network host 5 (assuming the host is configured):

```
# config -s config.sdt.hosts.host5.users.user1=John
# config -s config.sdt.hosts.host5.users.total=1 (total number of users having access to host)
```

To allow another user named 'Peter' access to the same host:

```
# config -s config.sdt.hosts.host5.users.user2=Peter
# config -s config.sdt.hosts.host5.users.total=2 (total number of users having access to host)
```

To edit any of the user element values, use the same approach as when adding user elements (i.e. use the '-s' parameter). If any of the config elements do not exist, they will automatically be created.

To delete the user called John, use the delete-node script:

```
# ./delete-node config.users.user2
```

The following command will synchronize the live system with the new configuration:

```
# config -r users
```

14.1.3 Adding and Removing User Groups

The console server is configured with a few default user groups (though only two of these groups are visible in the management console GUI). To determine how many groups are already present:

```
# config -g config.groups.total
```

Assume this value is six. Make sure to number any new groups you create from seven onwards.

To add a custom group to the configuration with Group name=Group7, Group description=MyGroup and Port access= 1,5 , issue the commands:

```
# config -s config.groups.group7.name=Group7
# config -s config.groups.group7.description=MyGroup
# config -s config.groups.total=7
# config -s config.groups.group7.port1=on
# config -s config.groups.group7.port5=on
```

Assume an RPC device is connected to port 1 on the console manager and the RPC is configured. To allow this group access to RPC outlet number 3 on the RPC device, run the two commands below:

```
# config -s config.ports.port1.power.outlet3.groups.group1=Group7
# config -s config.ports.port1.power.outlet3.groups.total=1 (total number of groups that have access to this outlet)
```

If more groups are allowed access to this power outlet, increment the *'config.ports.port1.power.outlet3.groups.total'* element accordingly.

To allow this group access to network host 5:

```
# config -s config.sdt.hosts.host5.groups.group1=Group7
# config -s config.sdt.hosts.host5.groups.total=1 (total number of groups having access to host)
```

To allow another group named 'Group8' access to the same host:

```
# config -s config.sdt.hosts.host5.groups.group2=Group8
# config -s config.sdt.hosts.host5.groups.total=2 (total number of users having access to host)
```

To delete the Group7, use the following command:

```
# rmuser Group7
```

⚠ **Attention:** The *rmuser* script is a generic script to remove any config element from config.xml correctly. However, any dependencies or references to this group will not be affected. Only the group details are deleted. The administrator is responsible for reviewing *config.xml* and removing group dependencies and references manually, specifically if the group had access to a host or RPC device.

The following command will synchronize the live system with the new configuration:

```
# config -a
```

14.1.4 Authentication

To change the type of authentication for the *console server*:

```
# config -s config.auth.type='authtype'
```

'authtype' can be:

```
Local
LocalTACACS
TACACS
TACACSLocal
TACACSDownLocal
LocalRADIUS
RADIUS
RADIUSLocal
RADIUSDownLocal
LocalLDAP
LDAP
LDAPLocal
LDAPDownLocal
```

To configure TACACS authentication:

```
# config -s config.auth.tacacs.auth_server='comma separated list' (list of remote authentication and authorization servers.)
# config -s config.auth.tacacs.acct_server='comma separated list' (list of remote accounting servers. If unset, Authentication and Authorization Server Address will be used.)
# config -s config.auth.tacacs.password='password'
```

To configure RADIUS authentication:

```
# config -s config.auth.radius.auth_server='comma separated list' (list of remote authentication and authorization servers.)
# config -s config.auth.radius.acct_server='comma separated list' (list of remote accounting servers. If unset, Authentication and Authorization Server Address will be used.)
# config -s config.auth.radius.password='password'
```

To configure LDAP authentication:

```
# config -s config.auth.ldap.server='comma separated list' (list of remote servers.)
# config -s config.auth.ldap.basedn='name' (The distinguished name of the search base. For example: dc=my-company,dc=com)
# config -s config.auth.ldap.binddn='name' (The distinguished name to bind to the server with. The
default is to bind anonymously.)
# config -s config.auth.radius.password='password'
```

The following command will synchronize the live system with the new configuration:

```
# config -r auth
```

14.1.5 Network Hosts

To determine the total number of currently configured hosts:

```
# config -g config.sdt.hosts.total
```

Assume this value is equal to 3. If you add another host, make sure to increment the total number of hosts from 3 to 4:

```
# config -s config.sdt.hosts.total=4
```

If the output is *config.sdt.hosts.total* , assume 0 hosts are configured.

Add Power Device Host

To add a UPS/RPC network host with the following details:

IP address / DNS name	192.168.2.5
Host name	remoteUPS
Description	UPSroom3
Type	UPS
Allowed services	ssh port 22 and https port 443
Log level for services	0

Issue the commands below:

```
# config -s config.sdt.hosts.host4.address=192.168.2.5
# config -s config.sdt.hosts.host4.name=remoteUPS
# config -s config.sdt.hosts.host4.description=UPSroom3
# config -s config.sdt.hosts.host4.device.type=ups
# config -s config.sdt.hosts.host4.tcpports.tcpport1=22
# config -s config.sdt.hosts.host4.tcpports.tcpport1.loglevel=0
# config -s config.sdt.hosts.host4.udpports.udpport2=443
# config -s config.sdt.hosts.host4.udpports.udpport2.loglevel=0
```

The *loglevel* can have a value of 0 or 1.

The default services that should be configured are: *22/tcp (ssh), 23/tcp (telnet), 80/tcp (http), 443/tcp (https), 1494/tcp (ica), 3389/tcp (rdp), 5900/tcp (vnc)*

Add Other Network Host

To add any other type of network host with the following details:

IP address / DNS name	192.168.3.10
Host name	OfficePC
Description	MyPC
Allowed services	ssh port 22,https port 443
log level for services	1

Issue the commands below. If the host is not a PDU or UPS power device, or a server with IPMI power control, leave the device type blank:

```
# config -s config.sdt.hosts.host4.address=192.168.3.10
# config -s config.sdt.hosts.host4.description=MyPC
# config -s config.sdt.hosts.host4.name=OfficePC
# config -s config.sdt.hosts.host4.device.type='' (leave this value blank)
# config -s config.sdt.hosts.host4.tcpports.tcpport1=22
# config -s config.sdt.hosts.host4.tcpports.tcpport1.loglevel=1
# config -s config.sdt.hosts.host4.udpports.tcppport2=443
# config -s config.sdt.hosts.host4.udpports.tcpport2.loglevel=1
```

To add the new host as a managed device, make sure to use the current total number of managed devices + 1, for the new device number.

To get the current number of managed devices:

```
# config -g config.devices.total
```

Assuming we already have one managed device, our new device will be device 2. Issue the following commands:

```
# config -s config. devices.device2.connections.connection1.name=192.168.3.10
# config -s config. devices.device2.connections.connection1.type=Host
# config -s config. devices.device2.name=OfficePC
# config -s config. devices.device2.description=MyPC
# config -s config.devices.total=2
```

The following command will synchronize the live system with the new configuration:

```
# config -hosts
```

14.1.6 Trusted Networks

You can further restrict remote access to serial ports based on the source IP address. To configure this via the command line, do the following:

Determine the total number of existing trusted network rules. If you have no existing rules, assume this is 0.

```
# config -g config.portaccess.total
```

This command should display *config.portaccess.total 1.*

If you *see config.portaccess.total* , you have 0 rules configured.

Your new rule will be the existing total, plus 1. For example, if the previous command gave you 0, you start with rule number 1. If you already have rule 1, your new rule will be number 2, etc.

To restrict access to serial port 5 to computers from a single class C network (e.g., *192.168.5.0*), issue the following commands (assuming you have a previous rule in place).

Add a trusted network:

```
# config -s config.portaccess.rule2.address=192.168.5.0
# config -s "config.portaccess.rule2.description=foo bar"
# config -s config.portaccess.rule2.netmask=255.255.255.0
# config -s config.portaccess.rule2.port5=on
# config -s config.portaccess.total=2
```

The following command will synchronize the live system with the new configuration:

```
# config -r serialconfig
```

14.1.7 Cascaded Ports

To add a new Secondary device with the following settings:

IP address/DNS name	192.168.0.153
Description	CM in office 42
Label	b096-16
Number of ports	16

The following commands must be issued:

```
# config -s config.cascade.Secondarys.Secondary1.address=192.168.0.153
# config -s "config.cascade.Secondarys.Secondary1.description=B096-16 in office 42"
# config -s config.cascade.Secondarys.Secondary1.label=b096-16
# config -s config.cascade.Secondarys.Secondary1.ports=16
```

The total number of Secondary devices must also be incremented. If this is the first Secondary device being added, type:

```
# config -s config.cascade.Secondarys.total=1
```

Increment this value when adding more Secondary devices.

Note: *If a Secondary device is added using the CLI, the Primary SSH public key will need to be manually copied to every Secondary device before cascaded ports will work. Refer to* ***4. Serial Port, Host, Device and User Configuration.***

The following command will synchronize the live system with the new configuration:

```
# config -r cascade
```

14.1.8 UPS Connections

Managed UPS Systems

Before adding a managed UPS, make sure at least one port has been configured to run in 'device mode', and that the device is set to 'ups'.

To add a managed UPS with the following values:

Connected via	Port 1
UPS name	My UPS
Description	UPS in room 5
Username to connect to UPS	User2
Password to connect to UPS	secret
Shutdown order	2 (0 shuts down first)
Driver	genericups
Driver option - option	option
Driver option - argument	argument
Logging	Enabled
Log interval	2 minutes
Run script when power is critical	Enabled

```
# config -s config.ups.monitors.monitor1.port=/dev/port01
If the port number is higher than 9, eg port 13, enter:
# config -s config.ups.monitors.monitor1.port=/dev/port13

# config -s "config.ups.monitors.monitor1.name=My UPS"
# config -s "config.ups.monitors.monitor1.description=UPS in room 5"
# config -s config.ups.monitors.monitor1.username=User2
# config -s config.ups.monitors.monitor1.password=secret
# config -s config.ups.monitors.monitor1.sdorder=2
# config -s config.ups.monitors.monitor1.driver=genericups
# config -s config.ups.monitors.monitor1.options.option1.opt=option
# config -s config.ups.monitors.monitor1.options.option1.arg=argument
# config -s config.ups.monitors.monitor1.options.total=1
# config -s config.ups.monitors.monitor1.log.enabled=on
# config -s config.ups.monitors.monitor1.log.interval=2
# config -s config.ups.monitors.monitor1.script.enabled=on
```

Make sure to increment the total monitors:

```
# config -s config.ups.monitors.total=1
```

The five commands below will add the UPS to 'Managed devices. Assuming there are already two managed devices configured:

```
# config -s "config.devices.device3.connections.connection1.name=My UPS"
# config -s "config.devices.device3.connections.connection1.type=UPS Unit"
# config -s "config.devices.device3.name=My UPS"
# config -s "config.devices.device3.description=UPS in toom 5"
# config -s config.devices.total=3
```

To delete this managed UPS:

```
# config -d config.ups.monitors.monitor1
```

Decrement *monitors.total* when deleting a managed UPS

Remote UPS Systems

To add a remote UPS with the following details (assuming this is your first remote UPS):

UPS name	oldUPS
Description	UPS in room 2
Address	192.168.50.50
Log status	Disabled
Log rate	240 seconds
Run shutdown script	Enabled

```
# config -s config.ups.remotes.remote1.name=oldUPS
# config -s "config.ups.remotes.remote1.description=UPS in room 2"
# config -s config.ups.remotes.remote1.address=192.168.50.50
# config -d config.ups.remotes.remote1.log.enabled
# config -s config.ups.remotes.remote1.log.interval=240
# config -s config.ups.remotes.remote1.script.enabled=on
# config -s config.ups.remotes.total=1
```

The following command will synchronize the live system with the new configuration:

```
# config -a
```

14.1.9 RPC Connections

You can add an RPC connection from the command line, but it is not recommended to do so because of dependency issues.

Before adding an RPC, the management console GUI code ensures at least 1 port has been configured to run in 'device mode', and that the device is set to 'rpc'.

To add an RPC with the following values:

RPC type	APC 7900
Connected via	Port 2
UPS name	MyRPC
Description	RPC in room 5
Login name for device	rpclogin
Login password for device	secret
SNMP community	v1 or v2c
Logging	Enabled
Log interval	600 second
Number of power outlets	4 (depends on the type/model of the RPC)

```
# config -s config.ports.port2.power.type=APC 7900
# config -s config.ports.port2.power.name=MyRPC
# config -s "config.ports.port2.power.description=RPC in room 5"
# config -s config.ports.port2.power.username=rpclogin
# config -s config.ports.port2.power.password=secret
# config -s config.ports.port2.power.snmp.community=v1
# config -s config.ports.port2.power.log.enabled=on
# config -s config.ports.port2.power.log.interval=600
# config -s config.ports.port2.power.outlets=4
```

The following five commands are used by the management console to add the RPC to 'Managed Devices':

```
# config -s config.devices.device3.connections.connection1.name=myRPC
# config -s "config.devices.device3.connections.connection1.type=RPC Unit"
# config -s config.devices.device3.name=myRPC
# config -s "config.devices.device3.description=RPC in room 5"
# config -s config.devices.total=3
```

The following command will synchronize the live system with the new configuration:

```
# config -a
```

14.1.10 Environmental

To configure an environmental monitor with the following details:

Monitor name	Envi4
Monitor Description	Monitor in room 5
Temperature offset	2
Humidity offset	5
Enable alarm 1 ?	yes
Alarm 1 label	door alarm
Enable alarm 2 ?	yes
Alarm 2 label	window alarm
Logging enabled ?	yes
Log interval	120 seconds

```
# config -s config.ports.port3.enviro.name=Envi4
# config -s "config.ports.port3.enviro.description=Monitor in room 5"
# config -s config.ports.port3.enviro.offsets.temp=2
# config -s config.ports.port3.enviro.offsets.humid=5
# config -s config.ports.port3.enviro.alarms.alarm1.alarmstate=on
# config -s config.ports.port3.enviro.alarms.alarm1.label=door alarm
# config -s config.ports.port3.enviro.alarms.alarm2.alarmstate=on
# config -s config.ports.port3.enviro.alarms.alarm2.label=window alarm
# config -s config.ports.port3.enviro.alarms.total=2
# config -s config.ports.port3.enviro.log.enabled=on
# config -s config.ports.port3.enviro.log.interval=120
```

It is important to assign alarms.total=2, even if they are off.

The following five commands will add the environmental monitor to 'Managed devices':

To get the total number of managed devices:

```
# config -g config.devices.total
```

Make sure to use the total + 1 for the new device below:

```
# config -s config. devices.device5.connections.connection1.name=Envi4
# config -s "config. devices.device5.connections.connection1.type=EMD Unit"
# config -s config. devices.device5.name=Envi4
# config -s "config. devices.device5.description=Monitor in room 5"
# config -s config.devices.total=5
```

The following command will synchronize the live system with the new configuration:

```
# config -a
```

14.1.11 Managed Devices

To add a managed device: (also see UPS, RPC connections and Environmental)

```
# config -s "config.devices.device8.name=my device"
# config -s "config.devices.device8.description=The eighth device"
# config -s "config.devices.device8.connections.connection1.name=my device"
# config -s config.devices.device8.connections.connection1.type=[serial | Host | UPS | RPC]
# config -s config.devices.total=8    (decrement this value when deleting a managed device)
```

To delete the above managed device:

```
# config -d config.devices.device8
```

The following command will synchronize the live system with the new configuration:

```
# config -a
```

14.1.12 Port Log

To configure serial/network port logging:

```
# config -s config.eventlog.server.address='remote server ip address'
# config -s config.eventlog.server.logfacility='facility'
```

'*facility*' can be:

Daemon
Local 0-7
Authentication
Kernel
User
Syslog
Mail
News
UUCP

```
# config -s config.eventlog.server.logpriority='priority'
```

'*priority*' can be:

Info
Alert
Critical
Debug
Emergency
Error
Notice
Warning

Assume the remote log server needs a username 'name1' and password 'secret':

```
# config -s config.eventlog.server.username=name1
# config -s config.eventlog.server.password=secret
```

To set the remote path as '/tripp-lite/logs' to save logged data:

```
# config -s config.eventlog.server.path=/ tripp-lite/logs
# config -s config.eventlog.server.type=[none | syslog | nfs | cifs | usb]
```

If the server type is set to usb, none of the other values need to be set. The mount point for storing on a remote USB device is */var/run/portmanager/logdir*

The following command will synchronize the live system with the new configuration:

```
# config -a
```

14.1.13 Alerts

You can add an email, SNMP or NAGIOS alert by following the steps below.

General Settings for All Alerts

Assume this is our second alert, and we want to send alert emails to john@tripplite.com and SMS text messages to peter@tripplite.com:

```
# config -s config.alerts.alert2.description=MySecondAlert
# config -s config.alerts.alert2.email=john@ tripplite.com
# config -s config.alerts.alert2.email2=peter@ tripplite.com
```

To use NAGIOS to notify of this alert:

```
# config -s config.alerts.alert2.nsca.enabled=on
```

To use SNMP to notify of this alert:

```
# config -s config.alerts.alert2.snmp.enabled=on
```

Increment the total alerts:

```
# config -s config.alerts.total=2
```

Below are the specific settings, depending on the type of alert required:

Connection Alert

To trigger an alert when a user connects to serial port 5 or network host 3:

```
# config -s config.alerts.alert2.host3='host name'
# config -s config.alerts.alert2.port5=on
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=login
```

Signal Alert

To trigger an alert when a signal changes state on port 1:

```
# config -s config.alerts.alert2.port1=on
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.signal=[ DSR | DCD | CTS ]
# config -s config.alerts.alert2.type=signal
```

Pattern Match Alert

To trigger an alert if the regular expression '.*0.0% id' is found in serial port 10's character stream:

```
# config -s "config.alerts.alert2.pattern=.*0.0% id"
# config -s config.alerts.alert2.port10=on
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=pattern
```

UPS Power Status Alert

To trigger an alert when *myUPS* (on localhost) or *thatUPS* (on remote host *192.168.0.50*) power status changes between on-line, on-battery and low battery:

```
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=ups
# config -s config.alerts.alert2.ups1=myUPS@localhost
# config -s config.alerts.alert2.ups2=thatUPS@192.168.0.50
```

Environmental and Power Sensor Alert

```
# config -s config.alerts.alert2.enviro.high.critical='critical value'
# config -s config.alerts.alert2.enviro.high.warning='warning value'
# config -s config.alerts.alert2.enviro.hysteresis='value'
# config -s config.alerts.alert2.enviro.low.critical='critical value'
# config -s config.alerts.alert2.enviro.low.warning='warning value'
# config -s config.alerts.alert2.enviro1='Enviro sensor name'
# config -s config.alerts.alert2.outlet#='RPCname'.outlet#
```

'alert2.outlet#' increments sequentially with each added outlet. The second 'outlet#' refers to the specific RPC power outlets.

```
# config -s config.alerts.alert2.rpc#='RPC name'
# config -s config.alerts.alert2.sensor=[ temp | humid | load | charge]
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=enviro
# config -s config.alerts.alert2.ups1='UPSname@hostname'
```

Example 1: To configure a temperature sensor alert for a sensor called 'SensorInRoom42':

```
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.enviro.high.critical=60
# config -s config.alerts.alert2.enviro.high.warning=50
# config -s config.alerts.alert2.enviro.hysteresis=2
# config -s config.alerts.alert2.enviro.low.critical=5
# config -s config.alerts.alert2.enviro.low.warning=10
# config -s config.alerts.alert2.enviro1=SensorInRoom42
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=enviro
```

Example 2: To configure a load sensor alert for outlets 2 and 4 for an RPC called 'RPCInRoom20':

```
# config -s config.alerts.alert2.outlet1='RPCname'.outlet2
# config -s config.alerts.alert2.outlet2='RPCname'.outlet4
# config -s config.alerts.alert2.enviro.high.critical=300
# config -s config.alerts.alert2.enviro.high.warning=280
# config -s config.alerts.alert2.enviro.hysteresis=20
# config -s config.alerts.alert2.enviro.low.critical=50
# config -s config.alerts.alert2.enviro.low.warning=70
# config -s config.alerts.alert2.rpc1=RPCInRoom20
# config -s config.alerts.alert2.sensor=load
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=enviro
```

Alarm Sensor Alert

To set an alert for 'doorAlarm' and 'windowAlarm', which are two alarms connected to an environmental sensor called 'SensorInRoom3'. Both alarms are disabled on Mondays from 8:15 am to 2:30 pm:

```
# config -s config.alerts.alert2.alarm1=SensorInRoom3.alarm1 (doorAlarm)
# config -s config.alerts.alert2.alarm1=SensorInRoom3.alarm2 (windowAlarm)
# config -s config.alerts.alert2.alarmrange.mon.from.hour=8
# config -s config.alerts.alert2.alarmrange.mon.from.min=15
# config -s config.alerts.alert2.alarmrange.mon.until.hour=14
# config -s config.alerts.alert2.alarmrange.mon.until.min=30
# config -s config.alerts.alert2.description='description'
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=alarm
```

To enable an alarm for the entire day:

```
# config -s config.alerts.alert2.alarmrange.mon.from.hour=0
# config -s config.alerts.alert2.alarmrange.mon.from.min=0
# config -s config.alerts.alert2.alarmrange.mon.until.hour=0
# config -s config.alerts.alert2.alarmrange.mon.until.min=0
```

The following command will synchronize the live system with the new configuration:

```
# config -r alerts
```

14.1.14 SMTP and SMS

To set up an SMTP mail or SMS server with the following details:

Outgoing server address	mail.tripplite.com
Secure connection type	SSL
Sender	john@tripplite.com
Server username	john
Server password	secret
Subject line	SMTP alerts

```
# config -s config.system.smtp.server=mail.tripplite.com
# config -s config.system.smtp.encryption=SSL (can also be TLS or None )
# config -s config.system.smtp.sender=john@tripplite.com
# config -s config.system.smtp.username=john
# config -s config.system.smtp.password=secret
# config -s config.system.smtp.subject=SMTP alerts
```

To set up an SMTP SMS server with the same details as above:

```
# config -s config.system.smtp.server2=mail.tripplite.com
# config -s config.system.smtp.encryption2=SSL (can also be TLS or None )
# config -s config.system.smtp.sender2=john@tripplite.com
# config -s config.system.smtp.username2=john
# config -s config.system.smtp.password2=secret
# config -s config.system.smtp.subject2=SMTP alerts
```

The following command will synchronize the live system with the new configuration:

```
# config -a
```

14.1.15 SNMP

To set up the SNMP agent on the device:

```
# config -s config.system.snmp.protocol=[ UDP | TCP ]
# config -s config.system.snmp.trapport='port number' (default is 162)
# config -s config.system.snmp.address='NMS IP network address'
# config -s config.system.snmp.commnity='community name' (v1 and v2c only)
# config -s config.system.snmp.engineid='ID' (v3 only)
# config -s config.system.snmp.username='username' (v3 only)
# config -s config.system.snmp.password='password' (v3 only)
# config -s config.system.snmp.version=[ 1 | 2c | 3 ]
```

The following command will synchronize the live system with the new configuration:

```
# config -a
```

14.1.16 Administration

To change the administration settings to:

System Name	og.mydomain.com
System Password (root account)	secret
Description	Device in office 2

```
# config -s config.system.name=og.mydomain.com
# config -P config.users.user1.password            (will prompt user for a password)
# config -s "config.system.location=Device in office 2"
```

***Note:** The -P parameter will prompt the user for a password and encrypt it. The value of any config element can be encrypted using the -P parameter, but only encrypted user passwords and system passwords are supported. If any other element value were to be encrypted, the value will become inaccessible and must be reset.*

An alternative to the second command above is:

```
# /etc/scripts/user-mod -P root
```

The following command will synchronize the live system with the new configuration:

```
# config –a
```

14.1.17 IP Settings

To configure the primary network interface with static settings:

IP address	192.168.0.23
Netmask	255.255.255.0
Default gateway	192.168.0.1
DNS server 1	192.168.0.1
DNS server 2	192.168.0.2

```
# config -s config.interfaces.wan.address=192.168.0.23
# config -s config.interfaces.wan.netmask=255.255.255.0
# config -s config.interfaces.wan.gateway=192.168.0.1
# config -s config.interfaces.wan.dns1=192.168.0.1
# config -s config.interfaces.wan.dns2=192.168.0.2
# config -s config.interfaces.wan.mode=static
# config -s config.interfaces.wan.media=[ Auto | 100baseTx-FD | 100baseTx-HD | 10baseT-HD ]
10baseT-FD
```

To enable bridging between all interfaces:

```
# config -s config.system.bridge.enabled=on
```

To enable IPv6 for all interfaces:

```
# config -s config.system.ipv6.enabled=on
```

To configure the management LAN interface, use the same commands as above but replace:

config.interfaces.wan, with config.interfaces.lan

To enable the management LAN interface, run the following command:

```
 config -d config.interfaces.lan.disabled
config -r ipconfig
```

Note: *Not all devices have a management LAN interface.*

To configure a failover device in case of an outage:

```
# config -s config.interfaces.wan.failover.address1='ip address'
# config -s config.interfaces.wan.failover.address2='ip address'
# config -s config.interfaces.wan.failover.interface=[ eth1 | console | modem ]
```

The network interfaces can also be configured automatically:

```
# config -s config.interfaces.wan.mode=dhcp
# config -s config.interfaces.lan.mode=dhcp
```

The following command will synchronize the live system with the new configuration:

```
# /bin/config –-run=ipconfig
```

The following command will synchronize the live system with the new configuration:

```
# config -r ipconfig
```

14.1.18 Date and Time Settings

To enable NTP using a server at pool.ntp.org, issue the following commands:

```
# config -s config.ntp.enabled=on
# config -s config.ntp.server=pool.ntp.org
```

Alternately, you can manually change the clock settings:

To change running system time:

```
# date 092216452005.05          Format is MMDDhhmm[[CC]YY][.ss]
```

The following command will save this new system time to the hardware clock:

```
# /bin/hwclock --systohc
```

Alternately, to change the hardware clock:

```
# /bin/hwclock --set --date=092216452005.05    Format is MMDDhhmm[[CC]YY][.ss]
```

The following command will save this new hardware clock time as the system time:

```
# /bin/hwclock --hctosys
```

To change the timezone:

```
# config -s config.system.timezone=US/Eastern
```

The following command will synchronize the live system with the new configuration:

```
# config -r time
```

14.1.19 Dial-In Settings

To enable dial-in access on the DB9 serial port from the command line with the following attributes:

Local IP Address	172.24.1.1
Remote IP Address	172.24.1.2
Authentication Type:	MSCHAPv2
Serial Port Baud Rate:	115200
Serial Port Flow Control:	Hardware
Custom Modem Initialization:	ATQ0V1H0
Callback phone	0800223665
User to dial as	user1
Password for user	secret

Run the following commands:

```
# config -s config.console.ppp.localip=172.24.1.1
# config -s config.console.ppp.remoteip=172.24.1.2
# config -s config.console.ppp.auth=MSCHAPv2
# config -s config.console.speed=115200
# config -s config.console.flow=Hardware
# config -s config.console.initstring=ATQ0V1H0
# config -s config.console.ppp.enabled=on
# config -s config.console.ppp.callback.enabled=on
# config -s config.console.ppp.callback.phone1=0800223665
# config -s config.console.ppp.username=user1
# config -s config.console.ppp.password=secret
```

To make the dialed connection the default route:

```
# config -s config.console.ppp.defaultroute=on
```

Please note that supported authentication types are 'None', 'PAP', 'CHAP' and 'MSCHAPv2'.
Supported serial port baud-rates are '9600', '19200', '38400', '57600', '115200', and '230400'.
Supported parity values are 'None', 'Odd', 'Even', 'Mark' and 'Space'.
Supported data-bits values are '8', '7', '6' and '5'.

Supported stop-bits values are '1', '1.5' and '2'.
Supported flow-control values are 'Hardware', 'Software' and 'None'.

If you do not wish to use out-of-band dial-in access, please note the procedure for enabling start-up messages on the console port is covered in section **15. Advanced Configuration**.

The following command will synchronize the live system with the new configuration:

```
# config –a
```

14.1.20 DHCP Server

To enable the DHCP server on the console management LAN with settings:

Default lease time	200000 seconds
Maximum lease time	300000 seconds
DNS server1	192.168.2.3
DNS server2	192.168.2.4
Domain name	company.com
Default gateway	192.168.0.1
IP pool 1 start address	192.168.0.20
IP pool 1 end address	192.168.0.100
Reserved IP address	192.168.0.50
MAC to reserve IP for	00:1e:67:82:72:d9
Name to identify this host	John-PC

Issue the commands:

```
# config -s config.interfaces.lan.dhcpd.enabled=on
# config -s config.interfaces.lan.dhcpd.defaultlease=200000
# config -s config.interfaces.lan.dhcpd.maxlease=300000
# config -s config.interfaces.lan.dhcpd.dns1=192.168.2.3
# config -s config.interfaces.lan.dhcpd.dns2=192.168.2.4
# config -s config.interfaces.lan.dhcpd.domain=company.com
# config -s config.interfaces.lan.dhcpd.gateway=192.168.0.1
# config -s config.interfaces.lan.dhcpd.pools.pool1.start=192.168.0.20
# config -s config.interfaces.lan.dhcpd.pools.pool1.end=192.168.0.100
# config -s config.interfaces.lan.dhcpd.pools.total=1
# config -s config.interfaces.lan.dhcpd.staticips.staticip1.ip=192.168.0.50
# config -s config.interfaces.lan.dhcpd.staticips.staticip1.mac=00:1e:67:82:72:d9
# config -s config.interfaces.lan.dhcpd.staticips.staticip1.host=John-PC
# config -s config.interfaces.lan.dhcpd.staticips.total=1
```

The following command will synchronize the live system with the new configuration:

```
# config –a
```

14.1.21 Services

You can manually enable or disable network servers from the command line. For example, to guarantee the following server configuration:

HTTP Server	Enabled
HTTPS Server	Disabled
Telnet Server	Disabled
SSH Server	Enabled
SNMP Server	Disabled
Ping Replies (Respond to ICMP echo requests)	Disabled

TFTP server	Enabled

```
# config -s config.services.http.enabled=on
# config -d config.services.https.enabled
# config -d config.services.telnet.enabled
# config -s config.services.ssh.enabled=on
# config -d config.services.snmp.enabled
# config -d config.services.pingreply.enabled
# config -s config.services.tftp.enabled=on
```

To set secondary port ranges for any service:

```
# config -s config.services.telnet.portbase='port base number'     Default: 2000
# config -s config.services.ssh.portbase='port base number'        Default: 3000
# config -s config.services.tcp.portbase='port base number'        Default: 4000
# config -s config.services.rfc2217.portbase='port base number'    Default: 5000
# config -s config.services.unauthtel.portbase='port base number Default: 6000
```

The following command will synchronize the live system with the new configuration:

```
# config -a
```

14.1.22 NAGIOS

To configure NAGIOS with the following settings:

NAGIOS host name	b096-16 (Name of this system)
NAGIOS host address	192.168.0.1 (IP to find this device at)
NAGIOS server address	192.168.0.10 (upstream NAGIOS server)
Enable SDT for NAGIOS ext.	Enabled
SDT gateway address	192.168.0.1 (defaults to host address)
Prefer NRPE over NSCA	Disabled (defaults to Disabled)

```
# config -s config.system.nagios.enabled=on
# config -s config.system.nagios.name=b096-16
# config -s config.system.nagios.address=192.168.0.1
# config -s config.system.nagios.server.address=192.168.0.10
# config -s config.system.nagios.sdt.disabled=on   (disables SDT for nagios extensions)
# config -s config.system.nagios.sdt.address=192.168.0.1
# config -s config.system.nagios.nrpe.prefer=''
```

To configure NRPE with following settings:

NRPE port	5600 (port to listen on for nrpe. Defaults to 5666)
NRPE user	user1 (User to run as. Defaults to nrpe)
NRPE group	group1 (Group to run as. Defaults to nobody)
Allow command arguments	Enabled

```
# config -s config.system.nagios.nrpe.enabled=on
# config -s config.system.nagios.nrpe.port=5600
# config -s config.system.nagios.user=user1
# config -s config.system.nagios.nrpe.group=group1
# config -s config.system.nagios.nrpe.cmdargs=on
```

To configure NSCA with the following settings:

NSCA encryption BLOWFISH (can be: [None | XOR | DES | TRPLEDES | CAST-256 | BLOWFISH | TWOFISH | RIJNDAEL-256 | SERPENT | GOST]

NSCA password	secret
NSCA check-in interval	5 minutes
NSCA port	5650 (defaults to 5667)
user to run as	User1 (defaults to nsca)
group to run as	Group1 (defaults to nobody)

```
# config -s config.system.nagios.nsca.enabled=on
# config -s config.system.nagios.nsca.encryption=BLOWFISH
# config -s config.system.nagios.nsca.secret=secret
# config -s config.system.nagios.nsca.interval=2
# config -s config.system.nagios.nsca.port=5650
# config -s config.system.nagios.nsca.user=User1
# config -s config.system.nagios.nsca.group=Group1
```

The following command will synchronize the live system with the new configuration:

```
# config –a
```

15. Advanced Configuration

Tripp Lite console servers run the embedded Linux operating system. As such, administrator users can configure the console server and monitor, and manage attached serial console and host devices from the command line using Linux commands and the config utility (as described in **14. Configuration from the Command Line**).

The Linux kernel in the console server also supports GNU bash shell script enabling the Administrator to run custom scripts. This chapter presents a number of useful scripts and scripting tools including:

- *delete-node*, a general script for deleting users, groups, hosts, UPS systems, etc.
- *ping-detect,* which will run specified commands when a specific host stops responding to ping requests.

15.1 Custom Scripting

The console server supports GNU *bash* shell commands (refer to **Appendix A**), enabling the Administrator to run custom scripts.

15.1.1 Custom Script to Run when Booting

The */etc/config/rc.local* script runs whenever the system boots. By default, this script file is empty. You can add any commands to this file if you want them to be run at boot time. For example, if you wanted to display *hello world*:

```
#!/bin/sh
echo "Hello World!"
```

If this script has been copied from a Windows computer, you may need to run the following command on the script before *bash* can run it successfully:

```
# dos2unix /etc/config/rc.local
```

Another scenario would be to call another custom script from the */etc/config/rc.local* file, ensuring your custom script will run whenever the system is booted.

15.1.2 Running Custom Scripts when Alerts are Triggered

Whenever an alert is triggered, specific scripts are called. These scripts all reside in */etc/scripts/*. Below is a list of the default scripts that run for each applicable alert:

- For a connection alert (when a user connects or disconnects from a port or network host): */etc/scripts/portmanager-user-alert* (for port connections) or */etc/scripts/sdt-user-alert* (for host connections).
- For a signal alert (when a signal on a port changes state): */etc/scripts/portmanager-signal-alert .*
- For a pattern match alert (when a specific regular expression is found in the serial ports character stream): */etc/scripts/portmanager-pattern-alert .*
- For a UPS status alert (when the UPS power status changes between on line, on battery, and low battery): */etc/scripts/ups-status-alert .*
- For an environmental, power and alarm sensor alerts (temperature, humidity, power load and battery charge alerts): */etc/scripts/environmental-alert .*
- For an interface failover alert: */etc/scripts/interface-failover-alert .*

All of these scripts perform a check to determine whether you have created a custom script to run. The code that performs this check is shown below (an extract from the file /etc/scripts/portmanager-pattern-alert):

```
# If there's a user-configured script, run it instead
scripts[0]="/etc/config/scripts/pattern-alert.${ALERT_PORTNAME}"
scripts[1]="/etc/config/scripts/portmanager-pattern-alert"
for (( i=0 ; i < ${#scripts[@]} ; i++ )); do
   if [ -f "${scripts[$i]}" ]; then
      exec /bin/sh "${scripts[$i]}"
   fi
done
```

This code shows there are two alternative scripts that can be run instead of the default one. This code first checks whether a file "*/etc/config/scripts/pattern-alert.${ALERT_PORTNAME}*" exists. The variable ${ALERT_PORTNAME} must be replaced with "port01" or "port13", or whichever port the alert should run. If this file cannot be found, the script checks whether the file "*/etc/config/scripts/portmanager-pattern-alert*" exists. If either of these files exist, the script calls the *exec* command on the first file that it finds and runs that custom file/script instead.

For example, you can copy the */etc/scripts/portmanager-pattern-alert* script file to */etc/config/scripts/portmanager-pattern-alert*:

```
# cd /
# mkdir /etc/config/scripts (if the directory does not already exist)
# cp /etc/scripts/portmanager-pattern-alert /etc/config/scripts/portmanager-pattern-alert
```

The next step is to edit the new script file. Open the file */etc/config/scripts/portmanager-pattern-alert* using vi (or any other editor), and remove the lines that check for a custom script (the code from above). This will prevent the new custom script from repeatedly calling itself. After these lines have been removed, edit the file or add any additional scripting to the file.

15.1.3 Sample Script - Power Cycling on Pattern Match

For example, if an RPC (PDU) is connected to port 1 on a console server and some telecommunications device connected to port 2, which is powered by the RPC outlet 3. Assuming the telecom device transmits a character stream "EMERGENCY" out on its serial console port every time that it encounters some specific error, the only way to fix this error is to power cycle the telecom device.

The first step is to set up a pattern-match alert on port 2 to check for the pattern "EMERGENCY".

Next, we need to create a custom script for this alert:

```
# cd /
# mkdir /etc/config/scripts (if the directory does not already exist)
# cp /etc/scripts/portmanager-pattern-alert /etc/config/scripts/portmanager-pattern-alert
```

***Note:** To prevent an infinite loop, make sure to remove the* if *statement (which checks for a custom script) from the new script.*

The *pmpower* utility is used to send power commands to an RPC device in order to power cycle the telecom device:

```
# pmpower -l port01 -o 3 cycle (The RPC is on serial port 1. The telecom device is powered by
RPC outlet 3)
```

Now append this command to our custom script. This will guarantee the telecom device will be power cycled every time the console reads the "EMERGENCY" character stream on port 2.

15.1.4 Sample Script - Multiple Email Notifications on Each Alert

If you desire to send more than one email when an alert triggers, you have to create a replacement script using the method described above and add the appropriate lines to your new script.

Currently, there is a script */etc/scripts/alert-email* that runs from within all the alert scripts (e.g., *portmanager-user-alert or environmental-alert*). The alert-email script is responsible for sending the email. The line that invokes the email script appears as follows:

```
/bin/sh /etc/scripts/alert-email $suffix &
```

If you wish to send another email to a single address or the same email to many recipients, edit the custom script appropriately. You can follow the examples in any of the seven alert scripts listed above. In particular, consider the *portmanager-user-alert* script. If you need to send the same alert email to more than one email address, find the lines in the script responsible for invoking the alert-email script, then add the following lines below the existing lines:

```
export TOADDR="emailaddress@domain.com"
/bin/sh /etc/scripts/alert-email $suffix &
```

These two lines assign a new email address to TOADDR and invoke the alert-email script in the background.

15.1.5 Deleting Configuration Values from the CLI

The *delete-node* script is provided to help with deleting nodes from the command line. The *"delete-node"* script takes one argument: the node name you want to delete (e.g., *"config.users.user1"* or *"config.sdt.hosts.host1"*).

Delete-node is a general script for deleting any node you desire (users, groups, hosts, UPS systems, etc.) from the command line. The script deletes the specified node and shuffles the remainder of the node values.

For example, if there are five users configured and we use the script to delete user 3, then user 4 will become user 3, user 5 will become user 4, and so on.

This creates a complication, as this script does NOT check for any other dependencies that the node being deleted may have had. You are responsible for making sure any references and dependencies connected to the deleted node are removed or corrected in the config.xml file.

The script treats all nodes the same. The syntax to run the script is *# ./delete-node {node name}* . To remove user 3:

```
# ./delete-node config.users.user3
```

The *delete-node* script

```
#!/bin/bash
#User must provide the node to be removed. e.g. "config.users.user1"
# Usage: delete-node {full node path}

if [ $# != 1 ]
then
        echo "Wrong number of arguments"
        echo "Usage: delnode {full '.' delimited node path}"
        exit 2
fi

# test for spaces
TEMP=`echo "$1" | sed 's/.* .*/N/'`
if [ "$TEMP" = "N" ]
then
        echo "Wrong input format"
        echo "Usage: delnode {full '.' delimited node path}"
        exit 2
```

```
fi

# testing if node exists
TEMP=`config -g config | grep "$1"`
if [ -z "$TEMP" ]
then
        echo "Node $1 not found"
        exit 0
fi

# LASTFIELD is the last field in the node path e.g. "user1"
# ROOTNODE is the upper level of the node e.g. "config.users"
# NUMBER is the integer value extracted from LASTFIELD e.g. "1"
# TOTALNODE is the node name for the total e.g. "config.users.total"
# TOTAL is the value of the total number of items before deleting e.g. "3"
# NEWTOTAL is the modified total i.e. TOTAL-1
# CHECKTOTAL checks if TOTAL is the actual total items in .xml

LASTFIELD=${1##*.}
ROOTNODE=${1%.*}
NUMBER=`echo $LASTFIELD | sed 's/^[a-zA-Z]*//g'`
TOTALNODE=`echo ${1%.*} | sed 's/\(.*\)/\1.total/'`
TOTAL=`config -g $TOTALNODE | sed 's/.* //'`
NEWTOTAL=$[ $TOTAL -1 ]

# Make backup copy of config file
cp /etc/config/config.xml /etc/config/config.bak
echo "backup of /etc/config/config.xml saved in /etc/config/config.bak"


if [ -z $NUMBER ] # test whether a singular node is being \
#deleted e.g. config.sdt.hosts
then

        echo "deleting $1"
        config -d "$1"

        echo Done
        exit 0

elif [ $NUMBER = $TOTAL ] # Test if only one item exists
then
        echo "only one item exists"
        # Deleting node
        echo "Deleting $1"
        config -d "$1"

        # Modifying item total.
        config -s "$TOTALNODE=0"

        echo Done
        exit 0

elif [ $NUMBER -lt $TOTAL ] # more than one item exists
```

```
then

        # Modify the users list so user numbers are sequential
        # by shifting the users into the gap one at a time...

        echo "Deleting $1"

        LASTFIELDTEXT=`echo $LASTFIELD | sed 's/[0-9]//g'`
        CHECKTOTAL=`config -g $ROOTNODE.$LASTFIELDTEXT$TOTAL`

        if [ -z "$CHECKTOTAL" ]
        then
                echo "WARNING: "$TOTALNODE" greater than number of items"
        fi

        COUNTER=1
        while [ $COUNTER != $((TOTAL-NUMBER+1)) ]
        do

                config -g $ROOTNODE.$LASTFIELDTEXT$((NUMBER+COUNTER)) \
                | while read LINE
                do
                        config -s \
                        "`echo "$LINE" | sed -e "s/$LASTFIELDTEXT$((NUMBER+ \
                        COUNTER))/$LASTFIELDTEXT$((NUMBER+COUNTER-1))/" \
                        -e 's / /=/'`"

                done

                let COUNTER++
        done

        # deleting last user
        config -d $ROOTNODE.$LASTFIELDTEXT$TOTAL

        # Modifying item total.
        config -s "$TOTALNODE=$NEWTOTAL"

        echo Done
        exit 0
else
        echo "error: item being deleted has an index greater than total items. Increase the total count
variable."
        exit 0
fi
```

15.1.6 Power Cycle Any Device upon a Ping Request Failure

The ping-detect script is designed to run specified commands when a monitored host stops responding to ping requests.

The first parameter taken by the *ping-detect* script is the hostname / IP address of the device to ping. Any other parameters are regarded as a command to run whenever the ping to the host fails. Ping-detect can run any number of commands.

Below is an example using ping-detect to power cycle an RPC (PDU) outlet whenever a specific host fails to respond to a ping request. The ping-detect is run from */etc/config/rc.local* to ensure the monitoring starts whenever the system boots.

Assuming a serially controlled RPC is connected to port01 on a console server and a router is powered by outlet 3 on the RPC (and the router has an internal IP address of 192.168.22.2), the following instructions will show you how to continuously ping the router. When the router fails to respond to a series of pings, the console server will send a command to RPC outlet 3 to power cycle the router and write the current date/time to a file:

- Copy the *ping-detect* script to */etc/config/scripts /* on the console server*.*
- Open */etc/config/rc.local* using vi.
- Add the following line to *rc.local*:

  ```
  /etc/config/scripts/ping-detect 192.168.22.2 /bin/bash -c "pmpower -l port01 -o 3 cycle && date" >
  /tmp/output.log &
  ```

The above command will cause the ping-detect script to continuously ping the host at 192.168.22.2 (i.e. the router). If the router crashes, it will no longer respond to ping requests. If this happens, the two commands *pmpower* and *date* will run. The output from these commands is sent to file */tmp/output.log* to maintain a record. The ping-detect is also run in the background using the *"&"*.

Remember the *rc.local* script is only run by default when the system boots. You can manually run the *rc.local* script or the ping-detect script, if desired.

Ping-Detect *S*cript

The above is just one example of using the ping-detect script. The concept behind the script is to run any number of commands when a specific host stops responding to ping requests. Here are details of the *ping-detect* script itself:

```
#!/bin/sh
# Usage: ping-detect HOST [COMMANDS...]
# This script takes 2 types of arguments: hostname/IPaddress to ping, and the commands to
# run if the ping fails 5 times in a row. This script can only take one host/IPaddress per
# instance. Multiple independent commands can be sent to the script. The commands will be
# run one after the other.
#
# PINGREP is the entire reply from the ping command
# LOSS is the percentage loss from the ping command
# $1 must be the hostname/IPaddress of device to ping
# $2... must be the commands to run when the pings fail.
COUNTER=0
TARGET="$1"
shift
# loop indefinitely:
while true
do
        # ping the device 10 times
        PINGREP=`ping -c 10 -i 1 "$TARGET" `
        #get the packet loss percentage
        LOSS=`echo "$PINGREP" | grep "%" | sed -e 's/.* \([0-9]*\)% .*/\1/'`
        if [ "$LOSS" -eq "100" ]
        then
                COUNTER=`expr $COUNTER + 1`
        else
                COUNTER=0
```

```
                sleep 30s
        fi
        if [ "$COUNTER" -eq 5 ]
        then
                COUNTER=0
                "$@"
                sleep 2s
        fi
done
```

15.1.7 Running Custom Scripts when a Configurator is Invoked

A configurator is responsible for reading the values in */etc/config/config.xml* and making the appropriate changes live. Some changes made by the configurators are part of the Linux configuration, such as user passwords or *ipconfig*.

There are currently nineteen configurators, with each responsible for a specific config group (e.g., the *"users"* configurator makes the user configurations in the *config.xml file* live). To see all the available configurators, type the following in a command line prompt:

```
# config
```

When a change is made using the management console web GUI, the appropriate configurator is automatically run. This can be problematic; if another user/administrator makes a change using the management console, the configurator could possibly overwrite any custom CLI/linux configurations you may have set.

The solution to such a situation is to create a custom script that runs after each configurator has run. After each configurator runs, it will check whether that appropriate custom script exists. You can then add any commands to the custom script that will be invoked after the configurator runs.

The custom scripts must be in the correct location:

/etc/config/scripts/config-post-

To create an alerts custom script:

```
# cd /etc/config/scripts
# touch config-post-alerts
# vi config-post-alerts
```

This script could be used to recover a specific backup config, overwrite a config, make copies of config files, etc.

15.1.8 Backing-Up the Configuration and Restoring Using a Local USB Drive

The ***/etc/scripts/backup-usb*** script has been written to save and load custom configuration using a USB flash drive. Before saving the configuration locally, you must prepare the USB storage device for use. To do this, disconnect all USB storage devices, except for the storage device you wish to use.

Usage: */etc/scripts/backup-usb* COMMAND [FILE]

COMMAND:

```
check-magic -- check volume label
set-magic -- set volume label
save [FILE] -- save configuration to USB
delete [FILE] -- delete a configuration tarbal from USB
list -- list available config backups on USB
load [FILE] -- load a specific config from USB
load-default -- load the default configuration
```

set-default [FILE] -- set which file becomes the default

First, check if the USB disk has a label:

```
# /etc/scripts/backup-usb check-magic
```

If this command returns "Magic volume not found", run the following command:

```
# /etc/scripts/backup-usb set-magic
```

To save the configuration:

```
# /etc/scripts/backup-usb save config-20May
```

To check if the backup was saved correctly:

```
# /etc/scripts/backup-usb list
```

If this command does not display *"* config-20May"*, there was an error saving the configuration.

The set-default command takes an input file as an argument and renames it to "default.opg". This default configuration remains stored on the USB disk. The next time you want to load the default config, it will be sourced from the new default.opg file. To set a config file as the default:

```
# /etc/scripts/backup-usb set-default config-20May
```

To load this default:

```
# /etc/scripts/backup-usb load-default
```

To load any other config file:

```
# /etc/scripts/backup-usb load {filename}
```

The */etc/scripts/backup-usb* script can be executed directly with various *COMMANDS* or called from other custom scripts you may create. However, it is recommended that you do not customize the */etc/scripts/backup-usb* script itself.

15.1.9 Backing Up the Configuration Off-Box

If you do not have a USB on your console server, you can back up the configuration to an off-box file. Before backing up, you need to arrange a way to transfer the backup off-box. This could be via an NFS share, a Samba (Windows) share to USB storage or copied off-box via the network. If backing up directly to off-box storage, make sure it is mounted.

/tmp is not a good location for the backup except as a temporary location before transferring it off-box. The */tmp* directory will not survive a reboot. The */etc/config* directory is not a good place either, as it will not survive a restore.

Backup and restore should be done by the root user to ensure correct file permissions are set. The config command is used to create a backup tarball:

```
config -e <Output File>
```

The tarball will be saved to the indicated location. It will contain the contents of the */etc/config /* directory in an uncompressed and unencrypted form.

Example nfs storage:

```
# mount -t nfs 192.168.0.2:/backups /mnt # config -e /mnt/b096.config

# umount/mnt/
```

Example transfer off-box via scp:

```
# config -e /tmp/b096.config
```

# scp /tmp/b096.config username@192.168.0.2:/backups

The config command is also used to restore a backup:

config -i <Input File>

This will extract the contents of the previously created backup to */tmp*, and then synchronize the */etc/config* directory with the copy in */tmp*.

One problem that may arise is lack of space in */tmp* to extract files to. The following command will temporarily increase the size of */tmp*:

mount -t tmpfs -o remount,size=2048k tmpfs /var

If restoring to a new unit or one that has been factory defaulted, it is important to make sure the process generating SSH keys is either stopped or completed before restoring configuration. If this is not done, then a mix of old and new keys may be put in place.

As SSH uses these keys to avoid man-in-the-middle attacks, logging in may be disrupted.

15.2 Advanced Portmanager

Tripp Lite's *portmanger* program manages the console server serial ports. It routes network connection to serial ports, checks permissions, and monitors and logs all the data flowing to/from the ports.

15.2.1 Portmanager Commands

pmshell

The *pmshell* command acts similar to the standard *tip* or *cu* commands, but all serial port access is directed via the portmanager.

Example: To connect to port 8 via the portmanager:

```
# pmshell -l port08
```

pmshell Commands:

Once connected, the pmshell command supports a subset of the '~' escape commands that tip/cu support. For SSH you must prefix the escape with an additional '~' command (i.e. use the '~~' escape).

Send Break: Typing the character sequence '~b' will generate a BREAK on the serial port (if you are doing this over SSH, you will need to type '~~b')

History: Typing the character sequence '~h' will generate a history on the serial port.

Quit pmshell: Typing the character sequence '~.' will exit from pmshell.

Set RTS to 1 run the command: *pmshell --rts=1*

Show all signals: # *pmshell –signals*

```
3DSR=1 DTR=1 CTS=1 RTS=1 DCD=0
```

Read a line of text from the serial port: # *pmshell –getline*

Notes: *Firmware version 3.5.2 and later includes pmshell escape command so you can now hit* ~m *from a connected serial port to drop back to* pmshell*.*

For console servers running firmware version 3.11.0 and above, *pmshell* has a set of built-in key sequences to access the power menu, return to the serial port selection menu, and so on. Extra controls (key sequences) can be added to the built-in key sequences and can be configured per serial port. All ports can behave the same or selectively add control sequences. The controls can be different from port to port for the same function.

For example, you could configure pmshell so that when you are using serial port 2, pressing *Ctrl+p* would take you straight to the power menu for that port.

The *pmshell* control commands are configured only via the command line.

A helper script configures a control command on a range of serial ports to eliminate the cumbersome task of entering the configuration command for every port. You will still need to use this script once per control function (see below). There are only six of control functions.

pmshell control functions and their built in key sequences:

~b - Generate BREAK - send a break to the console.

~h - View history - see the traffic logs for the port (must have port logging enabled).

~p - Power menu - open the power menu for the port (port must be configured for an RPC).

~m - Connect to port menu - go back to the serial port selection menu.

~. - Exit pmshell - exit pmshell completely.

~*?* - Show help message - shows the help message.

Per port control command config parameters:

config.ports.portX.ctrlcode.break - Generate BREAK.

config.ports.portX.ctrlcode.portlog - View History.

config.ports.portX.ctrlcode.power - Power menu.

config.ports.portX.ctrlcode.chooser - Connect to port menu.

config.ports.portX.ctrlcode.quit - Exit pmshell.

config.ports.portX.ctrlcode.help - Show help message.

The *pmshell* help message is NOT updated with the extra control command keys that may be configured. As an example, to configure *Ctrl+p* to open the power menu when using serial port 3, enter the following in the console server's command shell:

```
config -s config.ports.port3.ctrlcode.power=16
killall -HUP portmanager
```

The first command sets the power menu command to listen for Ctrl+p, where decimal 16 is the character code sent when you press Ctrl+p in the serial port session (see the range of control codes below). The second command (killall -HUP portmanager) tells portmanager to reload the configuration so the new control code will take effect. Rebooting the device will also work.

There is a script to set serial control codes on a range of ports so that bulk port configuration can be performed more easily. For example, to set the power menu control code to Ctrl+p (keycode 16) on ports 4 to 10 inclusive, enter the following at the command line:

```
/etc/scripts/set-serial-control-codes 4 10 power 16
```

This sets the power menu control key to Ctrl+p (see the range of control codes below). ***Note:*** *If nothing has been configured on a particular serial port in the included range, configuration for that port will be skipped.*

Control Codes (Ctrl+a=1 ... Ctrl+z=26):

Ctrl+a = 1

Ctrl+b = 2

Ctrl+c = 3

Ctrl+d = 4

Ctrl+e = 5

Ctrl+f = 6

Ctrl+g = 7

Ctrl+h = 8

Ctrl+i = 9

Ctrl+j = 10

Ctrl+k = 11

Ctrl+l = 12

Ctrl+m = 13

Ctrl+n = 14

Ctrl+o = 15

Ctrl+p = 16

Ctrl+q = 17

Ctrl+r = 18

Ctrl+s = 19

Ctrl+t = 20

Ctrl+u = 21

Ctrl+v = 22

Ctrl+w = 23

Ctrl+x = 24

Ctrl+y = 25

Ctrl+z = 26

pmchat

The *pmchat* command acts similar to the standard *chat* command, but all serial port access is directed via the portmanager.

For example, to run a chat script *via* the portmanager:

```
# pmchat -v -f /etc/config/scripts/port08.chat < /dev/port08
```

For more information on using *chat* (and *pmchat*), consult the UNIX manual pages:

http://techpubs.sgi.com/library/tpl/cgibin/getdoc.cgi?coll=linux&db=man&fname=/usr/share/catman/man8/chat.8.html

pmusers

The *pmusers* command is used to query the portmanager for active user sessions.

For example, to detect which users are currently active on which serial ports:

```
# pmusers
```

This command will output nothing if there are no active users currently connected to any ports. Otherwise, it will respond with a sorted list of usernames per active port:

```
Port 1:
        user1
        user2
Port 2:
        user1
Port 8:
        user2
```

The above output indicates a user named "*user1*" is actively connected to ports 1 and 2, while "*user2*" is connected to both ports 1 and 8

With firmware version 3.11 and later, the *pmusers* command is extended with the *--disconnect* option, which allows an admin user or root to disconnect console server sessions from the command line. The following connection types can be disconnected:

telnet
SSH
Raw TCP
Unauth'ed Telnet

You cannot disconnect an *RFC2217* session.

If the *--disconnect* option is specified, the *pmusers* command goes into disconnect mode, where you can specify the users with *-u*, the ports with *-l* (by *label*) or *-n* (by *name*).

By default, the command will prompt the user before actually disconnecting the matching sessions. This can be overridden with the *--no-prompt* argument.

Example: *pmuser* sessions:

```
# pmusers --disconnect
Disconnect all users from all ports? (y/n)
y
5 sessions were disconnected

# pmusers --disconnect -u robertw
Disconnect user robertw from all ports? (y/n)
y
1 session was disconnected

# pmusers --disconnect -u robertw -n 5
Disconnect user robertw from port 5 (BranchRouter01)? (y/n)
y
No sessions were disconnected

# pmusers --disconnect -n 5
Disconnect all users from port 5 (BranchRouter01)? (y/n)
y
2 sessions were disconnected

# pmusers --disconnect -u robertw -u pchunt -n 4 -n 6
Disconnect users robertw, pchunt from ports 4, 6? (y/n)
y
10 sessions were disconnected
```

```
# pmusers --disconnect -u tester --no-prompt
No sessions were disconnected
```

portmanager daemon

There is normally no need to stop and restart the daemon. To restart the daemon normally, simply run the command:

```
# portmanager
```

Supported command line options are:

Force portmanager to run in the foreground: *--nodaemon*

Set the level of debug logging: *--loglevel={debug,info,warn,error,alert}*

Change which configuration file it uses: *-c /etc/config/portmanager.conf*

Signals

Sending a SIGHUP signal to the portmanager will cause it to reread its configuration file.

15.2.2 External Scripts and Alerts

The portmanager has the ability to execute external scripts on certain events.

When a port is opened by the portmanager:

- It attempts to execute */etc/config/scripts/portXX.init* (where XX is the number of the port, *e.g.* 08). The script is run with STDIN and STDOUT, both connected to the serial port.
- If the script cannot be executed, portmanager will execute */etc/config/scripts/portXX.chat* via the chat command on the serial port.

When an alert occurs on a port:

- When an alert occurs on a port, the portmanager will attempt to execute */etc/config/scripts/portXX.alert* (where XX is the port number, e.g. 08).
- The script is run with STDIN containing the data that triggered the alert, and STDOUT redirected to /dev/null, NOT to the serial port. If you wish to communicate with the port, use *pmshell* or *pmchat* from within the script.
- If the script cannot be executed, the alert will be mailed to the address configured in the system administration section.

When a user connects to any port:

- If a file called */etc/config/pmshell-start.sh* exists, it will run when a user connects to a port. It provides two arguments: the "Port number" and the "Username". For example:

```
</etc/config/pmshell-start.sh >
#!/bin/sh
PORT="$1"
USER="$2"
echo "Welcome to port $PORT $USER"
< /etc/config/pmshell-start.sh>
```

- The return value from the script controls whether the user is accepted or not, if 0 is returned (or nothing is done on exit as in the above script) the user is permitted, otherwise the user is denied access.

- Here is a more complex script which reads from configuration to display the port label if available and denies access to the root user:

```
</etc/config/pmshell-start.sh>
#!/bin/sh
PORT="$1"
USER="$2"
LABEL=$(config -g config.ports.port$PORT.label | cut -f2- -d' ')
if [ "$USER" == "root" ]; then
        echo "Permission denied for Super User"
        exit 1
fi
if [ -z "$LABEL" ]; then
echo "Welcome $USER, you are connected to Port $PORT"
else
echo "Welcome $USER, you are connected to Port $PORT ($LABEL)"
fi
</etc/config/pmshell-start.sh>
```

15.3 Raw Access to Serial Ports

15.3.1 Access to Serial Ports

You can use *tip* and *stty* to completely bypass the portmanager and have raw access to the serial ports.

When you run tip on a portmanager-controlled port, portmanager closes that port and stops monitoring it until tip releases control.

With stty, the changes made to the port only "stick" until that port is closed and opened again. It is unlikely stty will be used for anything other than initial debugging of the serial connection.

If you want to use stty to configure the port, you can put stty commands in */etc/config/scripts/portXX.init* which runs whenever portmanager opens the port.

Otherwise, any setup you use with stty will get lost when the portmanager opens the port. The reason portmanager resets back to its config rather than using what is on the port is so the port is in a good state and will work, no matter what things are done to the serial port outside of portmanager.

15.3.2 Accessing the Console/Modem Port

The console dial-in is handled by *mgetty*, with automatic PPP login extensions. mgetty is a smart getty replacement, designed to be used with Hayes-compatible data and data/fax modems. mgetty knows about modem initialization, manual modem answering (so your modem does not answer if the machine is not ready), UUCP locking (so you can use the same device for dial-in and dial-out). mgetty provides extensive logging facilities. All standard mgetty options are supported.

Modem initialization strings:

- To override the standard modem initialization string either use the Management Console (refer to **5. Firewall, Failover and OOB Access**) or the command line config tool (refer to **14. Configuration from the Command Line**).

Enabling boot messages on the console:

- If you are not using a modem on the DB9 console port and instead wish to connect to it directly via Null Modem cable, you may want to enable verbose mode. Verbose mode allows you to see the standard linux start-up messages. This can be achieved with the following commands:

# /bin/config --set=config.console.debug=on # /bin/config --run=console # reboot

- If at some point in the future you chose to connect a modem for dial-in out-of-band access, the procedure can be reversed with the following commands:

  # /bin/config --del=config.console.debug # /bin/config --run=console # reboot

15.4 IP Filtering

The console server uses the *iptables* utility to provide a stateful firewall of LAN traffic. By default, rules are automatically inserted to allow access to enabled services and serial port access via enabled protocols. The commands that add these rules are contained in configuration files:

/etc/config/fw.rules

This is an executable shell script that runs whenever the LAN interface is brought up. Modifications are made to the iptables configuration because of CGI actions or the config command line tool.

The basic steps are as follows:

- Running iptables configuration is erased; per-interface and other standard system chains are installed.
- Fall through Block rules (default deny) are installed.
- **Serial & Network: Services** policies are installed in per-interface chains.
- Custom **Serial & Network: Firewall** rules are inserted at the top of the rule sets, taking priority over any other configuration.

If you require further firewall customization, extra rules can be persisted by creating a file at **/etc/config/scripts/firewall-post** containing iptables commands to amend the firewall policy.

Documentation about using the iptables command can be found at the Linux *netfilter* website *http://netfilter.org/documentation/index.html*.There are also many tutorials available at the netfilter website.

In particular, the tutorials listed on the netfilter how-to page.

15.5 SNMP Status Reporting

All console servers contain an SNMP Service (*snmpd*) which provides status information on demand. *snmpd* is an SNMP agent that binds to a port and awaits requests from SNMP management software. Upon receiving a request, it processes the request(s), collects the requested information and/or performs the requested operation(s) and returns the information to the sender.

***Note:** Initially, only advanced console server models were equipped with an SNMP Service. With firmware version 3.0 (and later), this support was extended to all console servers. Also, the MIBS were extended (and renamed for compliance) with this firmware release.*

All console servers can also be configured to send SNMP traps/messages to multiple remote SNMP Network Managers on defined trigger events. Refer to **7. Alerts, Auto-Response and Logging** for configuration details

15.5.1 Retrieving Status Information using SNMP

Console servers can provide serial and device status information via SNMP. This includes:

- Serial port status
- Active users
- Remote Power Control (RPC) and Power Distribution Unit (PDU) status
- Environmental Monitoring Device (EMD) status
- Signal alert status
- Environmental alert status

– UPS alert status

The MIBs in your console server are located in */etc/snmp/mibs.*

TL-STATUS-MIB.mib – This new MIB contains serial and connected device status information (for snmpstatusd & snmpalertd).

TL-STATUSv2-MIB.mib – This new MIB contains extended status and alert.

TL-SMI-MIB.mib – Enterprise structure of management information.

TLTRAP-MIB.mib – SMIv1 traps from old MIBS (as smilint will not let SMIv1 structures coexist with SMIv2).

15.5.2 Check Firewall Rules

- Select **System: Services.** Ensure the **SNMP daemon** box has been checked for the interface required. This will allow SNMP requests through the firewall for the specified interface.

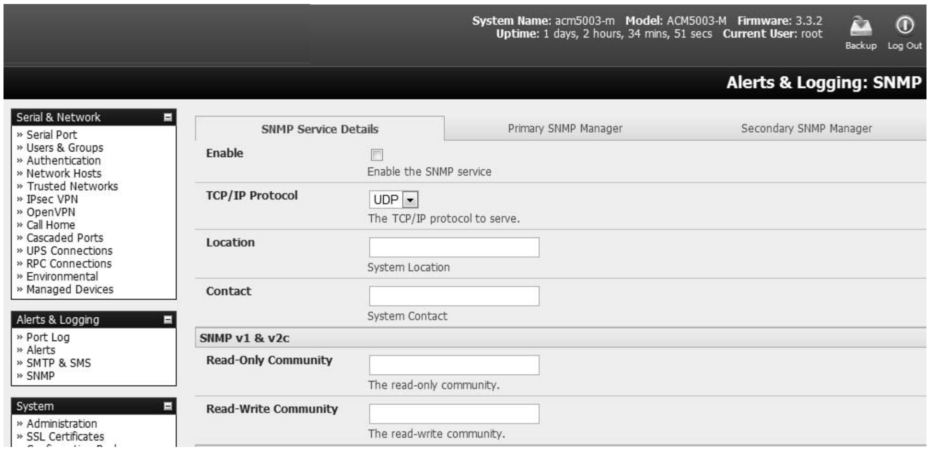
15.5.3 Enable SNMP Service

The console server supports different versions of SNMP, including SNMPv1, SNMPv2c and SNMPv3.

SNMP, although an industry standard, brings with it a variety of security concerns. For example, SNMPv1 and SNMPv2c offer no inherent privacy, while SNMPv3 is susceptible to man-in-the-middle attacks. Recent IETF developments suggests tunnelling SNMP over widely accepted technologies such as SSH (Secure Shell) or TLS (Transport Layer Security) rather than relying on a less mature security systems such as SNMPv3's USM (User-based Security Model).

Additional information regarding SNMP security issues and SNMPv3 can be found at:
http://net-snmp.sourceforge.net/wiki/index.php/TUT:Security
*http://www.ietf.org/html.charters/snmpv3-charter.htm*l.

- Select **Alerts & Logging: SNMP.**



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 2 hours, 34 mins, 51 secs **Current User:** root

Alerts & Logging: SNMP

SNMP Service Details | Primary SNMP Manager | Secondary SNMP Manager

Enable ☐ Enable the SNMP service

TCP/IP Protocol UDP
The TCP/IP protocol to serve.

Location
System Location

Contact
System Contact

SNMP v1 & v2c

Read-Only Community
The read-only community.

Read-Write Community
The read-write community.

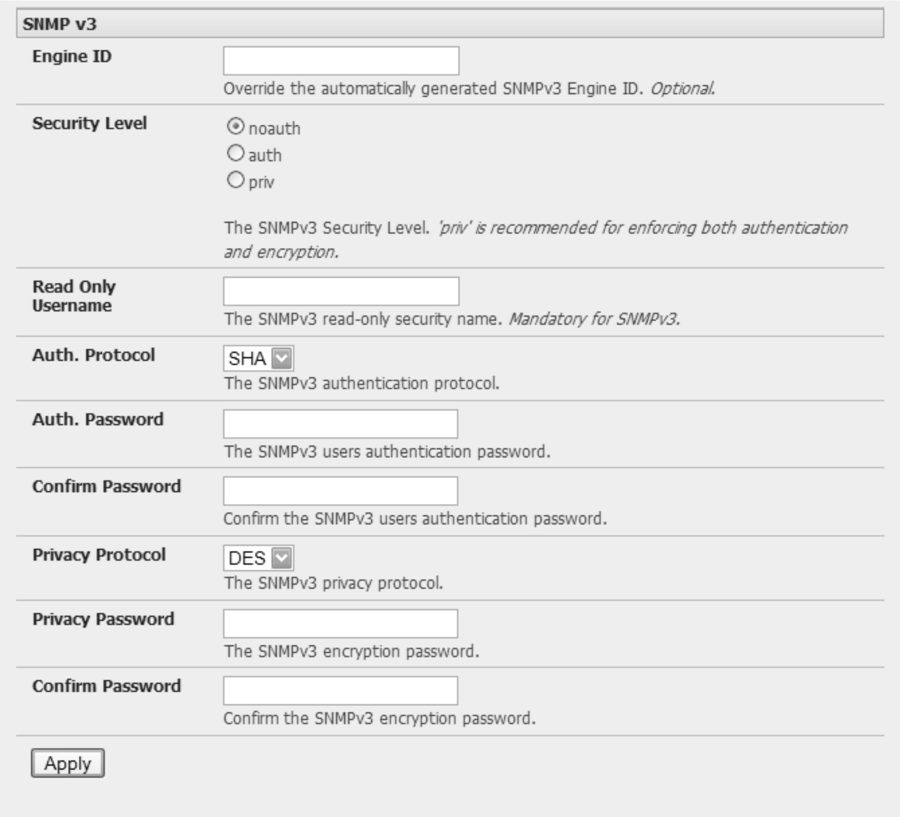
- The **SNMP Service Details** tab is shown by default. The SNMP Service Details tab controls aspects of the SNMP Service, including Security Level. It manages requests from external agents for Tripp Lite status information.
- Check the **Enable the SNMP Service** box to start the SNMP Service. The service is disabled by default.

- Select either **UDP** or **TCP** for the TCP/IP Protocol. UDP is the recommended protocol and selected by default. TCP should only be used in special cases, such as when Port Forwarding SNMP requests/responses to or from the Tripp Lite device is required.
- Complete the **Location** and **Contact** fields. The Location field should describe the physical location of the Tripp Lite device and will be used in response to requests for the SNMPv2-MIB::sysLocation.0 of the device. The Contact field refers to the person responsible for the Tripp Lite device (i.e. System Administrator). This will be used in response to request SNMPv2-MIB::sysContact.0.
- Enter the **Read-Only Community** and **Read-Write Community. <u>This is required for SNMP v1 & v2c only</u>.** The Read-Only Community field is used to specify the SNMPv1 or SNMPv2c community allowed read-only (GET and GETNEXT) access. This must be specified in order for both versions to become enabled. The Read-Write Community field is used to specify the SNMPv1 or SNMPv2c community allowed read-write (GET, GETNEXT and SET) access.
- Configure **SNMP v3,** if required. SNMP v3 provides secure SNMP operations with USM (User-based Security Model). It offers various levels of security, including user-based authentication and basic encryption.
  - The **Engine ID** is used to localize the SNMPv3 user. It will automatically generate from a network interface (eth0) hardware address if left blank, or must be entered as a hex value (e.g., 0x01020304).
  - Specify the **Security Level**:

    noauth No authentication or encryption is required. This is the minimum level of security.

    auth Authentication is required but encryption is not enforced. An authentication protocol (SHA or MD5) and password are required.

    priv Enforces the use of encryption. This is the highest level of security and requires an encryption protocol (DES or AES) and password, in addition to the authentication protocol and password.
  - Complete the **Read Only Username.** Enter the read-only security name. This field is mandatory and must be completed when configuring the console server for SNMPv3.
  - For a **Security Level** of **auth**, select the **Auth. Protocol (SHA** or **MD5)** and the **Auth. Password**. A password of at least 8 characters is required.
  - For a **Security Level** of **priv**, select the **Privacy Protocol (DES** or **AES)** and the **Privacy Password**. **AES** is recommended, as it provides stronger privacy but requires more intense calculations. A password of at least 8 characters is required.
- Click **Apply.**



SNMP v3

Engine ID	Override the automatically generated SNMPv3 Engine ID. *Optional.*
Security Level	● noauth ○ auth ○ priv The SNMPv3 Security Level. *'priv' is recommended for enforcing both authentication and encryption.*
Read Only Username	The SNMPv3 read-only security name. *Mandatory for SNMPv3.*
Auth. Protocol	SHA The SNMPv3 authentication protocol.
Auth. Password	The SNMPv3 users authentication password.
Confirm Password	Confirm the SNMPv3 users authentication password.
Privacy Protocol	DES The SNMPv3 privacy protocol.
Privacy Password	The SNMPv3 encryption password.
Confirm Password	Confirm the SNMPv3 encryption password.

- Set up serial ports and devices per operational requirements, such as UPS, RPC/PDU and EMD.
- Copy the MIBs from /etc/snmp/mibs on the Tripp Lite product to a local directory using *scp* or W*inscp*. For example:

  ```
  scp root@b096:/etc/snmp/mibs/*
  ```

- Using the *snmpwalk* and *snmpget* commands, the status information can be retrieved from any console server. For example:

  ```
  snmpwalk -Oa -v1 -M .:/usr/share/snmp/mibs -c public b096 TL-STATUS-MIB::tlStatus

  snmpget -Oa -v1 -M .:/usr/share/snmp/mibs -c public b096 TL-STATUSMIB::
  tlSerialPortStatusSpeed.2
  ```

noauth

```
snmpwalk -Oa –v3 –l noAuthNoPriv –u readonlyusername -M .:/usr/share/snmp/mibs b096 TL-
STATUS-MIB::tlStatus
```

auth

```
snmpwalk -Oa –v3 –l authNoPriv –u readonlyusername –a SHA –A “authpassword” -M
.:/usr/share/snmp/mibs b096 TL-STATUS-MIB::tlStatus
```

priv

```
snmpwalk -Oa –v3 –l authNoPriv –u readonlyusername –a SHA –A “authpassword” –x DES –X
“privpassword” -M .:/usr/share/snmp/mibs b096 TL-STATUS-MIB::tlStatus
```

-l	Security Level
-u	Security Name or Read Only Username
-a	Authentication Protocol – SHA or MD5
-A	Authentication Password
-x	Privacy Protocol – DES or AES
-X	Privacy Password

A MIB browser may be used to explore the Tripp Lite enterprise MIB structure.

15.5.4 Adding Multiple Remote SNMP Managers

You can add multiple SNMP servers for alert traps and the first and second SNMP servers using the management console (refer to **7. Alerts, Auto-Response and Logging**) or the command line config tool. Further SNMP servers must be added manually using config*.*

Log in to the console server's command line shell as root or an admin user. Refer to the management console UI or user documentation for descriptions of each field.

To set the SNMP Manager Address field:

```
config –set="config.system.snmp.address3=w.x.y.z"
```

.. replacing *w.x.y.z* with the IP address or DNS name.

To set the Manager Trap Port field:

```
config --set=”config.system.snmp.trapport3=162”
```

.. replacing 162 with the TCP/UDP port number.

To set the SNMP Manager Protocol field:

```
config --set="config.system.snmp.protocol3=UDP" or
config --set="config.system.snmp.protocol3=TCP"
```

To set the SNMP Manager Version field:

```
config --set="config.system.snmp.version3=3"
```

To set the SNMP Manager v1 & v2c community field:

```
config --set="config.system.snmp.community3=public"
```

To set the SNMP Manager v3 Engine ID field:

```
config –set="config.system.snmp.engineid3=0x8000000001020304"
```

.. replacing 0x8000000001020304 with the hex Engine-ID

To set the SNMP Manager v3 Security Level field:

```
config --set="config.system.snmp.seclevel3=noAuthNoPriv" or
config --set="config.system.snmp.seclevel3=authNoPriv" or
config --set="config.system.snmp.seclevel3=authPriv"
```

To set the SNMP Manager v3 Username field:

```
config --set="config.system.snmp.username3=username"
```

To set the SNMP Manager v3 Auth. Protocol and password fields:

```
config –set="config.system.snmp.authprotocol3=SHA" or

config --set="config.system.snmp.authprotocol3=MD5"
config --set="config.system.snmp.authpassword3=password 1"
```

To set the SNMP Manager v3 Privacy Protocol and password fields:

```
config –set="config.system.snmp.privprotocol3=AES" or
config –set="config.system.snmp.privprotocol3=DES"
config --set="config.system.snmp.privpassword3=password 2"
```

Once the fields are set, apply the configuration with the following command:

config --run snmp

You can add a third or more SNMP servers by incrementing the "2" in the above commands (e.g., config.system.snmp.protocol3, config.system.snmp.address3, etc.).

15.6 Secure Shell (SSH) Public Key Authentication

This section covers the generation of public and private keys in a Linux and Windows environment and configuring SSH for public key authentication. The steps to use in a clustering environment are:

- Generate a new public and private key pair.
- Upload the keys to the primary device and to each secondary console server.
- Fingerprint each connection to validate.

15.6.1 SSH Overview

Popular TCP/IP applications such as telnet, rlogin, ftp and others transmit their passwords unencrypted. Doing this across pubic networks like the Internet can have catastrophic consequences, as it allows an opening for eavesdropping, connection hijacking, and other network-level attacks.

Secure Shell (SSH) is a program used to log into another computer over a network, execute commands in a remote machine and move files from one machine to another. It provides strong authentication and secure communications over insecure channels.

OpenSSH, the *de facto* open source SSH application, encrypts all traffic (including passwords) to effectively eliminate these risks. Additionally, OpenSSH provides myriad secure tunneling capabilities, as well as a variety of authentication methods.

OpenSSH is the port of OpenBSD's excellent OpenSSH[0] to Linux and other versions of UNIX. OpenSSH is based on the last free version of Tatu Ylonen's sample implementation, with all patent-encumbered algorithms removed (to external libraries), all known security bugs fixed, new features reintroduced and many other fixes. The only changes in the Tripp Lite SSH implementation are:

- PAM support.
- EGD[1]/PRNGD[2] support and replacements for OpenBSD library functions that are absent from other versions of UNIX.
- The config files are now in */etc/config. e.g.*
  - */etc/config/sshd_config* instead of */etc/sshd_config*
  - */etc/config/ssh_config* instead of */etc/ssh_config*
  - */etc/config/users/<username>/.ssh* / instead of */home/<username>/.ssh/*

15.6.2 Generating Public Keys (Linux)

To generate new SSH key pairs, use the Linux *ssh-keygen* command. This will produce an RSA or DSA public/private key pair. You will be prompted for a path to store the two key files e.g. *id_dsa.pub* (the public key) and *id_dsa* (the private key). For example:

```
$ ssh-keygen -t [rsa|dsa]
Generating public/private [rsa|dsa] key pair.
Enter file in which to save the key (/home/user/.ssh/id_[rsa|dsa]):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
```

```
Your identification has been saved in /home/user/.ssh/id_[rsa|dsa].
Your public key has been saved in /home/user/.ssh/id_[rsa|dsa].pub.
The key fingerprint is:
28:aa:29:38:ba:40:f4:11:5e:3f:d4:fa:e5:36:14:d6 user@server
$
```

It is advisable to create a new directory to store your generated keys. It is also possible to name the files after the device for which they will be used. For example:

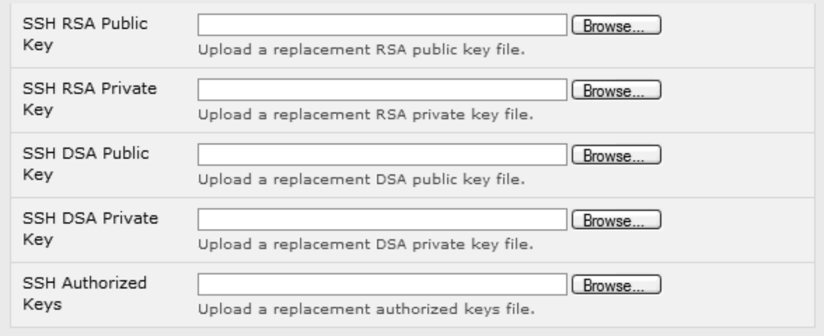
```
$ mkdir keys
$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/user/.ssh/id_rsa): /home/user/keys/control_room
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/user/keys/control_room
Your public key has been saved in /home/user/keys/control_room.pub.
The key fingerprint is:
28:aa:29:38:ba:40:f4:11:5e:3f:d4:fa:e5:36:14:d6 user@server
$
```

You must ensure no password is associated with the keys. If there is a password, the Tripp Lite devices will have no way to supply it as runtime.

Full documentation for the *ssh-keygen* command can be found at *http://www.openbsd.org/cgi-bin/man.cgi?query=ssh-keygen .*

15.6.3 Installing the SSH Public/Private Keys (Clustering)

For Tripp Lite console servers, the keys are simply uploaded through the web interface on the **System: Administration** page. This enables you to upload stored RSA or DSA Public Key pairs to the Primary device and apply the authorized key to the secondary device as described in **4. Serial Port, Host, Device and User Configuration.** Once complete, proceed to Fingerprinting, as described below.



SSH RSA Public Key	Browse... Upload a replacement RSA public key file.
SSH RSA Private Key	Browse... Upload a replacement RSA private key file.
SSH DSA Public Key	Browse... Upload a replacement DSA public key file.
SSH DSA Private Key	Browse... Upload a replacement DSA private key file.
SSH Authorized Keys	Browse... Upload a replacement authorized keys file.

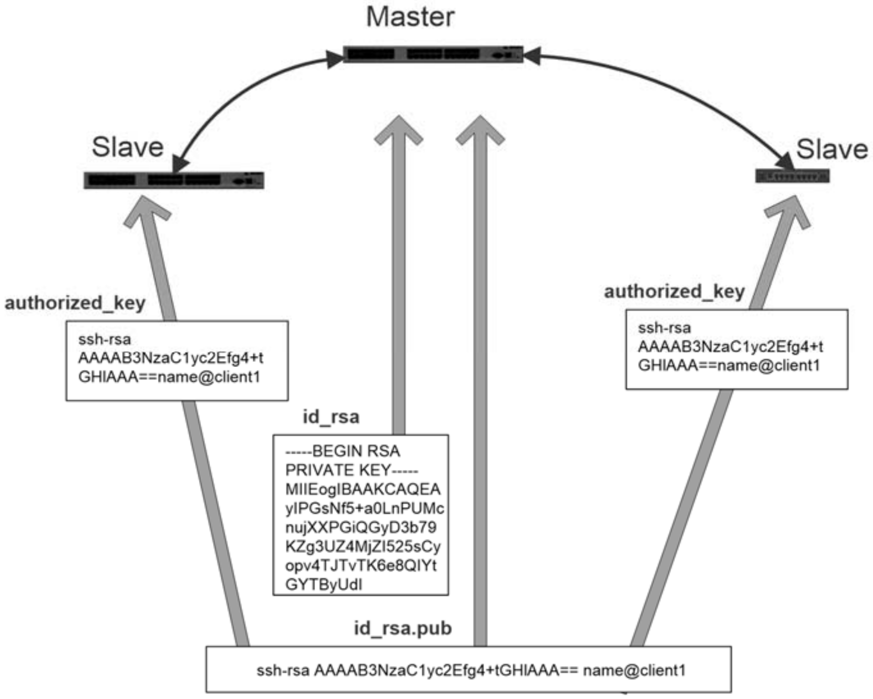
15.6.4 Installing SSH Public Key Authentication (Linux)

Alternately, the public key can be installed on the unit remotely from the Linux host with the *scp* utility as follows:
Assuming the user on the management console is called "fred"; the console server IP address is 192.168.0.1 (default). The public key is on the *linux/unix* computer in *~/.ssh/id_dsa.pub*. Execute the following command on the *linux/unix* computer:

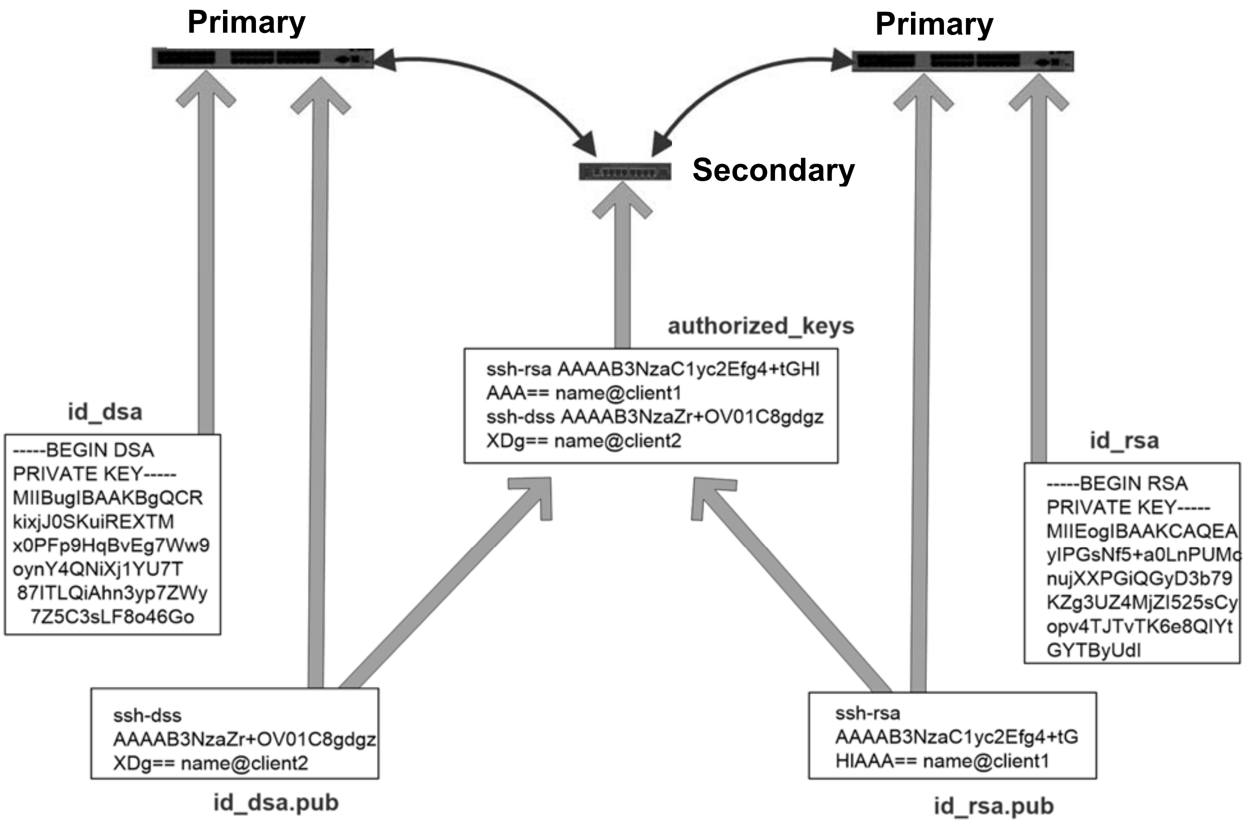
```
scp ~/.ssh/id_dsa.pub \
root@192.168.0.1:/etc/config/users/fred/.ssh/authorized_keys
```

The authorized_keys file on the console server needs to be owned by "fred”. As such, log in to the management console as **root** and type:

chown fred /etc/config/users/fred/.ssh/authorized_keys



If the Tripp Lite device selected to be the server will have only one client device, the *authorized_keys* file is simply a copy of the public key for that device. If one or more devices will be clients of the server, the *authorized_keys* file will contain a copy of all public keys. RSA and DSA keys may be freely mixed in the authorized_keys file. For example, assume we already have one server, called bridge_server, and two sets of key for the control_room and the plant_entrance:
$ ls /home/user/keys control_room control_room.pub plant_entrance plant_entrance.pub $ cat /home/user/keys/control_room.pub /home/user/keys/plant_entrance.pub > /home/user/keys/authorized_keys_bridge_server



More documentation on OpenSSH can be found at:

http://openssh.org/portable.html
http://www.openbsd.org/cgi-bin/man.cgi?query=ssh&sektion=1
http://www openbsd.org/cgi-bin/man.cgi?query=sshd.

15.6.5 Generating Public/Private Keys for SSH (Windows)

This section describes how to generate and configure SSH keys using Windows.

First, create a new user from the Tripp Lite management (the following example uses a user called "testuser"), making sure it is a member of the "users" group.

If you do not already have a public/private key pair, you can generate them now using *ssh-keygen*, *PuTTYgen* or a similar tool:

PuTTYgen: *http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html*

OpenSSH: *http://www.openssh.org/*

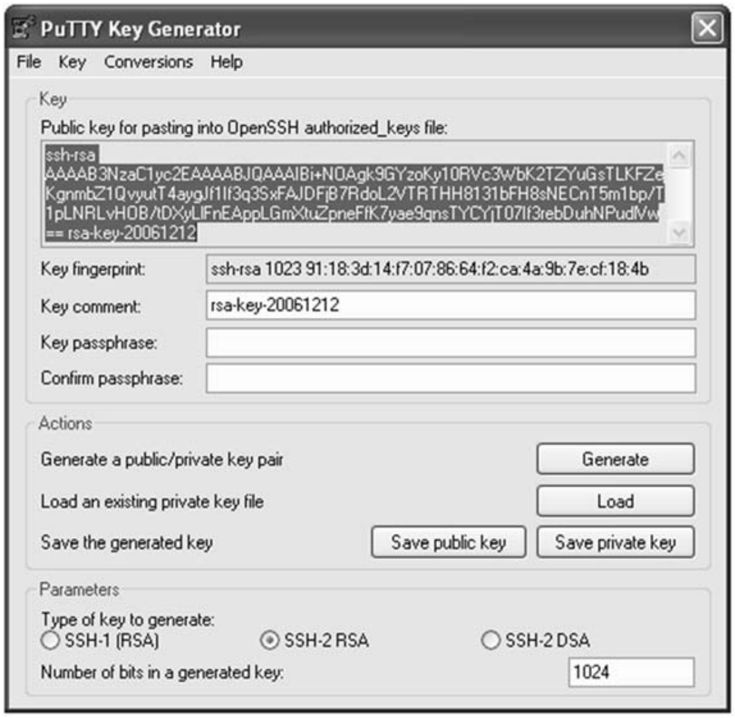
OpenSSH (Windows): *http://sshwindows.sourceforge.net/download/*

For example using PuTTYgen, make sure you have a recent version of the *puttygen.exe* (available from *http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html).* Also, make sure you have a recent version of WinSCP (available from *http://winscp.net/eng/download.php*).

To generate a SSH key using PuTTY *http://sourceforge.net/docs/F02/#clients:*

- Execute the PUTTYGEN.EXE program.
- Select the desired key type *SSH2 DSA* (you may use RSA or DSA) within the **Parameters** section.
- It is important that you leave the passphrase field blank.

- Click on the **Generate** button.
- Follow the instruction to move the mouse over the blank area of the program in order to create random data used by PUTTYGEN to generate secure keys. Key generation will occur once PUTTYGEN has collected sufficient random data.



Public key for pasting into OpenSSH authorized_keys file:

```
ssh-rsa
AAAAB3NzaC1yc2EAAAABJQAAAIBi+NOAgk9GYzoKy10RVc3WbK2TZYuGsTLKFZe
KgnmbZ1QvyutT4aygJf1If3q3SxFAJDFjB7RdoL2VTRTHH8131bFH8sNECnT5m1bp/T
1pLNRLvHOB/tDXyLlFnEAppLGmXtuZpneFfK7yae9qnsTYCYjT07If3rebDuhNPudlVw
== rsa-key-20061212
```

Key fingerprint: ssh-rsa 1023 91:18:3d:14:f7:07:86:64:f2:ca:4a:9b:7e:cf:18:4b

Key comment: rsa-key-20061212

Key passphrase:

Confirm passphrase:

Generate a public/private key pair

Load an existing private key file

Save the generated key

Type of key to generate:
○ SSH-1 (RSA) ● SSH-2 RSA ○ SSH-2 DSA

Number of bits in a generated key: 1024

- Create a new file " *authorized_keys* " (with notepad) and copy your public key data from the "Public key for pasting into OpenSSH authorized_keys file" section of the PuTTY Key Generator. Paste the key data to the "authorized_keys" file. Make sure there is only one line of text in this file.
- Use WinSCP to copy this "authorized_keys" file into the user's home directory. For example, */etc/config/users/testuser/.ssh/authorized_keys* of the Tripp Lite gateway will be the SSH server. You will need to make sure this file is in the correct format with the correct permissions with the following commands:

```
# dos2unix \
/etc/config/users/testuser/.ssh/authorized_keys && chown testuser \
/etc/config/users/testuser/.ssh/authorized_keys
```

- Using WinSCP, copy the attached sshd_config over */etc/config/sshd_config* on the server. Doing this ensures public key authentication is enabled.
- Test the Public Key by logging in as "testuser". Test the Public Key by logging in as "testuser" to the client Tripp Lite device and typing (you should not need to enter anything): # ssh -o StrictHostKeyChecking=no <server-ip>

To automate connection of the SSH tunnel from the client on every power-up, make the *clients /etc/config/rc.local* look like the following:

```
#!/bin/sh
ssh -L9001:127.0.0.1:4001 -N -o StrictHostKeyChecking=no testuser@<server-ip> &
```

This will run the tunnel redirecting local port 9001 to the server port 4001.

15.6.6 Fingerprinting

Fingerprints are used to ensure you are establishing an SSH session to who you think you are. On the first connection to a remote server, you will receive a fingerprint that can be used for future connections.

This fingerprint is related to the host key of the remote server. Fingerprints are stored in *~/.ssh/known_hosts*.

To receive the fingerprint from the remote server, log in to the client as the required user (usually root) and establish a connection to the remote host:

```
# ssh remhost
        The authenticity of host 'remhost (192.168.0.1)' can't be established.
        RSA key fingerprint is 8d:11:e0:7e:8a:6f:ad:f1:94:0f:93:fc:7c:e6:ef:56.
        Are you sure you want to continue connecting (yes/no)?
```

Answer **yes** to accept the key. The following message will appear:

```
        Warning: Permanently added 'remhost,192.168.0.1' (RSA) to the list of
        known hosts.
```

You may be prompted for a password, though there is no need to log in; you will have received the fingerprint and can Ctrl+C to cancel the connection. If the host key changes, you will receive the following warning and not be allowed to connect to the remote host:

```
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@  WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!   @
@ IT IS POSSIBLE THAT SOMEONE IS DOING SOMETHING NASTY! @
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
```

Someone could be eavesdropping on you right now (man-in-the-middle attack)!

It is also possible that the RSA host key has just been changed.

The fingerprint for the RSA key sent by the remote host is:

ab:7e:33:bd:85:50:5a:43:0b:e0:bd:43:3f:1c:a5:f8.

Please contact your system administrator.

Add correct host key in */.ssh/known_hosts* to get rid of this message.

Offending key in */.ssh/known_hosts:1*

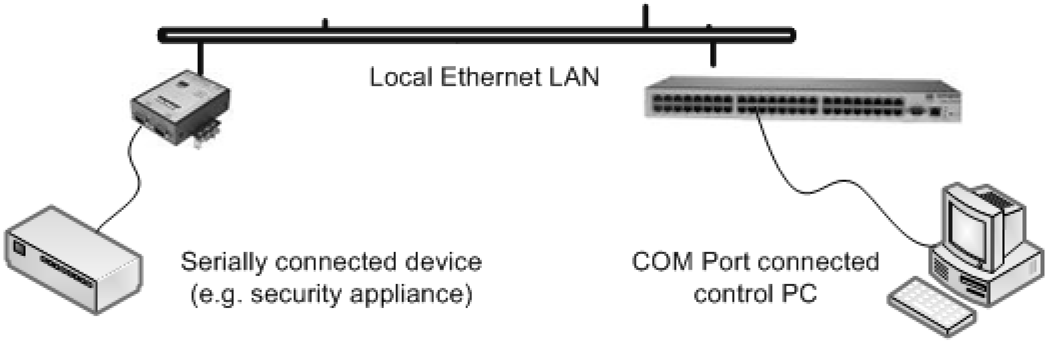
RSA host key for *remhost* has changed and you have requested strict checking.

Host key verification failed.

If the host key has been legitimately changed, it can be removed from the *~/.ssh/known_hosts* file and the new fingerprint added. If it has not changed, this indicates a serious problem that should be investigated immediately.

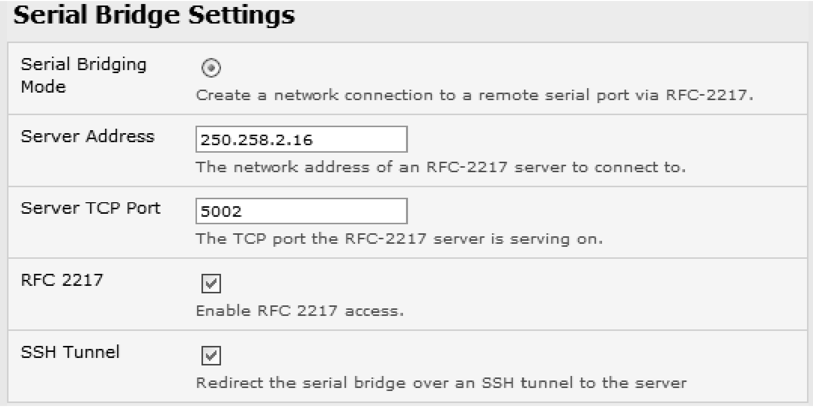
15.6.7 SSH Tunneled Serial Bridging

You have the option to apply SSH tunneling when two Tripp Lite console servers are configured for serial bridging.



As detailed in **4. Serial Port, Host, Device and User Configuration**, the server console server is set up in Console Server mode with either RAW or RFC2217 enabled, and the client console server is set up in Serial Bridging mode with the Server Address and Server TCP Port (4000 + port for RAW or 5000 + port # for RFC2217) specified:

- Select **SSH Tunnel** when configuring the **Serial Bridging Setting.**



Serial Bridge Settings

Serial Bridging Mode	● Create a network connection to a remote serial port via RFC-2217.
Server Address	250.258.2.16 The network address of an RFC-2217 server to connect to.
Server TCP Port	5002 The TCP port the RFC-2217 server is serving on.
RFC 2217	☑ Enable RFC 2217 access.
SSH Tunnel	☑ Redirect the serial bridge over an SSH tunnel to the server

Next, you will need to set up SSH keys for each end of the tunnel and upload these keys to the server and client console servers.

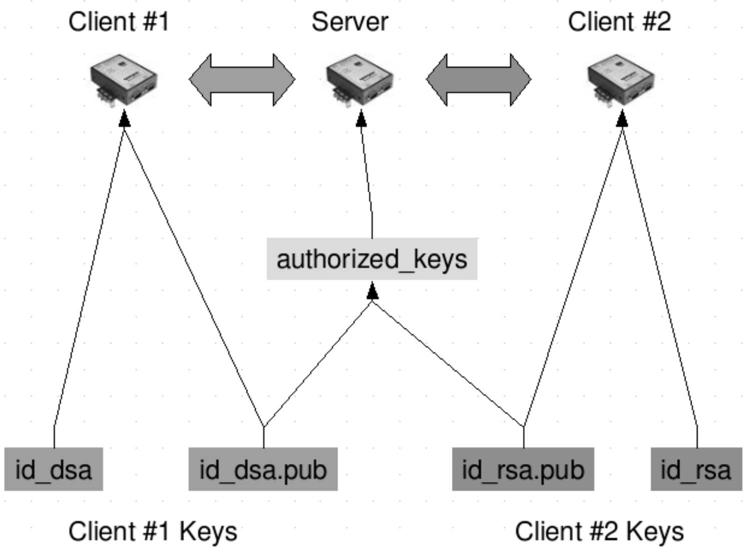
Client Keys

The first step in setting up SSH tunnels is to generate keys. Ideally, you will use a separate, secure machine to generate and store all keys to be used on the console servers. However, if this is not ideal to your situation, keys may be generated on the console servers themselves.

It is possible to generate only one set of keys and reuse them for every SSH session. While this is not recommended, each organization will need to balance the security of separate keys against the additional administration they bring.

Generated keys may be one of two types - RSA or DSA (and it is beyond the scope of this document to recommend one over the other). RSA keys will go into the files *id_rsa* and *id_rsa.pub*. DSA keys will be stored in the files *id_dsa* and *id_dsa.pub*.

For simplicity, the term *private key* will be used from this point forward to refer to either *id_rsa* or *id_dsa* and *public key* to refer to either *id_rsa.pub* or *id_dsa.pub.*



To generate the keys using OpenBSD's OpenSSH suite, use the *ssh-keygen* program:

```
$ ssh-keygen -t [rsa|dsa]
Generating public/private [rsa|dsa] key pair.
Enter file in which to save the key (/home/user/.ssh/id_[rsa|dsa]):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/user/.ssh/id_[rsa|dsa].
Your public key has been saved in /home/user/.ssh/id_[rsa|dsa].pub.
The key fingerprint is:
28:aa:29:38:ba:40:f4:11:5e:3f:d4:fa:e5:36:14:d6 user@server
$
```

It is advisable to create a new directory to store your generated keys. It is also possible to name the files after the device they will be used for. For example:

```
$ mkdir keys
$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/user/.ssh/id_rsa): /home/user/keys/control_room
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/user/keys/control_room
Your public key has been saved in /home/user/keys/control_room.pub.
The key fingerprint is:
28:aa:29:38:ba:40:f4:11:5e:3f:d4:fa:e5:36:14:d6 user@server
$
```

You should ensure there is no password associated with the keys. If there is a password, the console servers will have no way to supply it as runtime.

Authorized Keys

If the console server selected to be the server will have only one client device, then the *authorized_keys* file is simply a copy of the public key for that device. If one or more devices will be clients of the server, the *authorized_keys* file will contain a copy of all of the public keys. RSA and DSA keys may be freely mixed in the *authorized_keys* file.

For example, assume we already have one server, called *bridge_server*, and two sets of keys for the *control_room* and the *plant_entrance*:

```
$ ls /home/user/keys
control_room control_room.pub plant_entrance plant_entrance.pub
$ cat /home/user/keys/control_room.pub
 /home/user/keys/plant_entrance.pub >
 /home/user/keys/authorized_keys_bridge_server
```

Uploading Keys

The server keys can be uploaded through the web interface on the **System: Administration** page. If only one client will be connecting, simply upload the appropriate public key as the authorized keys file. Otherwise, upload the authorized keys file constructed in the previous step.

Each client will then need its own set of keys uploaded through the same page. Take care to ensure the correct type of keys (DSA or RSA) goes in the correct locations and that the public and private keys are in the correct location.

15.6.8 SDT Connector Public Key Authentication

SDT Connector can authenticate against a console server using your SSH key pair, rather than requiring your to enter your password (i.e. public key authentication).

- To use public key authentication with SDT Connector, first create an RSA or DSA key pair (using *ssh-keygen, PuTTYgen* or a similar tool) and add the public part of your SSH key pair to the console server.
- Next, add the private part of your SSH key pair (this file is typically named *id_rsa* or *id_dsa*) to SDT Connector client. Click **Edit: Preferences: Private Keys: Add**, locate the private key file and click **OK**. You do not have to add the public part of your SSH key pair, it is calculated using the private key.

SDT Connector will now use public key authentication when SSH connecting via console server. You may have to restart SDT Connector to shut down any existing tunnels that were established using password authentication.

If you have a host behind the console server that you connect to by clicking the SSH button in SDT Connector, you can also configure it for public key authentication. Essentially, what you are using is SSH over SSH. The two SSH connections are entirely separate, and the host configuration is entirely independent of SDT Connector and the console server. You must configure the SSH client that SDT Connector launches (e.g., Putty, OpenSSH) and the host's SSH server for public key authentication.

15.7 Secure Sockets Layer (SSL) Support

Secure Sockets Layer (SSL) is a protocol developed by Netscape for transmitting private documents *via* the Internet. SSL works by using a private key to encrypt data transferred over the SSL connection.

The console server includes OpenSSL. The OpenSSL Project is a collaborative effort to develop a robust, commercial-grade, full-featured and open source toolkit implementing the Secure Sockets Layer (SSL v2/v3) and Transport Layer Security (TLS v1) protocols, as well as a full-strength general-purpose cryptography library. The project is managed by a worldwide community of volunteers that use the Internet to communicate, plan and develop the OpenSSL toolkit and its related documentation.

OpenSSL is based on the Slay library developed by Eric A. Young and Tim J. Hudson. The OpenSSL toolkit is licensed under an Apache-style license, which means you are free to get and use it for commercial and non-commercial purposes subject to some simple license conditions. In the console server, OpenSSL is used primarily in conjunction with *http* in order to have secure browser access to the GUI management console across insecure networks.

More documentation on OpenSSL is available at:

http://www.openssl.org/docs/apps/openssl.html

http://www.openssl.org/docs/HOWTO/certificates.txt

15.8 HTTPS

The management console UI is served using HTTPS by the built in Cherokee webserver.

If your default network address is changed or the unit is to be accessed using a known domain name, you can use the following steps to replace the default SSL certificate and private key with those tailored for your new address.

15.8.1 Generating an Encryption Key

To create a 1024-bit RSA key with a password, issue the following command on the Linux host command line with the *openssl* utility installed:

```
openssl genrsa -des3 -out ssl_key.pem 1024
```

15.8.2 Generating a Self-Signed Certificate with OpenSSL

This example shows how to use OpenSSL to create a self-signed certificate. OpenSSL is available for most Linux distributions using the default package management mechanism. Windows users can check by going to *http://www.openssl.org/related/binaries.html*.

To create a 1024-bit RSA key and a self-signed certificate, issue the following *openssl* command from the host you have *openssl* installed on:

```
openssl req -x509 -nodes -days 1000 \
                                    -newkey rsa:1024 -keyout ssl_key.pem -out ssl_cert.pem
```

You will be prompted to enter a lot of information. Most does not matter, but the "Common Name" should be the domain name of your computer (e.g., test.tripplite.com). Once everything has been entered, the certificate will be created in a file called *ssl_cert.pem*.

15.8.3 Installing the Key and Certificate

The recommended method for copying files securely to the console server is with an SCP (Secure Copying Protocol) client. The scp utility is distributed with OpenSSH for most UNIX distributions, while Windows users can use something like the PSCP command line utility available with PuTTY.

The files created in the steps above can be installed remotely with the *scp* utility as follows:

```
scp ssl_key.pem root@<address of unit>:/etc/config/
scp ssl_cert.pem root@<address of unit>:/etc/config/
```

or using PSCP:

```
pscp -scp ssl_key.pem root@<address of unit>:/etc/config/
pscp -scp ssl_cert.pem root@<address of unit>:/etc/config/
```

PuTTY and the PSCP utility can be downloaded from:
*http://www.chiark.greenend.org.uk/~sgtatham/putty/download.htm*l.

More detailed documentation on the PSCP can be found at:
http://the.earth.li/~sgtatham/putty/0.58/htmldoc/Chapter5.html#pscp.

15.8.4 Launching the HTTPS Server

The easiest way to enable the HTTPS server is from the web management console. Simply click the appropriate checkbox in **Network: Services: HTTPS Server**. The HTTPS server will be activated, assuming the *ssl_key.pem* & *ssl_cert.pem* files exist in the */etc/config* directory.

Alternately, *inetd* can be configured to launch the secure *fnord* server from the command line of the unit as follows.

Edit the *inetd* configuration file. From the unit command line:

```
vi /etc/config/inetd.conf
```

Append a line:

```
443 stream tcp nowait root sslwrap -cert /etc/config/ssl_cert.pem -key /etc/config/ssl_key.pem -
exec /bin/httpd /home/httpd"
```

Save the file and signal *inetd* of the configuration change.

```
kill -HUP `cat /var/run/inetd.pid`
```

The HTTPS server should be accessible from a web client at a URL similar to: *https://<common name of unit>*

More detailed documentation about the *openssl* utility can be found at: *http://www.openssl.org/*

15.9 Power Strip Control

The console server supports a growing list of remote power-control devices (RPCs), which can be configured using the management console as described in **8. Power, Environment and Digital I/O**. These RPCs are controlled using the open source *PowerMan* and *Network UPS Tools*, and with Tripp Lite's *pmpower* utility.

15.9.1 PowerMan Tool

PowerMan provides power management in a data center or compute cluster environment. It performs operations such as power on, power off and power cycle via remote power controller (RPC) devices.

Synopsis
powerman [-option] [targets]
pm [-option] [targets]

Options
-1, --on Power ON targets.
-0, --off Power OFF targets.
-c, --cycle Power cycle targets.
-r, --reset Assert hardware reset for targets (if implemented by RPC).
-f, --flash Turn beacon ON for targets (if implemented by RPC).
-u, --unflash Turn beacon OFF for targets (if implemented by RPC).
-l, --list List available targets. If possible, output will be compressed into a host range (see TARGET SPECIFICATION below).
-q, --query Query plug status of targets. If none specified, query all targets. Status is not cached; each time this option is used, PowerMan queries the appropriate RPCs. Targets connected to RPCs that could not be contacted (e.g., due to network failure) are reported as status "unknown". If possible, output will be compressed into host ranges.
-n, --node Query node power status of targets (if implemented by RPC). If no targets are specified, query all targets. In this context, a node in the OFF state could be ON at the plug, but operating in standby power mode.

-b, --beacon Query beacon status (if implemented by RPC). If no targets are specified, query all targets.

-t, --temp Query node temperature (if implemented by RPC). If no targets are specified, query all targets. Temperature information is not interpreted by PowerMan and is reported as received from the RPC on one line per target, prefixed by target name.

-h, --help Display option summary.

-L, --license Show PowerMan license information.

-d, --destination host[:port] Connect to a PowerMan daemon on non-default host and optional port.

-V, --version Display the PowerMan version number and exit.

-D, --device Displays RPC status information. If targets are specified, only RPCs matching the target list are displayed.

-T, --telemetry Causes RPC telemetry information to be displayed as commands are processed. Useful for debugging device scripts.

-x, --exprange Expand host ranges in query responses.

For more details, refer to *http://linux.die.net/man/1/powerman.*
Also refer to *powermand* (*http://linux.die.net/man/1/powermand)* documentation and *powerman.conf* (*http://linux.die.net/man/5/powerman.conf*).

Target Specification
PowerMan target hostnames may be specified as comma-separated or space-separated hostnames or host ranges. Host ranges are of the general form: prefix[n-m,l-k,...], where n < m and l < k, etc. This form should not be confused with regular expression character classes (also denoted by "[]"). For example, foo[19] does not represent foo1 or foo9, but rather represents a degenerate range: foo19.

This range syntax is meant only as a convenience on clusters with a prefix NN naming convention. Range specification should not be considered necessary; the list foo1,foo9 could be specified as such, or by the range foo[1,9].

Some examples of PowerMan targets include:

Power on hosts bar,baz,foo01,foo02,...,foo05: *powerman --on bar baz foo[01-05]*

Power on hosts bar,foo7,foo9,foo10: *powerman --on bar,foo[7,9-10]*

Power on foo0,foo4,foo5: *powerman --on foo[0,4-5]*

As a reminder, some shells will interpret brackets ([and]) for pattern matching. Depending on your shell, it may be necessary to enclose ranged lists within quotes. For example, in tcsh, the last example above should be executed as:

powerman --on "foo[0,4-5]"

15.9.2 Pmpower tool

The *pmpower* utility is a high-level tool for manipulating remote preconfigured power devices connected to the console server via serial or network connection. The PDU, UPS and IPMI power devices are variously controlled using the open source *PowerMan, IPMItool* or *Network UPS Tools.* Tripp Lite's *pmpower* utility arches over these tools so devices can be controlled through the one command line:

pmpower [-?h] [-l device | -r host] [-o outlet] [-u username] [-p password] action

-?/-h This help message.
-l The serial port to use.
-o The outlet on the power target to apply to.
-r The remote host address for the power target.
-u Override the configured username.
-p Override the configured password.
on This *action* switches the specified device or outlet(s) on.

off This *action* switches the specified device or outlet(s) off.
cycle This *action* switches the specified device or outlet(s) off and on again.
status This *action* retrieves the current status of the device or outlet.

Examples:

To turn outlet 4 of the power device connected to serial port 2 on: # *pmpower -l port02 -o 4 on*

To turn an IPMI device off located at IP address 192.168.1.100 (where username is 'root' and password is 'calvin': # *pmpower -r 192.168.1.100 -u root -p calvin off*

Default system power device actions are specified in */etc/powerstrips.xml*. Custom power devices can be added in */etc/config/powerstrips.xml*. If an action is attempted which has not been configured for a specific power device, *pmpower* will exit with an error.

15.9.3 Adding New RPC Devices

There are a number of simple paths to adding support for new RPC devices.

The first is to have scripts support the particular RPC included in either the open source *PowerMan* project *(http://sourceforge.net/projects/powerman)* or the open source *NUT UPS Tools* project. The PowerMan device specifications are rather peculiar, and it is suggested you leave the actual writing of these scripts to the PowerMan authors. However, documentation on how they work can be found at *http://linux.die.net/man/5/powerman.dev*. The Network UPS Tools (NUT) project has recently moved on from its UPS management origins to also cover SNMP PDUs (and embrace PowerMan). Tripp Lite progressively includes the updated PowerMan and NUT build into the console server firmware releases.

The second path is to directly add support for the new RPC devices (or to customize the existing RPC device support) on your console server. The **Manage: Power** page uses information contained in */etc/powerstrips.xml* to configure and control devices attached to a serial port. The configuration also searches for (and loads) */etc/config/powerstrips.xml ,* if it exists.

The user can add their own support for more devices by adding their definitions into */etc/config/powerstrips.xml*. This file can be created on a host system and copied to the management console device using *scp*. Alternately, log in to the management console and use *ftp* or *wget* to transfer files.

Here is a brief description of the elements of the XML entries in */etc/config/powerstrips.xml*:

```
<powerstrip>
        <id>Name or ID of the device support</id>
        <outlet port="port-id-1">Display Port 1 in menu</outlet>
        <outlet port="port-id-2">Display Port 2 in menu</outlet>
        ...
        <on>script to turn power on</on>
        <off>script to power off</off>
        <cycle>script to cycle power</cycle>
        <status>script to write power status to /var/run/power-status</status>
        <speed>baud rate</speed>
        <charsize>character size</charsize>
        <stop>stop bits</stop>
        <parity>parity setting</parity>
</powerstrip>
```

The *id* appears on the web page in the list of available devices types to configure.

The outlets describe targets that the scripts can control. For example, a power control board may control several different outlets. The port-id is the native name for identifying the outlet. This value will be passed to the scripts in the environment variable *outlet*, allowing the script to address the correct outlet.

There are four possible scripts: *on, off, cycle* and *status*.

When a script is run, its standard input and output is redirected to the appropriate serial port. The script receives the outlet and port in the *outlet* and *port* environment variables, respectively.

The script can be anything that can be executed within the shell.

All of the existing scripts in */etc/powerstrips.xml* use the pmchat utility.

pmchat works just like the standard UNIX "chat" program, except it ensures interoperation with the port manager.

The final options *speed, charsize, stop* and *parity* define the recommended or default settings for the attached device.

15.10 IPMItool

The console server includes the *ipmitool* utility for managing and configuring devices that support the Intelligent Platform Management Interface (IPMI) versions 1.5 and 2.0 specifications.

IPMI is an open standard for monitoring, logging, recovery, inventory and control of implemented hardware independent of the main CPU, BIOS and OS. The service processor (or Baseboard Management Controller, BMC) is the brain behind platform management. Its primary purpose is to handle autonomous sensor monitoring and event logging.

The *ipmitool* program provides a simple command-line interface to the BMC. It features the ability to read the sensor data repository (SDR) and print sensor values, display the contents of the System Event Log (SEL), print Field Replaceable Unit (FRU) inventory information, read and set LAN configuration parameters, and perform remote chassis power control.

SYNOPSIS

```
ipmitool [-c|-h|-v|-V] -I open <command>

ipmitool [-c|-h|-v|-V] -I lan -H <hostname>
   [-p <port>]
   [-U <username>]
   [-A <authtype>]
   [-L <privlvl>]
   [-a|-E|-P|-f <password>]
   [-o <oemtype>]
   <command>

ipmitool [-c|-h|-v|-V] -I lanplus -H <hostname>
   [-p <port>]
   [-U <username>]
   [-L <privlvl>]
   [-a|-E|-P|-f <password>]
   [-o <oemtype>]
   [-C <ciphersuite>]
   <command>
```

Description

This program lets you manage Intelligent Platform Management Interface (IPMI) functions of either the local system via a kernel device driver or a remote system using IPMI version 1.5 and 2.0. These functions include printing FRU information, LAN configuration, sensor readings and remote chassis power control.

IPMI management of a local system interface requires a compatible IPMI kernel driver to be installed and configured. On Linux systems, this driver is called *OpenIPMI* and is included in standard distributions. On Solaris systems, this driver is called BMC and is included in Solaris 10. Management of a remote station requires the IPMI-over-LAN interface to be enabled and configured. Depending on the particular requirements of each system, it may be possible to enable the LAN interface using ipmitool over the system interface.

Options

-a Prompt for the remote server password.

-A <*authtype*>
Specify an authentication type to use during IPMIv1.5 *lan* session activation. Supported types are NONE, PASSWORD, MD5, or OEM.

-c Present output in CSV (comma separated variable) format. This is not available with all commands.

-C <*ciphersuite*>
The remote server authentication, integrity, and encryption algorithms to use for IPMIv2 *lanplus* connections. See table 22-19 in the IPMIv2 specification. The default is 3, which specifies RAKP-HMAC-SHA1 authentication, HMAC-SHA1-96 integrity, and AES-CBC-128 encryption algorithms.

-E The remote server password is specified by the environment variable *IPMI_PASSWORD*.

-f <*password_file*>
Specifies a file containing the remote server password. If this option is absent, or if password_file is empty, the password will default to NULL.

-h Get basic usage help from the command line.

-H <*address*>
Remote server address. Can be IP address or hostname. This option is required for *lan* and *lanplus* interfaces.

-I <*interface*>
Selects IPMI interface to use. Supported interfaces that are compiled in are visible in the usage help output.

-L <*privlvl*>
Force session privilege level. Can be CALLBACK, USER, OPERATOR, and ADMIN. Default is ADMIN.

-m <*local_address*>
Set the local IPMB address. The default is 0x20. There is no need to change this setting under normal operation.

-o <*oemtype*>
Select the OEM type to support. This usually involves minor hacks in place in the code to work around quirks in various BMCs from various manufacturers. Use *-o list* to see a list of current supported OEM types.

-p <*port*>
Remote server UDP port to connect to. Default is 623.

-P <*password*>
Remote server password is specified on the command line. If supported, it will be obscured in the process list. ***Note:*** *Specifying the password as a command line option is not recommended.*

-t <*target_address*>
Bridge IPMI requests to the remote target address.

-U <*username*>
Remote server username, default is NULL user.

-v Increase verbose output level. This option may be specified multiple times to increase the level of debug output. If given three times, you will get hexdumps of all incoming and outgoing packets.

-V Display version information.

If no password method is specified, ipmitool will prompt the user for a password. If no password is entered at the prompt, the remote server password will default to NULL.

Security

The ipmitool documentation highlights several security issues that should be considered before enabling the IPMI LAN interface. A remote station has the ability to control a system's power state as well as the ability to gather certain platform information. To reduce vulnerability, it is strongly advised that the IPMI LAN interface only be enabled in 'trusted' environments where system security is not an issue, where there is a dedicated secure management network, or access has been provided through a console server.

It is strongly advised you should not enable IPMI for remote access without setting a password and that the password should not be the same as any other password on that system.

When an IPMI password is changed on a remote machine with the IPMIv1.5 *lan* interface, the new password is sent across the network as clear text. This could be observed and then used to attack the remote system. As such, it is recommended that IPMI password management only be performed over IPMIv2.0 *lanplus* interface or the system interface on the local station.

For IPMI v1.5, the maximum password length is 16 characters. Passwords longer than 16 characters will be truncated.

For IPMI v2.0, the maximum password length is 20 characters. Passwords longer than 20 characters will be truncated.

Commands

help

This can be used to get command-line help on *ipmitool* commands. It may also be placed at the end of commands to get option usage help.

```
ipmitool help
```

```
Commands:
   raw   Send a RAW IPMI request and print
         response
   lan    Configure LAN Channels
   chassis Get chassis status and set power
         state
   event  Send pre-defined events to MC
   mc   Management Controller status and
         global enables
   sdr   Print Sensor Data Repository
         entries and readings
   sensor Print detailed sensor information
   fru    Print built-in FRU and scan SDR
         for FRU locators
   sel     Print System Event Log (SEL)
   pef     Configure Platform Event Filtering
         (PEF)
   sol     Configure IPMIv2.0 Serial-over-LAN
   isol    Configure IPMIv1.5 Serial-over-LAN
   user    Configure Management Controller
         users
   channel   Configure Management Controller
         channels
   session   Print session information
   exec    Run list of commands from file
   set     Set runtime variable for shell and
         exec
```

```
ipmitool chassis help
```

```
Chassis Commands: status, power, identify, policy, restart_cause, poh, bootdev
```

```
ipmitool chassis power help
```

chassis power Commands: status, on, off, cycle, reset, diag, soft

You will find more details on *ipmitools* at http://*ipmitool*.sourceforge.net/manpage.html.

15.11 Custom Development Kit (CDK)

Copy scripts, binaries and configuration files directly to the console server.

Tripp Lite also provides a free development kit that allows changes to be made to the software in console server firmware image. The customer can use the CDK to:

- Generate a firmware image without certain programs such as telnet, which may be banned by company policy.
- Generate an image with new programs such as custom Nagios plug-in binaries or company specific binary utilities.
- Generate an image with custom defaults (e.g., it may be required that the console server be configured to have a specific default serial port profile which is reverted to in the event of a factory reset.
- Place configuration files into the firmware image, which cannot then be modified. For example, # /bin/config –-set= tools update the configuration files in /etc/config which are read/write, whereas the files in /etc are read only and cannot be modified.

The CDK provides a snapshot of the Tripp Lite build process (taken after the programs have been compiled and copied to a temporary directory *romfs*) just before the compressed file systems are generated.

When the console servers are cascaded, the Primary unit is in control of the serial ports on the Secondary units, and the primary's management console provides a consolidated view of the settings for both its own and all the secondary unit's serial ports. However, the Primary unit does not provide a fully consolidated view. For example, **Status: Active Users** only displays those users active on the Primary unit's ports; you will need to write a custom bash script that parses the port logs if you want to find out who's logged in to cascaded serial ports from the Primary.

You will also want to enable remote or USB logging. Local logs only buffer 8K of data and do not persist between reboots.

This script would parse each port log file line by line. For example, each time it sees *'LOGIN: username'*, it adds username to the list of connected users for that port, and each time it sees *'LOGOUT: username'* it removes it from the list. In doing this, the list can be neatly formatted and displayed. It is also possible to run this as a CGI script on the remote log server.

To enable log storage and connection logging:
- Select **Alerts & Logging: Port Log**.
- **Configure** log storage.
- Select **Serial & Network: Serial Port**. Edit the serial port(s).
- Under **Console server**, select **Logging Level 1** and click **Apply**.

A useful tutorial on creating a bash script CGI can be found at:
http://www.yolinux.com/TUTORIALS/LinuxTutorialCgiShellScript.html

Similarly, the Primary unit will maintain a view of the status of the secondary units:
- Select **Status: Support Report.**
- Scroll down to **Processes.**
- Look for: ***/bin/ssh -MN -o ControlPath=/var/run/cascade/%h Secondaryname***
  These are the Secondary units that are connected.
- The end of the Secondary units' names will be truncated, so the first five characters must be unique.

Alternately, you can write a custom CGI script as described above. The connected Secondary units can be determined by running: *ls /var/run/cascade*. The configured Secondarys can be displayed by running: *config -g config.cascade.Secondarys*

15.12 SMS Server Tools

Firmware releases V3.1 and later include the SMS Server Tools software, which provides an SMS gateway that sends and receives short messages through GSM modems and mobile phones.

You can send short messages by simply storing text files into a special spool directory. The program monitors this directory and sends new files automatically. It also stores received short messages into another directory as text files. Binary messages (including Unicode text) are also supported (e.g., ring tone messages). It is also possible to send a WAP Push message to the WAP / MMS capable mobile phone.

The program can be run as an SMS daemon, which can be started automatically when the operating system starts. High availability can be ensured by using multiple GSM devices (currently up to 64, though this limit is easily changeable).

The program can run other external programs or scripts after events like receiving a new message and successfully sending a message. It can inform when the program detects a problem. These programs can inspect the related text files and perform automatic actions

The SMS Server Tools software needs a GSM modem (or mobile phone) with SMS command set according to the European specifications GSM 07.05 (=ETSI TS 300 585) and GSM 03.38 (=ETSI TS 100 900). AT command set is supported. Devices can be connected with serial port, infrared or USB.

For more information, refer to *http://smstools3.kekekasvi.com.*

15.13 Multicast

By default, all Tripp Lite console servers come with multicasting enabled. Multicasting provides Tripp Lite products with the ability to simultaneously transmit information from a single device to a select group of hosts.

Multicasting can be disabled and re-enabled from the command line when used with firmware release version 3.1 and later. To disable multicasting type:

```
ifconfig eth0 -multicast
```

To re-enable multicasting from the command line type:

```
ifconfig eth0 multicast
```

IPv6 may need to be restarted when toggling between multicast states.

15.14 Bulk Provisioning

Tripp Lite devices include wizard scripts to facilitate configuration and deployment *en masse*. These wizards operate at the command line level, so knowledge of the Linux command line and shell scripting is useful, but not necessary. Rather, they aim to be sufficiently user-friendly for remote hands to manage. This bulk-provisioning feature is supported by firmware version 3.9.1 or later.

The basic steps are:

1. Configure an individual "*golden Primary*" appliance with the baseline configuration shared by all Tripp Lite devices. This may be a minimal configuration if the installs are quite diverse, or a complete configuration when dealing with replicated installs.

2. Use make-template to turn the golden Primary's active configuration into a template configuration that may be applied to other devices.

3. Create an OPG backup of the templated golden Primary appliance.

4. Restore this configuration to each target devices via the CLI, web UI or using a USB thumb drive.

5. Login via the CLI to complete configuration using *setup-wizard*.

15.15 Zero Touch Provisioning

Zero Touch Provisioning (ZTP) was introduced with firmware release 3.15.1 to allow Tripp Lite devices to be provisioned during their initial boot from a DHCP server.

15.15.1 Preparation

These are typical steps for configuration over a trusted network:

1. Configure a same-model Tripp Lite device.
2. Optionally use the Bulk Provisioning wizard scripts to remove any appliance-specific settings (i.e. create a template configuration). Refer to **15.15 Bulk Provisioning** for more information.
3. Save the configuration as a Tripp Lite backup (.opg) file under **System: Configuration Backup** in the web UI, or via *config -e* in the CLI. Alternately, you can save the XML configuration as a file ending in *.xml*.
4. Publish the .opg or.xml file on a fileserver that understands one of the HTTPS, HTTP, FTP or TFTP protocols.
5. Configure your DHCP server to include a "vendor specific" option for Tripp Lite devices. The option text should be a URL to the location of the .opg or .xml file. The option text should not exceed 250 characters in length. It must end in either .opg or .xml.
6. Connect a new Tripp Lite device (either at defaults from the factory, or config erased) to the network. Apply power.
7. It may take up to 5 minutes for the device to find the .opg or .xml file via DHCP, download, install file and reboot.

15.15.2 Example ISC DHCP Server Configuration

The following is an example of an ISC DHCP server configuration fragment for serving an .opg configuration image:

```
option space tripp-lite code width 1 length width 1;
option tripp-lite.config-url code 1 = text;


class " tripp-lite -ztp" {
 match if option vendor-class-identifier ~~ "^Tripp Lite /";
```

```
     vendor-option-space tripp-lite;
     option tripp-lite.config-url "https://example.com/opg/${class}.opg";
    }
```

For other DHCP servers, please consult their documentation on specifying "Vendor Specific" option fields. We use sub-option 1 to hold the URL text.

15.15.3 Set Up an Untrusted LAN

If network security is a concern, you can have remote hands insert a trusted USB flash drive into the Tripp Lite device during provisioning. A summary of the steps required for deploying configuration in an untrusted network is outlined below:

1. Generate an X.509 certificate for the client. Place it and its private key file onto a USB flash drive (concatenated as a single file, client.pem).
2. Set up an HTTPS server that restricts access to the .opg or .xml file for HTTPS connections, providing the client certificate.
3. Save a copy of the CA cert (that signed the HTTP server's certificate) onto the USB flash drive as well (ca-bundle.crt).
4. Insert the USB flash drive into the Tripp Lite device **before connecting to power or the network**.
5. Continue with the steps above, but using only a https URL.
6. A detailed step-by-step document for preparing a USB flash drive and using OpenSSL to create keys is at Howto: set up a USB key for authenticated restore.

15.15.4 How it Works

This section explains in detail how the Tripp Lite device uses DHCP to obtain its initial configuration.

A Tripp Lite console manager is either configured or unconfigured. ZTP needs it to be in an unconfigured state, which is only obtained in the following ways:

- Firmware programming at factory.
- Pressing the **Config Erase** button twice during operation.
- Selecting **Config Erase** under **System: Administration** in the web UI, and rebooting.
- Creating the file /etc/config/.init and then rebooting (command-line)

When an unconfigured Tripp Lite boots, it performs these steps to find a configuration:

- The Tripp Lite device transmits a DHCP DISCOVER request onto its primary network interface (WAN). This DHCP request will carry a vendor class identifier of the form Tripp Lite/model-name (for example, Tripp Lite/B096) and its parameter request list will include option 43 (vendor-specific information).
- On receipt of a DHCP OFFER, the device will use the information in the offer to assign an IPv4 address to its primary network interface, add a default route, and prepare its DNS resolver.
- If the offer also contained an option 43 with sub-option 1, the device interprets the sub-option as a whitespace-separated list of URLs to configuration files to try to restore.
- If an NTP server option was provided in the DHCP offer, the system clock is (quickly) synchronized with the NTP server.
- The system now searches all attached USB storage devices for two optional certificate files. The first file is named ca-bundle.crt, and the second one is whichever one of the following filenames is found first:

  - client-AABBCCDDEEFF.pem (where AABBCCDDEEFF is the MAC address of the primary network interace); or
  - client-MODEL.pem (where MODEL is the (vendor class) model name in lowercase, truncated to before the first hyphen); or
  - client.pem
- If both files are found (ca-bundle.crt and a client.pem), then secure mode is enabled for the next section.
- Each URL in the list obtained from option 43 sub-option 1 is tried in sequence until one succeeds:
  - The URL undergoes substring replacement from the following table:

Substring	Replaced by
${mac}	the 12-digit MAC address of the device, lowercase
${model}	the full model name, in lowercase
${class}	the firmware hardware class
${version}	the firmware version number

  - The resulting URL must end in .opg or .xml (an optional ?query-string is permitted). If it does not, it is skipped and the next URL is tried.
  - In secure mode, the URL must use the https scheme or it is skipped.
  - Otherwise, the available schemes are: http https tftp ftp ftps.
  - The curl program is used to download the URL.
  - In secure mode, the server's certificate must validate against the ca-bundle.crt. The (reqiured) client.pem file is provided to authenticate the client to the server. Please see the curl documentation for the format of these files.
- The URL is downloaded. For .opg files, its header is checked to see if it is compatible with the current device. For .xml files, a parse check is made. If the check fails, the downloaded file is abandoned and the next URL is tried.
- The file is imported into the current configuration.
- The system checks to see if a hostname has been set in the config. If not, it is set to ${model}-${mac}.
- The system checks to see if it is still in an unconfigured state. If it is, then the network interface mode is set to DHCP. This effectively forces the system into a configured state, preventing a future reboot loop.
- The system reboots.

Notes: *If all the URLs were skipped or failed, the system will wait for 30 seconds before retrying. It will retry all URLs up to 10 times. After the 10th retry, the system reboots. If the system has been manually configured in the meantime, the retries stop and ZTP is disabled.*

If no option 43 is received over DHCP, no URLs are downloaded and no reboots occur: the system must be manually configured. Once configured (manually or by ZTP), a Tripp Lite device will no longer request option 43 from the DHCP server, and it will ignore option 43 configuration URLs presented to it.

15.16 Internal Storage

Some models have an internal USB flash drive, a non-volatile **NAND** flash partition, or both, which can be used by portmanager for log storage and the TFTP/FTP server for file storage.

These storage devices are automatically mounted as subdirectories of /var/mnt/. The default directory served by FTP or TFTP is set to the preferred internal storage (if any). Otherwise, it is set to the first detected attached USB storage. The location of portmanager logs must be manually configured.

15.16.1 Filesystem Location of FTP/TFTP Directory

Product	Preferred storage	Directory
B093	Internal flash	/var/mnt/storage.nvlog/tftpboot/
B094	Internal USB flash	/var/mnt/storage.usb/tftpboot/
B095	Internal USB flash option	/var/mnt/storage.usb/tftpboot/
B096	First-attached USB storage (see mounting USB disks section below)	/var/mnt/storage.usb/tftpboot/

15.16.2 Filesystem Location of Portmanager Logs

Port log server type	Directory
USB Flash Memory	/var/mnt/storage.usb/
Non-volatile internal storage	/var/mnt/storage.nvlog/
MicroSD Card	/var/mnt/storage.sd/
Other (NFS, CIFS, etc.)	*As explicitly configured*

15.16.3 Configuring FTP/TFTP Directory

The FTP or TFTP services can be configured to serve different directories via the command line. For example:

```
config -s config.services.ftp.directory=/var/mnt/storage.usb/my-ftp-dir
config -r services
```

The directory will be created if it does not already exist.

15.16.4 Mounting a Preferred USB Disk by Label

The "first" USB storage device is mounted at /var/mnt/storage.usb by detecting the lowest numbered disk partition (e.g., `/dev/sda1)`. However, this can be constrained to match a particular port or a labelled device.

1. Attach the USB disk you plan to use.

2. Look in directories `/dev/disk/by-path/` or `/dev/disk/by-label/` to find a suitably stable way of identifying your disk.

3. Use the following command to see the current device matching string used:

   ```
   config -g config.storage.usb.device
   ```

4. Change the path match with (for example):

   ```
   config -s config.storage.usb.device=/dev/disk/by-label/1103
   ```

APPENDIX A: Linux Commands and Source Code

The console server platform is a dedicated Linux computer optimized to provide monitoring and secure access to serial and network consoles of critical server systems and their supporting power and networking infrastructure.

Tripp Lite console servers are built on the uCLinux distribution as developed by the uCLinux project. This is GPL code, whose source can be found at *http://cvs.uclinux.org*.

Some uCLinux commands have config files that can be altered (e.g., portmanager, inetd, init, sshd).

Other commands you can run and configure (e.g., loopback, bash (shell), ftp, hwclock, iproute, iptables, netcat, ifconfig, mii-tool, netstat, route, ping, portmap, pppd, routed, setserial, smtpclient, stty, stunel, tcpdump, tftp, tip, traceroute).

Below are most of the standard uCLinux and Busybox commands (and some custom Tripp Lite commands) that are in the default build tree. The Administrator can use these to configure the console server, and monitor and manage attached serial console and host devices:

addgroup *	Add a group or add an user to a group
adduser *	Add an user
agetty	Alternative Linux getty
arp	Manipulate the system ARP cache
arping	Send ARP requests/replies
bash	GNU Bourne-Again Shell
busybox	Swiss army knife of embedded Linux commands
cat *	Concatenate FILE(s) and print them to stdout
chat	Useful for interacting with a modem connected to stdin/stdout
chgrp *	Change file access permissions
chmod *	Change file access permissions
chown *	Change file owner and group
config	Tripp Lite tool to manipulate and query the system configuration from the command line
cp *	Copy files and directories
date *	Print or set the system date and time
dd *	Convert and copy a file
deluser *	Delete USER from the system
df *	Report file system disk space usage
dhcpd	Dynamic Host Configuration Protocol server
discard	Network utility that monitors the discard port
dmesg *	Print or control the kernel ring buffer
echo *	Print the specified ARGs to stdout
erase	Tool for erasing MTD partitions
eraseall	Tool for erasing entire MTD partitions
false *	Do nothing, unsuccessful
find	Search for files
flashw	Write data to individual flash devices
flatfsd	Daemon to save RAM file systems back to FLASH
ftp	Internet file transfer program
gen-keys	SSH key generation program
getopt *	Parses command options

gettyd	Getty daemon
grep *	Print lines matching a pattern
gunzip *	Compress or expand files
gzip *	Compress or expand files
hd	ASCII, decimal, hexadecimal, octal dump
hostname *	Get or set hostname or DNS domain name
httpd	Listen for incoming HTTP requests
hwclock	Query and set hardware clock (RTC)
inetd	Network super-server daemon
inetd-echo	Network echo utility
init	Process control initialization
ip	Show or manipulate routing, devices, policy routing and tunnels
ipmitool	Linux IPMI manager
iptables	Administration tool for IPv4 packet filtering and NAT
ip6tables	Administration tool for IPv6 packet filtering
iptables-restore	Restore IP Tables
iptables-save	Save IP Tables
kill *	Send a signal to a process to end gracefully
ln *	Make links between files
login	Begin session on the system
loopback	Tripp Lite loopback diagnostic command
loopback1	Tripp Lite loopback diagnostic command
loopback2	Tripp Lite loopback diagnostic command
loopback8	Tripp Lite loopback diagnostic command
loopback16	Tripp Lite loopback diagnostic command
loopback48	Tripp Lite loopback diagnostic command
ls *	List directory contents
mail	Send and receive mail
mkdir *	Make directories
mkfs.jffs2	Create an MS-DOS file system under Linux
mknod *	Make block or character special files
more *	File perusal filter for crt viewing
mount *	Mount a file system
msmtp	SMTP mail client
mv *	Move (rename) files
nc	TCP/IP Swiss army knife
netflash	Upgrade firmware on ucLinux platforms using the blkmem interface
netstat	Print network connections, routing tables, interface statistics etc
ntpd	Network Time Protocol (NTP) daemon
pgrep	Display process(es) selected by regex pattern
pidof	Find the process ID of a running program
ping	Send ICMP ECHO_REQUEST packets to network hosts
ping6	IPv6 ping
pkill	Sends a signal to process(es) selected by regex pattern
pmchat	Tripp Lite command similar to the standard chat command (via portmanager)
pmdeny	
pminetd	

pmloggerd	
pmshell	Tripp Lite command similar to the standard *tip* or *cu*, but all serial port access is directed via the portmanager
pmusers	Tripp Lite command to query portmanager for active user sessions
portmanager	Tripp Lite command that handles all serial port access
portmap	DARPA port to RPC program number mapper
pppd	Point-to-Point protocol daemon
ps *	Report a snapshot of the current processes
pwd *	Print name of current/working directory
reboot *	Soft reboot
rm *	Remove files or directories
rmdir *	Remove empty directories
routed	Show or manipulate the IP routing table
routed	Show or manipulate the IP routing table
routef	IP Route tool to flush IPv4 routes
routel	IP Route tool to list routes
rtacct	Applet printing /proc/net/rt_acct
rtmon	RTnetlink listener
scp	Secure copy (remote file copy program)
sed *	Text stream editor
setmac	Sets the MAC address
setserial	Sets and reports serial port configuration
sh	Shell
showmac	Shows MAC address
sleep *	Delay for a specified amount of time
smbmnt	Helper utility for mounting SMB file systems
smbmount	Mount an SMBFS file system
smbumount	SMBFS umount for normal users
snmpd	SNMP daemon
snmptrap	Sends an SNMP notification to a manager
sredird	RFC 2217 compliant serial port redirector
ssh	OpenSSH SSH client (remote login program)
ssh-keygen	Authentication key generation, management, and conversion
sshd	OpenSSH SSH daemon
stty	Change and print terminal line settings
stunnel	Universal SSL tunnel
sync *	Flush file system buffers
sysctl	Configure kernel parameters at runtime
syslogd	System logging utility
tar *	The tar archiving utility
tc	Show traffic control settings
tcpdump	Dump traffic on a network
telnetd	Telnet protocol server
tftp	Client to transfer a file from/to tftp server
tftpd	Trivial file Transfer Protocol (tftp) server
tip	Simple terminal emulator/cu program for connecting to modems and serial devices
top	Provide a view of process activity in real time
touch *	Change file timestamps

traceroute	Print the route packets take to network host
traceroute6	Traceroute for IPv6
true *	Returns an exit code of TRUE (0)
umount *	Unmounts file systems
uname *	Print system information
usleep *	Delay for a specified amount of time
vconfig *	Create and remove virtual Ethernet devices
vi *	Busybox clone of the VI text editor
w	Show who is logged on and what they are doing
zcat *	Identical to gunzip -c

Commands appended with '*' come from Busybox (the “Swiss Army Knife” of embedded Linux), found at *http://www.busybox.net/downloads/BusyBox.html*.

Others are generic Linux commands. Most commands use the ***-h*** or ***--help*** argument to provide a terse runtime description of their behavior. More details on the generic Linux commands can found online at *http://en.tldp.org/HOWTO/HOWTO-INDEX/howtos.html* and *http://www.faqs.org/docs/Linux-HOWTO/Remote-Serial-Console-HOWTO.html.*

Using the ***ls*** command lets you view all the commands available in your console server’s */bin* directory.

A number of Tripp Lite tools listed above make it simple to configure the console server and ensure the changes are stored in the console server's flash memory. These commands are covered in the previous chapters and include:

- **config** allows manipulation and querying of the system configuration from the command line. With *config* a new configuration can be activated by running the relevant configurator, which performs the action necessary to make the configuration changes live.
- **portmanager** provides a buffered interface to each serial port. It is supported by the pmchat and pmshell commands, which ensure all serial port access is directed via the portmanager*.*
- **pmpower** is a configurable tool for manipulating remote power devices that are serially or network connected to the console server.
- **SDT Connector** is a java client applet that provides point-and-click SSH tunneled connections to the console server and managed devices.

There are also a number of other CLI commands related to other open source tools embedded in the console server, including:

- **PowerMan** provides power management for many preconfigured remote power controller (RPC) devices. For CLI details, go to *http://linux.die.net/man/1/powerman.*
- **Network UPS Tools (NUT)** provides reliable monitoring of UPS and PDU hardware and ensures safe shutdowns of connected systems. The aim is to monitor every kind of UPS and PDU. For CLI details, go to *http://www.networkupstools.org.*
- **Nagios** is a popular enterprise-class management tool that provides central monitoring of the hosts and services in distributed networks. For CLI details, go to *http://www.nagios.org*.

Many components of the console server software are licensed under the GNU General Public License (version 2), which Tripp Lite supports. You may obtain a copy of the GNU General Public License at ***http://www.fsf.org/copyleft/gpl.html***. Source code will be provided for any of the components of the software licensed under the GNU General Public License upon request.

APPENDIX B: Hardware Specification

FEATURE	VALUE
Dimensions	B093-004-2E4U / B093-008-2E4U / B093-004-2E4U-V / B093-008-2E4U-V / B093-008-2E4U-M: 5 1/8 x 4 3/4 x 1 3/8 in. (13 x 12 x 3.5 cm) B096-016 / B096-032 / B096-048: 17 x 12 x 1.75 in. (43.2 x 31.3. x 4.5 cm) B095-004-1E / B095-003-1E-M: 4.1x3.4x1.1 in. (10.3 x 8.7 x 2.8 cm) B094-008-2E-M-F / B094-008-2E-V: 6.5 x 4 x 1.4 in. (16.6 x 10.2 x 2.8 cm)
Weight	B093-004-2E4U / B093-008-2E4U / B093-004-2E4U-V / B093-008-2E4U-V / B093-008-2E4U-M: 1.3 lb. (0.6 kg) B096-016 / B096-032 / B096-048: 11.8 lb. (5.4 kg) B095-004-1E / B095-003-1E-M: 2.2 lb. (1.0 kg) B094-008-2E-M-F / B094-008-2E-V: 4 lb. (1.8 kg)
Ambient operating temperature	41°F to 122°F (5°C to 50°C)
Non-operating storage temp	(-20°F to 140°F (-30°C to 60°C)
Humidity	5% to 90%
Power	Refer to section **2. Installation**
Power consumption	All less than 30W

APPENDIX C: Safety and Certifications

Please follow the safety precautions below when installing and operating the console server:

- Do not remove the metal covers. There are no serviceable components inside. Opening or removing the cover may expose you to dangerous voltage, which may cause fire or electric shock. Refer all service to Tripp Lite qualified personnel.

- To avoid electric shock, the power cord protective grounding conductor must be connected through to ground.

- Always pull on the plug, not the cable, when disconnecting the power cord from the socket.

Do not connect or disconnect the console server during an electrical storm. It is recommended you use a surge protector or UPS to protect equipment from transient power fluctuations.

Use of this equipment in life support applications where failure of this equipment can reasonably be expected to cause the failure of the life support equipment or to significantly affect its safety or effectiveness is not recommended.

FCC Warning Statement

This device complies with Part 15 of the FCC rules. Operation of this device is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

WEEE Compliance Information for Tripp Lite Customers and Recyclers (European Union)

Under the Waste Electrical and Electronic Equipment (WEEE) Directive and implementing regulations, when customers buy new electrical and electronic equipment from Tripp Lite they are entitled to:

- Send old equipment for recycling on a one-for-one, like-for-like basis (this varies depending on the country)
- Send the new equipment back for recycling when this ultimately becomes waste

Regulatory Compliance Identification Numbers

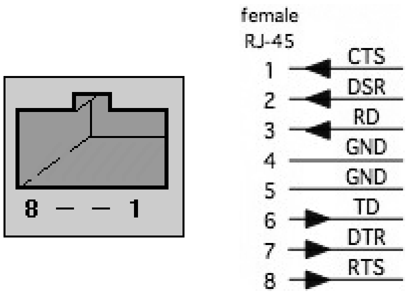
For the purpose of regulatory compliance certifications and identification, your Tripp Lite product has been assigned a unique series number. The series number can be found on the product nameplate label, along with all required approval markings and information. When requesting compliance information for this product, always refer to the series number. The series number should not be confused with the marking name or model number of the product.

APPENDIX D: Connectivity, TCP Ports and Serial I/O

Pin-out standards exist for both DB9 and DB25 connectors. However, there are no pinout standards for serial connectivity using RJ45 connectors. Most console servers and serially managed servers / router / switches / power devices have adopted their own unique pinout, so custom connectors and cables may be required to interconnect your console server.

Serial Port Pinout

The RJ45 connectors on the console servers have the following pinout:



PIN	SIGNAL	DEFINITION	DIRECTION
1	CTS	Clear To Send	Input
2	DSR	Data Set Ready	Input
3	RXD	Receive Data	Input
4	GND	Signal Ground	NA
5	GND	Signal Ground	NA
6	TXD	Transmit Data	Output
7	DTR	Data Terminal Ready	Output
8	RTS	Request To Send	Output

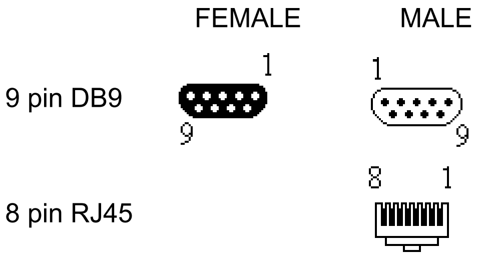
Local Console Port

The LOCAL (console/modem) port on the Console Server uses a standard DB9 connector as tabled below:

RS-232 Standard Pinouts

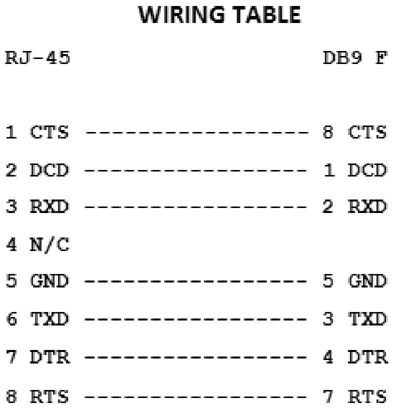
The RS-232 pinout standards for the DB9 connectors are tabled below:

SIGNAL	DB9	DEFINITION
TXD	3	Transmitted Data
RXD	2	Received Data
RTS	7	Request To Send
CTS	8	Clear To Send
DSR	6	Data Set Ready
GND	5	Signal Ground
CD	1	Received Line Signal Detector
DTR	4	Data Terminal Ready
RI	9	Ring Indicator



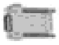
Connectors Included with Console Server

DB9F-RJ45S straight connector

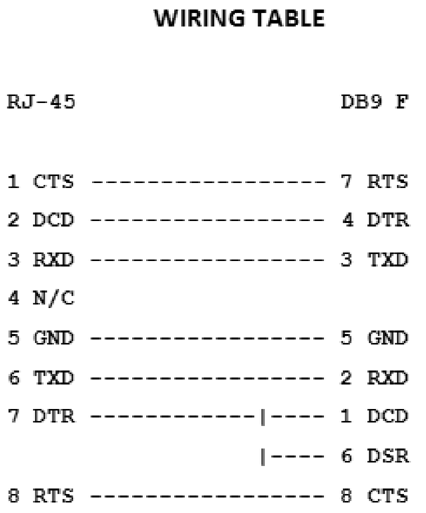


WIRING TABLE

RJ-45		DB9 F
1 CTS	-----------------	8 CTS
2 DCD	-----------------	1 DCD
3 RXD	-----------------	2 RXD
4 N/C		
5 GND	-----------------	5 GND
6 TXD	-----------------	3 TXD
7 DTR	-----------------	4 DTR
8 RTS	-----------------	7 RTS



DB9F-RJ45S cross-over connector



WIRING TABLE

```
RJ-45                  DB9 F

1 CTS ----------------- 7 RTS
2 DCD ----------------- 4 DTR
3 RXD ----------------- 3 TXD
4 N/C
5 GND ----------------- 5 GND
6 TXD ----------------- 2 RXD
7 DTR ------------|---- 1 DCD
                  |---- 6 DSR
8 RTS ----------------- 8 CTS
```

TCP/UDP Port Numbers

Port numbers are divided into three ranges: *Well-Known Ports, Registered Ports* and *Dynamic* and/or *Private Ports*. Well-Known Ports are those from 0 through 1023. Registered Ports are those from 1024 through 49151. Dynamic and/or Private Ports are those from 49152 through 65535.

Well-Known Ports are assigned by IANA. On most systems, they can only be used by system processes or by programs executed by privileged users. The table below shows some of the well-known port numbers. For more details, visit the IANA website*: http://www.iana.org/assignments/port-numbers.*

Port Number	Protocol	TCP/UDP
21	FTP (File Transfer Protocol)	TCP
22	SSH (Secure Shell)	TCP
23	Telnet	TCP
25	SMTP (Simple Mail Transfer Protocol)	TCP
37	Time	TCP, UCP
39	RLP (Resource Location Protocol)	UDP
49	TACACS, TACACS+	UDP
53	DNS	UDP
67	BOOTP server	UDP
68	BOOTP client	UDP
v69	TFTP	UDP
70	Gopher	TCP
79	Finger	TCP
80	HTTP	TCP
110	POP3	TCP
119	NNTP (Network News Transfer Protocol)	TCP
161/162	SNMP	UDP

443	HTTPS	TCP

APPENDIX E: Terminology

TERM	MEANING
3G	Third-generation cellular technology. The standards that determine 3G call for greater bandwidth and higher speeds for cellular networks.
AES	The Advanced Encryption Standard (AES) is a new block cipher standard to replace DES, developed by NIST, the US National Institute of Standards and Technology. AES ciphers use a 128-bit block and 128-, 192-, or 256-bit keys. The larger block size helps resist birthday attacks, while the large key size prevents brute force attacks.
APN	Access Point Name (APN) is used by carriers to identify an IP packet data network that a mobile data user wants to communicate with and the type of wireless service.
Authentication	Authentication is the technique by which a process verifies that its communication partner is who it is supposed to be and not an imposter. Authentication confirms that data is sent to the intended recipient and assures the recipient that the data originated from the expected sender and has not been altered on route.
BIOS	Basic Input/Output System is the built-in software in a computer that are executed on startup (boot) and that determine what the computer can do without accessing programs from a disk. On PCs, the BIOS contains all the code required to control the keyboard, display screen, disk drives, serial communications, and a number of miscellaneous functions.
Bonding	Ethernet Bonding or Failover is the ability to detect communication failure transparently and switch from one LAN connection to another.
BOOTP	Bootstrap Protocol. A protocol that allows a network user to automatically receive an IP address and have an operating system boot without user interaction. BOOTP is the basis for the more advanced DHCP.
Certificates	A digitally signed statement that contains information about an entity and the entity's public key, thus binding these two pieces of information together. A certificate is issued by a trusted organization (or entity) called a Certification Authority (CA) after the CA has verified that the entity is who it says it is.
Certificate Authority	A Certificate Authority is a trusted third party, which certifies public keys to truly belong to their claimed owners. It is a key part of any Public Key Infrastructure, since it allows users to trust that a given public key is the one they wish to use, either to send a private message to its owner or to verify the signature on a message sent by that owner.
Certificate Revocation List	A list of certificates that have been revoked by the CA before they expired. This may be necessary if the private key certificate has been compromised or if the holder of the certificate is to be denied the ability to establish a connection to the console server.
CHAP	Challenge-Handshake Authentication Protocol (CHAP) is used to verify a user's name and password for PPP Internet connections. It is more secure than PAP, the other main authentication protocol.
DES	The Data Encryption Standard is a block cipher with 64-bit blocks and a 56-bit key.

DHCP	Dynamic Host Configuration Protocol. A communications protocol that assigns IP addresses to computers when they are connected to the network.
DNS	Domain Name System that allocates Internet domain names and translates them into IP addresses. A domain name is a meaningful and easy to remember name for an IP address.
DUN	Dial-up Networking.
Encryption	The technique for converting a readable message (plaintext) into apparently random material (ciphertext) which cannot be read if intercepted. The proper decryption key is required to read the message.
Ethernet	A physical layer protocol based upon IEEE standards.
Firewall	A network gateway device that protects a private network from users on other networks. A firewall is usually installed to allow users on an intranet access to the public Internet without allowing public Internet users access to the intranet.
Gateway	A machine that provides a route (or pathway) to the outside world.
Hub	A network device that allows more than one computer to be connected as a LAN, usually using UTP cabling.
Internet	A worldwide system of computer networks - a public, cooperative, and self-sustaining network of networks accessible to hundreds of millions of people worldwide. The Internet is technically distinguished because it uses the TCP/IP set of protocols.
Intranet	A private TCP/IP network within an enterprise.
IPMI	Intelligent Platform Management Interface (IPMI) is a set of common interfaces to a computer system that system administrators can use to monitor system health and manage the system. The IPMI standard defines the protocols for interfacing with a service processor embedded into a server platform.
Key lifetimes	The length of time before keys are renegotiated.
LAN	Local Area Network.
LDAP	The Lightweight Directory Access Protocol (LDAP) is based on the X.500 standard, but significantly simpler and more readily adapted to meet custom needs. The core LDAP specifications are all defined in RFCs. LDAP is a protocol used to access information stored in an LDAP server.
LED	Light-Emitting Diode.
MAC address	Every piece of Ethernet hardware has a unique number assigned to it called its MAC address. Ethernet is used locally to connect the console server to the Internet, and it may share the local network with many other devices. The MAC address is used by the local Internet router in order to direct console server traffic to it rather than someone else in the local area. It is a 48-bit number usually written as a series of 6 hexadecimal octets (e.g., 00:d0:cf:00:5b:da). A console server has a MAC address listed on a label underneath the device.

MSCHAP	Microsoft Challenge Handshake Authentication Protocol (MSCHAP) is authentication for PPP connections between a computer using a Microsoft Windows operating system and a network access server. It is more secure than PAP or CHAP, and is the only option that also supports data encryption.
NAT	Network Address Translation. The translation of an IP address used on one network to an IP address on another network. Masquerading is one particular form of NAT.
Net mask	The way that computers know which part of a TCP/IP address refers to the network, and which part refers to the host range.
NFS	Network File System is a protocol that allows file sharing across a network. Users can view, store, and update files on a remote computer.
NTP	Network Time Protocol (NTP) used to synchronize clock times in a network of computers.
OUT OF BAND	Out-of-Band (OOB) management is any management done over channels and interfaces that are separate from those used for user/customer data. Examples include a serial console interface or a network interface connected to a dedicated management network that is not used to carry customer traffic, or to a BMC/service processor. Any management done over the same channels and interfaces used for user/customer data is In Band.
PAP	Password Authentication Protocol (PAP) is the usual method of user authentication used on the internet: sending a username and password to a server where they are compared with a table of authorized users. Whilst most common, PAP is the least secure of the authentication options.
PPP	Point-to-Point Protocol. A networking protocol for establishing simple links between two peers.
RADIUS	The Remote Authentication Dial-In User Service (RADIUS) protocol was developed by Livingston Enterprises as an access server authentication and accounting protocol. The RADIUS server can support a variety of methods to authenticate a user. When it is provided with the username and original password given by the user, it can support PPP, PAP or CHAP, UNIX login, and other authentication mechanisms.
Router	A network device that moves packets of data. A router differs from hubs and switches because it is "intelligent" and can route packets to their final destination.
SIM	Subscriber Identity Module (SIM) card stores unique serial numbers and security authentication used to identify a subscriber on mobile telephony devices.
SMASH	Systems Management Architecture for Server Hardware is a standards-based protocols aimed at increasing productivity of the management of a data center. The SMASH Command Line Protocol (SMASH CLP) specification provides an intuitive interface to heterogeneous servers independent of machine state, operating system or OS state, system topology or access method. It is a standard method for local and remote management of server hardware using out-of-band communication.
SMTP	Simple Mail Transfer Protocol. The console server includes SMTPclient, a minimal SMTP client that takes an email message body and passes it on to an SMTP server (default is the MTA on the local host).

SOL	Serial Over LAN (SOL) enables servers to transparently redirect the serial character stream from the baseboard universal asynchronous receiver/transmitter (UART) to and from the remote-client system over a LAN. With SOL support and BIOS redirection (to serial), remote managers can view the BIOS/POST output when powered on and reconfigured.
SSH	Secure Shell is secure transport protocol based on public-key cryptography.
SSL	Secure Sockets Layer is a protocol that provides authentication and encryption services between a web server and a web browser.
TACACS+	The Terminal Access Controller Access Control System (TACACS+) security protocol is a more recent protocol developed by Cisco. It provides detailed accounting information and flexible administrative control over the authentication and authorization processes. TACACS+ allows for a single access control server (the TACACS+ daemon) to provide authentication, authorization, and accounting services independently. Each service can be tied into its own database to take advantage of other services available on that server or on the network, depending on the capabilities of the daemon. There is a draft RFC detailing this protocol.
TCP/IP	Transmission Control Protocol/Internet Protocol. The basic protocol for Internet communication.
TCP/IP address	Fundamental Internet addressing method that uses the form nnn.nnn.nnn.nnn.
Telnet	Telnet is a terminal protocol that provides an easy-to-use method of creating terminal connections to a network.
UDP	User Datagram Protocol.
UTC	Coordinated Universal Time.
UTP	Unshielded Twisted Pair cabling. A type of Ethernet cable that can operate up to 100Mb/s. Also known as Category 5 or Cat5.
VNC	Virtual Network Computing (VNC) is a desktop protocol to remotely control another computer. It transmits the keyboard presses and mouse clicks from one computer to another, relaying the screen updates back in the other direction and over a network.
VPN	Virtual Private Network (VPN) is a network that uses a public telecommunication infrastructure and Internet to provide remote offices or individual users with secure access to their organization's network.
WAN	Wide Area Network.
WINS	Windows Internet Naming Service (WINS) manages the association of workstation names and locations with IP addresses.

APPENDIX F: End User License Agreements

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